

AMERICAN ACADEMY OF PEDIATRICS

Committee on Infectious Diseases and Committee on Practice and Ambulatory Medicine

Infection Control in Physicians' Offices

ABSTRACT. Infection control is an integral part of pediatric practice in outpatient settings as well as in hospitals. All employees should be educated regarding the routes of transmission and techniques used to prevent transmission of infectious agents. Policies for infection control and prevention should be written, readily available, updated annually, and enforced. The Centers for Disease Control and Prevention standard precautions for hospitalized patients with modifications from the American Academy of Pediatrics are appropriate for most patient encounters. As employers, pediatricians are required by the Occupational Safety and Health Administration (OSHA) to take precautions to protect staff likely to be exposed to blood or other potentially infectious materials while on the job. Key principles of infection control include the following: hand-washing before and after every patient contact, separation of infected, contagious children from uninfected children, safe handling and disposal of needles and other sharp medical devices, appropriate use of personal protection equipment such as gloves, appropriate sterilization, disinfection and antiseptics, and judicious use of antibiotics.

ABBREVIATION. OSHA, Occupational Safety and Health Administration.

Infection control practices have long been recognized as an important means of preventing transmission of infectious agents. Infection control is important in every patient encounter. Recommendations for infection control practices in hospitals are well-documented and updated on a regular basis.^{1,2} Because most patient encounters occur in outpatient settings, the availability of established guidelines for control of transmission of infection in office settings is critical.^{3,4} There are no comprehensive, national guidelines, however, for the practice of infection control in the outpatient setting.

The risk of developing infection after an outpatient clinic or office visit has been evaluated.⁵ In all instances, children who visited physicians' offices had better outcomes than children who did not receive regular care, but an office waiting area often presents opportunities for transmission of infectious agents among patients. Multiple outbreaks of measles,^{6,7} tuberculosis,⁸ and other infectious diseases have been traced to physicians' offices or clinics.^{3,9}

Most of the outbreaks reported in the outpatient setting were associated with noncompliance with in-

fection control procedures.⁹ To understand infection control issues, modes of transmission of infectious agents should be considered.¹⁰⁻¹⁴ Transmission can result from contact with contaminated hands, objects, and body material including blood, urine, stool, and respiratory tract secretions. Contaminated hands are the predominant mode of transmission, underscoring the importance of appropriate hand-washing before and after contact with each patient. Fomites, such as toys and office equipment, have been implicated in the transmission of some pathogens. Blood-borne pathogens can be spread if proper precautions with needles and other sharps (sharp instruments) are not followed. Standard precautions, as recommended for hospitalized patients (Table 1¹), should be followed at all times.

As employers, pediatricians are required by the Occupational Safety and Health Administration (OSHA) to take precautions to protect staff likely to be exposed to blood or other potentially infectious materials while on the job. OSHA has published guidelines for the protection of all health care workers from blood-borne agents.¹⁵ Each office is required to have a written plan to decrease the risk of transmission of blood-borne agents to employees. Furthermore, all employees who might be exposed to blood should be immunized against hepatitis B virus and regularly educated about risks of all blood-borne agents. The hepatitis B vaccine should be available, at no cost, to all employees who have occupational exposure to blood. Employees should sign a declination form if they choose not to be vaccinated, but vaccine should be provided free of charge if the employee later opts to receive it. Failure to comply with OSHA regulations can result in severe penalties and fines. Each office must be aware of current OSHA regulations and directives (see Table 2).

This review provides practical information regarding infection control in the office setting. The goal is to prevent transmission of infectious agents to patients and visitors, health care workers, and other employees in the office setting. Additional infection control recommendations may be necessary for other outpatient settings including dialysis centers, chemotherapy centers, procedure suites (eg, endoscopy), emergency centers, and outpatient surgery suites.³

GUIDELINES FOR HEALTH CARE DELIVERY

Hand-Washing

Hand-washing is the single most important method to prevent transmission of infectious agents.^{1,2,16-18} Hands should be washed before and after each contact with patients, body fluids, and

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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TABLE 1. Standard Precautions¹

Standard precautions, as recommended by the Centers for Disease Control and Prevention for hospitalized patients and modified by the American Academy of Pediatrics for children, should be used at all times with all patients. These precautions apply to blood, all body fluids, nonintact skin, and mucous membranes.

