



TEXAS DEPARTMENT OF STATE HEALTH SERVICES

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The Honorable Rick Perry
Governor's Office
Post Office Box 12428
Austin, TX 78711

Dear Governor Perry:

As directed by SB 872, the Department of State Health Services established a 14 member advisory panel to study and make recommendations for the collecting and reporting of health care associated infections (HAI).

The advisory panel was appointed in October 2005 by the Commissioner of State Health Services and is comprised of consumers, infection control professionals and health care facility leaders. A complete listing of the panel members and their roles on the panel is listed on page two of the attached report.

The HAI panel met nine times from November 2005 to October 2006. By consensus, the panel agreed on eight key findings. A comprehensive discussion paper is included as an appendix. The appendix documents the panel's rationale for its recommendations and provides insight into their perspective on implementing a Texas infection reporting system. The panel recognized that the details of a reporting system fell outside the scope of its charge, as enacted by SB 872, but the members felt strongly that this information would be valuable in the implementation of a reporting system, should one be created.

The eight key findings of the HAI panel represent a good faith effort to address this serious problem and DSHS supports these key findings and recommendations. It should be emphasized that any health care associated infections reporting system will entail significant cost for development and maintenance.

If you would like additional information on the process or the information contained in this report, please contact Kathryn C. Perkins, RN, MBA, Assistant Commissioner, Division for Regulatory Services at (512) 834-6660 or Kathy.Perkins@dshs.state.tx.us

Sincerely,

Charles E. Bell, M.D.
Acting Commissioner



TEXAS DEPARTMENT OF STATE HEALTH SERVICES

**Recommendations and Key Findings
Advisory Panel on Health Care-Associated Infections
Submitted to meet the reporting requirements of SB 872
79th Legislature, Regular Session**

Recommendations and Key Findings

Advisory Panel on Health Care-Associated Infections

Senate Bill 872 establishes a 14-member Advisory Panel on Health Care-Associated Infections to determine how hospitals and ambulatory surgical centers (ASCs) should report health care-associated infections to the Texas Department of State Health Services (DSHS). No later than Nov. 1, 2006, the commissioner of State Health Services must file a report with the Texas Legislature with a recommendation that legislation be enacted setting Sept. 1, 2007, as the date for hospitals and ASCs to comply with the collection and reporting of infection rates, process measures or both.

The advisory panel was appointed by the commissioner of State Health Services and was comprised of consumers, infection control professionals, physicians and health care facility leaders.

Legislative Charge

The legislation requires the following:

1. The advisory panel, using nationally accepted measures, shall study and recommend definitions and methodologies for collecting and reporting evidence-based data on:
 - a. infection rates;
 - b. process measures; or
 - c. both infection rates and process measures.
2. The advisory panel shall consider:
 - a. adjusting the reported infection rates to account for the differences in patient populations and for factors outside the control of the health care facility;
 - b. standardizing data collection methodology and reporting;
 - c. reviewing data collecting and reporting systems of other entities related to infection rates, such as the National Nosocomial Infections Surveillance System of the federal Centers for Disease Control and Prevention (CDC);
 - d. reviewing data collection and reporting systems of other entities related to process measures, such as the Joint Commission on Accreditation of Healthcare Organizations or the Centers for Medicare and Medicaid Services (CMS);
 - e. maximizing the efficient use of the resources required for health care facilities to conduct required surveillance and reporting;
 - f. recognizing the potential unintended consequences of public reporting that is poorly defined or executed and that may diminish the overall quality of this state's health care or mislead or fail to protect health care consumers who use the data; and
 - g. providing additional benefits to health care consumers.
3. Commissioner's Report to the Legislature:
 - a. Not later than November 1, 2006, the commissioner shall file a report with the presiding officer of each house of the legislature on the advisory panel's recommendations for legislation regarding the collection and reporting of infection rates, process measures, or both.
 - b. The report shall include a recommendation that the legislation set September 1, 2007 as the date for hospitals and ambulatory surgical centers to comply with the legislation.

Appointed Advisory Panel on Health Care-Associated Infections

The 14-member panel was appointed in accordance with the qualifications prescribed by the legislation.

Three physician members:

Chair: Jan Patterson, M.D., FACP, professor of infectious diseases and pathology, University of Texas Health Science Center at San Antonio

Scribe: Robert Haley, M.D., professor, University of Texas Southwestern Medical Center, Dallas

Luis Ostrosky-Zeichner, M.D., associate professor, University of Texas Health Science Center at Houston

Four infection control practitioner members:

Vice Chair: Gregory Bond, RN, BSN, MSN, CIC, infection control manager, Scott and White Memorial Hospital, Temple (resigned effective August 28, 2006)

Susan Jones, BA, MPH, M(ASCP), CIC, CHSP, infection control coordinator, Laredo Medical Center

Betsy Colvin, RN, BSN, CIC, director of quality/risk management, Sid Peterson Memorial Hospital, Kerrville

Patti Grant, RN, BSN, MS, CIC, infection control professional, Medical City Dallas Hospital, Dallas

Lynda Watkins, RN, BSN, CIC, infection prevention and control practitioner, Brackenridge Hospital, Seton Family of Hospitals, Austin, Texas (appointed to replace Gregory Bond)

One CEO of a licensed hospital:

Dan Stultz, M.D., CHE, chief executive officer, Shannon Health System, San Angelo

One CEO of a licensed ambulatory surgical center:

Marilyn Christian, RN, BSN, CNOR, CASC, Advantage Surgical Partners, Houston

Two members representing the public as consumers:

Lisa McGiffert, BA, campaign director, StopHospitalInfections.org, Consumers Union, Austin

Raquel Sanchez, consumer representative, Houston

Three department employees who served as non-voting members:

Neil Pascoe, RN, BSN, CIC, epidemiologist, Infectious Disease Control Unit, Texas Department of State Health Services, Austin (non-voting member)

Tom Betz, M.D., MPH, acting state epidemiologist and branch manager, Infectious Disease Control Unit, Texas Department of State Health Services, Austin (non-voting member)

Nance Stearman, RN, MSN, Medicare compliance officer, Regulatory Services, Texas Department of State Health Services, Austin (non-voting member)

The panel received assistance from other volunteers with specific expertise:

Jane Siegel, M.D. representing the Texas Pediatric Society Infectious Disease Committee

Marc Allen Connally, representing DSHS legal services

The panel met nine times between November, 2005 and October, 2006 and carefully considered the legislative charges. The goal of the panel was to recommend a system of reporting that improves patient safety through reduction in infection rates, helps consumers make informed choices and reduces health care costs. The public is increasingly concerned about health care-associated infections, infections that patients acquire during the course of receiving treatment for other conditions. The cost of health care is increasing, in part due to prolonged stays and utilization of resources attributable to HAI. Nationally HAIs account for an estimated 2 million infections, 90,000 deaths, and \$4.5 billion in excess health care costs annually. Health care facilities have undertaken performance improvement activities to reduce infections; however, in Texas no infection rates are available to the public for making informed choices.

In order to accomplish their primary charge to study and recommend definitions and methodologies for collecting and reporting evidence-based data, the panel participated in a number of activities. The panel utilized a number of resources from the CDC especially the Healthcare Infection Control Practices Advisory Committee (HICPAC)*. Some of the activities included:

- writing a comprehensive discussion paper, *Background, Rationales and Systems for Implementation of Public Reporting of Health Care-Associated Infection Rates in Texas*, for the purpose of guiding the legislature and DSHS in implementing the Texas infection reporting system;
- evaluating HAI public reporting initiatives implemented in other states;
- evaluating publicly available hospital report cards from the consumer's perspective
- reviewing a health plan initiative focused on reducing HAI;
- developing, administering and evaluating a web-based survey of Texas hospitals and ambulatory surgery centers to obtain baseline information about existing infection prevention and control programs;
- meeting with representatives from the Missouri Department of Health via teleconference regarding the Missouri application for reporting of HAI;
- meeting with a representative from the CDC via teleconference regarding the CDC's National Health Safety Network (NHSN) system for reporting of HAI;
- reviewing national standardized definitions for reporting of HAI, including the changes being revised by CDC in their conversion from the National Nosocomial Infections Surveillance System (NNIS) to NHSN;
- evaluating the private software most frequently used in hospitals for infection surveillance; and
- evaluating guidance issued by the HICPAC.

The panel should be recognized for more than 1,000 man hours of work in their mission to help the State of Texas move to a statewide infection reporting system. Without their expertise, this report would have lacked the scientific basis to assist the legislature in the 80th session.

*A federal advisory committee made up of 14 external infection control experts who provide advice and guidance to the CDC and the Secretary of the Department of Health and Human Services (HHS) regarding the practice of health care infection control, strategies for surveillance and prevention and control of health care associated infections in United States health care facilities.

Overall Reporting Requirements

Key Recommendation

- Texas should implement a system for Texas general hospitals and ambulatory surgery centers to publicly report health care-associated infection (HAI) rates with the following three objectives:
 - allow consumers to make informed choices about hospitals for their own care based on consideration of HAI rate comparisons;
 - incentivize facilities to reduce their infection rates by doing high yield outcome measurement; and
 - improve patient safety and reduce health care costs by reducing prolongation of stay and utilization of resources due to HAI.
- After review of CDC's NHSN reporting system and the Missouri Healthcare-Associated Infection Reporting System (MHIRS) the panel recommends that Texas adopt a system similar to MHIRS where the state collects its own data through an electronic interface with general hospitals and ASCs.
- Texas facility-specific reports should be available on a Web site and other formats accessible to the public.
- Facilities that are required to publicly report HAI rates under the legislation should include:
 - general hospitals licensed under Chapter 241, Texas Health and Safety Code, with the exception of comprehensive medical rehabilitation facilities, and
 - ambulatory surgery centers licensed under Chapter 243, Texas Health and Safety Code.
- Although not included in its statutory authority, the panel strongly recommends that state owned or operated hospitals, e.g. hospitals affiliated with the University of Texas, that provide acute medical or surgical services should be included in the Texas HAI reporting requirements.
- Public reporting of HAI should focus on outcome measures that measure the effectiveness of evidence-based infection prevention processes.
- Hospitals must rely on trained infection control professionals to identify and report required types of infections with accepted methods of clinical surveillance.
- Training should be provided by the state and should be reasonable in scope and specific to the public reporting requirement.
- Hospital discharge diagnosis codes should not be used as the source for HAI public reporting.
- The types of reported infections and data collection methods to be used will be those shown by evidence to assist in reducing HAI rates.
- CDC definitions should be used for reporting of HAI.

Conclusion

It is the overall recommendation of this panel that a mandatory HAI reporting system be implemented by the State of Texas. In order to expedite access to publicly available data, a phased-in approach should be taken, expanding the types of infection reported as the state and facilities build the infrastructure for a robust and refined reporting system. Initially, it is recommended that only outcome infection rates be reported, since process measures are already being reported to other organizations such as Joint Commission on Accreditation of Healthcare Organizations and CMS. Technology exists to either link to the publicly reported process measures or simply duplicate the existing reports on the Texas HAI Web site.

Infection Control and Prevention Professionals (ICP)

Key Recommendations

- Assure that individuals with training in infection control and prevention, as defined by Healthcare Infection Control Practices Advisory Committee (HICPAC), are employed by or are available by contract to all healthcare facilities so that the infection control program is managed by one or more qualified individuals. Certification in infection control (CIC) is recommended and is available through the Certification Board of Infection Control and Epidemiology.
- The specific infection control and prevention staffing should be determined according to the scope of the infection control program, the complexity of the healthcare facility or system, the characteristics of the patient population, the unique or urgent needs of the facility and community, and tools available for performing essential tasks, proposed staffing levels based on survey results and recommendations from professional organizations.
- Current vacancies in Infection Control and Prevention Professional (ICP) positions point to a statewide shortage. For that reason, further study is needed to determine the extent of the shortage. The study should be done in coordination with the Certification Board of Infection Control and Epidemiology, Inc. (CBICE) or other private organizations.

Key Findings

- The HAI panel made slight modifications to the definition of ICP as contained in the draft *1996 Guideline for Isolation Precautions*. The agreed-upon version defines an ICP as a person whose primary training is in either nursing, medical technology/clinical laboratory science, microbiology, public health, or, epidemiology and who has acquired specialized training in infection control. HICPAC further identifies key responsibilities for ICPs.
- HICPAC defines a health care epidemiologist as a person whose primary training is medical (M.D., D.O.) and/or masters or doctorate-level epidemiology who has received advanced training in healthcare epidemiology. Typically these professionals direct or provide consultation to an infection control program in a hospital, long term care facility (LTCF), or healthcare delivery system.
- Appropriate training is required to optimize the quality of work performed.
- There is agreement in the literature that one ICP per 250 acute care beds is inadequate to meet present infection control staffing needs. According to the draft HICPAC *Guideline for Isolation Precautions*, a Delphi project assessing staffing requirements to meet the expanded needs of infection control programs in the 21st century concluded that a ratio of 0.8 to 1.0 ICP per 100 occupied acute care beds is adequate. Recommendations for infection control staffing cannot be based on patient census alone, but rather must be determined by the scope of the program.

