

FIVE

PERSONAL PROTECTIVE EQUIPMENT AND DRAPES

KEY CONCEPTS you will learn in this chapter include:

- Which personal protective equipment (PPE) and practices are effective
- What the limitations of PPE are
- What the various types of drapes are
- How to use drapes appropriately

BACKGROUND

Healthcare workers are confronted each day with the difficult task of working safely within a hazardous environment. Today, the most common occupational risk faced by healthcare personnel is contact with blood and body fluids during routine patient care. This exposure to pathogens increases their risk for serious infection and possible death. Health workers in some occupational settings, such as surgery and delivery rooms, have a higher risk of exposure to these pathogens than in all other departments combined (Gershon and Vlahov 1992; Gershon and Zirkin 1995). Because of this increasing risk, better infection prevention guidelines and practices are needed to protect staff working in these areas. Moreover, staff members who know how to protect themselves from blood and body fluid exposures and consistently use these measures will also help protect their patients.

While there is a growing awareness of the seriousness of AIDS, as well as hepatitis C, and how they are acquired in the workplace, many healthcare staff do not perceive themselves to be at risk. Moreover, even those that do perceive the risk do not regularly use protective equipment such as gloves, or other practices (e.g., handwashing) available to them. This is due in part to a mistaken belief that AIDS is largely confined to certain “at-risk” groups—sex workers, IV drug users or homosexuals. Although this may have been true several years ago, in 2002 WHO estimated that more than 40 million people were infected with HIV around the world and that the virus is increasingly affecting the heterosexual population and spreading to nonurban areas.

Ongoing research has identified several psychosocial and organizational factors that may contribute to lack of compliance by healthcare staff. The most important of these are perceived to be:

- poor safety conditions for staff working in hospitals and clinics, and
- conflict of interest between providing the best patient care and protecting oneself from exposure (Gershon 1996).

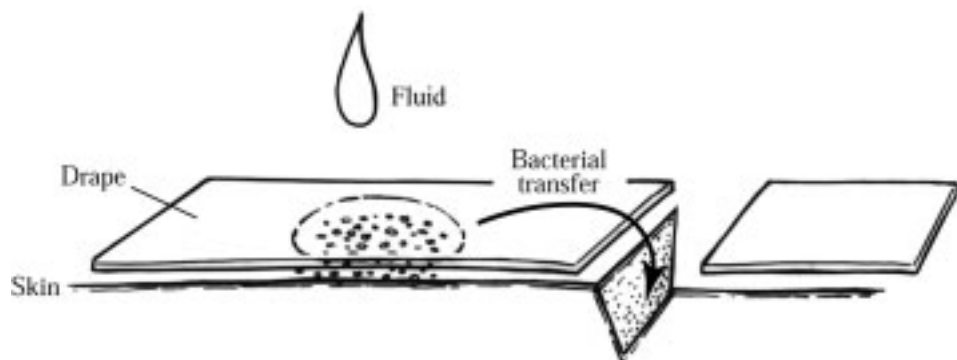
Finally, a study by the Institute of Medicine (1996) in the US implicated insufficient staffing and/or staff lacking the required knowledge and skills to meet the increased workload as important factors contributing to work-related injuries of nurses in hospitals. This situation also exists in most countries with limited resources as well.

PERSONAL PROTECTIVE EQUIPEMENT

Protective barriers, now commonly referred to as personal protective equipment (PPE), have been used for many years to protect patients from microorganisms present on staff working in the healthcare setting. More recently, with the emergence of AIDS and HCV and the resurgence of tuberculosis in many countries, use of PPE now has become important for protecting staff as well.

While some PPE, such as clean examination gloves, are extremely important in reducing the risk of transmission, others (e.g., cloth caps and shoe covers) continue to be used without convincing evidence of their effectiveness (Larson et al 1995). In fact, some common practices, such as having all staff in the operating room, not just the surgical team, wear masks, may increase costs while providing minimal, if any, protection to patients (Mitchell 1991). In addition, to be effective, PPE must be used correctly. For example, surgical gowns and drapes have been shown to prevent wound infection **only** when dry. When wet, cloth acts as a wick or sponge to draw bacteria from skin or equipment up through the fabric that can then contaminate a surgical wound (**Figure 5-1**).

