

# Guidelines for Environmental Infection Control in Health-Care Facilities

## Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC)

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The material in this report originated in the National Center for Infectious Diseases, James M. Hughes, M.D., Director; and the Division of Healthcare Quality Promotion, Steven L. Solomon, M.D., Acting Director.

### *Summary*

*The health-care facility environment is rarely implicated in disease transmission, except among patients who are immunocompromised. Nonetheless, inadvertent exposures to environmental pathogens (e.g., Aspergillus spp. and Legionella spp.) or airborne pathogens (e.g., Mycobacterium tuberculosis and varicella-zoster virus) can result in adverse patient outcomes and cause illness among health-care workers. Environmental infection-control strategies and engineering controls can effectively prevent these infections. The incidence of health-care--associated infections and pseudo-outbreaks can be minimized by 1) appropriate use of cleaners and disinfectants; 2) appropriate maintenance of medical equipment (e.g., automated endoscope reprocessors or hydrotherapy equipment); 3) adherence to water-quality standards for hemodialysis, and to ventilation standards for specialized care environments (e.g., airborne infection isolation rooms, protective environments, or operating rooms); and 4) prompt management of water intrusion into the facility. Routine environmental sampling is not usually advised, except for water quality determinations in hemodialysis settings and other situations where sampling is directed by epidemiologic principles, and results can be applied directly to infection-control decisions.*

### **Introduction**

## Parameters of the Report

This report, which contains the complete list of recommendations with pertinent references, is Part II of *Guidelines for Environmental Infection Control in Health-Care Facilities*. The full four-part guidelines will be available on CDC's Division of Healthcare Quality Promotion (DHQP) website. Relative to previous CDC guidelines, this report

- revises multiple sections (e.g., cleaning and disinfection of environmental surfaces, environmental sampling, laundry and bedding, and regulated medical waste) from previous editions of CDC's *Guideline for Handwashing and Hospital Environmental Control*;
- incorporates discussions of air and water environmental concerns from CDC's *Guideline for Prevention of Nosocomial Pneumonia*;
- consolidates relevant environmental infection-control measures from other CDC guidelines; and
- includes two topics not addressed in previous CDC guidelines --- infection-control concerns related to animals in health-care facilities and water quality in hemodialysis settings.

In the full guidelines, Part I, Background Information: Environmental Infection Control in Health-Care Facilities, provides a comprehensive review of the relevant scientific literature. Attention is given to engineering and infection-control concerns during construction, demolition, renovation, and repair of health-care facilities. Use of an infection-control risk assessment is strongly supported before the start of these or any other activities expected to generate dust or water aerosols. Also reviewed in Part I are infection-control measures used to recover from catastrophic events (e.g., flooding, sewage spills, loss of electricity and ventilation, or disruption of water supply) and the limited effects of environmental surfaces, laundry, plants, animals, medical wastes, cloth furnishings, and carpeting on disease transmission in health-care facilities. Part III and Part IV of the full guidelines provide references (for the complete guideline) and appendices, respectively.

Part II (this report) contains recommendations for environmental infection control in health-care facilities, describing control measures for preventing infections associated with air, water, or other elements of the environment. These recommendations represent the views of different divisions within CDC's National Center for Infectious Diseases and the Healthcare Infection Control Practices Advisory Committee (HICPAC), a 12-member group that advises CDC on concerns related to the surveillance, prevention, and control of health-care--associated infections, primarily in U.S. health-care facilities. In 1999, HICPAC's infection-control focus was expanded from acute-care hospitals to all venues where health care is provided (e.g., outpatient surgical centers, urgent care centers, clinics, outpatient dialysis centers, physicians' offices, and skilled nursing facilities). The topics addressed in this report are applicable to the majority of health-care facilities in the United States. This report is intended for use primarily by infection-control practitioners, epidemiologists, employee health and safety personnel, engineers, facility managers, information systems professionals, administrators, environmental service professionals,

