

**Healthcare facilities –
hygiene requirements and operating conditions.
Non-specific routes of infection transmission.**

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Ústav ochrany a podpory zdraví LF MU
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A Culture of Patient Safety

Culture has been defined as the deeply rooted assumptions, values, and norms of an organisation that guide the interactions of the members through attitudes, customs, and behaviours.

- A culture of patient safety involves:

- ❖ leadership,
- ❖ teamwork and collaboration,
- ❖ evidence-based practices,
- ❖ effective communication,
- ❖ human behaviour,
- ❖ learning,
- ❖ measurement,
- ❖ a just culture,
- ❖ systems-thinking,
- ❖ human factors,
- ❖ and zero tolerance.

Each topic can be applied to infection prevention and control (IPC) practice and make an important contribution to reducing infection risk.

Culture of Patient Safety, rooted assumptions, values, and norms of an organisation, guidelines.

- Health-care settings include hospitals, health centres, clinics, health posts, dental surgeries, general practitioner settings and home-based care are environments with a high prevalence of infectious disease agents.
- Patients, staff, carriers and neighbours of the health-care setting face unacceptable risks of infection if environmental health is inadequate.
- Hospital hygiene deals with the recognition and control, but primarily with the prevention of hospital infections.
- This guidance is based on the best critically appraised evidence currently available.
- Environmental health in health-care settings can significantly decrease the transmission of such Infections.
- Interventions to improve environmental health in health-care settings are intended to reduce the transmission of infections (in health-care settings) and therefore directly reduce the disease burden. They are also targeted at high-risk populations (for example, immunocompromised patients).
- Good hospital hygiene is vital to any strategy for preventing HCAs in hospitals
- .

Clean Care is Safer Care

- ❑ Safe patient care, including infection prevention, is a priority in all health care settings worldwide.
- ❑ A patient safety culture guides the attitudes, norms, and behaviours of individuals and organisations.
- ❑ In a safe culture of care, all staff and leaders assume accountability and responsibility for the well-being of patients.
- ❑ Patient safety requires teamwork and collaboration, communication, continual improvement efforts, measurement, understanding the social aspects of behaviour, and techniques such as human factors engineering.
- ❑ Recommendations for construction of health care facilities must be based mainly on experience and **assessment of infection risks**, considering available local resources.

Clean Care is Safer Care

- Patient safety is a global health care challenge.
- Early pioneers in infection prevention and control (IPC) promoted safe patient care through their work.
- Ignaz Semmelweis reduced maternal mortality through hand hygiene and Florence Nightingale minimised infections in wards during the Crimean war by rigorous environmental cleanliness.
- Joseph Lister insisted on antiseptics in surgery and reduced surgical site infections.
- Present-day IPC experts regard healthcare-associated infections (HAI) as a critical patient safety issue with complications that **are very often preventable**.

Chain of infections - epidemiological specifics and risks in healthcare facilities

THE CAUSATIVE AGENT OF INFECTION (bacteria /MRSA, VRSA, ESBL Clostridium difficile/, viruses, fungi, prions, protozoa)

1. the **presence of rezervoir (source)** of infection

patients	}	at the end of incubation period
staff		acute stage
students		carriers

2. the way **of transmission**

A/ direct contact – influenza, scabies

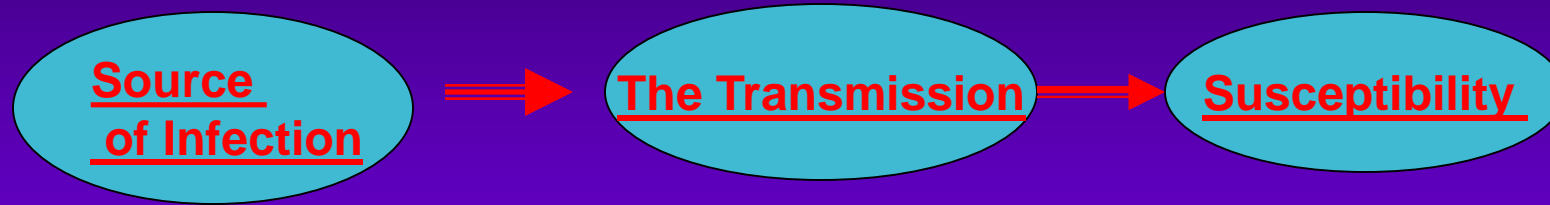
B/ indirect contact

- inhalation of droplets containing the infectious agents (TBC, measles, influenza...)
- ingestion of food or water that is contaminated (salmonella, Norwalk virus, VHA....)
- contamination of medical devices, instruments and dressings

3. **higher susceptibility of patients**

- basic illness
- therapy (ATB, immunosuppressive, corticosteroids)
- surgical operation
- non-physiological inputs (venous catheter, artificial lung ventilation, suction drains)

Chain of infections - epidemiological specifics and risks in healthcare facilities



patient



patient

patient



health workers -

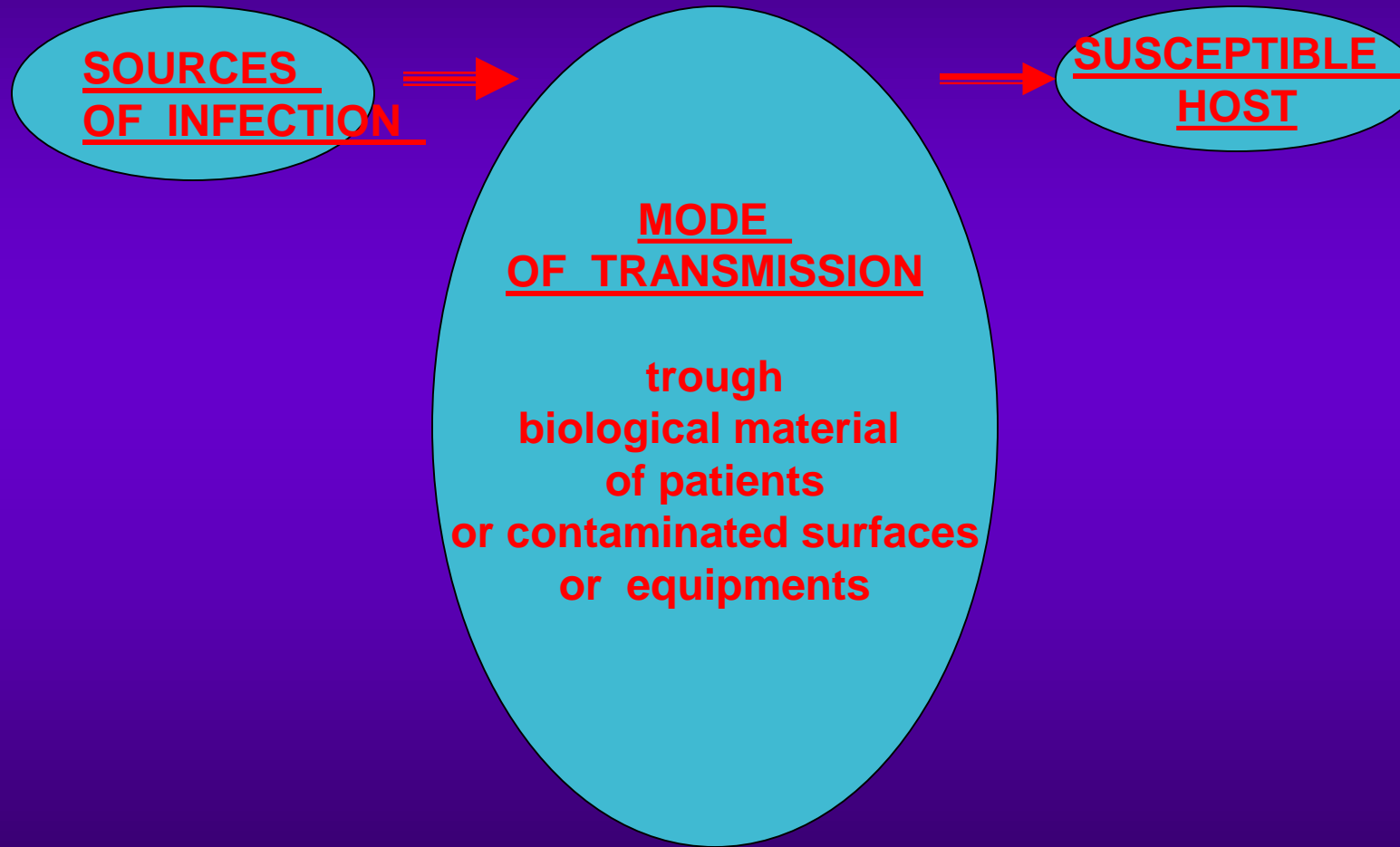
risk of professional infection - scabies

health workers



patient

**EPIDEMIC
PROCESS IN
THE HOSPITAL
ENVIRONMENT**



Biological materials –
their infectivity

1. Causative agents in blood, derivatives from
blood, plasma

VHB, VHC, VHA (short in the blood), HIV, CMV, rarely EBV,
virus of measles (viremie), kandy-kandidémie,

malária - (plasmodia can survive in fresh plasma 3 – 5°C - 14
days),

Toxoplasma gondii - (can survive in blood - 56 days)

Biological materials –
their infectivity

2. Causative agents in droplets

Adenovirus, coronaviruses, enteroviruses, herpes virus, myxovirus (**influenzae**), paramyxovirus, RSV, rhinovirus, *Stafylococcus*, *Streptococcus spp.*, *Meningococcus spp.*, *Haemophilus Influenzae*, *Neisseria meningitis*, *Bordetella pertussis*, *Bordetella parapertussis*, *Mycoplasma pneumoniae*, *Pneumocystis carinii*, *Kandidy....*

Biological materials –
their infectivity

3. Causative agents in stool

Enterovirus (VHA, poliomyelitis), VHE,
coxsackie virus, Adenovirus,
Enterobacteriaceae (*E.coli*, *Klebsiella pneumoniae*,
Pseudomonas aeruginosa, *Proteus spp.*, *Citrobacter*,
Enterobacter, *Serratia* **apod**)
Listeria monocytogenes, *Clostridium*
perfringens, *Clostridium tetani*,
Pneumocystis carinii

Biological materials –
their infectivity

Causative agents in:

4. URINE

Virus of measles, parotitis, CMV, VHB, papovavirus,
Listeria monocytogenes, *Candidae*

5. LIQUOR

HIV, **different causative agents of** meningitid

6. Salive

VHB, HIV, CMV, EBV, herpes virus hominis typ 1,2,
virus of measles, rubella

Biological materials –
their infectivity

7. TEARS, EYE - SECRET

VHB, HIV, adenoviruses, Enterovirus typ 70, *Coxsackie A 24*,
Staphylococcus aureus, hemophilus, pneumokoky, moraxely,
chlamydie