Conclusion

- Research shows that having an appropriate number of trained ICPs is an essential component of an effective infection prevention and control program. The qualifications and roles of ICPs should be defined in statute or regulation.

Validation of Data

Key Recommendation

- Data collected from health care facilities should be validated to ensure that HAIs are being accurately and completely reported and that rates are comparable from facility to facility or among all facilities in the reporting system.

Key Findings

- Incomplete ascertainment of reportable HAIs must be minimized because hospitals and ASCs that identify a smaller percentage of their infections could have erroneously lower infection rates, thus providing misleading guidance to consumers.
- Measures to minimize erroneous infection reporting should include such methods as:
 - including information about resources devoted to infection control and prevention on the public reporting Web site;
 - providing patients with a form at the time of discharge and encouraging them to report infections such as surgical site infections (SSIs) to the facility's infection control staff;
 - DSHS making available a Web-based system for patients to report possible HAIs to the state for validation;
 - requiring surgeons to report SSIs to the infection control program of the facility where the operation was performed; and
 - where applicable, comparing the reported infection rates with the process measures reported to the CMS to determine if the process measures are being carried out.
- DSHS should review infection control and reporting activities of hospitals and ASCs that have unusual data patterns or trends that suggest implausible rates (e.g., atypically low or erratic rates) or large numbers of unreported infections. This authority is available through existing law.

Conclusion

Recognizing the potential unintended consequences of public reporting that is poorly defined or executed and that may diminish the overall quality of this state's health care or mislead or fail to give health care consumers accurate comparisons, the panel recommends that methods be put in place to validate the data that is reported.

Reporting of Central Line-associated Primary Bloodstream Infections (BSI) in Special Care Settings

Key Recommendation

- General hospitals shall report laboratory-confirmed central line-associated primary bloodstream infections (BSI) in special care settings, such as intensive care units (ICUs).
- DSHS shall report the rate of BSIs to consumers.

Key Findings

- BSI is one of two outcome measures identified as highest priority for public reporting by the HICPAC on the basis of criteria, including frequency, severity and preventability of the outcome, the likelihood that they can be detected and reported accurately, ability to risk adjust, and the availability of well-established prevention strategies.
- For each special care unit, as defined by the NHSN *Patient Safety Component Protocol*, hospitals will report all laboratory-confirmed central-line associated primary BSI episodes and the causative pathogen, the number of central line days, and the BSI rate during the reporting period. In neonatal special care units, hospitals will report the numerator, denominator and rate separately for each birth weight category.
- Since ASCs do not operate special care units, it is not anticipated that they will report BSIs.

Conclusion

Central line-associated primary blood stream infections are associated with substantial cost, morbidity and mortality. For this reason, the panel recommends inclusion of this infection rate in the initial reporting requirements for general hospitals.

Reporting of Surgical Site Infection (SSI) Rates

Key Recommendation

- During the initial one-year phase-in period, each general hospital and ASC shall report surgical site infection data including post-discharge surveillance for the following procedures if performed at the facility: colon surgery, hip and knee arthroplasty, abdominal and vaginal hysterectomy, coronary artery bypass graft, and other vascular procedures.
- Pediatric hospitals shall report surgical site infection data including post-discharge surveillance for cardiac procedures (excluding thoracic), ventriculoperitoneal shunt procedures, and spinal surgery with instrumentation.
- Facilities not performing at least 50 of these selected procedures per month shall report SSI data, including post-discharge surveillance, for the three most frequently performed procedures on the NNIS list of surgical procedures.
- After the phase-in period, hospitals and ASCs will report SSI rates for an additional one-third of the procedures on the NNIS list of surgical procedures, continuing to phase in until SSIs on all procedures on the NNIS list are being reported. The phase-in schedule and reported procedures may be adjusted by DSHS depending on initial experience with the system or federal requirements.

Key Findings

- SSI is one of two outcome measures identified as highest priority for public reporting by the HICPAC on the basis of criteria, including frequency, severity and preventability of the outcome, the likelihood that they can be detected and reported accurately, ability to risk adjust, and the availability of well-established prevention strategies.
- Post-discharge surveillance should be conducted in order to identify infections that appear after the patient's discharge. A mechanism for surgeons and patients to report SSIs to the infection control program of the facility where the operation was performed should be developed.
- The panel recommends that a record for each selected procedure be reported, including the risk index as referenced in the NHSN guidelines. Reporting of this information allows calculation of verifiable rates by more sophisticated statistical methods.

Conclusion

SSIs are associated with substantial cost, morbidity and mortality. For this reason, the panel recommends inclusion of this infection rate in the initial reporting requirements for general hospitals and ambulatory surgery centers. Prevention guidelines exist and certain prevention processes can be monitored concurrently with data available through the Joint Commission on Accreditation of Healthcare Organizations or CMS.

Reporting of Health Care-Associated Respiratory Syncytial Virus (RSV) in Pediatric Inpatient Units

Key Recommendation

- General hospitals shall report health care-associated respiratory syncytial virus (RSV) in pediatric inpatient units.

Key Findings

- Respiratory syncytial virus (RSV) is the most common cause of bronchiolitis and pneumonia among infants and children under 1 year of age. Reactive airway disease and pulmonary function deficits are two conditions known to strike those who have suffered from RSV bronchiolitis in their first year of life.
- In a hospital setting, prevention strategies exist for prevention of RSV transmission.

Conclusion

RSV infections are associated with increased morbidity and cause repeated infections throughout life, usually associated with moderate-to-severe cold-like symptoms. For this reason, the panel recommends inclusion of this infection rate in the initial reporting requirements for general hospitals.

Confidentiality and immunity protections for reporting

Key Recommendations

- Legislation should include appropriate protections for information submitted to DSHS by hospitals and ambulatory surgical centers which will be used to calculate publicly reported infection rates of hospitals and ambulatory surgical centers.
- Legislation should clarify that published infection rates do not establish a standard of care in civil actions.
- Patient confidentiality should be strongly protected.

Key Findings

- In order to more accurately calculate health care-associated infection rates, facilities need to submit patient-specific data for some types of infections. This data must be protected because it contains confidential and sensitive personal health information. DSHS must ensure that all patient identifying information is handled in a secure manner.
- Many health care facilities are reluctant to support or cooperate with public reporting of health care-associated infections because they fear the information gathered by DSHS could be used against them in civil, criminal or administrative proceedings. Assurances in the law that underlying information about specific patients' treatments will remain confidential will relieve those fears and encourage more candid reporting to the agency. This level of confidentiality of underlying data is used currently by other Texas hospital quality report cards.
 - Language should be included in the law providing that information submitted by hospitals and other health care facilities to DSHS:
 - is not subject to disclosure under the state's Public Information Act, or discovery, subpoena, or other means of legal compulsion for release to any person; and
 - may not be admitted as evidence or otherwise disclosed in any civil, criminal or administrative proceeding.
 - Language should be included in the law stating that publicly reported infection rates cannot be used to establish a standard of care in a civil action. Similar information, such as hospital mortality rates for specific surgical procedures, has been reported in Texas for years without creating such standards or stimulating law suits. This change in the law would not affect current methods of collecting evidence in civil proceedings.

Conclusion

Failure to provide adequate legal protections of information submitted by hospitals and health care facilities would violate patient confidentiality and could cause some facilities to withhold information about health care-associated infections and hinder accurate and complete reporting.

Implementation and Future Direction

Key Recommendations

- As science and technology advance, the Texas health care associated infection reporting system should have the flexibility to expand the numbers and types of infections reported and available to the public.
- A permanent HAI advisory panel should be appointed to guide the implementation, development, maintenance and evaluation of the Texas HAI reporting system.
- Analysis of Methicillin-resistant *Staphylococcus aureus* (MRSA) prevalence should be considered in the future.
- The Texas HAI reporting system should be adequately funded through appropriations.

Key Findings

- Lessons learned from reporting initiatives in Texas and other states should be incorporated into the Texas HAI reporting system.
- Measures and rates that are shown to be ineffective or misleading should be replaced by new evidence-based measures.
- Over time, measures for additional types of health care facilities and additional types of infections should be added to reporting requirements.
- Health care-associated MRSA infections are a growing public health problem of great concern to the health care industry and the public. Many MRSA infections will be detected in the measures selected for initial reporting and can be separated out for analysis.
- When available, electronic health records and information technology systems should be utilized to replace manual data collection methods.

Conclusion

Publicly released reports should convey useful guidance to consumers and information to a diverse audience. The Texas HAI reporting system must be flexible in order to remain current with evolving science and technology.

Appendix

Background, Rationales and Systems for Implementation of Public Reporting of Health care-Associated Infection Rates in Texas

Background, Rationales and Systems for Implementation of

Public Reporting of Health care-Associated Infection Rates in Texas

Objectives for Public Reporting

The system for Texas hospitals to report health care-associated infection (HAI) rates to consumers has the following three objectives:

- 1) Allow consumers to make informed choices about hospitals for their own care based on consideration of HAI rate comparisons.
- 2) Motivate hospitals to reduce their infection rates by doing high yield outcome measurement.
- 3) Improve quality of care and patient safety, and reduce health care costs by reducing the extra length of stay due to HAI.

Health care Facilities to be Included or Excluded

The following classes (hereafter referred to as “health care facilities”) will be included in the statewide system for reporting HAI rates to consumers:

- General hospitals, including both acute-care general medical and surgical hospitals and pediatric hospitals
- Ambulatory surgery centers (ASCs)

The following class was not included in the expert panel’s charge but the panel recommends its inclusion in the reporting system:

- State owned or operated hospitals that provide acute medical or surgical services (e.g., University of Texas hospital systems)

The following classes of health care facilities will initially be excluded from the statewide system for reporting HAI rates to consumers but may be included in future years:

- Medical rehabilitation hospitals
- Long-term care facilities
- Psychiatric care facilities
- Drug and alcohol treatment centers
- Rehabilitation care facilities
- Federal facilities (Veterans Affairs and Defense departments)
- Renal dialysis centers

General Requirements for Data Collection and Reporting

- 1) Public reporting in Texas will focus on infection outcome measures and will not include process measures for the following reasons. Process measures are already being reported to other organizations (1-3), and rather than duplicating these systems, we will link the Texas hospitals’ infection reporting Webpages to the other Websites that report their process measure data. Second, infection risk is the result of many processes, and reporting of just a few for a given infection type might focus hospital effort on only those to the exclusion of other necessary ones. Third, infection outcome measures, if accurate, reflect the effect of all processes and are thus what consumers are most concerned to see.

- 2) To ensure acceptably accurate data, hospitals must rely on trained infection control staff to identify and report required types of infections with accepted methods of clinical surveillance, such as regular ward rounds and review of medical record and laboratory reports (4-6). The reporting must not depend primarily on the medical record, discharge code databases, or other administrative records systems (6), which are highly incomplete, inaccurate and inconsistent for measuring HAI rates (7-9).
- 3) Since 50-80% of surgical site infections (SSI) show up only after the patient's discharge from a hospital (10-21), 100% after discharge from an ASC, and few have bacteriologic cultures done, the measurement process must involve post-discharge surveying of surgeons and patients for SSI rates to be meaningful (10-21).
- 4) The types of infection and data collection methods to be used will be those that have been shown to assist in reducing HAI rates (22-29), so that the data required for public reporting will come merely as a by-product of good infection control practice. Rather than diverting resources from productive infection control activities, the public reporting system should increase the effort and resources devoted to epidemiologic measurement previously shown to be effective.
- 5) Since the measurement requirements of this public reporting system are consistent with evidence-based infection control practice (5, 22, 30-33), hospitals must ensure adequate infection control professional (ICP) resources as well as clerical and information technology support to accomplish the measurement without detracting from other required infection control activities. The definition of an ICP is provided in **Appendix A**. Historically, the recommendation for a staffing ratio of one full-time-equivalent ICP per 250 occupied beds was empirically validated (22) in the 1970s before the greatly expanded duties of ICPs, the progressive concentrating of more acute and complex illness in hospitals, and the emergence of new, highly immunosuppressed patient populations. Current staffing guidelines based on expert opinion (34) suggest at least one FTE ICP for every 100 occupied beds, but the most appropriate staffing ratio may be higher in hospitals with more complex than average patient mix. Use of interconnected infection control software, hospital databases, electronic medical records and other health information technology may reduce the staffing requirements for public reporting of infection rates.
- 6) In collaboration with DSHS and the Texas Hospital Association, the panel carried out a statewide survey of general hospitals and ASCs to inform the panel's deliberations (see **Appendix B**).
- 7) The types of HAIs to be reported must be defined by precise application of the recent Centers for Disease Control and Prevention (CDC) definitions (6, 35). Since CDC definitions may change and different versions appear in various published and unpublished sources, DSHS will determine which version of the definitions Texas hospitals will use to ensure uniformity of publicly reported HAI rates.
- 8) The system will require reporting of patient-level data from which DSHS can compute the required rates. To generate risk-adjusted HAI rates validly, it is necessary for hospitals to develop these patient-level data files. Once these patient-level datafiles are produced, transmitting them to the DSHS system for group analyses adds little more work and can be automated. Thus aggregating the patient-level data centrally will greatly increase the accuracy and comparability of the calculated rates by ensuring that all hospitals are in fact collecting the same data and the rates are being calculated identically. In addition, it will allow DSHS to apply uniform computational algorithms and risk adjustments and eventually build in more sophisticated calculation methods.

