TABLE 168-4 EXAMPLES OF EVIDENCE-BASED "BUNDLED INTERVENTIONS" TO PREVENT COMMON HEALTH CARE–ASSOCIATED INFECTIONS AND OTHER ADVERSE EVENTS

Prevention of Central Venous Catheter Infections
Catheter insertion bundle:
Educate personnel about catheter insertion and care.
Use chlorhexidine to prepare the insertion site.
Use maximal barrier precautions and asepsis during catheter insertion.
Consolidate insertion supplies (e.g., in an insertion kit or cart).
Use a checklist to enhance adherence to the "insertion bundle."
Empower nurses to halt insertion if asepsis is breached.
Catheter maintenance bundle:
Cleanse patients daily with chlorhexidine.
Maintain clean, dry dressings.
Enforce hand hygiene among health care workers.
Ask daily: Is the catheter needed? Remove catheter if not needed or used.
Prevention of Ventilator-Associated Events
Elevate head of bed to 30–45 degrees.
Decontaminate oropharynx regularly with chlorhexidine (controversial).
Give "sedation vacation" and assess readiness to extubate daily.
Use peptic ulcer disease prophylaxis.
Use deep-vein thrombosis prophylaxis (unless contraindicated).
Prevention of Surgical-Site Infections
Choose a surgeon wisely.
Administer prophylactic antibiotics within 1 h before surgery; discontinue within 24 h.
Limit any hair removal to the time of surgery; use clippers or do not remove hair at all.
Prepare surgical site with chlorhexidine-alcohol.
Maintain normal perioperative glucose levels (cardiac surgery patients).[a]
Maintain perioperative normothermia (colorectal surgery patients).[a]
Prevention of Urinary Tract Infections
Place bladder catheters only when absolutely needed (e.g., to relieve obstruction), not solely for the provider's convenience.
Use aseptic technique for catheter insertion and urinary tract instrumentation.
Minimize manipulation or opening of drainage systems.
Ask daily: Is the bladder catheter needed? Remove catheter if not needed.
Prevention of Pathogen Cross-Transmission
Cleanse hands with alcohol hand rub before and after all contacts with patients or their environments.

[a]These components of care are supported by clinical trials and experimental evidence in the specified populations; they may prove valuable for other surgical patients as well.

Source: Adapted from information presented at the following websites: *www.cdc.gov/hicpac/pubs.html*; *www.cdc.gov/HAI/prevent/prevention.html*; *www.ihi.org.*

inadequately disinfected urologic equipment and rarely from contaminated supplies.

Hospitals should monitor essential performance measures for preventing nosocomial UTIs (Table 168-4). Prompts to clinicians to assess a patient's need for continued use of an indwelling bladder catheter can improve removal rates and lessen the risk of UTI. Guidelines for managing postoperative urinary retention (e.g., with bladder scanners) also may limit the use or duration of catheterization. Other approaches to the prevention of UTIs have included the use of topical meatal antimicrobial agents, drainage bag disinfectants, and anti-infective catheters. None of the latter three measures is considered routine.

Administration of systemic antimicrobial agents for other purposes decreases the risk of UTI during the first 4 days of catheterization, after which resistant bacteria or yeasts emerge as pathogens. Prophylactic antibiotic administration at the time of catheter removal has been reported to decrease the risk of UTI. Selective decontamination of the gut also is associated with a reduced risk. Again, however, none of these approaches is routine.

Irrigation of catheters, with or without antimicrobial agents, may actually increase the risk of infection. A condom catheter for men without bladder obstruction may be more acceptable than an indwelling catheter and may lessen the risk of UTI if maintained carefully. The role of suprapubic catheters in preventing infection is not well defined.

Treatment of UTIs is based on the results of quantitative urine cultures (Chap. 162). The most common pathogens are *Escherichia coli*, nosocomial gram-negative bacilli, enterococci, and *Candida*. Several caveats apply in the treatment of institutionally acquired infection. First, in patients with chronic indwelling bladder catheters, especially those in long-term-care facilities, "catheter flora"—microorganisms living on encrustations within the catheter lumen—may differ from actual urinary tract pathogens. Therefore, for suspected UTI in the setting of chronic catheterization (especially in women), it is useful to replace the bladder catheter and to obtain a freshly voided urine specimen. Second, as in all nosocomial infections, at the time treatment is initiated on the basis of a positive culture, it is useful to repeat the culture to verify the persistence of infection. Third, the frequency with which UTIs occur may lead to the erroneous assumption that the urinary tract alone is the source of infection in a febrile hospitalized patient. Fourth, recovery of *Staphylococcus aureus* from urine cultures may result from hematogenous seeding and may indicate an occult systemic infection. Finally, although *Candida* is now the most common pathogen in nosocomial UTIs among patients on intensive care units (ICUs), treatment of candiduria is often unsuccessful and is recommended only when there is upper-pole or bladder-wall invasion, obstruction, neutropenia, or immunosuppression.

PNEUMONIA

Historically, pneumonia has accounted for ~10–15% of nosocomial infections; ventilator-associated pneumonia (VAP) occurred in 1 to >4 patients per 1000 ventilator-days, and these infections were reported as responsible for a mean of 10 extra hospital days and $23,000 in extra costs per episode. Most cases of bacterial nosocomial pneumonia are caused by aspiration of endogenous or hospital-acquired oropharyngeal (and occasionally gastric) flora. Nosocomial pneumonias are associated with more deaths than are infections at any other body site. However, attributable mortality rates suggest that the risk of dying from nosocomial pneumonia is affected greatly by other factors, including comorbidities, inadequate antibiotic treatment, and the involvement of specific pathogens (particularly *Pseudomonas aeruginosa* or *Acinetobacter*). Surveillance and accurate diagnosis of pneumonia have been problematic in hospitals because many patients, especially those in the ICU, have abnormal chest roentgenographs, fever, and leukocytosis potentially attributable to multiple causes. This diagnostic uncertainty has led to a refocus from VAP to "ventilator-associated events" (VAEs), conditions, and complications, for which worsening physiologic parameters, such as oxygenation, are key metrics. Early data suggest that ~5–10% of patients using mechanical ventilators develop VAEs. Viral pneumonias, which are particularly important in pediatric and immunocompromised patients, are discussed in the virology section and in Chap. 153.

Risk factors for nosocomial pneumonia include those events that increase colonization by potential pathogens (e.g., prior antimicrobial therapy, contaminated ventilator circuits or equipment, or decreased gastric acidity); those that facilitate aspiration of oropharyngeal contents into the lower respiratory tract (e.g., intubation, decreased levels of consciousness, or presence of a nasogastric tube); and those that reduce host defense mechanisms in the lung and permit overgrowth of aspirated pathogens (e.g., chronic obstructive pulmonary disease, extremes of age, or upper abdominal surgery).

Control measures for pneumonia (Table 168-4) are aimed at frequent testing of readiness for extubation, remediation of risk factors in patient care (e.g., minimizing aspiration-prone supine positioning), and aseptic care of respirator equipment (e.g., disinfecting or sterilizing all inline reusable components such as nebulizers, replacing tubing/breathing circuits only if required because of malfunction or visible soiling—rather than on the basis of duration of use—to lessen