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Evidence-Based Guidelines for Selected and Previously Considered Hospital- Acquired Conditions

Report Update

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**EVIDENCE-BASED GUIDELINES FOR SELECTED AND PREVIOUSLY
CONSIDERED HOSPITAL-ACQUIRED CONDITIONS**

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EXECUTIVE SUMMARY

The Centers for Medicare and Medicaid Services (CMS) recent payment provisions for preventable hospital-acquired conditions (HAC) are one of many recent CMS “value-based purchasing” initiatives through which the Medicare program is striving to tie payment to performance. Through collaboration with the Centers for Disease Control and Prevention (CDC) and extensive public input, CMS identified 10 HACs as being reasonably preventable based on the application of published, evidence-based guidelines and thus targeted these HACs for program payment reductions. Selected HACs have to be conditions that are high volume and/or high cost, be identified in the CMS grouper as a complication or comorbidity (CC) or major complication or comorbidity (MCC) for purposes of MS-DRG assignment, and be reasonably preventable using evidence-based guidelines (73 FR 48471-48491). In addition to 10 preventable HACs, there are seven “previously considered conditions” under agency and public review (75 FR 50042-50677).

The purpose of this report is to identify and characterize the contemporary evidence-based guidelines available for each of the selected and previously considered HACs that provide recommendations for the prevention of the corresponding condition in the acute hospital setting. Guidelines were primarily identified using the Agency for Healthcare Research and Quality (AHRQ) National Guidelines Clearing House (NGCH) and the CDC, along with relevant professional societies. Guidelines published in the United States were used, if available. In the absence of U.S. guidelines for a specific condition, international guidelines were included.

Evidence-based guidelines that included specific recommendations for the prevention of the condition were identified in nine of the 10 selected conditions. There are no current guidelines that address the prevention of air embolism, but two review articles which address specific prevention practices were identified. There were no U.S. guidelines for prevention of blood incompatibility. In this instance, three international guidelines citing evidence and providing specific prevention recommendations were also included. In the absence of evidence based guidelines reviews with specific prevention recommendations were cited.

There are seven previously considered conditions included in the report. Evidence-based guidelines with prevention recommendations were found for each of the previously considered HACs. For methicillin resistant *Staphylococcus aureus* (MRSA), guidelines were also included that covered strategies in the community to detect and reduce the presence of MRSA in the population served, since MRSA is most commonly brought into the hospital by asymptomatic carriers. Thus, community detection and control is an important additional strategy for transmission prevention in the hospital.

Only the CDC CAUTI 2009 guidelines for urinary catheter-related infection and the ISCI Health Care Protocol: Perioperative Protocol provide estimates of the effectiveness of the recommended in actions in preventing the condition, the former for catheter-associated urinary tract infection, and the later for surgical site infections following select procedures.

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SECTION 1 INTRODUCTION

1.1 Brief Background on Hospital-Acquired Conditions (HACs) and the Importance of Obtaining the Evidence-Based Guidelines Regarding Prevention of these Conditions

The Centers for Medicare and Medicaid Services' (CMS') recent payment provisions for preventable hospital-acquired conditions (HACs) are one of many recent CMS "value-based purchasing" initiatives through which the Medicare program is striving to tie payment to performance. Through collaboration with the Centers for Disease Control and Prevention (CDC) and extensive public input, CMS identified 10 HACs as being reasonably preventable based on the application of published, evidence-based guidelines, and thus targeted these HACs for program payment reductions. Selected HACs have to be conditions that are high volume and/or high cost, be identified in the CMS grouper as a complicating (CC) or major complicating (MCC) conditions for purposes of MS-DRG assignment, and be reasonably preventable using evidence-based guidelines (73 FR 48471-48491). In addition to 10 preventable HACs, there are seven "previously considered conditions" under agency and public review (75 FR 50042-50677).

This report represents a summary of evidence-based guidelines that can be used as a basis for hospital care that will reasonably be expected to prevent these specific HACs. Thus, this evidence-based guideline information is an essential ingredient in the selection of conditions and the maintenance of the payment decisions for HACs.

1.2 Organization of the Report

In the following sections of this report, we present our methodological approach to identifying the HAC-related evidence-based guidelines (Section 2), the results of our review of those guidelines (Section 3) (Tables 1 and 2), and a summary of the findings (Section 4) (Tables 3 and 4).

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SECTION 2 METHODS

2.1 Approach Used to Identify the Appropriate Guidelines

Our search for evidence-based guidelines for each of the HACs applied the following inclusion criteria:

- addressed the HAC of interest
- developed in the United States or international guidelines if no appropriate U.S. guidelines were located
- included information on actions to be taken to prevent the HAC of interest.

We included only current guidelines, excluding guidelines listed as withdrawn either by the National Guideline Clearing House (NGCH) or guideline developers. Relevant systematic reviews that meet the above criteria were included only when evidence based guidelines could not be identified.

2.1.1 Search of Guidelines.gov (<http://www.guidelines.gov>)

We began our systematic approach by searching the National Guideline Clearing House (NGCH) for guidelines representing each of the HACs. Alternative terms were used if we did not find the appropriate guidelines. For example, for blood incompatibility, we used the terms ABO compatibility, transfusion, transfusion reaction, and administration of blood products to identify relevant guidelines. Using a snowball approach, as we reviewed one guideline and it referred to another, we would investigate that guideline as well. We were aided by the fact that the NGCH contains a link to each of the HACs.

2.1.2 Search of CDC.gov

We also searched the CDC website for guidelines representing each of the HACs. The CDC did not have guidelines for foreign objects retained after surgery, pressure ulcers Stage III and IV, manifestations of poor glycemic control, or deep vein thrombosis and pulmonary embolism.

2.1.3 Search of Other Sources

In addition to the key sources listed above, we also searched the Agency for Healthcare Research and Quality (AHRQ) to locate HACs not found in the NGCH. In each incident, we were referred back to the NGCH. We also looked at the Federal Register and used PubMed and Google to identify other government and professional clinical associations that may have relevant information. For example, with blood incompatibility, we also searched the American Society of Transplantation, American Association of Blood Banks, and American Society of Clinical Pathology. For conditions with no available guidelines, we searched the Cochrane Database of Systematic Reviews in order to identify potentially applicable review articles. In

addition, links attached to the guidelines for additional information were used to clarify processes for evidence evaluation and as a means to identify other relevant guidelines.

2.1.4 Limitations of the Methods Used

The method of identifying primary and secondary sources of guidelines rely on the NGCH and the CDC's primary sources of guidelines relevant to selected and previously considered HACs. RTI recognizes that most, but potentially not all, evidence-based guidelines are contained in the NGCH. We assumed that all U.S. guidelines have been developed by professional societies or governmental agencies and employed a secondary search strategy to identify these sources that may not have provided their guidelines to the NGCH. It is possible that there are other *ad hoc* groups that have developed guidelines that may be missed by these techniques. For HACs for which U.S. guidelines were not identified, we did search for international guidelines that may be applicable. Because international guidelines may not be perceived to be applicable to U.S. providers, we did not perform a more extensive search and thus may have missed guideline sets from outside the United States.

2.2 Definition of Evidence-Based Guidelines Applied

Guideline-development processes have been evolving from expert panel recommendations supported by a selective literature search or based on a consensus of the panel members, to the more recent adoption of systematic processes. These processes employ an explicit evidence-grading and strength-of-evidence designation. A full systematic review also includes a literature search framed by critical questions as well as defined inclusion and exclusion criteria. There continue to be important clinical areas for which there is no definitive clinical trial or other relevant evidence base. This issue is typically addressed by either making no recommendation when there is clinical uncertainty, or by making recommendations, clearly specified as being expert opinion, that are typically based on clinical experience and reasoning from underlying scientific principles. To account for this evolution in “evidence-based guidelines,” we developed a three-tiered set of criteria to categorize the type of evidence-base used for each guideline.

We set Level I as the highest level of evidence-based guideline. To account for current guidelines-development processes, we have subdivided this level into Level Ia: guidelines that used a systematic literature search, rated the quality of each individual study considered, and graded the overall strength of evidence, or demonstrated that they used a “best evidence” approach through exclusion of information from studies deemed to be of lower internal validity; and Level Ib: guidelines that rated the quality of each individual study considered, graded the overall strength of evidence, or demonstrated the use of a “best evidence” approach, but did not employ a systematic methodology for the review of the literature. For those guidelines that did not describe a systematic methodology and only provided citations for the recommendation, we called these “evidence-cited” and designated them as Level II. Our lowest level, Level III, represented those guidelines that were based on expert opinion or no specific information to describe the basis of the recommendation. Guidelines typically present various levels of recommendation depending on the quality of evidence, and most employ expert opinion for some of the recommendations that are made when there is not sufficient evidence in the literature. The use of expert opinion may occur with Level Ia, Ib, or Level II guidelines and thus, guidelines may be rated as either Level Ia, Ib, or Level II and, **in addition**, Level III.

Level of Evidence

- **Level Ia:** Systematic literature search and review, indication of review of the quality of the studies or the overall body of literature, or a “best evidence” approach.
- **Level Ib:** Literature review and review of the quality of the studies or the overall body of literature, or a “best evidence” approach.
- **Level II:** Evidence is cited, but no discussion of quality or strength of evidence
- **Level III:** Expert opinion or no information on how recommendations were developed.

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SECTION 3 RESULTS

In this section, we describe the evidence based guidelines found for the 10 selected HACs and the seven previously considered HACs.

3.1 Selected Conditions

In **Table 1** below, we present the guidelines identified through our searches that provide recommendations to prevent the ten selected HACs:

- Foreign object retained after surgery
- Air embolism
- Blood incompatibility
- Pressure ulcers (Stage III and IV)
- Injuries from falls & trauma (fractures, dislocations, intracranial injuries, crushing injuries, burns, electric shock)
- Deep vein thrombosis (DVT)/pulmonary embolism(PE) for total knee replacement or hip replacement
- Manifestations of poor glycemic control (*Diabetic ketoacidosis, Hypoglycemic coma, Nonketotic hyperosmolar coma; Secondary diabetes with ketoacidosis or hyperosmolarity*)
- Catheter-associated urinary tract infection
- Vascular catheter-associated infection
- Surgical site infection (SSI) following Coronary Artery Bypass Graft (mediastinitis), bariatric surgery, or certain orthopedic procedures (spine, neck, shoulder, or elbow).

Each HAC is discussed in the text immediately below the table, which includes identification of the guideline developer and commentary on the evidence level and whether the guideline includes identification of appropriate actions to be taken to prevent the HAC. Note that, for clarity, the guidelines are references in the text by the guideline developer. Only two of the identified guidelines included a statement of the anticipated magnitude of prevention of events anticipated with use of the guideline recommendations.

Table 1
Identified guidelines for each selected hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention recommendations
<p>Foreign object retained after surgery</p> <p>AORN Journal. "Best Practices for Preventing a Retained Foreign Body." July 2006, S30-S36; Association of periOperative Registered Nurses (AORN)</p>	<p>http://www.aornjournal.org/article/S0001-2092(06)60172-5/fulltext</p>	<p>Level III: Expert Opinion</p>	<p>Not all recommendations are referenced.</p>	<p>Prevention recommendations include: consistently performing surgical counts according to national standards and facility policy, using only x-ray detectable [items], and conducting a methodical wound exploration before wound closure."</p>
<p>AORN Journal. "Recommended Practices for Sponge, Sharps, and Instrument Counts." February, 2006;83(2): 418, 421-6, 429-33. Association of periOperative Registered Nurses (AORN)</p>	<p>http://www.aornjournal.org/article/S0001-2092(06)60172-5/pdf</p>	<p>Level II: Evidence Cited</p>	<p>Full-text is also available here in html format: http://findarticles.com/p/articles/mi0FSL/is_2_83/ai_n26857830/ (accessed December 28, 2010)</p>	<p>Contains comprehensive recommendations for timing of counts, responsible persons, and proper use of sponges and sharps.</p>
<p>Statement on the Prevention of Retained Foreign Bodies after Surgery, 2005; American College of Surgeons and the Council of Surgical and Perioperative Safety <i>Bulletin of the American College of Surgeons</i> Vol.90, No. 10, October 2005</p>	<p>http://www.facs.org/fellows_info/statements/st-51.html</p>	<p>Level III: Expert opinion</p>	<p>1 page statement</p>	<p>"Consistent application and adherence to standardized counting procedures"</p>
<p>Health care protocol: Prevention of Unintentionally Retained Foreign Objects During Vaginal Deliveries. Third edition, November 2009; Institute for Clinical Systems Improvement (ICSI)</p>	<p>http://www.icsi.org/retained_foreign_objects_during_vaginal_deliveries/prevention_of_unintentionally_protocol.html (Redirects to pdf document)</p>	<p>Levels Ib and III: Literature search, evidence rating and expert opinion</p>	<p>A list of changes from the previous version is here: http://www.icsi.org/retained_foreign_objects_during_vaginal_deliveries/prevention_of_unintentionally_summary_of_changes.html</p>	<p>"The recommendations for prevention of unintentionally retained foreign objects during vaginal deliveries are presented in the form of a protocol and an algorithm with 12 components, accompanied by detailed annotations."</p>

(continued)

Table 1 (continued)
Identified guidelines for each selected hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention recommendations
Health Care Protocol: Prevention of Unintentionally Retained Foreign Objects in Surgery. First edition, September 2007; Institute for Clinical Systems Improvement (ICSI)	http://www.icsi.org/home/retained_foreign_objects_in_surgery_prevention_of_unintentionally_protocol_21475.html	Levels Ib and III: Literature search, evidence rating and expert opinion	None	“This protocol will describe the necessary steps, which if implemented, will prevent the unintentional retention of a foreign object in patients in the operating room (OR).”
Perioperative protocol. Health care protocol. Institute for Clinical Systems Improvement (ICSI) 2010	http://www.guideline.gov/content.aspx?id=15538 http://www.icsi.org/perioperative_protocol_36011/perioperative_protocol.html (redirects to PDF file)	Levels Ib and III: Literature search, evidence rating and expert opinion	Summary of changes is here: http://www.icsi.org/perioperative_protocol_36011/perioperative_summary_of_changes.html (redirects to PDF)	Contains detailed annotations for prevention of retained foreign bodies, including comprehensive descriptions of counting processes and recommendations for implementation.
Air embolism* <i>[no current guidelines available]</i> Fathi AR, Eshtehardi P, Meier B. Patent Foramen Ovale and Neurosurgery In Sitting Position: A Systematic Review. British Journal of Anesthesia. 2009 May;102(5):588-96. Epub 2009 Apr 4.	http://bjao.oxfordjournals.org/content/102/5/588.full.pdf+html	Systematic review with non-specific reference to study quality grading	Literature review and recommendations for prevention, not explicitly labeled as a guideline.	Describes recommendations for neurosurgery. “... we recommend screening for PFO and considering closure in cases in which the sitting position is the preferred neurosurgical approach. Our proposed management including the time of PFO closure according to available data is presented. However, the conclusions from our systematic review may be limited due to the lack of level A evidence and from using data from observational cohort studies.”

