BOARD OF SUPERVISORS

Gloria Molina
First District

Yvonne Brathwaite Burke
Second District

Zev Yaroslavsky
Third District

Don Knabe
Fourth District

Michael D. Antonovich
Fifth District

BRUCE A. CHERNOF, M.D.
Acting Director and Chief Medical Officer

JONATHAN E. FIELDING, M.D., M.P.H.
Director of Public Health and Health Officer

DEPARTMENT OF HEALTH SERVICES
313 North Figueroa Street, Room 909
Los Angeles, CA 90012
TEL (213) 240-8117 • FAX (213) 975-1273

www.lapublichealth.org

January 30, 2006

TO: Each Supervisor

FROM: Bruce A. Chernof, M.D.
Acting Director and Chief Medical Officer

Jonathan E. Fielding, M.D., M.P.H.
Director of Public Health and Health Officer

SUBJECT: **PUBLIC REPORTING OF HOSPITAL ACQUIRED INFECTIONS**

On May 21, 2005, the Board approved a motion by Supervisor Michael D. Antonovich directing the Department to report back to the Board with a comprehensive plan developed in cooperation with private hospitals to make public rates of hospital infections and outbreak information by hospital. This is an update to our report made October 17, 2005.

A physician from Public Health was a member of the California Department of Health Services (CDHS) statewide Working Group on reducing Healthcare Associated Infections. This group met monthly since July 2005. A final draft report from the working group was presented to the Director of the CDHS on January 4, 2006, who will determine when the report will be publicly available; we have attached the final draft for your consideration. The Working Group supports the public reporting of hospital compliance with process (quality) measures that are known to reduce hospital infections. However, the Working Group does not support public reporting of healthcare associated infections for a variety of reasons. Public Health staff on the Working Group represented the Department's view that selected infections should be made publicly reportable; we will write a letter to the CDHS Director outlining our position as a response to the final report.

Staff from Public Health are founding members of the Hospital Association of Southern California (HASC) Hospital-Acquired Infection Task Force. The purpose of the Task Force is to assist hospitals in reducing hospital-acquired infection. The Task Force met twice since our last report. Staff from Public Health were instrumental in developing a survey that will be

administered by HASC of infection control resources and practices in local hospitals. The information gathered from this survey will help the Task Force and Public Health assess the current state of hospital infection control in Los Angeles County and develop more comprehensive recommendations for the public reporting of hospital infections and process measures. The Task Force is waiting for the CDHS Director to issue her final report before taking further action.

Staff from Public Health attend infection control committee meetings at Los Angeles County Department of Health Services' five hospitals. The Hospital Outreach Unit in Public Health continues to collaborate and improve communications with hospitals in Los Angeles County.

State Senate Bill SB739 (Hospitals: infection control, Speier), which would have required certain hospital acquired infections to be publicly reported, was not passed out of the Legislature in 2005, but it is anticipated that it will be considered in 2006. The final report of the Healthcare Associated Infections Working Group may influence provisions in the bill, including public reporting of healthcare associated infections. Public Health will continue to work with the County's legislative advocates to support public reporting of healthcare associated infections.

We will provide further updates concerning our progress in working on public reporting of healthcare associated infections as changes occur. In the meantime, if you have any questions or need additional information, please let either of us know.

BAC:JEF:EB:sc
505:009 REF: 2967 (A039LM2005#3)

Attachment

c: Chief Administrative Officer
County Counsel
Executive Officer, Board of Supervisors

Recommendations for Reducing Morbidity and Mortality Related to Healthcare-Associated Infections in California

Healthcare-Associated Infections
Advisory Working Group
Final Report to the

California Department of Health
Services

December 31, 2005

DRAFT

This report was prepared by Chris Cahill, Gilberto F. Chavez, Kim M. Delahanty, Enid Eck, Justin Graham, Beth LaBouyer, Marion McDonald, Mary Mendelsohn, Shannon Oriola, and Jon Rosenberg.

Members of the Healthcare Associated Infections Advisory Working Group

CHAIR
Kim Delahanty, RN, BSN, PHN, MBA, CIC
Infection Control Epidemiology Unit
UCSD Medical Center, San Diego

Elizabeth A. Bancroft MD, SM
Medical Epidemiologist
Acute Communicable Disease Control
Los Angeles County Department of Health Services

Vicki Bermudez RN
Regulatory Policy Specialist
California Nurses Association

Beth Capell, PhD
Service Employees International Union

Raymond Chinn, MD, FACP
Hospital Epidemiologist
Sharp Memorial Hospital, San Diego

Sara Cody, MD
Communicable Disease Control Officer Assistant Health Officer
Santa Clara County Public Health Department

Stuart Cohen, MD
Professor, Division of Infectious Diseases
UCD School of Medicine
Clinical Director, Epidemiology and Infection Control
UCD Medical Center, Sacramento

Enid Eck, RN, MPH
Senior Consultant, HIV and Infectious Disease
Kaiser Permanente, Pasadena

Justin V. Graham, MD, MS
Lumetra's Associate Medical Director for Quality and Informatics

Dorel Harms
Vice President for Quality and Professional Services
California Hospital Association

T. Warner Hudson, MD, FACOEM, FAAFP
Director, Health, Safety & Environment
DST Output
California Medical Association

Mary Jann
Director
Developmental Programs and Regulatory Affairs
California Association of Health Facilities

William R. Jarvis, MD
President, Jason and Jarvis Associates

Zenith Khwaja, RN
Long Beach Memorial Medical Center

Beth LaBouyer
Executive Director
California Ambulatory Surgery Association

Marian McDonald, RN, MSN, CIC
Infection Control at Your Service
President, California APIC Coordinating Council

Lisa McGiffert
Senior Policy Analyst
Project Director
Consumers Union

Mary Mendelsohn, RN, CIC
Infection Control Coordinator
City of Hope National Medical Center

Shelly Morris, RN, CIC
Sutter Medical Center, Sacramento

Frank Myers, CIC
Manager of Clinical Epidemiology and Safety Systems
Scripps Mercy Hospital, San Diego

Shannon Oriola, RN, CIC, COHN
Lead Infection Control Practitioner
Sharp Metropolitan Medical Campus, San Diego

Sumant Ranji, MD
Assistant Professor of Medicine
UC San Francisco

Maribeth Shannon
Director for Hospitals and Nursing Homes
California HealthCare Foundation

Jonathan Teague
Healthcare Information Resources Center
Office of Statewide Health Planning and Development

Francesca Torriani, MD
Medical Director of Infection Control/Epidemiology
UC San Diego School of Medicine

Anvarali Velji, MD
Chief of Infectious Diseases
Kaiser South Sacramento Medical Center

Lennox Welsh
Acting Chief
Division of Occupational Safety and Health, California Department of Industrial Relations

Lisa Winston, MD
Assistant Clinical Professor
UC San Francisco School of Medicine
Hospital Epidemiologist, San Francisco General Hospital

DHS Non-Voting Members

CO-CHAIR
Gilberto F. Chavez, MD, MPH
State Epidemiologist

Chris Cahill MS, BS, RN
Infection Control Consultant
Licensing and Certification

Jon Rosenberg, M.D.
Infection Control and Healthcare Epidemiology, Communicable Disease Control

Table of Contents

Members of the Healthcare Associated Infections Advisory Working Group ..... Page 3

Executive Summary ..... Page 5

Section I. Background
- Introduction ..... Page 8
- Brief Historic Review of Programs ..... Page 9
- Challenges for Healthcare Associated Infections Surveillance in California ..... Page 10
- The Healthcare Associated Infections Advisory Working Group ..... Page 11

Section II. Consensus Recommendations
1. Recommendations to the California Department of Health Services..... Page 13
2. Recommendations for Healthcare Facility Infection Surveillance and Prevention Program Infrastructure ..... Page 15
3. Recommendations for Public and Internal Reporting of Outcome and Process Measures ..... Page 21
4. Recommendations for the Prevention of Influenza Transmission in Healthcare Facilities ..... Page 24
5. Recommendations for the Prevention of Central Venous Catheter Related Blood Stream Infections ..... Page 27
6. Recommendations for the Prevention of Antimicrobial Resistance ..... Page 28
7. Recommendations for the Prevention of Surgical Site Infections ..... Page 30
8. Recommendations for the Prevention of Ventilator-Associated Pneumonia ..... Page 33

Section III. Appendices
- Appendix A. Historic overview of Infection Surveillance and Prevention Programs ..... Page 34
- Appendix B. List of selected references ..... Page 37
- Appendix C. Glossary of abbreviations ..... Page 46

Executive Summary

Healthcare facilities across the state have seen a steady increase in the risk of healthcare associated infections (HAI) during recent decades. HAI are the most common complications affecting hospitalized patients today. It is estimated that between 5 and 10 percent develop one or more HAI annually. Approximately 25% of HAI involve patients in intensive care units. Urinary tract infections, surgical site infections, bloodstream infections, and pneumonia account for more than 80% of all HAI. Although we do not have precise estimates of the rates of HAI in California, using conservative figures, we estimate that 240,000 patients out those admitted to California hospitals each year develop HAI for a cost of approximately 3.1 billion dollars.

On July 2005, in response to the need to prevent unnecessary morbidity and mortality from HAI and the recent recommendations by the Little Hoover Commission, the California Department of Health Services (DHS) convened a broadly represented expert advisory group, the HAI Advisory Working Group (AWG). Through a consensus-based process, the HAI AWG developed a series of evidence-based recommendations aimed at reducing the morbidity and mortality from HAI in the state.

One of the most significant challenges identified by the AWG was the lack of sufficient staff and financial resources for infection control and epidemiology within DHS, local health departments, and healthcare facilities. The following is a brief summary of the key recommendations contained in this report.

1. **Recommendations to the California Department of Health Services**
   A total of 17 recommendations are included for specific actions by DHS to develop and implement an effective HAI surveillance and prevention program, assess its resource needs, appoint an HAI public reporting advisory committee, train health facility evaluator nurses, provide guidance on the interpretation of expert prevention recommendations, collaborate with the medical board and national organizations, explore the development of electronic reporting databases, train others in infection control, assist with outbreak investigations and follow up, and provide sufficient laboratory capacity. The AWG also called for changes to CCR Title 22, Section 70739 and others relevant Sections to ensure compliance with the seven essential functions for infections surveillance and prevention and to assure that all hospitals periodically assess the adequacy of their infection control resources.

2. **Recommendations for Healthcare Facility Infection Surveillance and Prevention Program Infrastructure**
   The AWG issued a total of seven recommendations with specific actions steps for healthcare facilities. These recommendations include annual assessments of the risk of acquisition and transmission of HAI, sharing

microbiology data on a real time basis, the development of evidence-based written infection prevention policies and procedures, protection of healthcare workers against infections diseases, development of education and training programs, assignment of infection control responsibilities to individuals with expert knowledge, and the evaluation of adequacy of resource for infection surveillance and prevention programs.

3. **Recommendations for Public and Internal Reporting of Outcome and Process Measures**
   This report includes four recommendations on reporting of HAI data. These recommendations include a call for public reporting of process measures (quality indicators), guidance on principles for public reporting programs, a call for internal (within healthcare facility) reporting of outcome and process measures, and the establishment of a standing advisory committee of outside experts to direct the public reporting of process measures (quality indicators).