Quality Control Measures to Ensure Completeness of Reporting

Incomplete ascertainment of reportable HAIs must be minimized because hospitals that identify a smaller percentage of their infections will have factitiously lower infection rates, thus providing misleading guidance to consumers (6, 27).

As a general measure of completeness of reporting, each hospital's Webpage on the public reporting Website will display standardized information about the hospital's infection prevention program, giving among other information, the level of HAI surveillance effort on an annual basis (see suggested reporting form in **Appendix C**).

DSHS should review infection control and reporting activities of hospitals and ASCs that have unusual data patterns or trends that suggest implausible rates (e.g., atypically low or erratic rates) or large numbers of unreported infections; this authority is available under current state law.

Information Technology Mechanisms for Hospitals' Reporting to DSHS

- 1) Hospitals will transmit their datafiles via a secure internet Website into a database management system developed, or procured, and maintained by the DSHS.
- 2) The interface will accept electronic downloads of files from hospitals, according to a standard downloading file structure that DSHS will make available to hospital IT staff and third party system vendors.
- 3) Alternatively, the DSHS interface will also allow manual entry of data for small hospitals with small volumes of data.
- 4) The transmitted records will contain patient identifying information to avoid and remove duplicate records and to determine whether a putative infection reported to the DSHS complaint system by a consumer was reported by the hospital and to allow the hospital to verify or refute it. This will require patient names, medical record numbers, and admission or operation dates. Patient confidentiality will be ensured by reporting through a secure Website and by security measures in the DSHS data management office. As a state-mandated public health reporting system, this activity will be exempt from HIPAA.
- 5) DSHS staff will explore with CDC the possibility of transmitting a de-identified subset of the reported data to the NHSN for valid research purposes, but DSHS will not rely on NHSN for collecting data from Texas hospitals or allow hospitals to substitute NHSN participation for reporting data to the Texas public reporting system.
- 6) As a measure of reporting completeness, DSHS will develop a secure Website (or use their current consumer complaints system) for consumers to report HAIs that they contracted along with sufficient information to corroborate the infection with the hospital and to determine whether the hospital had routinely reported it. DSHS will have to have sufficient staff over time to handle this corroboration task.

Design of the DSHS Website for Reporting to Consumers

The reporting Website must be designed to ensure the most effective communication of rather complex statistics and related issues to the consumers. The following issues are to be developed:

- 1) The overall layout
- 2) Hospitals' responses on a standardized evidence-based set of essential or desirable attributes of a successful infection control program (detailed in **Appendix C**).

- 3) Control charts for evaluating trends in rates over time, including comparisons from year to year
- 4) There should be special functions for comparing hospitals of a given size, type, city, and region.
- 5) The website should allow for comparing the patient mix in hospitals, within the limits of the collected data, for a given patient risk profile so that individual consumers could make comparisons most relevant to their own conditions.
- 6) Graphics should include information displayed in a variety of formats, including bar charts or stars indicating general comparisons, actual rates along with explanations of how to interpret them.
- 7) On each hospital's Webpage on the DSHS HAI rate reporting Website, include links to their reports of process measures on other systems' Websites, such as that of the Centers for Medicare and Medicaid Services (CMS) (1-3) and the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) ratings, and links to the hospital's own website. Efforts should begin to integrate hospital-specific information currently available in electronic format or on other Texas state websites, for example, the American Hospital Association annual surveys and hospital quality reports.
- 8) Incorporate Web-appropriate educational techniques that will educate consumers on proper interpretation of the rates and report cards, including the meaning of infection rates, statistical significance, risk adjustment, definitions of terms, methodology used to calculate the rate, and links to related studies where appropriate.
- 9) The data displayed on the Website should be provided in downloadable format also to facilitate consumers' doing their own analysis.
- 10) The public utilization of the Website should be analyzed for identifying improvements in Website design.

Training

When the public reporting has been put into state law and final regulations detailing the reporting requirements have been distributed to hospitals, DSHS will develop, or use existing sources for, a training and qualification program for hospital staff including the ICPs and support staff who will collect and transmit the infection data. The training and qualification process will have the following characteristics:

- 1) Infection control staff will be trained in use of the Texas public infection reporting system. The objective of the training will be narrowly defined to impart the methods of data collection and transmission required to participate in the HAI reporting system. The training will be designed to minimize the resources utilized by hospitals and ASCs to meet the reporting requirements.
- 2) The primary training in how to perform the surveillance, including infection definitions to be used, and data transfer for public reporting will consist of a self-administered web-based training program with a post-test to demonstrate mastery of the skills. Hospital personnel must have passed the training post-test to sign onto the DSHS Web-portal to report HAI data. The training will be patterned after the Web-based training tools used to train medical researchers in human subjects protection and HIPAA compliance.
- 3) Supplementary training such as teleconferences and regional classroom-style courses may be developed if later found to be needed.
- 4) Hospitals must provide an adequate force of ICPs and support staff trained in the public reporting system to maintain a high level of completeness and accuracy in the reporting process.

Patient Information and Education

A. Health care facility-based patient information and education

1. Health care facilities should make general infection-related information available to patients and their families at their facilities, to include awareness of the risk of infection and precautions the patient and the health care facility can take to prevent infections from occurring. This should include hand cleansing, precautions when visitors are present, encouragement to discuss and question precautions used by nurses and doctors, and information about evidence-based strategies that health care facilities can use to lower the rate of infection. The information can be presented in various forms such as brochures, posters, announcements over health care facility intercoms, presentations on the patient room televisions, and electronically to health care workers to print-out for family and visitors when needed. The health care facility's infection control educational program for employees and patients should be visible, including prompters throughout the health care facility (see **Appendix D** for resources).
2. Contact information for the unit supervisor should be posted in the patient rooms, along with a statement to contact them if health care workers and physicians fail to clean their hands prior to providing patient care.
3. When a patient is identified as having MRSA (methicillin-resistant *Staphylococcus aureus*), VRE (vancomycin-resistant enterococcus), *Clostridium difficile*, or other antibiotic-resistant infections, health care facility infection control programs should provide education materials that the bedside health care worker can give to the patient and family members about precautions for avoiding the spread of infection to others while in the health care facility and after discharge.
4. All surveys, questionnaires, post-discharge marketing mail sent or post-discharge phone calls to patients following a procedure or hospitalization should include a statement regarding common symptoms of health care-associated infections and ask the patient to contact a person identified by the health care facility (with a phone number) to report when these symptoms are present.

B. Education available for patients via the Department of State Health Services (DSHS) website

1. The DSHS website should include educational information to the public about health care-associated infections, including how they are defined and the different terms used for them (health care-associated infections, nosocomial, etc). This may be included in the same website sections with the health care facility comparisons, but should also be linked to relevant public health information about other infections. Terms relating to these infections should be searchable on the website.
2. The Department should provide information about MRSA in health care settings, in addition to the information about community-associated MRSA. Terms relating to these infections should be searchable on the website.
3. Selected information about evidence-based processes for infection prevention that have been endorsed or are being used by established quality of care and professional organizations¹ should be included in the DSHS public information pages on health care-

¹ Institute for Healthcare Improvement (IHI), National Quality Forum (NQF), Joint Commission on Accreditation of Healthcare Organizations (JCAHO), Accreditation Association for Ambulatory Health Care (AAAHC), Agency for Healthcare Research and Quality (AHRQ), Centers for Disease Control and Prevention (CDC), Society of

associated infections. This information should describe the specific practices that health care professionals use to prevent infections and link to the websites of these organizations and actual published studies for more detailed information. This would be an ongoing, regularly updated information site. The Department should consult with the health care-associated infection advisory committee, if created, or experts in infection control to identify these practices.

4. The DSHS web site should include information about what patients can do to prevent health care-associated infections, such as prompting health care workers to clean hands (see **Appendix D**). This information should be presented in a printable format so people can use it when discussing procedures and hospitalizations with their physicians and as a reminder while they are in the health care facility.
5. The DSHS web site should include a portal through which consumers may report suspected health care-associated infections. DSHS should create an online form that can be submitted electronically and should make hard copies of the form available upon request.

Confidentiality and Immunity Protections for Reporting

Failure to provide adequate legal protection of information submitted health care facilities would violate patient confidentiality and could cause some facilities to withhold information about health care-associated infections and hinder accurate and complete reporting.

- In order to more accurately calculate health care-associated infection rates, hospital need to submit patient specific data for some types of infections. This data must be protected because it contains confidential and sensitive personal health information. DSHS must ensure that all patient identifying information is handled in a secure manner.
- Many health care facilities are reluctant to support or cooperate with public reporting of health care-associated infections because they fear the information gathered by DSHS could be used against them in civil, criminal or administrative proceedings. Assurances in the law that underlying information about specific patients' treatments will remain confidential will relieve those fears and encourage more candid reporting to the agency. This level of confidentiality of underlying data is used currently by other Texas hospital quality report cards.
- Language should be included in the law providing that information submitted by hospitals and other health care facilities to the Department of State Health Services:
 - is not subject to disclosure under the state's Public Information Act, or discovery, subpoena, or other means of legal compulsion for release to any person; and
 - may not be admitted as evidence or otherwise disclosed in any civil, criminal or administrative proceeding.
- Language should be included in the law stating that publicly reported infection rates cannot be used to establish a standard of care in a civil action. Similar information, such as a hospital's mortality rates for specific surgical procedures, have been reported in Texas for years without creating such standards or stimulating law suits. This change in the law would not affect current methods of collecting evidence in civil proceedings.

Outcome Measures to be Reported by the Indicated Hospital Classes

In year 1 outcome measures will be reported for selected surgical site infections (SSI), laboratory-confirmed central line-associated primary bloodstream infection (BSI) in special care units, and respiratory syncytial virus (RSV) infections in pediatric hospital inpatients. Additional measures to be considered in later years are given in **Appendix E**.

MRSA infections are a growing public health problem of great concern to hospitals and the public. Although MRSA infections have not been selected as a specific outcome to be measured in year 1, many MRSA infections will be detected in year 1 in the SSI and BSI outcome measures and will be analyzed by DSHS for separate MRSA reports.

Details of the outcome measures to be reported in year 1 are given in the following three sections.

1. Central Line-Associated Primary Bloodstream Infections (CLA-BSI) in Special Care Units²

Types of hospitals to report: Acute-care general medical and surgical hospitals, pediatric hospitals.

Numerator: The number of laboratory-confirmed primary bloodstream infections (BSIs) beginning in special care unit patients while a central line (CL) is in place or within 48 hours after the CL was discontinued and within 48 hours after being transferred out of the special care unit (35). The NHSN methodology and definitions for CLA-BSI are given in **Appendix F**.

Numerator exclusions: CL-associated BSIs present or incubating upon admission to the special care unit, secondary BSI (due to infection with same pathogen already cultured from infection at another body site), blood culture contaminants isolated from only one of several simultaneous blood cultures, pseudobacteremias, and purulent phlebitis (35).

Denominator: Sum of the CL days of all patients in the special care unit during the month.³ A patient with >1 CL on a given day is counted only once for that day (35).

Risk Adjustment: Central line day denominator, stratified by type of special care unit, (further stratified by birthweight categories in neonatal special care units; $\leq 1,000$ gm vs $>1,000$ gm is a common categorization). The types of special care units include coronary care, cardiothoracic, medical, medical/surgical in major teaching hospitals, medical/surgical in non-teaching hospitals, neurosurgical, high risk nursery, and pediatric intensive care unit (42). The system will not include rates in burn intensive care units and will not display rates in pediatric surgical, pediatric trauma, pediatric burn and pediatric respiratory units separate from those in pediatric special care units.

Data level reported: Hospitals will report a record of each CLA-BSI and aggregate denominators for the number of central line days.

Fields reported on each CLA-BSI: patient name, medical record number, ICU type, birthweight if a neonate, onset date, pathogen 1, pathogen 2.

Aggregate denominators: number of central line days during the reporting period for each ICU type and for each birthweight category within neonatal special care unit.

Calculation method: the CLA-BSI rate during the reporting period for a given ICU type will be calculated as follows.⁴

² This is one of two outcome measures identified as highest priority for public reporting by the Hospital Infection Control Practices Advisory Committee (HICPAC) on the basis of criteria, including frequency, severity and preventability of the outcome, the likelihood that they can be detected and reported accurately, ability to risk adjust, and the availability of well established prevention strategies (6).

³ Rates of CL-BSI calculated with CL-day denominators and stratified by special care unit have been shown to be useful for inter-hospital comparisons (9, 30, 31, 36-41).

