

SUPPLEMENT ARTICLE: EXECUTIVE SUMMARY

A Compendium of Strategies to Prevent Healthcare-Associated Infections in Acute Care Hospitals

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Preventable healthcare-associated infections (HAIs) occur in US hospitals. Preventing these infections is a national priority, with initiatives led by healthcare organizations, professional associations, government and accrediting agencies, legislators, regulators, payers, and consumer advocacy groups. To assist acute care hospitals in focusing and prioritizing efforts to implement evidence-based practices for prevention of HAIs, the Society for Healthcare Epidemiology of America and the Infectious Diseases Society of America Standards and Practice Guidelines Committee appointed a task force to create a concise compendium of recommendations for the prevention of common HAIs. This compendium is implementation focused and differs from most previously published guidelines in that it highlights a set of basic HAI prevention strategies plus special approaches for use in locations and/or populations within the hospital when infections are not controlled by use of basic practices, recommends that accountability for implementing infection prevention practices be assigned to specific groups and individuals, and includes proposed performance measures for internal quality improvement efforts.

Infect Control Hosp Epidemiol 2008; 29:S12-S21

EXECUTIVE SUMMARY

The Centers for Disease Control and Prevention estimates that 1 of every 10-20 patients hospitalized in the United States develops a healthcare-associated infection (HAI). Infection prevention and control efforts have long been focused on monitoring and preventing HAIs, but HAI prevention has recently emerged as a national priority, with initiatives led by healthcare organizations, professional associations, government and accrediting agencies, legislators, regulators, payers, and consumer advocacy groups. Previous guidelines have provided detailed, evidence-based recommendations for detecting and preventing HAIs. In contrast, the accompanying documents go one important step further by presenting prac-

tical recommendations in a concise format designed to assist acute care hospitals in implementing and prioritizing their HAI prevention efforts. Four device- and procedure-associated HAI categories are targeted (central line-associated bloodstream infections [CLABSIs], ventilator-associated pneumonia [VAP], catheter-associated urinary tract infections [CAUTIs], and surgical site infections [SSIs]). In addition, 2 organism-specific HAI categories (methicillin-resistant *Staphylococcus aureus* [MRSA] infection and *Clostridium difficile* infection [CDI]) are included because of the increasing incidence and morbidity associated with acquisition of these organisms in the acute care setting.^{1,2}

The following is a summary of the strategies to prevent

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Accepted June 9, 2008; electronically published September 16, 2008.

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HAIs in acute care hospitals presented in this compendium. Criteria for grading the strength of recommendation and quality of evidence are described in Table 1.

Prevention of CLABSI

I. Basic practices for prevention and monitoring of CLABSI: recommended for all acute care hospitals

A. Before insertion

1. Educate healthcare personnel involved in the insertion, care, and maintenance of central venous catheters about CLABSI prevention (A-II).

B. At insertion

1. Use a catheter checklist to ensure adherence to infection prevention practices at the time of central venous catheter insertion (B-II).

2. Perform hand hygiene before catheter insertion or manipulation (B-II).

3. Avoid using the femoral vein for central venous access in adult patients (A-I).

4. Use an all-inclusive catheter cart or kit (B-II).

5. Use maximal sterile barrier precautions during central venous catheter insertion (A-I).

6. Use a chlorhexidine-based antiseptic for skin preparation in patients older than 2 months of age (A-I).

C. After insertion

1. Disinfect catheter hubs, needleless connectors, and injection ports before accessing the catheter (B-II).

2. Remove nonessential catheters (A-II).

3. For nontunneled central venous catheters in adults and adolescents, change transparent dressings and perform site care with a chlorhexidine-based antiseptic every 5-7 days or more frequently if the dressing is soiled, loose, or damp; change gauze dressings every 2 days or

more frequently if the dressing is soiled, loose, or damp (A-I).

4. Replace administration sets not used for blood, blood products, or lipids at intervals not longer than 96 hours (A-II).

