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Hospital built environment requirements for Infection Prevention and Control: **recommendations for hand hygiene, cleaning and disinfection and transmission-based precautions**

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Introduction

The hospital-built environment is recognised as one of the eight core components of WHO's infection prevention and control programme for national and acute healthcare facilities. To promote an effective and standardised clinical practice, WHO addresses that optimising the healthcare environment should be emphasised, which should ensure a working system that supports the effective implementation of IPC practices (1).

The objective of this report is to provide information to support the definition of infection prevention and control requirements for the built environment of healthcare facilities in resource-limited settings. The recommendations proposed in the report intend to support the implementation of the Intersectional MSF Policy and Strategic Framework for health structures, which focus on three pillars: hand hygiene, cleaning and disinfection, and transmission-based precautions. They aim to improve the design of healthcare facilities, creating a working environment that enhances and facilitates the behaviour of healthcare workers in the execution of IPC measures.

During the composition of this report, codes and norms that regulate the design of healthcare facilities as well as WHO and CDC guidelines were used as key references. Nevertheless, as there is limited evidence on the subject, the recommendations are mostly derived from theoretical rationale and experts' opinions. The recommendations presented in this report are not conclusive and require further investigation before dissemination or implementation in the field.

This report was produced by the SIU, and compiles information collected during the EReq project (Essential Requirements for the hospital-built environment – a collaboration between SIU, OCB and OCA) with additional information from beyond this project.

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Summary of recommendations

The recommendations listed below aim to provide proper built environment conditions for the implementation of Infection Prevention and Control (IPC) measures and are considered relevant in supporting MSF's IPC policy. They are intended to support architects and other professionals working on the planning and designing of healthcare facilities in resource-limited settings, as well as for use as assessment parameters of the built environment of healthcare facilities.[1] [2]

Hand hygiene

General recommendations:

- Ensure ready availability and optimal placement of hand hygiene materials and equipment at the point of care[3] (1).
    - Provide bottles of alcohol-based handrub, positioned at the point of care in each ward (or make sure such bottles are distributed among staff members) (2).
    - Ensure access to at least one sink for every ten beds, with soap and fresh towels available at every sink (2).

Specific recommendations for the patient zone[4]:

- Provide one alcohol-based handrub dispenser per patient bed (3) (especially at intensive care wards/rooms).
- In settings where alcohol-based handrub supply and quality can be ensured, the possibility of removing sinks in the patient zone should be considered – especially in areas of critical patients' care, such as NICU and ICU wards/rooms.
- In any case, it is necessary to ensure the availability of hand washing opportunities, such as through the use of mobile hand washing basins[5] or the provision of handwashing facilities accessible to staff working in treatment areas, allowing staff to perform hand hygiene when hands are visibly soiled.

Specific recommendations for hand washing facilities:

- Hands-free taps: In general, it is preferable to be able to wash hands without having to touch the tap with soiled hands. Ideally, taps should be opened using an elbow- or foot-operating system (2).[6]
- Scrub sinks: A handwashing facility, with a hands-free device, should be provided to allow staff to wash both hands and forearms. These should be located in a dedicated area near: operating rooms (Surgical Dept.); resuscitation rooms (Emergency Dept.); and delivery rooms (Obstetrics Dept.).

[1] **Wastewater disposal** and **waste management** specifications should be discussed with WatSan technical referent. For further information see Public Health Engineering in Precarious Situations, MSF 2010.
[2] Recommendations for the prevention of airborne pathogens are not included in this report. The subject requires a separated study.
[3] 'Point of care' refers to the place where the three following elements come together: the patient, the healthcare worker and care or treatment involving contact with the patient or his/her surroundings within the patient zone (1).
[4] 'Patient zone' is a concept that relates to the "geographical" visualization of key moments for hand hygiene. It contains the patient and his/her immediate surroundings. This typically includes the intact skin of the patient and all inanimate surfaces that are touched by or in direct physical contact with the patient such as the bed rails, bedside table, bed linen, infusion tubing and other medical equipment. Furthermore it contains surfaces frequently touched by HCWs while caring for the patient such as monitors, knobs and buttons, and other "high frequency" touch surfaces (2).
[5] Mobile handwashing basins were used in the study conducted by Hopman et al. (17)
[6] It is also possible to use knee operating system.

- Standard or clinical sinks/basins: At least one handwashing facility should be provided at: consultation rooms; laboratory and sterilization units; kitchens and laundry facilities; soiled utility rooms; housekeeping store rooms; and waste zones.
- Handwashing facilities should be provided in all staff changing rooms and toilet facilities.

Specific recommendations for alcohol-based handrub (ABHR) dispensers:

- For optimal compliance with hand hygiene, ABHRs should be readily available, either through dispensers close to the point of care or in small bottles for on-person carriage (4).
- The following characteristics should be considered a prerequisite for all dispensers and their placement:
    - Easy and unobstructed access
    - Logical placement
    - Standardised (regarding fillings/containers and "No-touch" system (operable hands-free) (2)
- Provide ABHR dispensers at: the foot of every patient bed or adjacent wall, at other multi-use patient care areas such as consultation rooms, and at the entrance of each inpatient unit, outpatient clinic, and other departments (3).

Cleaning and disinfection

Floor finish:

- In general, flooring in clinical areas should be seamless, smooth, slip-resistant and easily cleaned (5).
- Vinyl flooring should be the first option for the majority of the hospital's areas (see table 3). Nevertheless, if the proper quality of materials and installation of vinyl or resin cannot be guaranteed, the use of ceramic tiles is recommended as an alternative.
- For wet areas, such as in the laundry, mortuary, kitchen, and toilet facilities, ceramic tiles are recommended.

Wall finish:

- In general, wall finish should be fluid-resistant and easily cleaned, especially in areas where contact with blood or body fluids may occur (e.g. laboratories, operating rooms) and finish applied around plumbing fixtures should be smooth and water resistant (6).
- Using oil-based paint is recommended in all areas of the hospital, with the exception of wet areas (see table 4).
- For wet areas, such as toilets, kitchen, soiled utility room and sterilization unit, ceramic tiles should be used.

Ceiling finish:

- In general, an oil-based paint should be used in all areas of the hospital.

Working top material:

- In general, stainless steel should be used for most working surfaces in clinical and support areas.

- For laboratory worktops, a laminated surface is the most straightforward option. Whenever there is sufficient budget, hard resin should be used.

Support areas for cleaning and disinfection:

- **Housekeeping storeroom**[7]**:** Designate an area for storing materials and equipment used to clean and disinfect environmental surfaces (floors, walls, ceiling, and working surfaces). The number and location of housekeeping storerooms should be defined on a case-by-case basis. A general recommendation would see housekeeping storerooms provided at:
    - Surgical Dept., easily accessible from the operating room
    - Obstetrics Dept., easily accessible from the delivery room
    - Emergency Dept., easily accessible from the resuscitation and procedure room
    - Intensive care units and Inpatient dept.
    - Kitchen, laundry, and waste zone
    - Toilet and shower facilities (any cleaning materials used to clean toilet facilities should not be used to clean other areas of the healthcare facility)
- **Equipment room:** Designate an area for the cleaning and disinfection of equipment (e.g. patient beds, trolleys, incubators, etc.). This area should be placed close to where the equipment is used.
- **Sterilization Unit:** Designate a centralized decontamination and/or sterile supply department for the decontamination and sterilization of medical devices and other items/equipment (1) (see OCB guidelines).

Transmission-based precautions

- To achieve effective isolation, designated single rooms (preferably with private toilet and shower facilities) should be available for the placement of suspected or confirmed infectious patients (1).
- Provide at least one room dedicated to the isolation of patients at hospital facilities.
- Preferably, the isolation room should come equipped with an anteroom for staff to change clothes (PPE) wherever needed, creating a transition space between common areas and patient areas.

