

FIFTEEN

TRAFFIC FLOW AND ACTIVITY PATTERNS¹

KEY CONCEPTS you will learn in this chapter are:

- Why regulating traffic flow and defining activity patterns in hospitals and clinics are important
- How to design traffic flow and activity patterns in procedure, instrument processing and surgical areas
- What the traffic flow requirements are for these different areas

BACKGROUND

Microbial contamination is minimized by reducing the number of people permitted into an area and by defining the activities that take place there (Russell, Hugo and Ayliffe 1982).

Regulating the flow of visitors, patients and staff plays a central role in preventing disease transmission in healthcare facilities. Because the number of microorganisms in a designated area tends to be related to the number of people present and their activity, microbial contamination is expected—and found—to be high in areas such as waiting rooms and places where soiled surgical instruments and other equipment are initially processed.

An important objective of infection prevention is to minimize the level of microbial contamination in areas where patient care and instrument processing take place. Such areas include:

- **Procedure areas** where patients are examined and procedures (e.g., pelvic examinations, wound care management, blood drawing, immunizations, IUD insertions and removals, and normal childbirth) occur.
- **Surgical units** where major and minor operations are performed. The surgical unit also includes preoperative and recovery rooms as well as several other areas.
- **Work areas** where instruments are processed. These include dirty and clean areas where soiled instruments, equipment and other items are first cleaned and either high-level disinfected or sterilized and then stored.

¹ *Adapted from:* Tietjen, Cronin and McIntosh 1992.

It is important to direct activity patterns and traffic flow in these areas to keep contaminated areas separate from areas where procedures take place. Activities such as waste disposal, instrument processing and cleaning procedure areas should be carefully planned and organized to minimize the risk of infection to patients and healthcare workers. Equally important are designing and implementing traffic flow patterns that prevent soiled instruments and other items from crossing paths with cleaned, high-level disinfected or sterilized items.

Traffic flow also has to do with separating people who have, or are likely to have, communicable diseases from those who are at risk (susceptible). These people pose a great risk to susceptible patients and healthcare workers simply by being present in the same room; therefore, they need to be identified and quickly removed. For example, a child or teenager with a fever, an itchy rash on the head and body, and a negative history for chicken pox is best evaluated in the parking lot outside the hospital or clinic. Because triaging patients who may have a highly infectious disease involves staff quite different from those responsible for planning how to separate clean and dirty instruments, it is not addressed in this chapter. (Communicable disease triaging guidelines are fully described in **Chapter 21**.)

DEFINITIONS

- **At point of use.** Equipment, instruments and supply items are at the place where needed (e.g., sharps containers are placed within an arm's reach of where injections are being given).
- **Environmental controls.** Standards specifying procedures to be followed for the routine care, cleaning and disinfection of environmental surfaces, beds, bedrails, bedside equipment and other frequently touched surfaces.
- **Operating room.** Area or space where surgical procedures are performed.
- **Surgical unit.** Whole surgical area including the lockers and dressing rooms, preoperative and recovery rooms, peripheral support areas including storage space for sterile and high-level disinfected items and other consumable supplies, corridors leading to restricted areas, the operating room(s), scrub sink areas and the nursing station.