5. Perform surveillance for CLABSI (B-II).

6. Use antimicrobial ointments for hemodialysis catheter insertion sites (A-I).

II. Special approaches for the prevention of CLABSI: Perform a CLABSI risk assessment. These special approaches are recommended for use in locations and/or populations within the hospital for which outcome data and/or risk assessment suggest lack of effective control despite implementation of basic practices.

1. Bathe intensive care unit (ICU) patients older than 2 months of age with a chlorhexidine preparation on a daily basis (B-II).

2. Use antiseptic- or antimicrobial-impregnated central venous catheters for adult patients (A-I).

3. Use chlorhexidine-containing sponge dressings for central venous catheters in patients older than 2 months of age (B-I).

4. Use antimicrobial locks for central venous catheters (A-I).

III. Approaches that should not be considered a routine part of CLABSI prevention

1. Do not use antimicrobial prophylaxis for short-term or tunneled catheter insertion or while catheters are in situ (A-I).

2. Do not routinely replace central venous catheters or arterial catheters (A-I).

3. Do not routinely use positive-pressure needleless connectors with mechanical valves before a thorough assess-

TABLE 1. Strength of Recommendation and Quality of Evidence

Category/grade	Definition
Strength of recommendation	
A	Good evidence to support a recommendation for use
B	Moderate evidence to support a recommendation for use
C	Poor evidence to support a recommendation
Quality of evidence	
I	Evidence from ≥ 1 properly randomized, controlled trial
II	Evidence from ≥ 1 well-designed clinical trial, without randomization; from cohort or case-control analytic studies (preferably from >1 center); from multiple time series; or from dramatic results from uncontrolled experiments
III	Evidence from opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees

NOTE. Adapted from the Canadian Task Force on the Periodic Health Examination.³

ment of risks, benefits, and education regarding proper use (B-II).

Prevention of VAP

I. Basic practices for prevention and monitoring of VAP: recommended for all acute care hospitals

A. Education

1. Educate healthcare personnel who care for patients undergoing ventilation about VAP, including information about local epidemiology, risk factors, and patient outcomes (A-II).

2. Educate clinicians who care for patients undergoing ventilation about noninvasive ventilatory strategies (B-III).

B. Surveillance of VAP

1. Perform direct observation of compliance with VAP-specific process measures (B-III).

2. Conduct active surveillance for VAP and associated process measures in units that care for patients undergoing ventilation who are known or suspected to be at high risk for VAP on the basis of risk assessment (A-II).

C. Practice

1. Implement policies and practices for disinfection, sterilization, and maintenance of respiratory equipment that are aligned with evidence-based standards (eg, guidelines from the Centers for Disease Control and Prevention and professional organizations) (A-II).

2. Ensure that all patients (except those with medical contraindications) are maintained in a semirecumbent position (B-II).

3. Perform regular antiseptic oral care in accordance with product guidelines (A-I).

4. Provide easy access to noninvasive ventilation equipment and institute protocols to promote the use of noninvasive ventilation (B-III).

II. Special approaches for the prevention of VAP: Perform a VAP risk assessment. These special approaches are recommended for use in locations and/or populations within the hospital for which outcome data and/or risk assessment suggest a lack of effective control despite implementation of basic practices.

1. Use an endotracheal tube with in-line and subglottic suctioning for all eligible patients (B-II).

2. Ensure that all ICU beds used for patients undergoing ventilation have a built-in tool to provide continuous monitoring of the angle of incline (B-III).

III. Approaches that should not be considered a routine part of VAP prevention

1. Do not routinely administer intravenous immunoglobulin, white-cell-stimulating factors (filgrastim or sargramostim), enteral glutamine, or chest physiotherapy (A-III).