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Table 1 (continued)
Identified guidelines for each selected hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention recommendations
Mirski AM, Lele AV, Fitzsimmons L, Toung TJK. "Diagnosis and Treatment of Vascular Air Embolism." <i>Anesthesiology</i> 2007;106:164-77.	http://www.sarasotaanesthesia.com/reading/literature/Anes_Jan07_VenouseAir.pdf	Review. Evidence cited but not graded for quality.	Review article.	Reviews recommendations for patient positioning, insertion and removal of central venous access catheters, military antishock trousers, positive end-expiratory pressure, and avoidance of nitrous oxide during various surgical and non-operative procedures
Peter DA, Saxman C. Preventing air embolism when removing CVCs: an evidence-based approach to changing practice. <i>Medsurg Nurs.</i> 2003;12(4):223-228.	http://www.ncbi.nlm.nih.gov/pubmed/14515601 Article available for purchase.	Review. Evidence cited but not graded for quality.	Review article. Full text is also available here in html format: http://findarticles.com/p/articles/mi_m0FSS/is_4_12/ai_n18616012/pg_2/?tag=content:coll (accessed December 28, 2009)	Reviews recommendations for patient positioning, insertion and removal of venous catheters, and patient participation and education
Blood incompatibility* Guidelines for Compatibility Procedures in Blood Transfusion Laboratories- Standards in Haematology, 2004 British Committee for Standards in Haematology Blood Transfusion task Force. <i>Transfusion Medicine</i> , 2004; 14:59-73.	http://www.bcsghguidelines.com/documents/compatibility_bjh_2004.pdf	Level II: Evidence cited	Included British and Finnish work due to lack of standards from USA. Guideline currently under revision.	"Errors in patient identification and sample labeling may lead to ABO incompatible transfusions."
Blood Transfusion Indications and Administration, 2008, Finnish Medical Society Duodecim Finnish Medical Society Duodecim. Blood transfusion: indications and administration. In: EBM Guidelines. Evidence-Based Medicine. Helsinki, Finland: Wiley Interscience. John Wiley & Sons; 2008 Jan 10	http://www.guideline.gov/summary/summary.aspx?doc_id=12787&nbr=6589&css+6&xl=999 Article available for purchase.	Level II: Evidence cited	Finnish Guidelines	"Verify the identity of the patient."

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Table 1 (continued)
Identified guidelines for each selected hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention recommendations
<p>Pressure ulcers (Stage III and IV)</p> <p>Preventing pressure ulcers & skin tears, In: Evidence-based Geriatric Nursing Protocols for Best Practice, 2008</p> <p>Ayello EA, Sibbald RG.</p> <p>Preventing pressure ulcers and skin tears. In: Capezuti E, Zwicker D, Mezey M, Fulmer T, editor(s). Evidence-based geriatric nursing protocols for best practice. 3rd ed. New York (NY): Springer Publishing Company; 2008 Jan. p. 403-29.</p>	<p>http://www.guideline.gov/summary/summary.aspx?doc_id=12262&nbr=006346</p> <p>Chapter available for purchase; corresponding protocol available here: http://consultgerirn.org/topics/pressure_ulcers_and_skin_tears/want_to_know_more</p>	<p>Level Ia and III:</p> <p>Systematic review and expert opinion</p>	<p>Not specific to stage III and IV pressure ulcer.</p>	<p>“Assess skin daily, use moisturizers on dry skin”</p>
<p>Pressure Ulcer Prevention and Treatment Following Spinal Cord Injury, 2001 Paralyzed Veterans of America.</p> <p>Pressure ulcer prevention and treatment following spinal cord injury: a clinical practice guideline for health-care professionals. J Spinal Cord Med 2001 Spring;24(Suppl 1):S40-101.</p>	<p>http://www.guideline.gov/summary/summary.aspx?doc_id=2589&nbr=001815</p> <p>http://www.pva.org/site/DocServer/PU.pdf?docID=688</p>	<p>Level Ib and III:</p> <p>Literature search, evidence rating and expert opinion</p>	<p>None</p>	<p>“Avoid prolonged positional immobilization whenever possible.”</p>
<p>Health care protocol. Pressure ulcer prevention and treatment, 2010 update; Institute for Clinical Systems Improvement (ICSI)</p>	<p>http://www.guideline.gov/content.aspx?id=16004</p> <p>http://www.icsi.org/pressure_ulcer_treatment_protocol_review_and_comment/pressure_ulcer_treatment_protocol_protocol.html</p> <p>Article available for purchase.</p>	<p>Level Ib and III:</p> <p>Literature search, evidence rating and expert opinion</p>	<p>Strength of evidence included for some, but not all of the recommended processes</p>	<p>Similar recommendations and level of detail as row above. “Full risk assessment includes determining a person’s risk for pressure ulcers”</p>

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Table 1 (continued)
Identified guidelines for each selected hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention recommendations
<p>Clinical Practice and Quick Reference Guide for Pressure Ulcer Prevention.</p> <p>National Pressure Ulcer Advisory Panel (NPUAP) and European Pressure Ulcer Advisory Panel (EPUAP), 2010</p>	<p>http://www.npuap.org/resources.htm;</p> <p>http://www.npuap.org/Final_Quick_Prevention_for_web_2010.pdf</p>	<p>Levels Ia and III: Systematic Review and Expert Opinion</p>	<p>Jointly developed by NPUAP (USA) and EPUAP (European). Only the Quick Reference guide is available free of charge; however, the authors note that it contains only excerpts and should be used in conjunction with the Clinical Practice Guidelines</p>	<p>Provides recommendations for risk assessment policy and practice, skin assessment, patient nutrition, patient repositioning techniques and practices, support surfaces. Includes some recommendations specific to patients in the operating room.</p>
<p>Injuries from falls & trauma (fractures, dislocations, intracranial injuries, crushing injuries, burns, electric shock)</p> <p>Prevention of falls (acute care). Health care protocol, 2010 update. Institute for Clinical Systems Improvement (ICSI)</p>	<p>http://www.guideline.gov/content.aspx?id=16005</p> <p>http://www.icsi.org/falls_acute_care_prevention_of_protocol/falls_acute_care_prevention_of_protocol_24255.html</p>	<p>Levels Ib and III: Literature search, evidence rating and expert opinion</p>	<p>Summary of changes is here: http://www.icsi.org/falls_acute_care_prevention_of_protocol/falls_acute_care_prevention_of_summary_of_changes.html</p>	<p>Protocol with 6 detailed annotations for fall reduction</p>
<p>Gray-Micelli D. Preventing falls in acute care. In: Capezuti E, Zwicker D, Mezey M, Fulmer T, editor(s). Evidence-based geriatric nursing protocols for best practice. Hartford Institute for Geriatric Nursing 3rd ed. New York (NY): Springer Publishing Company; 2008. p. 161-98.</p>	<p>http://www.guideline.gov/summary/summary.aspx?doc_id=12265&nbr=006349</p>	<p>Level Ia and III: Systematic review and expert opinion</p>	<p>Chapter available for purchase; corresponding protocol available here: http://consultgerin.org/topics/falls/want_to_know_more</p>	<p>Includes recommendations for risk assessment and prevention of falls in older patients.</p>

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Table 1 (continued)
Identified guidelines for each selected hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention recommendations
Fall management guideline, 2007; Health Care Association of New Jersey	http://www.guideline.gov/summary/summary.aspx?doc_id=13484&006893 http://www.hca.nj.org/docs/hcanjbp_fallmgmt6.pdf	Level III: Expert opinion; (evidence not specifically stated)	None	Very detailed description for performing elements of a clinical assessment to prevent falls.
Practice Advisory for Prevention and Management of Operating Room Fires, 2008; American Society of Anesthesiologists Task Force on Operating Room Fires.	http://www.guideline.gov/summary/summary.aspx?doc_id=12547&nbr=006463 http://journals.lww.com/anesthesiology/Fulltext/2008/05000/Practice_Advisory_for_the_Prevention_and.6.aspx	Levels II and III: Evidence cited and expert opinion	None	“For all procedures: Surgical drapes should be configured to minimize the accumulation of oxidizers under the drapes and from flowing into the surgical site.
Reducing Adverse Drug Events In: Evidence-based geriatric nursing best protocols for practice, 2008 Hartford Institute for Geriatric Nursing Zwicker D, Fulmer T. Reducing adverse drug events. In: Capezuti E, Zwicker D, Mezey M, Fulmer T, editor(s). Evidence-based geriatric nursing protocols for best practice. 3rd ed. New York (NY): Springer Publishing Company; 2008. p257-308.	http://www.guideline.gov/summary/summary.aspx?doc_id=12258&nbr=06342 Chapter available for purchase; corresponding protocol available here: http://consultgerirn.org/topics/medication/want_to_know_more	Level Ia and III: Systematic review and expert opinion	None	“Initiation of a new medication – Assess for potential drug-disease and drug-drug interactions and correct doses – the most common causes of adverse drug reactions” that might lead to falls.

(continued)

Table 1 (continued)
Identified guidelines for each selected hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention recommendations
AORN Guidance Statement: Fire Prevention in the Operating Room. AORN J. 2005 May;81(5): 1067-75	http://www.ncbi.nlm.nih.gov/pubmed/15974389 http://chua2.fiu.edu/Nursing/anesthesiology/COURSES/Semester%201/NGR%206010%20ANES%20Techno/ANES%20Techno%20SLIDES/AORNStatement_FireSafety.pdf	Levels II and III: Evidence cited and expert opinion	None	Describes recommendations for health-care personnel education, development of an evacuation plan, and prevention strategies specific to different ignition sources (e.g. electrosurgical units, lasers, etc.)
Deep vein thrombosis (DVT)/pulmonary embolism(PE) for total knee replacement or hip replacement American Academy of Orthopaedic Surgeons Clinical Guideline on the Prevention of Symptomatic Pulmonary Embolism in Patients Undergoing Total Hip or Knee Arthroplasty, 2007; American Academy of Orthopaedic Surgeons (AAOS)	http://www.guideline.gov/summary/summary.aspx?doc_id=10850&nbr=005665 http://www.aaos.org/Research/guidelines/PE_guideline.pdf	Levels Ia and III: Systematic review of literature and expert opinion	Update predicted September 2011 Other supporting documents, including evidence tables, are linked here: http://www.aaos.org/Research/guidelines/PEguide.asp	Specific recommendations for determining risk classification and prevention therapy
Venous Thromboembolism Prophylaxis Guideline, Tenth edition, 2010; Institute for Clinical Systems Improvement (ICSI)	http://www.guideline.gov/content.aspx?id=24025 http://www.icsi.org/guidelines_and_more/gloss_prot/cardiovascular/venous_thromboembolism/venous_thromboembolism_6.html	Level Ib and III: Literature search, evidence rating and expert opinion	List of changes in the updated version is provided here: http://www.icsi.org/venous_thromboembolism_summary_of_changes.html Recommendations related to differences between “old” and Heparin Sodium, USP, per the latest FDA test results are described here: http://www.icsi.org/venous_thromboembolism_4.html	Specific recommendations for prevention in patients undergoing hip replacement or knee replacement

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Table 1 (continued)
Identified guidelines for each selected hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention recommendations
Perioperative protocol. Health care protocol. Institute for Clinical Systems Improvement (ICSI) 2010	http://www.guideline.gov/content.aspx?id=15538 http://www.icsi.org/perioperative_protocol_36011/perioperative_protocol.html (redirects to PDF file)	Levels Ib and III: Literature search, evidence rating and expert opinion	Summary of changes is here: http://www.icsi.org/perioperative_protocol_36011/perioperative_summary_of_changes.html (redirects to PDF)	Contains three annotations related to prevention of thromboembolism, not specific to orthopedic procedures, through medical and mechanical prophylaxis, bridging procedures, and patient positioning.
Kearon C, Kahn SR, Agnelli G, Goldhaber S, Raskob GE, Comerota AJ. Antithrombotic therapy for venous thromboembolic disease: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines (8th Edition). Chest 2008 Jun;133(6 Suppl):454S-545S.	http://www.guideline.gov/summary/summary.aspx?doc_id=12957&nbr=00666&string=DVT http://chestjournal.chestpubs.org/content/133/6_suppl/454S.full.pdf+html	Level Ib: Literature search and evidence rating	None	Addresses treatment of DVT to prevent PE
Geerts WH, Bergqvist D, Pineo GF, Heit JA, Samama CM, Lassen MR, Colwell CW. Prevention of venous thromboembolism: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines (8th Edition). Chest 2008 Jun;133(6 Suppl):381S-453S.	http://www.guideline.gov/summary/summary.aspx?doc_id=12956 http://chestjournal.chestpubs.org/content/133/6_suppl/381S.full.pdf+html	Level Ia: Systematic review of literature	None	Anticoagulant prophylaxis during Elective Hip Replacement and elective Knee Replacement, in patients with and without a high risk of bleeding
Douketis JD, Berger PB, Dunn AS, Jaffer AK, Spyropoulos AC, Becker RC, Ansell J. The perioperative management of antithrombotic therapy: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines (8th Edition). Chest 2008 Jun;133(6 Suppl):299S-339S.	http://www.guideline.gov/summary/summary.aspx?doc_id=12962 http://chestjournal.chestpubs.org/content/133/6_suppl/299S.full.pdf+html	Level Ia: Systematic review of literature	None	Recommended procedures for bridging of anticoagulation therapy