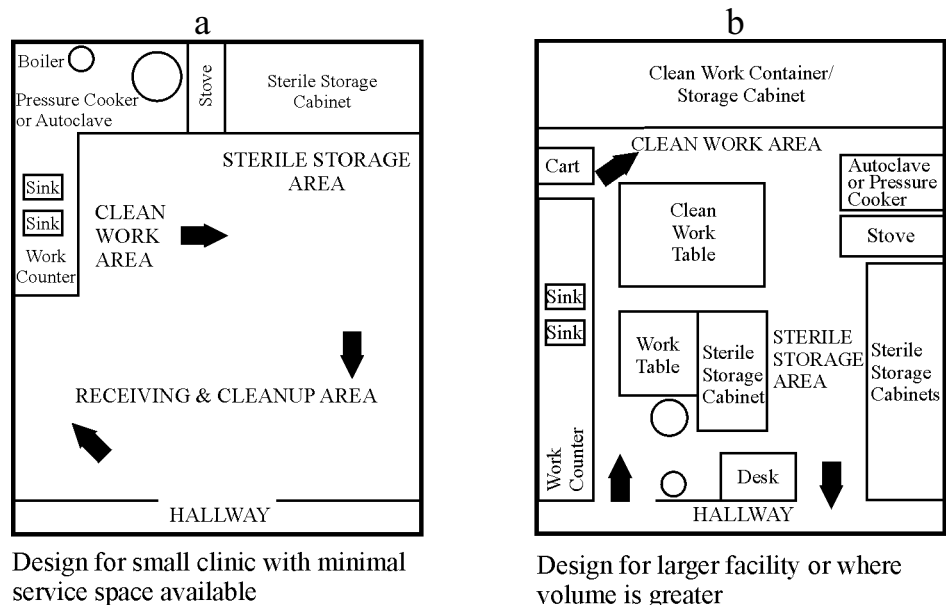
SPACE AND EQUIPMENT REQUIREMENTS

Healthcare facilities vary in the types of services they provide. For example, a rural clinic may offer only a few procedures (e.g., IUD insertion and removal, immunizations, antenatal care and minor surgery for suturing wounds or other trauma). Larger facilities (including district and referral hospitals) provide major and minor general surgical procedures in addition to ambulatory procedures. Regardless of the size of

the facility, however, the specific space and equipment requirements to perform a particular procedure generally do not vary.

In clinics where only minor procedures are performed, a **procedure room** with a handwashing sink is required for examining clients and performing procedures. A separate room with at least one sink for cleaning and an area for processing instruments and other items is also desirable (**Figure 15-1a**). Ideally, the processing area should include more than one room (e.g., a dirty room for receiving dirty instruments and a clean room for final processing and storage). If only a single room is available (**Figure 15-1a**), soiled equipment should be received and cleaned in an area of the room well away from where equipment is high-level disinfected or sterilized and stored.

Figure 15-1a and b. Floor Plans for Instrument Cleaning, High-Level Disinfecting and Sterilizing Areas in a Clinic and Larger Facility



Source: SEARO/WHO 1988.

Although the space requirements for performing various minor surgical procedures may not be different, depending on the classification of the procedure (semicritical or critical), the instrument processing requirements (high-level disinfection or sterilization) may be quite different. Inserting or removing an IUD, for example, is classified as a semicritical procedure involving intact mucous membranes, and the site (vagina and cervix) is not normally sterile, nor can it be made so (Spaulding 1968). By contrast, inserting a laparoscope into the abdomen is classified as a critical procedure because tissues that are normally sterile are being touched. For the former, either sterile or high-level disinfected instruments are acceptable, but for the latter the preferred final processing is sterilization (see

Note: Instruments should not be processed in the procedure room; nor should the handwashing sink be used for instrument cleaning.

Chapters 1 and 9).² Therefore, because of the need for sterile metal instruments with laparoscopy, an additional separate area for final processing (high-pressure sterilization by autoclaving) is desirable (**Figure 15-1b**). This is especially important if the volume of services is high (five or more procedures per day).

The space, equipment and need for well-defined traffic flow and activity patterns become progressively more complex as the type of surgical procedure changes from general surgery and obstetrics to open heart surgery. As a guide, the space requirements for the types of surgery typically performed at district hospitals are roughly the same as for a busy surgicenter or polyclinic. These include:

- Changing room and scrub area for clinic staff
- Preoperative area where clients are examined and evaluated prior to surgery
- Operating room
- Recovery area for patient observation after surgery (may be combined with the preoperative area)
- Processing area for cleaning and sterilizing or high-level disinfecting instruments and other items
- Space for storing sterile packs and/or high-level disinfected containers of instruments and other items

MINIMIZING MICROBIAL CONTAMINATION

The recommended infection prevention practices for minimizing microbial contamination of specific areas in healthcare facilities are briefly described below.

- Procedure Area**
- Limit traffic to authorized staff and patients at all times.
 - Permit **only** the patient and staff performing and assisting with procedures in the procedure room (family members should be limited with obstetrical procedures).
 - Patients can wear their own clean clothing.
 - Staff should wear attire and personal protective equipment (PPE) according to procedures performed.
 - Have a covered container filled with a 0.5% chlorine solution for immediate decontamination of instruments and other items once they are no longer needed.

² Because laparoscopes are heat-sensitive, they can only be sterilized using chemical sterilants, such as formaldehyde or glutaraldehydes.

- Have a leakproof, covered waste container for disposal of contaminated waste items (cotton, gauze, dressings) at point of use.
- Have a puncture-resistant container for safe disposal of sharps (e.g., used suture needles, hypodermic needles and syringes, and disposable scalpel blades) at point of use.
- Have storage space in procedure rooms for clean, high-level disinfected and sterile supplies. (Storage shelves should be enclosed to minimize dust and debris collecting on stored items.)