4. **Recommendations for the Prevention of Influenza Transmission in Healthcare Facilities**
   The AWG recommended several key strategies to prevent influenza transmission. These include offering on-site influenza vaccination to all healthcare workers at no cost, tracking vaccine doses administered, requiring vaccination or written declinations, provide influenza vaccination to inpatients and outpatients as recommended by national guidelines, instituting hygiene/cough etiquette protocols, developing procedures for isolation of patients with influenza, effective surveillance, adopting a season influenza plan, reporting influenza outbreaks, developing plans for managing patients with suspect avian influenza, and instituting pandemic influenza plans.

5. **Recommendations for the Prevention of Central Venous Catheter Related Blood Stream Infections**
   Six recommendations were issued by the AWG for the prevention of bloodstream infections including the development and implementation of policies and procedures addressing CDC published recommendations, training and education of healthcare professionals, assessment of healthcare worker competency, determining infection rates, monitoring rates in intensive care units (at a minimum), and internally monitoring/reporting compliance with evidence-based practice process measures.

6. **Recommendations for the Prevention of Antimicrobial Resistance**
   The AWG calls for the development and implementation of recommendations for the judicious use of antibiotics, the development and distribution of healthcare facility annual antimicrobial susceptibility results (antibiograms), evaluation of empiric antibiotic therapy, compliance with recommendations on antimicrobial prophylaxis, adherence to national guidelines for empiric antimicrobial therapy in outpatient acquired infections, and sharing of annual antibiograms with community partners.

7. **Recommendations for the Prevention of Surgical Site Infections**
   Key recommendations for preventing surgical site infections include forming a multidisciplinary committee to periodically evaluate compliance with policies an procedures within the facility, providing risk-stratified infection rates, administering prophylactic antibiotics to surgical patients, avoiding the use of razors for hair removal, using appropriate preoperative antiseptic skin preparation agents, maintaining serum glucose levels below 200mg/dl for diabetic and cardiothoracic patients, maintaining body temperature between 36 and 39 degrees centigrade during colorectal surgical procedures, using antiseptic techniques to prevent contaminating open wounds, adopting CDC guidelines for hand hygiene, and ensuring healthcare worker compliance with instrument cleaning, disinfecting and sterilizing.

8. **Recommendations for the Prevention of Ventilator-Associated Pneumonia**
   The AWG made six recommendations to prevent ventilator-associated pneumonia including forming a multidisciplinary committee to periodically evaluate compliance with policies an procedures within the facility, implementing the 2003 CDC guidelines for the prevention of healthcare associated pneumonia, educating healthcare workers, assessing healthcare worker compliance with policies and procedures, monitoring infection rates using the CDC case definition for HAI pneumonia, and reporting infection rates and compliance with process measures internally.

DRAFT

Section I. Background

Introduction

In 1992 the Centers for Disease Control and Prevention (CDC) conservatively estimated that 2 million patients developed one or more healthcare-associated infections (HAI) contributing directly or indirectly to more than 88,000 deaths annually in the United States. The majority of HAI, up to 35%, occur in intensive care unit (ICU) patients. Urinary tract infections (UTI), surgical site infections (SSI), bloodstream infections (BSI) and ventilator associated pneumonia (VAP) account for more than 80% of all HAI.

Changes in the delivery of health care may have contributed to an increase in the risk of HAI over the past decade. The number of acute care hospital beds and the average length of stay have decreased primarily due to the redirection of surgical procedures to ambulatory surgery centers. At the same time the number of ICU beds and the severity of illness of hospitalized patients have increased (the "intensification" of acute care hospitals). Additionally the proportion of hospitalized patients who are immunosuppressed because of advancing age, chronic illnesses such as diabetes, heart disease and tobacco related respiratory diseases has grown substantially.

The hospital microbial population is also rapidly changing in part due to inappropriate physician antimicrobial prescribing practices in both inpatient and outpatient settings. Another major contributor to HAI is the transmission of antibiotic resistant pathogens from patient-to-patient primarily on the unwashed hands of health care providers.

According to the Office of Statewide Health Planning and Development (OSHPD) records, 4.0 million patients were discharged from California hospitals in 2004. Using a conservative rate of 6.0% of the total number of discharged patients it is estimated that 240,000 HAI could have occurred in this year.

Assessing the financial burden of HAI in California is difficult because of the many federal, state and commercial capitation contracts that reimburse only for the original diagnosis and not for the infection that occurred as a result of that admission. A review of the literature conservatively estimates that each HAI costs an average of $13,000. Based on the number of HAI that could have occurred in California in 2004 the estimated cost of HAI to taxpayers and other purchasers of health care is estimated to be $ 3.1 billion. This excludes the cost to society for lost wages, productivity and medical legal costs of HAI.

Infection surveillance and prevention programs are possibly the most cost effective of all the hospital quality performance improvement projects implemented in hospitals today. The *Study of the Efficacy of Nosocomial*

Infection Control (SENIC) published in 1983 by the CDC demonstrated an overall 32% reduction in HAI in hospitals with high-intensity surveillance and prevention programs.

Clearly, HAI contribute significantly to morbidity, mortality, and healthcare costs in California. Preventing HAI would substantially diminish unnecessary suffering and save health care insurers, hospitals, and taxpayers billions of dollars annually.

Brief Historic Review of Infection Surveillance and Prevention Programs

Recommendations that specifically address surveillance and prevention of HAI have a long history and, in fact, were the precursor to current quality and performance improvement programs.

In 1958 the American Hospital Association (AHA) Advisory Committee recommended the implementation of infection surveillance programs in response to a nation-wide outbreak of *Staphylococcus aureus* infections identified primarily in newborn infants. Throughout the following decades the CDC, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and other professional organizations have published comprehensive recommendations and compliance standards.

In 1983 the CDC published the *Study on the Efficacy of Nosocomial Infection Control* (SENIC) which demonstrated an overall 32% reduction in HAI in hospitals with trained epidemiologists (physicians) and professional nurses who coordinated high-intensity surveillance and prevention programs.

Beginning in 1999, several other organizations and accrediting agencies including the Agency for Healthcare Research and Quality (AHRQ), the Hospital Infection Control Practices Advisory Committee (HICPAC), the JCAHO and the Institute of Healthcare Improvement (IHI) independently issued guidance documents or recommendations on infection prevention. Healthcare organizations, policymakers, program planners, consumer advocacy organizations and others were tasked with designing and implementing infection surveillance and prevention programs and responding to demands for HAI public reporting systems

For a detailed chronological listing of the most significant events in HAI prevention and control please see Appendix A.

Challenges for HAI Surveillance and Prevention in California

In addition to the nursing shortage in California, there is currently a shortage of experienced infection prevention professionals requiring hospital administrators to fill position vacancies by promoting a staff nurse with no prior training or expertise. Sixty percent (60%) or 271 of California's 450 acute care hospitals are licensed for less than 200 beds and thus are currently not required by regulation (CCR, Title 22) to have a full time equivalent infection surveillance and prevention professional. This problem is further magnified in well over 2,000 other licensed health care facilities, including nursing homes, dialysis centers and ambulatory surgical centers where health care is increasingly provided but little or no infection prevention resources are available. These facilities depend on California Department of Health Services (DHS) staff for outbreak management and prevention guidance.

To further compound the problem, California local health departments (LHD) are frequently requested to provide consultation on the management of outbreaks in hospitals and long-term care facilities. With little training in managing HAI in these facilities, their recommendations are often inefficient and costly. Most LHD are severely understaffed and are therefore not able to provide consultative or technical assistance to healthcare facilities or to assist in the implementation of critical HAI prevention initiatives.

Small acute care hospitals as well as other providers of healthcare are increasingly turning to the DHS and LHD for advice and consultation on issues including outbreaks of antimicrobial resistant organisms not previously considered a significant problem for these facilities. At the same time, larger hospitals are seeking advice and consultation for problems of increasing complexity including outbreaks of unusual pathogens such as atypical Mycobacteria wound infections and exposure to bloodborne pathogens through inadequately cleaned, disinfected or sterilized invasive medical devices including endoscopes.

In addition to requests for consultation by licensed health care facilities, non-health care related businesses (e.g. hair and nail salons, prisons, food services, etc.) and other state services including the Departments of Corrections, Social Services and Education also request infection prevention consultation including outbreak management assistance from the DHS and LHD.

One major challenge is the many unregulated venues where health care is increasingly being provided. This includes private physician offices where urologic, endoscope, and gynecologic procedures are performed and outpatient surgery services such as plastic surgery and pain management clinics. Suboptimal infection prevention practices in these venues include improper decontamination and sterilization of surgical instruments and invasive devices

such as endoscopes. The magnitude of this problem is unknown because HAI in these settings are not documented unless a complaint is filed with a state or local agency.

Today infection surveillance and prevention programs have had to prepare for community outbreaks such as Severe Acute Respiratory Syndrome (SARS), potential bioterrorism threats, community-associated MRSA, pandemic influenza, other new and reemerging transmissible infectious diseases, and finally public reporting of HAI. In addition to assuring that there is an effective and efficient facility program, infection control professionals are required to assist local and state health departments in disease reporting and outbreak investigation as well as planning for new and reemerging infectious disease threats such as pandemic influenza that might affect the community and the healthcare organization.

Implementation of current national recommendations to reduce HAI and improve patient outcomes requires that multidisciplinary teams set clear performance goals, establish baseline measurements, measure improvement over time and test various systems changes in order to find which processes lead to sustained improvement in a specific hospital. Developing baseline HAI data and measuring improvement over time requires intense surveillance including observation, the use of standardized definitions of infections as well as the collection, analysis and reporting of data by infection prevention professionals.

The Healthcare Associated Infections Advisory Working Group

In a 2005 follow-up report to the governor, the Little Hoover Commission (LHC) reemphasized their previous recommendations for improvements in infection prevention programs at the state level and urged the Governor and the Legislature to prioritize *"an aggressive response to hospital-acquired infections"*. In July 2005, in response to these recommendations, the DHS convened a broadly represented expert advisory group, the HAI Advisory Working Group (AWG). This group included infection surveillance and prevention professionals, infectious disease specialists, epidemiologists, hospital administrators and public health experts. In addition, the group had representation from a variety of stakeholders, including the California Medical Association, California Nurses Association, Consumer's Union, California Hospital Association, Service Employee International Union, California Conference of Local Health Officers, Los Angeles County Department of Health, the California APIC (Association for Professionals in Infection Control and Epidemiology) Coordinating Council, California Association of Health Facilities, California Healthcare Foundation, and the California Ambulatory Surgical Association. This advisory working group was tasked with developing a broad set of recommendations by December 31, 2005 that public and private entities could implement to reduce HAI in California. In developing their recommendations the group considered the latest research,

reviewed best practices, and considered information presented by subject matter experts.

To accomplish the mission the HAI AWG used a decision making process based on obtaining group consensus to assure support for each of the final recommendations. When consensus could not be reached, the group used a majority rule. In recognition of the public's interest on the subject, the HAI AWG proceedings were posted on the DHS website monthly and time for public comment was incorporated into each meetings agenda.

The HAI AWG held monthly meetings beginning on July 25, 2005. Because written recommendations were due by December 31, 2005, subgroups were formed to address the following areas: program infrastructure, public reporting, influenza, bloodstream infections, antimicrobial resistance, surgical site infections, and ventilator associated pneumonia. These subgroups drafted recommendations for the full HAI AWG to consider and act upon and were instrumental in the development of this final report.

The following section of this report details the specific recommendations made by the HAI AWG to DHS and their general recommendations in each of the critical areas.