Figure 5-1. Bacterial Transfer Through Fabric



As a consequence, hospital administrators, supervisors and healthcare workers need to be aware not only of the benefits and limitations of

specific PPE, but also of the actual role PPE play in preventing infection so that they can use them effectively and efficiently.

What Is Personal Protective Equipment?

Personal protective equipment includes: gloves, masks/respirators, eyewear (face shields, goggles or glasses), caps, gowns, aprons and other items. In many countries caps, masks, gowns and drapes are made of cloth or paper. The most effective barriers, however, are made of treated fabrics or synthetic materials that do not allow water or other liquids (blood or body fluids) to penetrate them. These fluid-resistant materials are not, however, widely available because they are expensive. Lightweight cotton cloth (with a thread count of 140/inch²) is the material most commonly used for surgical clothing (masks, caps and gowns) and drapes in many countries. Unfortunately, lightweight cotton does not provide an effective barrier because moisture can pass through it easily, allowing contamination. Denims, canvas and heavy twill, on the other hand, are too dense for steam penetration (i.e., they cannot be sterilized), are hard to wash and take too long to dry. When fabric is used, it should be white or light in color in order to show dirt and contamination easily.

Caps, masks or drapes made from paper should never be reused because there is no way to properly clean them. **If you can't wash it, don't reuse it!**

Examples of how PPE can reduce the risk of spreading microorganisms and who (patients, staff or the community) the equipment protects are shown in **Table 5-1**.

In the following sections, the PPE that has proven to be effective is described as well as some commonly used items not shown to be effective.

Types of Personal Protective Equipment

Remember: Wearing gloves does **not** replace handwashing or use of antiseptic handrubs.

Gloves protect hands from infectious materials and protect patients from microorganisms on staff members' hands. They are the most important physical barrier for preventing the spread of infection, but they must be changed between each patient contact to avoid cross-contamination. For example, examination gloves should be worn when handling blood, body fluids, secretions and excretions (except sweat), contaminated surfaces or equipment, and when touching nonintact skin or mucous membranes. (The appropriate use of gloves is discussed in detail in **Chapter 4**.)

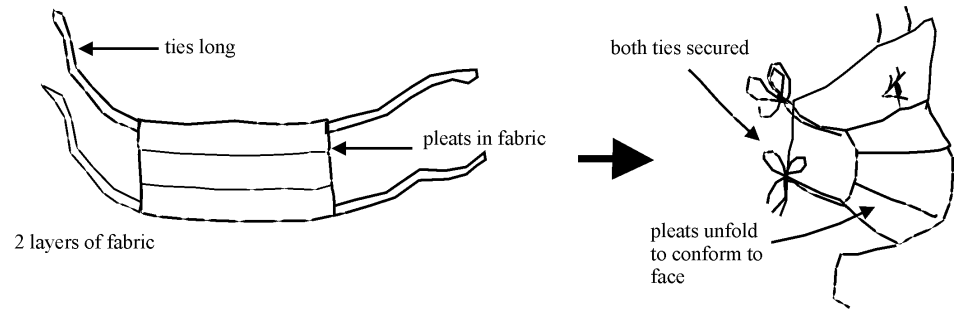
Masks should be large enough to cover the nose, lower face, jaw and facial hair (**Figure 5-2**). They are worn in an attempt to contain moisture droplets expelled as health workers or surgical staff speak, cough or sneeze, as well as to prevent accidental splashes of blood or other contaminated body fluids from entering the health workers' nose or

mouth. Unless the masks are made of fluid-resistant materials, however, they are not effective in preventing either very well.