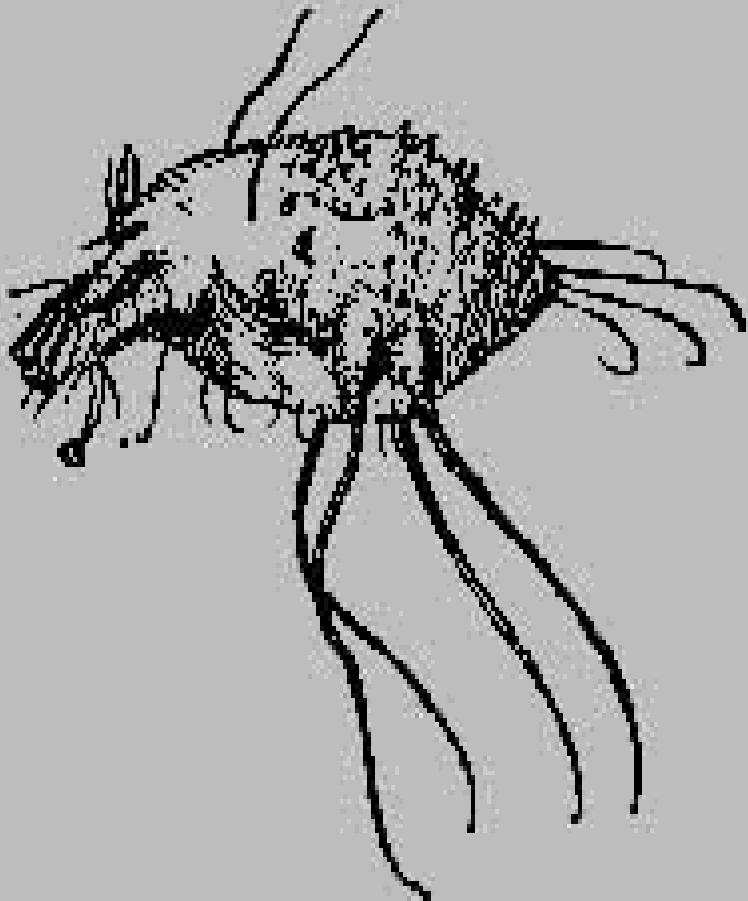
8. VAGINA AND CERVIX - SECRET

HIV, VHB, rare VHC, herpes virus hominis typ 1,2,
Streptococcus agalactiae, *Neisseria gonorrhoea*, *Haemophilus*
Ducreyi, *Treponema pallidum*, *Trichomonas vaginalis*,
Chlamydia lymfognulomatosis, *Chlamydia trachomatis*

9. EJACULAT

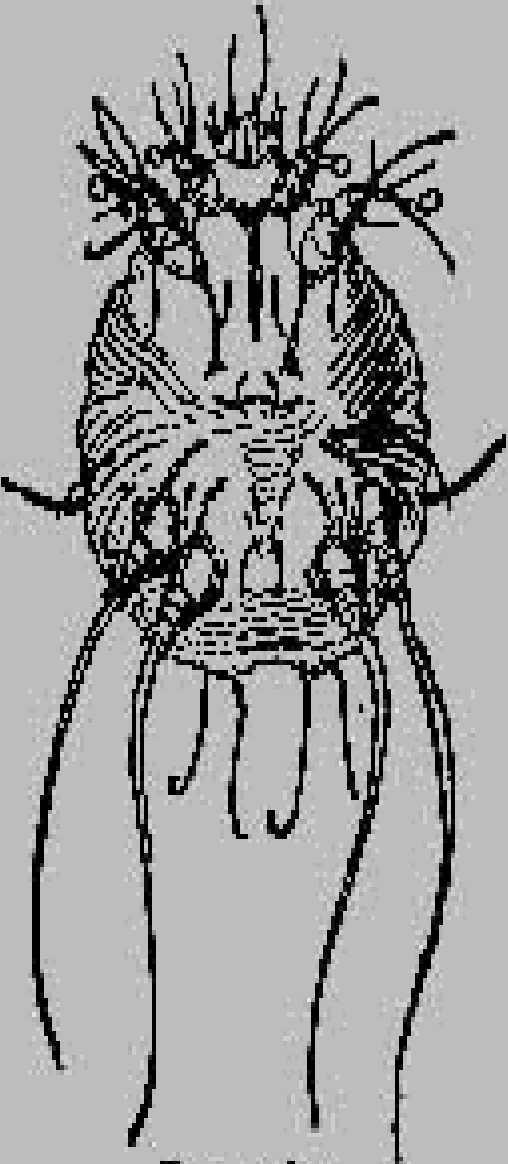
VHB, HIV, rare VHC, CMV,

**Scabies –
as a risk of
professional
exposure and illness**

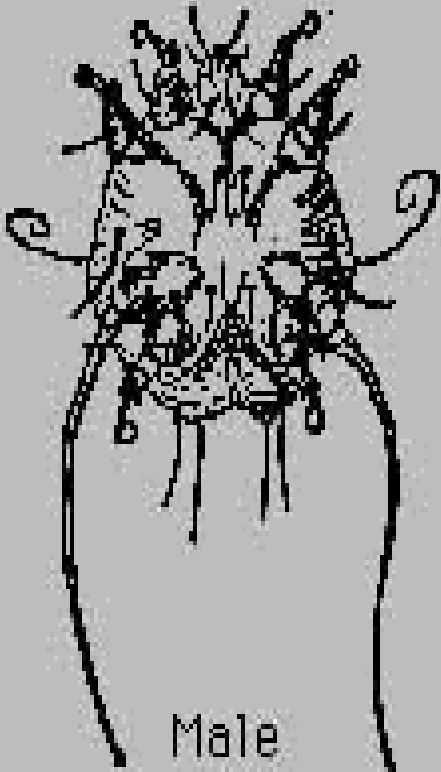


lateral

0.4 mm in length



Female



Male

Currently, the highest incidence of professional infections among health care professionals is scabies.



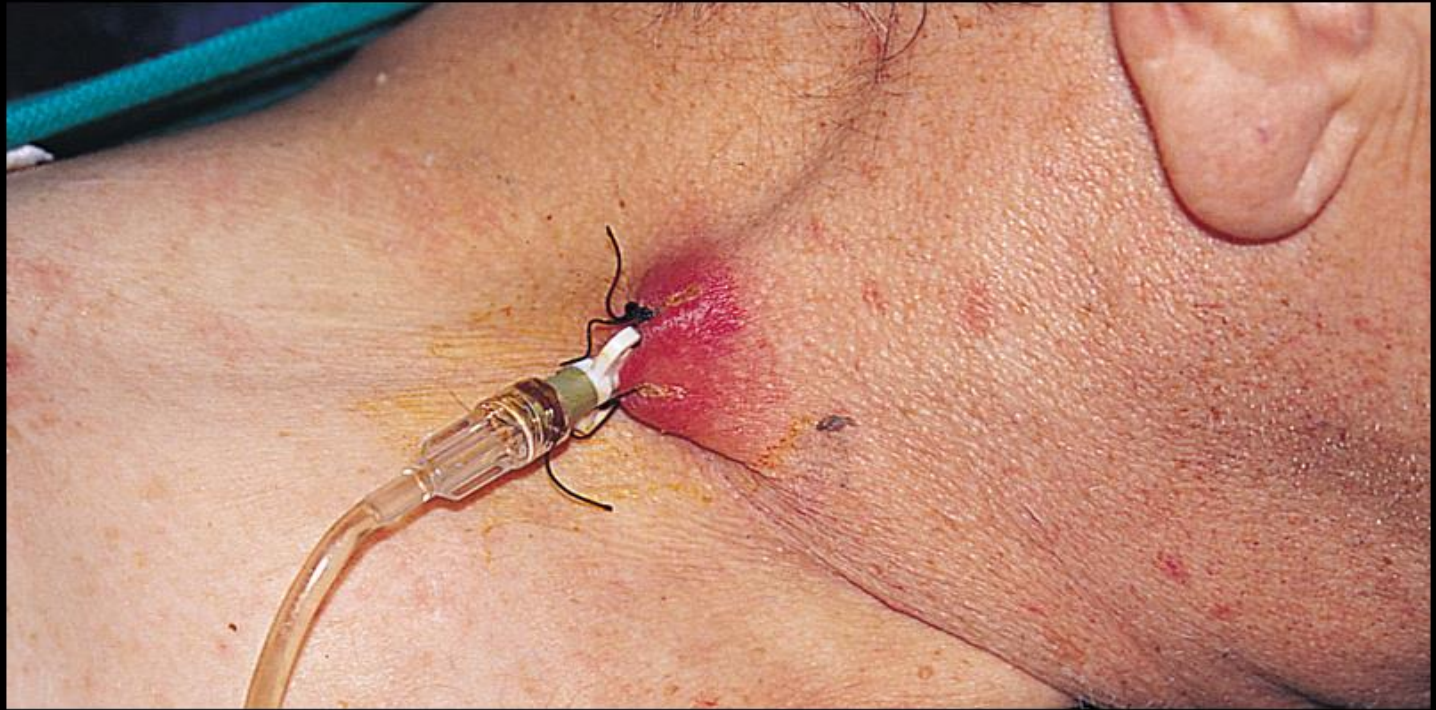
Crusted or
Norwegian scabies
in a patient who
has AIDS.



Staphylococcus aureus in a patient who has a Hickman catheter. The extending cellulitis (maximum extent shown by black marker pen line) has responded but the local tunnel infection persists and mandates line removal.