Hand-washing

- Hands should be washed before and after each patient encounter
- Hands and other body surfaces should be washed immediately and thoroughly if contaminated with blood or other body fluids
- Hands should be washed after removal of gloves

Barrier precautions to prevent skin and mucous membrane exposure

- Gloves should be worn for contact with blood, body fluids, mucous membranes, nonintact skin, and items or surfaces contaminated with body fluids. Gloves need not be used for routine care of well children including wiping a nose and changing diapers
- Gloves should be worn when performing venipuncture and other vascular access procedures
- Masks and protective eyewear or face shields should be used during procedures that are likely to generate droplets of blood or body fluids
- Water impermeable gowns or aprons should be worn during procedures that are likely to generate splashes of blood or other body fluids

Handling of Sharp Instruments

- Needles should not be recapped, bent, broken, removed by hand from syringes, or manipulated by hand
- Sharp instruments including needles should be placed in puncture-resistant containers for disposal
- Disposal containers should be as close as practical to the use areas
- Disposal containers should be out of the reach of children
- Reusable sharp instruments should be placed in puncture-resistant containers for transport to processing areas
- Safer medical devices should be used as soon as such devices are proven to be beneficial and costeffective

Resuscitation Equipment

- Equipment should be available for use in areas in which the need for resuscitation is predictable
- Mouth to mouth resuscitation should be avoided

TABLE 2. OSHA Regulations That Have an Impact on Physician Offices*

In 1994, the American Academy of Pediatrics (AAP) published an OSHA guide for pediatricians including a model exposure plan, documentation forms and other compliance tools.⁴³ This manual, though currently under revision pending anticipated final regulations, is available for sale via the AAP publications. Topics denoted with a dagger on the table below are not addressed in the current AAP OSHA guide. Update information is available from the Division of Health Care Finance and Practice and will be included in the revision of the AAP OSHA guide. Medical offices should have a customized comprehensive OSHA program. At minimum, it should address the following areas:

Blood-borne pathogen standard

- Universal precautions
- Risk determination
- Personal protective equipment
- Analysis of sharps injuries and safe sharps devices†
- Training
- Exposure control plan
- Record keeping
- Infectious/sharps waste disposal

Tuberculosis exposure†

- Risk assessment
- Employee screening
- Training
- Exposure control plan

Emergency preparedness†

Hazard communication standard

General safety†

Ergonomics†

Prevention of violence in the workplace†

contaminated or soiled materials; between dirty and clean procedures on the same patient, after removing gloves; before and after performing invasive procedures; after using the rest room; and whenever hands are visibly soiled. Liquid soap in pump dispensers is ideal; the dispenser should be disposable or should be rinsed and washed before refilling to avoid contamination. Antibacterial soaps are not necessary for routine use.¹⁶ Soaps containing alcohol are drying and damaging to skin. Bar soaps are not recommended because bars frequently are wet and easily contaminated with potential pathogens. Use of sinks is preferred to waterless hand cleansers, especially if the hands are soiled. Paper towels are preferred for hand drying and always should be available and reached easily by the health care

professional. Hand lotions should be available in pump-type containers that are replaced or cleaned at regular intervals.¹⁶ Hand lotions should not be petroleum-based as this may cause deterioration of latex material and thus reduce the effectiveness of gloves.

The method of hand-washing depends on the task to be performed. Routine hand-washing should be done by thoroughly covering the hands with soap and vigorously rubbing the hands under running water for at least 10 seconds. Washing with antimicrobial soaps, such as chlorhexidine or povidone-iodine, is recommended before performing invasive procedures. In these cases, nails are cleaned with disposable manicure sticks and hands and wrists are included in a 1-minute scrub.

Education

All employees at the time of orientation should receive and review information regarding infection control policies and procedures. Furthermore, regularly scheduled educational sessions for all staff are important to ensure that the level of hand-washing and infection control awareness remain high.^{19,20} Policies for infection control should be written, readily available, and enforced. All staff members should be aware of and motivated to follow these policies.²¹

Communication With Local and State Health Authorities

State and local health authorities determine which diseases should be reported. Office physicians must be aware of the rules and regulations in their municipality. Policies and procedures for communication with local and state health authorities regarding reportable diseases and suspected outbreaks should be established.