Surgical Unit

The surgical unit is often divided into four designated areas, which are defined by the activities performed in each—unrestricted area, transition zone, semirestricted area and restricted area. Environmental controls and use of surgical attire increase as one moves from unrestricted to restricted areas. Moreover, staff with respiratory or skin infections and uncovered open sores should not be allowed in the surgical unit.

Note: Post signs in each area to clearly indicate the appropriate environmental control and surgical attire required.

Unrestricted Area

This area is the entrance from the main corridor and is isolated from other areas of the surgical unit. This is the point through which staff, patients and materials enter the surgical unit.

Transition Zone

This area consists primarily of dressing rooms and lockers. It is where staff put on surgical attire that allows them to move from unrestricted to semirestricted or restricted areas in the surgical unit. Only authorized staff should enter this area.

Semirestricted Area

This is the peripheral support area of the surgical unit and includes preoperative and recovery rooms, storage space for sterile and high-level disinfected items, and corridors leading to the restricted area. Support activities (e.g., instrument processing and storage) for the operating room occur here.

- Limit traffic to authorized staff and patients at all times.
- Have a work area for processing of clean instruments.
- Have storage space for clean and sterile or high-level disinfected supplies with enclosed shelves to minimize dust and debris collecting on stored items.
- Have doors limiting access to the restricted area of the surgical unit.
- Staff who work in this area should wear surgical attire and a cap.

Note: Flipflops or sandals should not be worn as they provide no protection from dropped sharps.

Traffic Flow and Activity Patterns

- Staff should wear clean, closed shoes that will protect their feet from fluids and dropped items.

Restricted Area

This area consists of the operating room(s) and scrub sink areas.

Note: Never store instruments and other items in the operating room.

- Limit traffic to authorized staff and patients at all times.
- Keep the door closed at all times, except during movement of staff, patients, supplies and equipment.
- Scrubbed staff must wear full surgical attire and cover head and facial hair with a cap and mask.
- Staff should wear clean, closed shoes that will protect their feet from fluids and dropped items.
- Masks are required when sterile supplies are open and scrubbed staff are operating.
- Patients entering the surgical unit should wear clean gowns or be covered with clean linen, and have their hair covered.
- Patients do not need to wear masks during transport (unless they require airborne precautions).

Operating Room(s)

- Enclose the operating room to minimize dust and eliminate flies; central air conditioning is preferred. (If windows are the only ventilation, provide tight-fitting screens.)
- The operating room should be located away from areas of the hospital or healthcare facility that are heavily traveled by staff and patients.

Before surgical procedures:

- Place a clean, covered container filled with a 0.5% chlorine solution or other locally available and approved disinfectant for immediate decontamination of instruments and other items once they are no longer needed.
- Place a plastic bag or leakproof, covered waste container for contaminated waste items (cotton gauze, old dressings).
- Place a puncture-resistant container for the safe disposal of sharps (e.g., suture needles, hypodermic needles and syringes, and disposable scalpel blades) at the point of use but without contaminating the sterile field.
- Place a leakproof, covered waste container for soiled linen away from sterile items.

- Organize tables, Mayo and ring stands side by side in an area away from the traffic patterns and at least 45 cm (18 inches) from walls, cabinets and other nonsterile surfaces.
- Place a clean sheet, a lift sheet and armboard covers on the operating room bed.
- Check and set up suction, oxygen and anesthesia equipment.
- Place supplies and packages that are ready to open on the tables, not on the floor.
- Mayo stand and other nonsterile surfaces that are to be used during the procedure should be covered with a sterile towel or cloth.

During surgical procedures:

- Limit the number of staff entering the operating room only to those necessary to perform the procedure and to patients (family members as needed). Make the surgical team self-sufficient so that outside help is not required.
- Keep the doors closed at all times, except during movement of staff, patients, supplies and equipment.
- Keep the number of people and their movement to a minimum; the numbers of microorganisms increase with activity.
- Keep talking to a minimum in the presence of a sterile field.
- Scrubbed staff should wear full surgical attire, including:
 - a clean scrub suit covering bare arms (one or two pieces); if a two-piece pantsuit is worn, the top of the scrub suit should be tucked into the pants;
 - a clean surgical cap that covers the head;
 - clean, closed shoes that protect the feet from fluids or dropped items; and
 - sterile (or high-level disinfected) surgical gloves, protective eyewear and a mask covering the mouth, nose and any facial hair.
- Scrubbed staff should keep their arms and hands within the operative field at all times and touch only sterile items or areas.
- Nonscrubbed staff should wear surgical attire, including:
 - long sleeved jackets banded at the wrist and that are closed during use;
 - a clean surgical cap that covers the head;
 - clean, closed shoes that protect the feet from fluids or dropped items; and
 - a mask covering the mouth, nose and any facial hair.