2. Do not routinely use rotational therapy with kinetic or continuous lateral rotational therapy beds (B-II).

3. Do not routinely administer prophylactic aerosolized or systemic antimicrobials (B-III).

Prevention of CAUTI

I. Basic practices for prevention and monitoring of CAUTI: recommended for all acute care hospitals

A. Appropriate infrastructure for preventing CAUTI

1. Provide and implement written guidelines for catheter use, insertion, and maintenance (A-II).

2. Ensure that only trained, dedicated personnel insert urinary catheters (B-III).

3. Ensure that supplies necessary for aseptic-technique catheter insertion are available (A-III).

4. Implement a system for documenting the following information in the patient record: indications for catheter insertion, date and time of catheter insertion, individual who inserted catheter, and date and time of catheter removal (A-III).

5. Ensure that there are sufficient trained personnel and technology resources to support surveillance of catheter use and outcomes (A-III).

B. Surveillance of CAUTI

1. Identify the patient groups or units in which to conduct surveillance, on the basis of risk assessment, considering the frequency of catheter use and the potential risk factors (eg, types of surgery, obstetrics, and critical care) (B-III).

2. Use standardized criteria to identify patients who have a CAUTI (numerator data) (A-II).

3. Collect information on catheter-days (denominator data) for all patients in the patient groups or units being monitored (A-II).

4. Calculate CAUTI rates for target populations (A-II).

5. Measure the use of indwelling urinary catheters, including the percentage of patients with an indwelling urinary catheter inserted during hospitalization, the percentage of catheter use with accepted indications, and duration of indwelling catheter use (B-II).

6. Use surveillance methods for case finding that are appropriate for the institution and are documented to be valid (A-III).

C. Education and training

1. Educate healthcare personnel involved in the insertion, care, and maintenance of urinary catheters about

CAUTI prevention, including alternatives to indwelling catheters and procedures for catheter insertion, management, and removal (A-III).

D. Appropriate technique for catheter insertion

1. Insert urinary catheters only when necessary for patient care and leave them in place only as long as indications persist (A-II).

2. Consider other methods for management, including condom catheters or in-and-out catheterization, when appropriate (A-I).

3. Practice hand hygiene (in accordance with Centers for Disease Control and Prevention or World Health Organization guidelines) immediately before insertion of the catheter and before and after any manipulation of the catheter site or apparatus (A-III).

4. Insert catheters by use of aseptic technique and sterile equipment (A-III).

5. Use gloves, a drape, and sponges; a sterile or antiseptic solution for cleaning the urethral meatus; and a single-use packet of sterile lubricant jelly for insertion (A-III).

6. Use as small a catheter as possible that is consistent with proper drainage, to minimize urethral trauma (B-III).

E. Appropriate management of indwelling catheters

1. Properly secure indwelling catheters after insertion to prevent movement and urethral traction (A-III).

2. Maintain a sterile, continuously closed drainage system (A-I).

3. Do not disconnect the catheter and drainage tube unless the catheter must be irrigated (A-I).

4. Replace the collecting system by use of aseptic technique and after disinfecting the catheter-tubing junction when breaks in aseptic technique, disconnection, or leakage occur (B-III).

5. For examination of fresh urine, collect a small sample by aspirating urine from the sampling port with a sterile needle and syringe after cleansing the port with disinfectant (A-III).

6. Obtain larger volumes of urine for special analyses aseptically from the drainage bag (A-III).

7. Maintain unobstructed urine flow (A-II).

8. Empty the collecting bag regularly, using a separate collecting container for each patient, and avoid allowing the draining spigot to touch the collecting container (A-II).

9. Keep the collecting bag below the level of the bladder at all times (A-III).

10. Cleaning the meatal area with antiseptic solutions is unnecessary; routine hygiene is appropriate (A-I).

II. Special approaches for the prevention of CAUTI: Perform a CAUTI risk assessment. These special approaches are

recommended for use in locations and/or populations within the hospital for which outcome data and/or risk assessment suggest lack of effective control despite implementation of basic practices.

1. Implement an organization-wide program to identify and remove catheters that are no longer necessary, using 1 or more methods documented to be effective (A-II).

2. Develop a protocol for management of postoperative urinary retention, including nurse-directed use of intermittent catheterization and use of bladder scanners (B-I).

