



FIGURE 99-1 Causative pathogens by specific type of health care-associated infection as reported to the Centers for Disease Control and Prevention National Healthcare Safety Network. CAUTI, Catheter-associated urinary tract infections; CLABSI, central line-associated bloodstream infections; SSI, surgical site infections; VAP, ventilator-associated pneumonia. (Modified from Sievert DM, Ricks P, Edwards JR, et al: Antimicrobial-resistant pathogens associated with healthcare-associated infection: summary of data reported to the National Healthcare Safety Network at the Centers for Disease Control and Prevention, 2009-2010, *Infect Control Hosp Epidemiol* 34:1-14, 2013.)

altered mental status, pelvic or suprapubic pain, costovertebral angle tenderness, and acute onset of hematuria without another underlying cause. One of these signs or symptoms plus a positive urine culture with a known uropathogen ($>10^5$ colony-forming units) strongly suggests a CAUTI. Pyuria (>5 leukocytes/mL of urine) is not always a reliable indicator for infection in patients with indwelling catheters; pyuria and asymptomatic bacteruria are not necessarily indications for treatment. Risk factors for CAUTI acquisition include duration of catheterization, underlying fatal illness, age older than 50 years, having a nonsurgical underlying illness, and nonadherence to proper catheter care (E-Table 99-1).

The most effective method of preventing CAUTIs is to avoid placing urinary catheters unless absolutely necessary and to restrict catheter use to institutionally accepted indications. Proper insertion and care of urinary catheters are paramount (see Table 99-1). Maintenance of unobstructed flow with the collection bag below the bladder, use of a closed catheter system (even when sampling urine), and discontinuation of the catheter as soon as appropriate are key elements for preventing a CAUTI. Nurse-directed discontinuation protocols in which frontline personnel have defined parameters for removing catheters without requiring a provider's order are increasingly used to eliminate unnecessary catheters. The routine use of antimicrobial-coated catheters is not recommended except when infection rates remain elevated despite proper adherence to all other prevention strategies.

Treatment of asymptomatic bacteriuria usually is not recommended. Treatment of CAUTI is based on current Infectious Disease Society of America (IDSA) guidelines, and the choice of antimicrobial regimen should be based on the local antibiogram and identified syndrome (e.g., pyelonephritis). Before treatment, urine culture and sensitivity results are used to evaluate a resistant organism and tailor an empirical antimicrobial regimen.

Most clinicians prefer to replace or discontinue the catheter after a urinary tract infection is diagnosed. Guidelines recommend replacement if it has been in place for more than 2 weeks.

TABLE 99-2 DEFINITIONS OF TYPES OF NOSOCOMIAL PNEUMONIA

PNEUMONIA TYPE	DEFINITION
Health care–associated pneumonia (HCAP)	Pneumonia in any patient who was hospitalized in an acute care hospital for 2+ days within 90 days of infection; resided in an NH or LTCF; received recent IV antibiotic therapy, chemotherapy, or wound care within the past 30 days of the current infection; or attended a hospital or hemodialysis clinic
Hospital-acquired pneumonia (HAP)	Pneumonia that occurs at least 48 hours after admission and that was not incubating at the time of admission
Ventilator-associated pneumonia (VAP)	Pneumonia that arises 48-72 hours after endotracheal intubation

Data from American Thoracic Society, Infectious Diseases Society of America: Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia, *Am J Respir Crit Care Med* 171:388-416, 2005.
IV, Intravenous; LTCE, long-term care facility; NH, nursing home.

There is good evidence based on review by expert committees (grade A-III evidence) that duration of treatment can be 7 days if symptoms quickly resolve or 10 to 14 days if resolution is delayed. There is moderate evidence based on expert committees' opinions (grade B-III) that a 5-day course of levofloxacin can be considered if patients are not severely ill and the organism is sensitive to the drug. In nonpregnant women younger than 65 years of age, a 3-day course of antibiotic therapy can be considered after the urinary catheter has been removed (grade B-II).

HOSPITAL-ACQUIRED PNEUMONIA

HAP has become the most common HAI. Most HAPs occur in the ICU, and more than 90% are VAPs. Health care–associated pneumonia (HCAP) is considered along with HAP because of the etiologic similarities. Other definitions are given in Table 99-2.

The incidence of HAP or VAP is difficult to determine due to the various definitions that have been used for surveillance and the subjective nature of these diagnoses. Some studies have estimated that the incidence of VAP ranges from 2 to 16 cases per 1000 ventilator days. VAP is associated with increased length of hospital stay (10 days in one study), costs (approximately \$40,000), and mortality (attributable mortality rate of 13%, highest among surgical patients).

Risk factors for VAP include conditions that lead to increased aspiration or impairment of host defenses and bacterial colonization of the respiratory and upper gastrointestinal tracts (see E-Table 99-1). In a ventilated patient, the body's natural mechanical defense mechanisms (e.g., ciliated epithelium, mucus, cough) are interrupted, leading to colonization of the lower airways by potentially pathogenic organisms. The most significant source of these organisms tends to be the patient's own oropharynx and upper gastric contents.

The most commonly implicated respiratory pathogens are *S. aureus* and *P. aeruginosa*, followed by several Enterobacteriaceae species and *Acinetobacter baumannii* (see Fig. 99-1). Colonization with MDROs correlates with increasing duration of hospitalization. Guidelines argue that late (>4 days after admission) compared with early HAP may be the most useful factor when determining empirical antimicrobial therapy. Although bacteria play the largest role in HAP, fungi and viruses also must be considered in immunosuppressed patients.