Minimize the Likelihood of Liability to Third Parties

A number of third-party liability cases involve infectious diseases (ie, cases alleging that the physician is liable for injury to parties that came in contact with his/her patient). Although some courts have discussed these cases, holding that there can be no liability absent the physician-patient relationship, other courts have held that the physician owes a duty to third parties if contact with the infected patient is "reasonably foreseeable." Therefore, physicians should be aware that the sphere of physician duty to third parties may be expanding and should take appropriate steps to minimize such risks (see Table 3).

STANDARD PRECAUTIONS

Standard precautions, as recommended for hospitalized patients¹ (Table 1), should be used in the care of every child because it cannot be determined which child harbors an infectious agent. Gloves should be available for use by all health care professionals. Gloves should be worn when contact with blood, body fluids, secretions, excretions, and items contaminated with these fluids is reasonably antici-

pated. Gloves do not need to be worn for routine well-child care, such as wiping a nose or changing a diaper. When gloves are used, hands should be washed after they are removed because contamination can occur during removal or from a break in the glove.²² Masks, face shields, and protective eyewear should be worn if splashing of body fluids is anticipated. When soiling of clothes with blood, body fluids, secretions, or excretions is highly likely, gowns can be worn. Water impermeable gowns are needed if splashes of blood or blood-containing body fluids might occur.

The OSHA and National Institute for Occupational Safety and Health (NIOSH) guidelines require use of special masks—NIOSH-certified N-95 respirators—when caring for patients with contagious tuberculosis²³; use of these masks requires education to ensure proper fit. Rarely is there a need for use of such masks in pediatric offices because most children with tuberculosis are not contagious.²⁴ Final OSHA rules on protecting health care workers from tuberculosis exposure are expected later this year. Adults suspected to be contagious for tuberculosis should not be permitted in the office because they pose a hazard to patients and staff.

Skin surfaces that are contaminated with blood or other body fluids should be washed immediately and thoroughly. Environmental surfaces should be cleaned with a detergent, then treated with freshly prepared bleach solution (diluted 1:64; ¼ cup of bleach to 1 gallon of water, bleach contact time must be at least 30 seconds), with gloves worn during cleaning. Immunization with hepatitis B vaccine is mandated by OSHA for all persons whose job might involve exposure to blood or blood-containing body fluids.¹⁵

Impermeable and puncture-proof needle disposal containers, or sharps containers, should be available in areas where injections are given. The containers should not be overfilled and should be out of reach of young children. Policies consistent with state and local regulations for removal and incineration or sterilization should be in place. Policies for management of needlestick injuries should be readily available and understood by employees (example, Table

TABLE 3. Minimizing Third-Party Liability*

Until the law is clarified by the courts, the state legislatures, or Congress, a physician's efforts to minimize the risk of the physician's liability to third parties who are injured as a result of exposure to the physician's contagious patient will be fraught with uncertainty. Although not guaranteed to protect the physician for liability, the following suggestions may help minimize the likelihood of a successful third-party liability suit against the physician.

The physicians should:

- inform the patient about the contagious nature of the disease, treat the patient, explain fully to the patient the potential risk of the patient's illness to third parties, and give the patient proper advice about preventing the spread of the disease, including but not limited to advice about avoiding specific conduct that puts third parties at risk;
- make sure that he or she has the most current medical information available concerning the treatment of the disease and the possible risks of spread associated with the particular disease;
- learn about the relevant communicable disease reporting statutes and follow them accordingly;
- be sensitive to the potential for conflict between the physician's duty to third parties and the duty of confidentiality to the physician's patient;
- inform the patient of any action the physician intends to take to endeavor to protect third parties at risk of contact with the patient;
- keep accurate and complete medical records;
- when in doubt about the existence of a duty to third parties or how that duty may be satisfied, or when that duty conflicts with the duty to maintain the confidence of the patient, the physician should obtain legal advice from a competent professional.

* Berger J. Proper supervision of students, residents minimizes liability. *AAP News*. April 1999:7.

4). OSHA requires that employees receive education on the management of sharps injuries, that procedures not only be available and understood, but followed. As of November 5, 1999, OSHA requires that all percutaneous sharps injuries be recorded on the OSHA 200 log.

General Health Considerations of Office Staff

Individuals who work in health care are exposed frequently to persons with infectious diseases. Health care workers also pose a risk to patients and other personnel if they develop a communicable disease. Written policies, therefore, should exist regarding exclusion of staff members with contagious illnesses (Table 5). Respiratory tract infections may not be a reason to exclude office personnel, but precautions should be taken with an emphasis on hand-washing before all patient contacts.