⁴ In future years, the Texas system may be changed to require reporting of patient-level data including all patients with central lines; however, this would depend on the appearances of new technology, such as hand-held computers, that would reduce the time required to collect the daily denominator and risk factor data on all of the patients with central lines. *Fields reported on all special care unit CL patients might include:* patient name, medical record number, type of special care unit, and number of CL days (and birthweight in neonatal special care units). *To*

$$BSI\ rate = \frac{N\ of\ CL -\ BSIs}{Total\ CL\ days} \times 1,000$$

In neonatal special care units, hospitals will report the numerator, denominator and rate separately for each birthweight category.

Statistic reported to the public: The DSHS computer analysis will sum the numerators and the denominators from hospitals in a comparative group, calculate the rates from these aggregated numbers, and report the Primary BSI rate per 1,000 CL days for each special care unit type (substratified by birthweight categories in Pediatric hospitals) and tabulated by broad hospital size categories (such as <50, 50-199, 200-499, 500+ by university affiliated).⁵ Pathogen-specific CLA-BSI rates will also be reported for the major pathogens, with special emphasis on MRSA.

Use of the Rate Data in the Hospital to Reduce CL-Associated BSI Risks:

Feedback of performance data should be given to health care providers regularly so that interventions to improve performance can be implemented as quickly as possible (6).

Data collection requirements:

- a. For surveillance purposes, the ICP will determine whether each suspected CL-associated BSI meets the CDC criteria for laboratory-confirmed primary BSI (35).
- b. When a special care unit patient is transferred to another hospital area or another hospital, the receiving area or hospital is obligated to report to the sending hospital's infection control staff any CL-associated BSI occurring within 2 days after the transfer.

*Quality control measures:*⁶

- a. DSHS will review infection control and reporting activities of hospitals and ASCs that have unusual data patterns or trends that suggest implausible rates (e.g., atypically low or erratic rates) or large numbers of unreported infections; this authority is available under current state law.
- b. A concern of some members of the Panel was that the percentage of suspected BSIs that are cultured may vary widely among hospitals; indeed, extremely wide variation was documented across U.S. hospitals in the 1970s (43). The extent to which this variation has decreased has not been measured in recent decades, and some Panel members suspect that it continues. If so, it would seriously affect the validity of interhospital comparisons. The Panel considered the following recommendation but did not reach consensus, deciding instead to leave this question to be decided early in the implementation stage. For one month in the first year of reporting, hospitals would review all new suspected sepsis cases in patients with central lines in ICUs and record whether one or more blood cultures were drawn before antimicrobial therapy was initiated or changed. Hospitals would report to DSHS the numbers of suspected CLA-BSIs and the number of these that had appropriately timed blood cultures. The variation in these rates would evaluate the

develop a risk index for CL-BSI: type of CL catheter, number of CLs, permanent vs temporary CL, and anatomic site where CL inserted.

⁵ This hospital size stratification was found in the SENIC project to predict important differences in HAI rates (22).

⁶ The panel recommends against comparing the lists of infections reported by the prospective surveillance system with those reported through ICD-9-based billing or discharge reports because the latter have high rates of both false negative and false positive errors, making the reconciliation of the two lists difficult, time-consuming and unlikely to be useful (7-9).

validity of reporting only laboratory-confirmed primary CLA-BSIs but not uncultured clinical sepsis and guide future formulations of this reporting measure.

2. Surgical Site Infections (SSIs) ⁷

Types of hospitals likely to report: Acute-care general medical and surgical hospitals, pediatric hospitals, and ambulatory surgical centers.

Numerator: The number of SSIs occurring in the selected surgical procedures, including superficial, deep and organ space infections. ⁸

Post-discharge survey: To ensure comparability of rates among hospitals, post-discharge surveys must include regular and complete reporting of all SSIs in the selected surgical procedures by surgeons to the infection control staff in the hospital where the operation was performed. Each month the infection control staff will send a list of all included patient operations performed in a given month to all surgeons at least 28 days after the end of the reporting month, and surgeons will return the reports with clear notation of all SSIs with the following characteristics of the SSI: type of SSI (superficial, deep, organ space), onset date, pathogen 1 and pathogen 2, if cultured. ⁹

Numerator exclusions: Operations where the primary incision was not closed primarily

Denominator: Number of operations of the selected surgical procedures reported in the reporting month

Risk Adjustment: NNIS risk index ¹⁰

Data level reported: Report a record for each patient who underwent one of the selected operations during the reporting month,

Fields reported on all operated patients: patient name, medical record number, main procedure, duration of operation, wound class, ASA physical status code, performed with an endoscope vs open incision, and inpatient vs ambulatory surgery.

Fields reported just on the SSIs: indicator of type of SSI (superficial, deep, organ space), onset date, pathogen 1, pathogen 2, surveillance method that identified the infection (in-hospital, post-discharge, or reported first by the patient or family). ¹¹

⁷ This is one of two outcome measures identified as highest priority for public reporting by the Hospital Infection Control Practices Advisory Committee (HICPAC) on the basis of criteria, including frequency, severity and preventability of the outcome, the likelihood that they can be detected and reported accurately, ability to risk adjust, and the availability of well established prevention strategies (6).

⁸ By the 28th postoperative day the rate of appearance of SSIs declines to the point of diminishing returns (13).

⁹ The Texas public reporting statute will make clear that surgeons are required to report all SSIs to the infection control program of the hospital where the operation was performed. Initially, the law should include no penalties for failure of surgeons to report SSIs, but this should be monitored to determine whether the addition of penalties is required in future years. Note also that having a statutory requirement for surgeons to report SSIs to the hospital infection staff avoids putting hospital administration in the position of pressing surgeons to report.

¹⁰ The NNIS risk categories (44), a practical modification of the SENIC risk index which was derived and validated on a large nationally representative sample of operations (45), has been used extensively for intra- and inter-hospital infection rate comparisons (19, 24, 32, 46-53) and is recommended by the HICPAC public reporting guideline (6).

¹¹ The panel recommends reporting patient-level data, as is done in the SSI reporting option of NNIS/NHSN, because it allows calculation of verifiable rates by more sophisticated statistical methods. The alternative, reporting summary numerators, denominators and rates, is less verifiable but requires no less work by the hospitals. For either type of reporting, someone in the hospital must assemble the same type of surgical operation datafile to perform in-hospital and post-discharge surveillance and link the SSIs to the operations to calculate SSI rates within NNIS risk categories. This cannot be reliably done without constructing the data file.

Number and types of operations to report: The reporting of SSIs will be phased in over 2-4 years.

In year 1 when many hospitals and ASCs are first developing their measurement and reporting systems, they will report all operations of the following types:

- colon surgery,
- hip and knee arthroplasty
- abdominal and vaginal hysterectomy
- coronary artery bypass grafts (CABG) and other cardiovascular surgical procedures.

Hospitals and ASCs that do not perform at least 50 such operations per month, will also report their three highest volume procedures on the NNIS list of surgical procedures (detailed in **Appendix G**).¹²

In year 2, hospitals and ASCs will add an additional one-third of the procedures on the NNIS list of surgical procedures (**Appendix G**). In year 3, they will add the rest of the procedures on the NNIS list. DSHS will prescribe which procedures to add in years 2 and 3. The phase-in schedule will be adjusted by DSHS depending on initial experience with the system.^{13, 14}

For children, the procedures that are to be tracked are cardiovascular surgical procedures, placement of neurosurgical shunts, and spinal surgeries.

Statistics reported to the public:

- a. SSI rate per 100 operations in each NNIS risk category compared with the Texas reference rate in each category. Tabulated by broad hospital size categories (<50, 50-199, 200-499, 500+ by university affiliated).¹⁵
- b. Separate tables will give the SSI rates separately for superficial, deep, and organ space SSIs within NNIS risk categories for each of the reported procedures, organized by NNIS surgical procedure category (**Appendix G**).¹⁶

¹² The public reporting system will start with a relatively small minimum volume of only 50 operations per month to allow hospitals a manageable volume of reporting initially until the data collection systems are well developed. This volume will not provide consumers with statistically significant inter-hospital comparisons in the first year.

¹³ At the end of the phase-in period, all but the smallest hospitals will be reporting sufficient sample sizes to provide consumers with statistically significant inter-hospital comparisons. Information technology (IT) connections between operating room and infection control computers make denominator collection feasible for high volume operations.

¹⁴ Some prior systems required reporting of only hip arthroplasties, coronary artery bypass graft (CABG) and abdominal hysterectomies; however, the panel recommends against this limitation because many hospitals and ambulatory surgical centers perform few or none of these, and hip arthroplasties must be followed for at least 12 months to identify the majority of the SSIs before rates can be reported.

¹⁵ This hospital size stratification was found in the SENIC project to predict important differences in HAI rates (22).

¹⁶ Although many surgeons are uncomfortable with combining superficial with the deep and organ space infections, the complete stratification produces very small numbers in strata. Reporting the SIR, which is recommended by the HICPAC public reporting guideline (6), may overcome this problem of small numbers. Basically the SIR multiplies the number of operations in each NNIS risk category by the standard NNIS or Texas SSI rate in that category to get the expected number of SSIs in each, sums these over all NNIS risk categories to get the total expected number of SSIs, and divides the actual number of SSIs observed by the number expected to derive the SIR. The following illustrates how the SIR can show significant differences when the tests of individual strata do not:

- c. A single *Standardized Infection Ratio (SIR)* for SSI, controlling for surgical procedure and NNIS risk index, at the hospital and one each for superficial, deep and organ space SSI rates will be given at the bottom of each table as final summary statistics.¹⁷
- d. Pathogen-specific SSI rates will also be reported for the major pathogens, with special emphasis on MRSA.

Use of the Rate Data in the Hospital to Reduce SSI Risks:

Feedback of surgeon-specific and procedure-specific SSI rates should be given to surgeons regularly so that interventions to improve performance can be implemented as quickly as possible (6).¹⁸

Data collection requirements to ensure uniformity of SSI detection and reporting:

- a. The NNIS risk index is calculated for each operation from type of procedure, duration of the operation, wound class, ASA physical status code, and whether performed with an endoscope vs open incision.
- b. For surveillance purposes, the ICP will determine whether each suspected SSI and subtype meets the state-endorsed CDC criteria (35).
- c. When all SSIs identified by post-discharge surveillance have been entered into those patients' computer records, usually within 3 months after the end of the surveillance month, the file is transmitted via the DSHS secure website to the statewide database for analysis by DSHS staff.
- d. Additional recommended data collection procedures to increase uniformity are given in **Appendix H**.

*Quality control measures:*¹⁹

- a. The state public reporting statute will require that surgeons report all SSIs to the infection control staff of the hospital in which the operation was performed.²⁰

NNIS Risk Index	Your Hospital			NNIS or Texas Standard			Z	P _z	SIR	P _{SIR}
	Num	Denom	Rate	Num	Denom	Rate				
0	2	30	6.66	69	3,645	1.89	1.220	NS] 1.69	0.046
1	3	50	6.00	76	2,591	2.93	0.830	NS		
2	3	40	7.50	45	906	4.97	0.350	NS		
3	4	30	13.33	41	433	9.47	0.360	NS		
Total	12									

$SIR = Obs/Expected = 12/6.86 = 1.69$

¹⁷ This provides a single number, distributed like a relative risk (above/below a comparison equivalency point of 1.0). It minimizes perturbations from small numbers in some strata. (SIR = Observed / Expected, expressed like a relative risk, e.g., 1.5, 2.1, 0.9, 5.5).

¹⁸ Feedback of SSI rates to surgeons has been shown to be an important component of strategies to reduce SSI risk (22).

¹⁹ The panel recommends against comparing the lists of infections reported by the prospective surveillance system with those reported through ICD-9-based billing or discharge reports because the latter have high rates of both false negative and false positive errors, making the reconciliation of the two lists difficult, time-consuming and unlikely to be useful (7-9).

²⁰ The Texas public reporting statute will make clear that surgeons are required to report all SSIs to the infection control program of the hospital where the operation was performed. Initially, the law should include no penalties for failure of surgeons to report SSIs, but this should be monitored to determine whether the addition of penalties is required in future years. Note also that having a statutory requirement for surgeons to report SSIs to the hospital infection staff avoids putting hospital administration in the position of pressing surgeons to report.

- b. In the hospital the infection control staff will confirm reports of SSIs received from patients with the attending surgeon and use this confirmation process to monitor and reinforce completeness of reporting by the surgeons.
- c. The analysis will calculate the percentage of SSIs detected by each surveillance method (in-hospital vs post-discharge survey of surgeons) in each NNIS risk category.²¹ Report on the Website the percentage of SSIs detected in each postop week in each NNIS risk category.²² DSHS will review the infection reporting activities of hospitals will unusually high ratios of in-hospital to post-discharge detected SSIs.
- d. Hospitals and ASCs will be required to provide each surgical patient with a form at the time of discharge with the definition of the SSIs included in the reporting system and a reminder that they are encouraged to report such infections to the hospital's infection control staff and/or to DSHS by telephone or by using DSHS' secure Website. The DSHS staff will validate and tabulate the number of SSIs that were reported to DSHS by consumers but not by the hospital. If unreported infection is found to be a serious problem, in future years the numbers will be reported for individual hospitals.
- e. DSHS will review infection control and reporting activities of hospitals and ASCs that have unusual data patterns or trends that suggest implausible rates (e.g., atypically low or erratic rates) or large numbers of unreported infections; this authority is available under current state law.

