



Healthcare Infection Control Practices Advisory Committee

February 12-13, 2009
Atlanta, Georgia

SAFER • HEALTHIER • PEOPLE™



Clinical and Environmental Laboratory Branch

HICPAC Update

SAFER • HEALTHIER • PEOPLE™



New Activity

- 2006 DTBE convened an expert consultation on the role of CDC with regard to NTM.
 - The consultant's recommendations requested increased support in three areas: epidemiology and surveillance, laboratory issues and environmental issues.
- 2008 CCID OD held an internal meeting to determine a suitable home for the NTM
- Nontuberculous mycobacteria reference identification and typing to be transferred to DHQP from DTBE
- MOU being developed DTBE will transfer 1FTE and salary, the HPLC system (Beckman System Gold), pattern libraries, and continued support



VRSA

“It Takes Two to Tango”



- VRSA likely occurs because a *vanA* plasmid in VRE transfers to *S. aureus* by conjugation
- What do we know about the VRE donor:
 - In Michigan VRSA (7/9 US VRSA), the donor is VR *E. faecalis* carrying *vanA* on an Inc18-like (broad-host range, conjugative plasmid)
 - VRE with Inc18-like *vanA* plasmids are found more frequently in MI VRE than VRE from other locations (JB Patel et al. ICAAC 2008)



Can We Predict Which *S. aureus* will be *vanA* Recipients?

- In vitro conjugation studies indicate that Inc18-like *vanA* plasmid transfer to *S. aureus* when:
 - The *S. aureus* isolate contains a pSK41-like plasmid or
 - The conjugation is performed in the presence of culture filtrate of *S. aureus* containing a pSK41-like plasmid
- Mechanism?
 - pSK41-like plasmids produces a pheromone-like peptide which may facilitate conjugation with *Enterococcus* spp.



Bacterial Characterization, Typing, and Identification Team (BACTi)



Staphylococcus aureus:

- Evaluation of spa typing and T5000 (PCR-mass spec) system for strain typing
- Evaluation of best sites and best methods for detecting *S. aureus* colonization with "CA-MRSA" strains

Clostridium difficile

- Evaluation of strains from community-associated *C. difficile* infection
- Improvement of PFGE protocol: shortened from 1 week to 2 days
- Gearing up for study of *C. difficile* collected as part of EIP national surveillance activity



Environmental and Applied Microbiology Team



- Effectiveness of point of use monochloramine disinfection in controlling *Legionella pneumophila* and *Mycobacterium spp.*
- Completed evaluation of mycobacteria intervention study at a SNF evaluating shock chlorination and use of point of use filters
- Structural analysis of biofilm formation by rapidly and slowly growing nontuberculous mycobacteria
 - RGMs biofilm development was influenced more by nutrient level than substrate material
 - MAC is better adapted for growth in potable water systems than in laboratory incubation conditions
 - MAC has over RGM in low nutrient environments.



Water Safety Funded FY09 Projects

- Influence of Amoeba on Chlorine Efficacy against Pathogens Residing in Water Distribution System
- Evaluation of shock chlorination and chloramination for pathogen control in biofilms



Preparedness Research Rapid Susceptibility

- Develop, evaluate, and validate a real-time PCR method to detect resistance to antimicrobial agents
 - Rapid MIC test for *Bacillus anthracis* utilizing rv-PCR tested against 14 different
 - Growth parameters: medium, inoculum, and incubation temperature are based on CLSI guidelines
 - Does not rely on detection of specific genes or mutations

Preparedness Research

- LRN Swab Protocol for recovery of *Bacillus anthracis* from smooth nonporous surfaces
- LRN Etest method for *Yersinia pestis*
- Disinfection of *Burkholderia pseudomallei* in potable water





Update: National Healthcare Safety Network (NHSN)

Daniel Pollock
Surveillance Branch
Division of Healthcare Quality Promotion

HICPAC Meeting
February 12, 2009

SAFER • HEALTHIER • PEOPLE™

NHSN Update



- Growth continues: 2146 facilities in 48 States as of February 10, 2009
- More mandates: 19 States use NHSN as infrastructure for mandatory reporting
- New functionality: Central Line Insertion Practices and High Risk Patient Influenza Vaccination Coverage
- Current pilot: Hemovigilance module
- Forthcoming modules: Multidrug-Resistant Organism and *Clostridium difficile* Associated Disease and Healthcare Personnel Safety
- Definition reviews and changes: Urinary Tract Infection and Pneumonia
- Advances in electronic surveillance: Reporting via electronic messages and electronic documents



MDRO and CDAD Modules



- All Module documentation and guidance (i.e., protocol, data collection forms, instructions, training presentations, etc.) are posted to the NHSN website
- Some facilities affiliated with state reporting mandates or specific initiatives (i.e., CMS 9th SOW) have already begun to collect data on paper forms in anticipation of the pending launch
- Important change to the Module's requirements: Facilities no longer have to conduct Infection Surveillance in at least one unit to meet Module minimum requirements, but can now choose between Infection Surveillance or LabID Event reporting to meet the minimum requirement



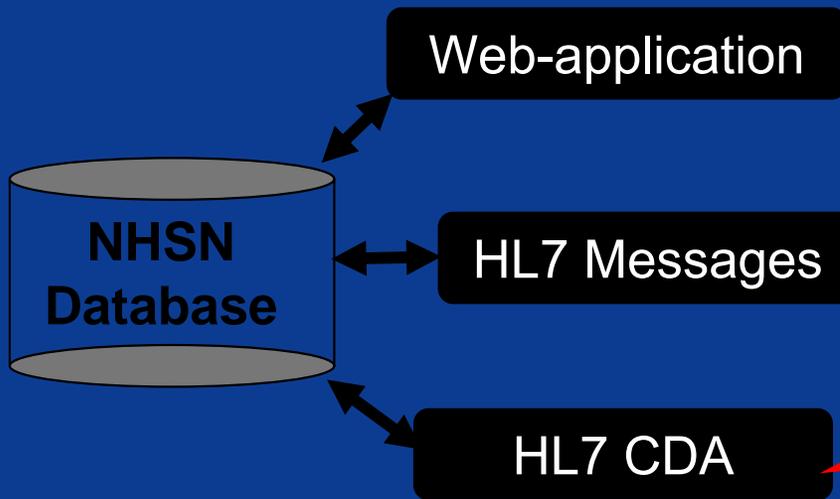
NHSN Definitions

Urinary Tract Infection – Definition changes

- Asymptomatic bacteriuria no longer a NHSN infection
- Reduced the time period to associate indwelling catheter usage with UTI from 7 days to 48 hours
- Removed symptoms common to presence of indwelling catheter and not specific to UTI
- Changes applied starting January 2009

Pneumonia – Definition under review

Relationship of NHSN to CDC's BioSense and ONC's Strategy for a Nationwide Health Information Network (NHIN)



Data flows to CDC's National Healthcare Safety Network (NHSN) via manual data entry in a web-based application or electronic reporting via Health Level Seven (HL7) messages and Clinical Document Architecture (CDA) reports.

BioSense Program

Provides technical infrastructure for HL7 messaging of laboratory results, admission/discharge/transfer, and pharmacy data from hospitals to NHSN.

Office of National Coordinator - NHIN
Provides a national strategy and technical framework for interoperable systems in which electronic messages and documents, such as those used in NHSN, enable data exchanges between healthcare and public health and provide a foundation for electronic health record systems and State and regional Health Information Exchanges (HIEs).

NHSN Members Page - Current

[Home](#) | [About CDC](#) | [Press Room](#) | [A-Z Index](#) | [Contact Us](#)



Department of Health and Human Services
Centers for Disease Control and Prevention

[CDC en Español](#)

Search:

[Infection Control Home](#) > [Protecting Patients](#) > [Surveillance](#) >

National Healthcare Safety Network (NHSN)

[Overview](#)

[How to Enroll](#)

**NHSN
Members**

NHSN Members Page

What's New

- > [Biovigilance Component / Hemovigilance Module](#)
- ↓ [NHSN Report 2008](#)
November 2008 (2.95 MB / 18 pages)
- > [High Risk Inpatient Influenza Vaccination Module Training Course](#)
- > [NHSN Central Line Insertion Practices \(CLIP\) Training Course](#)
- > [NHSN Patient Safety Component Specific Event Criteria Training Course](#)
- ↓ [CDC/NHSN surveillance definition of health care-associated infection and criteria for specific types of infections in the acute care setting](#)
June 2008 (1.33MB / 24 pages)

Recently Updated

- ↓ [The Health Insurance Portability and Accountability Act \(HIPAA\) Privacy Rule](#)
Slide presentation PDF (86KB/ 12 slides), [Text only version](#).
- > [FAQ's about HIPAA Privacy Rule](#)
August 2008
- ↓ [NHSN Manual: Patient Safety Protocols](#)
January, 2008 (1.21 MB / 98 pages)
- ↓ [Importing Patient Safety Procedure Data v1.3.5.8](#) (138 KB / 8 pages)

Resources

- > [NHSN Document Library](#)
- > [Newsletters](#)
- > [Training](#)

[Printer-friendly version](#)

Infection Control Topics

- > [Infection Control Home](#)
- > [Healthcare-Associated Infections](#)
- > [Protecting Patients](#)
- > [Protecting Healthcare Workers](#)
- > [Infection Control Guidelines](#)
- > [Infection Control A-Z](#)
- > [About DHQP](#)

NHSN Resources

- > [Document Library](#)
- > [Newsletters](#)
- ↓ [NHSN Report 2006](#)
AJIC, PDF (285KB, 12 pages)
- > [Training](#)
- > [Contact Us](#)



NHSN Members Page - Future

National Healthcare Safety Network (NHSN) (Theme = teal)

The National Healthcare Safety Network (NHSN) is a voluntary, secure, internet-based surveillance system that integrates and expands legacy patient and healthcare personnel safety surveillance systems managed by the Division of Healthcare Quality Promotion (DHQP) at CDC. NHSN also includes a new component for hospitals to monitor adverse reactions and incidents associated with receipt of blood and blood products. Enrollment is open to all types of healthcare facilities in the United States, including acute care hospitals, long term acute care hospitals, psychiatric hospitals, rehabilitation hospitals, outpatient dialysis centers, ambulatory surgery centers, and long term care facilities. For more information, click on the topics below.