In adults, screening for tuberculosis using the Mantoux skin test should be done before employment to ensure active tuberculosis is detected early and treated. When necessary, employees should be excluded from the office until they are no longer infectious.⁹ A test is considered positive in a healthy health care professional if an area of induration of at least 10 mm is detected. For persons with underlying conditions or known household exposure to tuber-

culosis, 5 mm of induration is considered positive. If the Mantoux test is positive, the employee is referred for evaluation and appropriate management.²⁵ The frequency of repeat skin testing for PPD-negative employees should be based on the risk of exposure to people with active tuberculosis. Risk factors will vary from employee to employee; yearly testing should be considered in practices where there has been a high rate of documented tuberculosis or skin test conversion among families and patients or among health care professionals. Consultation with local health departments is useful to determine the prevalence of tuberculosis in the local area.

Policies should be established regarding immunization of employees, volunteers, students, and residents (Table 6).^{26,27} Immunization records should be maintained for all employees.

OFFICE DESIGN

Sinks

Properly functioning sinks with adjacent soap dispensers and disposable towels should be conveniently located in all patient care areas. Faucet aerators are discouraged because they are often contaminated by *Pseudomonas* species and other bacteria.

TABLE 4. Needlestick and Sharps Injury

Step 1: Document the type of injury. Complete OSHA 200 log. Was blood involved? Is the source of the blood known? How significant was the injury? For example, was it a deep injection or blood spill onto intact skin?

Step 2: Determine the status of the source patient. If this is not possible, base actions on the likelihood of exposure considering source of needle and type of exposure. If the source is known, obtain permission and determine the serologic status of the source to hepatitis B virus, hepatitis C virus, and the human immunodeficiency virus (HIV).

Step 3: Determine the immunity of the employee. Was hepatitis B virus vaccine (HBV) received? Was the employee tested for anti-hepatitis B surface antigen (HBsAg)? If response to vaccination is unknown, obtain blood for anti-HBsAg. Obtain permission and test for antibody to HIV.

Step 4: Following the steps outlined below for HBV prophylaxis after percutaneous or permucosal exposure:

If exposed person is unvaccinated:

- Source HBsAg-positive: hepatitis B immunoglobulin (HBIG) (0.06 mL/kg; maximum dose: 5 mL) intramuscularly and begin HBV vaccine series
- Source HBsAg-negative: begin HBV vaccine series
- Source not tested or unknown: begin HBV vaccine series

If exposed person was vaccinated and responded:

- No treatment necessary

If exposed person was vaccinated and did not respond:

- Source HBsAg-positive: HBIG immediately and in 1 month or HBIG and initiate revaccination
- Source HBsAg-negative: no treatment
- Source not tested or unknown: if high-risk source, consider HBIG or HBIG and HBV revaccination as for HBsAg-positive source

If exposed person was vaccinated and not tested for a response:

- Source HBsAg-positive: test exposed for anti-HBs, if positive, no treatment; if negative, 1 dose of HBIG and initiate revaccination

Step 5: Consider screening the employee for antibody to hepatitis C and HIV. Repeat serologic testing should be done at 1 and 6 months after exposure.

Step 6: Consider prophylaxis against HIV. See chart for suggested agents.⁴² Most offices will not be equipped to deal with follow-up care. However, initial prophylaxis should be initiated within an hour of exposure. Thus, offices should consider having a supply of the drugs used for prophylaxis or be able to arrange to have them within an hour. Follow-up care should be arranged with a specialist in the management of HIV infection.

Step 7: Use this opportunity to educate the exposed person regarding risks of exposure, safe handling of sharps, immunization, standard precautions, and safe work habits.

Chart: Postexposure HIV Prophylaxis Regimens (As of January 1999, See Internet site www.cdcnpi.org for Updated Information)

Basic regimen: recommended when the degree of exposure is such that postexposure prophylaxis is appropriate but no increased risk for HIV transmission has been observed; examples include mucous membrane exposure or solid needle percutaneous exposure

Four weeks (28 days) of both zidovudine, 600 mg every day in divided doses (ie, 300 mg twice a day, 200 mg 3 times a day, or 100 mg every 4 hours), and lamivudine, 150 mg twice a day

Expanded regimen: recommended when the degree of exposure represents an increased HIV transmission risk; examples include percutaneous injury with large-bore hollow needle, deep puncture, less severe injury but with blood from a patient known to have high titers of HIV