3. Establish a system for analyzing and reporting data on catheter use and adverse events from catheter use (B-III).

III. Approaches that should not be considered a routine part of CAUTI prevention

1. Do not routinely use silver-coated or other antibacterial catheters (A-I).

2. Do not screen for asymptomatic bacteruria in catheterized patients (A-II).

3. Do not treat asymptomatic bacteruria in catheterized patients except before invasive urologic procedures (A-I).

4. Avoid catheter irrigation (A-I).

5. Do not use systemic antimicrobials routinely as prophylaxis (A-II).

6. Do not change catheters routinely (A-III).

Prevention of SSI

I. Basic practices for prevention and monitoring of SSI: recommended for all acute care hospitals

A. Surveillance of SSI

1. Perform surveillance for SSI (A-II).

2. Provide ongoing feedback on SSI surveillance and process measures to surgical and perioperative personnel and leadership (A-II).

3. Increase the efficiency of surveillance through the use of automated data (A-II).

B. Practice

1. Administer antimicrobial prophylaxis in accordance with evidence-based standards and guidelines (A-I).

2. Do not remove hair at the operative site unless the presence of hair will interfere with the operation; do not use razors (A-II).

3. Control blood glucose level during the immediate postoperative period for patients undergoing cardiac surgery (A-I).

4. Measure and provide feedback to providers on the rates of compliance with process measures, including antimicrobial prophylaxis, proper hair removal, and glucose control (for cardiac surgery) (A-III).

5. Implement policies and practices aimed at reducing the risk of SSI that meet regulatory and accreditation requirements and that are aligned with evidence-based standards (eg, Centers for Disease Control and Prevention and professional organization guidelines) (A-II).

C. Education

1. Educate surgeons and perioperative personnel about SSI prevention (A-III).
2. Educate patients and their families about SSI prevention, as appropriate (A-III).

II. Special approaches for the prevention of SSI: Perform an SSI risk assessment. These special approaches are recommended for use in locations and/or populations within the hospital for which outcome data and/or risk assessment suggest a lack of effective control despite implementation of basic practices.

1. Perform expanded SSI surveillance to determine the source and extent of the problem and to identify possible targets for intervention (B-II).

III. Approaches that should not be considered a routine part of SSI prevention

1. Do not routinely use vancomycin for antimicrobial prophylaxis; vancomycin can, however, be an appropriate agent for specific clinical circumstances (B-II).
2. Do not routinely delay surgery to provide parenteral nutrition (A-I).

Prevention of MRSA Transmission

I. Basic practices for prevention and monitoring of MRSA transmission: recommended for all acute care hospitals

A. Components of an MRSA transmission prevention program

1. Conduct an MRSA risk assessment (B-III).
2. Implement an MRSA monitoring program (A-III).
3. Promote compliance with Centers for Disease Control and Prevention or World Health Organization hand-hygiene recommendations (A-II).
4. Use contact precautions for MRSA-colonized or -infected patients (A-II).
5. Ensure cleaning and disinfection of equipment and the environment (B-III).
6. Educate healthcare personnel about MRSA, including risk factors, routes of transmission, outcomes associated with infection, prevention measures, and local epidemiology (B-III).
7. Implement a laboratory-based alert system that immediately notifies infection prevention and control per-

sonnel and clinical personnel of new MRSA-colonized or -infected patients (B-III).

8. Implement an alert system that identifies readmitted or transferred MRSA-colonized or -infected patients (B-III).

9. Provide MRSA data and other outcome measures to key stakeholders, including senior leadership, physicians, and nursing staff (B-III).

10. Educate patients and their families about MRSA, as appropriate (B-III).

II. Special approaches for the prevention of MRSA transmission: These special approaches are recommended for use in locations and/or populations within the hospital for which outcome data and/or risk assessment suggest lack of effective control despite implementation of basic practices.

A. Active surveillance testing: MRSA screening program for patients

1. Implement an MRSA active surveillance testing program as part of a multifaceted strategy to control and prevent MRSA transmission when evidence suggests that there is ongoing transmission of MRSA despite effective implementation of basic practices (B-II).