(continued)

Table 1 (continued)
Identified guidelines for each selected hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention recommendations
<p>Manifestations of poor glycemic control</p> <p><i>Diabetic ketoacidosis, Hypoglycemic coma, Nonketotic hyperosmolar coma; Secondary diabetes with ketoacidosis or hyperosmolarity</i></p> <p>Medical Guidelines for Clinical Practice for the Management of Diabetes Mellitus. Diabetes management in the hospital setting. 2007; American Association of Clinical Endocrinologists.</p> <p>AACE Diabetes Mellitus Clinical Practice Guidelines Task Force. Endocr Pract 2007 May-Jun;13(Suppl 1):59-63.</p>	<p>http://www.guideline.gov/summary/summary.aspx?doc_id=11100&nbr=005859</p> <p>http://aace.metapress.com/content/a205210114r6l833/</p>	<p>Level Ib: Literature search and evidence rating</p>	<p>None</p>	<p>Recommendations for the routine glucose monitoring and a plan for treatment of hospitalized patients with diabetes designed to maintain glucose control and prevent hyperglycemic or hypoglycemic episodes and resultant complications. Recommendations also provide for special circumstances, including the use of concomitant medication that may worsen glucose control.</p>
<p>Perioperative protocol. Health care protocol. Institute for Clinical Systems Improvement (ICSI) 2010</p>	<p>http://www.guideline.gov/content.aspx?id=15538</p> <p>http://www.icsi.org/perioperative_protocol_36011/perioperative_protocol.html (redirects to PDF file)</p>	<p>Levels Ib and III: Literature search, evidence rating and expert opinion</p>	<p>Summary of changes is here: http://www.icsi.org/perioperative_protocol_36011/perioperative_summary_of_changes.html (redirects to PDF)</p>	<p>Glucose monitoring should be part of standardized preoperative, intraoperative, and postoperative care. Tight glucose control may or may not be beneficial among nondiabetic patients.</p>
<p>Standards of Medical Care in Diabetes, VIII. Diabetes Care in Specific Settings. 2010; American Diabetes Association.</p> <p>Diabetes Care. 2010 Jan; 33 Suppl 1:S11-S61.</p>	<p>http://www.guideline.gov/content.aspx?id=15690</p> <p>http://care.diabetesjournals.org/content/33/Supplement_1/S11.full.pdf+html</p>	<p>Level Ib and III: Literature search, evidence rating and expert opinion</p>	<p>Yearly guideline update.</p>	<p>Recommendations for the monitoring, treatment of glucose to prevent and treat manifestations of hypoglycemia and hyperglycemia. Section VIII presents recommendations specific to patients in the hospital setting.</p>

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Table 1 (continued)
Identified guidelines for each selected hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention recommendations
Diagnosis and Management of Type 2 Diabetes Mellitus in Adults, Fourteenth Edition, 2010: Institute for Clinical Systems Improvement (ICSI)	http://www.guideline.gov/content.aspx?id=14856 http://www.icsi.org/guidelines_and_more/gloss_prot/other_health_care_conditions/diabetes_mellitus_type_2/diabetes_mellitus_type_2_management_of_6.html	Levels Ia and III: Systematic review and expert opinion,	List of updates since previous version: http://www.icsi.org/diabetes_mellitus_type_2/diabetes_mellitus_type_2_management_of_summary_of_changes_2.html	Recommendations for the monitoring, treatment of glucose to prevent and treat manifestations of hypoglycemia and hyperglycemia
Catheter-associated urinary tract infection Guideline for Prevention of Catheter Associated Urinary Tract Infection (CAUTI), 2009; HICPAC, CDC	http://www.guideline.gov/content.aspx?id=15519 http://www.cdc.gov/ncidod/dhqp/pdf/guidelines/CAUTI_Guideline2009final.pdf Appendices here: http://www.cdc.gov/hicpac/pdf/CAUTI/CAUTI_GuidelineAppendices2009final.pdf	Level Ia: Systematic Review	None	Recommendation for the appropriate use and procedures for insertion and maintenance of urinary catheters to minimize the occurrence of urinary tract infection
Strategies to Prevent CAUTI in Acute Care Hospitals, 2008; Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America Infect Control Hosp Epidemiol 2008 Oct;29 Suppl 1:S41-50.	http://www.guideline.gov/summary/summary.aspx?doc_id=13394&nbr=006805 http://www.ncbi.nlm.nih.gov/pubmed/18840088 Article available for purchase.	Levels Ib and III: Literature search, evidence rating and expert opinion	From: SHEA/IDSA Compendium of Strategies to Prevent Healthcare-Associated Infections in Acute Care Hospitals, http://www.shea-online.org/about/compendium.cfm	Recommendations for preventing and monitoring catheter-associated urinary tract infection

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Table 1 (continued)
Identified guidelines for each selected hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention recommendations
Best Practice Policy Statement on Urological Surgery Antimicrobial Prophylaxis, 2007; American Urologic Association Education and Research, Inc.	http://www.guideline.gov/summary/summary.aspx?doc_id=12210&nbr=006297 http://www.aunet.org/content/guidelines-and-quality-care/clinical-guidelines/main-reports/antimicroprop08.pdf	Levels Ib and III: Literature search, evidence rating and expert opinion	None	Prophylactic antibiotic recommendations for urologic instrumentation. Including catheters to prevent systemic infections in select patients
Guide to the care of the hospitalized patient with ischemic stroke. 2nd edition, 2008; American Association of Neuroscience Nurses	http://www.guideline.gov/summary/summary.aspx?doc_id=13575 http://www.aann.org/pdf/cpg/aannischemicstroke.pdf	Levels Ib and III: Literature search, evidence rating and expert opinion	None	Stroke patients are at risk for a higher incidence of UTI because of changes in sphincter control and frequent use of an indwelling catheter . If at all possible, placement of indwelling catheters should be avoided because of this risk (Level 3 ; Adams et al., 2007). A change in a patient's LOC should lead to suspicion of a UTI if there are no other reasons for neurological deterioration. Urinalysis and cultures should be obtained if a UTI is suspected (Adams et al., 2007; Roth et al., 2001).
Prevention of catheter-associated urinary tract infections. In: Betsy Lehman Center for Patient Safety and Medical Error Reduction, JSI Research and Training Institute, 2008; Massachusetts Department of Public Health	http://www.guideline.gov/summary/summary.aspx?doc_id=12923&nbr=006637 http://www.mass.gov/Eeohhs2/docs/dph/patient_safety/haipcp_final_report_pt1.pdf	Levels Ia and III: Systematic review and expert opinion	None	Detailed list of protocols for prevention of CAUTI. Includes “Special Approaches for Prevention of CAUTI: 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.”

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Table 1 (continued)
Identified guidelines for each selected hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention recommendations
<p>Vascular catheter-associated infection*</p> <p>Strategies to Prevent Central Line-Associated Bloodstream Infection in Acute Care Hospitals, 2008; Infectious Diseases Society of America, Society for Healthcare Epidemiology of America</p> <p>Infect Control Hosp Epidemiol 2008 Oct; 29 Suppl 1:S22-30.</p>	<p>http://www.guideline.gov/summary/summary.aspx?doc_id=13395&nbr=006806</p> <p>http://www.ncbi.nlm.nih.gov/pubmed/18840085</p> <p>Article available for purchase.</p>	<p>Level Ib and III: Literature search, evidence rating and expert opinion</p>	<p>An update of prior guidelines</p> <p>From: SHEA/IDSA Compendium of Strategies to Prevent Healthcare-Associated Infections in Acute Care Hospitals, http://www.shea-online.org/about/compendium.cfm</p>	<p>Comprehensive recommendations for the insertion and maintenance of central line catheters</p>
<p>Prevention of blood stream infections. In: Prevention and Control of Health Care Associated infections in Massachusetts, 2008. Betsy Lehman Center for Patient Safety and Medical Error Reduction, JSI Research and Training Institute, Inc. Massachusetts Department of Public Health 2008 Jan 31. p. 69-82.</p>	<p>http://www.guideline.gov/summary/summary.aspx?doc_id=12922&nbr=006636</p> <p>http://www.mass.gov/Eeohhs2/docs/dph/patient_safety/haipcp_final_report_pt1.pdf</p>	<p>Levels Ib and III: Literature search, evidence rating and expert opinion</p>	<p>None</p>	<p>“Maintain aseptic technique for the insertion and care of intravascular catheters.”</p>
<p>Preservation of peripheral veins in patients with chronic kidney disease. 2008; Association for Vascular Access (AVA), American Society of Diagnostic and Interventional Nephrology (ASDIN).</p>	<p>http://www.guideline.gov/summary/summary.aspx?doc_id=12497</p> <p>http://www.avainfo.org/website/download.asp?id=193195</p>	<p>Level III: Expert opinion</p>	<p>None</p>	<p>“Currently there are no nationally recognized policies or guidelines which address the need for specialized venous access care in patients with chronic kidney disease. The American Society of Diagnostic and Interventional Nephrology/Association for Vascular Access (ASDIN/AVA) Joint Clinical Practice Committee proposes the following...”</p>

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Table 1 (continued)
Identified guidelines for each selected hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention recommendations
NKF-KDOQI clinical practice guidelines for vascular access: update 2006. NKF-KDOQI, Vascular Access Work Group. Am J Kidney Dis 2006 Jul;48 Suppl 1:S248-73.	http://www.guideline.gov/summary/summary.aspx?doc_id=10017 http://download.journals.elsevierhealth.com/pdfs/journals/0272-6386/PIIS0272638606006469.pdf HTML: http://www.kidney.org/professionals/kdoqi/guidelines_updates/doki_uptoc.html#a	Levels Ia and III: Systematic review and expert opinion	Detailed.	Includes recommendations for “Infection-control measures that should be used for all HD catheters and port catheter systems”
Guidelines for the Prevention of Intravascular Catheter-related Infections, 2002; CDC MMWR Recomm Rep. 2002 Aug 9;51(RR-10):1-29.	http://www.cdc.gov/MMWR/PREVIEW/MMWRHTML/rr5110a1.htm http://www.cdc.gov/mmwr/PDF/rr/rr5110.pdf http://www.cdc.gov/hicpac/pubs.html#2	Levels Ia and III: Systematic review and expert opinion	2010 update final issue review, here: http://www.cdc.gov/hicpac/pdf/BSI_guideline_IssuesMay17final.pdf	Addresses central venous line and vascular access catheters insertion and maintenance in adults and children
Surgical site infection (SSI) Tools and measures for the prevention of surgical site infection, 2010; CMS	http://www.qualitynet.org/dcs/ContentServer?c=MQParents&pageName=Medqic%2FMeasure%2FMeasuresHome&cid=1089815967030&parentName=Topic	Based on guidelines	Publicly reported infection prevention measures	Operationalizes clinical recommendations for prevention of surgical site infection.

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Table 1 (continued)
Identified guidelines for each selected hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention recommendations
Strategies to Prevent Surgical Site Infections in Acute Care Hospitals, 2008; Infectious Diseases Society of America, Society for Healthcare Epidemiology of America Infect Control Hosp Epidemiol 2008 Oct;29 Suppl 1:S51-61.	http://www.guideline.gov/summary/summary.aspx?doc_id=13399&nbr=006810 http://www.ncbi.nlm.nih.gov/pubmed/18840089 Article available for purchase.	Level Ib and III: Literature search, evidence rating and expert opinion	From: SHEA/IDSA Compendium of Strategies to Prevent Healthcare-Associated Infections in Acute Care Hospitals, http://www.shea-online.org/about/compendium.cfm	General recommendations for prevention of surgical site infection. Includes some recommendations related to cardiac surgery. “Stop prophylaxis within 24 hours after the procedure for all procedures except cardiac surgery; for cardiac surgery, antimicrobial prophylaxis should be stopped within 48 hours”
Prevention of surgical site infections, In: Prevention and Control of Healthcare-Associated Infections in Massachusetts, 2008; Betsy Lehman Center for Patient Safety and Medical Error Reduction, JSI Research and Training Institute, Massachusetts Department of Public Health	http://www.guideline.gov/summary/summary.aspx?doc_id=12921&nbr=006635 http://www.mass.gov/Eeohhs2/docs/dph/patient_safety/haipcp_final_report_pt1.pdf	Level Ib and III: Literature search, evidence rating and expert opinion	No specific reference to bariatric or orthopedic procedures	Comprehensive description of preoperative, interoperative, and postoperative SSI prevention measures. “Whenever possible, identify and treat all infections remote to the surgical site before elective operation and postpone elective operations on patients with remote site infections until the infection has resolved.” “For adult cardiac surgery patients, ensure that blood glucose levels measured at 6 a.m. on postoperative days one and two are maintained below 200 mg/dL.”
Antibiotic Prophylaxis in Spine Surgery, 2007; North American Spine Society (NASS)	http://www.guideline.gov/summary/summary.aspx?doc_id=12191&nbr=006288 http://www.spine.org/Documents/Antibiotic_Prophylaxis_Web.pdf	Level Ib and III: Literature search, evidence rating and expert opinion	No specific guidelines for CABG or shoulder or elbow surgeries.	“Patients undergoing spine surgery should receive preoperative prophylactic antibiotics.”