Section II. Consensus Recommendations

1. Recommendations to the California Department of Health Services (DHS)

Recommendation 1.1
The HAI AWG strongly recommends the development and implementation of an infection surveillance and prevention program within the DHS with adequate resources to serve and assist licensed and unlicensed healthcare facilities in California.

Recommendation 1.2
In order to assure implementation of the recommendations within this document, the HAI AWG strongly urges that the DHS consider conducting a comprehensive assessment of currently available resources DHS should consider using methodology similar to the joint CDC and APIC study *Staffing requirements for infection control programs in US healthcare facilities: Delphi* Project published in AJIC 2002, Oct: 30(6) 321-33 to determine appropriate staffing for the DHS and local health departments (LHD) infection surveillance and prevention programs.

Recommendation 1.3
To assist the DHS in the mission of reducing HAI, an advisory committee composed of infection prevention professionals, hospital administrators, hospital epidemiologists, public health officers as well as providers and purchasers of health care should be appointed. The purpose of the committee would be to direct and monitor the implementation of public reporting of quality measures to ensure the public has access to timely, relevant and accurate data.

Recommendation 1.4
Educate Licensing and Certification Program Health Facility Evaluator Nurses (HFEN) as soon as possible to effectively survey hospitals and other licensed healthcare facilities for compliance with current and future infection surveillance and prevention strategies and regulations.

Recommendation 1.5
Provide guidance to HFEN on the interpretation of infection surveillance and prevention recommendations issued by CDC, HICPAC, SHEA, APIC and other professional organizations.

Recommendation 1.6
Communicate the recommendations contained in this consensus document to the JCAHO. Require JCAHO surveyors responsible for accrediting California healthcare facilities to receive education and training to effectively evaluate compliance with current and future infection surveillance and prevention strategies.

Recommendation 1.7
Communicate the recommendations contained in this consensus document to the Centers for Medicare and Medicaid Services (CMS) to assist in the development of effective regulatory interpretive guidelines.

Recommendation 1.8
Communicate the recommendations contained in this consensus document to the California Medical Board and offer assistance in developing effective infection prevention strategies to physicians who perform invasive procedures in non-certified facilities.

Recommendation 1.9
Explore the possibility of developing a statewide electronic reporting database to monitor increases in specific invasive antibiotic resistant organisms such as methicillin-resistant *Staphylococcus aureus* as well as central line related bloodstream infections and surgical site infections related to coronary artery bypass surgery and other high risk surgical procedures.

Recommendation 1.10
Develop training and education programs for healthcare facility infection prevention professionals new to the profession.

Recommendation 1.11
Participate in developing educational programs on infection prevention for LHD and the general public.

Recommendation 1.12
Provide consultation and assistance to other State agencies (e.g., Departments of Corrections, Social Services, etc.) in the development and implementation of infection prevention guidelines.

Recommendation 1.13
Provide educational materials and web-based training programs and current infection prevention information on a website.

Recommendation 1.14
Assist in the investigation and follow-up of clusters and outbreaks of healthcare facility associated infections.

Recommendation 1.15
Revise CCR Title 22, Section 70739 and other Title 22 sections related to infection surveillance and prevention programs to ensure compliance with the seven essential functions of an effective infections surveillance and prevention program as outlined in the *"Requirements for Infrastructure and Essential*

Activities of Infection Control and Epidemiology: A Consensus Panel Report" and any future recommendations.

Recommendation 1.16
Title 22, Section 70739 and other Title 22 sections should be revised to assure that all hospital periodically assess the adequacy of resources allocated to the infection control program for staffing infection surveillance and prevention programs utilizing the recommendations outlined in the joint CDC and APIC study entitled *"Staffing requirements for infection control programs in US healthcare facilities: Delphi Project"* published in *AJIC 2002, Oct: 30(6) 321-33.*

Recommendation 1.17
Provide sufficient laboratory capacity to support healthcare facilities and LHD with pathogen identification, molecular epidemiology and antimicrobial susceptibility testing for the investigation of outbreaks and surveillance of antimicrobial resistance.

2. Recommendations for Healthcare Facility Infection Surveillance and Prevention Program Infrastructure

Recommendation 2.1

Hospitals should assess the risk of acquisition and transmission of HAI at least annually as the demographics of the geographical area changes, new diagnostic and therapeutic services are introduced, construction and renovation projects impact normal internal or external operations or other factors known to affect HAI rates arise. The following are essential action steps for the implementation of this recommendation.

- Risk assessment for HAI should be based on historic surveillance data (if available), an assessment of high risk, high cost, high volume invasive procedures performed and the socioeconomic status of population served.
- A written surveillance plan should document the specific populations and services to be included in the program, definitions and data sources to be used for data collection, risk stratification methods, numerators and denominators, preparation and distribution of reports and aggregated comparative (internal or external) data used to guide meaningful comparisons.
- Surveillance data should be analyzed and reported to department and service managers, administrators and to medical staff chiefs of service, as applicable. Infection rates should be easy to understand and thoroughly explained.
- Where available only standardized definitions of infections for surveillance purposes should be used for data collection, analyses and reporting.

- Appropriate clinical data should be used to monitor and improve processes of care and clinical outcomes. Administrative (medical records coding) data should not be the sole source of HAI data.
- Hospitals should consider training technicians to collect surveillance data. Hospitals using data mining technology should validate the data.
- Sentinel events should be voluntarily reported to the JCAHO. Unusual occurrences such as outbreaks which threaten the welfare, health and safety of patients, personnel or visitors must be reported to the LHD and to the CDHS Licensing and Certification Program district office with jurisdiction over the facility (California Code of Regulations, Title 22).
- Hospitals should use baseline surveillance data including microbiologic data to identify clusters and outbreaks of infections.
- Antimicrobial resistant organisms such as methicillin-resistant *Staphylococcus aureus* should be tracked and trended.

Recommendation 2.2

Appropriate and timely microbiology data should be made available on a real time basis. The following are essential action steps for the implementation of this recommendation.

- To facilitate multiple automated streams of aggregate data, sustained and real time support should be provided by the facility's information technology department including: microbiology, patient demographics, patient location, length of stay, antimicrobial utilization, invasive procedures and device utilization days, attending and consulting physicians and billing data.
- Microbiological data should be electronically retrievable and maintained in a manner that permits rapid access to reports by type of organism, antimicrobial sensitivity pattern, type of clinical specimen, patient identification, attending physician, location of patient when culture was obtained, current location of patient if different, dates when the culture was obtained, preliminary and final culture results and information on who reported and who received critical value reports.
- An annual aggregated antibiogram should be made available to physicians. Microbiologists should comply with the recommendations of the Clinical and Laboratory Standards Institute (CLSI)
- Staff should be trained to properly collect clinical specimens for culture, interpret culture and sensitivity reports and report critical laboratory values to physicians. Cultures should be obtained prior to initiating antibiotic therapy, when possible.
- A baseline rate of specific organisms at specific anatomical sites should be maintained by the laboratory and increases in the incidence of specific or unusual organisms above baseline should be reported to the infection surveillance and prevention professional.

- The microbiologist should work closely with infection prevention professionals and participate in decisions related to obtaining surveillance cultures, be capable of rapidly identifying organisms related to bioterrorism and outbreaks of diseases in the community and the hospital, provide assistance in obtaining rapid diagnostic tests and molecular studies and implement a "critical or unusual value" notification system.
- Medical and nursing staff should be knowledgeable about the indications for obtaining clinical specimens. Cultures should be obtained prior to initiating antibiotic therapy, when possible.
- Adequate pathology and radiology services should be available to assist with the diagnosis of an infectious disease.

Recommendation 2.3

Written infection prevention policies and procedures should be evidence-based, developed by infection control professionals in collaboration with appropriate physicians and other healthcare facility staff, developed to fit the structure, function and population of the healthcare facility, be communicated to staff, enforced by staff physicians, administrators, managers and supervisors and updated periodically. The following are essential action steps for the implementation of this recommendation.

- Infection prevention strategies should be evidenced-based (HICPAC or other professional organizations) when the evidence is available and have been validated to reduce HAI. Infection prevention research and innovation is strongly encouraged.
- Hospitals should implement sustainable processes for compliance with the Institute of Healthcare Improvement's (IHI) infection prevention and sepsis related measurement bundles.
- Infection prevention strategies for each department and service should be developed, implemented, revised as necessary and reviewed by the infection surveillance and prevention committee for effectiveness in protecting patients and employees.
- Isolation strategies should be based on an assessment of the risk for pathogen transmission.
- Department and service managers and supervisors should frequently monitor staff for compliance with hospital and department specific infection prevention procedures including hand hygiene, isolation and use of personal protective equipment policies. Corrective action should be taken as necessary and the findings should be reported to the infection prevention committee.
- Environmental service managers should assure that staff are properly trained to maintain a sanitary environment and periodically observed for competence in the procedures for which they are responsible.

- Department and service managers responsible for cleaning decontaminating and sterilizing medical equipment and supplies should develop and implement policies based on manufacturer's instructions as well as recommendations from the infection surveillance and prevention committee and professional organizations. Staff should be properly trained and periodically observed for competence in the procedures for which they are responsible.

Recommendation 2.4

Healthcare facilities should protect their personnel from exposure to infectious diseases. Employees should comply with work restrictions when sick with an infectious disease and be offered immunization as recommended by current CDC Guidelines for healthcare workers. The following are essential action steps for the implementation of this recommendation.

- Employee health policies and procedures related to the infection prevention program should be developed, implemented, monitored and revised as necessary to assure consistency with current evidence-based recommendations.
- Infection prevention professionals should work collaboratively with employee health professionals.
- Employee health policies and procedures related to infectious diseases should be reviewed and approved by the hospital's infection surveillance and prevention committee.
- New employees should be evaluated for evidence of conditions related to communicable diseases such as tuberculosis.
- Employees should be offered immunizations for vaccine preventable infections as required by regulation or recommended by current CDC guidelines and the Advisory Committee on Immunization Practices for Healthcare Personnel.
- Employee health programs should implement the most current CDC recommendations for post exposure prophylaxis to blood-borne pathogens such as hepatitis B virus, hepatitis C virus, human immunodeficiency virus (HIV), tuberculosis and other infectious diseases.
- Policies and procedures for evaluating employees exposed to a communicable disease, ill with a communicable disease, indications for work restrictions and return to work should be developed, implemented and communicated to all employees. Compliance should be monitored.
- Employee health professionals should work closely with non-hospital based agencies and organizations such as paramedics, homecare personnel, nursing registries and nursing homes and assist in the management of an exposure to a communicable or infectious disease.

- Employee health professional should define circumstances in which an agency should report newly identified communicable disease in staff who have worked recently.

Recommendation 2.5

To prevent HAI and occupational exposure to infectious diseases, healthcare facilities should plan, implement and revise organized education and training programs in consultation with experts in epidemiology, infectious diseases and infection prevention professionals. The following are essential action steps for the implementation of this recommendation.