B. Active surveillance testing for MRSA among healthcare personnel

1. Screen healthcare personnel for MRSA infection or colonization only if they are epidemiologically linked to a cluster of MRSA infections (B-III).

C. Routine bathing with chlorhexidine

1. Routinely bathe adult ICU patients with chlorhexidine (B-III).

D. MRSA decolonization therapy for MRSA-colonized persons

1. Provide decolonization therapy to MRSA-colonized patients in conjunction with an active surveillance testing program (B-III).

Prevention of CDI

I. Basic practices for prevention and monitoring of CDI: recommended for all acute care hospitals

A. Components of a CDI prevention program

1. Use contact precautions for infected patients, with a single-patient room preferred (A-II for hand hygiene,

A-I for gloves, B-III for gowns, and B-III for single-patient room).

2. Ensure cleaning and disinfection of equipment and the environment (B-III for equipment and B-II for the environment).

3. Implement a laboratory-based alert system to provide immediate notification to infection prevention and control personnel and clinical personnel about patients with newly diagnosed CDI (B-III).

4. Conduct CDI surveillance and analyze and report CDI data (B-III).

5. Educate healthcare personnel, housekeeping personnel, and hospital administration about CDI (B-III).

6. Educate patients and their families about CDI, as appropriate (B-III).

7. Measure compliance with Centers for Disease Control and Prevention or World Health Organization hand-hygiene and contact precaution recommendations (B-III).

II. Special approaches for the prevention of CDI: Perform a CDI risk assessment. These special approaches are recommended for use in locations and/or populations within the hospital for which outcome data and/or risk assessment suggest lack of effective control despite implementation of basic practices.

A. Approaches to minimize *C. difficile* transmission by healthcare personnel

1. Intensify the assessment of compliance with process measures (B-III).

2. Perform hand hygiene with soap and water as the preferred method before exiting the room of a patient with CDI (B-III).

3. Place patients with diarrhea under contact precautions while *C. difficile* test results are pending (B-III).

4. Prolong the duration of contact precautions after the patient becomes asymptomatic until hospital discharge (B-III).

B. Approaches to minimize CDI transmission from the environment

1. Assess the adequacy of room cleaning (B-III).

2. Use sodium hypochlorite (bleach)-containing cleaning agents for environmental cleaning. Implement a system to coordinate with the housekeeping department if it is determined that sodium hypochlorite is needed for environmental disinfection (B-II).

C. Approaches to reduce the risk of CDI acquisition

1. Initiate an antimicrobial stewardship program (A-II).

III. Approaches that should not be considered a routine part of CDI prevention

1. Do not test patients without signs or symptoms of CDI for *C. difficile* (B-II).

2. Do not repeat *C. difficile* testing at the end of successful therapy for a patient recently treated for CDI (B-III).

INTRODUCTION

The US Centers for Disease Control and Prevention estimates that nearly 2 million patients (5%-10% of hospitalized patients) experience an HAI each year; these infections lead to almost 100,000 deaths and \$4.5-\$6.5 billion in extra costs.⁴⁻⁶

The accompanying compendium of HAI prevention strategies is the result of collaboration among professional societies, including the Society for Healthcare Epidemiology of America (SHEA), the Infectious Diseases Society of America (IDSA), the Association for Professionals in Infection Control and Epidemiology, and other organizations committed to improving the safety and quality of patient care, including the Joint Commission and the American Hospital Association. Recognizing the importance of HAI prevention, these organizations worked in partnership to provide acute care hospitals with concise, practical, and evidence-based strategies to enhance their HAI prevention programs.

Healthcare facilities are currently straining to accommodate an increasing number of infection prevention initiatives, regulatory obligations, and requirements for collection and reporting of performance measures. In addition, some recommended practices aimed at HAI prevention require infrastructure that is not currently available at all hospitals, such as surveillance methods that require information technology support. To assist healthcare facilities in focusing and prioritizing their HAI prevention efforts, the recommendations contained within this compendium are prioritized on the basis of the strength of the supporting evidence, the consensus of the authors, and the intensity of resources required for implementation.