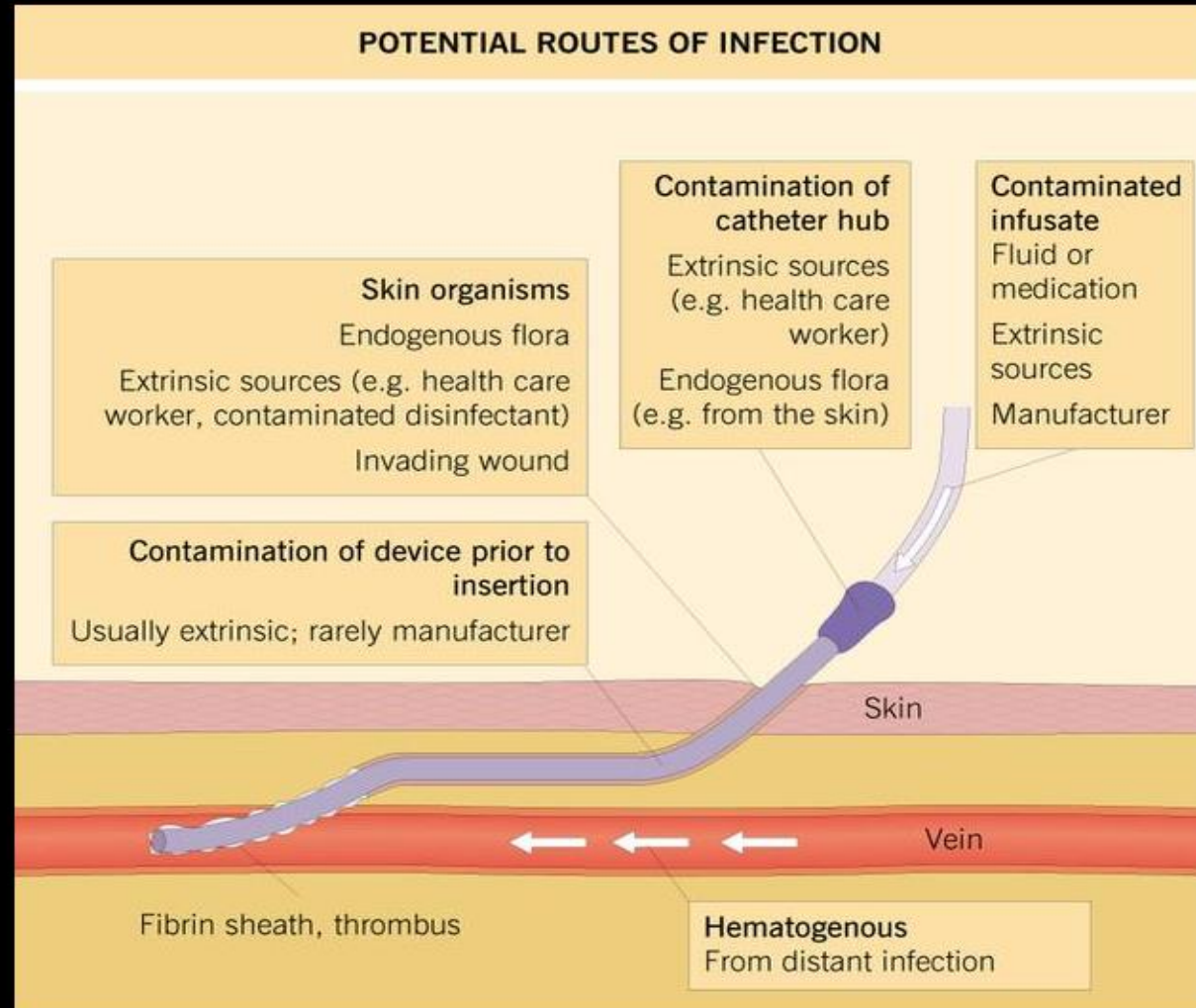
Catheter exit site infection
in a patient with central
venous catheterization
through the jugular vein.



Diffuse skin involvement with petechial lesions in a patient with *Staphylococcus aureus* bacteremia, endocarditis and acute aortic insufficiency.

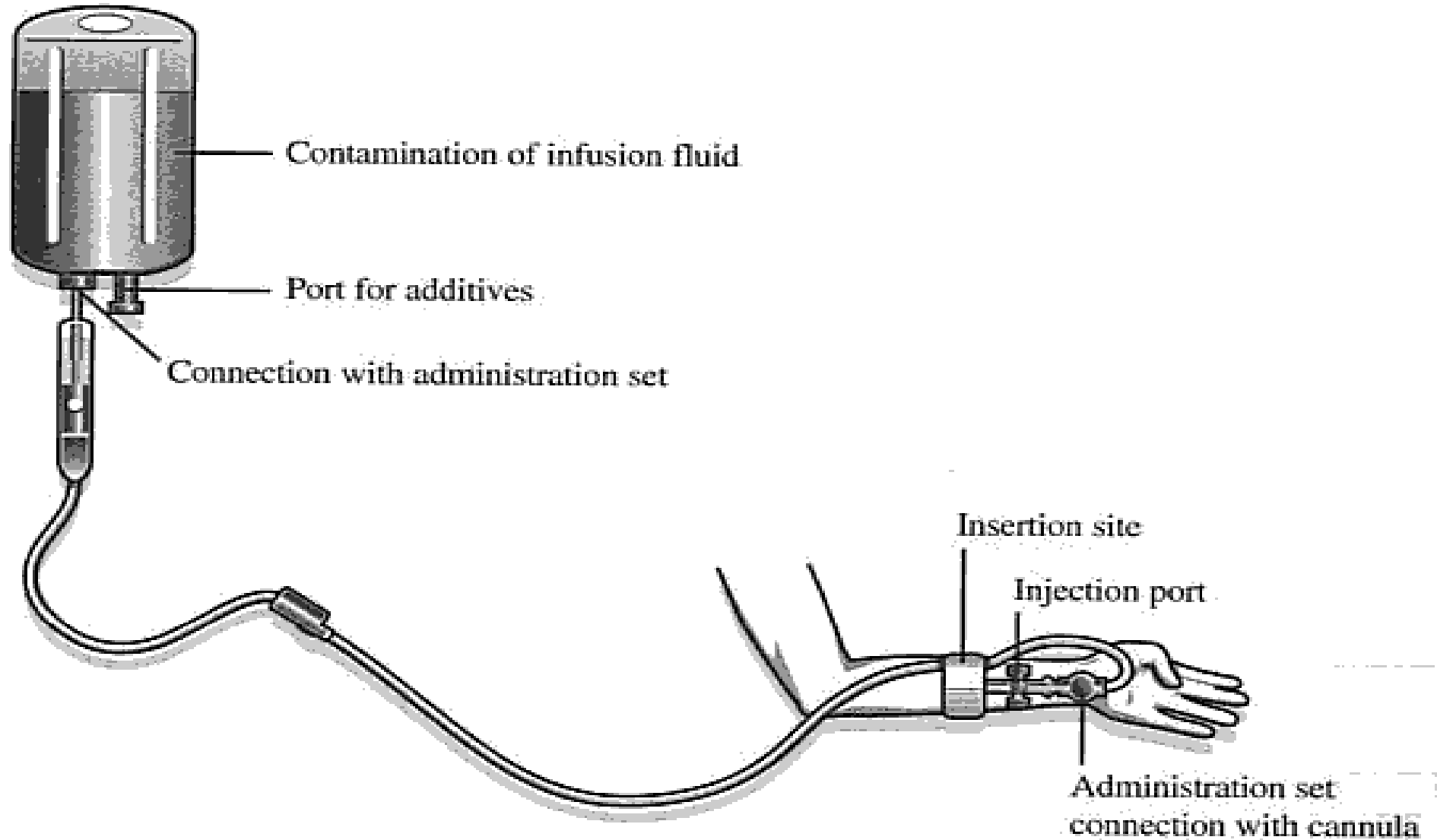


Potential routes of infection



Intravenous Infusions

Sites of Possible Contamination



An acutely infected knee replacement.
The site was washed out but the infection failed to resolve.
At re-operation the implant was found to be loose and it needed to be removed.
Staphylococcus aureus was grown from deep specimens.

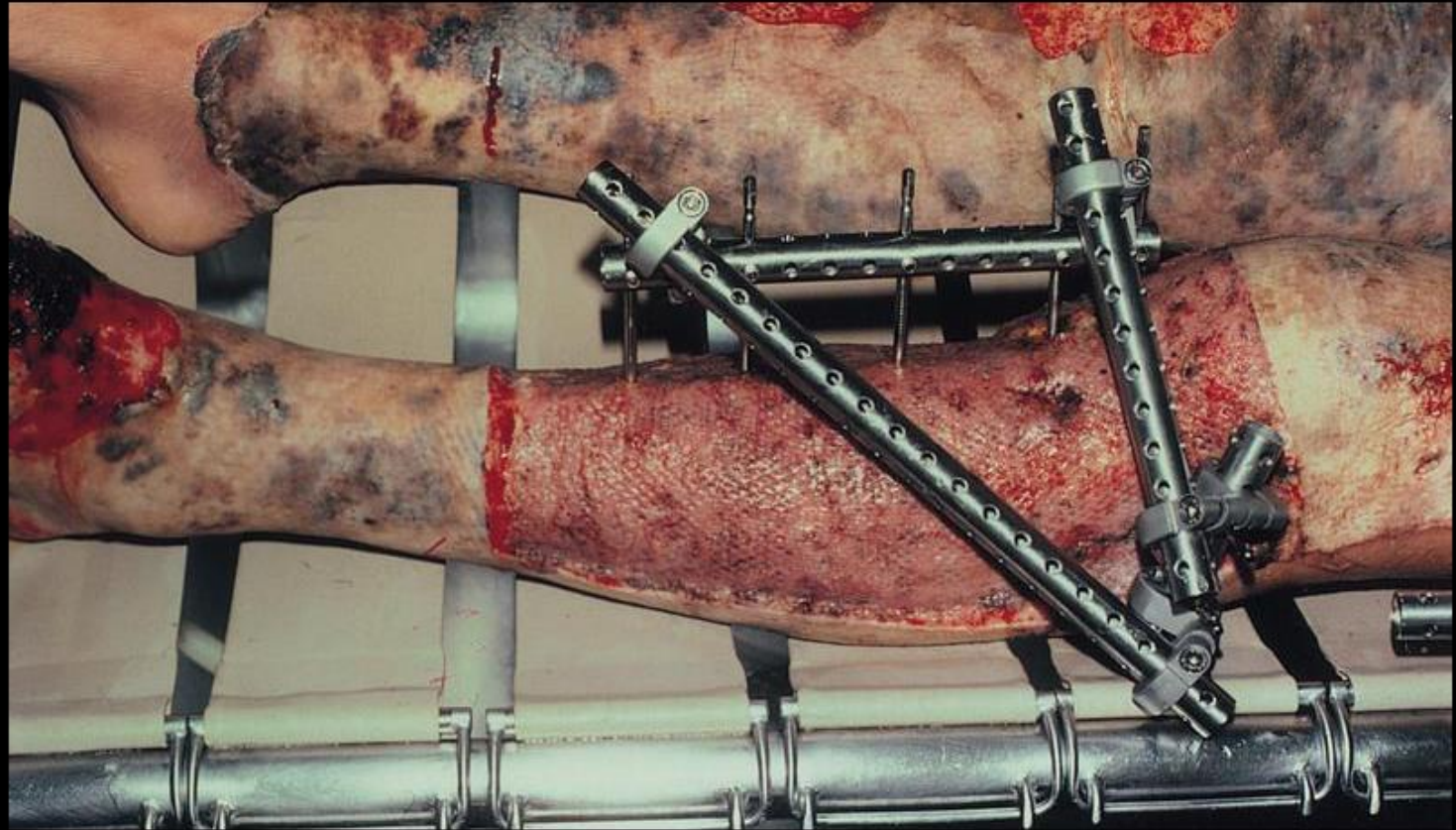


*Typical X-ray image of
infected hip replacement
with laconic clarifications
and rapid migration*