Text size: [S](#) [M](#) [L](#) [XL](#)

[Email page](#)

[Print page](#)

[Bookmark and share](#)

[Get NHSN email updates](#)

[Get email updates](#)

To receive email updates about NHSN, enter your email address:

[What's this?](#)

Topics

<p>About NHSN Overview, Confidentiality, How data is used...</p>	<p>Patient Safety Component Overview, Procedure, Device, Medication-associated, MDRO, & HRIIV Modules</p>
<p>Enrollment Requirements Eligibility, How to enroll, Training, System Requirements, Security...</p>	<p>Healthcare Personnel Safety Component Overview, Blood/Body Fluids Exposure; & Influenza Vaccination</p>
<p>Resource Library Reports, Manuals, Newsletters, Forms...</p>	<p>Biovigilance Component Overview, Hemovigilance Module Publications...</p>
<p>Data Collection Forms Forms provided for routine data collection including customizable forms to meet specific needs...</p>	<p>NHSN Training Training webcast, corresponding slidesets, and materials...</p>

Data & Statistics

States with Facilities reporting in NHSN CDC currently supports more than 2000 hospitals using NHSN to fulfill state reporting requirements.

[More Data & Statistics >>](#)

NHSN Report 2008 NHSN Report, data summary for 2006 through 2007 (This area is for spotlight items)

Contact NHSN:

Centers for Disease Control and Prevention
National Healthcare Safety Network
 MS-A24
 1600 Clifton Rd
 Atlanta, GA 30333

nhsn@cdc.gov

[More contact info >>](#)

Clinical Document Architecture (CDA)

The CDA standard can help transfer clinical information between existing systems in order to get information to the point of care, as needed, when needed.

[More >>](#)



NHSN Members Page - Future



A-Z Index [A](#) [B](#) [C](#) [D](#) [E](#) [F](#) [G](#) [H](#) [I](#) [J](#) [K](#) [L](#) [M](#) [N](#) [O](#) [P](#) [Q](#) [R](#) [S](#) [T](#) [U](#) [V](#) [W](#) [X](#) [Y](#) [Z](#) <#>

National Healthcare Safety Network (NHSN)

- NHSN**
- About NHSN
- Enrollment Requirements
- ▶ **Begin Enrollment**
- NHSN Security
- Manuals
- Enrollment Training
- Enrollment Forms
- Patient Safety Component
- Healthcare Personnel Safety Component
- Biovigilance Component
- Data Collection Forms
- NHSN Training
- Data & Statistics
- Resource Library
- Clinical Document Architecture
- NHSN Contacts

[NHSN](#) > [Enrollment Requirements](#)

Begin Enrollment Process

Enrolling in NHSN is a multiple step process, outlined below, that is completed by the person designated to serve as the Facility Administrator. The steps must be followed in the order listed to ensure a successful enrollment.

The person designated as the NHSN Facility Administrator is the only person who can enroll a facility in NHSN or reassign the role of Facility Administrator. This person will also have the ability to nominate groups, that is, entities with which your hospital wants to share some/all of its data (e.g., state or county health department, corporate headquarters).

For complete detailed enrollment instructions please download the [NHSN Facility Administrator Enrollment Guide PDF \(970 KB / 29 pages\)](#).

Before attempting to enroll, as the Facility Administrator you must:

Review the following documents and fulfill training requirements:

- ↓ [Purposes, Eligibility, Requirements and Confidentiality](#)
April 2006 (46 KB / 2 pages)
- ↓ [NHSN Facility Administrator Enrollment Guide](#)
June 2008 (1.23 MB / 29 pages)
- ↓ [NHSN Manual: Patient Safety Protocol](#)
January 2008 (1.21 MB / 98 pages)
- ▶ [Training Requirements for Facility Administrators](#)

When you have completed the required trainings and read the above documents, you are ready to enroll. Follow the steps below to complete the enrollment process.

NOTE: Please make sure that your email system will not block emails from nhsn@cdc.gov and PHINTech@cdc.gov before beginning enrollment.

Read the NHSN Rules of Behavior.
 In order to participate in the NHSN, you must read and agree to abide by the following rules of behavior for safeguarding the system's security.

Register your facility in the NHSN.
 After agreeing to the Rules of Behavior, you will be taken to the NHSN Registration page.

Obtain your Digital ID Certificate from the Secure Data Network (SDN)
 After you register your facility, NHSN will send you an email containing the website and password to apply for a digital certificate. Please do not apply for a digital certificate until you have received

Text size: [S](#) [M](#) [L](#) [XL](#)

[Email page](#)

[Print page](#)

[Bookmark and share](#)

[Get NHSN email updates](#)

[Get email updates](#)

To receive email updates about NHSN, enter your email address:

[What's this?](#)

Contact NHSN:

Centers for Disease Control and Prevention
 National Healthcare Safety Network
 MS-A24
 1600 Clifton Rd
 Atlanta, GA 30333

nhsn@cdc.gov

[More contact info >>](#)

- More Related Links**
- [FAQ About Enrollment](#)
 - [FAQ About Security](#)
 - [FAQ's About Digital Certificates](#)
 - [FAQ's About HIPAA Privacy Rule](#)

NHSN Members Page - Future

CDC Home



Centers for Disease Control and Prevention
Your Online Source for Credible Health Information

SEARCH

A-Z Index [A](#) [B](#) [C](#) [D](#) [E](#) [F](#) [G](#) [H](#) [I](#) [J](#) [K](#) [L](#) [M](#) [N](#) [O](#) [P](#) [Q](#) [R](#) [S](#) [T](#) [U](#) [V](#) [W](#) [X](#) [Y](#) [Z](#) <#>

National Healthcare Safety Network (NHSN)

NHSN

- About NHSN
- Enrollment Requirements
- Patient Safety Component
- Healthcare Personnel Safety Component
- Biovigilance Component
- Data Collection Forms
- NHSN Training
- Data & Statistics
- ▶ **Resource Library**
- Reports
- Manuals
- Data Collection Forms
- Newsletters
- Clinical Document Architecture
- NHSN Contacts

More Related Links

- [FAQ About Enrollment](#)
- [FAQ About Security](#)
- [FAQ's About Digital Certificates](#)
- [FAQ's About HIPAA Privacy Rule](#)

[NHSN](#)

Resource Library

NHSN Manuals

Facility Administrator Enrollment Guide June 2008 (970 KB / 29 pages)
A step by step start-up guide for users designated as the Facility Administrators

Group Administrator Guide June 2008 (1.35 MB / 26 pages)
A step by step start-up guide for users designated as the Group Administrator

Rules of Behavior for Facility/Group Administrators Aug 2005 (130KB / 13pages)
Defines the rules of behavior in terms of policy and responsibility for the intended audience of CDC NHSN team members and NHSN facility/group member users.

User Start-up Guide June 2008 (1.29MB / 24 pages)
A step by step start-up guide for users.

Rules of Behavior for Users Aug 2005 (103 KB / 12 pages)
Defines the rules of behavior in terms of policy and responsibility for the intended audience of CDC NHSN team members and NHSN member users.

Patient Safety Protocols January, 2008 (1.21 MB / 98 pages)
Events and locations and/or procedures monitored in the Patient Safety Component includes instructions for completing data collection forms.

Text size: [S](#) [M](#) [L](#) [XL](#)

[Email page](#)

[Print page](#)

[Bookmark and share](#)

[Get NHSN email updates](#)

[Get email updates](#)

To receive email updates about NHSN, enter your email address:

[What's this?](#)

Contact NHSN:

 Centers for Disease Control and Prevention
National Healthcare Safety Network
MS-A24
1600 Clifton Rd
Atlanta, GA 30333

nhsn@cdc.gov

[More contact info »](#)



Proposed Changes of MMR Vaccine 'Evidence of Immunity' Requirements for Healthcare Personnel

Amy Parker, Kathleen Gallagher, Joe Perz, Jane Seward

February 12, 2009

HICPAC Meeting

SAFER • HEALTHIER • PEOPLE™



Outline

- Provide background on current MMR vaccine recommendations for HCP
 - Routine vaccination
 - Vaccination during outbreaks

- Discuss proposed changes & rationales



ACIP/ HICPAC MMR Recommendations



CDC
DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION

December 26, 1997 / Vol. 46 / No. RR-18

MMWR[™] *Recommendations
and
Reports*

MORBIDITY AND MORTALITY WEEKLY REPORT

Immunization of Health-Care Workers

**Recommendations of the Advisory Committee
on Immunization Practices (ACIP) and the Hospital
Infection Control Practices Advisory Committee
(HICPAC)**

CDC
DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION

May 22, 1998 / Vol. 47 / No. RR-8

MMWR[™] *Recommendations
and
Reports*

MORBIDITY AND MORTALITY WEEKLY REPORT

**Measles, Mumps, and Rubella —
Vaccine Use and Strategies
for Elimination of Measles, Rubella, and
Congenital Rubella Syndrome and
Control of Mumps:**

**Recommendations of the Advisory Committee on
Immunization Practices (ACIP)**

Routine MMR Vaccine Recommendations for HCP*



- MMR vaccine policy recommendations:
 - Measles (1998)¹ & Mumps (2006)²: 2 doses⁺
 - Rubella (1998)¹: 1 dose

- “Persons who work within medical facilities should be immune to measles and rubella... vaccine should be considered for all personnel, including those born before 1957, who have no proof of immunity”

- “Health-care workers have a responsibility to avoid transmitting these diseases and thereby causing harm to patients”¹

- “health-care facilities should consider recommending MMR vaccine(s) to unvaccinated workers born before 1957”¹

* Without other evidence of immunity

⁺MMR is the vaccine of choice when protection against any of these three diseases is required on or after the first birthday, unless any of its component vaccines is contraindicated.

1. CDC *MMWR* 1997;46{RR-18}:1-42. 2. CDC. *MMWR*. 1998;47{RR-8}:1-57
2. CDC. *MMWR* Notice to Readers. 2006;55(22):629-630

Current ACIP MMR Vaccine 'Presumptive Evidence of Immunity' Requirements for HCP^{1,2}

1. Documentation of administration of appropriate vaccination against measles, mumps, and rubella (i.e., administration on or after the first birthday of two doses of live measles and mumps vaccine separated by greater than or equal to 28 days and one dose of live rubella vaccine)
2. Laboratory evidence of immunity
3. Documentation of physician diagnosed disease (measles & mumps)
4. Born before 1957*+

*May vary depending on current state or local requirements.

+ Health-care facilities should consider recommending a dose of MMR vaccine for unvaccinated workers born before 1957 who are at risk for occupational exposure to measles and who do not have a history of measles disease or laboratory evidence of measles immunity.