The recommendations within this compendium are largely based on previously published HAI prevention guidelines available from a number of organizations, including the Healthcare Infection Control Practices Advisory Committee and the Centers for Disease Control and Prevention, SHEA, the IDSA, and the Association for Professionals in Infection Control and Epidemiology,⁷⁻¹⁵ and relevant literature published after these guidelines. They are not meant to supplant these more detailed documents. Rather, the aim of this compendium is to provide acute care hospitals with practical guidance by use of an implementation-focused format.

Despite the existence of guidelines for the prevention of specific types of HAIs, there is often a gap between what is recommended and what is practiced.^{16,17} To reduce this gap

TABLE 2. Literature Search Subject Headings and Date Ranges

Topic	Subject headings	Date range
Catheter-associated bloodstream infection	Catheter; central line; central venous; intravascular; bacteremia; bloodstream infection; prevention	2002-2007
Ventilator-associated pneumonia	Pneumonia, ventilator associated; infection AND pneumonia, bacterial; infection control AND pneumonia, bacterial	1950-2007
Catheter-associated urinary tract infection	Catheter AND urinary; urinary tract infection AND catheter; urinary tract infection AND nosocomial AND catheter; urinary tract infection AND nosocomial	1990-2007
Surgical site infection	Wound infection; surgical site infection; postoperative infection; surgical wound; surgical wound infection	1980-2007
Methicillin-resistant <i>Staphylococcus aureus</i> <i>Clostridium difficile</i> -associated disease	<i>Staphylococcus aureus</i> ; methicillin resistance; prevention; surveillance <i>Clostridium difficile</i>	1996-Apr 2008 2002-2007

and to promote a culture of safety and individual accountability, this compendium aims to promote the establishment of infrastructure required to support these detection and prevention approaches, including adequate staffing of hospitals with trained infection prevention and control professionals, and to assign accountability for implementing effective infection prevention practices to hospital leaders, healthcare providers, and support staff.

Six documents are included, each focused on a category of HAI selected by the task force members (hereafter referred to as the HAI Allied Task Force) on the basis of the frequency of occurrence, impact on the morbidity and mortality of patients hospitalized in acute care facilities, and potential preventability through adherence to evidence-based practices. These categories include

- central line-associated bloodstream infection (CLABSI),
- surgical site infection (SSI),
- ventilator-associated pneumonia (VAP),
- catheter-associated urinary tract infection (CAUTI),
- methicillin-resistant *S. aureus* (MRSA) transmission, and
- *C. difficile* infection (CDI).

References to more detailed information available in previously published guidelines are provided in each article.

Each article contains a statement of concern and a brief summary of previously described detection and prevention methods, recommendations for implementing evidence-based prevention approaches, and proposed performance measures (both process and outcome measures) for internal monitoring.

Each recommendation is ranked on the basis of the strength of recommendation and quality of evidence as required by the IDSA Standards and Practice Guidelines Committee (Table 1). Recommendations are prioritized into (1) evidence-based basic practices that should be adopted by all acute care hospitals and (2) special approaches for use in locations and/or populations within the hospitals when infections are not controlled by use of basic practices. Recommendations that might ordinarily be included in a guideline with a C-level strength of recommendation were excluded

from these sections of the compendium and are discussed in the “unresolved issues” sections; this was done to help hospitals to focus their implementation efforts on the most strongly recommended prevention practices. Hospitals can prioritize their efforts by initially focusing on implementation of the prevention approaches listed as basic practices recommended for all acute care hospitals. If HAI surveillance or other risk assessments suggest that there is ongoing transmission despite implementation of basic practices, hospitals should then consider adopting some or all of the prevention approaches listed under the “special approaches” section of each document. These can be implemented within specific locations or patient populations or can be implemented hospitalwide, depending on outcome data, risk assessment, and/or local requirements. Most of the special approaches listed in these documents are supported by studies based on the control of HAI outbreaks and require additional personnel and financial resources for implementation.