- Persons working or consulting in the organization including, but not limited to, administrators, department managers and supervisors, medical and nursing staff, students and volunteers should be trained in current infection prevention strategies and be able to translate didactic principles into practice. Tools should be developed and used to verify the skills of direct and indirect patient care providers.
- Direct patient care providers including nurses, physicians and diagnostic and therapeutic ancillary staff should be required to demonstrate minimum written, verbal and performance competency skills in hand hygiene, the use of personal protective equipment and facility specific isolation procedures.
- Department administrators, managers and supervisors should frequently observe healthcare worker-patient interactions for compliance with hand hygiene, use of personal protective equipment and facility specific isolation procedures and take corrective action as necessary.
- Educational programs should be evaluated periodically for effectiveness and attendance should be monitored.
- Education programs should meet the needs of specific employee work groups including the literacy level and primary language spoken.
- New and revised infection prevention strategies should be communicated and all affected staff should be responsible for implementing these strategies.
- The clinician appointed as the hospital epidemiologist (Chair, Infection Prevention Committee) should, within one year of accepting the position, attend an infection surveillance and prevention training program or have commensurate experience. Attendance should be documented in the credential files. Ongoing continuing education specific to infection prevention is highly recommended.
- The hospital epidemiologist (Chair, Infection Prevention Committee) should have a job description and, when indicated, a contract that specifies the hospital's requirements for appropriate initial and ongoing training, expected duties such as committee participation, antibiotic utilization, consultation with the infection control professional, education of

staff physicians, and assisting with a cluster or outbreak investigation and with endemic HAI reduction.

- The hospital epidemiologist should serve as the infection prevention program champion who promotes appropriate strategies through communication and problem resolution with peers.
- Members of the infection surveillance and prevention committee (required by CCR, Title 22), should be knowledgeable about infection prevention strategies, participate in enforcing the program goals and set the example for their peers as well as the employees through participation in the hand hygiene program and compliance with transmission prevention policies.

Recommendation 2.6

Because responsibilities of infection surveillance and prevention programs are expanding due to increases in the intensity and complexity of patient care services delivered, the severity of patient illness and the delivery of care in ambulatory settings, the healthcare facility should assign the responsibility for effectively managing its infection surveillance and prevention program to an individual or individuals with expert knowledge of surveillance and prevention skills. The following are essential action steps for the implementation of this recommendation.

- Infection surveillance and prevention professional positions should be at least the level of manager in the organization and report directly to a senior administrator.
- Infection prevention professionals should communicate surveillance data, problems and interventions directly to the senior management team, medical and nursing staff committees and the governing body.
- The qualifications of the designated professional may be met thorough ongoing education, training and experience. Certification through a professional organization is highly recommended.
- Infection prevention professionals should coordinate all surveillance and prevention activities within the organization.
- Infection prevention professionals should work closely with LHD in developing rationale strategies for controlling emerging infectious diseases such as pandemic influenza.
- Infection prevention professionals should be visible in the organization, available for consultation and have the authority to cross between department and service lines.
- Infection prevention strategies should be based on current and evolving scientific evidence as provided by the HICPAC, CDC, SHEA, APIC or other professional organizations.
- The appropriate duties of the infection prevention professional are those directed primarily toward HAI prevention. If duties unrelated to that goal

are assigned, adequate resources should be provided to ensure that the infection surveillance and prevention program is not compromised.

- Adequate resources including laboratory, equipment, supplies, computer hardware and software, and access to electronic libraries should be allocated to the program.
- The program should have a designated cost center, budget, funding and resources to support recommended interventions.

Recommendation 2.7

Healthcare facility senior leadership, in collaboration with the appropriate infection prevention professionals, should evaluate and demonstrate adequacy of resources directed to the infection surveillance and prevention program. The evaluation should be based on historic surveillance data (if available and interpretable), the need to reduce HAI-associated costs, the current and projected community population growth, the volume of high risk and high cost invasive inpatient and outpatient procedures performed, projected advances in technology, the number of intensive care unit beds, number of emergency department visits, the number of outpatient visits, number of licensed medical-surgical beds and number of employees.

All healthcare facilities should utilize the joint CDC and Association for Professionals in Infection Control and Epidemiology (APIC) study *Staffing requirements for infection control programs in U.S. healthcare facilities: Dephi Project* to determine appropriate staffing for infection surveillance and prevention programs. Additionally the SENIC study conducted by CDC, which recommends that each hospital have available at least one dedicated and educated physician epidemiologist should be utilized to determine staffing for facility programs.

3. Recommendations for Public and Internal Reporting of Outcome and Process Measures

Public reporting of measures of healthcare performance is gaining popularity as a means to hold providers accountable for the quality of medical care. Consumers and payers have begun to demand quality indicator data from providers in order to make more informed healthcare decisions. Providers have acquiesced, although with some misgivings out of concern that the data can be biased or misleading, and may potentially lead to unintended adverse consequences for patients.

According to the HICPAC, at this time there is insufficient evidence regarding the effectiveness of public reporting systems to prevent or reduce the incidence of HAI. Nevertheless, the HAI AWG has concluded that public reporting of relevant quality indicators probably has the potential to decrease HAI in California, but

only if such a program is implemented carefully and with full regard to the consequences to providers and patients.

The HICPAC recently published a set of guidelines containing detailed recommendations for policymakers regarding this issue. We urge California policymakers to study this document, which highlights the essential elements of a public reporting system for HAI, the potential consequences of mandatory public reporting, and a recommended starter set of quality indicators.

Quality indicators can generally be divided into process measures and outcome measures. Process measures examine processes of care (such as surgical antimicrobial prophylaxis, influenza vaccination or central line insertion practices) that should not vary substantially from patient to patient or facility to facility. They do not require adjustment for the patient's risk of infection or the mix of patients seen by a particular facility. The goal of these processes is, ultimately, to improve outcomes. We believe that, if healthcare providers adhere to appropriate process measures nearly 100% of the time, we will see dramatic reductions in the outcomes we are trying to prevent, namely HAI and mortality. The HAI AWG achieved consensus in its recommendation to endorse public reporting of process measures intended to reduce healthcare associated infections. The HAI AWG also strongly encourages providers to internally monitor their own adherence to evidence-based processes that are known to reduce HAI.

Outcome measures describe outcomes of care (such as rates of certain infections, deaths or readmissions attributable to infections) that may or may not be the result of processes in place in healthcare facilities. Healthcare consumers may find outcome measures valuable because they represent direct results of healthcare delivery. Advocates of outcome measures claim that the powerful message delivered by disclosure of outcomes may have a much greater effect on quality improvement initiatives than indirect process measures.

However, outcome measures may be more likely to be subject to confounding, bias and misinterpretation. Different facilities see patients with different distributions of severity of illness, underlying diseases or types of invasive procedures; thus, tertiary care facilities that treat the sickest patients will tend to have higher infection rates, regardless of their adherence to evidence-based infection prevention measures. Risk-adjustment calculations can partially reduce this kind of bias, but many feel the science of risk-adjustment is currently not up to the task of creating meaningful comparisons between the varieties of healthcare facilities that might be compared by a California healthcare consumer. Additionally, facilities with superior surveillance systems for HAI may be penalized because they do a better job identifying and reporting infections; conversely, those with poor or non-existent surveillance will appear to have few or no infections or deaths attributable to infections.

Paradoxically, outcome reporting can create incentives for providers to turn away the sickest and most severely ill patients. Facilities that are being judged on deaths or infection rates may choose to withhold treatment from patients at higher risk for those outcomes in an attempt to improve publicly reported ratings. They may also inappropriately transfer those patients to different levels of care, other institutions, or out of state to avoid negative publicity for adverse outcomes. Finally, mandatory reporting of outcome measures may cause facilities to divert resources away from patient care towards collection of data for favorable risk-adjustment purposes.

The HAI AWG achieved consensus on the recommendation that all facilities should routinely collect and analyze important outcome measures, such as deaths and morbidity due to HAI or the measures developed by HICPAC, for internal benchmarking and continuous quality improvement. However, the HAI AWG could not achieve consensus on a recommendation regarding public reporting of healthcare-associated infection rates or mortality.

Recommendation 3.1
There should be requirements or strong incentives for public reporting of process measures (including those discussed elsewhere in this report or endorsed by HICPAC) that are standardized across facilities.

Recommendation 3.2
DHS should take into account the following principles when developing any public reporting program:

- Ensure all quality measures are standardized, evidence-based, representative of important problems and useful both to the consumer as well as the facility for quality improvement.
- Develop transparent risk-adjustment standards for hospitals with different patient mixes.
- Support adequate case-finding methods; in-house and post-discharge surveillance; and data validity checks.
- Do not use administrative (billing) data as the sole means of measuring processes or outcomes.
- Minimize the (often unfunded) burden of measurement on providers by developing reporting systems that interface with those already in use for other initiatives and planning for automated, electronic reporting for those facilities implementing appropriate health information technology.
- Evaluate possible unintended adverse consequences of public reporting, including the potential for high-risk patients to be denied medical care.
- Encourage truthful reporting by publicly publishing results in comparison deciles (e.g., top 10%, top 20%), rather than specific numerical results (e.g., 94% vs. 92% performance) that invite gaming the system to outscore competitors.

DRAFT

- Slowly phase in any new mandates for public reporting in a transparent fashion, open to public comment from both consumers and providers.
- Issue timely and verifiable reports that reflect current conditions in the healthcare facilities.

Recommendation 3.3
All healthcare facilities should report outcome and process measures internally. At a minimum, these should include the HICPAC outcome and process measures. These measures should be standardized and reproducible within the institution. They should be used as internal benchmarks to inform facility leadership and staff on the status of infection prevention and control efforts.

Recommendation 3.4
DHS should convene a standing advisory committee of outside experts to direct and monitor the implementation of public reporting of quality measures, to ensure the public has access to timely, relevant, and accurate data.

4. Recommendations for the Prevention of Influenza Transmission in Healthcare Facilities

Reports of transmission of influenza from healthcare workers to patients have been extensively documented in the scientific literature. Recent evidence suggests that both symptomatic and asymptomatic persons are capable of transmitting the virus. The ACIP, HICPAC and SHEA have recently approved stronger recommendations to improve persistently low (~ 36%) influenza vaccination rates among health care workers.

The term 'health care worker' as defined by the National Foundation for Infectious Disease extends to any employee in a health care setting who comes into direct contact with patients. This includes physicians, nurses, physician assistants, students of the health care professions and other personnel in hospital and outpatient settings. In addition, housekeepers, dietary workers, social workers, physical therapists, medical emergency response workers, employees in nursing homes and other chronic care facilities, and those who provide care in the home setting should be included the definition of a health care worker for these recommendations.

Strategies that have been effective in improving healthcare worker influenza vaccination rates include: 1) support by senior management, 2) mobile vaccination carts and 3) the availability of vaccination during all work shifts.

Recommendation 4.1
Using a multidisciplinary approach, each healthcare facility should develop, implement and evaluate the following action steps:

- Offer influenza vaccination to healthcare workers at the work site, at no cost and to all shifts.
- Accurately track the number of vaccine doses administered to healthcare workers. Provide vaccination rates by department to department managers. Include workers vaccinated elsewhere during the same season in reported rates.
- Require vaccination or written declination by healthcare workers providing direct patient care (see proposed declination statement below).
- Document the reasons that healthcare workers decline vaccination, such as previous receipt of the current vaccine, religious objections or fear of needles. (Due to privacy concerns, healthcare workers may decline to state their reasons for refusal).
- Use these responses to develop opportunities for education and intervention.
- Offer intranasal influenza vaccine as appropriate to those who express fear of needles.
- Consider implementing a system to track other healthcare worker groups who may rotate through the institution (e.g. licensed independent practitioners).
- Consider addressing in contracts influenza vaccination of contract workers.