ACIP Recommendations for MMR Vaccine during *Outbreaks*

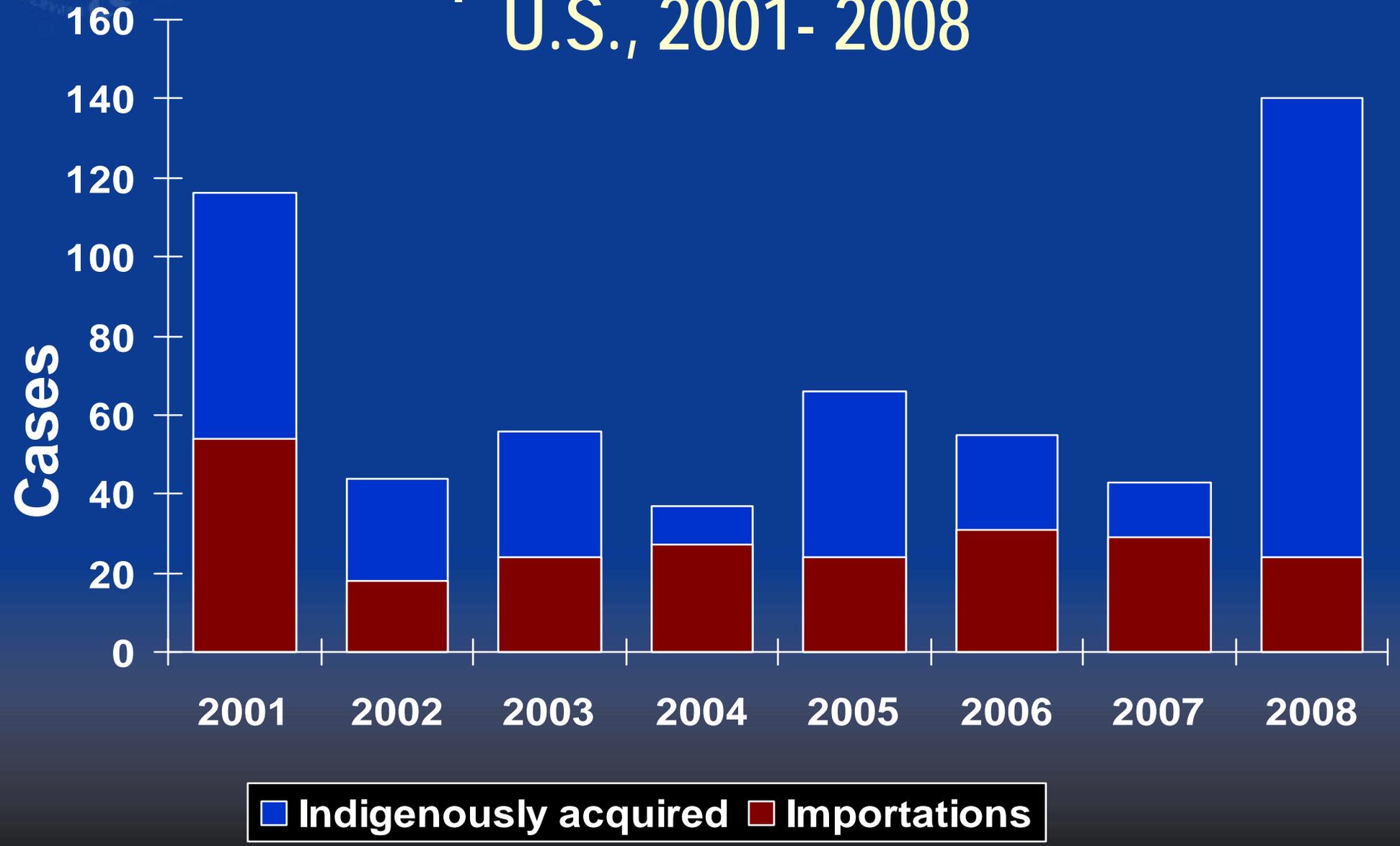
- **Measles and rubella outbreaks**-- “during outbreaks, health-care facilities also should strongly consider recommending a dose of MMR vaccine to unvaccinated health-care workers born before 1957 who do not have serologic evidence of measles or rubella immunity or a history of measles disease.”¹
- **Mumps outbreaks**-- “During an outbreak, health-care facilities should strongly consider recommending 2 doses of a live mumps virus vaccine to unvaccinated workers born before 1957 who do not have evidence of mumps immunity”²

1. CDC. *MMWR* 1998;47{RR-8}:1-57

2. CDC. *MMWR* Notice to Readers. 2006;55(22):629-630



Reported Measles Cases U.S., 2001- 2008





Population Seroprevalence to Measles, Mumps, & Rubella



- Overall, population seroprevalance to measles, mumps, and rubella in the U.S. is high
- In persons born between 1967-1976, 15-20% do not have antibodies to one or more of the three diseases
- Among adults born before 1957, ~3-8% lack antibodies to at least one of the MMR antigens

Measles in Healthcare Facilities



- Measles is a well-described nosocomial problem; infected persons frequently seek medical care^{1, 2, 3}
- Washington state, 1996-- HCP have a greater risk of being exposed to and acquiring measles than adults of similar age⁴
 - 19x risk (RR 19, 95% CI 7.4, 45.4, $p < 0.01$)
- During 1985–1992, 643 measles cases were reported; 27% were born before 1957⁵

1. Atkinson WL, Markowitz LE, Adams NC, Seastrom GR. Transmission of measles in medical settings—United States, 1985–1989. *Am J Med.* 1991;91:320S–4S.

2. Davis R, Orenstein WA, Frank JA, et al. Transmission of measles in medical settings. *JAMA* 1986;255:1295–8.

3. Atkinson WL. Measles and health care workers [editorial]. *Infect Control Hosp Epidemiol* 1994;15:5–7.

4. Steingart KR, Tomas AR, Dykewicz CA, Redd SC. Transmission of measles virus in healthcare settings during a communitywide outbreak. *Infect Control Hosp Epidemiol.* 1999; 20: 115-19.

5. CDC. *MMWR.* 1998; 47{RR-8}:1-57

Measles in Healthcare Facilities in the Post-Elimination Era, 2001- 08

- During 2001- 08, 27 reported measles cases were transmitted in healthcare settings, accounting for 5% of all reported U.S. measles cases (*CDC, unpublished data*)
 - 15 (11%) of 140 cases in 2008 were transmitted in a healthcare setting
- Considerable economic costs
 - Range of ~\$100,000 to \$400,000



Economic Impact Nosocomial Measles Outbreak AZ, 2008



- In Arizona in 2008, the largest nosocomial U.S. measles outbreak (14 cases) occurred in 20 years
- At hospital A, hospitalization of measles case resulted in:
 - > 6,000 hospital contact investigations
 - 4,269 hospital contacts
 - 1,872 HCP
 - Review of measles documentation of immunity of 2,000 HCP and emergency serology and vaccination of 400
 - One HCP vaccinated during the outbreak developed measles
 - Cost > \$400,000

Rationale for Proposed Changes



- In era of measles and rubella elimination, the tolerance for any cases or exposures has decreased
- To maintain elimination, goal is 100% immunity in high risk populations (e.g., HCP)
- Proposed changes are driven by measles
 - Highly contagious with chance of spread in unvaccinated groups
 - Importations into U.S. are continuing
- With high exposure risk, it is important to protect HCP preemptively
- During outbreaks, it is disruptive and time-consuming to determine which staff are born before 1957, to find them, and to vaccinate
- Current permissive vaccine recommendations are not clear



Overview of Proposed Revisions to Evidence of Immunity Criteria

- Currently, healthcare personnel are considered to have evidence of immunity if they have one or more of the following:
 - 1) Appropriate vaccination against measles, mumps, and rubella (i.e., administration on or after the first birthday of two doses of live measles and mumps vaccine separated by greater than or equal to 28 days and at least one dose of live rubella vaccine)
 - 2) Laboratory evidence of immunity or laboratory-confirmation of disease
 - 3) Documentation of physician diagnosed disease (measles & mumps)
 - 4) Born before 1957



Rationale for Including 'Laboratory Confirmation of Disease'



- Include for completeness. Cases are rare and naturally acquired immunity is robust and long lasting
- For surveillance purposes, we rely on laboratory confirmation of disease (especially, measles and rubella)
- Reasonable to conclude that persons who have laboratory evidence of disease are immune
- Varicella is already including 'laboratory confirmation of disease'¹



Rationale for Eliminating 'Documentation of Physician Diagnosed Measles or Mumps'

- Potentially susceptible persons may be working in healthcare settings, because current recommendations are not being adhered to as intended
- It may not be feasible to contact childhood physicians to obtain documentation of disease history
- Accuracy of clinical diagnosis has declined, esp. with vaccine-modified disease (mumps)

Rationale for Eliminating 'Born before 1957'



- Optimal to assure immunity through a preemptive vaccine policy
 - Current routine recommendations are permissive & suggest that 1 dose of MMR vaccine “be considered” for this age group
 - Current outbreak recommendations to “strongly consider” administering MMR vaccine to all HCP born before 1957 are disruptive and challenging to implement
- The updated varicella recommendations do not include birth year as presumptive evidence of immunity for HCP
- Many facilities already test for immunity of all HCP, regardless of birth year

BOX. Evidence of immunity to varicella

Evidence of immunity to varicella includes any of the following:

- documentation of age-appropriate vaccination with a varicella vaccine
 - preschool-aged children (i.e., aged ≥ 12 months): 1 dose
 - school-aged children, adolescents, and adults: 2 doses*
- laboratory evidence of immunity[†] or laboratory confirmation of disease
- birth in the United States before 1980[§]
- diagnosis or verification of a history of varicella disease by a health-care provider[‡]
- diagnosis or verification of a history of herpes zoster by a health-care provider

* For children who received their first dose at age < 13 years and for whom the interval between the 2 doses was ≥ 28 days, the second dose is considered valid.

[†] Commercial assays can be used to assess disease-induced immunity, but they lack sensitivity to always detect vaccine-induced immunity (i.e., they might yield false-negative results).

[§] For health-care personnel, pregnant women, and immunocompromised persons, birth before 1980 should not be considered evidence of immunity.

[‡] Verification of history or diagnosis of typical disease can be provided by any health-care provider (e.g., school or occupational clinic nurse, nurse practitioner, physician assistant, or physician). For persons reporting a history of, or reporting with, atypical or mild cases, assessment by a physician or their designee is recommended, and one of the following should be sought: 1) an epidemiologic link to a typical varicella case to a laboratory-confirmed case or 2) evidence of laboratory confirmation, if it was performed at the time of acute disease. When such documentation is lacking, persons should not be considered as having a valid history of disease because other diseases might mimic mild atypical varicella.