²¹ Hospitals with low surveillance effort would be expected to report a low percentage of SSIs (<50%) detected with onset after discharge.

²² Hospitals with low surveillance effort would be expected to report a low percentage of SSIs (<50%) with onset after the first postoperative week.

3. Healthcare-Associated Infections Caused by Respiratory Syncytial Virus (RSV) in All Pediatric Inpatients²³

Types of hospitals to report: Acute-care general medical and surgical hospitals with pediatric inpatient units and pediatric hospitals

Numerator: The number of laboratory-confirmed RSV infections in children with onset in each pediatric unit >48 hours after admission for another condition.

Numerator exclusions: None

Denominator: Number of occupied beds or bassinets in each pediatric unit

Risk Adjustment: None (all such infections are preventable in theory; however, introduction by visiting family members may not always be preventable)

Data level reported: Report a record for each hospitalized patient with a clinical RSV infection,
Fields reported on all RSV infected infants and children: medical record number (for audit purposes) and birthweight for those infants in NICUs.

Statistic reported to the public:

- a. Number of healthcare-associated RSV infections per month in each pediatric inpatient unit.
- b. Rates of healthcare-associated RSV infection per 10 beds/bassinets

Quality control measures:

Verification by DSHS that testing for RSV is regularly performed for new onset respiratory tract disease in inpatient infants and children.

²³ Pediatric inpatient units, pediatric intensive care units, and neonatal intensive care units.

Appendix A

Definition of an Infection Control Professional²⁴

A person whose primary training is in either nursing, medical technology/clinical laboratory scientist, microbiology, public health, or, epidemiology and who has acquired specialized training in infection control. Responsibilities may include collection, analysis, and feedback of infection data and trends to health care providers; consultation on infection risk assessment, prevention and control strategies; performance of education and training activities; implementation of evidence-based infection control practices or those mandated by regulatory and licensing agencies; application of epidemiologic principles to improve patient outcomes; participation in planning renovation and construction projects (e.g., to ensure appropriate containment of construction dust); evaluation of new products or procedures on patient outcomes; oversight of employee health services related to infection prevention; implementation of preparedness plans; communication within the health care setting, with local and state health departments, and with the community at large concerning infection control issues; and participation in research. Certification in infection control (CIC) is recommended, and is available through the Certification Board of Infection Control and Epidemiology.

SUPPLEMENTAL INFORMATION

Fundamental elements to prevent transmission of infectious agents in health care settings

II.A. Health care system components that influence the effectiveness of precautions to prevent transmission

II.A1. Administrative measures. Health care organizations can demonstrate a commitment to preventing transmission of infectious agents by incorporating infection control into the objectives of the organization's patient and occupational safety programs (IOM, 1999 [To err.]; Gerberding JL. *Ann Intern Med* 2002;137:665; Leape LL. *JAMA* 2002;288:501; Burke JP. *N Engl J Med* 2003;348:651; Shulman L *Crit Care Clin.* 2005;21:111). An infrastructure to

²⁴ This definition of an infection control professional (ICP), including the evidence-based references of the responsibilities of such individuals, is from the current draft document of the revised *1996 Guideline for Isolation Precautions*, that was accepted as a final draft, by the Health care Infection Control Practices Advisory Committee (HICPAC) during their June, 2006, meeting. An earlier version of this guideline that was posted for public comment in June 2004 can be accessed at the following website: <http://www.premierinc.com/all/safety/resources/guidelines/review.jsp>. This draft does not reflect the changes made in response to public comments, and final publication is anticipated in early 2007.

The Texas Advisory Panel on Health Care-associated Infections made the following three additions (shown in italics) to the HICPAC definition of an ICP: a) Infection Control and Prevention Professional (ICP); b) a person with primary training in public health; and, c) Certification in Infection Control is recommended and available through the Certification Board of Infection Control and Epidemiology.

HICPAC is a federal advisory committee made up of 14 external infection control experts who provide advice and guidance to the Centers for Disease Control and Prevention (CDC) and the Secretary of the Department of Health and Human Services (HHS) regarding the practice of health care infection control, strategies for surveillance and prevention and control of health care-associated infections in United States health care facilities.

guide, support, and monitor adherence to Standard and Transmission-Based Precautions (Goldmann DA. JAMA 1996;275:234; Scheckler WE. ICHE 1998;19:114; Friedman C. ICHE 1999; 20:695) will facilitate fulfillment of the organization's mission and achievement of the Joint Commission on Accreditation of Health care Organization's patient safety goal to decrease HAIs (http://www.jcaho.org/accredited+organizations/patient+safety/04+npsg/04_faqs.htm). Policies and procedures that explain how Standard and Transmission-Based Precautions are applied, including systems used to identify and communicate information about patients with potentially transmissible infectious agents, are essential to ensure the success of these measures and may vary according to the characteristics of the organization.

A key administrative measure is provision of fiscal and human resources for maintaining infection control and occupational health programs that are responsive to emerging needs. Specific components include bedside nurse (Jackson M. AJIC 2002; 30:199) and infection control professional (ICP) (O'Boyle C. AJIC 2002;30:321) staffing levels, inclusion of ICPs in facility construction and design decisions (MMWR 2003; 52:RR-10), clinical microbiology laboratory support (Peterson LR CID 2001; 32: 605; McGowan JE Nature Reviews. 2004; 2: 251-8), adequate supplies and equipment including facility ventilation systems (MMWR 2003; 52[RR-10]), adherence monitoring (www.ihl.org/IHI/Programs/Campaign), assessment and correction of system failures that contribute to transmission (Curtis JR. Crit Care Med. 2006;34:211; Pronovost PJ Lancet 2004;363:1061), and providing feedback to health care personnel and senior administrators (Goldmann DA. JAMA 1996;275:234; Scheckler WE. ICHE 1998;19:114; Friedman C. ICHE 1999; 20:695; Goldrick BA AJIC 2002;30:437). The positive influence of institutional leadership has been demonstrated repeatedly in studies of HCW adherence to recommended hand hygiene practices (CDC. MMWR 2002;51(RR-16); Shlaes DM. ICHE 1997; 18:275 ; IOM, 1998 [antimicrob.resist]; Goldmann DA. JAMA 1996;275:234; Scheckler WE. ICHE 1998;19:114; Friedman C. ICHE 1999; 20:695; Bonomo RA. J Gerontol A Biol Sci Med Sci 1999;54(6):B260; Larson EL. Behav Med 2000;26(1):14; Pittet D. Lancet 2000;356:1307; Murthy R. Chest 2001;119(2 Suppl):405S; Rondeau KV. Healthc Manage Forum 2002;15:17). Thus, health care administrator involvement in infection control processes can improve understanding of the rationale and resource requirements for following recommended infection control practices.

Several administrative factors may affect the transmission of infectious agents in health care settings; institutional culture, individual worker behavior, and the work environment. Each of these areas is suitable for performance improvement monitoring and incorporation into the organization's patient safety goals (IOM, 1999 [To err.]; Gerberding JL. Ann Intern Med 2002;137:665; Burke JP. N Engl J Med 2003;348:651; Stelfox HT. JAMA 2003;290:1899)

II.A.1.a.Scope of work and staffing needs for infection control professionals.

The effectiveness of infection surveillance and control programs in preventing nosocomial infections in United States hospitals was assessed by the CDC through the Study on the Efficacy of Nosocomial Infection Control (SENIC Project) conducted 1970-76 (Am J Epidemiol 1985;121:182-205). In a representative sample of US general hospitals, Haley and colleagues found that having a trained, involved infection control physician or microbiologist and one infection control nurse per 250 beds were essential components of effective infection control programs that were associated with a 32% reduction in the four infections studied (CVC-associated bloodstream infections, ventilator-associated pneumonia, catheter-related urinary tract infections, and surgical site infections).

Since that landmark study was published, responsibilities of ICPs have expanded with the growing complexity of the health care system, the patient populations served, and the use of increasing numbers of medical devices in all types of health care settings. The scope of work of ICPs was first assessed in 1982 (McArthur BJ AJIC 1984; 12:88; Shannon et al 1984; Pugliese G AJIC 1984; 12: 221) by the Certification Board of Infection Control (CBIC), and has been re-assessed every five years since that time (Larson E AJIC 1988; 16:198; Bjerke NB AJIC 1993; 21;51; Turner JG AJIC 1999; 27;145; Goldrick BA AJIC, 2002; 30:437). The findings of these task analyses have been used to develop and update the Infection Control Certification Examination, offered for the first time in 1983. With each survey, a growing number and complexity of tasks were identified. The following activities are being assigned currently to ICPs in response to emerging challenges: 1) surveillance and infection prevention at facilities affiliated with the primary acute care hospitals, e.g., ambulatory clinics, day surgery centers, long term care facilities, rehabilitation centers, home care in addition to the primary hospital; 2) oversight of employee health services related to infection prevention, e.g. assessment of risk and administration of recommended treatment following exposure to infectious agents, tuberculosis screening, influenza vaccination, respiratory protection fit testing, administration of other vaccines as indicated such as smallpox vaccine in 2003; 3) preparedness planning for annual influenza outbreaks, pandemic influenza, SARS, bioweapons attacks; 4) adherence monitoring for selected infection control practices; 5) oversight of risk assessment and implementation of prevention measures associated with construction and renovation; 6) prevention of transmission of MDROs; 7) evaluation of new products that could be associated with increased infection risk. e.g., intravenous infusion materials, for introduction and assessment of performance after implementation; 8) mandatory public reporting of health care-associated infections in states as legislation is enacted; 9) increased communication with the public and with local public health departments concerning infection control-related issues; and 9) participation in local and multi-center research projects (Scheckler W ICHE 1998; 19:114; Friedman C ICHE 1999; 20: 695; O'Boyle C AJIC 2002; 30: 321; Health Canada AJIC 2004; 32: 2-6; Lee TH NEJM 2004; 350: 2409, Goldrick BA AJIC 2002;30:437).

None of the CBIC job analyses addressed specific staffing requirements to accomplish the identified tasks, although the surveys included information about hours worked and the 2001 survey (Goldrick BA AJIC 2002; 30:437) included the number of ICPs assigned to the responding facilities. However, there is agreement in the literature that 1 ICP per 250 acute care beds is inadequate to meet present infection control staffing needs. A Delphi project that assessed staffing requirements to meet the expanded needs of infection control programs in the 21st century concluded that a ratio of 0.8 to 1.0 ICP per 100 occupied acute care beds is adequate staffing (O'Boyle C AJIC 2002; 30: 321). This ratio is similar to findings from a survey of participants in the National Nosocomial Infections Surveillance (NNIS) system participants (Richards C AJIC 2001; 29: 400) that found the median number of occupied beds or average daily census per ICP was 115. Other studies have made similar recommendations for large acute care hospitals, long term care facilities, and small rural hospitals: 3 per 500 in acute care and 1 per 150-250 beds in longterm care settings (Health Canada AJIC 2004; 32: 2-6); 1.56 per 250 rural hospital beds (Stevenson KB AJIC 2004; 32: 255). The foregoing demonstrates that recommendations for infection control staffing can no longer be based on patient census alone, but rather must be determined by the scope of the program, characteristics of the patient population, complexity of the health care system, tools available for performing essential tasks (e.g., electronic tracking and laboratory support for surveillance), and unique or urgent needs of the institution and community (O'Boyle C AJIC 2002; 30: 321). Furthermore, appropriate

training is required to optimize the quality of work performed (Turner JG AJIC 1999;27:145; Goldrick BA A JIC 2002;30:437; Simonds DN AJIC 1997;25:202).

II.A.1.a.i. Infection Control Nurse Liaison. Designating a bedside nurse on a patient care unit as an infection control liaison or “link nurse” is reported to be an effective adjunct to enhance infection control education, problem identification and problem-solving at the unit level (Dawson SJ J Hosp Infect 2003; 54: 251; Wright J AJIC 2002; 30: 174; Teare EL J Hosp Infect. 1996;34:267; Ching TY J Adv Nurs 1990; 15: 1128; Amundsen J AJIC 1983; 11: 20; Ross KA AJIC 1982; 10: 24). Such individuals receive some training in basic infection control and have frequent communication with the ICPs, but maintain their primary role as bedside caregiver on their units. The infection control nurse liaison increases the awareness of infection control at the unit level. He or she is especially effective in implementation of new policies or control interventions because of the rapport with individuals on the unit and the understanding of unit-specific challenges, including strategies that are likely to be successful in that specific environment. This position is an adjunct to, not a replacement for, fully trained ICPs. Furthermore, the use of infection control liaison nurses is not considered in ICP staffing plans.