General support areas

- **Soiled utility room:** Provide a dedicated area for the disposal of body fluids and liquids, as well as for the temporary storage of waste, soiled linen, and soiled reusable medical devices (RMD). A dedicated soiled utility room should be provided at: Surgical Dept.; Obstetrical Dept.; Emergency Dept.; Intensive Care Units; and Inpatient Dept.
- **Staff changing room:** Provide facilities for staff to change clothes and/or shower whenever needed, before and after entering clinical/work stations. A designated staff changing room should be provided at: Surgical Dept.; Obstetrical Dept.; Emergency Dept.; Intensive Care Units; and Inpatient Dept.
- **Toilet and shower facilities**: Provide at least one toilet designated for women/girls to manage menstrual hygiene needs; one separate toilet for staff; and at least one toilet meeting the needs of people with limited physical abilities. A minimum of one toilet for every 20 users should be provided in inpatient settings (1). However, the

[7] This functional area should not be merged with the soiled utility room.

number and location of toilet and shower facilities in any given hospital environment should be discussed on a case-by-case basis.

- **Clean supply storage**: Designate a clean storage area for patient care items and equipment, including sterile material, and a separate area for the storage of clean linen (1).

Hand Hygiene

Hand hygiene is defined as any action of hygienic hand antisepsis to reduce transient microbial flora. It is generally performed either by hand rubbing with an alcohol-based formulation or by hand washing with either plain or antimicrobial soap and water. Hand hygiene is considered a major component of standard precautions and the most important measure that can be taken to prevent healthcare-associated infections. Moreover, considerable evidence exists which demonstrates that hand hygiene can reduce the transmission of pathogens, thus decreasing HAI rates and cross-transmission of antimicrobial resistant pathogens (2).

According to WHO, successful and sustained hand hygiene improvement can be achieved through implementing a multimodal strategy, addressing different obstacles and behavioural barriers. The multimodal strategy consists of the implementation of several components[8] of the WHO Multimodal Hand Hygiene Improvement Strategy, where all components are considered crucial for the establishment and effective function of IPC programmes (4).

One of the five essential components of the multimodal strategy is the 'system change', which refers to the work system where hand hygiene takes place and to the **infrastructure** (equipment and facilities) that enables proper compliance to hand hygiene guidelines (1). The infrastructure required to perform hand hygiene is directly linked to the built environment and is reflected in the healthcare facility design requirements.

Hand hygiene infrastructure

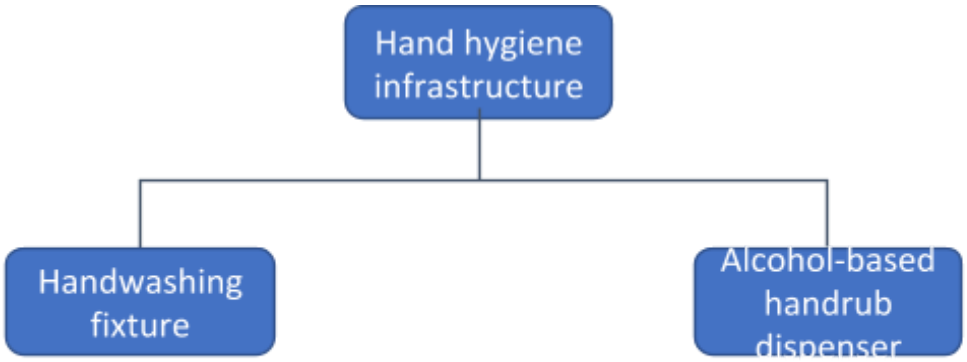
All components of the multimodal strategy are considered equally important; nevertheless, WHO states that hand hygiene compliance is only possible if adequate infrastructure and supply of hand hygiene products are ensured at the right time and location. In general, WHO recommends providing ready availability and optimal placement of hand hygiene materials and equipment at the point of care (1).

Although WHO Guidelines provide a comprehensive review of scientific data and include technical information to plan implementation strategies, it is necessary to identify recommendations that are specific to each functional area of healthcare facilities, in addition to identifying suitable options for resource-limited settings. Recommendations for hand hygiene infrastructure should address the different types of suitable equipment as well as their appropriate location and quantity.

The first aspect to consider when designing hand hygiene infrastructure is the choice between a handwashing fixture and an alcohol-based handrub dispenser. This includes weighing the appropriateness and feasibility of the different types of equipment that fall under those two options, as represented in the graphic below:

Hand hygiene infrastructure

[8] The five essential elements of the WHO multimodal hand hygiene improvement strategy: (1) **system change**, including availability of alcohol-based handrub at the point of patient care and/or access to a safe, continuous water supply and soap and towels; (2) **training and education** of healthcare professionals; (3) **monitoring** of hand hygiene practices and performance feedback; (4) **reminders** in the workplace; and (5) **cultural change,** the creation of a hand hygiene safety culture with the participation of both individual HCWs and senior hospital managers (2).



Types:

- Clinical/Standard sink/basin for hand washing/disinfection
- Scrub sink for hands and forearms washing/ disinfection

Types:

- Wall- and bed-mounted dispensers
- Table-top dispensers (pumps)
- Pocket- and clip-on dispensers
- Automated-wall mounted

Tapware:

- Hands-free (touchless) taps/faucet
  - Elbow-operated taps
  - Foot or knee-operated taps
  - Sensor-activated (Infrared)
- Hand-operated taps/faucets
  - Wall or basin taps

Handwashing fixture and Alcohol-based handrub dispensers

The recommendations of the WHO-mandated international panel of experts propose indications for hand hygiene in healthcare activities that could be used worldwide. These evidence- and consensus-based recommendations aim for optimal hand hygiene practices and successful hand hygiene promotion. The following recommendations refer to the indications for hand hygiene and the use of handwashing fixture or Alcohol-based handrub dispensers, as described later (2):

Handwashing fixture:

- Wash hands with soap and water when visibly dirty or visibly soiled with blood or other body fluids, or after using the toilet.
- If exposure to potential spore-forming pathogens is strongly suspected or proven, including outbreaks of Clostridium difficile, hand washing with soap and water is the preferred means of performing hand hygiene.

Alcohol-based handrub:

- Use an alcohol-based handrub as the preferred means of routine hand antisepsis in all clinical situations listed below:[9]
    - Before and after touching the patient
    - Before handling an invasive device for patient care, regardless of whether or not gloves are used
    - After contact with body fluids or excretions, mucous membranes, non-intact skin, or wound dressings
    - If moving from a contaminated body site to another body site during the care of the same patient
    - After contact with inanimate surfaces and objects (including medical equipment) in the immediate vicinity of the patient
    - After removing sterile or non-sterile gloves
- Before handling medication or preparing food, perform hand hygiene using an alcohol-based handrub or wash hands with either plain or antimicrobial soap and water.

Remark: Soap and alcohol-based handrub should **not** be used concomitantly (2).

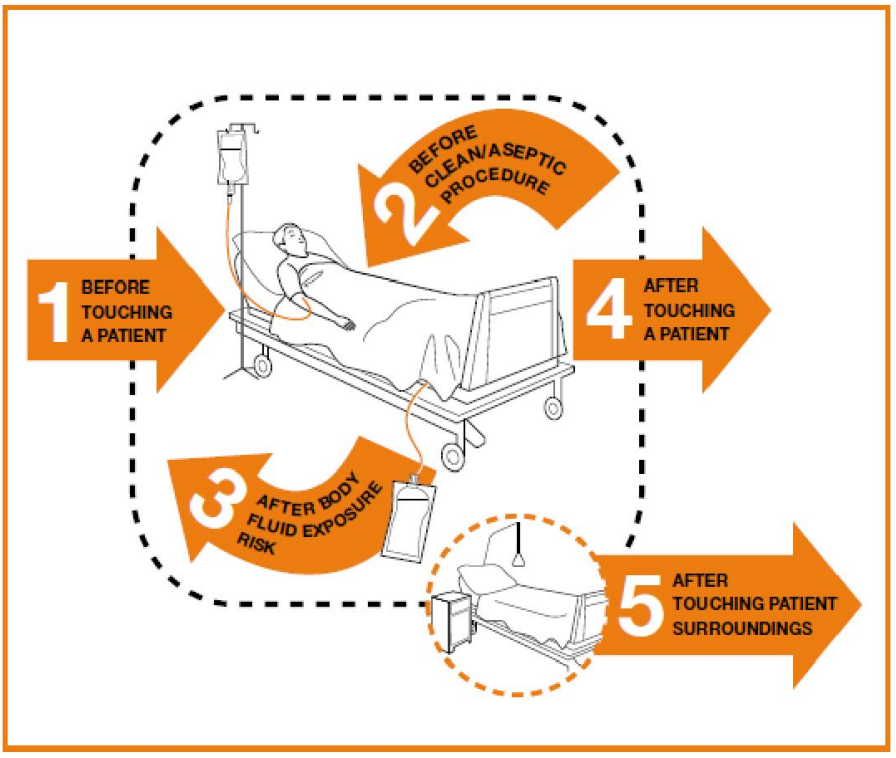


Figure 1: Unified visuals for "My five moments for hand hygiene" (2)

A systematic review of publications between 1992 and 2002 regarding the effectiveness of alcohol-based solutions for hand hygiene showed that alcohol-based handrubs remove organisms more effectively, require less time, and cause skin irritation less often than handwashing with soap or other antiseptic agents and water (7) (2). At present, alcohol-based handrubs are the only known means of rapidly and effectively inactivating a wide range of potentially harmful microorganisms on hands (8) (9) (10) (11). WHO recommends alcohol-based handrubs based on the following factors (2):

[9] If alcohol-based handrub is not obtainable, wash hands with soap and water (2).