The following is an example of a healthcare worker declination to be vaccinated for influenza:

Due to my occupation, I may transmit influenza to my patients and other healthcare workers, as well as to my family and friends, even though I have no symptoms. This can result in serious infection, particularly in persons at high risk for influenza complications. I have received education about the effectiveness of influenza vaccination as well as possible adverse events. I have been given the opportunity to be immunized with influenza vaccine at no charge to myself. However, I decline influenza vaccination at this time. I understand that by declining this vaccine, I continue to be at risk of acquiring influenza, potentially resulting in transmission to my patients and others. If in the future if I want to be immunized with influenza vaccine, I can receive the vaccine, if available, at no charge to myself.

Recommendation 4.2

Healthcare facilities should provide influenza vaccination to appropriate inpatients and outpatients as recommended by national guidelines.

Recommendation 4.3

To minimize risk of transmission of endemic seasonal influenza, healthcare facilities should implement the following actions steps:

- Institute respiratory hygiene/cough etiquette protocols in high risk exposure areas such as emergency departments and outpatient clinics, to include visual alerts, tissues to contain respiratory secretions, no-touch receptacles for discarded tissues, sinks for hand washing or alcohol antiseptic hand hygiene products, readily available masks at point of initial contact, and training of front line staff to offer education, masks and tissues to persons with respiratory symptoms.
- Define and implement procedures for identifying and appropriately isolating patients with influenza.
- Have effective surveillance to ensure early detection of influenza illness in healthcare workers, including a procedure for the evaluation of healthcare workers with febrile respiratory illness and to identify outbreaks among workers.
- Have a seasonal influenza outbreak response plan to include:
    - Planning for staffing contingencies,
    - Access to rapid diagnostic testing,
    - Conditions for initiation of antiviral prophylaxis, and
    - Conditions to trigger limitation of group activities, restriction of visitors, closure to admissions or other appropriate responses.
- Report influenza outbreaks both internally and to the local health department and the Department of Health Services Licensing and Certification office with jurisdiction over the facility.

Recommendation 4.4

Healthcare facilities should have a plan for managing a patient suspected or known to have the strain of avian influenza which is currently not sustainably transmitted human-to-human. The plan should address:

- Patient identification,
- Contact with the local health department,
- Specimen collection. Directions are available at http://www.dhs.ca.gov/ps/dcdc/VRDL/html/FLU/H5N1/H5N1specimen%20collectionguidelines.pdf .
- Reporting using the state form, available at http://www.dhs.ca.gov/ps/dcdc/VRDL/html/FLU/H5N1/CA%20Avian%20Flu%20Case%20Report%20Form%209.05.pdf .
- Isolation,
- Healthcare worker use of personal protective equipment, and
- Communication plan.

Recommendation 4.5

Healthcare facilities should have a pandemic plan which:

- Documents collaboration with local or state health departments,
- Describes management of possible pandemic influenza including:
    - Patient identification,
    - Reporting to local health departments,

  - Specimen collection,
  - Isolation, and
  - Use of personal protective equipment.
- Describes effective surveillance to ensure early detection of influenza illness in healthcare workers, including a procedure for the evaluation of healthcare workers with febrile respiratory illness, to identify outbreaks among workers.

5. Recommendations for the Prevention of Central Venous Catheter Related Blood Stream Infections

Bloodstream infections (BSI) caused by central venous catheters (CVC) are the focus of numerous quality outcome projects including Leapfrog, National Quality Forum (NQF), and the Institute for Healthcare Improvement (IHI) 100K Lives Campaign. The reason for this focus is the high-risk, high-cost impact of this HAI and the multiple opportunities for decreasing infection rates.

In California it is estimated that nearly 12,000 patients develop a CVC- related BSI annually. The associated cost in primarily non-reimbursed compensation to hospitals ranges from $35,000 to $56,000 per infection or $400 million to $667 million annually.

The majority of BSIs occur because the CVC is urgently needed and aseptic technique cannot always be maintained in these situations. Other risk factors for infection, especially in ICU patients include the length of time the catheter is in place, colonization of the insertion site with hospital-acquired pathogens and the numerous manipulations by trained and untrained staff for the purpose of administering medications, fluids and blood products each day. Patient related risk factors such as underlying diseases and severity of illness also contribute to the risk of infection.

Central venous catheters are also used extensively in outpatient settings including oncology centers, dialysis centers. The extent to which infections occur in these settings is unknown as there is limited or no surveillance and therefore no ability to determine trends in infection rates. Additionally verification of compliance with evidence-based infection prevention practices by DHS and JCAHO surveyors is often absent in these settings. Poor infection prevention practices, including training on insertion and maintenance of CVC and reuse of multi-dose vials have been cited as causes of outbreaks of hepatitis B virus and hepatitis C virus in these facilities.

Recommendation 5.1
Healthcare facilities using CVCs should develop and implement policies and procedures addressing, at a minimum, category 1A recommendations of the

DRAFT

CDC Guidelines for the Prevention of Intravascular Catheter-Related Infections, published in the MMWR (August 9, 2002/Vol 51/No. RR10).

Recommendation 5.2
Healthcare facilities using CVCs should provide training and education to healthcare professionals responsible for inserting and maintaining intravascular catheters.

Recommendation 5.3
Healthcare facilities using CVCs should assess healthcare worker competency for inserting and maintaining CVC. The method for documenting competency assessment should determined by the healthcare facility.

Recommendation 5.4
Healthcare facilities using CVCs should determine CVC infection rates using the CDC surveillance definitions.

Recommendation 5.5
Healthcare facilities using CVCs should monitor, at a minimum, CVC infection rates in intensive care units.

Recommendation 5.6
Healthcare facilities using CVCs should monitor and report compliance with the following process measures internally:

- Maximum barrier precautions on insertion,
- Optimal catheter insertion site selection with subclavian vein as the preferred site,
- Chlorahexidine skin antisepsis,
- Daily review and assessment of catheter's necessity, and
- Hand hygiene during insertion and for catheter manipulations

6. Recommendations for the Prevention of Antimicrobial Resistance

The prevalence of multi-drug resistant organisms (MDRO) in U.S. health care facilities has increased steadily over the last several decades. Methicillin-resistant *Staphylococcus aureus* (MRSA) was first isolated in the U.S. in 1968 and by 2002 accounted for 57% of *S. aureus* infections in ICU patients reported to the National Nosocomial Infections Surveillance (NNIS) system. A similar rise in prevalence occurred with vancomycin-resistant enterococcus (VRE) during the 1990s. Although ensuring adequate matching in comparisons of patients infected with MDROs and control patients is problematic, several studies have reported an association between MDRO infections and increased morbidity and

mortality, length of stay, and healthcare costs. In 1998 the Institutes of Medicine estimated that in the U.S antimicrobial resistance cost at least $4 - $5 million annually.

The prevalence of MDRO varies temporally, geographically, and by healthcare setting. The type and level of acute care also influences the prevalence of MDRO. Intensive care units, especially those in urban areas and tertiary care facilities, have a higher prevalence of MDRO infections than do small community hospitals. High rates of MRSA, VRE or extended spectrum beta lactamase (ESBL)-producing *gram-negative bacilli* colonization prevail in some, but not all long-term care facilities (LTCF). The frequency of clinical infection with these pathogens, however, is lower in LTCF residents than in patients in acute care hospitals. Antimicrobial resistance is also an emerging issue in the community. The prevalence of a clonally distinct strain of MRSA causing skin and soft tissue infections as well as invasive disease has increased dramatically over the past 5 years.

The clinical, logistical and financial impacts of the emergence and prevalence of a specific MDRO are important factors that determine healthcare facility prioritization of MDRO control programs. There are many reports in the published literature of successful control of outbreaks of MDRO in healthcare facilities. Many strategies, including enhancement of hand hygiene practices, active surveillance cultures, contact isolation, and judicious antibiotic use, have been employed, but it is difficult to attribute success in controlling MDRO transmission to a single strategy. Some of the methods aimed at controlling MDRO transmission in healthcare settings are controversial. Proponents of active surveillance argue that MDRO cultures obtained for clinical purposes will identify only a small number of the patients harboring the organism. Currently, experts disagree about the extent to which active surveillance cultures should be performed, the extent to which patients should be placed in isolation, and whether healthcare facilities should track the incidence of MDRO transmission within their facility.

Prevention of antimicrobial resistance requires prevention of transmission and judicious antibiotic use to minimize the emergence of MDROs. The HAI Advisory Workgroup discussed several issues related to preventing transmission of MDROs within healthcare facilities, but could not achieve a consensus or majority opinion on the subject. Since the HAI AWG is charged with making specific and feasible recommendations to the CDHS within a specific time frame, the HAI AWG elected to focus recommendations on the area of antibiotic stewardship to reduce the pressure for the emergence of antibiotic resistant pathogens.

Recommendation 6.1
Recommendations for the judicious use of antibiotics should be developed, implemented and monitored jointly by the infection prevention and pharmacy and

DRAFT

therapeutics committees in consultation with chiefs of surgical and medical specialties, hospitalists, and intensivists.

Recommendation 6.2
Microbiologists, in consultation with infection prevention and pharmacy and therapeutics committees should develop and distribute annual antimicrobial susceptibility results (i.e., antibiograms) of common pathogens identified. The antibiogram should be based on single isolates from the same patient and be compiled according to the Clinical and Laboratory Standards Institute (CLSI) and made available to all staff and consulting physicians.

Recommendation 6.3
Empiric antibiotic therapy should be evaluated within 48 hours after being initiated. Therapeutic antibiotic therapy should be based on the antimicrobial susceptibilities of the organism identified. The duration of therapeutic antibiotic therapy should be based on recommendations from professional organizations and published studies.

Recommendation 6.4
Healthcare facilities should provide feedback to providers (surgeons and anesthesiologists) regarding compliance with recommendations on surgical antimicrobial prophylaxis. (See recommendations 7.1 – 7.10)

Recommendation 6.5
Providers should follow national guidelines for empiric antimicrobial therapy in outpatient acquired infections or provide justification when they are not followed. Healthcare facilities should consider implementing antibiotic order sets for the treatment of community-acquired pneumonia.

Recommendation 6.5
Healthcare facilities should be encouraged to share their annual antibiograms with community partners, including other healthcare facilities and the local health department, to assess the spread of MDROs and share strategies to control these organisms. Isolates may be shared with public health laboratories with the capability of applying molecular techniques to determine the extent of transmission of MDROs among facilities.

7. Recommendations for the Prevention of Surgical Site Infections

More than 70 million surgical procedures are currently performed each year in the U.S. Surgical site infections (SSI) are the most frequently reported HAI among hospitalized patients and account for a significant portion of healthcare costs. It is estimated that in the future nearly 75% of all surgical procedures will

be performed in "ambulatory", "same-day" or "outpatient" operating rooms that are not subjected to regulatory oversight, further increasing the importance of implementing SSI prevention practices.

The identification of SSI involves interpretation of clinical and laboratory findings and it is crucial that a surveillance program use standardized definitions of infection. Providing risk-adjusted rates has been shown to reduce surgeon-specific rates of SSI.

Perioperative antimicrobial prophylaxis that is safe, cost-effective, has a spectrum of action that covers most of the probable intra-operative bacterial contaminants, and achieves bactericidal tissue and serum levels at the time of skin incision should be used. Recommendations for the timing of administration are based on a study of 2,847 surgery patients at Latter-Day Saints Hospital in Salt Lake City where the lowest incidence of post-operative infection was associated with antimicrobial administration during the one hour period before the incision.