California Hospital Serological Screening Survey Results* (n=56 out of 450)



- 95% of hospitals report performing serologic screening for VPDs
 - 89% routinely screen employees born before 1957
 - Primarily (75%) if they are new employees
 - Almost half screen employees even if they can provide proof of immunity
 - Almost all (93-95%) report screening for measles and rubella
 - Less (77%) screening for mumps

* K. Harriman, CA Dept Health, personal communication

Occupational Health Survey (n= 35)

- 10 (29%) of 35 facilities conduct serologic screening and/or vaccination on ALL employees, regardless of age*
- 8 additional facilities serologically screen and/or vaccinate all NEW employees*. Thus, a total of 18 (51%) of 35 facilities screen all NEW employees.
- 12 (35%) of 34 facilities accept physician-diagnosed disease
- 16 (64%) of the 25 facilities currently not screening and/or vaccinating all employees estimated how long it would take to implement the new policy:
 - 3 (19%) would implement changes in <1 year
 - 9 (56%) in 1-2 years
 - 2 (13%) in 3-4 years
 - 2 (13%) in ≥5 years



Implementation



- Testing for measles, mumps and rubella immunity for persons born <1957 could be conducted concurrently with varicella immunity testing (required since 2007)
- These policies could be implemented as new employees join the staff and/or with other annual routine disease-prevention measures (e.g., influenza vaccination, TB skin testing)
- Implementation could be started soon and phased in within a few years.

Conclusions



- Current policy established more than a decade ago
- In an era of measles and rubella elimination, high standards for immunity are appropriate for HCP
- HCP have a duty to protect themselves and their patients from diseases preventable by vaccination
- Current permissive recommendations are confusing
- Determining who is presumed immune & provide vaccination during measles outbreaks is costly & disruptive
- Despite elimination, measles exposures and outbreaks are likely to continue in healthcare facilities
- Some facilities are already implementing the proposed changes



Prevention and Response Branch Updates

HICPAC Meeting
February 2009

SAFER • HEALTHIER • PEOPLE™



Outbreak Investigation Examples

- November 2008: Outbreak of Carbapenem Resistant *K. pneumoniae* (CRKP) at a Long Term Care Facility in IL (Jonathan Duffy, EISO)
- December 2008: Outbreak of Hepatitis B in a Long Term Care Facility in CA (Matt Wise, EISO)



Other PRB Activities - Examples

- Infection Control Audit Tool
- Healthcare Facility Cleaning
 - Training Module
- Community MRSA – ED patients
- MRSA Prevention Behavioral Interventions
- Safe Injection Practices Campaign



**ONE NEEDLE,
ONE SYRINGE,
ONLY ONE TIME.**



Safe Injection Practices Coalition
www.ONEandONLYcampaign.org

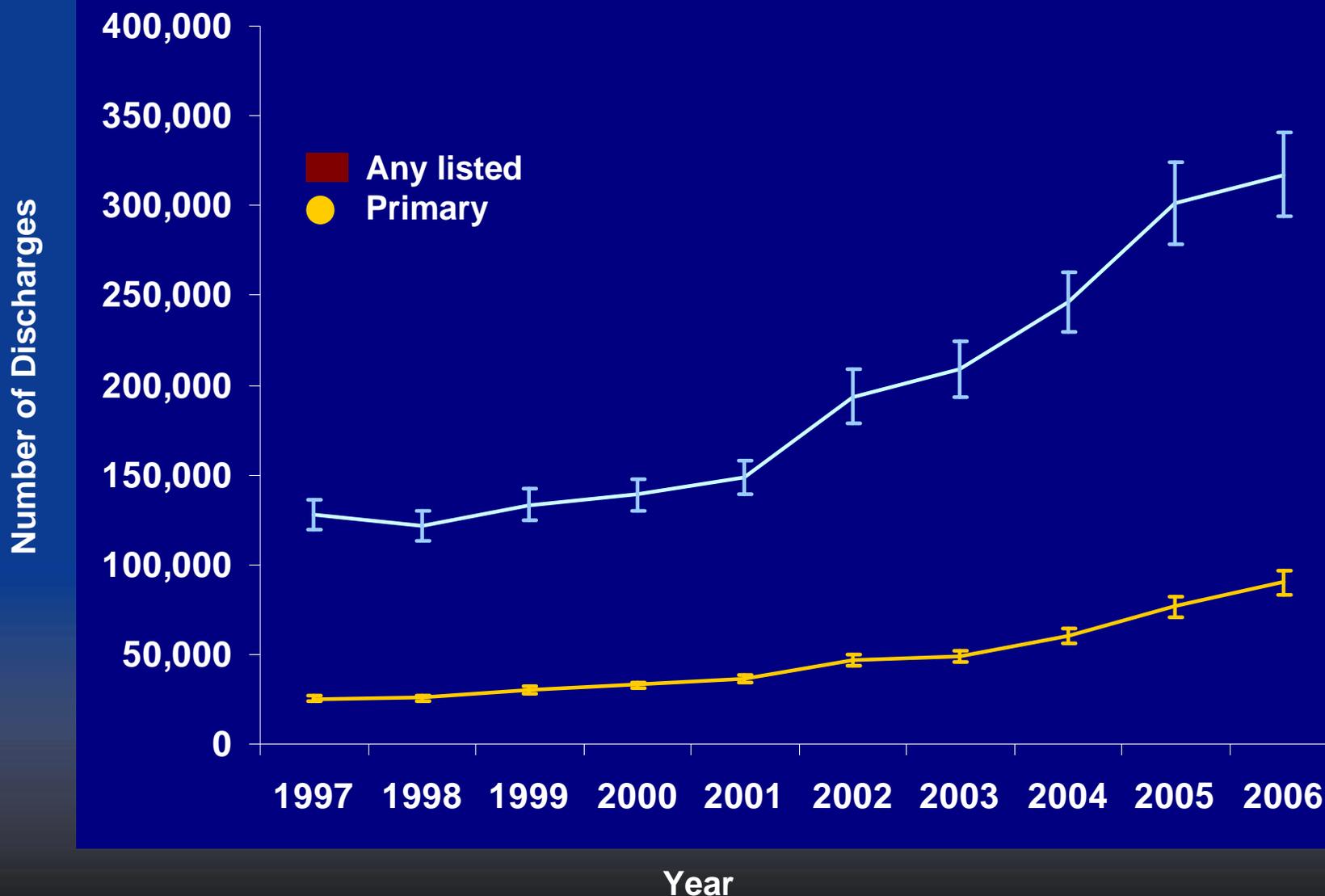


Update on *Clostridium difficile* infections

Infection Control Questions and
Conundrums

SAFER • HEALTHIER • PEOPLE™

Hospitalizations impacted by CDI: continued increase through 2006





SHEA/IDSA Compendium: basic and special approaches for the prevention of CDI

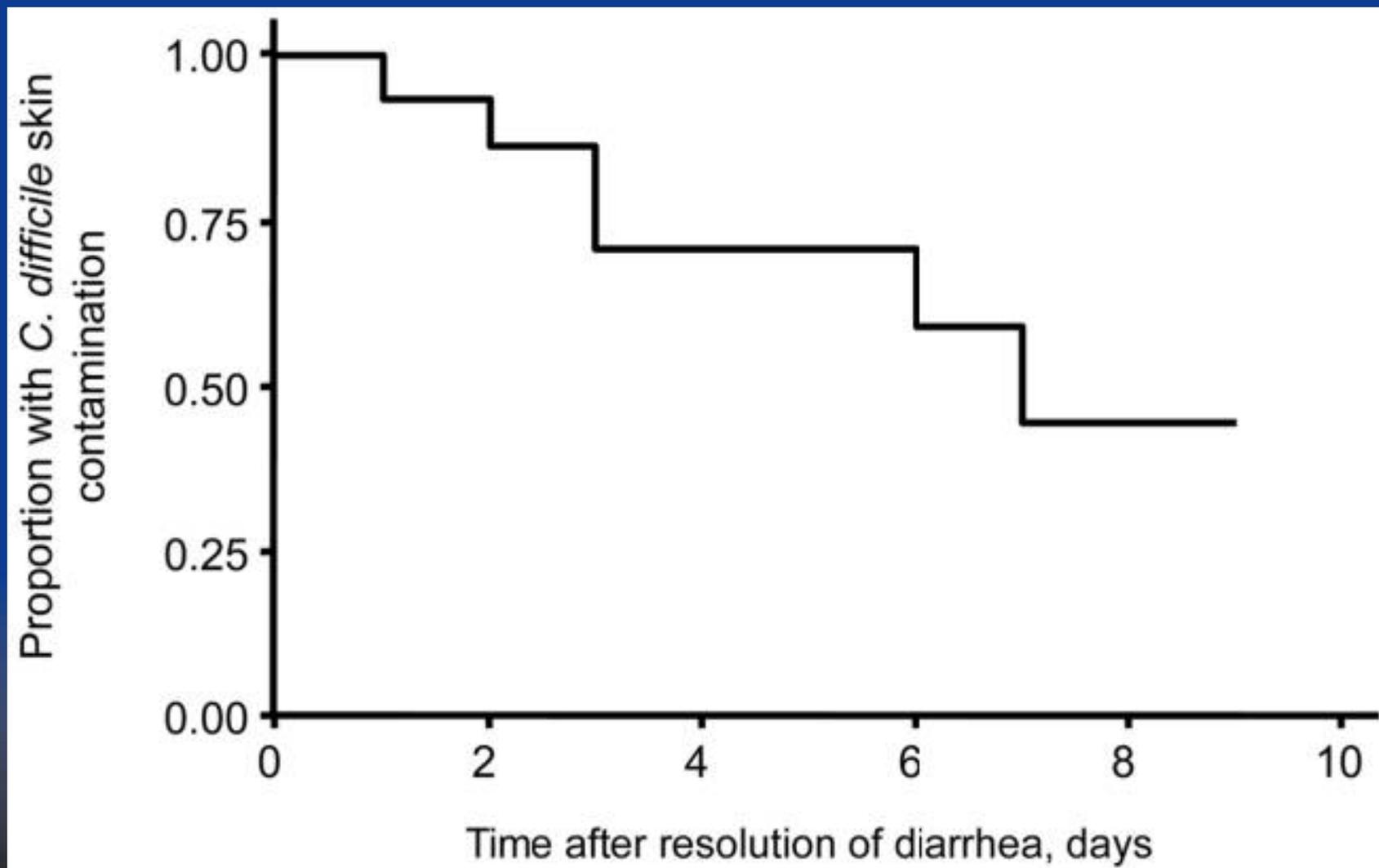
S81 INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY OCTOBER 2008, VOL. 29, SUPPLEMENT 1