Basic regimen plus either indinavir, 800 mg every 8 hours, or nelfinavir, 750 mg 3 times a day

TABLE 5. Work Restriction Policies for Employees⁴⁴

Infection	Restriction	Length of Restriction
Conjunctivitis	Restrict from direct patient care	Until discharge resolved
Gastroenteritis	Restrict from direct patient care and food preparation	Until symptoms resolve or person is deemed noncontagious
Hepatitis A	Restrict from direct patient care	Until 1 wk after onset of jaundice
Hepatitis B	None*	
Hepatitis C	None*	
Herpes simplex, orofacial	Restrict from direct care of newborn infants	Until lesions dry
HIV	None*	
Measles	Exclude from office	Until 7 d after onset of rash
Mumps	Exclude from office	Until 9 d after onset of parotitis
Pediculosis	Restrict from direct patient contact	Until treated
Pertussis	Exclude from office	Until treated for 5 d
Rubella	Exclude from office	Until 5 d after onset of rash
Staphylococcal skin infection	Restrict from direct patient care	Until treated for 24 h
Streptococcal infection, group A	Restrict from direct patient care	Until treated for 24 h
Tuberculosis, active	Exclude from office	Until proven noninfectious
Varicella	Exclude from office	Until lesions crusted
Zoster	If covered, restrict from care of immunocompromised patients If cannot be covered, restrict from patient care	Until lesions crusted

* Health care providers with these infections should avoid performing procedures considered to be at risk for transmission of blood from provider to patient.

TABLE 6. Suggested Immunizations for Office Staff^{26,27}

All staff members should receive the following immunizations:

Measles-mumps-rubella vaccine

All health care workers born after 1957 should have received 2 doses of vaccine, unless the person has had natural measles. Note that it is very difficult to diagnose rubella. Office staff members often have contact with pregnant women; thus, it is optimal to ensure that all staff members are immune to rubella. Some experts recommend serologic screening for all employees to ensure immunity to measles and rubella.

Polio

Most staff members will have been immunized as children. This should be documented in employee records. If an employee has not been immunized, the person should receive inactivated poliovirus vaccine (series of 3 doses, at least 1 month between the first 2 doses and 4 months between the second and third doses).

Hepatitis B vaccine

Hepatitis vaccine should be offered free of charge and strongly recommended for any employee who might come in contact with blood. Postvaccination screening for antibody to hepatitis B surface antigen (HbsAg) (anti-HBs) is advised for people at ongoing risk for blood exposure. Personnel who do not respond to the primary series should be revaccinated with a second 3-dose vaccine series or evaluated for the presence of HbsAg carriage. Revaccinated people should be tested for anti-HBs at completion of the second vaccine series; if they do not respond, no further vaccination is given and they should be evaluated for the presence of HbsAg. If the employee refuses vaccination or has a medical contraindication to hepatitis vaccine, this should be documented in the employee's file.

Varicella-zoster vaccine

All employees should be questioned about a history of varicella. Those employees with a negative or unknown history of disease who have not previously received vaccine should have a varicella antibody test performed. All employees with no history of disease or vaccination and who lack detectable varicella antibody should be offered varicella vaccine. Alternatively, vaccine can be offered to all employees with no history of infection. Adults require 2 doses of varicella vaccine, each dose separated by a minimum of 4 weeks. If the employee has a medical contraindication to varicella vaccine or refuses vaccination, this information should be placed in the employee's file.

Influenza vaccine

Vaccine use should be promoted and offered free of charge yearly to all employees.

The following vaccines should be considered:

Diphtheria and tetanus vaccine

Diphtheria and tetanus immunization is recommended every 10 years.

Pneumococcal Vaccine

This vaccine is recommended for adults and children at risk for serious disease due to the pneumococcus. All adults older than 65 years and persons with splenic dysfunction or absence, spinal fluid leaks, nephrotic syndrome, chronic cardiorespiratory disease, cirrhosis, alcoholism, chronic renal disease, diabetes mellitus, HIV infection, and other conditions associated with immunosuppression should be immunized.

Waiting Areas

Waiting rooms and reception areas offer the opportunity for child-to-child interaction, and, unfortunately, child-to-child transmission of infectious agents. Waiting rooms can be compared with child care settings, where contamination of the environment and transmission of infectious agents occur at an increased rate compared with the home setting.