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Table 1 (continued)
Identified guidelines for each selected hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention recommendations
Guideline for Prevention of Surgical Site Infection, 1999; CDC Infect Control Hosp Epidemiol. 1999 Apr;20(4):250-78	http://www.cdc.gov/ncidod/dhqp/pdf/guidelines/SI.pdf http://www.cdc.gov/hicpac/pubs.html#3	Level Ib and III: Literature search, evidence rating and expert opinion	No specific guidelines for CABG, orthopedic, or bariatric surgeries.	Comprehensive recommendations for prevention of surgical site infection
Antibiotic prophylaxis in cardiac surgery, Parts II, 2005; Society of Thoracic Surgeons Workforce on Evidence Based Surgery.	http://www.guideline.gov/content.aspx?id=10411 http://ats.ctsnetjournals.org/cgi/reprint/83/4/1569	Levels Ib and III Literature search, evidence rating and expert opinion.	The type of evidence is identified and graded for major recommendations.	Major recommendations for prevention of surgical site infections following cardiac surgery – soft tissue sterna infections and suppurative mediastinitis — include those application of topical antibiotics, choice of primary prophylactic antibiotic, and appropriate dosing.
American Association of Clinical Endocrinologists, The Obesity Society, and American Society for Metabolic and Bariatric Surgery Medical Guidelines for Clinical Practice for the Perioperative Nutritional, Metabolic, and Nonsurgical Support of the Bariatric Surgery Patient. 2008 Endocr Pract. 2008;14(Suppl 1)	http://www.guideline.gov/content.aspx?id=13022 http://www.aace.com/pub/pdf/guidelines/Bariatric.pdf	Level Ib and III: Literature search, evidence rating and expert opinion	Minimal mention of surgical site infection.	“Prophylactic antibiotics that cover skin organisms should be administered at the time of LAGB to prevent wound infection at the adjustment port site.” “Removal of excess fluid is recommended to decrease the risks for major wound infections.” (Evidence level 4)
Perioperative protocol. Health care protocol. Institute for Clinical Systems Improvement (ICSI) 2010	http://www.guideline.gov/content.aspx?id=15538 http://www.icsi.org/perioperative_protocol_36011/perioperative_protocol.html (redirects to PDF file)	Levels Ib and III: Literature search, evidence rating and expert opinion	Summary of changes is here: http://www.icsi.org/perioperative_protocol_36011/perioperative_summary_of_changes.html (redirects to PDF)	“By focusing on adherence to recognized techniques and protocols, the National Surgical Infection Prevention Collaborative was able to reduce surgical site infections by 27% by focusing on timing of antibiotic prophylaxis, use of appropriate antibiotics, and the discontinuation of antibiotics within 24 hours in patients undergoing a variety of major procedures.” p 8

* “Access Device Guidelines-Recommendations for Nursing Practice and Education.” 2004 Oncology Nursing Society was withdrawn from the guideline lists for Air embolism, Blood incompatibility, and Vascular catheter infection.

A. Foreign Object Retained after Surgery

1. Guidelines identified

We found six guidelines relating to foreign object retained after surgery:

- Statement on the Prevention of Retained Foreign Bodies after Surgery (American College of Surgeons [ACS])
- Best Practices for Preventing a Retained Foreign Body (Association of periOperative Registered Nurses [AORN])
- Recommended Practices for Sponge, Sharps, and Instrument Counts (AORN)
- Prevention of unintentionally retained foreign objects during vaginal deliveries. Health care protocol (ICSI)
- Health Care Protocol: Prevention of Unintentionally Retained Foreign Objects in Surgery (ICSI).
- Health Care Protocol: Perioperative Protocol (ICSI).

2. Guidelines considered “evidence-based”

The ICSI Health Care Protocols cites evidence and provide ratings for the strength of evidence, but not individual studies; protocols are finalized based on consensus from a panel of experts. The ACS statement cites evidence and expert opinion, but does not mention quality rating of individual studies or strength of evidence. The AORN article “Recommended Practices for Sponge, Sharps, and Instrument Counts” cites evidence, while “Best Practices for Preventing a Retained Foreign Body” is based on expert opinion.

3. Identification of the appropriate actions to be taken to prevent the condition

All statements describe actions to take to prevent the retention of foreign objects. The ACS statement recommends consistent application and adherence to standardized counting procedures and use of the AHRQ Patient Safety Indicators (PSIs), which are a set of indicators for measuring in-hospital complications and adverse events. The ICSI Health Care Protocols and AORN Recommended Practices for Sponge, Sharps, and Instrument Counts describe specific procedures for use in the operating room and labor and delivery. The Protocol for Prevention of Unintentionally Retained Foreign Objects during Vaginal Deliveries delineates differences in procedures between the operating arena and labor and delivery.

B. Air Embolism

1. Guidelines identified

We identified no current guidelines for air embolism in the NGCH. The guideline listed in the June 5, 2010 version of this report, *Access Device Guidelines: Recommendations for*

Nursing Practice and Education (NGC-4666), has been withdrawn. Therefore, we list below several pertinent reviews.

- One systematic review of air embolism complications in neurosurgery was identified (Fathi *et al*, 2009).
- Two non-systematic reviews of the risk of air embolism during various surgical and non-operative procedures were selected (Mirski *et al*, 2007; Peter and Saxman, 2003). In addition to risk factors, the authors describe methods for prevention and treatment of air embolism.

2. *Guidelines considered “evidence-based”*

N/A

3. *Identification of the appropriate actions to be taken to prevent the condition*

Fathi *et al.* recommend peri-operative screening for patent Foramen Ovale and considering closure two to four weeks before surgery, especially in cases where the horizontal position confers considerably higher risk. They also note that, “For most intradural surgical procedures, antithrombotic therapy should be stopped seven to 10 days before surgery and not recommenced until one week after surgery, provided no perioperative major bleeding occurs.” The reviews by Mathi *et al.* and Peter and Saxman describe recommendations for patient positioning and insertion and removal of venous catheters. The former also reviews evidence for use of military antishock trousers and avoidance of nitrous oxide, while the later emphasizes patient participation during catheter insertion and removal.

C. Blood Incompatibility

1. *Guidelines identified*

No U.S guidelines and two international guidelines were identified for blood incompatibility:

- Blood Transfusion: Indications and Administration (Finnish Medical Society Duodecim).
- Guidelines for Compatibility Procedures in Blood Transfusion Laboratories—Standards in Haematology (British Committee for Standards in Haematology [BCHS] Blood Transfusion Task Force)

Recently withdrawn were “Transfusion guidelines for neonates and older children. (2) Amendments and corrections to the transfusion guidelines for neonates and older children.” (British Committee for Standards in Haematology [BCHS] Blood Transfusion Task Force)

The guideline listed in the June 5, 2010 version of this report, *Access Device Guidelines: Recommendations for Nursing Practice and Education (NGC-4666)*, has also been withdrawn.

2. *Guidelines considered “evidence-based”*

All of the guidelines cite evidence, and the Finnish guideline also cites expert opinion. Neither guideline provides quality ratings of individual studies or strength of evidence mentioned.

3. *Identification of the appropriate actions to be taken to prevent the condition*

All of the guidelines describe actions to reduce the occurrence of blood incompatibility. The *Transfusion Medicine* guidelines recommend ABO and RhD pre-transfusion grouping of the recipient. The BCHS Guidelines for Compatibility Procedures in Blood Transfusion Laboratories point out that error in patient identification and sample labeling may lead to ABO-incompatible transfusions. The Finnish guideline cites patient identification.

D. Pressure Ulcers (Stages III and IV)

1. *Guidelines identified*

Four U.S. guidelines, including one written in collaboration with an international advisory group, were identified relating to pressure ulcers:

- Preventing pressure ulcers & skin tears, In: *Evidence-based Geriatric Nursing Protocols for Best Practice* (Hartford Institute for Geriatric Nursing)
- Pressure Ulcer Prevention and Treatment Following Spinal Cord Injury (Paralyzed Veterans of America [PVA])
- Skin Safety Protocol: Risk Assessment and Prevention of Pressure Ulcers (Institute for Clinical Systems Improvement [ICSI])
- Clinical Practice Guidelines and Quick Reference Guide for Pressure Ulcer Prevention (National Pressure Ulcer Advisory Panel [NPUAP] and European Pressure Ulcer Advisory Panel [EPUAP]).

Note: The Clinical Practice Guideline-Prediction, Prevention, Early Treatment of Pressure Ulcers in Adults (U.S. Preventive Services Task Force) have been withdrawn by AHRQ.

2. *Guidelines considered “evidence-based”*

All of the guidelines cite evidence and use expert opinion for some recommendations. All provide evidence grading and strength of recommendation for each recommendation. The Hartford Institute guidelines does not contain information specific only to stage III and IV pressure ulcers. The NPUAP-EPUAP Clinical and Quick Reference Guides incorporates individual study quality rating and strength of evidence grading; it discusses and reconciles international differences in ulcer categorization, but does not contain recommendations specific to Stage III and IV pressure ulcers.

3. *Identification of the appropriate actions to be taken to prevent the condition*

The Hartford Institute guideline recommends that all individuals at risk should have a systematic skin inspection at least once a day, with results documented, and describes the use of moisturizers on dry skin as part of a very detailed protocol. The PVA guideline recommends avoiding prolonged positional immobilization whenever possible. The ICSI guidelines recommend a head-to-toe skin assessment at admission in conjunction with a reliable risk assessment tool. The NPUAP-EPUAP Quick Reference Guide provides a comprehensive set of recommendations including pressure ulcer risk assessment, patient skin assessment, patient positioning, support surfaces, and recommendations specific to patients in the operating room.

E. Injuries from Falls and Trauma

1. *Guidelines identified*

Six U.S. guidelines relating to injuries from falls and trauma were identified through the NGCH:

- Health Care Protocol: Prevention of Falls (acute care). (ICSI)
- Preventing falls in acute care, In: *Evidence-based Geriatric Nursing Protocols for Best Practice* (Hartford Institute for Geriatric Nursing)
- Falls Management Guideline, 2007 (Health Care Association of New Jersey [HCANJ])
- AORN Guidance Statement: Fire Prevention in the Operating Room, 2005 (AORN).
- Practice Advisory for Prevention and Management of Operating Room Fires (American Society of Anesthesiologists [ASA])
- Reducing adverse events, In: *Evidence-based Geriatric Nursing Protocols for Best Practice* (Hartford Institute for Geriatric Nursing)

The guideline “Changing the Practice of Physical Restraint Use in Acute Care (University of Iowa)” has been withdrawn.

2. *Guidelines considered “evidence-based”*

All but one of the guidelines, the HCANJ guideline, cite evidence for most or all of their recommendations. Five of the guidelines use level-of-evidence levels and strength of recommendations, including expert opinion, for each recommendation opinion. The ASA guideline and AORN guidance statement cite evidence, but do not report an evidence-grading system.

3. *Identification of the appropriate actions to be taken to prevent the condition*

Four of the fall-related guidelines provide detailed recommendations: the Hartford Institute Preventing Falls guideline; the ICSI guideline (protocol with 6 detailed annotations); the Hartford Institute Reducing adverse events guideline; and the HCANJ guideline (detailed procedures for clinical assessment).

The Hartford Institute protocol, Reducing Adverse Events, recommends assessing the patient for any potential drug-disease and drug-drug interactions or incorrect doses, which are the most common causes of adverse drug reactions that could lead to falls.

For burn prevention, the ASA guideline recommends that for all procedures, surgical drapes should be configured to minimize the accumulation of oxidizers under the drapes and prevent them from flowing into the surgical site. The AORN Guidance Statement contains comprehensive recommendations for prevention of operating room fires.

F. Deep Vein Thrombosis (DVT)/Pulmonary Embolism (PE) for Total Knee Replacement or Hip Replacement

1. *Guidelines identified*

Six prevention guidelines were identified for deep vein thrombosis (DVT)/pulmonary embolism (PE) for total knee replacement or hip replacement:

- Clinical Guideline on the Prevention of Symptomatic Pulmonary Embolism in Patients Undergoing Total Hip or Knee Arthroplasty (American Academy of Orthopaedic Surgeons [AAOS])
- Venous Thromboembolism Prophylaxis, 2010 (ICSI)
- Health care Protocol: Perioperative Protocol, 2010 (ICSI)
- Antithrombotic therapy for venous thromboembolic disease, In: *The American College of Chest Physicians Evidence-based Clinical Practice Guidelines 2008* (American College of Chest Physicians [ACCP])
- Prevention of venous thromboembolism, In: *The American College of Chest Physicians evidence-based clinical practice guidelines* ([ACCP], 8th edition).
- *The perioperative management of antithrombotic therapy*, In: *The American College of Chest Physicians Evidence-Based Clinical Practice Guidelines* ([ACCP], 8th Edition).

Only two of the above guidelines, the AAOS and AACP Prevention of venous thromboembolism, are specific to total knee and hip replacement surgeries. Both the Perioperative Protocol (ICIS) and AACP Perioperative management of antithrombotic therapy contain recommendations for bridging procedures.

AHRQ published an online document, *Preventing Hospital-Acquired Venous Thromboembolism: A Guide for Effective Quality Improvement*, as a general guide for quality improvement. (Maynard G, Stein J. AHRQ Publication No. 08-0075, August 2008. (Agency for Healthcare Research and Quality, Rockville, MD. <http://www.ahrq.gov/qual/vtguide/>) While DVT-PE is used as an example preventable condition, this document provides a best practice example of guideline recommended prevention practices at two medical centers. The ACCP guidelines referenced by the AHRQ document is included in Tables 1 and 3.

2. *Guidelines considered “evidence-based”*

All of the guidelines are evidence-based, and all but the ACCP guidelines cite expert opinion. There are quality ratings of individual studies and strength of evidence for recommendations for all of the guideline recommendations.