SUPPLEMENT ARTICLE: SHEA/IDSA PRACTICE RECOMMENDATION

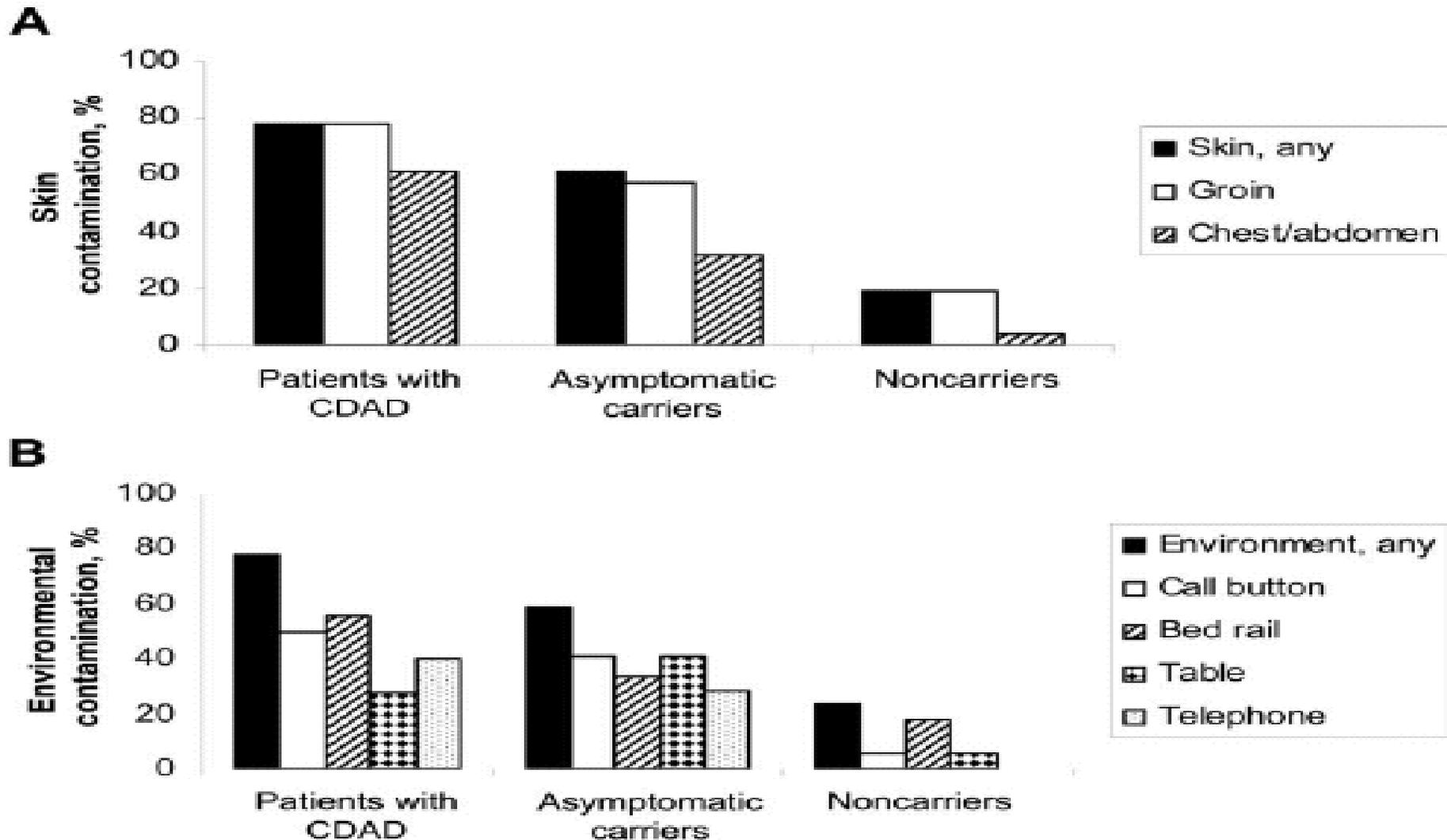
Strategies to Prevent *Clostridium difficile* Infections in Acute Care Hospitals

Erik R. Dubberke, MD; Dale N. Gerding, MD; David Classen, MD, MS; Kathleen M. Arias, MS, CIC;
Kelly Podgorny, RN, MS, CPHQ; Deverick J. Anderson, MD, MPH; Helen Burstin, MD; David P. Calfee, MD, MS;
Susan E. Coffin, MD, MPH; Victoria Fraser, MD; Frances A. Griffin, RRT, MPA; Peter Gross, MD; Keith S. Kaye, MD;
Michael Klompas, MD; Evelyn Lo, MD; Jonas Marschall, MD; Leonard A. Mermel, DO, ScM; Lindsay Nicolle, MD;
David A. Pegues, MD; Trish M. Perl, MD; Sanjay Saint, MD; Cassandra D. Salgado, MD, MS;
Robert A. Weinstein, MD; Robert Wise, MD; Deborah S. Yokoe, MD, MPH

Rationale to consider extending isolation beyond duration of diarrhea (N=27)



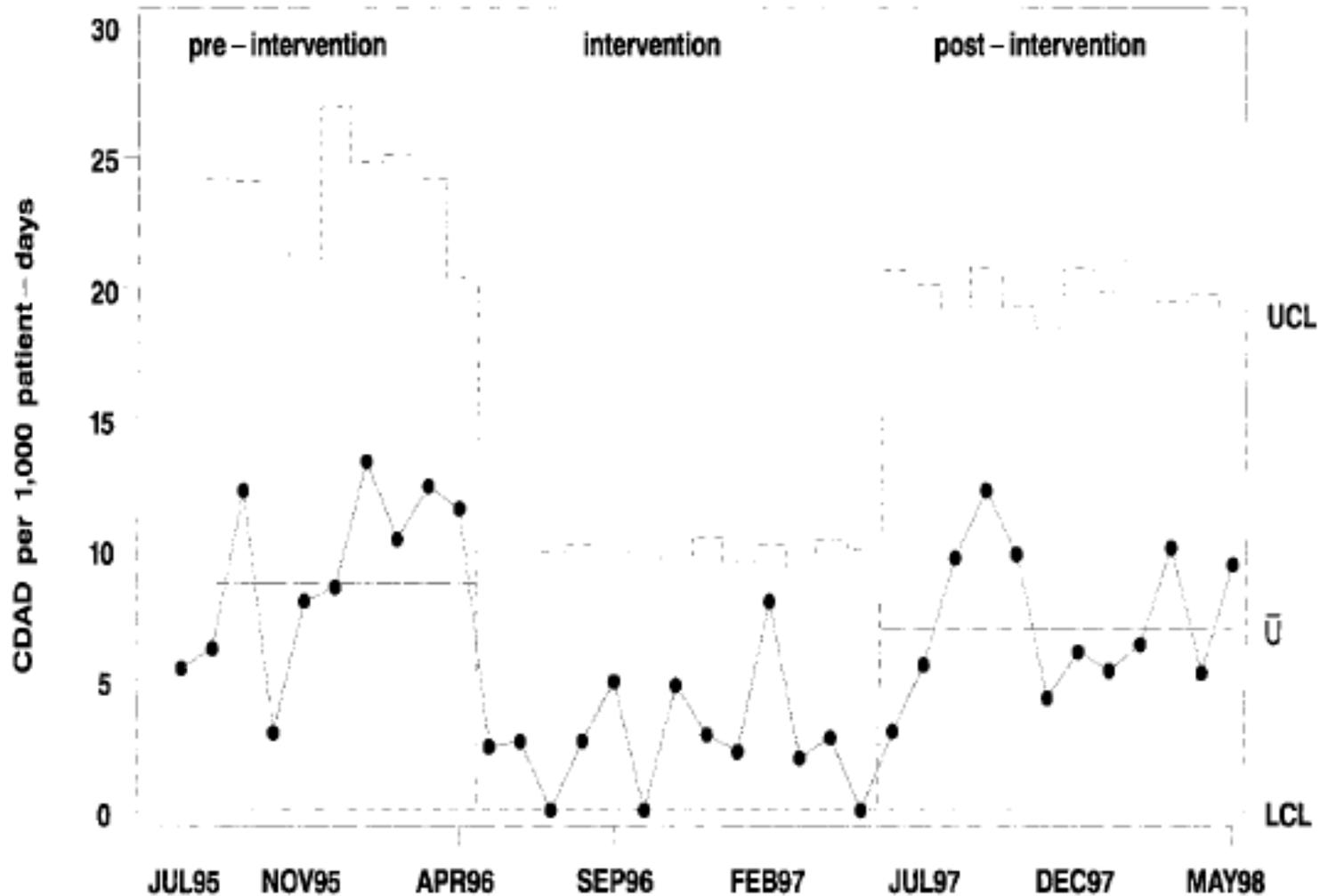
Potential benefit in identifying asymptomatic carriage: contain skin and environmental contamination



Potential benefit in identifying asymptomatic carriers: employ alternative hand hygiene methods

<u>Method</u>	<u>Decrease in mean colony counts</u>	
	<u>Log₁₀ CFU/mL</u>	<u>95%CI</u>
Warm water & soap	1.76	1.47 – 2.05
Cold water & soap	1.76	1.29 – 2.23
Warm water & antibacterial soap	1.36	0.99 – 1.73
Antiseptic hand wipe	0.59	0.25 – 0.92
Alcohol hand rub	-0.09	-0.58 – 0.41

Potential benefit in identifying asymptomatic carriers: environmental disinfection with bleach





Current PCR-based *Clostridium difficile* test

- FDA-approved for diagnosis in symptomatic patients only
- DHQP (PRB) holding discussions with manufacturer'(s) regarding use of PCR-based diagnostics for the detection of carriers and potential infection control interventions



Questions and conundrums

- What are the potential ramifications and implications of identifying asymptomatic *Clostridium difficile* carriers?
- In the interim, should HICPAC extend the duration of isolation for CDI patients in the isolation guideline?