WHERE MICROORGANISMS ARE FOUND	HOW MICROORGANISMS ARE SPREAD	BARRIERS TO STOP THE SPREAD OF MICROORGANISMS	WHO THE BARRIER PROTECTS
Healthcare staff			
hair and scalp	shedding skin or hair	cap	patient
nose and mouth	coughing, talking	mask	patient
body and skin	shedding skin or hair	scrubsuit, covergown	patient
hands	touching	gloves, handwashing or waterless antiseptic handrub	patient
Patient's mucous membranes and nonintact skin	touching	gloves	patient and staff
Patient's blood and body fluids	splashing or spraying	gloves, eyewear, mask, drapes, apron	staff
	touching (contact)	instrument processing utility gloves,	patient staff
	accidental exposure with contaminated needles and scalpel blades	protective footwear, decontamination and disposal; use a Safe or Neutral Zone during surgery	staff
	infectious waste	utility gloves, plastic bags and disposal	staff and community
Patient's unprepped skin	touching	skin prep, drapes, gloves	patient
Clinic or hospital environment	touching	gloves, handwashing dressings	staff and their family staff and community

Masks are made from a variety of materials ranging from lightweight cotton, gauze or even paper to synthetics, some of which are fluid-resistant. Masks made from cotton or paper are very comfortable but not fluid-resistant or effective as a filter. Masks made from synthetics can provide some protection from large-particle droplets (> 5 µm in size) spread by coughs or sneezes from a healthcare worker who is close (less than 3 feet/1 meter) to a patient. They are, however, somewhat uncomfortable to wear (difficult to breath through). Even the best surgical masks, however, are not designed to provide a tight enough fit (face seal) to prevent air leakage around the edges. Thus, they do not effectively filter inhaled air (Chen and Welleke 1992) and should no longer be recommended for that purpose.

Figure 5-2. Masks



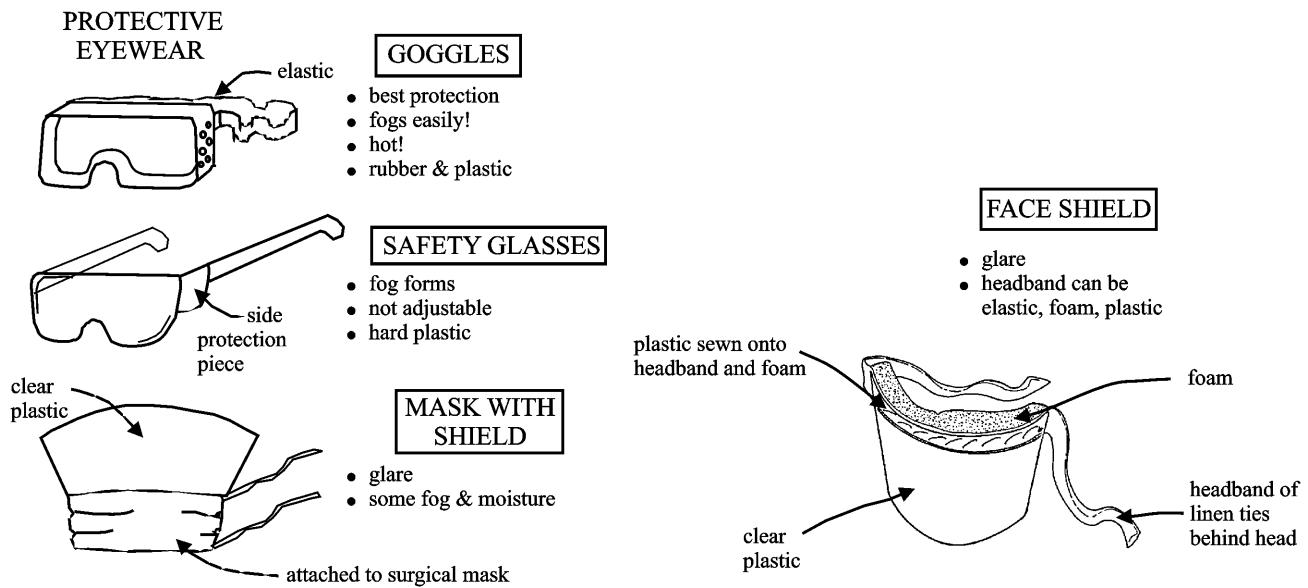
When removing, handle masks by the strings as the center of the mask contains the most contamination (Rothrock, McEwen and Smith 2003).