- Evidence-based intrinsic advantages of fast-acting and broad-spectrum microbicidal activity with minimal risk of generating resistance to antimicrobial agents.
- Suitability for use in resource-limited or remote areas with lack of accessibility to sinks or other facilities for hand hygiene (including clean water, towels, etc.).
- Capacity to promote improved compliance with hand hygiene by making the process faster and more convenient.
- Economic benefit by reducing annual costs for hand hygiene, representing approximately 1% of extra-costs generated by HCAI.
- Minimization of risks from adverse events because of increased safety associated with better acceptability and tolerance compared with products.

While handwashing fixtures are needed to clean soiled hands and are a crucial component in the effort to prevent and control infections in healthcare facilities, there is some evidence suggesting a transmission route of pathogens from sinks to hands (12) (13). Sink drains can accumulate strains with resistance genes and become a potential source of pathogens (13); drains can then function as an open bacterial reservoir (14). The drains of a handwashing fixture can contain stagnant water, which supports the growth of microorganisms that can be a source of and be transferred to hands during hand hygiene procedures (15) (16).

Removing sinks from patient rooms and introducing 'water-free'[10] patient care has been associated with a significant reduction of HAI cases in Intensive Care Units (17). Additionally, the introduction of a waterless system for hand hygiene is considered a cost-effective measure (2). Consequently, at settings where alcohol-based handrub supply and quality can be ensured, it is recommended to assess the possibility of removing sinks in the patient zone, especially in functional areas where critical patients are treated or placed, such as NICU and ICU wards. Nevertheless, it might still be necessary to guarantee access to an alternate means of handwashing, such as mobile handwashing basins,[11] to allow staff to perform hand hygiene when hands are visibly soiled.

According to WHO, successful behavioural hand hygiene promotion programmes can induce increased compliance. However, as ingrained hand hygiene behaviour can persist, it may be necessary to continue requiring handwashing with water and soap. Thus, the provision and accessibility of sinks must continue to be carefully considered when designing healthcare facilities (2).

Specifications for hand hygiene equipment

WHO recommends providing bottles of alcohol-based handrub, positioned at the point of care in each ward (or handed out to staff), and at least one sink for every ten beds, with soap and fresh towels available at every sink (2).

Hand hygiene products, such as alcohol-based handrub, should be easily accessible and placed within arm's reach of where patient care or treatment is taking place. Ideally, the infrastructure for hand hygiene should be accessible to staff in a way that allows them to perform hand hygiene without to leaving the patient zone (2).

[10] All patient care related activities taking place in the patient room and would normally involve the use of tap water were adapted to a 'water-free' alternative (17).
[11] Mobile handwashing basins were used in the study conducted by Hopman et al. (17)

Additional recommendations for the location of Alcohol-Based Hand Rub (ABHR) dispenser include (3):

- At the foot of every patient bed or adjacent wall.
- Affixed to mobile work trolleys (e.g. intravenous, drug and dressing trolleys).
- In areas with high staff traffic (e.g. staff station, utility rooms and at the entrance to patient rooms).
- In other multi-use patient care areas, such as consultation rooms.
- At the entrance of each inpatient unit, outpatient clinic, and other departments.
- In public areas such as waiting rooms, receptions areas, hospital foyers, and near elevator doors in high traffic areas.

In primary care and outpatient settings where clinical procedures or examinations of patients/clients are undertaken, a clinical hand-wash basin should be placed close to where procedures take place (5).

Handwashing fixture equipment

Hand washing fixtures can be divided into two types pertaining to their intended function: **standard or clinical sinks/basins** for hand washing/disinfection; and **scrub sinks** for hand and forearm washing/disinfection. Wherever hand hygiene guidelines require the washing/disinfection of hands and forearms,[12] such as in the surgical department, a scrub sink should be provided. For all other cases, such as consultation rooms and toilet facilities, a standard/clinical sink/basin should be adopted.

Sinks/basins have different models and sizes that will vary in accordance with local markets. Nevertheless, all sinks should follow the recommendations below[13]:

- Basins should be provided with clean water, soap, single-use or clean reusable towels, and wherever possible, they should be hands-free operable (2).
- The water stream from a faucet should not fall directly into the waste outlet to prevent the possible aerosolisation of pathogens residing in the waste outlet (18) (19).
- Taps should be fitted with an aerator screen.[14] The mesh of the aerator screen should be sufficiently wide to ensure that no water remains on top of the aerator screen, as this may lead to bacterial contamination and consequent spread of microbes (19) (2).
- Hand washing basins should be large enough to control splashing and be designed so that any water retention is avoided. Also, walls adjacent to hand wash basins should be made of non-porous material (20).
- Sinks/basins should have no overflow; have curved sides; be either sealed to the wall or far enough away from the wall to allow effective cleaning (3).
- Tap water should be delivered at a suitable temperature to allow hand washing under running water (3).
- Hand basins should be made of hard, non-scratch material (usually porcelain or stainless steel) and be easy to clean and disinfect (3).

[12] It would be desirable to investigate if there is a necessity to provide a sink for washing/disinfecting hands and forearms in the delivery room, at the Obstetrics Department, as well as in the resuscitation room in the Emergency Department.
[13] Wherever possible use the standard model available in MSF catalogue.
[14] An aerator screen is a mesh screen made of metal or plastic that is attached to the end of a faucet, simply screwed onto the faucet head, creating a non-splashing stream and often delivering a mixture of water and air.

Additional recommendations for scrub sinks:

- Should have sufficient space between the waterspout and the sink to enable adequate washing up to the elbow. The basin should be a large wall-mounted type, with hands-free taps, with warm and cold water delivered by a common spout (3).
- If the sink does not have foot controls or long handles to operate with elbows, either ask someone else to turn off the tap or use the towel to turn off the tap to avoid re-contaminating hands (21).
- Should be designed to reduce the risk of splashes (2).

Basin/sink tapware

According to WHO, it is preferable to enable handwashing without requiring touching the tap with soiled hands. Ideally, taps should be opened by using an elbow or a foot[15]; in settings without budget restrictions sensor-activated taps may be used (2).

The WHO guidelines for hand hygiene states that manual or elbow- or foot-activated taps should be considered the optimal standard within healthcare settings. However, recommendations for their use are not evidence-based. Furthermore, it should be noted that the provision of hands-free operable tapware is not among the highest priorities for IPC, particularly in settings where both budget and local resources are limited (2).

Regarding the use of sensor-activated taps, it should be noted that the electrical system's reliability and local availability of spare parts for maintenance require assessment. Electronically-activated taps present maintenance and reliability issues; if the unit fails due to technical reasons, it could result in the failure of the hand hygiene programme (2).