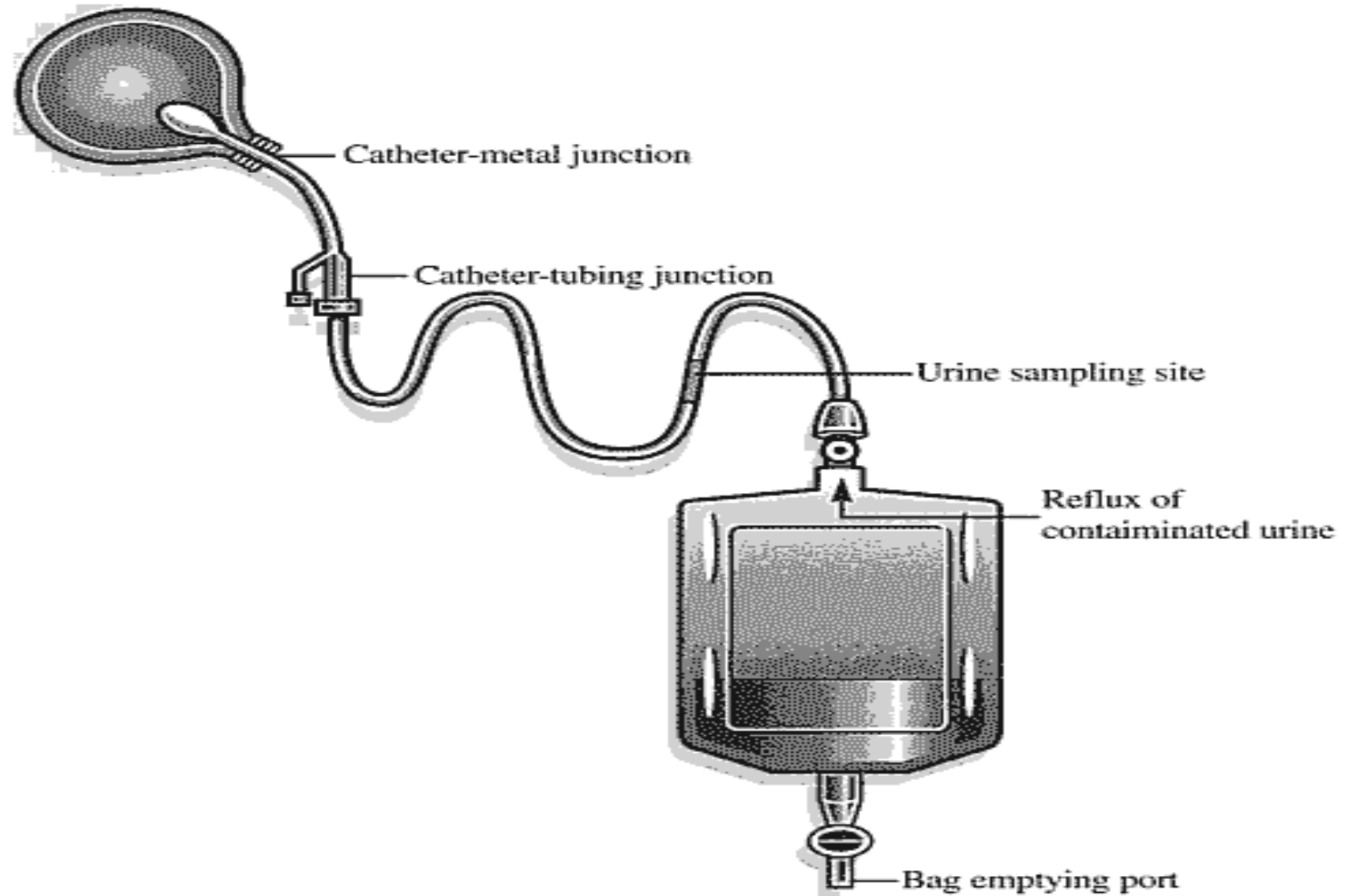
- Díky pečlivé přípravě pacientů, zavedení super-sterilních sálů a speciálnímu režimu na nich, díky lepší operační technice a preventivnímu podávání antibiotik byla **incidence hluboké infekce snížena na dnes všeobecně udávané jedno až dvě procenta.**
- MUDr. David Jahoda, doc. MUDr. Pavel Vavřík, CSc., MUDr. Ivan Landor, CSc., I. ortopedická klinika FN Motol a UK 1. LF, Praha, foto z archivu autora



Burned leg that has been
superinfected with
Pseudomonas aeruginosa.



Indwelling Catheterisation of Urinary Tract Sites of Possible Contamination



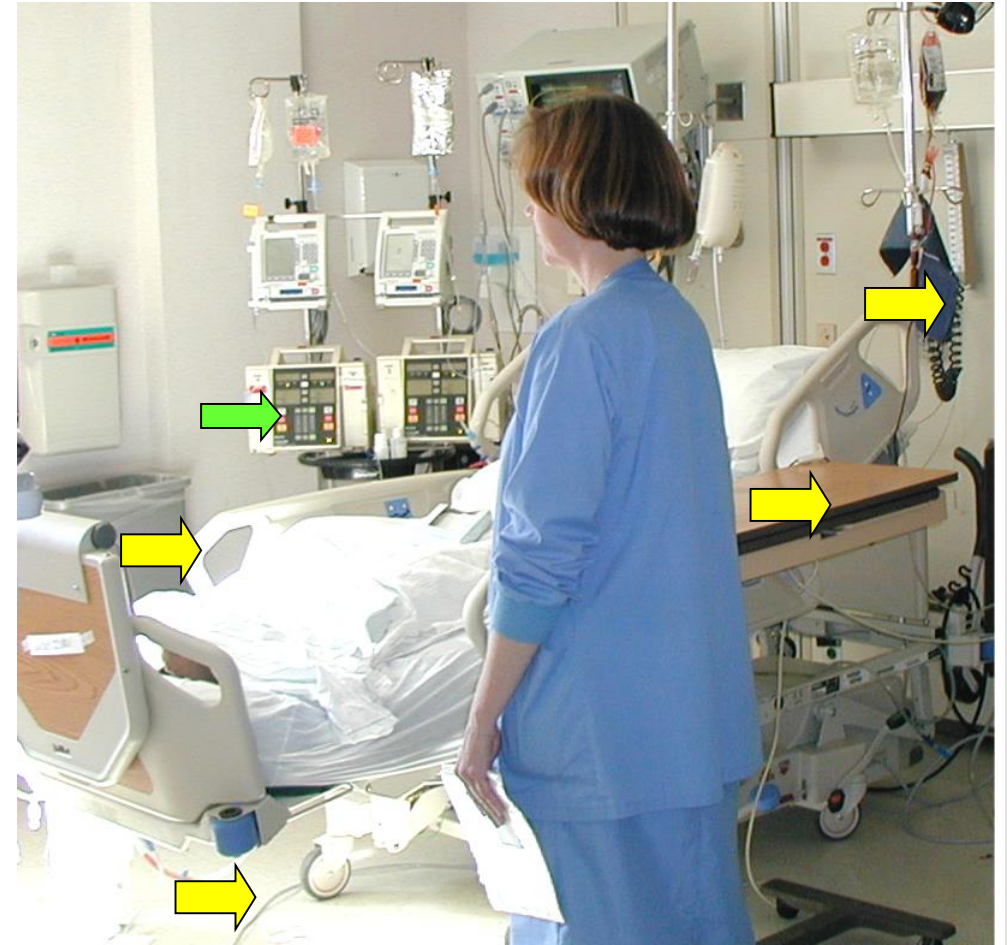
Indwelling Catheterisation
of Urinary Tract

Epidemiological specifics and risks in healthcare facilities.

Disease risk	Prevention measures
Airborne infections (e.g., avian influenza, SARS, tuberculosis)	<ul style="list-style-type: none"> • Ventilation, air-conditioning (HVAC) and isolation • Space available per patient • Spacing of beds • Use of separate rooms for highly vulnerable or infectious patients • Use of masks and correct incineration of wastes
Water-, food- or handborne infections (e.g. diarrhoea)	<ul style="list-style-type: none"> • Water supply (quality and access) • Excreta disposal • Hygiene facilities • Food hygiene • Hand hygiene
Infection of wounds/surgical incisions from contaminated water, medical devices and dressings (e.g. sepsis)	<ul style="list-style-type: none"> • Use of single-use medical devices and dressings • Pre-disinfection • Cleaning and sterilization of instruments and dressings • Good-quality water • Asepsis in surgical or dressings procedures
Bloodborne infections due to contaminated needles and syringes, unsafe blood transfusion (e.g. HBV, HCV, HIV)	<ul style="list-style-type: none"> • Health-care waste management and use of single-use needles and syringes • Safe blood transfusion
Heat- and cold-related stress and discomfort (e.g. higher fever)	<ul style="list-style-type: none"> • Heating, ventilation, air-conditioning (HVAC) and insulation
Vector-borne disease transmission	<ul style="list-style-type: none"> • Control of disease vectors in and around buildings • Protection of patients

Examples of Contaminated Environmental Surfaces

- **Items frequently contaminated near patients include:**
 - **Bed rails**
 - **Bed linen**
 - **Overbed tables**
 - **Blood pressure cuffs**
 - **Intravenous pumps**
 - **Nurse call buttons**
 - **Urinary collection bags**