The true need for all operating room staff to wear a surgical mask as a means of preventing wound infection is questionable. Study results are conflicting, but even the authors of those showing no increase in wound infection rates acknowledge that masks should be worn by the surgeon and all staff who are scrubbed, in case of sneezing or coughing (Mitchell 1991). Thus, at present, the primary reason for wearing masks, especially those made of cotton gauze or paper (materials that are not fluid-resistant), is to provide some protection to the wearer from splashes or sprays of a patient's blood or potentially contaminated body fluids from entering the nose and mouth.

Respirators are specialized types of masks, called particulate respirators, that are recommended for situations in which filtering inhaled air is deemed important (e.g., for the care of a person with pulmonary tuberculosis). They contain multiple layers of filter material and fit the face tightly. They are considerably more difficult to breathe through and more expensive than surgical masks. Evidence that use of these specialized masks is effective is lacking.

Eyewear protects staff in the event of an accidental splash of blood or other body fluid by covering the eyes. Eyewear includes clear plastic goggles, safety glasses, face shields and visors. Prescription glasses or glasses with plain lenses also are acceptable (**Figure 5-3**). Masks and eyewear or face shields should be worn when performing any task where an accidental splash into the face is likely (e.g., performing cesarean section or vaginal delivery or when cleaning instruments). If face shields are not available, goggles or glasses and a mask can be used together.

Figure 5-3. Eyewear



Caps are used to keep the hair and scalp covered so that flakes of skin and hair are not shed into the wound during surgery. Caps should be large enough to cover **all** hair. While caps provide some protection to the patient, their primary purpose is to protect the wearer from blood or body fluid splashes and sprays.

Scrubsuits or covergowns are worn over, or instead of, street clothes. The main use of covergowns is to protect the healthcare workers' clothing. Scrubsuits usually consist of drawstring pants and a shirt. A V-neck shirt must not be cut so low as to slide off the wearer's shoulders or expose men's chest hair. There is little evidence that scrubsuits are needed during routine procedures when soiling of clothes is not likely (Goldman 1991). For example, in two studies, having personnel wear isolation gowns, caps and masks was not successful in reducing infection risk for patients as measured by infection or colonization (Donowitz 1986; Haque and Chagla 1989).

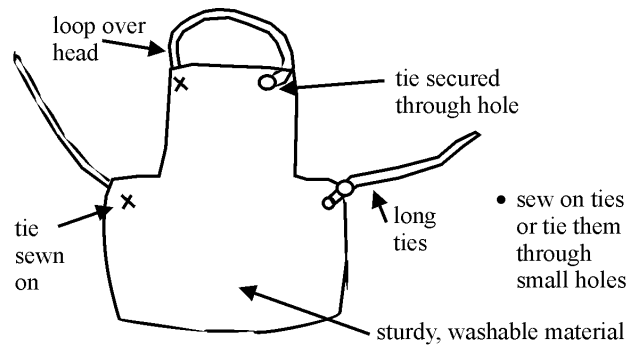
Surgical gowns were first used to protect patients from microorganisms present on the abdomen and arms of healthcare staff during surgery. Surgical gowns made of fluid-resistant materials do play a role in keeping blood and other fluids, such as amniotic fluid, off the skin of personnel, particularly in operating, delivery and emergency rooms. Lightweight cloth gowns, however, which are generally all that are available in most countries, offer little protection. Under these circumstances, if large spills occur, the best thing to do is shower or bathe as soon as possible after completing the operation or procedure. If surgical gowns are worn, sleeves should either taper gently toward the wrists or end with elastic or ties around the wrists. (Large, droopy sleeves invite accidental contamination.)

Remember: Do not lean on or rub up against draped areas, because bacteria penetrate even dry material easily due to the physical pressure exerted by leaning against the drapes.

In addition, the cuffs of the surgical gloves should completely cover the end of the sleeves.

Aprons made of rubber or plastic provide a waterproof barrier along the front of the health worker's body (**Figure 5-4**). An apron should be worn when cleaning or during a procedure in which blood or body fluid spills are anticipated (e.g., cesarean section or vaginal delivery). Aprons keep contaminated fluids off the healthcare worker's clothing and skin. In surgery, wearing a clean plastic apron over the scrubsuit will not only help prevent the surgeon or assistant from being exposed to blood or body fluids (e.g. amniotic fluid), but also prevent the surgeon's or assistant's abdominal skin from being a source of contamination to the patient (Moylan and Kennedy 1980).