Handwashing basins tapware advantages and disadvantages:

Elbow-operated taps	
Advantages: ● Do not require hand contact at any point during the hand-washing operation, avoiding cross-contamination between users. ● Low maintenance and easy to install. ● Simple and reliable design. ● Easy to install and maintain (22).	Disadvantages: ● Usually not available in resource-limited settings. ● Local availability of spare parts for maintenance cannot be guaranteed (22).
Foot or knee-operated taps	
Advantages: ● Designed for water control where users must not touch taps. ● Reduce risk of pathogenic hand contamination by avoiding contact between hands and tap surfaces. ● Water saving – automatically switch water off after operation (22).	Disadvantages: ● Usually not available in resource-limited settings. ● Local availability of spare parts for maintenance and local labour skills for installations cannot be guaranteed.
Sensor-activated (Infrared)	
Advantages:	Disadvantages:

[15] It is also possible to use knee operating system.

● Do not require hand contact with the tap at any point during the handwashing operation, avoiding cross-contamination between users (22). ● Can be programmed to control water flow (time and volume).	● Usually not available in resource-limited settings. ● Local availability of spare parts for maintenance and local labour skills for installations cannot be assured. ● Electronically-activated taps present maintenance and reliability issues. Unit failure could result in the failure of the hand hygiene programme (2). ● Requires a reliable electrical supply. ● Sensor taps require higher initial investment than traditional taps (22).
Wall/Basin taps (hands operable)	
Advantages: ● Locally available, spare parts can usually be found in the local market. ● Easy to install and maintain.	Disadvantages: ● Their use requires physical contact between hands and taps, creating a risk of cross-contamination between users.

Table 1: Handwashing basins tapware advantages and disadvantages.

Alcohol-based handrub dispenser equipment

For optimal compliance with hand hygiene, handrubs should be readily available, either through dispensers close to the point of care or in small bottles for on-person carriage. Dispensers may be affixed to patients´ beds or on walls or placed on bedside tables or in trolleys (4).

WHO guidelines recommend the use of multiple forms of dispensers in combination to achieve optimal compliance, such as wall-mounted and bottles for on-person carriage used at the point of care. The choice of the dispensing system will also be influenced by financial constraints as well as logistical concerns, such as the local availability of supplies and equipment. The advantages and disadvantages of the different dispenser methods are presented below (2):

Wall- and bed-mounted dispensers	
Advantages: ● HCWs know where they are – allows for attainment of hand hygiene in alignment with the “Five Moments” concept. ● Can be operated by a no-touch system (if elbow-operated). ● Standardised refill (freedom to choose other suppliers). ● Visible to staff, patients, and visitors.	Disadvantages: ● Not always placed in convenient locations; in some units, they will not align with the requirements of the “Five Moments” concept. ● Dependent on good service (refilling and maintenance). ● Patients and visitors can access and ingest (e.g. in areas where patients are confused and paediatric wards). ● Can splash on the floor and stain certain floor surfaces.
Table-top dispensers (pumps)	
Advantages:	Disadvantages: ● No fixed location.

• Use at the point of care allowing attainment of hand hygiene in alignment with the "Five Moments" concept. • Low cost.	• Patients and visitors can access and ingest (e.g. in in areas where patients are confused and paediatric wards). • Harder to avoid hand-to-pump touch, increased risk of cross-contamination.
Pocket- and clip-on dispensers	
Advantages: • Constant access by HCWs – increases the perception of self-efficacy among HCWs. • No access for patients and visitors for safety purposes (e.g. avoiding consumption by young or confused patients).	Disadvantages: • Can run out at the point of care, thus requiring back-up and facilitated access inwards to be refilled. • Considerable costs. • Dependent on the supplier (clip-on). • Environmental and disposal related concerns, if containers are not reused.
Automated-wall mounted	
Advantages: • Faster and 'aesthetically appealing'. • No touching required.	Disadvantages: • Unusable when out of order. • Costs of maintenance. • Dependent on supplier.

Table 2: Advantages and disadvantages of the different dispenser (WHO, 2009; page 138) (2)

Handrub dispenser requirements

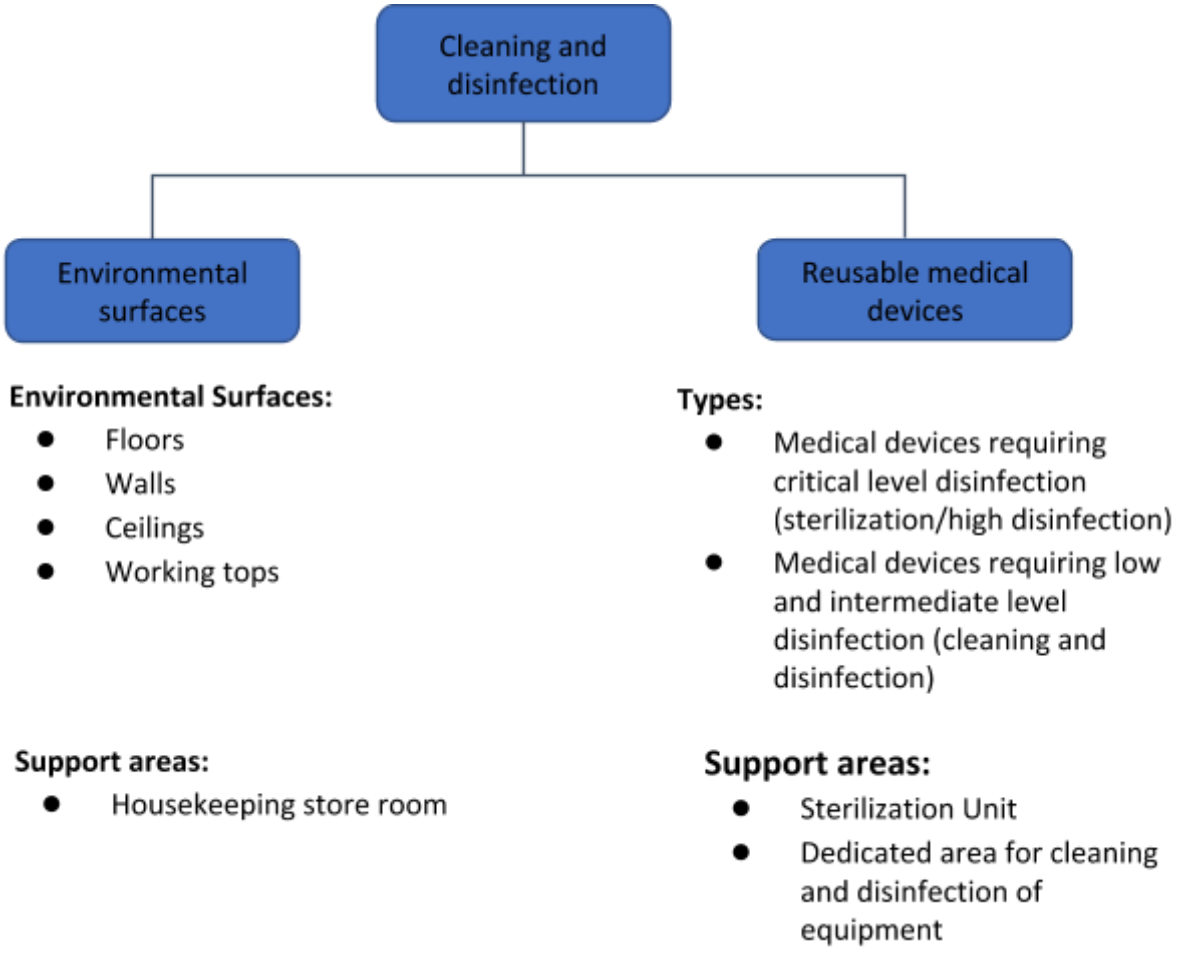
The following characteristics should be considered prerequisites for all dispensers and their placement (2):

- Easy and unobstructed access: Allow enough space around the dispenser, e.g. do not place under cupboards or next to other objects that hinder/obscure free access.
- Logical placement: Healthcare workers should know intuitively where dispensers are placed. They should be as close as possible e.g. to where patient contact is taking place, to avoid having to leave the care/treatment zone.
- Wide availability: Available in all patient rooms (possibly at the bedside), all examination rooms and other points of care.
- Standardised (regarding fillings/containers): Standardisation should ensure that dispensers can be used with products from multiple brands, rather than being limited to a single manufacturer.[16]
- "No-touch" system (operable hands-free): To allow use by contact with a clean body part (e.g. elbow dispenser, or pump on a bottle operated by a clean wrist). This does not include pocket bottles or systems worn on HCWs' uniforms.
- Disposable reservoir: Dispensers should generally have a disposable reservoir (container/bottle) that should not be refilled. If reusable reservoirs have to be used, they should be cleaned and disinfected according to WHO guidelines.
- Avoid contamination: Dispenser design should eliminate the need for contaminated hands to come into direct contact with parts of the dispenser delivery system and/or any parts that will not be possible to clean.