Most SSI are caused by organisms present on the patient's skin prior to surgery, therefore preventing surgical site contamination is of critical importance. Prior to applying an antiseptic skin preparation the area surrounding the intended surgical site should be free of gross soil. The prepared area should be large enough to extend the incision, create new incisions or drain sites, if necessary. There is no evidence that hair removal from a surgical site has a beneficial effect on surgical outcomes. In contrast, shaving results in breaks in the skin and increases the risk of SSI. Shaving immediately before the operation is associated with lower SSI rates compared to shaving 24 hours before the operation. Depilatory agents can cause hypersensitivity reactions that may increase the risk of SSI. If hair removal is deemed necessary by the surgeon, it should be accomplished with the use of clippers just before the skin incision.

Blood glucose and body temperature are both related to risk of SSI. Control of blood glucose (< 200mg/dl) has been shown to reduce the risk of SSI in diabetics and non-diabetic cardiothoracic surgery patients. Maintenance of perioperative normothermia has been shown to reduce the risk of SSI following elective colectomy.

Recommendation 7.1
Healthcare facilities should form a multidisciplinary committee to develop, implement and periodically evaluate compliance with policies and procedures to prevent SSI.

Recommendation 7.2
Healthcare facilities should provide surgical teams with risk stratified infection rates using the CDC definitions of an SSI infection.

DRAFT

Recommendation 7.3
Administer prophylactic antimicrobials to surgical patients according to established national guidelines. Healthcare facilities should adopt measures to ensure that: (1) physicians use the recommended prophylactic antibiotic, (2) that the prophylactic antimicrobial is administered within 1 hour before the incision (except for vancomycin which is administered two hours before the incision), (3) that only one dose of an antimicrobial is given unless the procedure is longer than the half-life of the drug and (4) the prophylactic antimicrobial is discontinued within 4 hours of the surgery.

Recommendation 7.4
Healthcare teams should remove hair when necessary from surgical site with clippers; razors should not be used.

Recommendation 7.5
Healthcare facilities should select an appropriate preoperative antiseptic skin preparation agent.

Recommendation 7.6
Healthcare teams should maintain serum glucose lower then 200mg/dl for diabetic and cardiothoracic patients during the perioperative period.

Recommendation 7.7
Healthcare teams should maintain the patient's body temperature between 36 - 39 degrees centigrade during colorectal surgery procedures.

Recommendation 7.8
Healthcare teams should use aseptic technique to prevent contamination of the open wounds; follow current Association of Operating Room Nurses (AORN) as a standard of care.

Recommendation 7.9
Healthcare facilities should use the CDC *Guideline for Hand Hygiene in Health-care Settings* when developing policies and procedures addressing surgical hand antisepsis.

Recommendation 7.10
Healthcare facilities should ensure healthcare worker compliance with current instrument cleaning, disinfecting and sterilizing procedures. Use Association for the Advancement of Medical Instrumentation standards to development policies, protocols and competencies for instrument decontamination and sterilization.

8. Recommendations for the Prevention of Ventilator-Associated Pneumonia

Ventilator-associated pneumonia (VAP) is the most common HAI in ICU patients and contributes disproportionately to both poor outcomes and the high cost of caring for critically ill patients. As many as 10% to 20% of patients receiving >48 hours of mechanical ventilation develop VAP, with a two-fold increase in mortality (attributable mortalities of 6 - 40%), an increase in hospital stay of 4 -11 days at a cost of $10,000 - $40,000 per infection.

Recommendation 8.1
Healthcare facilities should form a multidisciplinary committee that includes frontline staff to develop, implement and periodically evaluate compliance with policies and procedures to prevent VAP.

Recommendation 8.2
Healthcare facilities should implement the CDC *Guidelines for the Prevention of Healthcare Associated Pneumonia*, 2003 Category 1A and 1B recommendations related to VAP and incorporate the additional IHI recommendations found at: http://www.ihi.org/ihi including the following process recommendations:

- Elevate the head of the bed of ventilated patients to 30° to 45° (in the absence of medical contraindication) to prevent aspiration.
- Reduce sedation and analgesic administration and assess readiness to extubate the patient on a daily basis.

Recommendation 8.3
Healthcare facilities should educate health-care workers about VAP infection prevention measures.

Recommendation 8.4
Healthcare facilities should develop methods to assess healthcare worker compliance with facility policies and procedures including accountability and incentive structures.

Recommendation 8.5
Healthcare facilities should monitor rates of VAP infection using the CDC surveillance definitions for HAI pneumonia.

Recommendation 8.6
Healthcare facilities should report rates of infection and compliance with process measures internally and use the data to support VAP quality improvement efforts.

Section III. Appendices

Appendix A

Historic Overview of Infection Surveillance and Prevention Programs

Recommendations that specifically address surveillance and prevention of healthcare-associated infections (HAI) have a long history and, in fact, were the precursor to current quality and performance improvement programs. The following is a brief chronological overview:

- 1958 - American Hospital Association (AHA) Advisory Committee on Infections within Hospitals in response to a nation-wide outbreak *Staphylococcus aureus* infection primarily in newborn infants recommended the implementation of infection surveillance programs;
- 1970 - Centers for Disease Control and Prevention (CDC) recommended that hospitals hire and train nurses and hospital epidemiologists;
- 1976 – Joint Commission Accreditation of Healthcare Organizations (JCAHO) published the first standards for organization, surveillance, reporting, evaluation, record maintenance, and other infection surveillance and prevention activities as a condition of accreditation.
- 1983 – CDC completed the Study on the Efficacy of Nosocomial Infection Control (SCENIC) project which demonstrated an overall 32% reduction in HAI infections involving 4 major sites (respiratory, surgical wound, urinary and respiratory tract) in hospitals with trained hospital epidemiologists (physicians) and professional nurses who coordinated high-intensity surveillance and prevention programs.
- 1998 - The national benchmark consensus panel report, *Infrastructure, Category Requirements and Essential Infection Control Activities* was published in the Society for Healthcare Epidemiology of America (SHEA) journal (ICHE, Feb.1998). The SHEA consensus panel convened in July 1996 and the report including the recommendations was endorsed by panel members representing JCAHO, AHA, the CDC, the Association for Professionals in Infection Control and Epidemiology (APIC) and other professional organizations.
- 1999 - CDC incorporated the consensus panel recommendations for specific activities/functions that, when fully implemented, assure compliance with and reflect JCAHO requirements. The seven essential functions include:
    1. Managing Critical Data and Information
    2. Setting and Recommending Policies and procedures
    3. Compliance with Regulations, Guidelines and Accreditation Requirements
    4. Intervening Directly to Prevent Transmission of Infectious Diseases
    5. Education and Training of Healthcare Workers

6. Personnel Support
7. Non-personnel Support

- 2000-"To Err is Human" was published by the Institute of Medicine, giving rise to a renewed emphasis on patient safety with particular attention to prevention of HAI
- 2001- Agency for Healthcare Research and Quality (AHRQ) issued a report entitled Making Health Care Safer: A Critical Analysis of Patient Safety Practices which recommended 79 evidence-based patient-safety practices. Seven of these practices involved infection control or prevention and were judged worthy of widespread implementation based on the strength of the evidence:
    1. Practices to improve hand washing compliance
    2. Barrier precautions
    3. Changes in antibiotic use
    4. Prevention of healthcare associated urinary tract infections
    5. Prevention of intravascular catheter associated Infections
    6. Prevention of ventilator-associated pneumonia
    7. Prevention of Surgical Site Infections
- 2005-Centers for Medicare and Medicaid Services (CMS) Conditions of Participation and Conditions for Coverage reinforced that health care organizations must meet to participate in the Medicare and Medicaid programs. These standards are used to improve quality and protect the health and safety of beneficiaries.
- 2005- CDC's Healthcare Infection Control Practices Advisory Committee (HICPAC) issued a guidance document to assist policymakers, program planners, consumer advocacy organizations, and others tasked with designing and implementing public reporting systems for HAIs. HICPAC recommended that persons who design and implement such systems:
    1. Use established public health surveillance methods when designing and implementing mandatory HAI reporting systems
    2. Create multidisciplinary advisory panels, including persons with expertise in the prevention and control of HAIs, to monitor the planning and oversight of HAI public reporting systems
    3. Choose appropriate process and outcome measures based on facility type and phase in measures to allow time for facilities to adapt and to permit ongoing evaluation of data validity
    4. Provide regular and confidential feedback of performance data to healthcare providers.

  HICPAC recommended that states establishing public reporting systems for HAIs select one or more of 5 specific process or outcome measures as appropriate for hospitals or long-term care facilities in their jurisdictions.
- 2005 - JCAHO issued revised standards for hospital infection control programs.
- 2005-Institute of Healthcare Improvement (IHI) The Institute for Healthcare Improvement (IHI), a non-profit organization founded in 1991, has been

DRAFT

the catalyst for nation wide changes to improved patient outcomes in the U.S. The goal of IHI is to promote saving a specified number of lives (100,000 between January 2005 and July 2006) through the adoption of evidenced based practices and procedures that can improve patient outcomes. According to Donald Berwick, MD, President and CEO of IHI, as of September of this year 2800 hospitals (half of all US acute care hospitals) had joined the campaign. The three infection prevention related bundles recommended by IHI for implementation include:

- Central line associated infections;
- Surgical site infections; and
- Ventilator associated pneumonia.

Appendix B

List of Selected References

1. Burke, J. Infection Control – A Problem for Patient Safety. N Engl J Med 2003; 348;7: 651-656.
2. Eggimann P. Infection control in the ICU. Chest, 2001;120: 2059-93.
3. Scheckler WE, Buck AS, Farr BM, et al. Requirements for Infrastructure and Essential Activities of Infection Control and Epidemiology in Hospitals: A Consensus Panel Report. Infect Control Epidemiology 1998. 19: 114-124.
4. Weinstein R. Nosocomial infection update. Emerg Infect Dis. 1998; 4: 416-20.
5. Wenzel, R., The economics of nosocomial infection. J Hosp Infect, 1995; 31: 79-87.
6. Center for Disease Control and Prevention, Public Health Focus: Surveillance, Prevention, and Control of Nosocomial Infections. 1992; 41(42): 783-787.
7. Coffin SE, Infection Control, Hospital Epidemiology, and Patient Safety. Infect Dis Clin 2005; 19:647-665.
8. Society for Healthcare Epidemiology. Position paper: an approach to the evaluation of quality of the outcome of care in hospitalized patients, with a focus on nosocomial infection indicators. Infect Control Hosp Epidemiology. 1995; 16: 308-316.
9. Wong ES, Mermel, RM, Perl TM, et al. Public Disclosure of Healthcare-Associated Infections: The Role of the Society for Healthcare Epidemiology of America. Infection Control and Hospital Epidemiology. 2005: 210-212.
10. McKibben L, Tokars JI, et al, Guidance on public reporting of healthcare-associated infections: recommendations of the Healthcare Infection Control Practices Advisory Committee. Am J Infect Control 2005; 33(214-26).
11. Weinstein RA, Brennan PJ, Infection-Control Report Cards-Securing Patient Safety. N Enl J Med. 2005; 353(3): 225-227.
12. Armstrong GL, Pinner RW. Trends in factious disease mortality in the United States during the 20th century. JAMA 1999; 281 (1): 61-6.
13. National Nosocomial Infections Surveillance System Report, data summary from January 1992 through June 2004. Am J Infect Control 2004; 32: 470-85.
14. Pestonik SL, Evans RS, Burke JP. Implementing Antibiotic Practice Guidelines Through Computer-Assisted Decision Support. Ann Intern Med 1996; 124: 884-890.
15. Yates, R., New intervention strategies for reducing antibiotic resistance. Chest 1999; 115: 24S-27S.