and architects. Key recommendations include

## Key Terms

**Airborne infection isolation (AII)** refers to the isolation of patients infected with organisms spread via airborne droplet nuclei  $<5\ \mu\text{m}$  in diameter. This isolation area receives numerous air changes per hour (ACH) ( $\geq 12$  ACH for new construction as of 2001;  $\geq 6$  ACH for construction before 2001), and is under negative pressure, such that the direction of the air flow is from the outside adjacent space (e.g., the corridor) into the room. The air in an AII room is preferably exhausted to the outside, but may be recirculated provided that the return air is filtered through a high-efficiency particulate air (HEPA) filter. The use of personal respiratory protection is also indicated for persons entering these rooms when caring for TB or smallpox patients and for staff who lack immunity to airborne viral diseases (e.g., measles or varicella zoster virus [VZV] infection).

## Rating Categories

Recommendations are rated according to the following categories:

**Category IA.** Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies.

**Category IB.** Strongly recommended for implementation and supported by certain experimental, clinical, or epidemiologic studies and a strong theoretic rationale.

**Category IC.** Required by state or federal regulation, or representing an established association standard. (Note: Abbreviations for governing agencies and regulatory citations are listed where appropriate. Recommendations from regulations adopted at state levels are also noted. Recommendations from AIA guidelines cite the appropriate sections of the standards.)

**Category II.** Suggested for implementation and supported by suggestive clinical or epidemiologic studies, or a theoretic rationale.

**Unresolved issue.** No recommendation is offered. No consensus or insufficient evidence exists regarding efficacy.

## Recommendations --- Air

### I. Air-Handling Systems in Health-Care Facilities

- A. Use AIA guidelines as minimum standards where state or local regulations are not in place for design and construction of ventilation systems in new or renovated health-care facilities. Ensure that existing structures continue to meet the specifications in effect at the time of construction (*I*). Category IC (AIA: 1.1.A,

- 5.4)
- B. When ultraviolet germicidal irradiation (UVGI) is used as a supplemental engineering control, install fixtures 1) on the wall near the ceiling or suspended from the ceiling as an upper air unit; 2) in the air-return duct of an AII area; or 3) in designated enclosed areas or booths for sputum induction (34). Category II

#### IV. Infection-Control and Ventilation Requirements for AII Rooms

- A. Incorporate certain specifications into the planning and construction or renovation of AII units (1,34,100,101,104) (Figure 3). Category IB, IC

1. Maintain continuous negative air pressure (2.5 Pa [0.01 inch water gauge]) in relation to the air pressure in the corridor; monitor air pressure periodically, preferably daily, with

audible manometers or smoke tubes at the door (for existing AII rooms), or with a permanently installed visual monitoring mechanism. Document the results of monitoring

(1,100,101). Category IC (AIA: 7.2.C7, Table 7.2)

2. Ensure that rooms are well-sealed by properly constructing windows, doors, and air-intake and exhaust ports; when monitoring indicates air leakage, locate the leak and make

necessary repairs (1,99,100). Category IB, IC (AIA: 7.2.C3)

3. Install self-closing devices on all AII room exit doors (1). Category IC (AIA: 7.2.C4)

4. Provide ventilation to ensure  $\geq 12$  ACH for renovated rooms and new rooms, and  $\geq 6$  ACH for existing AII rooms (1,34,104). Category IB, IC (AIA: Table 7.2)

5. Direct exhaust air to the outside, away from air-intake and populated areas. If this is not practical, air from the room can be recirculated after passing through a HEPA filter (1,34).

Category IC (AIA: Table 7.2)

- B. Where supplemental engineering controls for air cleaning are indicated from a risk assessment of the AII area, install UVGI units in the exhaust air ducts of the HVAC system to supplement HEPA filtration or install UVGI fixtures on or near the ceiling to irradiate upper room air (34). Category II