Efforts should be made to limit transmission of infectious agents by avoidance of crowding, shortening waiting times, and minimizing the sharing of toys. Infected children who are symptomatic should be segregated from well children as quickly as possible. There are no studies documenting the need for, or benefit of, separate waiting areas for well and ill children.⁵ Sick adults should be discouraged from

spending time in waiting areas. Triage should begin at the time the office visit is scheduled. Parents of a contagious child should register with the receptionist immediately; in some cases, the child may be asked to use a separate entrance to avoid the waiting area. Ideally, immunocompromised children should not wait in the general waiting area but be escorted immediately to an examining room.

Toys in the office should be disposable or washable and of appropriate sizes and shapes to avoid aspiration or other injuries. Ideally, toys should be cleaned between use to avoid transfer of infectious agents.²⁸ Toys contaminated with body fluids should be removed until cleaned. The value of antibacterial soaps for cleansing and antibacterial agents within the toys is unproven. These agents also add expense. Regular cleansing of toys in a dishwasher at the end of each day decreases microbial contamination and eliminates organic material on the toy.

Floors in the waiting area and office are often soiled with body secretions as well as dirt. These surfaces should be cleaned regularly. After spills involving blood or body fluids contaminated with blood, floors should be first cleaned with detergent, then disinfected promptly using a freshly prepared bleach solution ($\frac{1}{4}$ cup of bleach in 1 gallon of water, bleach contact time at least 30 seconds). Linoleum or wood floors are optimal surfaces to keep clean.

Examination Rooms

Equipment should be cleaned after each use. Although furniture in the room generally is not a major concern for transfer of infectious agents, contamination of the examining table can be a problem. Covering the table with disposable paper or linen, which is changed between patients, decreases the risk for transmission of microbes. More thorough cleaning should be done if contamination is visible. Where diaper changing has occurred, more thorough cleaning should be done to remove visible soil. This is followed by sanitizing the surface using a freshly prepared solution of 1:64 household bleach ($\frac{1}{4}$ cup diluted in 1 gallon of water) applied for 2 minutes, rinsed, and dried.

Rest Rooms

Rest rooms for staff and patient use should be provided and cleaned daily and whenever visibly soiled. A diaper changing area should be provided in at least 1 rest room with disposable paper and a receptacle for soiled diapers and paper.

Air Flow

Certain infections, including varicella, measles, and tuberculosis, are transmitted by the air-borne route. Unfortunately, the number of air exchanges in buildings that house outpatient facilities often is low, and the air is frequently recirculated.

Physicians should be aware of air flow patterns to limit transmission of air-borne pathogens. Special arrangements are recommended for patients considered to be contagious including the following: 1) making efforts to see these patients at the end of the day; 2) quickly triaging these patients out of common

waiting areas; and 3) closing the door of the examining room and limiting access to the patient by visitors and staff members who are not immune to the suspected disease. The duration of time that airborne viruses remain in a room depends on air exchange rates; for example, in hospitals where air exchange rates are 6 to 8 per hour, several air exchanges occur within 30 minutes. Recommended air exchange rates depend on the stated use of a room. Recommendations and guidelines are made by the American Society of Heating, Refrigerating and Air Conditioning Engineers located in Atlanta, Georgia. The current recommended air exchange rate for a medical office examination room is 6 air changes per hour with 2 outside air exchanges per hour.

Personal and Diagnostic Equipment

The role of stethoscopes and other examining devices in transmitting infectious agents is unclear; however, stethoscopes can be contaminated with multi-drug-resistant bacteria. A reasonable means of decreasing contamination is to wipe the bell and diaphragm of the stethoscope as well as the handle and body of otoscopes or ophthalmoscopes regularly and whenever they become soiled; a paper towel with soap and water or an alcohol wipe is effective. Ear cures should be cleaned after each use and, if contaminated by blood, should be disinfected with a bleach solution or alcohol.

Ballpoint pens, patient charts, computer keyboards, and the mouse can be contaminated with infectious agents that can be transmitted by hands to other environmental sources. Because these items rarely are cleaned, hand-washing before and after patient contact is necessary to minimize the potential transfer of bacteria and viruses from equipment to patients.

In most cases, blood pressure cuffs are placed on intact skin so the risk of transmission of infectious agents is minimal. These cuffs should not be placed in direct contact with damaged or nonintact skin.