16. Shlaes DM, John JF, Craig WA, Bornstein DL, et al, Society for Healthcare Epidemilogy of America and Infectious Diseases Society of America Joint Committee on the Prevention of Antimicrobial Resistance: Guidelines for the Prevention of Antimicrobial Resistance in Hospitals. Infect Control Hosp Epidemiol 1997; 18: 275-291.
17. Byers KE, D.L., Simonton BM, Anglim AM, Adal KA, Farr, BM. Disinfection of hospital rooms contaminated with vancomycin-resistant Enterococcus faecium. Infect Control Hosp Epidemiol 1998; 19: 261-264.
18. Shojania KG, McDonald KM, Wachter RM, Markowitz AJ, Making healthcare safer: A critical analysis of patient safety practices. Evid Rep Technol Assess (Summ) 2001; 43: i-x, 1-668.
19. Garner JS. Guideline for isolation precautions in hospitals. Infect Control Hosp Epidemiol 1996; 17: 53-80.
20. Kim PW, R, Perencevich EN, Harris AD. Rates of hand disinfection associated with glove use, patient isolation, and changes between exposure to various body sites. Am J Infect Control 2003; 31(2): p. 97-103.
21. Pittet D. Hand hygiene and patient care: pursuing the Semmelweis legacy. Lancet Infect Dis 2001; 1: 9-20.
22. Greco PJ. Changing physicians' practices [letter]. N Engl J Med; 1993(329): 1271-1274.
23. Gerding DN, Hughes RA, et al. Aminoglycoside Resistance and Aminoglycoside Usage; Ten Years of Experience in One Hospital. Antimicrobial Agents and Chemotherapy 1991: 35; 1284-1290.
24. Chamot E, et al. Effectiveness of combination antimicrobial therapy for Pseudomonas aeruginosa bacteermia. Antimicrob Agents Chemother, 2003; 47(9): 2756-64.
25. Malangoni, M. Single versus combination antimicrobial therapy for Ventilator-associated pneumonia. Am J Surgery 2000; 179(2 Suppl 1) 58-62.
26. Ballow CH. Tends in antibiotic utilization and bacterial resistance: report of the National Nosocomial Resistance Surveillance Group. Diagn Microbiol Infect Dis 1992; 15: 37S-42S.
27. Rahal JJ, Horn D, et al, Class restriction of cephalosporin use to control total cephalosporin resistance in nosocomial Klebsiella. JAMA 1998; 280: 1233-1237.
28. Quale J, L.D., Saurina G, et al, Manipulation of a hospital antimicrobial formulary to control an outbreak of vancomycin-resistant enterococci. Clin Infect Dis 1996; 23: 020-1025.
29. Kollef, M., Prevention of hospital-associated pneumonia and ventilator-associated pneumonia. Crit Care Med 2004; 32:1396-1405.
30. Collard HR, Matthay MA. Prevention of Ventilator-Associated Pneumonia: An Evidence-Based Systematic Review. Ann Intern Med 2003; 138: 494-501.
31. Chastra, F. Ventilator-associated Pneumonia. Am J Respir Criti Care Med 2002; 165: 867-903.

32. Osmon SB. Prevention of Pneumonia in the Hospital Setting. Clin Chest Med 2005; 26:135-142.
33. Raymond DP, Sawyer RG. Preventing Antimicrobial-Resistant Bacterial Infections in Surgical Patients. Surg Infect 2002; 3(4): 375-85.
34. Antonelli M, Rocco M, et al. A comparison of noninvasive positive-pressure ventilation and conventional mechanical ventilation in patients with acute respiratory failure. N Engl J Med 1998; 339: 429-35.
35. Girou E, Taille S, et al. Secular trends in nosocomial infections and mortality associated with noninvasive ventilation in patients with exacerbation of COPD and pulmonary edema. JAMA 2003; 290: 2985-91.
36. Cook DJ, Cook RJ, et al, Incidence of and risk factors for ventilator-associated pneumonia in critically ill patients. Ann Intern med 1998; 129: 433-40.
37. Ely EW, Haponik EF, et al. Mechanical ventilator weaning protocols driven by non-physician health-care professionals: evidence-based clinical practice guidelines. Chest 2001; 120: 454S-63S.
38. Kollef, M. Ventilator-associated pneumonia. A multivariate analysis. JAMA 1993; 270:1965-70.
39. Mahul P, Jospe R, et al. Prevention of nosocomial pneumonia in intubated patients: respective role of mechanical subglottic secretions drainage and stress ulcer prophylaxis. Intensive Care Med 1992; 18: 20-5.
40. Valles J, A.A., Rello J, et al, Continous aspiration of subglottic secretions in preventing ventilator-associated pneumonia. Ann Intern Med 1995; 122: 179-86.
41. Kollef MH, Sundt TM. A randomized clinical trial of continuous aspiration of subglottic secretions in cardiac surgery patients. Chest 1999; 116:1339-46.
42. Smulders K, Weers-Pothoff I, et al. A randomized clinical trail of intermittent subglottic secretion drainage in patients receiving mechanical ventilation. Chest 2002; 121: 858-62.
43. Heyland DK, Dhaliwal R, Greenwood J. Optimizing the benefits and minimizing the risk of enteral nutrition in the critically ill; role of small bowel feeding. (Review.) J Parenter Enteral Nutr 2002; 26(6Suppl): S51-5; discussion S56-7.
44. Nathans AB. Selective decontamination of the digestive tract in surgical patients: a systematic review of the evidence. Arch Surg 1999; 134: 170-6.
45. D'amico R, Leonetti C, Torri V, Tinazzi A, Liverati A. Effectiveness of antibiotic prophylaxis in critically ill adult patients: systematic review of randomized controlled trials. BMJ 1998; 316: 1275-85.
46. Hurly, J., Prophylaxis with enteral antibiotics in ventilated patients: selective decontamination or selective cross-infection? Antimicrob Agents Chemother 1995; 39: 941-7.
47. Heyland DK, Jaeschke R, Griffith L, et al. Selective decontamination of the digestive tract. An overview. Chest 1994; 105:1221-9.

48. Dreyfuss D, Gros I, et al. Mechanical ventilation with heated humidifiers or heat and moisture exchangers: effects on patient colonization and incidence of nosocomial pneumonia. Am J Respir Crit Care Med 1995; 151: 986-92.
49. Messor A, Vaiani M, Gorini M, Corrado A. Bleeding and pneumonia in intensive care patients given ranititidine and sucralfate for prevention of stress ulcer: meta-analysis of randomized controlled trials. BMJ 2000;. 321:1103-1106.
50. Tryba M. Gastric alkalinzation, pneumonia, and systemic infections: the controversy. Scan J Gastroenterol Suppl 1995; 210: 53-9.
51. Tryba, M. Sucralfate versus antacids or H2-antagoinsts for stress ulcer porphylaxis: a meta-analysis on efficacy and pneumonia rate. Crit Care Med, 1991; 19:942-9.
52. Cook, D. Stress ulcer prophylaxis:gastrointestinal bleeding and nosocomial pneumonia. Best evidence synthesis. Scand J Gastro Suppl, 1995; 210: 48-52.
53. Cook DJ, Guyatt GH, Heyland DK, Griffith LE, Buckingham L, et al. Stress ulcer prophylaxis in critically ill patients. Resolving discordant meta-analyses. JAMA 1996; 275: 308-314.
54. Nichol KL, Mulloly J, Lask R, Fillbrandt, K, Iwane, M. Influenza Vaccination and Reduction in Hospitalizations for Cardiac Disease and Stroke among the Elderly. N Engl J Med 2003; 348(14): 1322-32.
55. Vamvakas, E. Transfusion-associated cancer recurrence and postoperative infection: Meta-analysis of randomized, controlled clinical trails. Transfusion 1996; 36: 175-186.
56. Taylor RW, O'Brien J. Impact of allogenic packed red blood cell transfusion on nosocomial infection rates in the critically ill patient. Crit Care Med 2002; 30: 2249-2254.
57. Tang R, Wang YL. Risk factors for surgical site infection after elective resection of the colon and rectum: A single center prospective study of 2,809 consecutive patients. Ann Surg 2001; 234:181-199.
58. Shorr AF, Kelly DM, Kollef MH. Red blood cell transfusion and ventilator-associated pneumonia. A potential link? . Crit Care Med 2004; 32(3): 666-74.
59. Dellinger EP, H.S., Bratzler DW, Johnson RM, Daniel DM, Bunt DM, Baumgarner GA, Sugarman JR, Hospital collaborate to decrease surgical site infections. Am J Surgery, 2005. 190: p. 9-15.
60. Nichols, R.L. Preventing Surgical Site Infections: A Surgeon's Perspective. Emergin Infectious Diseases 2001; 7(2): 220-224.
61. Bratzler DW. Antimicrobial prophylaxis for surgery: an advisory statement from the National Surgical Infection Prevention Project. The American Journal of Surgery 2005; 189: 395-404.
62. Burke, J. The effective period of preventive antibiotic action in experimental incision and dermal lesions. Surgery 1961; 50: 61-8.
63. Nichols, R.L. Preventing Surgical Site Infection. Clinical Medicine & Research 2004; 2(2):115-118.

64. Barie, P. Surgical Site Infections: Epidemiology and Prevention. Surgical Infections 2002; 3 Supplement: S9-S21.
65. Mangram AJ, Pearson ML, Silver LH, Jarvis WR. Guideline for Prevention of Surgical Site Infection. Infection Control and Hospital Epidemiology 1999; 20(4):247-278.
66. Cardo DM, Mayhall CG. Validation of surgical wound surveillance. Infect Control Hosp Epidemiology 1993; 14: 211-215.
67. Saint S, Lipsky BA The clinical and economic consequences of nosocomial central venous catheter-related infection: are antimicrobial catheters useful? Infect Control Hosp Epidemiology 2000; 21: 375-380.
68. Byers K, et al., Case fatality rate for catheter-related bloodstream infections (CRSBI): a meta-analysis [abstract43]. In: Proceedings of the 5th annual meeting of the Society for Hospital Epidemiology of America, 1995.
69. Wenzel RP, E.M. The Impact of Hospital-Acquired Bloodstream Infections. Emerg Infect Dis 2001; 7(2): 174-177.
70. O'Grady NP, Dellinger EP, Gerberding JL, Heard SO, et al. Guidelines for the prevention of intravascular catheter-related infections. Centers for Disease Control and Prevention. MMWR 2002; 51(RR-10): -29.
71. van der Wouden et al. Preventing influenza: An overview of systematic reviews. Respiratory Medicine, 2005. In Press, Corrected Proof.
72. Salgado CD, et al. Influenza in the acute hospital setting. The Lancet Infectious Diseases 2002; 2:145-155.
73. Thompson WW, S.D., Weintraub E, et al. Mortality associated with influenza and respiratory syncytial virus in the United States. JAMA 2003; 289: 179-86.
74. Stott DJ, Carman WF. Nosocomial transmission of influenza. Occup Med 2002; 52(5): 249-53.
75. Heimberger T, et al. Knowledge and attitudes of healthcare workers about influenza: why are they not getting vaccinated? Infect Control Hosp Epidemiol 1995; 16: 412-15.
76. Centers for Disease Control and Prevention. Interventions to Increase Influenza Vaccination of Health-Care Workers --- California and Minnesota. MMWR 2005; 54(8):196-9.
77. CDC National Nosocomial Infection (NNIS) System Report, Data Summary from January 1992-June 2001, Issued August 2001. Am J Infec Control 2000:29;404-21
78. Institute of Medicine. Microbial threats to health emergence, detection, and response. Washington, DC: National Academies Press 1998.
79. Muto, et al. SHEA Guideline for Preventing Nosocomial Transmission of Multidrug-Resistant Strains of Staphylococcus aureus and Enterococcus.
80. CDC. Campaign to prevent antimicrobial resistance in healthcare settings.
81. Kollef, et al. Inadequate Antimicrobial Treatment of Infections. A Risk Factor for Hospital Mortality Among Critically Ill Patients. Chest 1999:115;464-474
82. http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5408a1.htm