[16] A "Euro-dispenser" has been developed that holds European standard 500 ml and 1000 ml containers (2).

Cleaning and disinfection

The subject Cleaning and Disinfection is divided in two components: environmental surfaces and reusable medical devices, as described in the diagram below:



This report considers environmental surfaces to comprise materials used to cover floors, walls, ceilings and working tops. It also includes recommendations for the housekeeping storeroom, considered an important functional area supporting the cleaning and disinfection of environmental surfaces. Recommendations for housekeeping storerooms are presented in the Support Areas chapter and in the annex report 'Technical Specifications for Finish Materials and Support Areas'.

Medical equipment surfaces are not considered to fall under the scope of the built environment and are therefore not included in this report. For recommendations on the design of sterilization units for reprocessing reusable medical devices, please refer to the OCB MSF 'Guideline for Planning and Design of Health care Facilities'.

Environmental surfaces

In 1991, to establish a correlation between surfaces and potential risk of transmission of infection, Centers for Disease Control (CDC) proposed an addition to Spaulding´s original

classification[17] for medical and surgical instruments (23), by introducing a category designated as "environmental surfaces". This additional category represents surfaces that do not come into direct contact with patients during care and are considered to carry minimum risk of disease transmission to patients and staff (23).

According to CDC, the principles of cleaning and disinfecting environmental surfaces should consider the intended use of the surface or item in patient care. Environmental surfaces can be safely decontaminated using less rigorous methods than those used on medical instruments and devices, and can be divided into two sub-categories (24):

- Housekeeping surfaces (e.g. floors, walls, and table tops).
- Medical equipment surfaces[18] (e.g. knobs or handles on haemodialysis machines, x-ray machines, instrument carts, etc.).

Housekeeping surfaces can be separated into surfaces with minimal hand-contact (e.g. floors and ceilings) and with frequent hand-contact or 'high touch surfaces' (e.g. doorknobs, bed rails, light switches, wall areas around the toilet in a patient's room, and the edges of privacy curtains) (25). Due to its scope, the report´s recommendations are limited to housekeeping surface only, defined here as floors, walls, ceilings and working surfaces/table tops.

Contaminated surfaces can serve as a reservoir of potential pathogens. Nevertheless, environmental surfaces are not directly associated with the transmission of infections to patients and staff (24). In this regard, the transfer of microorganisms from environmental surfaces to patients is fundamentally made through hand contact with surfaces (26) (27). There is limited evidence to suggest that floors, walls, and ceilings are a significant source of healthcare-associated infection (HAI) (28). According to CDC, the infection risk to patients from contaminated floors is small (24) (29), and pathogenic microorganisms do not readily adhere to walls or ceilings unless the surface becomes moist, sticky, or damaged (30). However, the appropriate selection of environmental surfaces – which takes into consideration its technical characteristics, cleaning and disinfection properties – is a fundamental step to reducing the potential risk of cross-contamination and healthcare-associated infection (HAI) (24).

The selection of housekeeping surfaces for healthcare facilities can be based on the properties of finish materials, such as permeability and seamlessness of surfaces, in addition to the expected performance outcomes, which will depend on the different requirements demanded by the activities within each healthcare facility functional area[19] (31). Nevertheless, some general criteria can be established for selecting environmental surfaces that will support the attainment of IPC requirements; the major parameters for the selection of finish materials are their cleaning and disinfection properties, especially in functional areas where contamination with blood or body fluid is likely to happen (5).

Environmental surfaces should then be allocated to specific functional spaces in accordance with patient and staff risk factor of acquiring an infection. In principle, environmental

[17] The Spaulding classification for medical and surgical instruments outlines three categories based on the potential for the instrument to transmit infection if the instrument is microbiologically contaminated before use, defined as "critical," "semicritical," and "noncritical." (24)
[18] Medical equipment surfaces do not relate to the built environment and are therefore not included in this report.
[19] Classification functional areas: clinical dry; clinical wet; no-clinical dry; clinical specialist; no-clinical wet; heavy traffic; specialist patient areas. (31)

surfaces in areas for patients with an increased propensity for infection (e.g. immunosuppressed patients) and for patients at a higher infection risk (e.g. intensive care and burn units) must meet higher surface material property standards compared to, for example, administrative offices. In categorising these factors, clinical support areas such as clean supplies storage and sterilisation units, which have a direct link to patient's safety and possible exposure to transmission of infection, will also be considered (32).

The correlation between finish materials, functional spaces, and risk factors can inform decision making wherever financial or other operational constraints necessitate a prioritisation of investments. By providing a clear categorisation of risk factors associated with the use of a particular finish material in a particular setting, decision makers can ensure that priority will be given to the improvement of areas that present a higher risk for patients and staff, thus complying more closely with the prevention and control of HAI.

Another critical aspect to consider is the quality of materials and the installation of housekeeping surfaces. Whenever housekeeping surfaces are not properly fitted or consist of low-quality components, their required properties – such as permeability and seamlessness – may be compromised. Irregularities in the surface might propitiate the accumulation of pathogens as well as complicate its proper cleaning and disinfection (33). Additionally,, factors such as the appropriateness of the existing floor or walls to serve as a sub-base for the installation of new finishes, the local availability of finish materials, and skilled labour for their installation should be considered (34).

Floor finish

Flooring materials can be classified as hard (ceramic tiles, concrete, etc.), resilient (vinyl sheet, rubber, and linoleum) or soft (carpets, textile – these are not included in this report). Within each category, flooring finish suitability for use is defined by certain properties, which include: permeability, smoothness, slip-resistance, fire hazard properties, dirt retention/control, component size, and method of joining, among others (35) (34).

In general, flooring materials in clinical areas should be seamless and smooth, slip-resistant, easily cleaned and comply with the following requirements (5):

- Coving should be fitted between the floor and the wall to prevent accumulation of dust and dirt in corners and crevices.
- Any joints should be welded or sealed to prevent accumulation of dirt and damage due to water ingress.
- In areas where frequent wet cleaning methods are employed (for example, clinical areas and operating rooms), floors should be made of materials that are unaffected by the chemical agents used for cleaning and resistant to any corrosion caused by disinfectants.
- Floors that are particularly subject to traffic when wet (bathrooms, kitchens) should have a slip-resistant surface, but still be easily to clean.

Where floors meet wall surfaces in wet areas, floor finish should be curved at the junction to avoid a square joint (turned up minimum 100mm from the floor), which assists cleaning maintenance and can improve infection control measures. Skirting in all clinical areas and functional spaces subject to frequent wetting cleaning methods should be integrated with the floor, tightly sealed against the wall and constructed without voids (3).

The selection of floor finishes should also consider operational constraints, such as costs, the availability of local skilled labour for installation, the availability of finish materials in the local market, the time frame of operations (emergency or long-term projects), and the full life-cycle, maintenance and sustainability of the floor wherever possible. For this particular report, which addresses requirements for IPC, cleaning and disinfection properties of finish materials were prioritised.

For MSF operational contexts, four suitable materials were identified, selected on the basis of their practicality in relation to the various requirements of different zones. These are: vinyl sheeting, resin, ceramic tiles, and concrete floors. Among those options, vinyl flooring should be the first option for the majority of the hospital's areas (see table 3). Since its introduction to the market, polyvinylchloride (PVC) or 'Vinyl' sheet has been one of the primary flooring materials used in healthcare facilities. Its inherent characteristics, such as durability, resilience and imperviousness, can provide low-maintenance and hygienic solutions (34). Although the use of vinyl is prevalent and accepted in the healthcare environment globally (35), vinyl is usually not available in the majority of resource-limited settings, and frequently there is no skilled labour to carry out its installation, which makes vinyl an unviable option in several settings where MSF works.