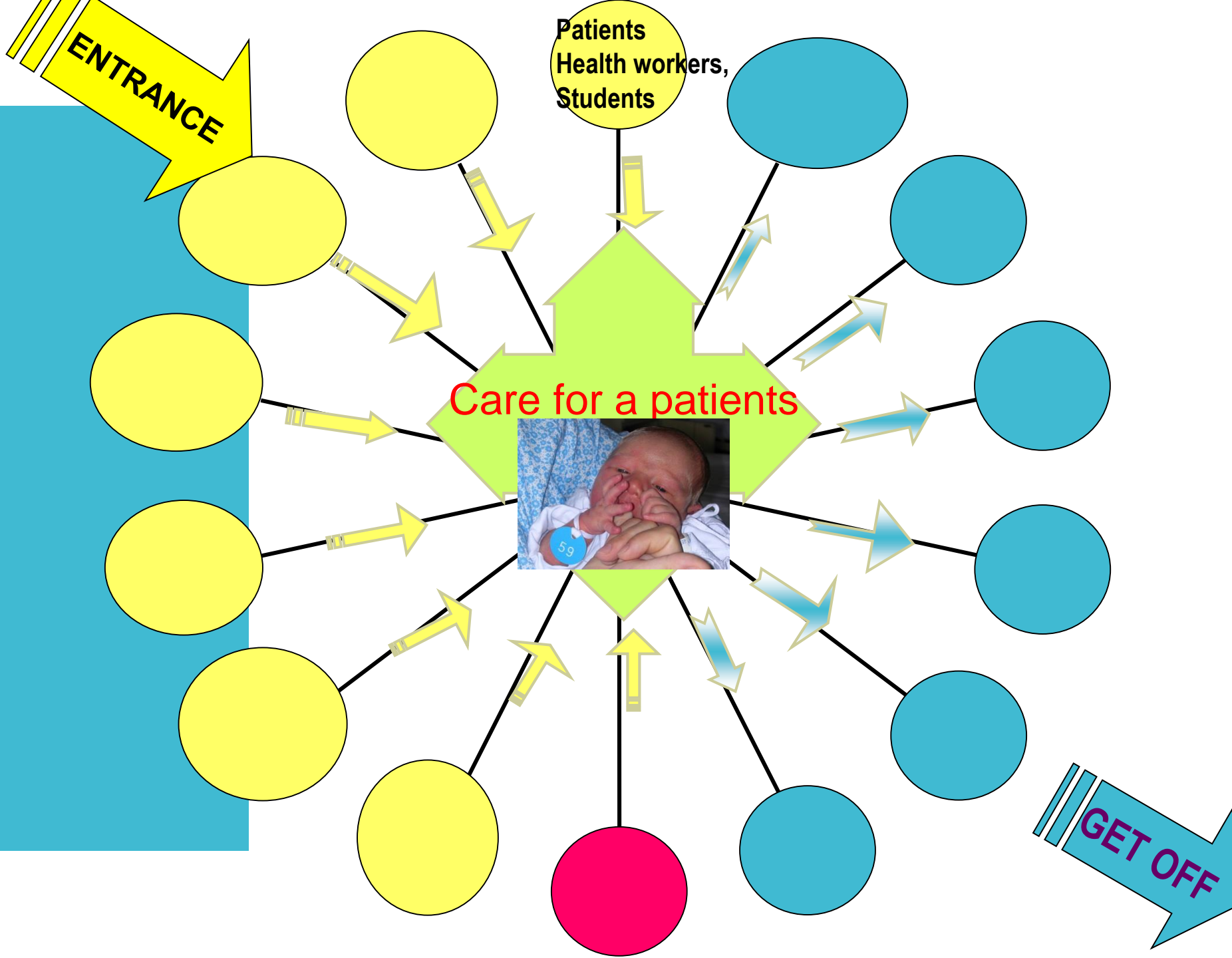


- John M. Boyce, MD
- Chief, Infectious Diseases Section
- Hospital of Saint Raphael

Hospital hygiene

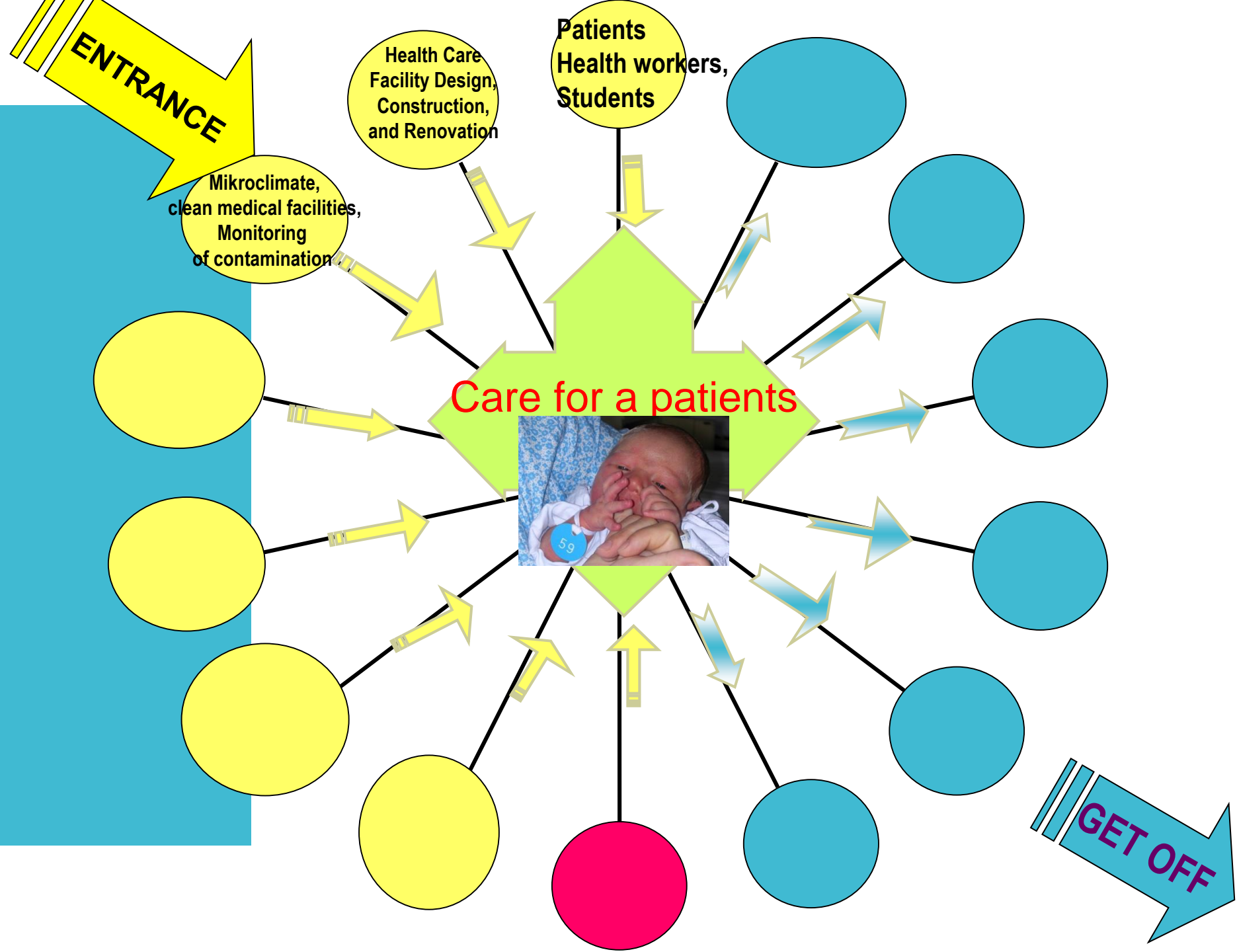
- Putting policy into practice in this area demands strong links between sectors such as:
- building and construction management, planning,
- purchasing technology,
- ventilation and air conditioning
- hospital water supplies and sanitation, potable water,
- hand hygiene
- housekeeping, cleaning and disinfection the general hospital environment,
- linen management, bed care
- disinfection and sterilization of medical devices
- catering to patients and staff, prevention of healthcare-associated foodborne illnesses
- patient transport and laboratory samples
- healthcare waste management; proper sorting and minimizing the amount of waste
-
-

Clean side of traffic



Unclean side of traffic

Clean side of traffic



Unclean side of traffic

Health Care Facility Design, Construction, and Renovation

Recommendations for construction of health care facilities must be based mainly on experience and **assessment of infection risks**, considering available local resources, as published evidence is scarce. Patients' vulnerability to air and water contaminants while in or near a construction site must be taken into account.

Several factors might influence transmission of infection, some of which are listed below:

- Vulnerability of patients in ICUs, operation theatres, in common wards and in out-patients' clinics where patients are at different stages of susceptibility to infection.
- Numbers and types of rooms
- Number of beds in a room
- Numbers of patients, staff, and visitors
- Numbers and types of procedures and examinations
- Storage of equipment and textiles
- Available space and adequate equipment
- Floors, finishes, and surfaces
- Water, electricity, and sanitation
- Ventilation and air quality
- Space for handling used and unused medical equipment
- Space for handling food, laundry, and waste

Mikroclimate,
clean medical
facilities,
Monitoring
of contamination



Mikroclimate,
clean medical facilities.
Monitoring
of contamination.

Positive pressure gradient
of the air .



Mikroclimate,
clean medical facilities.
Monitoring
of contamination.

Positive pressure gradient
of the air .

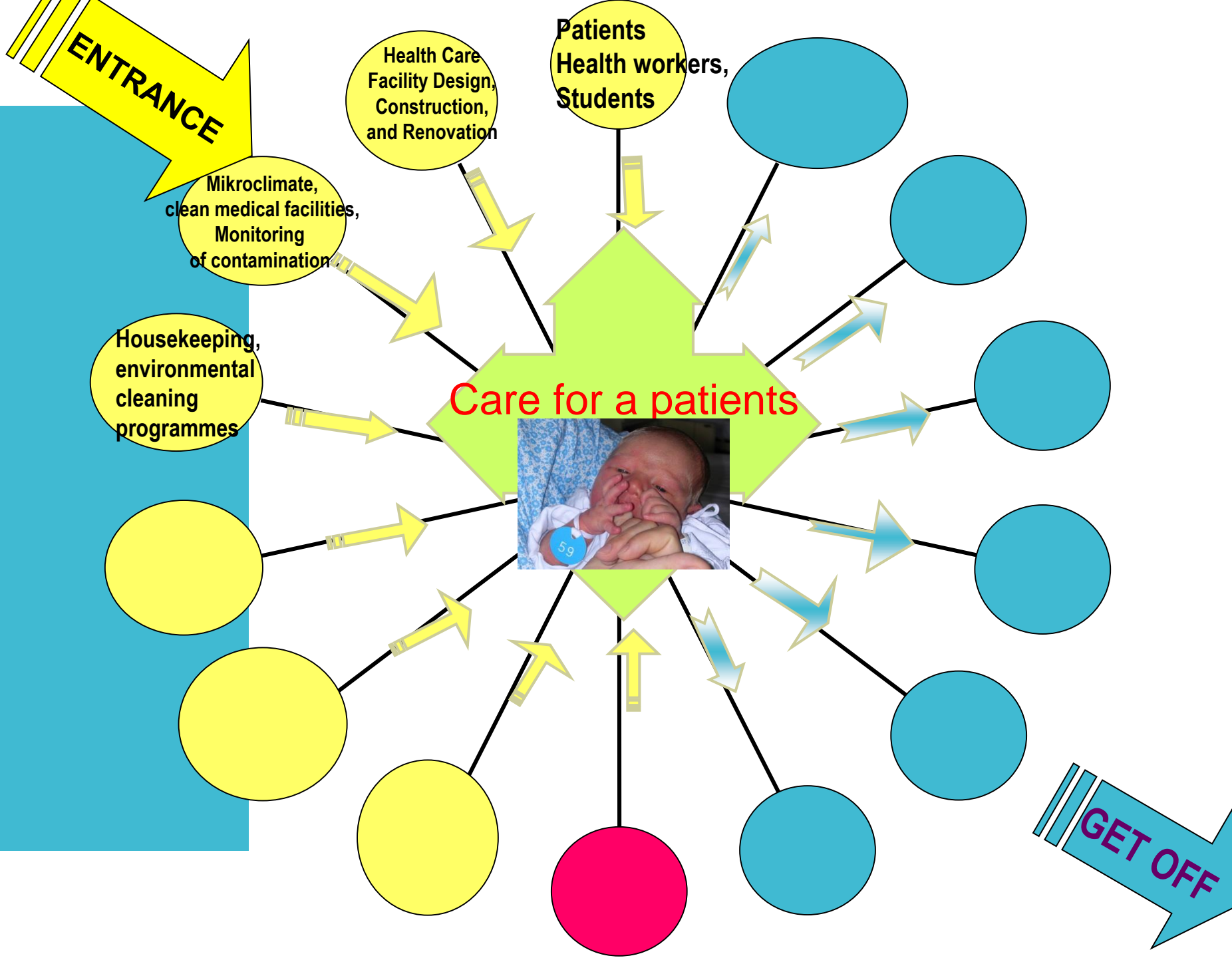


ICU

House keeping, linen management,
caring for a bed.....
Non-physiological inputs into the
body.