Figure 5-4. Aprons



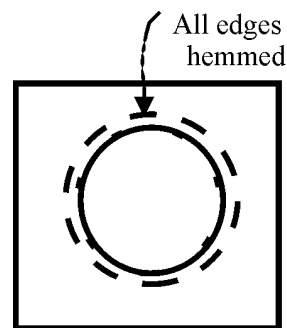
Footwear is worn to protect feet from injury by sharps or heavy items that may accidentally fall on them. For this reason, sandals, “thongs” or shoes made of soft materials (cloth) should not be worn. Rubber boots or leather shoes provide more protection, but they must be kept clean and free of contamination from blood or other body fluid spills. Shoe covers are unnecessary if clean, sturdy shoes are available for use **only** in the surgical area. One study suggests that cloth or paper shoe covers may increase contamination because they allow blood to soak through to shoes and they are often worn outside the operating room where they are then removed with ungloved hands (Summers et al 1992).

THE ROLE OF DRAPES

In many countries, drapes are usually made of hemmed linen squares of varying sizes. They are used to create an operative field around an incision, wrap instruments and other items for sterilization, cover tables in the operating room and keep clients warm during surgical procedures (OR Manager 1990a). The main types of drapes are:

- **Towel drapes** are used for drying hands, squaring off the operative site (several towel drapes are needed for this) and wrapping small instruments and syringes. They are often made of heavier cotton cloth than other linen items, which makes them somewhat more water-resistant.
- **Drapes or lap sheets** are used for covering the patient. They are large, usually made of lightweight cotton and provide only limited protection to patients or staff.
- **Site drapes** are made of cotton and have a circular opening in the center that is placed over the prepped operative site (**Figure 5-5**). These drapes are primarily intended for use with minor surgical procedures (small incisions).

Figure 5-5. Site Drape Sheet



- **Pack wrapper drapes**, large drapes that become a table cover when the sterile instrument pack is opened. This drape only needs to be large enough for wrapping the instruments and, when opened, to cover the tabletop completely.

Using Drapes for Surgical Procedures

Remember: Once a sterile drape touches the patient's skin, it is no longer sterile.

Using sterile **towel drapes** to create a work area around the incision limits the amount of skin that needs to be cleaned and prepped with antiseptic solution prior to placing the drapes. Although this area is often called the "sterile field," it is only briefly sterile. As shown in **Figure 5-1**, cloth drapes allow moisture to soak through them and can help spread organisms from skin, even after surgical cleansing with an antiseptic agent, into the incision. Thus, neither gloved hands (sterile or high-level disinfected) nor sterile or high-level disinfected instruments and other items should touch the towel drapes once they are in place. Because cloth drapes do not serve as an effective barrier, clean, dry towel drapes can be used if sterile towel drapes are not available.

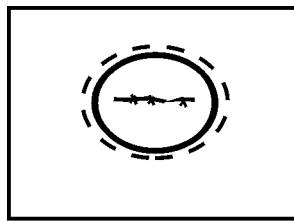
The way in which the operative site is prepared and draped depends on the type of procedure to be performed. The following guidelines for draping are designed to reduce overuse of costly sterile items and to avoid unnecessary draping:

- All drapes should be applied around a completely dry, widely prepped area.
- If sterile drapes are used, sterile or high-level disinfected surgical gloves should be worn when placing the drapes. (When putting drapes in place, care must be taken not to touch the patient's body with gloved hands.)
- Drapes should be handled as little as possible and should never be shaken or flapped. Always hold drapes above the area to be draped, and discard the drape if it falls below this area.

Minor Surgical Procedures (Norplant implants insertion or removal or minilaparotomy)

- Use a **site drape** that allows at least 5 cm (or 2 inches) of open skin around the incision (**Figure 5-6**). Alternatively, towel drapes can be used. (If sterile site or towel drapes are not available, clean, dry drapes can be used.)