3. *Identification of the appropriate actions to be taken to prevent the condition*

All guidelines describe actions to take to prevent DVT/PE. The AAOS guideline recommends that all patients should be assessed pre-operatively for elevated risk (greater than standard risk) of pulmonary embolism. The ICSI guidelines recommend that risk factor assessment be completed pre-operatively for every patient whose surgical admission is planned. The AACP guideline “Prevention of venous thromboembolism” contains recommendations specific to various surgical procedures, including total hip replacement, hip fracture surgery, total knee replacement, and knee arthroscopy. “The perioperative management of antithrombotic therapy” (AACP) lists recommendations for perioperative management of patients who are receiving: Vitamin K antagonists, bridging anticoagulation, or antiplatelet therapy, as well as those who require urgent surgical or other invasive procedures. The ICSI Perioperative Protocol includes recommendations for DVT/PE prevention as part of a set of standard pre-, inter-, and post-operative protocols.

G. Manifestations of Poor Glycemic Control

1. *Guidelines identified*

Four guidelines were identified that address manifestations of poor glycemic control:

- Medical Guidelines for Clinical Practice for the Management Of Diabetes Mellitus (The American Association of Clinical Endocrinologists [ACEA])
- The Standards of Medical Care 2009 (American Diabetes Association [ADA])
- Diagnosis and Management of Type-2 Diabetes Mellitus in Adults (ICSI).
- Health care Protocol: Perioperative Protocol, 2010 (ICSI)

2. *Guidelines considered “evidence-based”*

All four of the guidelines cite evidence and use levels of evidence and strength of recommendation for each recommendation. The ADA standards cite evidence and expert

opinion. Both ICSI guidelines use systematic review with quality rating of individual studies and strength of evidence mentioned, as well as expert opinion.

3. *Identification of the appropriate actions to be taken to prevent the condition*

All of the guidelines provide comprehensive recommendation for the diagnosis and treatment of diabetes mellitus and its complications. They each include hospital-specific guidelines that provide recommendations to appropriately monitor and treat glucose levels to prevent hypoglycemia and hyperglycemia for primary and secondary causes of poor glucose control. The first three guidelines listed above also address treatment of ketoacidosis and hyperosmolar coma after they have developed. The ICSI Perioperative Protocol discusses glycemic control in the context of surgical site infection prevention, and notes that “tight glycemic control (blood sugar <110 except parturients, blood sugar <100)” is controversial and may “add risks of hypoglycemia to selected patients...” (p 23, 59).

H. Catheter-Associated Urinary Tract Infection

1. *Guidelines identified*

Five guidelines were identified for catheter-associated urinary tract infection (UTI):

- Guideline for Prevention of Catheter Associated Urinary Tract Infection (CAUTI) 2009 (Healthcare Infection Control Practices Advisory Committee [HICPAC])
- Strategies to Prevent CAUTI in Acute Care Hospitals (The Society for Healthcare Epidemiology of America [SHEA] IDSA Compendium)
- Best Practice Policy Statement on Urological Surgery Antimicrobial Prophylaxis (American Urological Association Education and Research, Inc. [AUA]).
- Guide to the care of the hospitalized patient with ischemic stroke. 2nd ed. (American Association of Neuroscience Nurses, [AANN])
- Prevention of catheter-associated urinary tract infections. In: Prevention and control of healthcare-associated infections in Massachusetts. (Massachusetts Department of Public Health [MDPH])

The HICPAC guideline was identified through the CDC website, and the others were identified via the NGCH.

2. *Guidelines considered “evidence-based”*

All of the guidelines cite evidence. The HICPAC guideline uses systematic review with the GRADE system, which does not provide for expert opinion. The remaining four guidelines use level-of-evidence grading for every recommendation, as well as expert opinion.

3. *Identification of the appropriate actions to be taken to prevent the condition*

The HICPAC guideline recommends the use of urinary catheters in operative patients only as necessary, rather than routinely. **The guideline notes that 17% to 69% of CAUTI may be preventable with recommended infection control measures.** “The strategies to prevent CAUTI in acute care recommended the insertion of urinary catheters only when necessary for patient care and leaving them in place only as long as indications persist.” The AANN guideline recommends against the placement of indwelling catheters among patients receiving treatment for stroke, because of the elevated risk of infection among this population. The MDPH guidelines include recommendations for surveillance and education and training, in addition to catheter insertion and management.

I. Vascular Catheter-Associated Infection

1. *Guidelines identified*

Five guidelines were identified for vascular catheter-associated infection:

- Strategies to Prevent Central Line-Associated Bloodstream Infection in Acute Care Hospitals (Infectious Disease Society of America [IDSA]-SHEA Compendium)
- Prevention of blood stream infections, In: Prevention and Control of Health Care Associated infections in Massachusetts (MDPH)
- Guidelines for the Prevention of Intravascular Catheter-related Infections 2002 (CDC)
- Preservation of peripheral veins in patients with chronic kidney disease. (Association for Vascular Access (AVA), American Society of Diagnostic and Interventional Nephrology (ASDIN)).
- NKF-KDOQI clinical practice guidelines for vascular access: update 2006. (National Kidney Foundation, Kidney Disease Outcomes Quality Initiative, Vascular Access Work Group)

All of these guidelines were obtained through the NGCH except for the CDC’s Guidelines for the Prevention of Intravascular Catheter-related Infections.

2. *Guidelines considered “evidence-based”*

Four of the five guidelines cite evidence. The IDSA-SHEA guidelines use level-of-evidence and strength-of-recommendation methodology and incorporated expert opinion. The MDPH guideline uses the CDC grading system for level of evidence and strength of recommendation and cites expert opinion. The ONS guidelines cite evidence, but do not provide level of evidence and strength of recommendation. The CDC and NKF-KDOQI guidelines use systematic review and provided for expert opinion.

3. *Identification of the appropriate actions to be taken to prevent the condition*

The IDSA-SHEA guideline recommends use of a catheter checklist to ensure adherence to infection prevention practices at the time of CVC insertion. The MDPH guideline recommends the maintenance of aseptic technique for the insertion and care of intravascular catheters. The strategies to prevent central line-associated infections in acute-care hospitals recommend the use of aseptic technique, including the use of a cap, mask, sterile gown, sterile gloves, and a large sterile sheet for the insertion of central venous catheters (CVCs), such as peripherally inserted central catheters, or guide-wire exchange. NKF-KDOQI recommendations also contain recommendations for vascular catheter access and cleansing of catheter sites.

These guidelines do not provide information on the likelihood of preventing vascular catheter-associated infection if the prevention strategies are followed.

J. Surgical Site Infection following Coronary Bypass Artery Graft (CABG), Bariatric Surgery for Obesity, and Certain Orthopedic Procedures

1. *Guidelines identified*

Seven guidelines were identified for surgical site infection, of which four are general guidelines for SSI prevention applicable to all surgical categories.

- Strategies to Prevent Surgical Site Infection in Acute Care Hospitals, 2008 (IDSA-SHEA Compendium)
- Prevention of surgical site infections, In: Prevention and Control of Healthcare-associated Infections in Massachusetts (MDPH)
- Guideline for Prevention of Surgical Site Infection, 1999 (Centers for Disease Control and Prevention)
- Antibiotic Prophylaxis in Spine Surgery, (North American Spine Society [NASS])
- Antibiotic prophylaxis in cardiac surgery, Part II (Society of Thoracic Surgeons Workforce on Evidence Based Surgery) (Note: Part I has been withdrawn.)
- American Association of Clinical Endocrinologists, The Obesity Society, and American Society for Metabolic and Bariatric Surgery Medical Guidelines for Clinical Practice for the Perioperative Nutritional, Metabolic, and Nonsurgical Support of the Bariatric Surgery Patient. (AAACE/TOS/ASMBS)
- Health care Protocol: Perioperative Protocol, 2010 (ICSI)

The HICPAC guideline was identified through the CDC website, and the others were identified via searches of the NGCH.

In addition, the CMS Surgical Improvement Care (SCIP) infection prevention measures are included as specific recommendations for prevention of surgical site infection.

2. *Guidelines considered “evidence-based”*

All seven guidelines use a level-of-evidence grading system and strength-of-recommendation grade for each recommendation. All sets of guidelines except the ACOG guideline incorporate expert opinion into their level-of-evidence grading.

3. *Identification of the appropriate actions to be taken to prevent the condition*

The IDSA-SHEA and the MDPH guidelines recommend clipping rather than shaving the surgical site, the timely and appropriate use of prophylactic antibiotics, and the control of blood glucose for patients undergoing coronary bypass surgery. These guidelines also specify that, whenever possible, all infections remote to the surgical site should be identified and treated before elective operation, and elective operations on patients with remote site infections should be postponed until the infection has resolved. The CDC guidelines provide comprehensive recommendations for SSI prevention, including instructions for preoperative preparation of the patient and surgical team (hand/forearm antisepsis for surgical team members, antimicrobial prophylaxis); intraoperative recommendations (proper ventilation of the operating room, disinfection of environmental surfaces, sterilization of surgical instruments, surgical attire and drapes, surgical technique); and postoperative incision care; and surveillance.

The guidelines for prevention of surgical site infection among cardiac and bariatric patients focus on appropriate and timely preoperative prophylactic antibiotics. Additionally, the AACE/TOS/ASMBS guidelines note that infections rates are lower following laparoscopic surgeries and pars flaccid band insertion during LAGB procedures, and that drainage of seromas may also help prevent infection. All guidelines except the AACE/TOS/ASMBS guideline consider the evidence for the most appropriate class of antibiotic for a specific surgical procedure, timeliness of administration, and duration of administration. The ICSI Perioperative Protocol contains extensive recommendations for general SSI prevention and notes that **“By focusing on adherence to recognized techniques and protocols, the National Surgical Infection Prevention Collaborative was able to reduce surgical site infections by 27%.”**

3.2 **Previously Considered Conditions**

In Table 2, we present the guidelines identified through our searches, for the seven previously considered conditions listed below:

- Delirium
- Ventilator-associated pneumonia
- *Clostridium difficile*
- Legionnaires’ Disease
- Iatrogenic pneumothorax

- *Staphylococcus aureus* sepsis
- Methicillin-resistant staphylococcus aureus

The text sections immediately below the table discuss each previously considered HAC and provide the developer of the guidelines in parentheses and commentary on the evidence level and whether the guideline includes identification of appropriate actions to be taken to prevent the HAC. Note that, for clarity, the guidelines are references in the text by the developer. None of the guidelines identified included a statement of the magnitude of prevention of events anticipated with use of the guideline recommendations.

Table 2
Identified guidelines for each previously considered hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention Recommendations
Delirium* Delirium: prevention, early recognition, and treatment, In: Evidence-based Geriatric Nursing Protocols for Best Practice, 2008; Hartford Institute for Geriatric Nursing – Academic Institution 3rd ed. 2008 Jan. p. 111-25.	http://www.guideline.gov/summary/summary.aspx?doc_id=12261 Chapter available for purchase; corresponding protocol available here: http://consultgerim.org/topics/delirium/want_to_know_more	Level Ia and III: Systematic review and expert opinion	Guidelines developed by nursing experts from across the country; update of 2003 guidelines	Addresses assessment and mitigation of risk factors for delirium, as well as monitoring of delirium
Evidence-based practice guideline: acute confusion/delirium, 2009. University of Iowa Gerontological Nursing Interventions Research Center, Research Translation and Dissemination Core J Gerontol Nurs. 2009 Nov;35(11):11-8.	http://www.guideline.gov/summary/summary.aspx?doc_id=14340 http://www.ncbi.nlm.nih.gov/sites/pubmed/19904851	Level Ia: Systematic review	Update of 1998 guidelines	Delirium rarely has one single cause for the condition, but has a multi-factorial etiology (Inouye & Charpentier, 1996). Studies suggest that primary prevention of delirium is probably the most effective strategy for reducing the overall incidence of delirium of hospitalized medical/surgical patients.
Comprehensive assessment and management of the critically ill. In: Evidence-based geriatric nursing protocols for best practice. Hartford Institute for Geriatric Nursing. 3rd ed, 2008. p. 565-93.	http://www.guideline.gov/summary/summary.aspx?doc_id=12253 Chapter available for purchase; corresponding protocol available here: http://consultgerim.org/topics/critical_care/want_to_know_more	Level Ia and III: Systematic review and expert opinion	None	“Closely monitor the older adult's neurologic/mental status. Screen for delirium and sedation level at least once per shift. Implement interventions to reduce delirium.”