Update: Guideline for the Prevention and Management of Norovirus Outbreaks in Healthcare Settings

Kurt Stevenson, MD

HICPAC Meeting

Feb 12, 2009

SAFER • HEALTHIER • PEOPLE™



Norovirus Guideline Working Group

■ Core Working Group

- Tara MacCannell, DHQP, CDC
- Kurt Stevenson, Ohio State, HICPAC
- Craig Umscheid, CEP, UPHS
- Rajender Agarwal, CEP, UPHS
- Ingi Lee, CEP, UPHS
- Gretchen Kuntz, CEP, UPHS

■ External Review

- Cliff McDonald, DHQP, CDC
- Aron Hall, NCIRD, CDC
- John Boyce, Hospital of St. Raphael, New Haven, CT

■ Internal Review

- Keith Ramsey, HICPAC
- Elexis Elward, HICPAC



Prior Key Questions

1. What patient, virus or institution characteristics increase or decrease the risk of Norovirus infection in healthcare settings?
2. What interventions best prevent Norovirus outbreaks in healthcare settings?
3. What are the best methods to identify a Norovirus outbreak in a healthcare setting?
4. What patient management interventions best contain Norovirus outbreaks in healthcare settings?
5. What environmental management interventions best contain Norovirus outbreaks in healthcare settings?



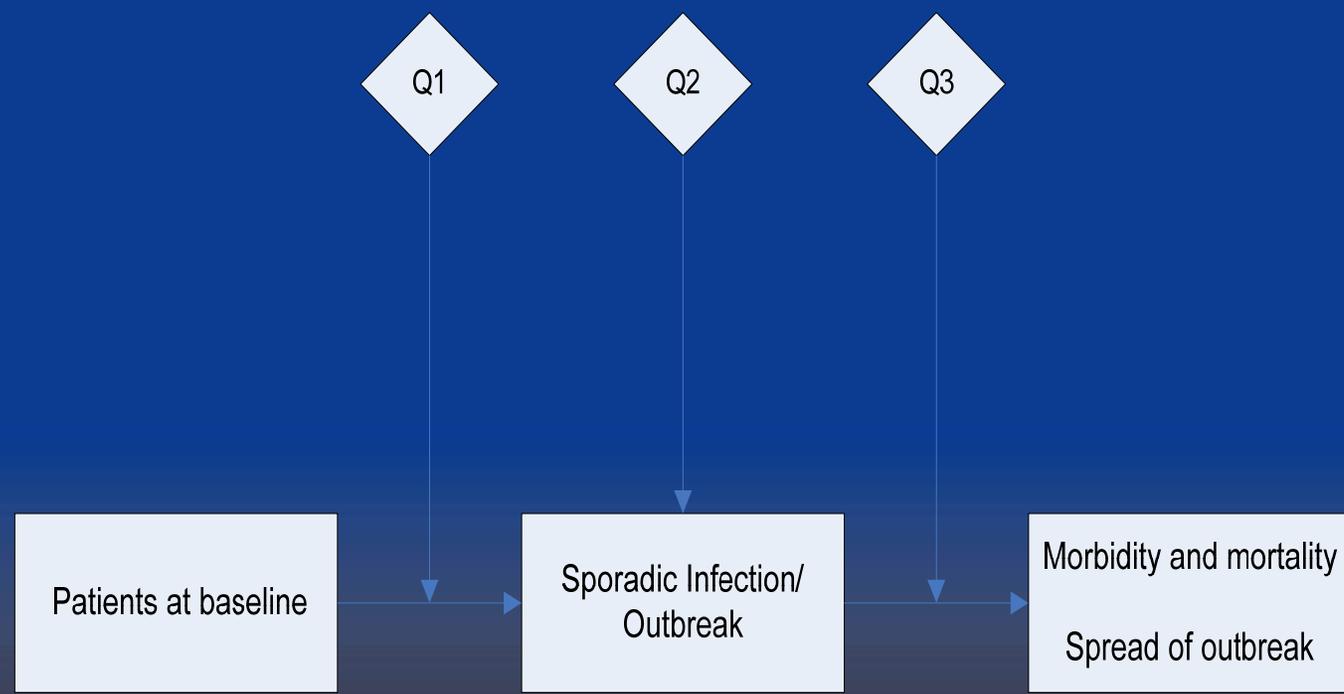
Updated Key Questions



1. What patient, virus or environmental characteristics increase or decrease the risk of Norovirus infection in healthcare settings?
2. What are the best methods to identify a Norovirus occurrence or outbreak in healthcare settings?
3. What interventions best prevent or contain Norovirus outbreaks in healthcare settings?

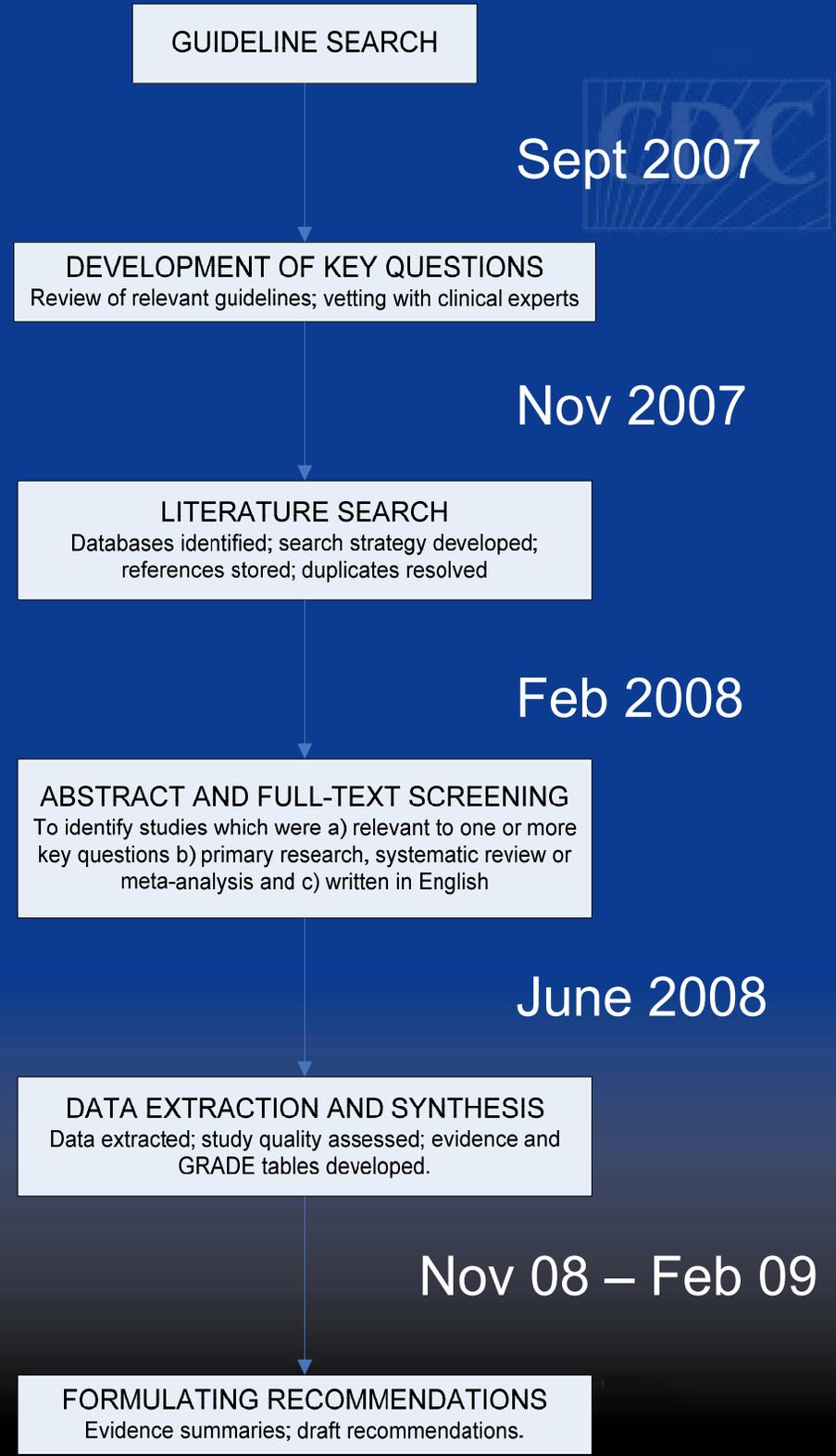


Analytic Framework for Research Questions





General Guideline Development Process





Current Steps

GUIDELINE SEARCH

DEVELOPMENT OF KEY QUESTIONS
Review of relevant guidelines; vetting with clinical experts

LITERATURE SEARCH
Databases identified; search strategy developed;
references stored; duplicates resolved

ABSTRACT AND FULL-TEXT SCREENING
To identify studies which were a) relevant to one or more
key questions b) primary research, systematic review or
meta-analysis and c) written in English

DATA EXTRACTION AND SYNTHESIS
Data extracted; study quality assessed; evidence and
GRADE tables developed.

FORMULATING RECOMMENDATIONS
Evidence summaries; draft recommendations.

■ Narrative summaries

■ Recommendations



Q1: What person, virus or environmental characteristics impact the risk of Norovirus infection in healthcare settings?



Theme		Ref ID	
Person characteristics	Demographic characteristics	Age	642; 1513; 358; 502; 1024; 2416, 1041
		Gender	358; 2416
		Race	1513
		Education	763
		Patient characteristics	1324; 1237
		Staff characteristics	642; 520; 1324; 1237
	Clinical characteristics	HIV	502; 1525; 1606
		Immune co-morbidities	358
		Other co-morbidities	358; 2416
	Laboratory characteristics	Antibody levels	2228; 1960
Secretor genotype		400; 468; 830	
ABO phenotype		830; 506; 729; 5114; 954	
Virus characteristics		358; 011; 673	
Environmental characteristics	Institution characteristics	511; 963	
	Pets	763	
	Diet	4084; 763; 326; 1288; 154; 031; 046; 1003; 576; 1847; 1881; 1921; 506	
	Proximity to infected persons	763; 1513; 1024; 1122; 798; 1555; 897; 017	



Example Narrative Summary: Q1 Risk factors for Norovirus

Q1.3.3 Diet

We found low quality evidence to suggest that extrinsic contamination of food items are commonly implicated as reservoirs for Norovirus infection. Ten observational studies itemized statistically significant food sources implicated in community outbreaks. Common to all of these fresh food sources is a symptomatic or asymptomatic food handler/preparer. Prepared sauces, sandwiches, fruits/vegetables, and salads were most often cited as extrinsically contaminated sources of Norovirus outbreaks, but more importantly these data reflect the breadth of foods that become contaminated. Tap water and ice were also associated with Norovirus contamination during an outbreak with an ill food-handler.



Example Recommendations: Q1 Risk factors for Norovirus

Performing hand hygiene prior to the preparation of food items and beverages is a key measure in the prevention of food-related Norovirus outbreaks. Food handlers should not prepare or handle food or work in the vicinity of food when they experience symptoms of Norovirus. (**Category IC**) (Key Question 1)

Q2. What are the best methods to identify a Norovirus outbreak in healthcare settings?