Figure 5-6. Placing a Site Drape



site drape in place

- Place the hole in the drape over the prepped incision site and do not move it once it has touched the skin.
- If the site drape is not sterile, put on sterile or high-level disinfected gloves **after** placing the drape on the patient to avoid contaminating the gloves.

Major Surgical Procedures (laparotomy or cesarean section)

Remember: Lap sheets do not need to cover the entire patient.

Remember: Sterile cloth drapes do not replace good aseptic technique.

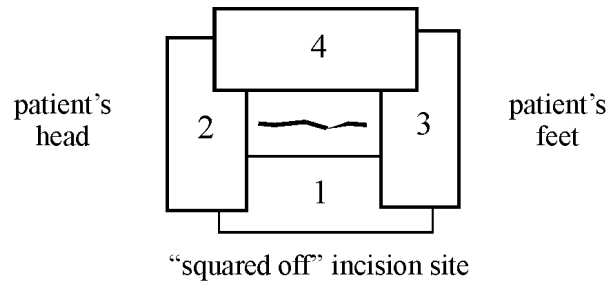
- Use large **drapes** or **lap sheets** to cover the patient's body if it is necessary to keep her warm. These drapes do not need to be sterile because they will not be near the incision site (Belkin 1992). They should be clean and dry.
- After cleansing the skin with an antiseptic agent, place the towel drapes to square off the incision site (allow at least 5 cm, or 2 inches, of open skin around all sides of the proposed incision site).
- Begin by placing the towel drape closest to you to decrease the chance of contamination (**Figure 5-7**). Holding one side of the drape, allow the other side to touch the abdominal skin about 2 inches away from

the proposed incision site. Gently drop the rest of the drape onto the abdomen. Once in place, the drape should never be moved closer to the incision. It can, however, be pulled away from it.

- Place three additional drapes (2, 3 and 4) to square off the work area as shown in **Figure 5-7**.

Note: Avoid reaching across the incision site unless it has been draped.

Figure 5-7. Squaring Off a Work Area



- Use **nonperforating** towel clips to secure the corners of the towel drapes.

During Procedures

Do not use the patient's body or the draped area for placing instruments. Placing sterile or high-level disinfected instruments or other items on drapes, even if they were sterile initially, will contaminate them. Also, doing this may make the items harder to find and may cause them to fall off the operating room table if the patient moves. If an instrument stand (Mayo) covered with a sterile towel or drape is not available, a sterile or high-level disinfected plastic or metal instrument tray can be placed on the drape covering the patient and used to hold instruments during the procedure.

If a drape is torn or cut during a procedure, it should be covered with a new drape. Do not, however, place new drapes on top of a drape that has become wet. There is no evidence that this is effective in creating a barrier (OR Manager 1990b).

As drapes wear out and new drapes are needed, try to buy replacement drapes that have a high thread count.

See **Chapter 13** for information on processing linens (caps, gowns, masks and drapes).

MAKING THE WORKPLACE SAFER

Despite the limited success of educational programs aimed at changing healthcare worker behavior regarding use of PPE, primary prevention must continue to be the focus of future actions. To be more successful, efforts designed to make the workplace environment safer should be directed to all cadres of health workers—not just physicians and nurses. For example, in some countries, with the exception of operating room personnel, housekeeping staff have the highest rate of needlestick injuries caused by used needles being incorrectly discarded in wastebaskets.

Improving compliance following educational and behavior change efforts can be enhanced if:

- There is consistent support by hospital administrators of the recommended safety efforts (e.g., identified deficiencies are corrected, dangerous practices are eliminated and staff are actively encouraged to seek inexpensive, doable solutions).
- Supervisors regularly provide feedback and reward appropriate behavior (e.g., handwashing between patient contacts).
- Role models, especially physicians and other senior staff and faculty, actively support recommended infection prevention practices and model appropriate behavior (Lipscomb and Rosenstock 1997).

Moreover, making the recommendations appropriate and easy for staff to use and monitor can lead to better compliance and health worker safety. Finally, because healthcare is a vitally important and rewarding profession, it is the responsibility of all healthcare professionals to help create a safer environment for patients and fellow workers.

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