(continued)

Table 2 (continued)
Identified guidelines for each previously considered hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention Recommendations
<p>Ventilator-associated pneumonia**</p> <p>Guidelines for the Management of Adults with Hospital-acquired, Ventilator-associated, and Healthcare-associated Pneumonia, 2005; American Thoracic Society, Infectious Diseases Society of America</p> <p><i>American Journal of Respiratory and Critical Care Medicine</i> Vol. 171. pp. 388-416</p>	<p>http://ajrcm.atsjournals.org/cgi/content/full/171/4/388</p>	<p>Level Ib and III: Literature search, evidence rating and expert opinion</p>	<p>None</p>	<p>Recommendation for assessment and reduction of risk factors and treatment of Ventilator-associated pneumonia</p>
<p>Prevention of ventilator-associated pneumonia, In: Prevention and Control of Healthcare-Associated Infections in Massachusetts, 2008; Betsy Lehman Center for Patient Safety and Medical Error Reduction, JSI Research and Training Institute, Massachusetts Department of Public Health</p>	<p>http://www.guideline.gov/content.aspx?id=12920</p> <p>http://www.mass.gov/Eeohhs2/docs/dph/patient_safety/haipcp_final_report_pt1.pdf</p>	<p>Level Ib and III: Literature search, evidence rating and expert opinion</p>	<p>None</p>	<p>Recommendation for assessment and reduction of risk factors and treatment of Ventilator-associated pneumonia</p>
<p>Comprehensive assessment and management of the critically ill.</p> <p>In: Evidence-based geriatric nursing protocols for best practice. 3rd ed, 2008. Hartford Institute for Geriatric Nursing</p>	<p>http://www.guideline.gov/summary/summary.aspx?doc_id=12253</p> <p>Chapter available for purchase; corresponding protocol available here:</p> <p>http://consultgerim.org/topics/critical_care/want_to_know_more</p>	<p>Level Ia and III: Systematic review and expert opinion</p>	<p>None</p>	<p>“Exercise standard ventilator-associated pneumonia (VAP) precautions</p> <ul style="list-style-type: none"> • Keep the head of the bed elevated to more than 30 degrees • Provide frequent oral care • Assess the need for stress ulcer prophylaxis • Turn the patient as tolerated • Maintain general hygiene practices”

(continued)

Table 2 (continued)
Identified guidelines for each previously considered hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention Recommendations
<p>AARC Clinical Practice Guidelines: Care of the Ventilator Circuit and Its Relation to Ventilator-Associated Pneumonia, 2003; AARC</p> <p><i>Respir Care.</i> 2003;48:869–879</p>	<p>http://www.rcjournal.com/cpgs/pdf/09_03.0869.pdf</p>	<p>Level Ia and III: Systematic review and expert opinion</p>	<p>None</p>	<p>Identifies risk factors and recommends practices for management of the ventilator circuit to prevent ventilator-associated pneumonia</p>
<p>Strategies to prevent ventilator-associated pneumonia in acute care hospitals.</p> <p>Infect Control Hosp Epidemiol 2008 Oct; 29 Suppl 1:S31-40.</p>	<p>http://www.guidelines.gov/summary/summary.aspx?doc_id=13396</p> <p>http://www.ncbi.nlm.nih.gov/pubmed/18840087</p> <p>Article available for purchase.</p>	<p>Level Ib: Literature search and evidence rating</p>	<p>From: SHEA/IDSA Compendium of Strategies to Prevent Healthcare-Associated Infections in Acute Care Hospitals, http://www.shea-online.org/about/compendium.cfm</p>	<p>Includes Special approaches for the prevention of VAP for use in locations and/or populations within the hospital that have unacceptably high VAP rates despite implementation of the basic VAP prevention procedures listed herein; also approaches that should not be considered a routine part of VAP prevention.</p> <p>Each recommendation includes a ranking for the strength and the quality of evidence supporting it.</p>
<p><i>Clostridium difficile</i></p> <p>Strategies to Prevent <i>Clostridium difficile</i> Infections in Acute Care Hospitals, 2008;</p> <p>Society for Healthcare Epidemiology of America, the Infectious Diseases Society of America</p> <p>Infect Control Hosp Epidemiol 2008 Oct;29 Suppl 1:S81-92</p>	<p>http://www.guidelines.gov/summary/summary.aspx?doc_id=13398</p> <p>http://www.ncbi.nlm.nih.gov/pubmed/18840091</p> <p>Article available for purchase.</p>	<p>Level Ib and III: Literature search, evidence rating and expert opinion</p>	<p>From: SHEA/IDSA Compendium of Strategies to Prevent Healthcare-Associated Infections in Acute Care Hospitals, http://www.shea-online.org/about/compendium.cfm</p>	<p>Comprehensive recommendations for prevention of <i>C. difficile</i> transmission and implementation of prevention and monitoring strategies.</p>

(continued)

Table 2 (continued)
Identified guidelines for each previously considered hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention Recommendations
<p>Clinical Practice Guidelines for <i>Clostridium difficile</i> Infection in Adults: 2010 Update; Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA)</p> <p>Infect Control Hosp Epidemiol. 2010 May;31(5):431-55.</p>	<p>http://www.ncbi.nlm.nih.gov/pubmed/20307191</p> <p>Article available for purchase.</p> <p>neither linked nor archived on NGC</p>	<p>Level Ia and III: Systematic review and expert opinion</p>	None	<p>Lists prevention and control measures including recommendations for hospital staff and visitors, environmental disinfection, antimicrobial use restrictions, and probiotics.</p>
<p>Hand hygiene recommendations. In: Prevention and control of healthcare-associated infections in Massachusetts. Part 1: final recommendations of the Expert Panel. 2008; Betsy Lehman Center for Patient Safety and Medical Error Reduction, JSI Research and Training Institute, Inc., and the Massachusetts Department of Public Health</p>	<p>http://www.guideline.gov/summary/summary.aspx?doc_id=12913</p> <p>http://www.mass.gov/Eeohhs2/docs/dph/patient_safety/haip_cp_final_report_pt1.pdf</p>	<p>Level Ia and III: Systematic review and expert opinion</p>	None	<p>“Based on in vitro data, alcohol is not effective at killing spores of organisms such as <i>Clostridium difficile</i> or <i>Bacillus anthracis</i>. (III) Although no direct comparison studies have been conducted, washing hands with water and soap physically removes spores from the skin and therefore may be more effective in this clinical setting. In the setting of an outbreak of a spore-forming organism such as <i>Clostridium difficile</i>, washing hands with soap and water is recommended.</p>
<p>Management of Multidrug Resistant Organisms in Health Care Settings, 2006; CDC</p>	<p>http://www.guideline.gov/content.aspx?id=10764</p> <p>http://www.cdc.gov/ncidod/dhqp/pdf/ar/mdroGuideline2006.pdf</p>	<p>Level Ib and III: Literature search, evidence rating and expert opinion</p>	None	<p>Approaches to Minimize <i>C. difficile</i> transmission, and appropriate use of antibiotics</p>

(continued)

Table 2 (continued)
Identified guidelines for each previously considered hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention Recommendations
Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008; CDC and the Healthcare Infection Control Practices Advisory Committee.	http://www.cdc.gov/hicpac/Disinfection_Sterilization/acknowledg.html http://www.cdc.gov/hicpac/pdf/guidelines/Disinfection_Nov_2008.pdf	Level Ia and II: Systematic review and evidence cited	Addresses sterilization for a broad range of pathogens	Describes inactivation techniques for <i>C. difficile</i>
Legionnaires' Disease Guidelines for Environmental Infection Control in Health-Care Facilities, 2003; CDC and the Healthcare Infection Control Practices Advisory Committee MMWR Recomm Rep. 2003 June 6; 52(RR10);1-42	http://www.cdc.gov/mmwr/PDF/rr/rr5210.pdf http://www.cdc.gov/hicpac/pdf/guidelines/eic_in_HCF_03.pdf	Level Ib.: Literature search and evidence rating	Errata here: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5242a9.htm	Contains recommendations for Controlling Waterborne Health-Care–Associated Legionnaires Disease as well as General Infection-Control Strategies for Preventing Legionnaires Disease
Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008; CDC and the Healthcare Infection Control Practices Advisory Committee.	http://www.cdc.gov/hicpac/Disinfection_Sterilization/acknowledg.html http://www.cdc.gov/hicpac/pdf/guidelines/Disinfection_Nov_2008.pdf	Level Ia and II: Systematic review and evidence cited	Addresses sterilization for a broad range of pathogens	Contains general recommendations for disinfection of water supplies and hydrotherapy equipment

(continued)

Table 2 (continued)
Identified guidelines for each previously considered hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention Recommendations
<p>Iatrogenic pneumothorax</p> <p>ACR Appropriateness Criteria® needle biopsy in the thorax, 2008; American College of Radiology</p> <p>Ray CE Jr., Funaki BS, Brown DB, Gemery JM, Khan AR, Kinney TB, Kostelic JK, Lorenz JM, Millward SF, Nemcek AA Jr., Owens CA, Reinhart RD, Silberzweig JE, Siskin GP, Vatakencherry G, Kaiser L, Raoof S, Expert Panel on Interventional Radiology. ACR Appropriateness Criteria® needle biopsy in the thorax. Reston (VA): American College of Radiology (ACR); 2008.</p>	<p>http://www.guideline.gov/summary/summary.aspx?doc_id=13661</p> <p>Evidence table available here: http://www.acr.org/acet/Needle-Biopsy-in-the-Thorax-ET.pdf</p> <p>Methods are described here: http://www.acr.org/SecondaryMainMenuCategories/quality_safety/app_criteria/Overview.aspx</p>	<p>Level Ib and III: Literature search, evidence rating and expert opinion</p>	<p>Individual studies were assigned “strength of evidence” quality scores, but no ratings of evidence strength across studies were provided.</p>	<p>“Using a steeper angle of the biopsy needle may decrease the risk of pneumothorax.”</p> <p>“The most common complication requiring intervention is pneumothorax (10% to 30%).”</p>
<p>Staphylococcus aureus sepsis</p> <p>Guidelines for the Prevention of Intravascular Catheter-related Infections, 2002; CDC</p> <p>MMWR Recomm Rep. 2002 Aug 9;51(RR-10):1-29.</p>	<p>http://www.cdc.gov/MMWR/PREVIEW/MMWRHTML/rr5110a1.htm</p> <p>http://www.sheafonline.org/Assets/files/position_papers/hicpac_catheter.pdf</p>	<p>Levels Ia and III: Systematic review and expert opinion</p>	<p>2010 update awaiting final issue review, here: http://www.cdc.gov/hicpac/pdf/BSI_guideline_Issues_May17final.pdf</p>	<p>Addresses central venous line and vascular access catheters insertion and maintenance in adults and children</p>

(continued)

Table 2 (continued)
Identified guidelines for each previously considered hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention Recommendations
<p>Strategies to Prevent Central Line-Associated Bloodstream Infection in Acute Care Hospitals, 2008; Infectious Diseases Society of America, Society for Healthcare Epidemiology of America</p> <p>Infect Control Hosp Epidemiol 2008 Oct;29 Suppl 1:S22-30.</p>	<p>http://www.guideline.gov/summary/summary.aspx?doc_id=13395&nbr=006806</p> <p>http://www.ncbi.nlm.nih.gov/pubmed/18840085</p> <p>Article available for purchase.</p>	<p>Level Ib and III: Literature search, evidence rating and expert opinion</p>	<p>An update of prior guidelines</p> <p>From: SHEA/IDSA Compendium of Strategies to Prevent Healthcare-Associated Infections in Acute Care Hospitals, http://www.shea-online.org/about/compendium.cfm</p>	<p>Comprehensive recommendations for prevention of catheter-associated blood stream infections.</p>
<p>Methicillin-resistant <i>Staphylococcus aureus</i></p> <p>Strategies to Prevent Transmission of Methicillin-Resistant <i>Staphylococcus aureus</i> in Acute Care Hospitals, 2008; Infectious Diseases Society of America—Medical Specialty Society, Society for Healthcare Epidemiology of America</p> <p>Infect Control Hosp Epidemiol. 2008 Oct; 29 Suppl 1:S62-80.</p>	<p>http://www.guideline.gov/content.aspx?id=13397</p> <p>Article available for purchase.</p> <p>http://www.ncbi.nlm.nih.gov/pubmed/18840090?dopt=Abstract</p>	<p>Level Ib and III: Literature search, evidence rating and expert opinion</p>	<p>From: SHEA/IDSA Compendium of Strategies to Prevent Healthcare-Associated Infections in Acute Care Hospitals, http://www.shea-online.org/about/compendium.cfm</p> <p>Not adapted from a previous guideline</p>	<p>Strategies to detect MRSA colonization, prevent its spread and treat infections are recommended</p>
<p>SHEA Guideline for Preventing Nosocomial Transmission of Multidrug Resistant Strains of <i>Staphylococcus aureus</i> And Enterococcus. 2003; SHEA</p> <p>Infect Control Hosp Epidemiol. 2003 May;24(5):362-86.</p>	<p>http://www.ncbi.nlm.nih.gov/pubmed/12785411?dopt=Abstract</p>	<p>Level Ia: Systematic Review</p>	<p>None</p>	<p>Recommends strategies to detect and prevent the spread of MRSA in the community and the hospital setting</p>

(continued)

Table 2 (continued)
Identified guidelines for each previously considered hospital-acquired condition

Evidence-based guideline and publishing organization	Location	Evidence level	Comments	Prevention Recommendations
Management of Multidrug-resistant Organisms in Healthcare Settings, 2006; CDC-HICPAC	http://www.cdc.gov/ncidod/dhqp/pdf/ar/MDROGuideline2006.pdf .	Level Ib and III: Literature search, evidence rating and expert opinion	None	Strategies to detect and prevent the spread and treat infections with multidrug resistant organisms, including MRA are recommended
Community Associated Methicillin-resistant Staphylococcus Aureus: Guidelines for Clinical Management and Control of Transmission, 2005; Wisconsin Division of Public Health.	http://dhfs.wisconsin.gov/communication/resources/pdf/files/CAMRSAGuide1105.pdf	Level II and III: Evidence cited and expert opinion	None	Guidelines for the detection of colonization, prevention of transmission and treatment of MRSA

* “Prevention of Delirium in older hospitalized patients, In: Making Health Care Safer: A Critical Analysis of Patient Safety Practices, 2001; AHRQ,” previously listed here, has been withdrawn.

** Guidelines for Preventing Health-Care–Associated Pneumonia, 2003, CDC, have been withdrawn.

A. Delirium

1. Guidelines identified

Three U.S. guidelines were found that addressed the prevention, recognition, and treatment of delirium in hospitals:

- Delirium: prevention, early recognition, and treatment, In: *Evidence-based Geriatric Nursing Protocols for Best Practice* (Hartford Institute for Geriatric Nursing)
- Comprehensive assessment and management of the critically ill. In: *Evidence-based geriatric nursing protocols for best practice* (Hartford Institute for Geriatric Nursing)
- Evidence-based practice guideline: acute confusion/ delirium. Iowa City (IA): University of Iowa Gerontological Nursing Interventions Research Center, Research Translation and Dissemination Core; 2009

The Hartford Institute developed their guidelines in 2008 as an update to their 2003 guidelines; expert nurses from across the country developed the guideline’s recommendations. The Iowa guideline was published in 2009. The APA guideline is much older, originally from 1999, although an informal update (“Guideline Watch”) was published in 2004.