Theme		Ref ID	
Clinical features/criteria		348	
Specimen Collection		044	
Diagnostic methods	Fecal specimens	EIA/ELISA	5118; 238; 660; 053; 144; 228; 4519; 757; 801; 848; 2351
		EM	801; 848
		PCR	3090; 5115; 655; 049; 068; 130; 167; 052; 668; 008; 223; 911; 983; 4225
		NASBA	856; 5780
	Food specimens	PCR	4285
	Water specimens	PCR	068; 4225
		Concentration method	5853

Q2 Summary Table: Norovirus Diagnostics



Summary Table of Test Characteristics

Diagnostic method	Reference standard	Quantity and type of evidence	Findings*				
			Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Detection limit
Kaplan criteria	Clinical microbiologic testing	1 DIAG ⁴³	68	99	97	82	NA
EIA/ELISA†	PCR	10 DIAG ^{45-47,49-55}	31 – 90	73 – 100	52 – 100	56-97	NA
EM†	PCR	2 DIAG ^{46,55}	24 – 58	98-99	88-94	71-91	NA
PCR†	EM	8 DIAG ^{56,58-62,64,66}	56	83	19	97	<10 to > 10 ⁷ copies
NASBA†	PCR	1 DIAG ⁷¹	100	50	-	-	NA

* Range from studies that reported test characteristics

† Data from fecal specimens

Q3. What interventions best prevent or contain Norovirus outbreaks in healthcare settings?



Theme	Ref ID	
Virus shedding	934; 1056; 3554; 176; 2140	
Survivability of Norovirus	Fomites	3958; 360; 361; 406; 914; 154; 1098; 1317; 095; 4356
	Foods and food preparation surfaces	337; 154
	Water	1280; 095
Components of an outbreak prevention program	Hand hygiene	522; 141; 1041; 163; 4006; 5586; 405; 282; 306; 388; 915; 958; 1410; 708; 1237; 1555; 017; 769; 510; 730; 374
	Protective apparel for visitors and/or staff	079; 163; 4006; 282; 405; 306; 787; 879; 890; 3894; 708; 521; 1237
	Sick policies for staff	522; 1554; 079; 163; 4006; 405; 879; 890; 915; 916; 942; 3894; 708; 521; 4084
	Isolation of affected patients and staff	1554; 163; 4006; 5586; 879; 890; 958; 3979; 708; 521; 079; 141; 405; 282; 306; 1555
	Closure of ward	1554; 079; 141; 5586; 405; 890; 915; 708; 592
	Visitor policies	079; 4006; 5586; 282; 3979
	Education	079; 141; 5586; 3894; 3979
	Disinfection	897; 3958; 313; 3879; 3891; 4234; 4603; 6200; 6202; 628; 067; 122; 5985; 522; 1554; 079; 1041; 405; 282; 787; 890; 3979; 708; 521
	Surveillance	141; 282; 642
	Standard Precautions	708; 079
Medications	212; 2014	

Q3 Summary Table: Prevention Strategies

MEASURES FOR PREVENTION AND CONTROL OF NOROVIRUS OUTBREAKS IN THE PUBLISHED LITERATURE

1. HAND HYGIENE

- Wash hands with liquid soap and water (scrub for 15 seconds and rinse with water) and dry with a disposable paper towel
- Wash hands after going to the bathroom and prior to each meal
- Implement mandatory hand disinfection with a product containing 95% alcohol
- Make alcohol based handrubs available by every bedside
- Implement hygiene measures without waiting for virological confirmation
- Keep fingernails short and scrub with soap and nailbrush while washing hands if work involves handling food

2. PROTECTIVE APPAREL

- Wear gloves, mask and apron for contact with an affected patient or environment
- Encourage visitors to use protective apparel for contact with an affected patient

3. ISOLATION/COHORTING OF AFFECTED PATIENTS

- Cohort nurse or isolate symptomatic patients

4. STAFF POLICIES

- Exclude affected staff from work until symptom free for 48 hours
- Exclude non-essential personnel from an affected ward
- Prohibit staff working in affected areas from working in unaffected areas for 48 hours

5. WARD POLICIES

- Close the ward to new admission

6. VISITOR POLICIES

- Restrict visitors to 1-2 per patient and prohibit children from visiting
- Screen visitors for gastroenteritis and prohibit them from visiting if symptomatic

7. DISINFECTION

- Increase the frequency of routine ward, bathroom or toilet cleaning
- Disinfect vomitus immediately with concentrated hypochlorite
- Steam clean carpets
- Disinfect hard surfaces with 0.1% hypochlorite after cleaning
- Discard fabrics and furniture that cannot be disinfected
- Bathroom surfaces and high touch surfaces are specific areas of decontamination

8. EDUCATION OF HEALTHCARE WORKERS

- Educate healthcare workers (possible topics include identification of Norovirus, spread of gastroenteritis, cleaning and disinfection procedures, isolation, transfers and discharge)
- Educate family members of patients

9. SURVEILLANCE

- Perform active surveillance after defining the surveillance period and establishing the case definition
- Perform contact tracing among staff
- Review admission records of patients

10. STANDARD PRECAUTIONS

- Standard precautions must be followed at all times

Next Steps...

- Complete evidence summaries for Q1-3
- Complete recs for Q1-3
- Peer review
- Publication

Timeframe: June '09

GUIDELINE SEARCH

DEVELOPMENT OF KEY QUESTIONS

Review of relevant guidelines; vetting with clinical experts

LITERATURE SEARCH

Databases identified; search strategy developed; references stored; duplicates resolved

ABSTRACT AND FULL-TEXT SCREENING

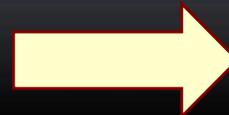
To identify studies which were a) relevant to one or more key questions b) primary research, systematic review or meta-analysis and c) written in English

DATA EXTRACTION AND SYNTHESIS

Data extracted; study quality assessed; evidence and GRADE tables developed.

FORMULATING RECOMMENDATIONS

Evidence summaries; draft recommendations.





Surgical Site Infection: A Surgeon's View

William Schechter, MD
Professor of Surgery
University of California, San Francisco
San Francisco General Hospital

SAFER • HEALTHIER • PEOPLE™



Infections and Surgery

- Surgical Site Infections
- Catheter Associated Infections
 - Intravascular catheters
 - Drainage Catheters
 - Bladder
 - Abdomen
 - Chest
 - Cranial Vault
 - Soft Tissues
- Ventilator Associated Pneumonias
- Occupational/Therapeutic Transmission of Blood-borne Infections
- Treatment of Established Infections requiring:
 - Debridement
 - Drainage
 - Source Control

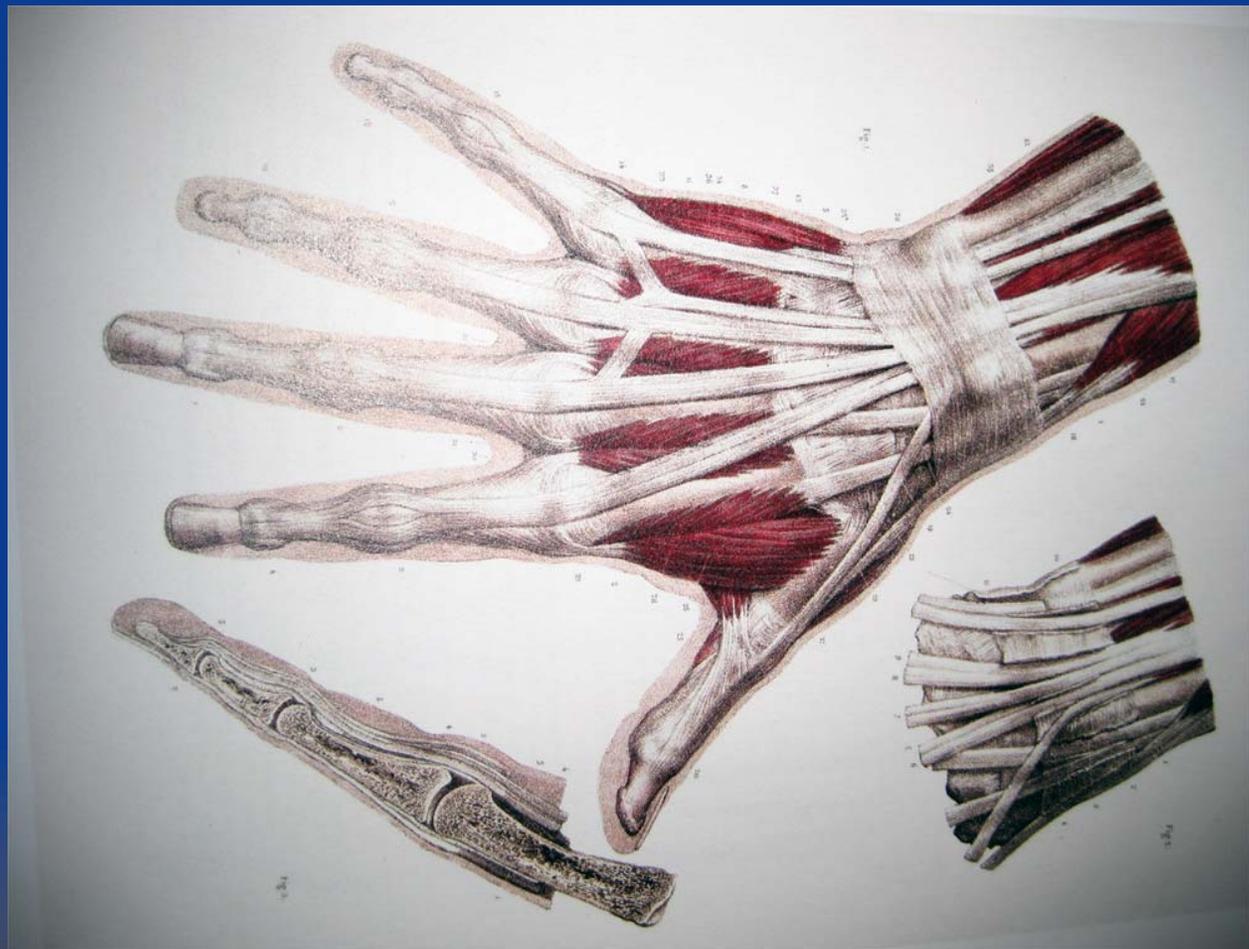


Surgical Site Infection

- Superficial (Wound) Infections
- Deep (Intra-abdominal or Intra-thoracic) infections



Why is a Human Bite so Dangerous??