In MSF contexts, resin or ceramic tiles can provide an alternative to vinyl. Resin produces continuous, seamless coatings, a high chemical resistance, a more impervious surface than cementitious coatings, and (unlike tiles) it is without joints (35). However, resin is more expensive than tiles and concrete flooring, its installation requires specialised labour, and if not correctly applied, might provide inferior performance outcomes compared to tiles. Wherever resin is available, and satisfactory installation can be ensured, it could replace vinyl, especially in critical areas.

If the proper quality of materials and installation of vinyl and resin cannot be guaranteed, ceramic tiles can be used as an alternative. The individual tile unit complies with selection criteria for the majority of the areas in a healthcare facility (being impervious and easy to clean and disinfect) (35). Ceramic tiles were frequently used in healthcare facilities before Vinyl became widespread (34). To this day, tiles are the most commonly used finish in wet areas, such as laundry, mortuary, kitchen, toilets, utility and cleaning areas, due to their impervious quality and efficient performance under wet conditions (35). Tiles are also less expensive than vinyl and resin, and can be found and installed practically worldwide, especially in resource-limited settings.

Regarding costs, concrete floors come at the lowest price of all finish materials selected. However, they present several negative aspects regarding IPC. Large concrete surfaces require joints that can store moisture and encourage microbial growth (35) and hairline cracking and other defects are common (34). Because of their dark colour, concrete floors make it more difficult to identify soiled areas, and mechanical cleaning is less straight-forward when compared with tiles or resin. Furthermore, when consulting the literature, no recommendation was found for the use of concrete floors in any internal areas of healthcare facilities – only for outside areas and warehouses.

Floor finish according to infection risk and functional areas[20]:

Zones	Infection risk	1st option	2nd option	3rd option	4th option
Zone I	**Low or negligible risk** Example: offices, administrative services, lobby, technical services, stairways, technical sector (workshop), logistics sector (storehouse), pharmacy, etc.	Vinyl, resin or ceramic tiles	Concrete	-	-
Zone II	**Moderate risk** Example: maternity, functional rehabilitation care, functional rehabilitation rooms, outpatient consultation, central sterilization (washing area), morgue, bathrooms, waiting rooms, waste storage and treatment area, laundry, kitchen, changing rooms, corridors, etc.	Vinyl	Resin	Ceramic tiles	Concrete
Zone III	**High risk** Example: intensive care unit, emergency department, post-anaesthesia care unit/recovery room, delivery rooms, paediatrics, surgery, internal medicine, central sterilisation (packaging area), laboratories, isolation, operating room dressing rooms, etc.	Vinyl	Resin	Ceramic tiles	Concrete
Zone IV	**Very high risk** Example: operating rooms, burn unit, etc.	Vinyl	Resin	Ceramic tiles	Concrete

Table 3: Floor finish according to infection risk and functional areas

Wall finish

As a general recommendation, wall finish should be fluid resistant and easily cleaned, especially in areas where contact with blood or body fluids may occur (e.g. laboratories or operating rooms), and finish around plumbing fixtures should be smooth and water resistant (6). Other requirements from the best practices guidance for IPC in the built environment from the UK Department of Health for walls are (36):

- Smooth, hard, seamless and impervious surfaces are required in clinical areas as they are easier to clean.
- Wall surfaces are to be free from fissures, open joints or crevices.
- Walls penetrated by pipes, ducts, and conduits are to be sealed tightly to stop entry of pests, to maintain acoustic integrity, to maintain fire resistance and for hygienic reasons.

[20] Risk categories from MSF-OCP Hygiene Guidelines for Health Care Facilities, 2013.

- Wall finish should not comprise materials that promote or sustain the growth of fungi and microorganisms.
- Wall finish is to be durable and able to withstand minor impacts without the need for additional wall protection.
- Wall finish is to be impermeable and easily wiped over if necessary and not be physically affected or degraded by detergents and disinfectants.

The quality of the wall finish is directly associated with the quality of the substrate, especially with a liquid finish such as paint. Poor quality of the substrate or plaster will affect the integrity of the smoothness and impervious finish, where cracks in the plaster can become a reservoir of pathogens (12).

As with floor finishes, cleaning and disinfection properties are prioritized in tandem with IPC requirements. Nevertheless, the selection of wall finishes should also consider operational constraints such as costs, availability of local skilled labour for installation, local availability in the market, time of operations (emergency or long-term projects) and the full life-cycle and maintenance/sustainability wherever possible. In this regard, for MSF operational contexts, four suitable materials were identified, selected on the basis of their practicality in relation to the various requirements of different zones. These are: oil-based painting, porcelain and ceramic tiles, and water-based painting.

Washable, water-resistant oil-based painting is recommended for the majority of hospital areas (except for wet areas, see table 4). Oil-based paints have a seamless finish produced by painted plaster, ideal for areas where infection prevention is paramount as the surface is impervious to water, oil, and other fluids. Oil-based paint is relatively inexpensive compared to other wall finish. However, any mechanical damage can lead to small cracks and the potential risk of adhering pathogenic microorganisms in the wall surfaces (33).

Ceramic tiles are recommended for all wet areas, such as toilet facilities, changing rooms, soiled utility rooms, housekeeping storerooms, kitchen, and laundry and sterilisation unit. For outside areas, water-based paint is recommended.

Wall finish according to infection risk and functional areas:[21]

Zones	Infection risk	1st option	2nd option
Zone I	**Low or negligible risk** Example: offices, administrative services, lobby, technical services, stairways, technical sector (workshop), the logistics sector (storehouse), pharmacy, etc.	Water-based paint	-
Zone II	**Moderate risk (dry)** Example: maternity, functional rehabilitation care, functional rehabilitation rooms, outpatient consultation, morgue, waiting rooms, changing rooms, corridors, etc.	Oil-based paint	-
	Moderate risk (wet)	Ceramic tiles	Oil-based paint

[21] Risk categories from MSF-OCP Hygiene Guidelines for Health Care Facilities, 2013.

	Central sterilisation (washing area), bathrooms, waste storage and treatment area, laundry, kitchen.		
Zone III	**High risk (dry)** Example: intensive care unit, post-anaesthesia care unit/recovery room, paediatrics, surgery, internal medicine, central sterilisation (packaging area), operating room dressing rooms, etc.	Oil-based paint	-
	High risk (wet) Emergency department, delivery rooms, laboratories, isolation.	Ceramic tiles	Oil-based paint
Zone IV	**Very high risk** Example: operating rooms, burn unit, etc.	Ceramic tiles	Oil-based paint

Table 4: Wall finish according to infection risk and functional areas

Ceiling finish

Ceilings can be divided into three types: actual structure overhead (concrete slab); membrane fixed directly to the structure overhead (for example a nail-up ceiling board, not included in this report); and a membrane suspended from the structure overhead (suspended grid system) (37). Possible types of installation of ceilings:

- Concrete slab: Surface finish can range from off-shutter smooth concrete to plastered and painted surface treatment. It has limited flexibility for service outlets (could not be hidden under the ceiling), however it provides a stable structure where more massive fittings need to be attached to the ceiling (e.g. surgical lamps).
- Suspended grid system: This allows flexibility for positioning lights, ventilation, and other services. Replacement of damaged areas is simple and the easy access to technical installations for maintenance.

Ceiling finish in clinical areas should be easily cleaned and not physically affected or degraded by detergents and disinfectants (36). Smooth surfaces on concealed suspension systems should be impervious and able to withstand hard cleaning regimes. This system requires maintenance and might harbour dust and pests; therefore, it should be avoided in high-risk areas unless adequately sealed (29).

Ceiling structures should cover all conduits, piping, ductwork and open construction systems. Ceilings in critical areas and clean storages must be monolithic from wall to wall without fissures, open joints, or crevices that may retain dirt particles (38). For each type of ceiling, different finishes can be applied, such as paint on seamless plaster or plywood, vinyl-clad ceiling tiles, or polyester. In any case, ceiling finish and materials should be smooth, impervious and joint-less/seamless (37).

Working surfaces (Table tops)

For this report, three finish materials were selected for working surfaces: stainless steel, laminated, and hard resin. All three have the necessary properties for medical use and can be applied as working surfaces, depending on the intended type of activity. In general, work surfaces should be impervious, designed for easy cleaning, and be free of fissures and

unsealed joints. They should be able to withstand the effects of regular cleaning with both detergents and disinfectants and be resistant to chemicals and moisture (39).