Clean side of traffic



Unclean side of traffic

Level of Disinfection/ Cleaning Required for Patient Care Equipment

John M. Boyce, MD
Chief, Infectious Diseases Section
Hospital of Saint Raphael

Spaulding Classification of Objects	Application	Level of Germicidal Action Required
Critical	Entry or penetration into sterile tissue, cavity or bloodstream	Sterilization
Semi-critical	Contact with mucous membranes, or non- intact skin	High-level Disinfection
Non-critical	Contact with intact skin	Low-level Disinfection

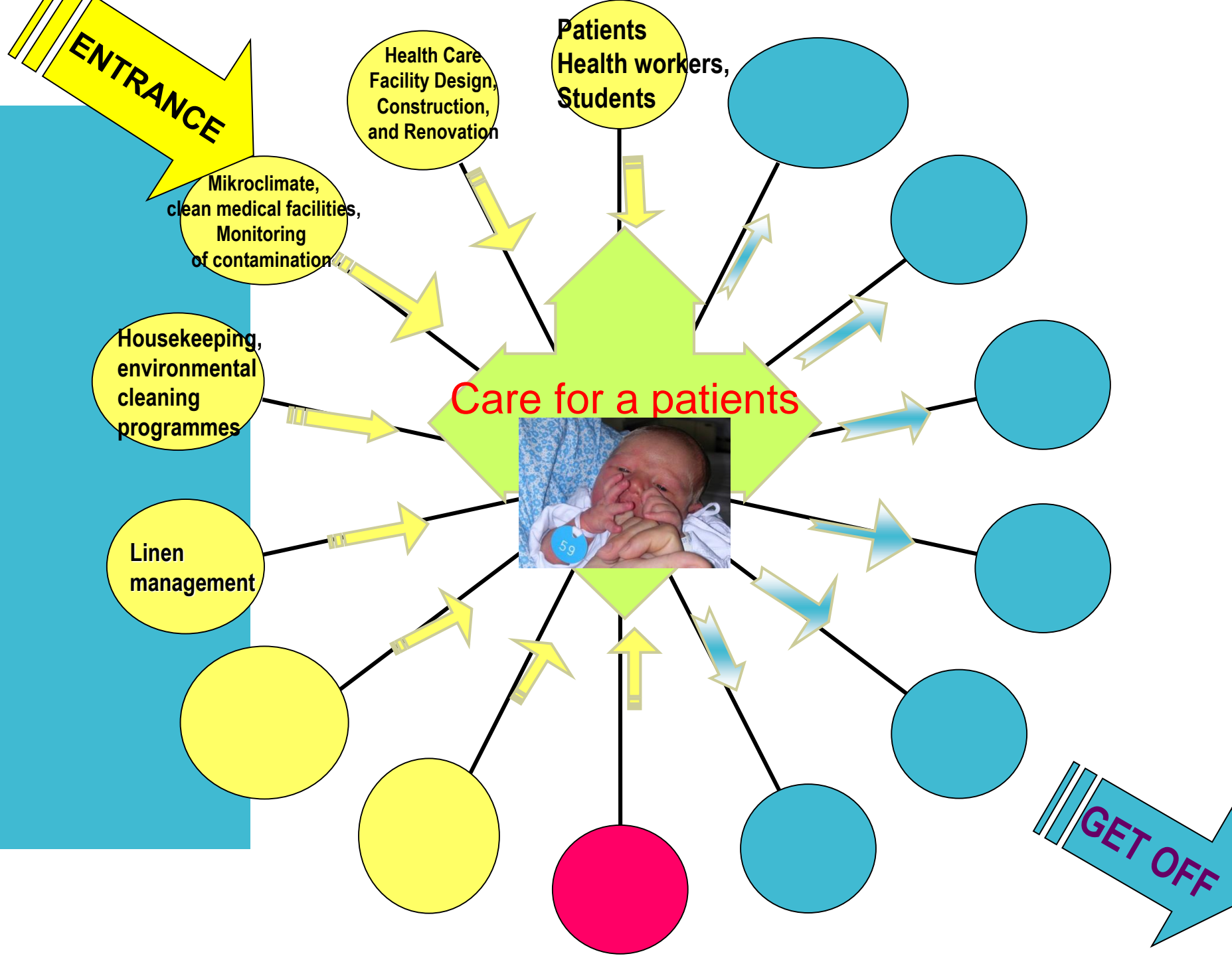
Housekeeping

- Contaminated environmental surfaces can lead to an increased risk of transmission of pathogens to patients via the hands of healthcare workers or medical equipment.
- Cleaning with detergent and water always precedes disinfection since disinfectants are deactivated in the presence of organic matter, chemical deposits, and dirt.
- Cleaning must focus on high-touch surfaces and other areas that may be heavily contaminated. These areas may vary depending on the type of clinical activity in an area.

Housekeeping

- Environmental cleaning programmes include:
 - 1) setting standards for cleaning,
 - 2) fixing a cleaning routine with checklists that cover all areas,
 - 3) using cleaning products, education, direct supervision, as well as periodic objective monitoring of the effectiveness of cleaning (if feasible), and
 - 4) providing immediate feedback to cleaning staff.
- There is no consensus on the use of disinfectants for routine cleaning of non-critical surfaces.
- Low-touch surfaces X high-touch surfaces

Clean side of traffic



Unclean side of traffic

The management of linen

- In clinical areas, the management of linen has a dual purpose, namely to keep clean linen clean until it reaches the patient and to prevent dirty linen from contaminating patients, staff, the environment, or other linen.

-

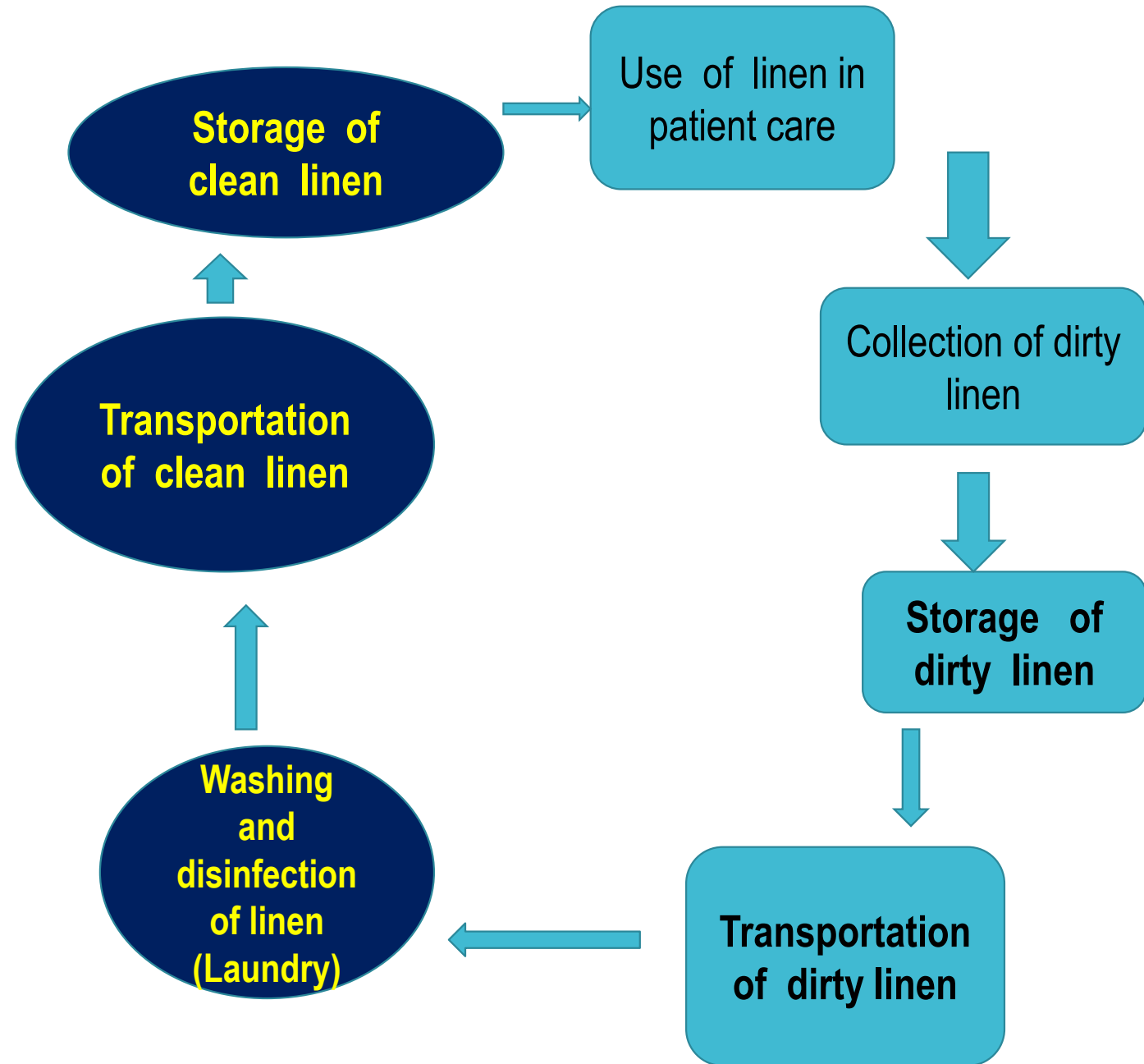
The management of linen

- There must be a clear separation between clean and dirty linen.