METHODS

Panel Composition

SHEA and the IDSA Standards and Practice Guidelines Committee convened experts in the prevention and monitoring of HAIs. The HAI Allied Task Force members are listed at the end of the text of this summary.

Literature Review and Analysis

For this compendium, the HAI Allied Task Force reviewed previously published guidelines and recommendations relevant to each section and performed computerized literature searches using PubMed. Searches of the English-language literature focused on human studies published after existing guidelines through 2007, using the subject headings listed in Table 2.

Process Overview

In evaluating the evidence regarding the prevention and monitoring of HAIs, the HAI Allied Task Force followed a process

used in the development of other IDSA guidelines, including a systematic weighting of the quality of the evidence and the grade of recommendation (Table 1).

Consensus Development

The HAI Allied Task Force met on 17 occasions via teleconference to complete the compendium. The purpose of the teleconferences was to discuss the questions to be addressed, make writing assignments, and discuss recommendations. All members of the HAI Allied Task Force participated in the preparation and review of the draft documents. The compendium was then submitted to a subgroup of the HAI Allied Task Force with implementation expertise that, through a series of additional teleconferences and communications, performed extensive editing and reformatting to create implementation-focused text.

Review and Approval Process

A critical stage in the development process is peer review. Peer reviewers are relied on for expert, critical, and unbiased scientific appraisals of the documents. The SHEA/IDSA employed a process used for all SHEA/IDSA guidelines that includes a multilevel review and approval. Comments were obtained from several outside reviewers who complied with the SHEA/IDSA policy on conflict of interest disclosure. In addition, 8 stakeholder organizations provided comments on the document. Finally, the guideline was reviewed and approved by the IDSA Standards and Practice Guidelines Committee and the Board of Directors of the SHEA and the IDSA prior to dissemination.

Disclosure of Conflicts of Interest

All members of the HAI Allied Task Force and the external peer reviewers complied with the IDSA policy on conflicts of interest, which requires disclosure of any financial or other interest within the past 2 years that might be construed as constituting an actual, potential, or apparent conflict. Members of the HAI Allied Task Force and the external reviewers were provided with the IDSA conflicts of interest disclosure statement and were asked to identify ties to companies developing products that might be affected by promulgation of the compendium. Information was requested regarding employment, consultancies, stock ownership, honoraria, research funding, expert testimony, and membership on company advisory committees. The task force made decisions on a case-by-case basis as to whether an individual's role should be limited as a result of a conflict. Potential conflicts are listed in the Acknowledgments.

Mechanism for Updating the Compendium

At annual intervals, SHEA, the Association for Professionals in Infection Control and Epidemiology, the IDSA Standards and Practice Guidelines Committee liaison advisor, and the chair of the Standards and Practice Guidelines Committee

will determine the need for revisions to the compendium on the basis of an examination of current literature. If necessary, the entire task force will be reconvened to discuss potential changes. When appropriate, the panel will recommend revision of the compendium to SHEA, Association for Professionals in Infection Control and Epidemiology, the IDSA Standards and Practice Guidelines Committee, and the boards of directors of these organizations for review and approval.

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ACKNOWLEDGMENTS

We thank Edward Septimus, MD, Donald Goldmann, MD, Richard Platt, MD, the SHEA Pediatric Special Interest Committee, members of and liaisons to the Healthcare Infection Control Practices Advisory Committee, the Infectious Diseases Society of America, Society for Healthcare Epidemiology of America, and Association for Professionals in Infection Control and Epidemiology boards of directors, and the many stakeholder organizations with infection prevention and control expertise who reviewed these documents for their very insightful comments and suggestions. We are also grateful to Jennifer Bright, Jennifer Padberg, Nancy Olins, and Annette Mucha for their organizational assistance and expertise.

Financial support. Support for this compendium was provided by the Society for Healthcare Epidemiology of America and the Infectious Diseases Society of America.