Part IV: Recommendations

These recommendations are designed to prevent transmission of infectious agents among patients and health care personnel in all settings where health care is delivered. As in other CDC/HICPAC guidelines, each recommendation is categorized on the basis of existing scientific data, theoretical rationale, applicability, and when possible, economic impact. The CDC/HICPAC system for categorizing recommendations is as follows:

Category IA. Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies.

Category IB. Strongly recommended for implementation and supported by some experimental, clinical, or epidemiologic studies and a strong theoretical rationale.

Category IC. Required for implementation, as mandated by federal and/or state regulation or standard.

Category II. Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale.

No recommendation; unresolved issue. Practices for which insufficient evidence or no consensus regarding efficacy exists.

I. Administrative Responsibilities

Health care organization administrators should ensure the implementation of recommendations in this section.

- I.A. Incorporate preventing transmission of infectious agents into the objectives of the organization’s patient and occupational safety programs (IOM 1999; Gerberding JL Ann Intern Med 2002;137:665; Leape LL JAMA 2002;288:501; Burke JP NEJM 2003;348:651; Lundstrom T AJIC 2002;30:93; Clarke SP AJIC 2002;30:207; Larson EL Behav Med 2000;26:14; www.cms.gov). *Category IB/IC*
- I.B. Make preventing transmission of infectious agents a priority for the health care organization. Provide administrative support, including fiscal and human resources for maintaining infection control programs (Haley RW Am J Epidemiol 1985;121:182; Goldmann DA JAMA 1996;275:234; Kretzer EK AJIC 1998;26:245; Scheckler WE ICHE 1998;19:114; Friedman C ICHE 1999;20:695; Larson EL Behav Med 2000;26:14; CDC MMWR 2002;51[RR-16]; O’Boyle C AJIC 2002;30:321; Pittet D Lancet 2000;356:1307; Goldrick BA AJIC 2002;30:437; Rondeau KV Healthc Manage Forum

2002;15:17; Murthy R Chest 2001;119(2 Suppl):405S-11S; www.cms.gov). *Category IB/IC*

- I.B.1. Assure that individuals with training in infection control are employed by or are available by contract to all health care facilities so that the infection control program is managed by one or more qualified individuals (Haley RW Am J Epidemiol 1985;121:182; O'Boyle C AJIC 2002;30:321; Emori TG Am J Epidemiol 1980;11:592; Richards C AJIC 2001;29:400-3; Stevenson KB AJIC 2004;32:255-61; Health Canada AJIC 2003;32:2; Turner JG AJIC 1999;27:145; Goldrick BA AJIC 2002;30:437; Simonds DN AJIC 1997;25:2002; www.cmc.gov). *Category IB/IC*
- I.B.1.a. Determine the specific infection control full-time equivalents (FTEs) according to the scope of the infection control program, the complexity of the health care facility or system, the characteristics of the patient population, the unique or urgent needs of the facility and community, and proposed staffing levels based on survey results and recommendations from professional organizations (Scheckler WE ICHE 1998;19:114; Friedman C ICHE 1999;20:695; O'Boyle C AJIC 2002;30:321; Haley RW Am J Epidemiol 1985;121:182; Richards C AJIC 2001;29:400-3; Stevenson KB AJIC 2004;32:255-61; Health Canada AJIC 2004;32:2; Shannon R AJIC 1984;12:187; Pugliese G AJIC 1984;12:221; Larson E AJIC 1988;16:198; Bjerke NB AJIC 1993;21:51; Turner JG AJIC 1999;27:145; Richet HN ICHE 2003;24:334; Anderson DJ. SHEA 2006; Abstract # 146). *Category IB*

Appendix B

Characteristics of Infection Control Programs in Texas, May 2006 DSHS Health Care Associated Infections Advisory Panel

The Advisory Panel determined that a voluntary survey of infection control programs in hospitals and ambulatory surgery centers (ASCs) across the state was needed to determine the staffing, depth, and gaps of existing programs. The Panel developed the survey based on areas pertinent for public reporting and for evidence-based characteristics of effective programs. The survey was designed as a web-based on-line survey and monitored by the Department of State Health Services (DSHS). A cover letter was sent to administrators of hospitals and ASCs with an explanation of the importance of the survey and request that it be completed by the infection control practitioner. The survey was undertaken by DSHS in April and data were compiled in May, 2006.

Response rates:

- The overall response rate was 214/850 facilities (25%).
- The hospital overall response rate was 179/500 (36%).
- The ASC response rate was 35/350 (10%).
- Of the hospitals responding and providing size information, 117/152 (77%) had fewer than 200 beds and 35/152 (23%) had 200 or more beds.

Key findings:

- 48/52 (92%) of hospital respondents and 10/12 (83%) of ASC respondents had a formal process to review and disseminate infection control data.
- 127/179 (71%) of hospitals and 22/35 (63%) of ASCs responded that they had one infection control professional (ICP) per 100 beds.
- However, of hospitals providing an ICP to bed ratio, 4/29 (14%) achieved a ratio of 0.8 ICP per 100 beds.
- The mean ratio of ICP per 100 beds was 0.5.
- 132/179 (74%) of hospitals and 27/35 (77%) of ASCs had adequate information technology support for infection control.
- 91/179 (51%) of hospitals and 21/35 (60%) of ASCs had adequate clerical support.
- 57/179 (32%) of hospitals and 9/35 (26%) of ASCs had an ICP with certification in infection control.
- 87/179 (49%) of hospitals and 15/35 (43%) of ASCs had a physician with infection control training providing medical direction.
- 169/179 (94%) of hospitals and 28/35 (80%) of ASCs had an ICP that performed surveillance for health care associated infections.
- 161/179 (90%) of hospitals and 34/35 (97%) of ASCs used a standard definition for benchmarking, but only 137/179 (77%) of hospitals and 27/35 (77%) of ASCs used CDC definitions that allow for national benchmarking.
- Only 29/179 (16%) of hospitals and 6/35 (17%) of ASCs used computerized surveillance software.
- 70/179 (39%) of hospitals currently surveyed for primary bloodstream infections.
- 101/179 (56%) of hospitals and 26/35 (74%) of ASCs currently surveyed for surgical site infections.

Conclusions:

- The overall response rate was relatively low, though higher for hospitals than for ASCs. However, the Panel assessed that this response provided a useful survey of infection control program practices in the state.
- While most facilities have a process to review and disseminate infection control data, there is not adequate support (staff support, certified ICPs, information technology) for optimal programs.
- Many facilities are already performing some type of surgical site infection surveillance, and a substantial number are performing primary bloodstream infection surveillance.
- Definitions used for surveillance must be standardized across the state to allow for comparisons and benchmarking with national standards.

Appendix C

Standardized evidence-based set of essential or desirable attributes of a successful infection control program

GENERAL

	YES	NO	COMMENTS
Facility has an infection control program			Infection control programs protect patients, visitors and employees
Facility has an an evaluation and reporting structure for the infection control program			Infection control programs need an evaluation and reporting structure

PROGRAM STAFFING

No. of full time equivalent infection control professionals (ICP) employed by the facility	
Average number of occupied beds in the facility	

	YES	NO	COMMENTS
Program has at least one ICP with Certification in Infection Control (CIC)			CIC certification of ICPs assures an optimal level of skills
A physician with training in healthcare epidemiology is available for medical direction or consultation			A physician with training in healthcare epidemiology is important for an effective program

PROGRAM FUNCTIONALITY

	YES	NO	COMMENTS
Infection control program performs surveillance for healthcare-associated infections			Surveillance for healthcare-associated infections is the first step in identifying problems and monitoring progress
Infection control program analyzes surveillance data to monitor and improve infection control and healthcare outcomes			Effective programs analyze and act upon the data they collect, striving to improve infection control and healthcare outcomes
Infection control program utilizes standardized definitions that allow for internal and external benchmarking			Using standardized definitions allows programs to monitor their rates over time, comparing them to national benchmarks
Infection control program writes, implements and updates evidence-based infection control policies for the facility			The existence and implementation of policies allows for uniformity in healthcare and infection prevention procedures
Infection control program are in compliance with local, regional and national regulations, guidelines and accreditation requirements			Local, regional and national agencies have infection control standards as part of their licensing or accreditation criteria
Infection control program works in collaboration with the occupational health program			Infection control and employee health programs often overlap and must work together to protect patients, visitors and employees
Infection control program has procedures for identifying and managing outbreaks			Infection control programs must have procedures to quickly and effectively identify and manage outbreaks of infection
Infection control program actively educates and trains healthcare workers in the facility			Infection control programs must provide continuing education to prevent infections to patients, visitors and employees
Infection control program has input in product selection			Healthcare product decisions have infection control repercussions
Infection control program monitors risks of construction activities			Uncontained construction activities increase the risk of infection
Infection control program has information technology support			Infection control programs must have adequate support to function
Infection control program has clerical support			Infection control programs must have adequate support to function
Infection control program has microbiology laboratory support			Infection control programs must have adequate support to function

Appendix D:

Examples of Resources for Preventive Measures for Consumers

Living with MRSA, Tacoma/Pierce County Health Department

<http://www.tpchd.org/files/library/3550750db4a81b14.pdf>

Preventing central line-associated blood stream infections, Institute for Health care Improvement

<http://www.ihl.org/NR/rdonlyres/6EC98A37-8B5E-4821-B0FE-DA1AB651D834/0/CentralLineInfectionsPtsandFam.pdf>

Preventing Ventilator-associated Pneumonia, Institute for Health care Improvement

<http://www.ihl.org/NR/rdonlyres/818C1992-F318-4DBD-AE54-B45BCD3AD7DB/0/VentilatorAssociatedPneumoniaPtsandFam.pdf>

Preventing surgical site infections [http://www.ihl.org/NR/rdonlyres/0EE409F4-2F6A-4B55-](http://www.ihl.org/NR/rdonlyres/0EE409F4-2F6A-4B55-AB01-16B6D6935EC5/0/SurgicalSiteInfectionsPtsandFam.pdf)

[AB01-16B6D6935EC5/0/SurgicalSiteInfectionsPtsandFam.pdf](http://www.ihl.org/NR/rdonlyres/0EE409F4-2F6A-4B55-AB01-16B6D6935EC5/0/SurgicalSiteInfectionsPtsandFam.pdf)

Tips for reducing the likelihood of acquiring a health care -associated infection:

1. If you have an infection anywhere in/on your body, advise your surgeon prior to your operation.
2. Do not remove hair by shaving prior to surgery as this can cause an irritation which can increase your likelihood of an infection. If your surgeon or any other hospital staff intends to shave the incision area, question them and ask for an alternative method to cleanse the area.
3. Notify your surgeon if you are a diabetic as special regulation of your blood sugar may be required.
4. If you use tobacco products (cigarettes, cigars, pipes, chewing/dipping tobacco), stopping at least 30 days prior to surgery can reduce your chance of infection.
5. Shower or bathe with an antiseptic agent or soap in the days leading up to your surgery, and at least the night before the day of surgery.
6. Let your surgeon know all medications you are currently taking, especially if any are antibiotics or steroids. Know your medications and keep a current list with you.
7. Follow your surgeon's guidelines for caring for the wound dressing while in and out of the hospital.
8. Ask the health care staff for a daily review of the need for continuing IVs, catheters and ventilators.
9. Hand hygiene is an important way to prevent infection. Observe and speak up if you don't see nurses, health care workers and doctors clean their hands. Do not hesitate to ask them to do so prior to taking care of you. Also ask visitors to clean their hands prior to and after visiting with you.
10. Ask questions of your surgeon if you there is anything you don't understand about the upcoming procedure; ask for advice, ask for brochures and pamphlets on your surgery.
11. SPEAK UP!! Patient safety is everyone's responsibility. The more information you have about health care, the better you can make decisions about your care.

Appendix E

Additional Reporting Measures to be Considered in Future Years

The following types of HAIs will be considered for inclusion in future years in the statewide system for reporting HAI rates to consumers:

- 1) Methicillin-resistant *Staphylococcus aureus* (MRSA) beyond MRSA SSI and CLA-BSI
- 2) Neonatal infections caused by group B streptococcus
- 3) Ventilator-associated pneumonia
- 4) Nosocomial pneumonia (hospitals with no special care unit, no surgery)
- 5) Urinary catheter-associated urinary tract infections
- 6) Post-operative pneumonia (no ventilator)
- 7) Central line-associated bacteremia in chronic indwelling central lines and hemodialysis
- 8) Rotavirus infections in Pediatric hospitals
- 9) Infections caused by vancomycin-resistant enterococcus (VRE)
- 10) Hospital-associated rate of seasonal influenza in hospitalized patients

One strongly evidence-based process measure that may be considered is:

- 11) The hospital's rate of seasonal influenza immunization of its employees along with the number of doses of vaccine the hospital requested and received

Appendix F

NHSN Definitions of Central Line-Associated Primary Bloodstream Infection²⁵

Methodology

This module requires active, patient-based, prospective surveillance of device-associated infections and their corresponding denominator data by a trained infection control professional (ICP). This means that the ICP shall seek out infections during a patient's stay by screening a variety of data sources, such as laboratory, pharmacy, admission/discharge/transfer, radiology/imaging, and pathology databases, and patient charts, including history and physical exam notes, nurses/physicians notes, temperature charts, etc. Others may be trained to screen data sources for these infections, but the ICP must make the final determination. Laboratory-based surveillance should not be used alone, unless all possible criteria for identifying an infection are solely determined by laboratory evidence. Retrospective chart reviews should be used only when patients are discharged before all information can be gathered. Use NHSN forms to collect all required data, using the definitions of each data field. To minimize the ICP's data collection burden, others may be trained to collect the denominator data. These data should be collected at the same time each day. When denominator data are available from electronic databases (e.g., ventilator days from respiratory therapy), these sources may be used as long as the counts are not substantially different from manually collected counts.