The guideline, “Prevention of Delirium in older hospitalized patients, In: Making Health Care Safer: A Critical Analysis of Patient Safety Practices, 2001 (AHRQ) has been withdrawn. Also considered out of date is the Levels Ib and III Practice Guideline for the Treatment of Patients With Delirium, 1999; American Psychiatric Association (http://www.psychiatryonline.com/pracGuide/pracGuideTopic_2.aspx), though an informal “Guideline Watch” may be found at <http://www.psychiatryonline.com/content.aspx?aid=147844>.

2. *Guidelines considered “evidence-based”*

The Hartford Institute protocols use a six-tier grading level of evidence. Systematic reviews are the highest level of evidence (Level I), followed by randomized controlled trials (RCTs) at Level II, and on down to Level VI for expert opinions and consensus panels. The protocols’ recommendations are based on the protocols from two multi-component delirium prevention studies, published in 1999 and 2001. The APA guideline employs a comprehensive literature review; evidence grading, including expert opinion; and evidence tables, and the guideline has undergone widespread review and comment. The Iowa guideline is a comprehensive review with evidence grading and expert opinion.

3. *Identification of the appropriate actions to be taken to prevent the condition*

The Hartford Institute protocols provide parameters for assessment, nursing care strategies to eliminate or minimize risk factors, and instructions for establishing a therapeutic environment and providing follow-up measures of quality care. For example, the protocols’ specific recommendations for eliminating or minimizing risk factors include the following:

- Administer medications judiciously; avoid high-risk medications
- Prevent/promptly and appropriately treat infections
- Prevent/promptly treat dehydration and electrolyte disturbances
- Provide adequate pain control
- Maximize oxygen delivery (supplemental oxygen, blood, and blood pressure support as needed)
- Use sensory aids as appropriate
- Regulate bowel/bladder function
- Provide adequate nutrition.

The APA’s guideline provides the following information: disease definition; epidemiology and natural history for delirium; treatment principles and alternatives; formulation and implementation of treatment plans; and clinical features influencing treatment. This guideline also includes discussion of appropriate assessment instrument and prevention

recommendations that focus on clinical identification of delirium (causes and differential diagnoses) and treatments to prevent further complications.

The Iowa guideline provides information on assessment principles, assessment tools, and recommended interventions for the prevention of delirium in older hospitalized patients. Single, multi-, and pharmaceutical interventions are listed with evidence grades. Recommended interventions include nurse and/or physician education, guidance for staff nurses regarding care, promotion of proper nutrition and electrolyte balance, pain management, discontinuation of urinary catheter, and early mobilization.

B. Ventilator-Associated Pneumonia

1. Guidelines identified

Five guidelines were identified for ventilator-associated pneumonia:

- Guidelines for the Management of Adults with Hospital-acquired, Ventilator-associated, and Healthcare-associated Pneumonia (American Thoracic Society [ATS] and Infectious Diseases Society of America [IDSA])
- Comprehensive assessment and management of the critically ill. In: Capezuti E, Zwicker D, Mezey M, Fulmer T, editor(s). Evidence-based geriatric nursing protocols for best practice. (Hartford Institute for Geriatric Nursing [HIGN])
- Prevention of ventilator-associated pneumonia, In: *Prevention and Control of Healthcare-Associated Infections in Massachusetts*. (Massachusetts Department of Public Health [MDPH])
- AARC Clinical Practice Guidelines: Care of the Ventilator Circuit and Its Relation to Ventilator-Associated Pneumonia. (American Association of Respiratory Care [AARC])
- Strategies to prevent ventilator-associated pneumonia in acute care hospitals. (Society for Healthcare Epidemiology of America [SHEA]/Infectious Diseases Society of America [IDSA] Compendium)

Note: The “Guidelines for Preventing Health-Care-Associated Pneumonia, 2003” (CDC) were withdrawn from the National Guideline Clearinghouse in 2010.

The ATS and the IDSA published their guidelines in 2005 and 2008, respectively, on the management of adults with hospital acquired, ventilator-associated, and healthcare-associated pneumonia. The SHEA-IDSA guidelines for VAP prevention were likewise published in 2008 and were developed using the same process as other IDSA guidelines. Expert nurses from across the country developed The Hartford Institute guidelines in 2008 as an update to their 2003 guidelines. The ATS guidelines were the primary source for the most recent 2008 guidelines from the MDPH. The MDPH guidelines focus on the prevention of ventilator-associated pneumonia and are part of a larger body of work on prevention and control of healthcare-

associated infections in Massachusetts. The AARC guidelines for the care of the Ventilator Circuit was published in 2003 and provides specific recommendations for identifying risk factors and for management of the ventilator circuit to prevent ventilator-associated pneumonia. The CDC recommendations were the combined effort of the CDC and HICPAC. This effort provided no new recommendations for ventilator-associated pneumonia from their 1994 guidelines, but the new guidelines did note that there were unresolved issues in regard to oral decontamination.

2. *Guidelines considered “evidence-based”*

The ATS-IDSA guidelines use the same grading system for evidence-based recommendations previously used for the ATS Community-Acquired Pneumonia statement. Using three tiers of evidence levels, the guidelines’ highest level consists of RCTs. Well designed, non-randomized controlled trials (e.g., large case series, cohort studies, case-controlled studies) are considered Level II, with case studies and expert opinion at the lowest level, Level III.

Though the MDPH guidelines use the ATS guidelines as their source, they employ a more specific grading system when reviewing the evidence. In addition, the MDPH guidelines are developed from a comprehensive reference library developed by a local specialist in hospital-acquired infection and further supplemented by searches conducted by an experienced librarian (as advised by the Expert Panel and Task Group members). All studies were reviewed for internal validity or methodological rigor, and only high-quality studies were used for the evidence base from which guidelines’ recommendations were developed. The MDPH grading system consists of five tiers of levels of evidence, with RCTs at the highest level (Level I), continuing on through to Level IV for expert opinions. Level V is reserved for when no quality studies are identified and no other clear guidance are available. The strength of recommendation ranking consists of six tiers, from A (strongly recommended) to D (recommended against implementation), followed by UI (unresolved issue) and finally by no recommendation when there is insufficient evidence or no consensus regarding efficacy. This panel adapts the strength-of-recommendation ranking scales from the system developed by HICPAC and published in 2005. (McKibben L, Horan T, et al). Guidance on public reporting of healthcare associated infections: Recommendations of the Healthcare Infection Control Practices Advisory Committee. AJIC. 2005; 33: 217-226)

The Hartford Institute protocols use a six-tier grading level of evidence. Systematic reviews are the highest level of evidence (Level I), followed by randomized controlled trials (RCTs) at Level II, and on down to Level VI for expert opinions and consensus panels. The guideline recommendations for prevention of pneumonia are graded Level IV.

The AARC guidelines use a systematic review of the literature, grading of the evidence, and expert opinion.

The IDSA-SHEA guidelines adapt the Canadian Task Force on the Periodic Health Examination. Their quality rating is based on three tiers: the highest level (Level I) requires evidence from one or more proper RCTs, followed by the second level (Level II) comprised of evidence from one or more well-designed non-randomized clinical trials or cohort, case-

controlled, multiple-time-series studies or from “dramatic results of uncontrolled experiments.” Level III is expert opinion, consensus statements, or descriptive studies. The strength of the recommendation is described using a three-tiered ranking labeled A-C, with A the strongest.

3. *Identification of the appropriate actions to be taken to prevent the condition*

The ATS guidelines cover the major points and recommendations for modifiable risk factors, general prophylaxis, diagnosis, clinical strategy, comparing diagnostic strategies, initial antibiotic therapy, optimal antibiotic therapy, selected multi-drug resistant pathogens, assessing response to therapy and performance indicators. Specific performance indicators include:

- Circulate hospital-acquired infection prevention guidelines to appropriate medical staff (administrators for quality and safety, physicians, and nurses) for review.
- Provide epidemiologic data on the prevalence and types of multi-drug resistant pathogens in intensive care unit patients and current antibiograms to select appropriate initial antibiotic therapy.
- Select specific parts of the guideline for implementation by the medical and surgical services, including the intensive care units, and monitor compliance with the guidelines in relation to patient outcomes.
- Identify modifiable risk factors and develop programs to reduce the risk of pneumonia through changing these risk factors.

The MDPH guidelines include basic practices for prevention and monitoring of ventilator-associated pneumonia in acute care hospitals. This includes components on education, surveillance, practice, accountability, and approaches for special circumstances. The IDSA-SHEA guidelines include special approaches for prevention of ventilator-associated pneumonia in hospitals with unacceptably high ventilator-associated pneumonia rates after following basic prevention procedures, such as “using an endotracheal tube with in-line, subglottic suctioning for all eligible patients, and ensure that all intensive care unit beds used for patients undergoing ventilation have a built-in tool to provide continuous monitoring of the angle of incline.” The guidelines also provide guidance on approaches that should not be considered a routine part of ventilator-associated pneumonia prevention, such as the following:

- Do not routinely administer intravenous immunoglobulin, white-cell–stimulating factors (filgrastim or sargramostim), enteral glutamine, or chest physiotherapy
- Do not routinely use rotational therapy with kinetic or continuous lateral rotational therapy beds
- Do not routinely administer prophylactic aerosolized or systemic antimicrobials or actions that are not consistently supported one way or another by evidence (referred to as unresolved issues)

- Avoidance of H2 antagonist or proton pump inhibitors for patients who are not at high risk for developing gastrointestinal bleeding
- Selective digestive tract decontamination for all patients undergoing ventilation
- Use of antiseptic-impregnated endotracheal tubes
- Intensive glycemic control.

The AARC guidelines make specific recommendations for the changing of ventilator circuits, suction procedures, and the use of humidifiers.

The Hartford guidelines recommend standard ventilator-associated pneumonia (VAP) precautions, including elevation of the head of the bed to more than 30 degrees, frequent oral care, assessment of the need for stress ulcer prophylaxis, turning of the patient, and maintenance of general hygiene practices.

The SHEA-IDSa guidelines include recommendations for education, surveillance, practices for disinfection and sterilization of equipment, and assignment of accountability, as well as special approaches for prevention in hospitals with high rates of VAP. They also distinguish approaches that should not be routine in VAP prevention practices.

C. *Clostridium difficile* – Associated Disease

1. Guidelines identified

Five U.S. guidelines were found that address strategies to prevent *Clostridium difficile* infections (CDI) in acute care hospitals:

- Strategies to Prevent *Clostridium difficile* Infections in Acute Care Hospitals, 2008 (IDSa-SHEA Compendium)
- Clinical Practice Guidelines for *Clostridium difficile* Infection in Adults: 2010 (IDSa-SHEA)
- Management of Multidrug Resistant Organisms in Health Care Settings, 2006 (CDC)
- Hand hygiene recommendations. In: Betsy Lehman Center for Patient Safety and Medical Error Reduction, JSI Research and Training Institute, Inc. Prevention and control of healthcare-associated infections in Massachusetts. Part 1: final recommendations of the Expert Panel (MDPH)
- Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008; (CDC-HIPAC)

The ISSA-SHEA recommendations are based on previously published guidelines from the HIPAC and the CDC, SHEA, ISDA, and the Association for Professionals in Infection

Control and Epidemiology, as well as from other relevant literature recently published after the prior guidelines were released. The CDC guidelines address CDI prevention as well. The SHEA-IDSA 2010 Clinical Practice guidelines were located using an internet search engine.

2. *Guidelines considered “evidence-based”*

The IDSA-SHEA quality-of-evidence approach is based on three tiers: Level I requires evidence from one or more RCTs; Level II is comprised of evidence from one or more well-designed non-randomized clinical trials or cohort, case-controlled, multiple-time-series studies or from “dramatic results of uncontrolled experiments”; and Level III involves expert opinion, consensus statements, or descriptive studies. This approach was adapted from the Canadian Task Force on the Periodic Health Examination.

The CDC guidelines use a bi-level approach with specific categories. Level I, the highest level, consists of three categories: a) well-designed experimental, clinical, or epidemiologic studies, b) “certain” clinical or epidemiologic studies and by strong theoretical rationale, and c) mandated by federal or state regulation or standard. Category II evidence is suggestive clinical or epidemiologic studies or strong theoretical rationale. Insufficient evidence or no consensus is rated as “No recommendation” or “Unresolved Issue.”

3. *Identification of the appropriate actions to be taken to prevent the condition*

Recommendations include components of a CDI prevention program, performing a CDI risk assessment; employment of routine prevention approaches, as well as approaches that should *not* be used for routine prevention; and a discussion of unresolved issues. Specifically, the components of a CDI prevention program should include the following:

- Use contact precautions for infected patients, with a single-patient room preferred
- Ensure cleaning and disinfection of equipment and the environment
- 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
- Conduct CDI surveillance, and analyze and report CDI data
- Educate healthcare personnel, housekeeping personnel, and hospital administration about CDI
- Educate patients and their families about CDI, as appropriate
- Measure compliance with CDC or World Health Organization hand-hygiene and contact precaution recommendations.

The Clinical Practice Guidelines for *Clostridium difficile* Infection in Adults: 2010 (IDSA-SHEA) contain recommendations for the prevention of horizontal transmission of *C. difficile* in the hospital setting, including:

- Use of gloves and gowns by healthcare workers and visitors
- Compliance with good hand hygiene practices
- Private rooms or, at the least, dedicated commodes for patients with CDI
- Duration of control measure implementation
- Routine identification of asymptomatic carriers is not recommended.