Working top material:

- In general, stainless steel should be used for most working surfaces in clinical and support areas.
- For laboratory worktops, a laminated surface is the most straightforward option. Whenever there is sufficient budget, hard resin should be used.

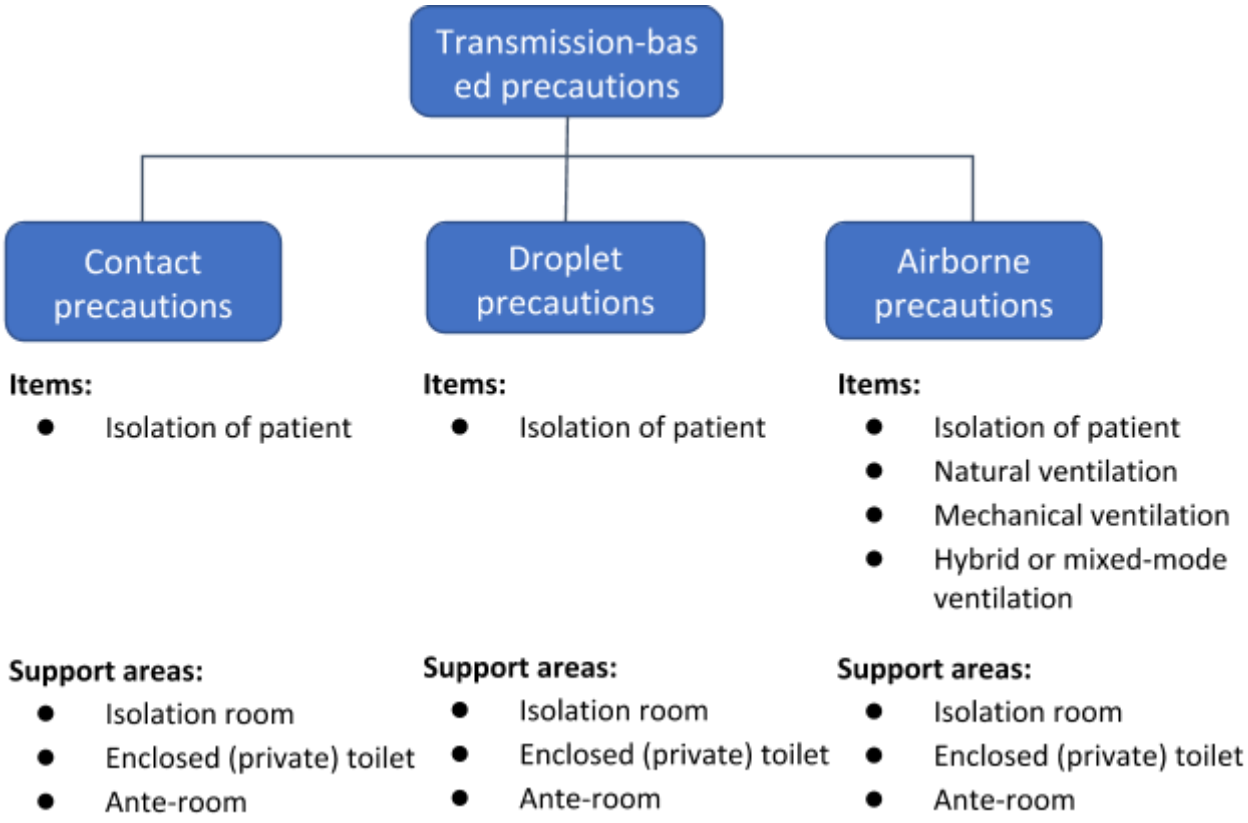
In resource-limited settings it is usual for working benches and counters to be covered with ceramic tiles. However, the joints of ceramic tile surfaces are porous and can retain moisture which encourages the growth of mould (33), and their use should therefore be avoided. Furthermore, the use of plastic (sheets), oil-based paint, or wood as working surfaces are advised against.

Transmission-based precaution

Transmission-Based Precautions refer to additional measures to the standard precautions and are designated for patients who are known or suspected to be infected or colonised with infectious agents that require additional control measures to effectively prevent transmission of pathogens (40).

The modes of transmission of pathogens can vary by type of organism, and some pathogens may be transmitted through more than one route. In general, the routes of transmission are direct or indirect contact, (e.g. Herpes simplex virus [HSV], respiratory syncytial virus, Staphylococcus aureus), droplets, (e.g. influenza virus, B. pertussis) or airborne routes (e.g. M. tuberculosis) (40).

Transmission-Based Precautions



According to WHO, to achieve effective isolation, designated single rooms (preferably with private toilet and shower facilities) should be available for the placement of suspected or confirmed infectious patients (1). Wherever possible transmission of an infectious agent is cause for concern, single-patient rooms are the preferred alternative, especially for patients requiring airborne precautions. However, in reality healthcare facilities in resource-limited settings are mostly provided with multi-bed rooms and have a limited number of single-patient rooms available (41).

It is common to group together (cohort) patients who are colonized or infected with the same organism. This practice is intended to restrict their care to one area and prevent contact with other patients. Nevertheless, considering that clinical patient status can be caused by more than one infectious agent, when available, single patient rooms are always the preferred option to isolate patients (41). Listed below are the CDC recommendations for isolation of patients based on the modes of transmission:

Contact precaution

Use Contact Precautions when dealing with patients with known or suspected infections that represent an increased risk for contact transmission (41).

- **Ensure appropriate patient placement** in a single patient space or room, if available, in *acute care hospitals*. In *long-term* and other residential settings, make room placement decisions that effectively balance risks to other patients. In *ambulatory settings*, place patients requiring contact precautions in an exam room or cubicle as soon as possible.

- **Use personal protective equipment (PPE) appropriately,** including a gown and gloves. Wear a gown and gloves for all interactions that may involve contact with the patient or the patient's environment. Donning PPE prior to entering a patient room and then adequately discarding them before exiting will aid the effort to contain pathogens.
- **Limit transport and movement of patients** outside of the room for medically-necessary purposes. When transport or movement is necessary, cover or contain the infected or colonised areas of the patient's body. Remove and dispose of contaminated PPE and perform hand hygiene before transporting patients who have been assigned Contact Precautions. Don clean PPE to handle the patient at the transport location.
- **Use disposable or dedicated patient-care equipment** (e.g. blood pressure cuffs). If common use of equipment for multiple patients is unavoidable, clean and disinfect such equipment before use on another patient.

Droplet precaution

Use Droplet Precautions for patients known or suspected to be infected with pathogens transmitted by respiratory droplets that are generated by a patient who is coughing, sneezing, or talking (41).

- **Ensure appropriate patient placement** in a single room if possible, in *acute care hospitals*. If single rooms are not available, follow the recommendations for alternative patient placement considerations in the Guideline for Isolation Precautions. In *long-term care* and other residential settings, make decisions regarding patient placement on a case-by-case basis, considering infection risks to other patients in the room and available alternatives. In *ambulatory settings*, place patients who require Droplet Precautions in an exam room or cubicle as soon as possible and instruct patients to follow Respiratory Hygiene/Cough Etiquette recommendations.
- **Use personal protective equipment (PPE) appropriately.** Don a mask upon entry into the patient room or patient space.
- **Limit transport and movement of patients** outside the room to medically-necessary purposes. If transport or movement outside of the room is necessary, instruct the patient to wear a mask and follow Respiratory Hygiene/Cough Etiquette.

Airborne precaution

Use Airborne Precautions for patients known or suspected to be infected with pathogens transmitted by an airborne route (e.g. tuberculosis, measles, chickenpox, disseminated herpes zoster) (41).

- **Ensure appropriate patient placement in an airborne infection isolation room (AIIR [22])** constructed according to the Guideline for Isolation Precautions. In settings where Airborne Precautions cannot be implemented due to limited engineering resources, masking the patient and placing the patient in a private room with the door closed

[22] Airborne infection isolation room (AIIR). Formerly, negative pressure isolation room, an AIIR is a single-occupancy patient-care room used to isolate persons with a suspected or confirmed airborne infectious disease. Environmental factors are controlled in AIIRs to minimize the transmission of infectious agents that are usually transmitted from person to person by droplet nuclei associated with coughing or aerosolization of contaminated fluids. AIIRs should provide negative pressure in the room (so that air flows under the door gap into the room); and an air flow rate of 6-12 ACH (6 ACH for existing structures, 12 ACH for new construction or renovation); and direct exhaust of air from the room to the outside of the building or recirculation of air through a HEPA filter before returning to circulation (44).

will reduce the likelihood of airborne transmission until the patient is either transferred to a facility with an AIIR or has returned home.