Definitions: Primary bloodstream infections are classified according to the criteria used, either as laboratory-confirmed bloodstream infection (LCBI) or clinical sepsis (CSEP). CSEP may be used to report only a primary BSI in neonates (< 30 days old) and infants (< 1 year old). Report only those events that are with the nursing care area where the patient was assigned when the BSI was acquired and are central line-associated (a central line or umbilical catheter was in place at the time of, or within 48 hours before, onset of the event). If the BSI develops in a patient within 48 hours of discharge from a location, indicate the discharging location on the infection report, not the current location of the patient.

- **Central line:** An intravascular catheter that terminates at or close to the heart or in one of the great vessels which is used for infusion, withdrawal of blood, or hemodynamic monitoring. The following are considered great vessels for the purpose of reporting central-line infections and counting central-line days in the NHSN system: Aorta, pulmonary artery, superior vena cava, inferior vena cava, brachiocephalic veins, internal jugular veins, subclavian veins, external iliac veins, and common femoral veins.
 - NOTE: An introducer is considered an intravascular catheter
 - NOTE: In neonates, the umbilical artery/vein is considered a great vessel.
 - NOTE: Neither [the location of] the insertion site nor the type of device may be used to determine if a line qualifies as a central line. The device must terminate in one of these vessels or in or near the heart to qualify as a central line.
 - NOTE: Pacemaker wires and other nonlumened devices inserted into central blood vessels or the heart are not considered central lines, because fluids are not infused, pushed, nor withdrawn through such devices.
- **Infusion:** The introduction of a solution through a blood vessel via a catheter lumen. This may include continuous infusions such as nutritional fluids or medications, or it may include intermittent infusions such as flushes or IV antimicrobial administration, or blood, in the case of transfusion or hemodialysis.
- **Umbilical Catheter:** A central vascular device inserted through the umbilical artery or vein in a neonate
- **Temporary Central Line:** Non-tunneled catheter

²⁵ From <http://www.cdc.gov/ncidod/hip/nhsn/members/PSProtocolsMay06.pdf>

- Permanent Central Line: Includes
 - Tunneled catheters, including certain dialysis catheters
 - Implanted catheters (including ports)

Laboratory-confirmed bloodstream infection (LCBI)

LCBI criteria may be used for all patients.

LCBI must meet one of the following three criteria:

Criterion 1: Patient has a recognized pathogen cultured from one or more blood cultures and organism cultured from blood is not related to an infection at another site.

Criterion 2: Patient has at least one of the following signs or symptoms: fever (>38°C), chills, or hypotension and signs and symptoms and positive laboratory results are not related to an infection at another site and at least one of the following:

- a. common skin contaminant (e.g., diphtheroids, *Bacillus* sp., *Propionibacterium* sp., coagulase-negative staphylococci, or micrococci) is cultured from two or more blood cultures drawn on separate occasions
- b. common skin contaminant (e.g., diphtheroids, *Bacillus* sp., *Propionibacterium* sp., coagulase-negative staphylococci, or micrococci) is cultured from at least one blood culture from a patient with an intravascular line, and the physician institutes appropriate antimicrobial therapy
- c. positive antigen test on blood (e.g., *H. influenzae*, *S. pneumoniae*, *N. meningitidis*, or Group B *Streptococcus*).

Criterion 3: Patient < 1 year of age has at least one of the following signs or symptoms: fever (>38°C, rectal), hypothermia (<37°C, rectal), apnea, or bradycardia and signs and symptoms and positive laboratory results are not related to an infection at another site and at least one of the following:

- a. common skin contaminant (e.g., diphtheroids, *Bacillus* sp., *Propionibacterium* sp., coagulase-negative staphylococci, or micrococci) is cultured from two or more blood cultures drawn on separate occasions
- b. common skin contaminant (e.g., diphtheroids, *Bacillus* sp., *Propionibacterium* sp., coagulase-negative staphylococci, or micrococci) is cultured from at least one blood culture from a patient with an intravascular line, and physician institutes appropriate antimicrobial therapy
- c. positive antigen test on blood or urine (e.g., *H. influenzae*, *S. pneumoniae*, *N. meningitidis*, or Group B *Streptococcus*).

Clinical sepsis (CSEP)

CSEP may be used only to report a primary BSI in neonates and infants.

To report a CSEP, the following criterion must be met:

Patient < 1 year of age has at least one of the following clinical signs or symptoms with no other recognized cause: fever (>38°, rectal), hypothermia (<37°, rectal), apnea, or bradycardia

and blood culture not done or no organisms or antigen detected in blood and no apparent infection at another site and physician institutes treatment for sepsis.

Numerator Data: The *Primary Bloodstream Infection (BSI) Form* (CDC 57.75D) is used to collect and report each CLABSI that is identified during the month selected for surveillance. The *Instructions for Completion of Primary Bloodstream Infection Form* (Tables 2 and 2a.) contains brief instructions for collection and entry of each data element on the form. The Primary BSI form includes patient demographic information on whether a central line was present, and, if so, the type of central line the patient had as appropriate to the location; these data will be used to calculate linespecific infection rates. Additional data include the specific criteria met for identifying the primary BSI, whether the patient died, the organisms isolated from blood cultures, and the organisms' antimicrobial susceptibilities.

Denominator Data: Denominator data that are collected differ according to the location of the patients being monitored. For ICUs and locations other than specialty care areas and NICUs, the number of patients with one or more central lines of any type is collected daily, at the same time each day, and then summed and the total is reported for the month on the *Denominators for Intensive Care Unit (ICU)/Other Locations (Not NICU or Specialty Care Area (SCA))* (CDC 57.75L).

For specialty care areas, the number of patients with one or more central lines is dichotomized into those with permanent central lines and those with temporary central lines on the *Denominators for Specialty Care Area* (CDC 57.75K). Each is collected daily, at the same time each day, summed and the total for each is reported for the month. This distinction is made because permanent lines are commonly used in patients frequenting these areas and may have lower rates of associated infection than central lines inserted for temporary use. If a patient has both a temporary and a permanent central line, only the temporary line is counted.

In NICUs, again because of differing infection risks, the number of patients with central lines and those with umbilical catheters is collected daily, at the same time each day, summed and the total for each is reported for the month. If a patient has both an umbilical catheter and a central line, count as an umbilical catheter only. However, on the *Denominators for Neonatal Intensive Care Unit (NICU)* (CDC 57.75J), patients are further stratified by birthweight in five categories since risk of BSI also varies by birthweight.

Determination of temporary central line days in any type of patient care area: At the same time each day, the number of patients with one or more temporary central lines are counted and at the end of the month these counts are summed and used as a denominator. If a patient has more than one temporary central line on a given day, this is counted only as one central line day. If a patient has both a temporary and a permanent central line on the same day, the day is counted as one temporary central line day.

Determination of permanent central line days in SCA and non-SCA patient care areas: If a patient has only a permanent central line, include it in the daily permanent central line-day count, beginning on the day of first access and continuing through the entire stay. If a patient has both a permanent and a temporary central line on the same day, the day is counted as one temporary central line day.

Data Analyses: The CLABSI rate per 1000 central line-days is calculated by dividing the number of CLABSI by the number of central line-days and multiplying the result by 1000. The Central Line Utilization Ratio is calculated by dividing the number of central line-days by the number of patientdays. These calculations will be performed separately for different types of ICUs, specialty care areas, and other locations in the institution. Separate rates and ratios will also be calculated for different types of catheters and birthweight categories in NICUs, as appropriate.

Appendix G

High risk surgical procedure groups reported in NNIS²⁶

XLAP	Abdominal surgery or laparotomy	NEPH	Nephrectomy
AMP	Amputation of a limb	FX	Open reduction of fracture
AAA	Aortic aneurysm repair	OCVS	Other Cardiovascular surgery
APPY	Appendectomy	OES	Other Endocrine system
AVSD	Arteriovenous shunt for dialysis	OENT	Other ENT surgery
BILI	Bile/Liver/Pancreas operations	OEYE	Other Eye surgery
BRST	Breast surgery	OGIT	Other Gastrointestinal surgery
CBGB	CABG-chest & donor sites	OGU	Other Genitourinary surgery
CBGC	CABG-chest site only	OBL	Other Hematologic or Lymphatic surgery
CARD	Cardiac (open heart) surgery	OSKN	Other Integumentary system surgery
CEA	Carotid endarterectomy	OMS	Other Musculoskeletal surgery
CHOL	Cholecystectomy	ONS	Other Nervous system surgery
COLO	Colon surgery	OOB	Other Obstetric surgery
CRAN	Craniotomy	ORES	Other Respiratory system surgery
CSEC	C-section	OVRV	Ovarian surgery
GAST	Gastric surgery	PACE	Pacemaker surgery
HTP	Heart transplant	PVBY	Peripheral artery bypass surgery
HER	Herniorrhaphy	PRST	Prostate surgery
HPRO	Hip prosthesis	REC	Rectal surgery
HYST	Hysterectomy - abdominal	SB	Small Bowel surgery
VHYS	Hysterectomy - vaginal	FUSN	Spinal fusion (primary)
KTP	Kidney transplant	RFUSN	Spinal refusion (repeat surgery)
KPRO	Knee prosthesis	SPLE	Spleen surgery
LAM	Laminectomy	THOR	Thoracic surgery
LTP	Liver transplant	THYR	Thyroid surgery
NECK	Neck surgery	VSHN	Ventricular shunt

²⁶ The most recent CDC list of high volume, high risk surgical procedure categories developed for reporting to NHSN (see <http://www.cdc.gov/ncidod/hip/nhsn/members/PSProtocolsMay06.pdf>) includes lists of the ICD-9 codes that define each procedure category. The earlier versions used in NNIS were published in journals (54, 55).

Appendix H

Suggested Procedures for Collecting SSI Data to Ensure Uniformity of SSI Detection and Reporting

1. Each day computer records of all operation performed the day before are downloaded from the operating room's computer database to the infection control surgical surveillance database. The downloaded records contain the patient's name, medical record number, operation date, main procedure, duration of operation, wound class, ASA physical status code, entry into the abdominal cavity, performed with an endoscope vs open incision, and inpatient vs ambulatory surgery. (If the OR has no computer patient listing, the operation records will have to be entered manually. Generally this would occur in small hospitals with fewer than 20 operations are per week, thus producing a minimal data entry burden.)
2. The NNIS risk index is then calculated for each operation from duration of the operation, wound class, ASA physical status code, entry into the abdominal cavity (from procedure code), and whether performed with an endoscope vs open incision.
3. A qualified ICP will make clinical rounds daily in each surgical floor and unit to ascertain and record in each surgical patient's surveillance record whether a SSI has occurred, and if so, its date of onset and whether it was a superficial, deep or organ space infection.
4. For surveillance purposes, the ICP will determine whether each suspected SSI and subtype meets the latest CDC criteria (35).
5. Post-discharge surveillance will be performed on or after the 28th postoperative day to query all surgeons on the occurrence of SSI as follows:²⁷ The infection control staff will send a report to each surgeon on or after the 28th postoperative day²⁸ listing all of his/her patients who were operated on during the index month. The surgeon then will mark whether an SSI occurred and if so, its onset date, whether it was a superficial, deep or organ space infection, and the pathogens isolated (if any), and return the list to the infection control department for the SSIs to be entered into the SSI database.²⁹
6. Passive reporting of SSIs by patients will serve as a constant, though incomplete check on the completeness of reporting by the surgeons. The hospital will provide a postcard or letter to each operated patient at discharge instructing them how to report of SSI to the hospital's infection control department and to the DSHS secure patient reporting Website.³⁰ The hospital's infection control department will confirm reports of SSIs received from patients with the attending surgeon and use this confirmation process to monitor the completeness of reporting by the surgeons.
7. When a surgical patient is transferred or admitted to another hospital area or another hospital, the receiving area or hospital is obligated to report to the sending hospital's infection control staff any SSI that develop.

²⁷ Studies that employed both surgeon and patient surveys found that both were required for maximal sensitivity of reporting SSIs after discharge (10, 11, 15, 16).

