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Health Care–Associated Infections

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INTRODUCTION

A health care–associated infection (HAI) is an infection that did not exist or was not incubating at the time of admission to the health care facility. Infections with an onset of more than 48 hours after admission and within 7 to 30 days after facility discharge are defined as HAIs. These infections can occur in all types of health care settings, including acute care units, long-term care facilities, rehabilitation facilities, outpatient dialysis clinics, and outpatient surgical centers.

HAIs cause a substantial degree of morbidity and mortality. A 2011 survey conducted by the Centers for Disease Control and Prevention (CDC) Emerging Infection Program reported an acute care hospital HAI prevalence of 6.8%. Extrapolating from acute care admission data (about 35 million admissions per year), approximately 2 million acute care HAIs occur annually in the United States. Beyond the extensive morbidity and mortality they cause, HAIs are costly, calculated as $13,973 per infection in one review. These costs are likely to be underestimated because of incomplete estimation of the outpatient costs of parenteral antibiotics, skilled nursing care, physical rehabilitation, and lost work days.

As of January 2011, the Centers for Medicare and Medicaid Services (CMS) required public reporting of certain facility-specific HAI outcomes as part of value-based purchasing. As of January 2013, the following acute care–related HAIs are required for reporting by CDC's National Healthcare Safety Network (NHSN): catheter-associated urinary tract infections (CAUTIs) and central line–associated bloodstream infections (CLABSIs) in intensive care units (ICUs), colon and abdominal hysterectomy surgical site infections (SSIs), hospital-onset *Clostridium difficile* infections (CDIs), and hospital-onset methicillin-resistant *Staphylococcus aureus* (MRSA) bacteremias. The importance of preventing HAIs has never been more apparent.

The major types of HAIs include the infections reported to CMS, hospital-acquired pneumonia (HAP) or ventilator-associated pneumonia (VAP), and multidrug-resistant organisms (MDROs). MDROs are pathogens with resistance to various important antibiotics (e.g., MRSA, vancomycin-resistant *Enterococcus* (VRE), antibiotic-resistant gram-negative bacilli). This chapter reviews the major classes of HAIs, with a focus on prevention, diagnosis, and treatment.

HEALTH CARE EPIDEMIOLOGY AND INFECTION PREVENTION

In the age of increasing MDROs, shortage of new antibiotics, and public reporting of HAIs, the importance of efforts to prevent HAIs is growing. The fields of health care epidemiology and infection prevention focus on the practices of tracking HAIs in a systematic fashion (i.e., surveillance) to implement evidence-based HAI prevention practices.

Although HAIs were once thought to be the cost of being critically ill and receiving care in a hospital, several key events occurred during the past decade that shifted that perception. In 2006, Pronovost and colleagues implemented a "simple and inexpensive intervention" in 103 ICUs in the state of Michigan while participating in the Michigan Health and Hospital Association Keystone ICU project. This landmark study showed a reduction in the median rate of CLABSIs from 2.7 per 1000 catheter days to zero. These results shifted the discussion from merely controlling HAIs to preventing them. Other major events have included recognition and effectiveness of using bundles of evidence-based practices to reduce HAIs; recognition of the HAI burden in nonacute, non-ICU settings; and importance of quality improvement science in reducing HAIs.

The prevention of HAIs has become increasingly possible, and various types of prevention interventions can reduce the HAI burden dramatically. In 2010, Wenzel and Edmund described these interventions as horizontal and vertical strategies (Table 99-1). Horizontal infection prevention strategies are broad practices (e.g., hand hygiene, isolation precautions) aimed at preventing many or all types of HAIs, regardless of the specific pathogen, procedure, or device. Vertical HAI prevention strategies are directed at specific types of HAIs or target a specific organism. Vertical strategies include using procedural checklists or standardized bundles and MRSA decolonization.

CATHETER-ASSOCIATED URINARY TRACT INFECTIONS

In a survey performed by the CDC in 2011, CAUTIs were the second most common device-associated infection. The incidence of CAUTIs in 2011 ranged from 0 to 4.2 per 1000 catheter days, compared with the 2006-2007 period, when rates were between 3.4 and 7.7 per 1000 catheter days. The estimated additional cost of a CAUTI was $589 to $758 per infection in 1998 dollars, and