The CDC-HIPAC guideline describes practices for inactivation of *C. difficile* spores, including the use of diluted hypochlorite solutions to disinfect rooms of patients with CDI. Contaminated medical devices should be cleaned with two percent glutaraldehyde, peracetic acid, or *ortho*-Phthalaldehyde. For routine disinfection of the environment, use of an EPA-registered germicidal agent is recommended.

The MPDH guidelines for hand hygiene note that alcohol is not effective at killing *C. difficile* spores in vitro. Washing hands with soap and water to physically remove spores is recommended.

D. Legionnaires' Disease

1. Guidelines identified

We found two current guidelines that address Legionnaires' disease:

- Guidelines for Environmental Infection Control in Health-Care Facilities, 2003 (CDC)
- Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008; (CDC-HIPAC)

Note: The Guidelines for Preventing Health Care–Associated Pneumonia, 2003 (CDC-HICPAC) have been withdrawn.

2. Guidelines considered “evidence-based”

The levels of evidence used are based on two levels, one with categories. Level 1, the higher level, consists of three categories: a) well-designed experimental, clinical, or epidemiologic studies, b) “certain” clinical or epidemiologic studies and by strong theoretical rationale, and c) mandated by federal or state regulation or standard. Category II evidence is suggestive clinical or epidemiologic studies or strong theoretical rationale. Insufficient evidence or no consensus is rated as “No recommendation” or “Unresolved Issue.”

3. *Identification of the appropriate actions to be taken to prevent the condition*

The Guidelines for Environmental Infection Control in Health-Care Facilities also describe general infection control practices. Also described are testing and engineering procedures for controlling health-care associated Legionnaires Disease, such as use of superheated or hyperchlorinated water to flush contaminated systems. The CDC-HICPAC guideline describes chlorine disinfection of hospital water supplies and use of copper-silver ionization to prevent the spread of *Legionella*.

E. Iatrogenic Pneumothorax

1. *Guidelines identified*

We found one guideline that addressed iatrogenic pneumothorax, but only in the setting of thoracic needle biopsy:

- ACR Appropriateness Criteria® needle biopsy in the thorax (American College of Radiology [ACR])

2. *Guidelines considered “evidence-based”*

This guideline is based on a literature review and expert opinion. Individual studies identified during the review were assigned “strength of evidence ratings” (quality assessment scores) from 1 to 4, with 1 defined as “The conclusions of the study are valid and strongly supported by study design, analysis and results”; 2 as “The conclusions of the study are likely valid, but study design does not permit certainty”; 3 as “The conclusions of the study may be valid but the evidence supporting the conclusions is inconclusive or equivocal”; and 4 as “The conclusions of the study may not be valid because the evidence may not be reliable given the study design or analysis.” Recommendations for individual outcomes (e.g., pneumothorax) were not provided.

3. *Identification of the appropriate actions to be taken to prevent the condition*

The ACR guideline states that “Using a steeper angle of the biopsy needle may decrease the risk of pneumothorax,” (from a study with a quality rating of “2”) and that “Prior surgery and prone positioning during biopsy seem to provide a “protective effect” against clinically significant post-biopsy pneumothorax” (study quality rating “1”). These guidelines also note that pneumothorax is most common complication of percutaneous lung biopsy requiring intervention, occurring in 10%-30% of these procedures.

F. *Staphylococcus aureus* Sepsis

1. *Guidelines identified*

We identified only two guidelines that briefly addressed *Staphylococcus aureus* sepsis, both in the context of prevention of general blood stream infections. Most identified references from the searches were for methicillin-resistant staphylococcus (MRSA), which is another

previously considered HAC. The CDC guidelines for prevention of central line infections address prevention strategies to prevent bacterial infection.

- Strategies to prevent central line-associated bloodstream infections in acute care hospitals (SHEA/IDSA Compendium), 2008
- Guidelines for the Prevention of Catheter-related infection. CDC, 2002

2. *Guidelines considered “evidence-based”*

The SHEA/IDSA guidelines use a quality rating is based on three tiers: the highest level (Level I) requires evidence from one or more proper RCTs, followed by the second level (Level II) comprised of evidence from one or more well-designed non-randomized clinical trials or cohort, case-controlled, multiple-time-series studies or from “dramatic results of uncontrolled experiments.” Level III is expert opinion, consensus statements, or descriptive studies. The CDC guidelines use a systematic review strategy and provide for expert opinion (“supported by suggestive clinical or epidemiologic studies or a theoretical rationale.

3. *Identification of the appropriate actions to be taken to prevent the condition*

The CDC guidelines for prevention of intravascular catheter-related infection recommend the use of aseptic technique including the use of a cap, mask, sterile gown, sterile gloves, and a large sterile sheet for the insertion of CVCs, including peripherally inserted central catheters, or guide-wire exchanged.

The SHEA/IDSA guidelines recommend use of antimicrobial ointments for hemodialysis catheter insertion sites. For patients with a history of recurrent *Staphylococcus aureus* central line-associated blood stream infection, Povidone-iodine or polysporin ointment should be applied to hemodialysis catheter insertion sites.

G. Methicillin Resistant *Staphylococcus aureus* (MRSA)

1. *Guidelines identified*

Four U.S. guidelines were identified that address MRSA:

- Strategies to Prevent Transmission of Methicillin-Resistant *Staphylococcus aureus* in Acute Care Hospitals (IDSA–Medical Specialty Society–SHEA, Compendium)
- SHEA Guideline for Preventing Nosocomial Transmission of Multidrug Resistant Strains of *Staphylococcus aureus* and Enterococcus (SHEA)
- Management of Multidrug-Resistant Organisms in Healthcare Settings (CDC)
- Community Associated Methicillin-resistant *Staphylococcus aureus*: Guidelines for Clinical Management and Control Of Transmission (Wisconsin Division of Public Health [WDPH])

The most recent guideline, released in 2008 by the IDS–Medical Specialty Society, and SHEA, covers strategies to prevent transmission of MRSA in acute care hospitals. It is the first MRSA guideline developed by this group and was not adapted from any other source.

MRSA is also a condition that may be acquired in the community. The transmission of MRSA in the hospital is therefore significantly impacted by the level of asymptomatic carriers in the community. Thus the WDPG guideline, which addresses community control and prevention, was also included.

2. *Guidelines considered “evidence-based”*

Quality ratings for the evidence in the 2008 collaborative effort on strategies to prevent transmission (IDSA–SHEA) were adapted from the Canadian Task Force on the Periodic Health Examination. Quality of evidence is based on three tiers: the highest level (Level I) requires evidence from one or more proper RCTs, followed by the second level (Level II) comprised of evidence from one or more well-designed non-randomized clinical trials or cohort, case-controlled, multiple-time-series studies or from “dramatic results of uncontrolled experiments.” Level III is expert opinion, consensus statements or descriptive studies. The SHEA guidelines for preventing transmission used also used a systematic review strategy with evidence ratings.

The CDC guideline used a bi-level approach with specific categories. Level 1, the higher level consists of three categories: a) well-designed experimental, clinical, or epidemiologic studies, b) “certain” clinical or epidemiologic studies and by strong theoretical rationale, c) mandated by federal or state regulation or standard. Category II evidence is suggestive clinical or epidemiologic studies or strong theoretical rationale. Insufficient evidence or no consensus is rated as “No recommendation” or “Unresolved Issue.” The WDPH guidelines cite references, but do not provide the search strategy or an evidence rating strategy.

3. *Identification of the appropriate actions to be taken to prevent the condition*

Each practice recommendation is associated with both strength of recommendation and quality of evidence grade. Components of a MRSA Transmission Prevention Program include risk assessment, monitoring, compliance with CDC and World Health Organization hand hygiene recommendations, use of contact precautions, cleaning and disinfection of equipment and environment, education, personnel, alert systems, special approaches and unresolved issues. The CDC guideline suggests implementing systems to communicate information about MRSA, among other reportable multi-drug resistant organisms, education and training, use of antimicrobial agents, surveillance, infection control procedures, and environmental and administrative measures.

SECTION 4 DISCUSSION

Summaries of the numbers of guidelines found for each selected and previously considered condition are provided in Tables 3 and 4, respectively. The number of guidelines with Level Ia: Systematic Reviews; Level Ib: Evidence-grading system Level II: Evidence Cited; Level III: Expert Opinion are also summarized by condition. Note that guidelines may employ Level III: Expert Opinion **in addition** to Level Ia, Level Ib or Level II.

4.1 Selected Conditions

Table 3
Summary of the number and ratings of available guidelines

Condition	Guidelines with recommendations for prevention of the condition	Guidelines with Level Ia: Systematic review and evidence grading	Guidelines with Level Ib evidence rating	Guidelines with Level II: Evidence cited only	Guidelines with Level III: Expert opinion
Foreign object retained after surgery	6	0	3	1	5
Air embolus	0	0	0	0	0
Blood incompatibility	2	0	0	2	0
Pressure Ulcers (Stages III and IV)	4	2	2	0	4
Injuries from falls & trauma	6	2	1	2	6
Deep vein thrombosis pulmonary embolism for total knee or hip replacement	6	3	3	0	3
Manifestations of poor glycemic control	4	1	3	0	3
Catheter-associated urinary tract infection	5	2	3	0	4
Vascular catheter associated infection	5	2	2	0	5
Surgical site infection following selected cardiac, bariatric, or orthopedic surgeries	7	0	2	1	2

4.2 Previously Considered Conditions

Table 4
Summary of the number and ratings of available guidelines

Condition	Guidelines with recommendations for prevention of the condition	Guidelines with Level Ia: Systematic review and evidence grading	Guidelines with Level Ib evidence rating	Guidelines with Level II: Evidence cited only	Guidelines with Level III: Expert opinion
Delirium	3	3	0	0	2
Ventilator-Associated Pneumonia	5	2	3	0	4
<i>Clostridium difficile</i> -associated disease	5	3	2	1	4
Legionnaires disease	2	1	1	1	0
Iatrogenic pneumothorax	1	0	1	0	1
<i>Staphylococcus aureus</i> septicemia	2	1	1	0	2
Methicillin-resistant <i>Staphylococcus aureus</i>	4	1	2	1	3

**APPENDIX
EVIDENCE-BASED GUIDELINES FOR SELECTED
AND PREVIOUSLY CONSIDERED HOSPITAL-ACQUIRED CONDITIONS
WITHDRAWN GUIDELINES**

January 5, 2011

The following guidelines appeared in earlier versions of the RTI report but have since been withdrawn by National Guideline Clearinghouse or by guideline developers.

The National Guideline Clearinghouse (NGC) maintains a list of withdrawn or archived guidelines at the following website: <http://www.guideline.gov/browse/archive.aspx?type=2>. Where possible, links have been provided below to full-text or companion articles. Withdrawn guidelines on the NGC site cannot be linked directly, but can be located alphabetically by developer.

I. Selected Conditions

A. Air Embolism

- “Access Device Guidelines: Recommendations for Nursing Practice and Education.” 2nd edition, 2004 Oncology Nursing Society NGC:004666. Available for purchase.

B. Blood Incompatibility

- “Access Device Guidelines: Recommendations for Nursing Practice and Education.” 2nd edition, 2004. Oncology Nursing Society NGC:004666. Available for purchase.
- “Transfusion guidelines for neonates and older children” (2004) and “Amendments and corrections to the transfusion guidelines for neonates and older children.” (2005). British Committee for Standards in Haematology [BCHS] Blood Transfusion Task Force. NGC:006583. Companion article:
<http://www.ncbi.nlm.nih.gov/pubmed/14984493>;
<http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2141.2004.04815.x/pdf>

C. Pressure Ulcers (Stages III and IV)

- Clinical Practice Guideline: Prediction, Prevention, Early Treatment of Pressure Ulcers in Adults. U.S. Preventive Services Task Force. AHCPR Supported Guide and Guidelines. 1992-2008.
<http://www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=hsahcpr&part=A4521>
(withdrawal notice: <http://www.ahrq.gov/clinic/cpgonline.htm>)

D. Injuries from Falls and Trauma

- “Changing the Practice of Physical Restraint Use in Acute Care.” 2005. University of Iowa Gerontological Nursing Interventions Research Center, Research Translation and Dissemination Core . NGC:004806. Companion article:
<http://www.ncbi.nlm.nih.gov/pubmed/17310658>;

E. Deep Vein Thrombosis (DVT)/Pulmonary Embolism (PE) for Total Knee Replacement or Hip Replacement

- Antibiotic prophylaxis in cardiac surgery, Part I, Duration of Antibiotic Treatment 2005; Society of Thoracic Surgeons Workforce on Evidence Based Surgery. NGC:004297.
<http://www.sts.org/documents/pdf/guidelines/AntibioticProphylaxisinCardiacSurgeryPartIDuration.pdf>

F. Vascular Catheter-Associated Infection

- “Access Device Guidelines: Recommendations for Nursing Practice and Education.” 2nd edition, 2004 Oncology Nursing Society NGC:004666.

II. Previously Considered Conditions

A. Delirium

- “Prevention of Delirium in older hospitalized patients, In: Making Health Care Safer: A Critical Analysis of Patient Safety Practices, 2001; AHRQ,”
<http://www.ahrq.gov/clinic/ptsafety/>
- “Practice Guideline for the Treatment of Patients With Delirium,” 1999; American Psychiatric Association.
(http://www.psychiatryonline.com/pracGuide/pracGuideTopic_2.aspx)

B. Ventilator-Associated Pneumonia

- “Guidelines for Preventing Health-Care-Associated Pneumonia, 2003” (CDC) Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee. MMWR Recomm Rep 2004 Mar 26;53(RR-3):1-36. NGC:003506. Article: <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5303a1.htm>

C. Legionnaires’ Disease

- “Guidelines for Preventing Health-Care-Associated Pneumonia, 2003” (CDC) Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee. MMWR Recomm Rep 2004 Mar 26;53(RR-3):1-36. NGC:003506. Article: <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5303a1.htm>