²⁸ By the 28th postoperative day the rate of appearance of SSIs declines to the point of diminishing returns (13).

²⁹ For efficiency in many hospitals the report of all a surgeon's patients operated on during the index month will be sent to him/her the last day of the month following the index month, thus ensuring ensures that every patient is given at least 28 days of followup for the appearance of SSI.

³⁰ The panel chose to require, as a minimum, for hospitals to survey patients for SSI by providing them a postcard or letter at discharge, which informs the patients of the need to report with minimal cost and administrative burden. Hospitals, however, are encouraged to go further by mailing postcards or make telephone calls to surgical patients on or after the 28th postoperative day (10-13, 15, 16, 18-20, 56, 57).

8. When all SSIs identified by post-discharge surveillance have been entered into those patients' computer records, usually within 3 months after the end of the surveillance month, the file is transmitted via the DSHS secure website to the statewide database for analysis by DSHS staff.

References

1. Hospital Quality Initiatives: Overview. Centers for Medicare & Medicaid Services. 2006. http://www.cms.hhs.gov/HospitalQualityInits/01_Overview.asp#TopOfPage
2. Performance measurement initiatives. Joint Commission on Accreditation of Healthcare Organizations. 2006. <http://www.jcaho.org/PerformanceMeasurement/PerformanceMeasurement/>
3. Surgical Care Improvement Project. A National Quality Partnership. 2006. http://www.medqic.org/scip/scip_measures.html
4. Lee TB, Baker OG, Lee JT, Scheckler WE, Steele L, Laxton CE. Recommended practices for surveillance. Association for Professionals in Infection Control and Epidemiology, Inc. Surveillance Initiative working Group. *American Journal of Infection Control* 1998;26:277-88.
5. Scheckler WE, Brimhall D, Buck AS et al. Requirements for infrastructure and essential activities of infection control and epidemiology in hospitals: a consensus panel report. Society for Healthcare Epidemiology of America. *Infection Control & Hospital Epidemiology* 1998;19:114-24.
6. McKibben L, Horan TC, Tokars JI et al. Guidance on public reporting of healthcare-associated infections: recommendations of the Healthcare Infection Control Practices Advisory Committee. *Infection Control & Hospital Epidemiology* 2005;26:580-7.
7. Thomas EJ, Lipsitz SR, Studdert DM, Brennan TA. The reliability of medical record review for estimating adverse event rates. *Annals of Internal Medicine* 2002;136:812-6.
8. Wright SB, Huskins WC, Dokholyan RS, Goldmann DA, Platt R. Administrative databases provide inaccurate data for surveillance of long-term central venous catheter-associated infections. *Infection Control & Hospital Epidemiology* 2003;24:946-9.
9. Braun BI, Kritchevsky SB, Kusek L et al. Comparing bloodstream infection rates: the effect of indicator specifications in the evaluation of processes and indicators in infection control (EPIC) study. *Infection Control & Hospital Epidemiology* 2006;27:14-22.
10. Brown RB, Bradley S, Opitz E, Cipriani D, Pieczarka R, Sands M. Surgical wound infections documented after hospital discharge. *American Journal of Infection Control* 1987;15:54-8.
11. Manian FA, Meyer L. Comprehensive surveillance of surgical wound infections in outpatient and inpatient surgery. *Infection Control & Hospital Epidemiology* 1990;11:515-20.

12. Hulton LJ, Olmsted RN, Treston-Aurand J, Craig CP. Effect of postdischarge surveillance on rates of infectious complications after cesarean section. *American Journal of Infection Control* 1992;20:198-201.
13. Weigelt JA, Dryer D, Haley RW. The necessity and efficiency of wound surveillance after discharge. *Archives of Surgery* 1992;127:77-82.
14. Ferraz EM, Ferraz AA, Coelho HS et al. Postdischarge surveillance for nosocomial wound infection: does judicious monitoring find cases? *American Journal of Infection Control* 1995;23:290-4.
15. Gravel-Tropper D, Oxley C, Memish Z, Garber GE. Underestimation of surgical site infection rates in obstetrics and gynecology. *American Journal of Infection Control* 1995;23:22-6.
16. Sands K, Vineyard G, Platt R. Surgical site infections occurring after hospital discharge. *Journal of Infectious Diseases* 1996;173:963-70.
17. Weiss CA, III, Statz CL, Dahms RA, Remucal MJ, Dunn DL, Beilman GJ. Six years of surgical wound infection surveillance at a tertiary care center: review of the microbiologic and epidemiological aspects of 20,007 wounds. *Archives of Surgery* 1999;134:1041-8.
18. Creedy DK, Noy DL. Postdischarge surveillance after cesarean section. *Birth* 2001;28:264-9.
19. Reid R, Simcock JW, Chisholm L, Dobbs B, Frizelle FA. Postdischarge clean wound infections: incidence underestimated and risk factors overemphasized. *ANZ Journal of Surgery* 2002;72:339-43.
20. Noy D, Creedy D. Postdischarge surveillance of surgical site infections: a multi-method approach to data collection. *American Journal of Infection Control* 2002;30:417-24.
21. Avato JL, Lai KK. Impact of postdischarge surveillance on surgical-site infection rates for coronary artery bypass procedures.[see comment]. *Infection Control & Hospital Epidemiology* 2002;23:364-7.
22. Haley RW, Culver DH, White JW et al. The efficacy of infection surveillance and control programs in preventing nosocomial infections in US hospitals. *American Journal of Epidemiology* 1985;121:182-205.
23. Haley RW. Surveillance by objective: a new priority-directed approach to the control of nosocomial infections. The National Foundation for Infectious Diseases lecture. *American Journal of Infection Control* 1985;13:78-89.
24. Haley RW. The scientific basis for using surveillance and risk factor data to reduce nosocomial infection rates. *Journal of Hospital Infection* 1995;30 suppl:3-14.
25. Mead PB, Pories SE, Hall P, Vacek PM, Davis JH, Jr., Gamelli RL. Decreasing the incidence of surgical wound infections. Validation of a surveillance-notification program. *Archives of Surgery* 1986;121:458-61.

26. Gaynes RP, Solomon S. Improving hospital-acquired infection rates: the CDC experience. *Joint Commission Journal on Quality Improvement* 1996;22:457-67.
27. Archibald LK, Gaynes RP. Hospital-acquired infections in the United States: the importance of interhospital comparisons. *Infectious Disease Clinics of North America* 1997;11:245-55.
28. McConkey SJ, L'Ecuyer PB, Murphy DM, Leet TL, Sundt TM, Fraser VJ. Results of a comprehensive infection control program for reducing surgical-site infections in coronary artery bypass surgery. *Infection Control & Hospital Epidemiology* 1999;20:533-8.
29. Kaye KS, et al. Favorable impact of an infection control network on nosocomial infection rates in community hospitals. *Infection Control & Hospital Epidemiology* 2006;27:228-32.
30. Gaynes RP, Martone WJ, Culver DH et al. Comparison of rates of nosocomial infections in neonatal intensive care units in the United States: National Nosocomial Infections Surveillance System. *American Journal of Medicine* 1991;91:192S-6S.
31. Gaynes R, Culver DH, Banerjee S, Edwards JR, Henderson TS. Meaningful interhospital comparisons of infection rates in intensive care units. *American Journal of Infection Control* 1993;21:43-4.
32. Gaynes RP, Culver DH, Horan TC, Edwards JR, Richards C, Tolson JS. Surgical site infection (SSI) rates in the United States, 1992-1998: the National Nosocomial Infections Surveillance System basic SSI risk index. *Clinical Infectious Diseases* 2001;33:Suppl-77.
33. Siegel J, Strausbaugh L, Jackson M, Rhinehart E, Chiarello LA. *Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings*. Atlanta: Hospital Infections Practices Advisory Committee, CDC, 2006.
34. O'Boyle C, Jackson M, Henly SJ. Staffing requirements for infection control programs in US health care facilities: Delphi project. *American Journal of Infection Control* 2002;30:321-33.
35. CDC definitions of nosocomial infections. Centers for Disease Control and Surveillance. 2006. http://www.cdc.gov/ncidod/dhqp/nnis_pubs.html
36. Jarvis WR, Edwards JR, Culver DH et al. Nosocomial infection rates in adult and pediatric intensive care units in the United States: National Nosocomial Infections Surveillance System. *American Journal of Medicine* 1991;91:185S-91S.
37. Richards MJ, Edwards JR, Culver DH, Gaynes RP. Nosocomial infections in medical intensive care units in the United States. National Nosocomial Infections Surveillance System. *Critical Care Medicine* 1999;27:887-92.
38. Richards MJ, Edwards JR, Culver DH, Gaynes RP. Nosocomial infections in pediatric intensive care units in the United States. National Nosocomial Infections Surveillance System. *Pediatrics* 1999;103:e39.

39. Richards MJ, Edwards JR, Culver DH, Gaynes RP. Nosocomial infections in coronary care units in the United States. National Nosocomial Infections Surveillance System. *American Journal of Cardiology* 1998;82:789-93.
40. Emori TG, Edwards JR, Culver DH et al. Accuracy of reporting nosocomial infections in intensive-care-unit patients to the National Nosocomial Infections Surveillance System: a pilot study. *Infection Control & Hospital Epidemiology* 1998;19:308-16.
41. Keita-Perse O, Edwards JR, Culver DH, Gaynes RP. Comparing nosocomial infection rates among surgical intensive-care units: the importance of separating cardiothoracic and general surgery intensive-care units. *Infection Control & Hospital Epidemiology* 1998;19:260-1.
42. O'Grady NP, Alexander M, Dellinger EP et al. Guidelines for the prevention of intravascular catheter-related infections. *Infection Control & Hospital Epidemiology* 2002;23:759-69.
43. Haley RW, Culver DH, Morgan WM, White JW, Emori TG, Hooton TM. Increased recognition of infectious diseases in US hospitals through increased use of diagnostic tests, 1970-1976. *American Journal of Epidemiology* 1985;121:168-81.
44. Culver DH, Horan TC, Gaynes RP et al. Surgical wound infection rates by wound class, operative procedure, and patient risk index. National Nosocomial Infections Surveillance System. *American Journal of Medicine* 1991;91:152S-7S.
45. Haley RW, Culver DH, Morgan WM, White JW, Emori TG, Hooton TM. Identifying patients at high risk of surgical wound infection. A simple multivariate index of patient susceptibility and wound contamination. *American Journal of Epidemiology* 1985;121:206-15.
46. Gross PA. Striving for benchmark infection rates: progress in control for patient mix. *American Journal of Medicine* 1991;91:16S-20S.
47. Ronveaux O, Mertens R, Dupont Y. Surgical wound infection surveillance: results from the Belgian hospital network. *Acta Chirurgica Belgica* 1996;96:3-10.
48. Barrasa Villar JI, Domingo C, I, Vizmanos SF. Use of the NNIS index for determining the intrinsic risk of surgical infection. *Medicina Clinica* 1996;107:767-71.
49. Korinek AM. Risk factors for neurosurgical site infections after craniotomy: a prospective multicenter study of 2944 patients. The French Study Group of Neurosurgical Infections, the SEHP, and the C-CLIN Paris-Nord. Service Epidemiologie Hygiene et Prevention. *Neurosurgery* 1997;41:1073-9.
50. Freitas PF, Campos ML, Cipriano ZM. Suitability of the Hospital Infection National Surveillance System (NNISS) risk index for the prediction of the incidence of surgical site infection at a university hospital in Florianopolis, South Brazil. *Revista Da Associacao Medica Brasileira* 2000;46:359-62.

51. Astagneau P, Rioux C, Golliot F, Brucker G, INCISO Network Study Group. Morbidity and mortality associated with surgical site infections: results from the 1997-1999 INCISO surveillance. *Journal of Hospital Infection* 2001;48:267-74.
52. Pishori T, Siddiqui AR, Ahmed M. Surgical wound infection surveillance in general surgery procedures at a teaching hospital in Pakistan. *American Journal of Infection Control* 2003;31:296-301.
53. Thu LT, Dibley MJ, Ewald B, Tien NP, Lam LD. Incidence of surgical site infections and accompanying risk factors in Vietnamese orthopaedic patients. *Journal of Hospital Infection* 2005;60:360-7.
54. Garner JS, Jarvis WR, Emori TG, Horan TC, Hughes JM. CDC definitions for nosocomial infections, 1988. *American Journal of Infection Control* 1988;16:128-40.
55. Horan TC, Gaynes RP, Martone WJ, Jarvis WR, Emori TG. CDC definitions of nosocomial surgical site infections, 1992: a modification of CDC definitions of surgical wound infections. *Infection Control & Hospital Epidemiology* 1992;13:606-8.
56. Roberts FJ, Walsh A, Wing P, Dvorak M, Schweigel J. The influence of surveillance methods on surgical wound infection rates in a tertiary care spinal surgery service. *Spine* 1998;23:366-70.
57. Fields CL. Outcomes of a postdischarge surveillance system for surgical site infections at a Midwestern regional referral center hospital. *American Journal of Infection Control* 1999;27:158-64.