Note: Healthcare personnel do not need to wear cover-gowns when leaving the operating room (Manangan et al 2001).

Note: If splashes or spills of blood or amniotic fluid are expected, wear a faceshield and plastic or rubber apron.

- Nonscrubbed staff should stay at the periphery of the operating room, keeping their distance from sterile areas. They should not lean or reach over the operative field.
- Clean accidental spills or contaminated debris in areas outside the surgical field with a 0.5% chlorine solution as promptly as possible. (A nonscrubbed staff member wearing utility gloves should do this.)

After surgical procedures, nonscrubbed staff wearing utility gloves should:

- Collect all waste and remove it from the room in closed leakproof containers.
- Close and remove puncture-resistant containers when they are three quarters full.
- Remove covered containers with a 0.5% chlorine solution with instruments and surgical gloves from the room.
- Remove soiled linen in closed leakproof containers.
- Remove waste, soiled linen, soiled instruments and equipment, and supplies that have been opened but not used, in an enclosed cart or in a leakproof, covered waste container. (Be sure that these items do not re-enter the restricted area.)

Work Area

According to the size and type of the healthcare facility, the work area for processing instruments (e.g., the Central Supply Department or CSD) may be part of or connected to the surgical unit, or it may be an independent area somewhere away from the surgical unit.

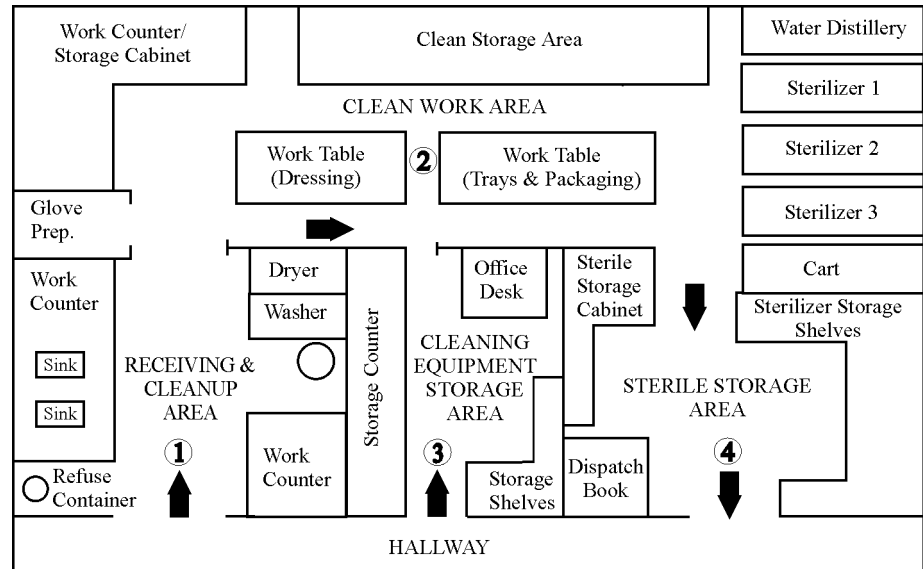
This is the area where instruments, surgical gloves and equipment are processed, and where staff should be specially trained in handling and processing and storing instruments, equipment and other clean, sterile or high-level disinfected items. The CSD is considered a semi-restricted area, so all the recommendations for traffic patterns and proper attire described above should be followed.

Remember: Permit only authorized personnel to enter this area.

A CSD consists of four areas, as shown in **Figure 15-2**. These areas are:

1. the “dirty” receiving/cleanup area,
2. the “clean” work area,
3. the cleaning equipment storage area, and
4. the sterile or high-level disinfected storage area.

Figure 15-2. Floor Plan for a Central Supply Department in a Hospital



Following surgery, decontaminate instruments, surgical gloves and other items by placing them in a plastic container filled with a 0.5% chlorine solution at the point of use. Cover the container and transport it to the CSD or designated instrument and equipment processing area. Alternatively, place soiled instruments in their original sterile wrap and transport them to the CSD where they can be immediately decontaminated before further processing.

Note: Develop flow patterns to help ensure that contaminated items never come in contact with clean, disinfected or sterile items.

Separate the “dirty” receiving/cleanup area (1) from the “clean” work area (2) with a physical barrier (wall and door). If this is not possible, use a screen or paint a red line on the floor to designate separation between areas.

The function and equipment requirements for the four areas of a typical CSD are summarized below.

“Dirty” Receiving/Cleanup Area (1)

In this area soiled items are received, disassembled and washed, rinsed and dried.