- **Restrict susceptible healthcare personnel from entering the room** of patients known or suspected to have measles, chickenpox, disseminated zoster, or smallpox if other immune healthcare personnel are available.
- **Use personal protective equipment (PPE) appropriately**, including a fit-tested NIOSH-approved N95 or higher-level respirator for healthcare personnel.
- **Limit transport and movement of patients** outside the room to medically-necessary purposes. If transport or movement outside an AIIR is necessary, instruct patients to wear a surgical mask if possible, and observe Respiratory Hygiene/Cough Etiquette. Healthcare personnel transporting patients who are on Airborne Precautions do not need to wear a mask or respirator during transport if the patient is wearing a mask and infectious skin lesions are covered.

Support areas

Complementary to the three Pillars, this report provides recommendations for functional areas that are important to support IPC measures. According to WHO, several functional areas, such as appropriated sanitation facilities and areas dedicated to waste management, are essential for the provision of appropriate IPC measures (1).

Soiled utility room

WHO consider functional areas dedicated to waste management, such as sluice and bedpan cleaning areas, to be essential building features for the provision of appropriate IPC measures (1). The soiled utility room is a functional area used for the disposal of body fluids and liquids as well as for the temporary storage of waste, soiled linen, and soiled reusable medical devices (RMD). Usually, a soiled utility room in inpatient care areas (IPD and ICU) should provide facilities for the cleaning of bedpans.

The soiled utility room should be equipped with a collection point for soiled goods (soiled area), a hand wash basin, a sluice sink or flusher disinfector, and a storage area for PPE and cleaning material (for cleaning the soiled utility room premises). The soiled material collected should remain in the soiled utility room until it can be safely transferred to the sterilisation unit, laundry, and waste zone.

Some departments/units might require a dedicated soiled utility room, such as surgical dept. and intensive care units (6)[23], to facilitate the collection of waste, soiled linen and RMD. Wherever possible, the soiled utility room should be placed close to where the soiled material is generated, thus reducing the movement of soiled material through the hospital.

In all cases, the soiled utility room should be placed in a separate location to and without cross-flow with clean supply and medical equipment storage areas. Wherever possible, it should be near the nursing station and patient care areas. The Soiled Utility room area should not be merged with the Housekeeping Storeroom.

 For technical specifications, see annexe report: Soiled Utility Room.

[23] Including Obstetrics, Emergency and Inpatient Departments.

Housekeeping storeroom

An area should be designated for the storage of material and equipment used to clean and disinfect environmental surfaces (floors, walls, ceilings, and working surfaces) accessible to all clinical and non-clinical activities in the hospital. This functional area is intended for the storage of cleaning equipment and material, storage of PPE for hygienists, to provide facilities to refill/dispose of water used for cleaning surfaces, and to clean mops.

Some departments/units might require a dedicated housekeeping storeroom, such as surgical dept. and Intensive Care Units (6)[24], to facilitate their cleaning procedures and to avoid using the same cleaning equipment in different areas of the hospital, thus decreasing the risk of spreading pathogens between departments/units. In addition, providing a housekeeping storeroom that is easily accessible from toilet/latrine facilities, staff change rooms, sterilisation units, laundry, and kitchen is recommended. The feasibility of providing a housekeeping storeroom exclusively for the cleaning of staff changing rooms and toilet facilities should be considered.

Wherever possible, the housekeeping storage room should be placed in a separate location and without cross-flow with clean supply and medical equipment storage areas and near the nursing station and patient care areas. The Housekeeping Storeroom area should not be merged with the soiled utility room.

- For technical specifications, see annexe report: Housekeeping Storeroom.

Clean supply storage

Providing a dedicated clean storage area for patient care items and equipment, including sterile material, and a separate area for the storage of clean linen, is recommended (1). Such an area is used for storage of clean materials and sterile medical supplies as part of the healthcare facility system for distribution of goods.

The storage area could be a specific room, or cupboards placed out of the way of traffic. In small facilities, storage for clean supplies is provided by means of cupboards in the treatment areas and nursing station. Wherever possible, the clean supply storage should be placed in a separate location and without cross-flow with the soiled utility room and near the nursing station and patient care areas.

Personal hygiene and sanitation facilities

According to WHO, an essential requirement for IPC is to provide appropriated sanitation facilities, following international and national standards. Without the availability of sanitary facilities, as well as a safe water supply, IPC cannot be effectively implemented and healthcare worker, patient and visitor safety put at risk (1).

Staff changing room

This area should provide facilities for staff to change clothes and shower whenever needed, before and after entering clinical/work stations. This functional area provides a place for staff to store personal items/clothes in individual lockers, for temporary storage of staff

[24] Including Obstetrics, Emergency and Inpatient Departments.

soiled uniforms/clothes, and the provision of toilet and shower facilities. The staff changing room should provide separate changing areas for male and female staff members, and should have natural ventilation. Wherever natural ventilation is not possible, mechanical ventilation must be provided.

It is recommended to provide a dedicated staff changing room for staff working at the Surgical Dept. and Intensive Care Units (6)[25]. A dedicated staff changing room might have a positive impact on the prevention and control of infections by:

- Creating a barrier between hospital corridors (dirty areas) to critical areas (clean areas) where staff can perform hand hygiene, change clothes and/or wear PPE before accessing working stations. This is especially important for critical areas.
- Decreasing the movement of staff in and out of the dept/unit by providing a toilet facility easily accessible from staff working areas.

Whenever a dedicated staff changing room is added/included, the design of the changing room should be set up to promote a one-way traffic flow, so that staff coming from outside the department/unit can change clothes and shoes before entering their working areas.

Also recommended is the provision of a separate staff changing room easily accessible to staff working in supportive services, such as the kitchen, laundry and sterilisation unit. The number and location of staff changing rooms in the hospitals should be further discussed. Technical specifications regarding wastewater disposal should be discussed with a WatSan technical referent.

The general staff changing room should be located close to the hospital's main entrance, or the entrance used by the majority of staff. Staff should be able to change clothes and shower before accessing working/clinical areas.

For technical specifications, see annexe report: Staff Changing Rooms.

Toilet and shower facilities

The WHO recommends providing at least one toilet designated for women/girls to manage menstrual hygiene needs; one separate toilet for staff; and at least one toilet meeting the needs of people with limited physical disabilities. (1). A minimum of one toilet for every 20 users should be provided in inpatient settings (1). However, the number and location of toilet and shower facilities in any given hospital should be discussed on a case-by-case basis.

Technical specifications regarding wastewater disposal should be discussed with a WatSan technical referent; for technical specifications regarding the design of latrines, please consult Public Health Engineering in Precarious Situations, MSF 2010.

For technical specifications, see annexe report: Toilet and Shower Facilities

Accessibility standards for toilet and shower rooms

WHO recommends providing at least one toilet facility meeting with the needs of people with limited physical disabilities (1). Nevertheless, some consideration should be given to

[25] Including Obstetrics, Emergency and Inpatient Departments.

the fact that hospital settings entail a significant number of patients/users with permanent and/or temporary physical limitations, such as pregnant women, surgical or elderly patients, patients with fractures, etc. To make the building accessible to those with permanent and/or temporary physical disabilities, the hospital requires specific design standards.[26]

This report only provides recommendations for the design of toilet and shower facilities adapted for wheelchair users, as well as those suitable for the majority of physical disability cases. Additional information for the general building accessibility standards (ramps slops, the width of corridors, etc.) should be developed.

- For technical specifications, see annexe report: Accessibility Standards for Toilet and Shower Rooms.

[26] For further information, please consult: Committee ISO/TC59/SC16 (ed.), Building construction – Accessibility and usability of the built environment, ISO 21542:2011, International Organization for Standardization, Geneva, 2011.

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