TABLE 99-1 STRATEGIES FOR PREVENTING HEALTH CARE–ASSOCIATED INFECTIONS

HORIZONTAL STRATEGIES (TO PREVENT ALL OR MANY TYPES OF HAI)

1. Standard precautions
   - Hand hygiene
   - Use of appropriate PPE
   - Respiratory hygiene and cough etiquette
   - Appropriate environmental cleaning and waste disposal
2. Chlorhexidine bathing in ICUs*
3. Isolation precautions appropriate for pathogen
4. Steps to prevent needlestick injuries
5. MDRO decolonization
6. Education of health care workers on IC/IP protocols

VERTICAL STRATEGIES (SPECIFIC TO HAI TYPE)

CAUTI

Urinary catheter placed only for appropriate indications:
- Urinary retention or obstruction
- Need for accurate UOP measurement in critical illness
- Incontinence and perineal or sacral wounds
- Comfort care use for terminal illness

Consider alternatives:
- Condom catheters
- Intermittent catheterization

Proper insertion and maintenance:
- Maintain aseptic technique
- Properly secure catheter to patient
- Maintain closed drainage system
- Maintain unobstructed flow

Urinary catheter premeditated stop order or RN-initiated discontinuation policy

Anti-infective catheters if infection rates remain high

VAP

Use noninvasive ventilation when able

On intubation:
- Semirecumbent position (30-45 degrees) unless contraindicated
- Hypopharyngeal suctioning
- Avoid gastric overdistention
- Use cuffed ET tube
- Oral care (with chlorhexidine oral rinse), tooth brushing
- Keep ventilatory circuit closed unless changing for soiling or malfunctioning
- Daily targeted sedation management
- Spontaneous breathing trial if screening finds applicable

Use weaning protocols to minimize duration of ventilation

CLABSI

Use checklist for device insertion:
- Bundle supplies
- All present use at least face mask, then proceduralist uses sterile gown and gloves, mask, and head cap
- Avoid femoral line placement if possible
- Skin antisepsis with alcohol and >0.5% chlorhexidine
- Use of chlorhexidine-impregnated dressing or sponge at insertion site
- Empower personnel to stop nonemergent insertion if improper technique is followed

Maintenance:
- Access as infrequently as feasible
- Scrub the access hub or port with antiseptic

Daily audits for assessment of device need and potential discontinuation

SSI

Preoperative strategies:
- Nonirritative hair removal with clippers (not razors)
- Eradicate remote infection
- Decolonization of *Staphylococcus aureus* if carrier
- Smoking cessation
- Glucose control, hemoglobin A_{1c} <7% if possible
- Avoid immunosuppressive medication in perioperative period
- Identify and address malnutrition

Intraoperative strategies:
- In OR: proper ventilation, minimize traffic, proper attire, and surgical scrub
- Proper skin preparation (chlorhexidine plus alcohol or povidone plus alcohol) and draping
- Antimicrobial prophylaxis; proper timing, dosing, and intraoperative redosing
- Maintain normothermia
- Glucose control
- Tissue oxygenation, preoperative and postoperative supplementation

CDI

Prevention of acquisition:
- Antimicrobial stewardship

Prevention of transmission:
- Contact precautions (e.g., empirical placement for those suspected of CDI before confirmation of diagnosis)
- Hand hygiene with soap and water before leaving the patient's room
- Continue contact precautions until discharge

Appropriate environmental cleaning with bleach-containing agents

CAUTI, Catheter-associated urinary tract infection; CDI, *Clostridium difficile* infection; CLABSI, central line–associated bloodstream infection; ET, endotracheal; HAI, health care–associated infection; IC/IP, infection control or prevention; ICU, intensive care unit; MDRO, multidrug-resistant organism; OR, operating room; PPE, personal protective equipment; RN, registered nurse; SSI, surgical site infection; UOP, urine output; VAP, ventilator-associated pneumonia.

*Current data are not strong for prevention of CAUTI, VAP, and CDI by this method.

the total annual cost associated with CAUTIs in U.S. hospitals in 2007 was estimated between $390 and $450 million.

CAUTI complications include cystitis, pyelonephritis, and in up to 4%, bacteremia. Although urinary catheter–associated bacteremias are rare, they are an underappreciated cause of health care–associated bacteremias and have been estimated to cost an additional $3744 per episode. Most of the epidemiologic data on CAUTIs are from ICU patients. However, some studies describe rates of CAUTI among the non-ICU population that are similar to rates among ICU patients when calculated in catheter days, and in some instances, the absolute number of infections is higher outside of the ICU.

Most health care–associated urinary tract infections are catheter associated. A catheterized patient's daily risk of developing bacteruria is about 3% to 10%. Indwelling urinary catheters disrupt several mechanisms of the natural defense against infection, including urine flow, length of the urethra, and micturition to prevent attachment of potential pathogens to the uroepithelium. Tamm-Horsfall proteins, the most abundant soluble proteins in the urine, play a significant role by binding uropathogenic bacteria, facilitating wash out, and lowering the threshold for activating local innate immunity. These soluble proteins are prevented from entering the lower urinary tract by the catheters.

An indwelling catheter allows colonization, attachment, and biofilm formation by certain microorganisms. Most of the organisms causing CAUTIs arrive by ascending the urethra from the meatus and perineum. The most common uropathogens identified in CAUTIs are *Escherichia coli, Candida* species, *Klebsiella* species, *Pseudomonas aeruginosa*, and *Enterococcus* species (Fig. 99-1).

Common symptoms of a urinary tract infection (e.g., dysuria, urinary frequency) may not be useful in diagnosing a patient with an indwelling catheter. However, the most common clinical manifestations of a CAUTI are fever (≥38° C) and bacteruria. Other signs and symptoms of a CAUTI can include rigors,