Potential conflicts of interest. D.S.Y. has received a research grant from Sage Products. L.A.M. has received research grants from and served as a consultant to 3M, Angiotech, and Cadence and is a consultant to Ash Access Technology. D.J.A. has received a research grant from Pfizer and has served on advisory councils for Schering-Plough and Pfizer. K.M.A. is the immediate past president of the Association for Professionals in Infection Control and Epidemiology and serves on its board of directors. H.B.'s participation does not represent official endorsement of the compendium by the National Quality Forum. D.P.C. is a member of the speakers' bureau for Enturia. S.E.C. has received a research grant from Merck. E.R.D. is a member of the speakers' bureaus for Elan, Enzon, Schering-Plough, Viropharma, Pfizer, and Astellas

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REFERENCES

1. Klevens RM, Morrison MA, Nadle J, et al. Invasive methicillin-resistant *Staphylococcus aureus* infections in the United States. *JAMA* 2007; 298:1763-1771.
2. McDonald LC, Killgore GE, Thompson A, et al. An epidemic, toxin gene-variant strain of *Clostridium difficile*. *N Engl J Med* 2005; 353:2433-2441.
3. Canadian Task Force on the Periodic Health Examination. The periodic health examination. *Can Med Assoc J* 1979; 121:1193-1254.
4. Klevens RM, Edwards JR, Richards CL Jr, et al. Estimating health care-associated infections and deaths in U.S. hospitals, 2002. *Public Health Rep* 2007; 122:160-166.
5. Public health focus: surveillance, prevention, and control of nosocomial infections. *MMWR Morb Mortal Wkly Rep* 1992; 41:783-787.
6. Stone PW, Braccia D, Larson E. Systematic review of economic analyses of health care-associated infections. *Am J Infect Control* 2005; 33:501-509.
7. Tablan OC, Anderson LJ, Besser R, Bridges C, Hajjeh R. Guidelines for preventing health-care-associated pneumonia, 2003: recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee. *MMWR Recomm Rep* 2004; 53(RR-3):1-36.
8. O'Grady NP, Alexander M, Dellinger EP, et al. Guidelines for the prevention of intravascular catheter-related infections. Centers for Disease Control and Prevention. *MMWR Recomm Rep* 2002; 51(RR-10):1-29.
9. Mermel LA. Prevention of intravascular catheter-related infections. *Ann Intern Med* 2000; 132:391-402.
10. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection, 1999. Hospital Infection Control Practices Advisory Committee. *Infect Control Hosp Epidemiol* 1999; 20:250-278; quiz 279-280.
11. Gerding DN, Johnson S, Peterson LR, Mulligan ME, Silva J Jr. *Clostridium difficile*-associated diarrhea and colitis. *Infect Control Hosp Epidemiol* 1995; 16:459-477.
12. Siegel JD, Rhinehart E, Jackson M, Chiarello L, Committee THICPA.

- Management of multidrug-resistant organisms in healthcare settings 2006. Available at: <http://www.cdc.gov/ncidod/dhqp/pdf/ar/MDROGuideline2006.pdf>. Accessed July 10, 2008.
13. Wong ES, Hooton T. Guideline for prevention of catheter-associated urinary tract infections. Available at: http://www.cdc.gov/ncidod/dhqp/gl_catheter_assoc.html. Accessed July 25, 2007.
 14. Boyce JM, Pittet D. Guideline for hand hygiene in health-care settings. Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. Society for Healthcare Epidemiology of America/Association for Professionals in Infection Control/Infectious Diseases Society of America. *MMWR Recomm Rep* 2002; 51(RR-16):1-45, quiz CE41-CE44.
 15. Mermel L. Correction: catheter-related bloodstream infections. *Ann Intern Med* 2000; 133:395.
 16. Goldmann D. System failure versus personal accountability—the case for clean hands. *N Engl J Med* 2006; 355:121-123.
 17. Jarvis WR. The Lowbury Lecture. The United States approach to strategies in the battle against healthcare-associated infections, 2006: transitioning from benchmarking to zero tolerance and clinician accountability. *J Hosp Infect* 2007; 65(Suppl 2):3-9.