The “dirty” receiving/cleanup area should have:

- a receiving counter;³
- two sinks if possible (one for cleaning and one for rinsing) with a clean water supply; and
- a clean equipment counter for drying.

Remember: Staff in the receiving/cleanup area should wear plastic aprons, utility gloves and safety goggles or face shields to protect themselves from spills and splashes.

³ If it is not possible to decontaminate instruments and other items in procedure or operating rooms, a decontamination counter is needed for this step.

“Clean” Work Area (2)

In the clean work area, cleaned items are:

- inspected for flaws or damage;
- packaged (if indicated), and either sterilized or high-level disinfected; and
- sent for storage as packaged or air dried and placed in a sterile or high-level disinfected container.

Note: Staff entering the clean work area should wear clean cover gowns.

The clean work area should have:

- a large work table;
- shelves for holding clean and packaged items; and
- a high-pressure steam sterilizer, a dry-heat oven, a steamer or a boiler.

Clean Equipment Storage Area (3)

Store clean equipment in this area. CSD staff also should enter the CSD through this area. Equip the area with:

- shelves (preferably enclosed) for storing clean equipment, and
- an office or desk for record keeping.

Sterile or High-Level Disinfected Storage Area (4)

Store sterilized packs and covered sterile or high-level disinfected containers in this area. This area should be separated from the central sterile supply area.

Note: Unwrapped objects must be used immediately.

- Limit access to the storage area and/or store items in closed cabinets or shelves. (Enclosed shelves or cabinets are preferred as they protect packs and containers from dust and debris. Open shelves are acceptable if the area has limited access, and housekeeping and ventilation practices are controlled.)
- Keep the storage area clean, dry, dust-free and lint-free by following a regular housekeeping schedule.
- Packs and containers with sterile or high-level disinfected items should be stored 20 to 25 cm (8 to 10 inches) off the floor, 45 to 50 cm (18 to 20 inches) from the ceiling and 15 to 20 cm (6 to 8 inches) from an outside wall.
- Do not use cardboard boxes for storage. (Cardboard boxes shed dust and debris and may harbor insects.)

- Date and rotate the supplies (first in, first out). This process serves as a reminder that the package is susceptible to contamination and conserves storage space, **but it does not guarantee sterility**.
- Packs will remain sterile as long as the integrity of the package is maintained.
- Sterile or high-level disinfected containers remain so until they are opened.
- Dispense sterile and high-level disinfected articles from this area.

Shelf Life (Belkin 1997a; Belkin 1997b)

- The shelf life of a packaged sterile item is event-related and not time-related. An event can compromise the integrity and effectiveness of the package.
- Events that can compromise or destroy package sterility include multiple handling, loss of package integrity, moisture penetration and airborne contamination.
- Sterility is lost when the package has tears in the wrapper, has become wet, has been dropped on the floor, has dust on it or is not sealed.
- The shelf life of a sterile package will depend on the quality of packing, conditions during storage and transport, and the amount of handling prior to use.
- Sealing sterile packs in plastic bags can help prevent damage and contamination.
- Most contaminating events are related to excessive or improper handling of the packages. The ideal number of times an item should be handled is three:
 1. when removing it from the sterilizer cart and placing on a storage shelf,
 2. when transporting it to the place where it is to be used, and
 3. when selecting it to be opened for use.

Remember: Touch or handle sterile packages as little as possible.

Factors that can destroy sterility or compromise the efficiency of the packaging material to act as a bacterial barrier are:

- dust;
- moisture;
- holes, breaks, rupture of seals; and
- opening the package.

Before using any item that has been stored, check the package to be sure it is not dirty, wet or damaged.

**Handling and
Transporting
Instruments and
Other Items**

Note: If supplies are being delivered to the surgical area, one person standing outside should pass them through the door to a person inside the operating room.

- Keep clean and high-level disinfected or sterile instruments and other items separate from soiled equipment and waste items. Do not transport or store these items together.
- Transport high-level disinfected and sterile instruments and other items to the procedure or operating room in a closed cart or container with a **cover** to prevent contamination.
- Remove supplies from all shipping cartons and boxes before bringing such supplies into the procedure room, the operating room or the clean work area of the CSD. (Shipping boxes shed dust and harbor insects that may contaminate these areas.)
- Transport soiled supplies and instruments to the receiving/cleanup area of the CSD in leakproof, covered waste containers.
- Transport contaminated waste to the disposal site in leakproof, covered waste containers.

(For additional information regarding handling and managing waste items, see **Chapter 8**.)

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