83. http://www.cdc.gov/ncidod/hip/flu_vac.htm
84. http://www.publichealth.va.gov/flu/flu_toolkit.htm
85. ACIP/HICPAC Guideline on Influenza Vaccination of Healthcare Workers (In Press)
86. Bridges CB, Kuehnert MJ, Hall CB. Transmission of influenza: Implications for control in healthcare settings. Clin Infect Dis 2003;37:1094-1101.
87. What can Healtcare workers do to prevent infections in healthcare settings? http://www.cdc.gov/ncidod/hip/prevention_week.htm
88. Guidelines for Preventing Health-Care Associated Pneumonia, 2003, Recommendation of CDC and the Healthcare Infection Control Practices Advisory Committee, MMWR, March 26, 2004/Vol.53/No. RR-3.
89. American College of Surgeons. Manual on Control of Infection in Surgical Patients, Second Edition. Philadelphia: J.B. Lippincott Company, 1984.
89. Association of PeriOperative Registered Nurses. Standards, Recommended Practices, and Guidelines, 2005 Edition. Denver: AORN Publications, 2005. (copy not available in binder)
90. Pryor KO, Fahey TJ, Lien CA, Goldstein PA. "Surgical Site Infection and the Routine Use of Perioperative Hyperoxia in a General Surgical Population." JAMA, 2004. 291:79-87.
91 Choksey MS, Malik IA. "Zero tolerance to shunt infections: can it be achieved?." J Neurol Neurosurg Psychiatry 2004. 75:87-91.
92 Parienti JJ, Thibon P, Heller R, Le Roux Y, Theobald P, Bensadoun H, Bouvet A, Lemarchand F, Le Coutour X. "Hand-Rubbing With an Aqueous Alcoholic Solution vs. Traditional Surgical Hand Scrubbing and 30-Day Surgical Site Infection Rates." JAMA, 2002. 288:722-727.
93 Morikane K, Nishioka M, Tanimura H, Noguchi H, Konishi T, Kobayashi H. "Using Surveillance Data to Direct Infection Control Efforts to Reduce Surgical-Site Infections Following Clean Abdominal Operations in Japan." Infection Control and Hospital Epidemiology, 2002. 23(7):404-6.
94. Geubbels E, Wille J, Nagelkerke N, Vandenbroucke-Grauls C, Grobbee D, de Boer A. "Hospital-Related Determinants For Surgical-Site Infection Following Hip Arthroplasty." Infection Control and Hospital Epidemiology, 2005. 26(5):435-441.
95. Janelle J, Howard R, Fry D. "Surgical Site Infections". Association for Professionals in Infection Control and Epidemiology, 2005. 23:1-10.
96. Mangram A, Horan T, Pearson M, Silver L, Jarvis W, "The Hospital Infection Control Practices Advisory Committee. Guideline for Prevention of Surgical Site Infection, 1999". Infection Control and Hospital Epidemiology, 1999. 20(4):247-278.
97. Church, Nancy. "Surgical Services". Association for Professionals in Infection Control and Epidemiology, 2005. 23:1-10.
98. "Measure Information Form SIP-1, 2, 3." Specifications Manual for National Hospital Quality Measures.

99. "Prevention of Surgical Site Infection." Institute For Healthcare Improvement, WWW.IHI.ORG.
100. Denault A, Frechette D. "Prevention: Supplemental Oxygen Reduces the Incidence of Surgical-Wound Infection." Can J Anesth, 2001. 48(9):844-846.
101. Dellinger EP, Hausmann S, Bratzler D, Johnson R, Daniel D, Bunt K, Baumgardner G, Sugarman J. "Hospitals Collaborate to Decrease Surgical Site Infections." American Journal of Surgery, 2005. 190(2005)9-15.
102. Mayzler O, Weksler N, Domchik S, Klein M, Mizrahi S, Gurman G. "Does Supplemental Perioperative Oxygen Administration Reduce the Incidence of Wound Infection in Elective Colorectal Surgery?." Minerva Anestesiologica, 2005. 71:21-5.
103. Geubbels E, Bakker H, Houtman P, van Noort-Klaassen, Pelk M, Sassen T, Wille J. "Promoting Quality Through Surveillance of Surgical Site Infections: Five Prevention Success Stories." American Journal of Infection Control, 2004. 32(7):424-430.
104. Nichols, Ronald. "The Operating Room." Hospital Infections. Boston: Little, Brown, 1992. Pg. 461-473.
105. Cavanillas A, Rodriguez-Contreras R, Rodriguez M, Abril O, Gigosos R, Solvas J, Vargas R. "Preoperative Stay as a Risk Factor for Nosocomial Infection." European Journal of Epidemiology, 1991. 7(6):670-6.
106. Hernandez K, Ramos E, Seas C, Henostroza G, Gotuzzo E. "Incidence of and Risk Factors for Surgical-Site Infections in a Peruvian Hospital." Infection Control and Hospital Epidemiology, 2005. 26(5):473-477.
107. Lathan R, Lancaster A, Covington J, Pirolo J, Thomas C. "The Association of Diabetes and Glucose Control With Surgical-Site Infections Among Cardiothoracic Surgery Patients." Infection Control and Hospital Epidemiology, 2001. 22(10):607-612.
108. Minnema B, Vearncombe M, Augustin A, Gollish J, Simor A. "Risk Factors For Surgical-Site Infection Following Primary Total Knee Arthroplasty." Infection Control and Hospital Epidemiology, 2004. 25(6):477-480.
109. Barie, Philip. "Surgical Site Infections: Epidemiology and Prevention." Surgical Infections. 2002. Volume 3, S9-S21.
110. Sehulster LM, Chinn RYW, Arduino MJ, Carpenter J, Donlan R, Ashford D, Besser R, Fields B, McNeil MM, Whitney C, Wong S, Juranek D, Cleveland J. Guidelines for environmental infection control in health-care facilities. Recommendations from the CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). Chicago IL; American Society for Healthcare Engineering/American Hospital Association; 2004
111. Leapfrog http://www.leapfroggroup.org/home
112. NQF http://www.qualityforum.org/
113. IHI http://www.ihi.org/ihi

114. CDC, Reductions in central line-assocaited bloodstream infections amongst patients in intensive care units-Pennyslvania, April 2001-March 2004. MMWR, October 14, 2005/54/(40):1013-1016.
115. O'Grady NP, Alexander M, Dellinger EP, Gerberding JL, Heard SO, Maki DG, Masur H, McCormick RD, Mermal LA, Pearson ML, Raad II, Randolph A, Weinstein RA, Guidelines for the prevention of intravascular catheter-related infections. Centers for Disease Control and Prevention. MMWR, 2002. (RR-10):
116. Samandari T, Malakmadze N, Balter S, Perz J, Khrishova M, Swetnam L, Bornschlegel K, Phillips M, Poshni I, Nautiyal P, Nainan D, Bell B, Williams, I. A large outbreak of hepatitis B virus infections associated with frequent injections in physician's office. Infection Control and Hospital Epidemiology, 2005. 9:945-751.
117. Savey A, Simon F, Ozopet J, lepoutre A, Fabry J, Desenclos JC. A large nosocomial outbreak of hepatitis C virus infections at a hemodialysis center. Infection Control and Hospital Epidemiology, 2005. 9:752-761.
118. Pearson ML. Guideline for prevention of intravascular device-related infections. Part I. Intravascular device-related infections: an overview. The Hospital Infection Control Practices Advisory Committee. Am J Infect Control 1996;24:262--77.
119. Mermel LA. Prevention of intravascular catheter-related infections. Ann Intern Med 2000;132:391--402.
120. CDC. National Nosocomial Infections Surveillance (NNIS) System report, data summary from October 1986--April 1998, issued June 1998. Am J Infect Control 1998;26:522--33.
121. Digiovine B, Chenoweth C, Watts C, Higgins M. The attributable mortality and costs of primary nosocomial bloodstream infections in the intensive care unit. Am J Respir Crit Care Med 1999;160:976--81.
122. Rello J, Ochagavia A, Sabanes E, et al. Evaluation of outcome of intravenous catheter-related infections in critically ill patients. Am J Respir Crit Care Med 2000;162:1027--30.
123. Soufir L, Timsit JF, Mahe C, Carlet J, Regnier B, Chevret S. Attributable morbidity and mortality of catheter-related septicemia in critically ill patients: a matched, risk-adjusted, cohort study. Infect Control Hosp Epidemiol 1999;20:396--401.
124. Collignon PJ. Intravascular catheter associated sepsis: a common problem. The Australian Study on Intravascular Catheter Associated Sepsis. Med J Aust 1994;161:374--8.
125. Pittet D, Tarara D, Wenzel RP. Nosocomial bloodstream infection in critically ill patients. Excess length of stay, extra costs, and attributable mortality. JAMA 1994;271:1598--601.
126. Dimick JB, Pelz RK, Consunji R, Swoboda SM, Hendrix CW, Lipsett PA. Increased resource use associated with catheter-related bloodstream infection in the surgical intensive care unit. Arch Surg 2001;136:229--34.
127. Mermel LA. Correction: catheter related bloodstream-infections. Ann Intern Med 2000;133:395.

128. Kluger DM, Maki DG. The relative risk of intravascular device related bloodstream infections in adults [Abstract]. In: Abstracts of the 39th Interscience Conference on Antimicrobial Agents and Chemotherapy. San Francisco, CA: American Society for Microbiology, 1999:514.
129. McKebben L, Horan T, Tolames J, Fowler G, Cardo D, Paerson M, Brennan D. Guidance on public reporting of healthcare-associated infections: Recommendations of the Healthcare Infection Control Practices Advisory Committee. AJIC,2005. 4:217-225.

DRAFT

Appendix C

Glossary of Abbreviations

AHRQ	Agency for Healthcare Research and Quality
APIC	Association for Professionals in Infection Control and Epidemiology
AWG	Advisory Working Group
BSI	Bloodstream infections
CDC	Centers for Disease Control and Prevention
CVC	Central venous catheters
DHS	California Department of Health Services
HAI	Healthcare Associated Infections
HICPAC	CDC's Hospital Infection Control Practices Advisory Committee
JCAHO	Joint Commission on Accreditation of Healthcare Organizations
LHD	Local Health Departments
MDRO	Multi-drug resistant organisms
MRSA	Methicillin-Resistant Staphylococcus Aureus
SHEA	Society for Healthcare Epidemiology of America
SSI	Surgical site infections
VAP	Ventilator-associated pneumonia