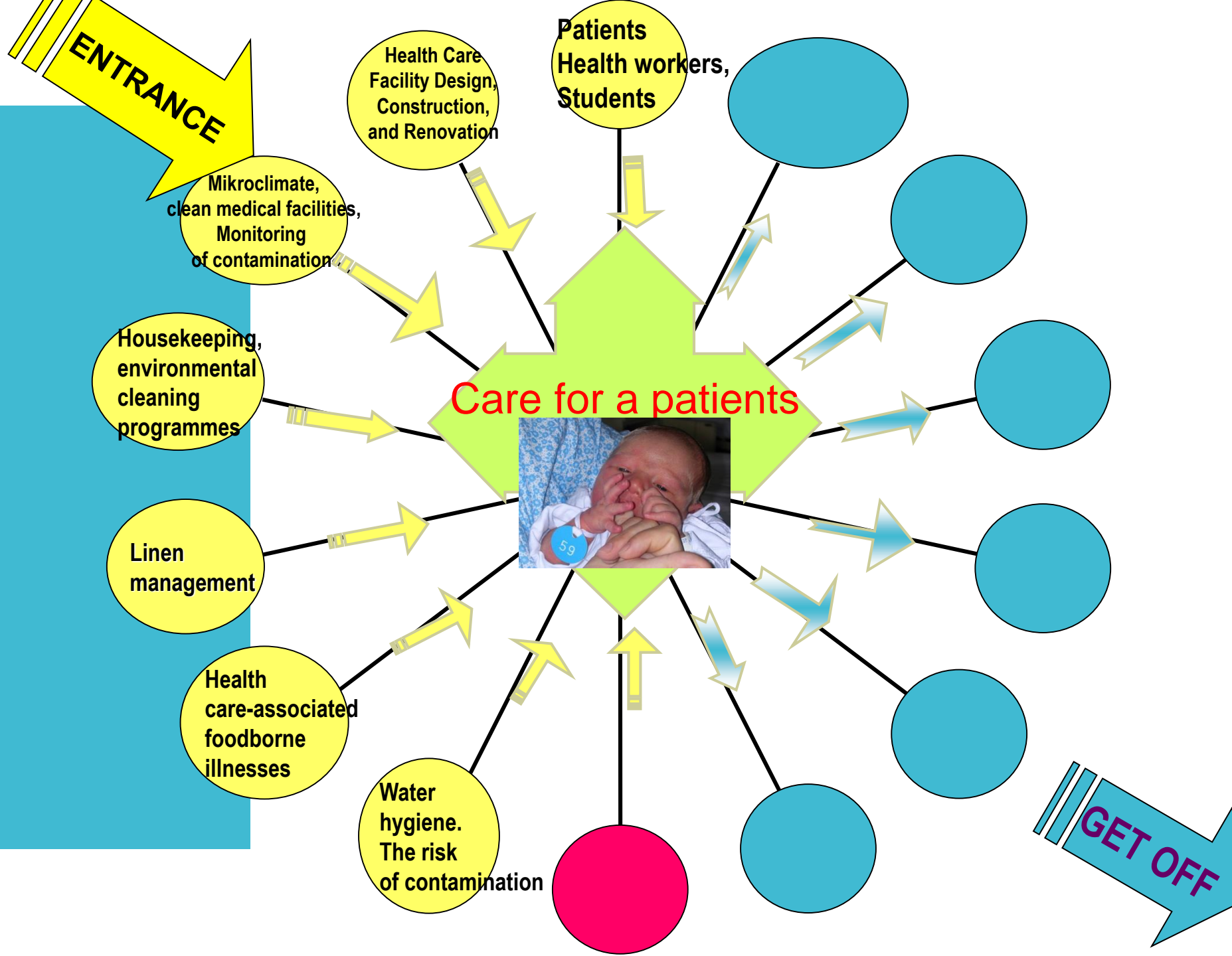
There are different types of dirty linen:

- **Used linen** is linen that has been used in patient care but is not visibly soiled.
- **Soiled linen** is visibly contaminated with blood, body fluids, secretions, or excretions, i.e., with a high bio-load of microorganisms.
- **Infectious linen** is linen that was used in the care of patients on transmission-based precautions (i.e. patients with communicable disease, colonised, or infected with multi-drug resistant micro-organisms). The contamination may not be visible.
- **Infested linen** is linen used in the care of patients with parasites, such as lice, fleas, bedbugs, or scabies.

Laundry Cycle



Clean side of traffic



Unclean side of traffic

Water Hygiene

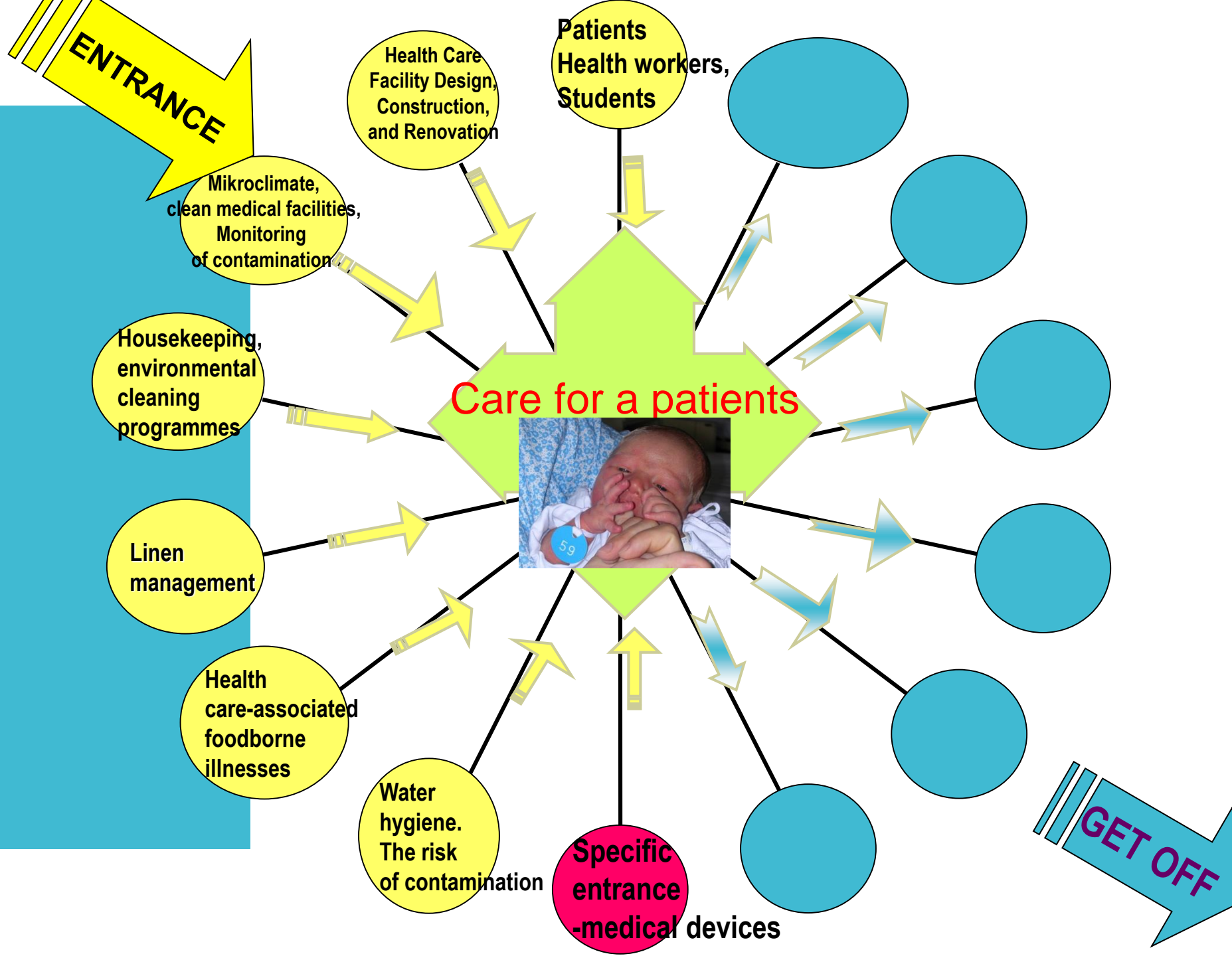
- Everyone should have access to water free from pathogenic microbial and chemical contaminants.
- Hospitals often have complex plumbing and ambient-temperature water treatment systems. Both can be colonised by microorganisms. Efforts are necessary to prevent infectious risks from bacterial contamination and formation of biofilms.
- In health care settings a continuous supply of a great quantity of safe water is essential.
- Potable water can be rendered microbiologically safe by boiling, filtering, or chlorination.
- In health care settings, additional water treatment may be necessary (e.g., deionisation).
- The infection prevention and control team should monitor and assess the risks for contamination of water in their facilities.
- Hospital water supplies from specific areas should be tested regularly to confirm freedom from contamination

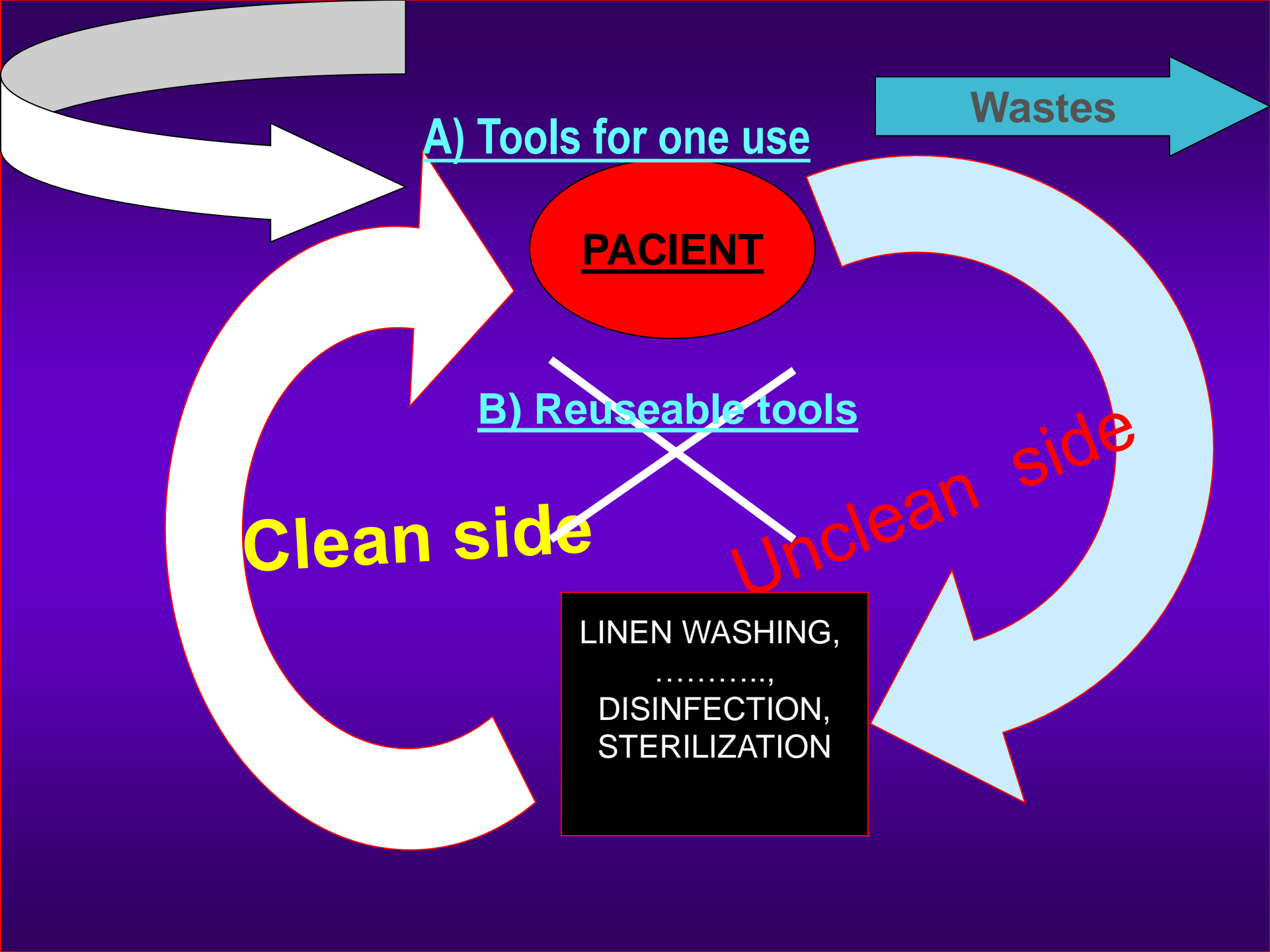
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Water Hygiene