Whenever economically and medically feasible, disposable supplies should be used. Plastic sleeves are available for use with glass thermometers. Any contaminated thermometer should be disinfected. Electronic thermometers have single-use shields, but care must be taken to avoid contaminating the housing of the thermometer. The "box" should be wiped whenever soiled and after measuring the temperature of an infected child; paper towels with soap and water or alcohol wipes can be used.

Care should be taken to avoid contamination of pulse oximetry and tympanometry equipment with any body secretions, and equipment should be cleaned carefully after each use. Pieces of other office equipment, such as electrocardiogram machines and Denver Developmental Testing kits (Denver Developmental Materials Incorporated, Denver, CO), should be cleaned whenever contaminated by patient secretions.

STERILIZATION, DISINFECTION, AND ANTISEPSIS

Sterilization completely eliminates or destroys all forms of microbial life. Disinfection reduces, but

does not eliminate, the microbial burden. The extent of disinfection depends on the type of disinfectant and its concentration, the resistance of the microbes, and the contact time. Cleaning removes foreign material from objects. Antisepsis refers to the process used to decontaminate the skin of the patient or health care professional.

All equipment should be cleaned regularly and stored where it will not become contaminated. Equipment having contact with mucous membranes requires high-level disinfection, whereas instruments that penetrate skin or mucosal membranes must be sterile (Table 7).^{29,30}

Sterilization is accomplished by autoclave, dry heat, or gas.³⁰ Items must be cleaned manually with soap and water to remove organic debris before autoclaving. Steam autoclaving uses distilled water that must reach a temperature of 121° to 132°C. Recommended time for exposure of items is 20 minutes for unwrapped instruments and 30 minutes for small packs. Unwrapped instruments should be used immediately or aseptically transferred to a sterile container. Hot air oven sterilization is used only for items that cannot be sterilized by autoclaving. The oven temperature should be 170°C for an exposure time of 1 hour.

The sterilization equipment should be monitored by the use of various indicators to ensure that the process has been effective. Manual indicators ensure that a machine reaches the correct temperature and pressure. Chemical indicators are useful in showing that the wrapped package has been sterilized. Biological indicators are necessary to ensure sterility. A variety of indicator systems are available. The procedure recommended by the manufacturer to document sterility should be done at least weekly and results should be recorded.

Packs that have been sterilized should be dated and stored in clean, dry areas to minimize recontamination. Muslin wrapped materials cannot be stored for more than a few months, whereas plastic wrapped packs can be stored safely for 1 year.

For this statement, the terms for disinfection are taken from standards for sterilization, disinfection, and antisepsis in hospitals.²⁹ High-level disinfection is used for instruments having contact with mucous membranes. Two types of procedures may be used. 1) *Boiling*. Instruments are placed in boiling water for at least 20 minutes. The vessel used for boiling

should be cleaned daily. 2) *Chemical disinfection*. Chemical disinfection is accomplished with glutaraldehyde, hydrogen peroxide, or sodium hypochlorite (bleach). Two percent glutaraldehyde solutions are most commonly used; however, these products have potential toxicity if proper ventilation is not ensured. The solution should be prepared according to manufacturer's instructions. A 6% solution of hydrogen peroxide is safe and effective to use with most medical instruments. A 1:64 dilution of sodium hypochlorite is effective for disinfection. The only disinfectant approved for use in hospitals is 2% glutaraldehyde. After disinfection, instruments are rinsed with sterile water, dried, and stored aseptically to avoid recontamination.

Intermediate-level disinfection is accomplished with ethanol and isopropanol, iodine and iodophors, phenols and phenolics, and 1:64 dilutions of sodium hypochlorite.

Low-level disinfection is appropriate for instruments that do not touch mucous membranes; examples include bedpans, blood pressure cuffs, crutches, and table tops. Low-level disinfectants include phenols and phenolics, quaternary ammonium compounds, 1:500 dilutions of sodium hypochlorite, and iodine and iodophors.

Written policies for sterilization and disinfection in the office will ensure that these procedures are performed properly, and regular reviews should be conducted to be sure that policies are being followed.

Antiseptics are chemical agents intended for use on skin or tissue. Skin preparation agents include isopropyl alcohol, chlorhexidine gluconate, iodine, and iodophors. Alcohol is the preferred skin preparation for immunizations and venipuncture for routine blood collection. Most skin preparation agents must be allowed to dry before surface bacteria are killed. Tincture of iodine is active on contact and thus could be considered the preferred skin preparation agent for invasive procedures, such as insertion of indwelling intravenous catheters and when obtaining blood for culture. Povidone iodine is an acceptable alternative. Contamination of antiseptics has been associated with outbreaks of infections and pseudoepidemics attributable to false-positive blood cultures.^{31,32} To prevent contamination, bottles of antiseptics should be dated, should not be refilled, and should be inspected and discarded if not used within 3 months. Alcohol pads and iodine products pre-

TABLE 7. Sterilization, Disinfection, and Antisepsis^{30,31}

Instrument	Level of Disinfection
Critical instrument or device: any instrument that enters tissue, for example, needles	Sterilize
Semicritical instrument or device: contact mucous membranes but do not enter tissue, for example, laryngoscope	Sterilize or high-level disinfection
Noncritical instruments or devices: instruments that touch only intact skin, for example, stethoscopes or blood pressure cuffs	Detergent and water cleaning or low-level disinfection
Environmental surfaces: knobs, handles, carts, or table tops	Soap and water or low-level disinfection

pared for single use are available and eliminate the need for bottles of antiseptics.

GENERAL HOUSEKEEPING

Offices and office equipment should be cleaned daily. Surfaces should be cleaned with a low-level disinfectant. Phenolics, iodophors, and quaternary ammonium compounds are appropriate for use in daily cleaning and disinfection of surfaces. Blood spills should be cleaned, using disposable gloves. The area should be disinfected with a freshly prepared solution of 1:10 household bleach applied for at least 30 seconds and wiped after the minimum contact time. Gloves should be worn during cleanup of any blood or body fluid.

DISPOSAL OF MEDICAL WASTES

The federal OSHA standard as well as local and state regulations dictate the proper disposal of medical wastes, including dressings, needles, sharps, and body fluid samples.^{33,34} All physicians should be aware of the policies in their municipality and ensure that regulated wastes are disposed of appropriately. Basic principles include defining which items constitute infectious waste and which do not; appropriately separating, labeling, storing, and transporting items in these 2 categories; instructing staff on how to handle infectious wastes; and developing plans for managing waste, spills, and inadvertent exposures.

JUDICIOUS USE OF ANTIMICROBIALS

Another aspect of infection control is diagnosis of infection and institution of antibiotic therapy when indicated. Inappropriate use of antimicrobial agents in hospitals and in physician offices has contributed to the emergence of antibiotic-resistant organisms. The Centers for Disease Control and Prevention and the American Academy of Pediatrics have provided guidelines for the judicious use of antibiotics.³⁵⁻⁴⁰

Guidelines have been published for isolation and precautions for hospitalized children and adults who acquire resistant flora.⁴¹ Patients may continue to harbor resistant bacteria as part of their respiratory or gastrointestinal tract flora. These organisms include methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin intermediate susceptible *S aureus* (glycopeptide intermediate *S aureus* or GISA), vancomycin-resistant *Enterococcus* species (VRE), and extended-spectrum β -lactamase-producing or multiply-resistant Gram-negative bacteria. Handwashing before and after contact with these colonized children is appropriate; no guidelines for management of these patients in office settings have been published.

SUMMARY OF INFECTION CONTROL POLICIES

1. All health care workers should wash their hands before and after patient contact. Parents and children should be taught the importance of handwashing.
2. Standard precautions should be used in dealing with all patients.
3. Contact between infected, contagious children and uninfected children should be minimized.

Policies to deal with children who present with infections, such as varicella or measles, should be implemented. Prompt triage of immunocompromised children should be performed routinely.

4. Alcohol is preferred for skin preparation before immunization and routine venipuncture. Skin preparation for incision, suture, and collection of blood for culture, requires iodine; solutions of choice are 1% or 2% tincture of iodine or povidone iodine.
5. Needles and sharps should be handled with great care. Needle disposal units that are impermeable and puncture-proof should be available next to the areas used for injection or venipuncture. The containers should not be overfilled and should be kept out of the reach of young children. Policies should be established for removal and incineration or sterilization of contents.
6. Policies for management of needlestick injuries should also be in place.
7. Standard guidelines for sterilization, disinfection, and antisepsis should be followed.
8. Judicious use of antimicrobial agents is essential to limit the emergence and spread of drug-resistant bacteria.
9. Outpatient offices and clinics should develop policies and procedures for communication with local and state health authorities regarding reportable diseases and suspected outbreaks.
10. Ongoing educational programs that encompass appropriate aspects of infection control should be implemented, reinforced, and evaluated on a regular basis.

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