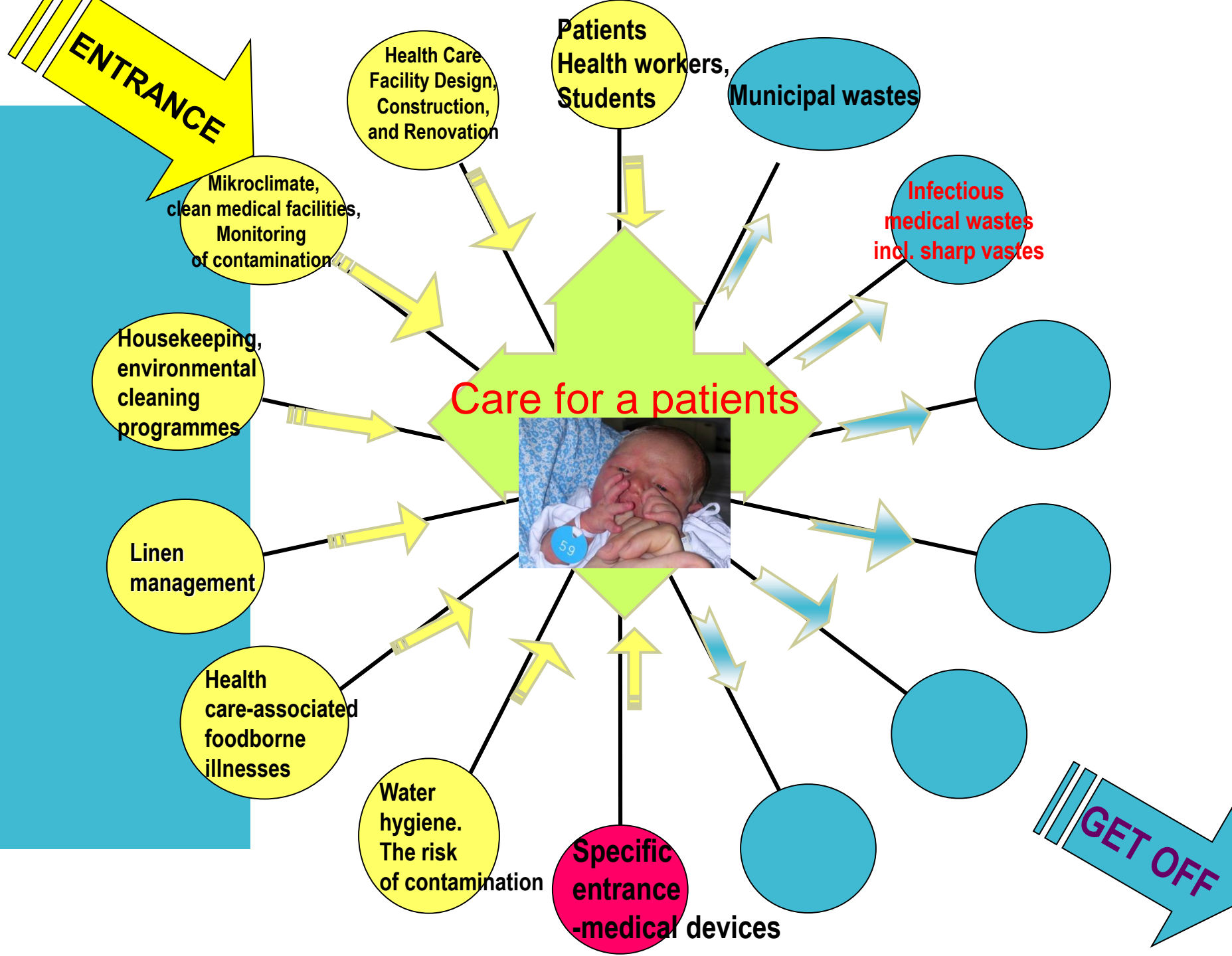
- **Modes of transmission for waterborne infections**
- A). Direct contact [e.g., hydrotherapy]
- B). Ingestion of water [e.g., contaminated ice]
- C). Indirect-contact transmission [e.g., improperly reprocessed medical device]
- D). Inhalation of aerosols dispersed from water sources

Clean side of traffic



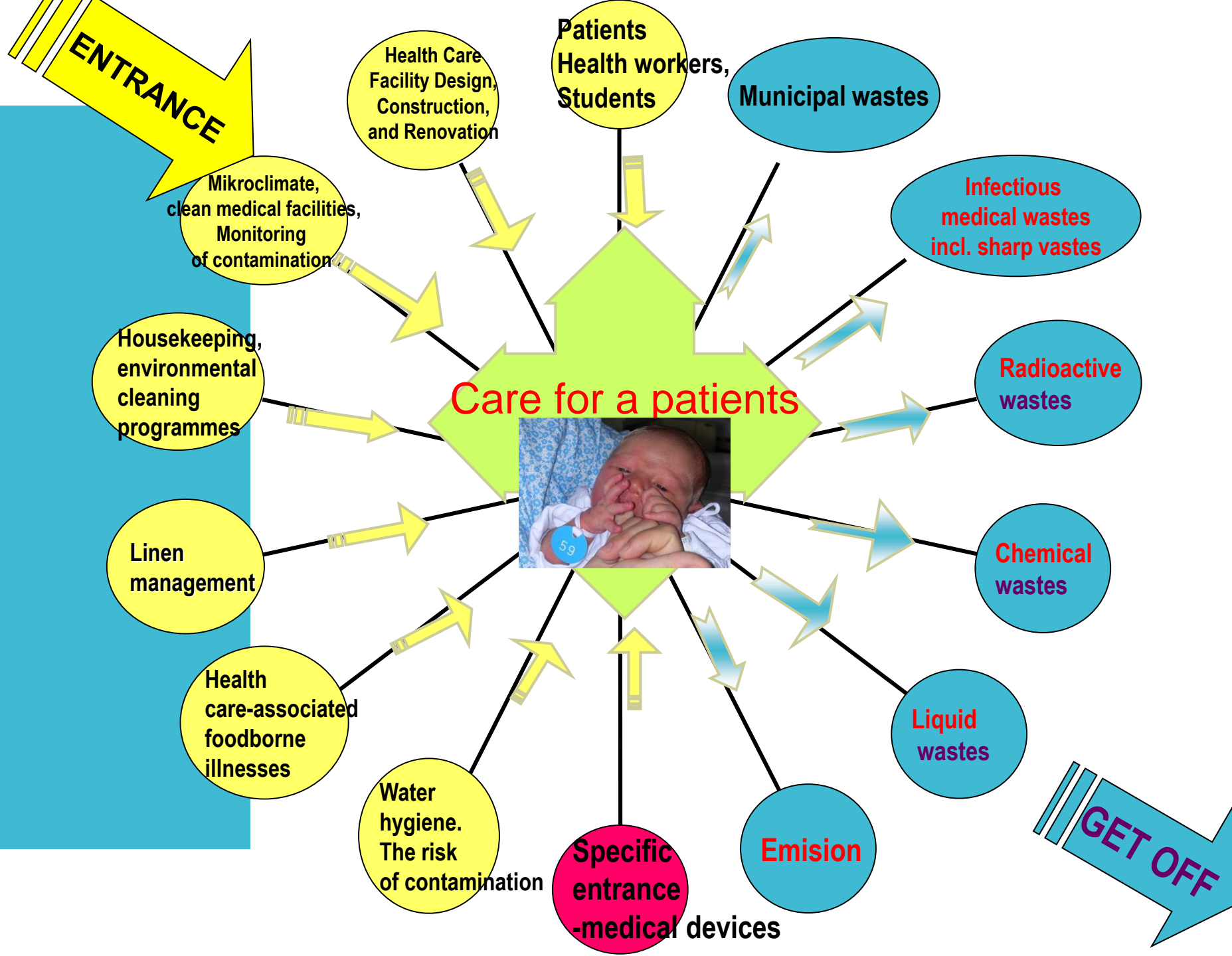


Clean side of traffic



Unclean side of traffic

Clean side of traffic



Unclean side of traffic

Healthcare Waste Management

- Sharps are the most likely health care waste to cause injury and/or exposure. Therefore, at a minimum, a waste management program must focus on sharps handling.
- Proper segregation using available means will reduce the risk of disease transmission and minimise the amount of potentially infectious health care waste generated.
- A range of treatment options for waste are available. Consideration should be given to those that reduce the opportunity for exposure and impact on the environment.
- Education and regular reinforcement of practices are the keys to success.

**Municipal waste –
syringes ?????
with blood !!!**



Municipial waste
– syringes ??????
with blood !!!



Municipial waste –
?????? !!!



Sorted waste –
glasses ????
with syringes and
needles (after
using) !!!



**Sorted waste – glasses
with giving set (after
using) !!!!**



The rest
medicaments in
the glasses =
hazardous waste
!!!



**The bag with blood
in the transparent
sack !!!!
(must be black and
nontransparent
and fat (0,2 mm)
with symbol
„Biological Risk)**



Education and training of staff.

- Health-care settings also provide an educational opportunity to promote safe
- environments that are relevant to the population at large, and thereby also contribute to
- safe environments at home and in community settings, such as schools.