- Human Bites to the face most common (65%) of patients in ER
- **Infected** Human Bites most common in the hand*
- Evidence from 1 trial that prophylactic antibiotics important for human bites**
- No evidence that prophylactic antibiotics important for animal bites**

*Henry FP, Purcell EM, Eadie PA. The human bite injury: a clinical audit and discussion regarding the Management of this alcohol fuelled phenomenon. *Emerg Med J* 2007;24:455-8.

**Meideiros IM, Saconato H. Antibiotic Prophylaxis for mammalian bites. *Cochrane Database of Systematic Reviews*: Review 2001 Issue 2.



Factors influencing SSI

- Virulence of Organism
- Host Defenses
- Blood Supply/ O_2 Tension of Wound



Risk Factors for SSI



Host Factors

- Nutritional Status
- ASA Status
- Immunosuppression
- Steroids
- Obesity
- Diabetes Mellitus
- Peripheral Vascular Disease
- Shock



Character and Management of wound

- Irradiated Wound bed
- Re-do Operation through Cicatrix
- Wound Classification
- Insertion of Foreign Body
- Dessication of fat
- Extensive retraction on soft tissues for exposure
- Tension on Wound Closure
- Wound Open or Closed??
- **O₂ Tension in Wound**



Importance of Venous Drainage

Edema → Infection

SAFER • HEALTHIER • PEOPLE™



Does the Incision Make a Difference?

Wound Infection Rate

Lap Gastric Bypass	Open Gastric Bypass	Odds Ratio (95% CI)
0.5	2.3	5.07 (3.8-6.9)

Primarily Affects Superficial SSI's but not Deep Space Infections

Nguyen NT, Hinojosa M, Fayad C, et al. Use and outcomes of laparoscopic versus open gastric bypass at academic medical centers. J Am Coll Surg. 2007 Aug;205(2):248-55



Treatment of Nasal Carriage of *Staphylococcus aureus*??

- Cochrane Review Meta-Analysis
- 9 RCT's, 3396 patients
- Reduction in nosocomial *S. aureus* infection (RR 0.55, 95% CI 0.34 to 0.89)
- BUT significant increase in infections due to organisms other than *S. aureus* (RR 1.38 95% CI 1.118 to 1.72)

van Rijen M, Bonten M, Wenzel R, Khuytmans J. Mupirocin ointment for preventing *Staphylococcus aureus* infections in nasal carriers. *Cochrane Database Syst Rev.* 2008



Pre-operative Bathing or Showering with Antiseptics

- *Cleanliness is next to Godliness*
BUT
- A Cochrane Review of 6 studies with 10,000 patients found no evidence of efficacy in reducing SSI

Webster J, Osborne S. **Preoperative bathing or showering with skin antiseptics to prevent surgical site infection**
Cochrane Database of Systematic Reviews 2009;



Clip Hair if you must but do not Shave in region of incision

Tanner J, Woodings D, Moncaster K. Preoperative hair removal to reduce surgical site infection *Cochrane Database of Systematic Reviews*, Issue 1, 2009



Use of Adhesive Drapes to Prevent SSI

No evidence that adhesive drapes or iodophor impregnated adhesive drapes reduce SSI. ? Increase risk of SSI

Webster J, Alghamadi. Use of plastic adhesive drapes during surgery for preventing Surgical Site Infection. Cochrane Database of Systematic Reviews: Reviews 2007.

SAFER • HEALTHIER • PEOPLE™



Process of Care

SCIP Criteria

- Receive prophylactic anti-biotic within 1 hour prior to the incision
- Receive proper prophylactic antibiotic
- Prophylactic antibiotic discontinued within 24 hours of surgery
- Glucose control in cardiac surgery patients
- Glucose control in diabetic surgical patients
- Normothermia
- Proper hair clipping



Can Guidelines for SSI Prevention be implemented outside a controlled trial?

- Yes
- But: Reduction in SSI did not reach statistical significance after successful introduction of protocol

Forbes SS, Stephen WJ, Harper WL, et al. Implementation of evidence-based practices for surgical site infection prophylaxis: results of a pre- and postintervention study. **J Am Coll Surg. 2008 Sep;207(3):336-41**



SSI and Bowel Surgery

- 12 month study 2006-2007
- Parameters monitored: antibiotic selection, dosage, timing, redosing and discontinuation, hair removal technique, intraoperative and postoperative body temperature, and perioperative glucose control for 12 months
 - 90% compliance
 - SSI for Colon Surgery: 20%
 - SSI for Small Bowel Surgery: 11%

Wick EC, Gibbs L, Indorf LA, et al. Implementation of quality measures to reduce surgical site infection in colorectal patients. *Dis Colon Rectum*. 2008 Jul;51(7):1004-9



Bowel Prep and Elective Colon Surgery Cochrane Meta-Analysis

***No statistically significant evidence
that patients benefit from a
mechanical bowel prep***

Guenaga KK, Matos D, Wille-Jørgensen P. Mechanical bowel preparation for elective colorectal surgery. Cochrane Database Syst Rev. 2009 Jan 21;(1):CD001544

SAFER • HEALTHIER • PEOPLE™



Does Surveillance Reduce the the Rate of SSI

- Yes: 12%-8%
- Hawthorne Effect????

Kaya E, Yetim I, Dervisoglu A, et al. Risk factors for and effect of a one-year surveillance program on surgical site infection at a university hospital in Turkey.

Surg Infect (Larchmt). 2006 Dec;7(6):519-26



Surgical Site Infection Prevention: The Importance of Operative Duration and Blood Transfusion—Results of the First American College of Surgeons-National Surgical Quality Improvement Program Best Practices Initiative

Campbell DA, Henderson WG, Engle MJ et al. J Am Coll Surg 2008;207: 808-820.



SSI NSQIP Study

- 20 low outlier and 13 high outlier hospitals for SSI identified using 2006 data.
- Each hospital administered a process of care survey
- Site visits conducted at 5 hospitals
- Comparisons between low and high outlier hospitals made



Results

- High SSI Outlier Hospitals
 - Higher trainee to bed ratios ($p < 0.0001$)
 - Longer operative times ($p < 0.001$)
 - Patients more likely to be anemic at start of operation ($p = 0.007$)
 - Patients more likely to receive blood transfusion ($p = 0.03$)
 - RVU was 8% higher – but not statistically significant



Conclusion

- Basic surgical technique, asepsis, etc. performed competently in most hospitals—further improvements in this area unlikely to significantly affect SSI rate.
- Smaller Hospitals, less staff turnover, better teamwork lower infections
- Effect of SCIP initiative re: timing of antibx, temperature regulation and glycemic control remains to be determined.
- Variables affecting SSI
 - Longer Duration of Operative Time
 - Blood Transfusions





Schechter's Guide to SSI Reduction

- Operate only on young thin healthy patients
- Do not operate on the intestinal tract
- Do the operation as speedily as possible consistent with the anatomy (Drive within the speed limit!!)



Schechter's Guide to SSI Reduction

- Clip Hair Pre-op if necessary—no shaving
- Manage the skin and soft tissues with care
- Do not insert foreign bodies into the patient
- Maintain venous drainage



Schechter's Guide to SSI Reduction

- Do not close wounds under tension
- Close wounds with ischemic beds with well vascularized flaps
- Do not transfuse blood if possible
- Monitor SSI Results and give immediate feedback to the



Pediatric Infection Prevention

Alexis Elward M.D., M.P.H.

February 12, 2009

Healthcare Infection Control Practice
Advisory Committee

SAFER • HEALTHIER • PEOPLE™



Objectives

- Review issues specific to pediatric infection prevention
- Identify gaps
 - Benchmarking
 - Research
- Review Stakeholders
- Discuss manner in which future HICPAC guidelines should address these issues



Pediatric Infection Prevention

- Diseases: High volume /or high morbidity hospital-acquired infections
 - Central line-associated bloodstream infections (CLABSI)
 - Surgical Site Infections (SSI)
 - Methicillin Resistant *Staphylococcus aureus* (MRSA) colonization and infection
 - Viral infections in immunocompromised hosts

- Patients
 - Family centered care
 - Parents visiting while ill
 - Parents colonized with antibiotic resistant organisms
 - Developmentally appropriate, child centered care
 - Pet Therapy
 - Social interactions for the chronically ill child on isolation precautions
 - Child Life



Pediatric Hospital-Acquired Infections: High volume, high morbidity



Pediatrics: Denominators

- Estimated 6.6 million children are hospitalized in US annually¹
 - 18% of all hospital admissions in US
- 72% of pediatric patients are less than one year of age¹
- 24% are hospitalized in children's hospitals¹
- Overall in-hospital deaths 0.39%¹



Pediatrics: Denominator

- Of an estimated 5,708 registered hospitals in US¹, approximately 50 are freestanding children's hospitals²
- 18 children's hospitals reported data to NHSN in 2007³
 - 36% of children's hospitals
 - 74 Pediatric Intensive Care Units (PICUs)
 - 127 Neonatal Intensive Care Unit (NICUs)

¹American Hospital Association; <http://www.aha.org>, 2007 Annual Survey

²Child Health Corporation of America; <http://www.chca.org> ³ NHSN



Pediatrics: Gap #1

- Difficult to ascertain the entire denominator
 - Exact number of children's hospitals
 - Number of PICUs and Pediatric Cardiac Intensive Care Units
 - Number of children admitted each year to intensive care units
 - PICU definition
 - Heterogeneous patient and provider mix



Pediatric CLABSI

- Estimated 11-18% attributable mortality¹
- Attributable length of stay of 7 days¹
- Attributable cost of \$39,000-\$50,000 per episode²⁻⁵

¹Millikan et al, Crit Care Med 1988, ²Dominguez et al, Crit Care Med 2001,
²Slonim et al Pediatr Crit Care Med 2001 ³Sing-Naz et al, Crit Care Med 1996
⁵Elward et al, Pediatrics 2005



Pediatrics: Gap #2

- Attributable mortality controlling for other predictors of mortality and severity of illness



Pediatric CLABSIs

- 2,697 CLABSIs in pediatric patients/yr in US¹
 - 28% of BSIs reported to NHSN occurred in NICU and PICU patients
 - 300 deaths per year attributable to BSI in pediatrics
 - 18,879 ICU days per year attributable to BSI in pediatrics
 - \$105 million annually

¹ Hidron et al for NHSN, Infect Control Hosp Epidemiol 2008; 29:996-1011



NHSN Pediatric BSI data

Table 3. Pooled means and key percentiles of the distribution of central line-associated BSI rates and central line utilization ratios, by type of location, DA module, 2006 through 2007

Type of location	Central line-associated BSI rate*				Percentile				
	No. of locations	No. of CLABSI	Central line-days	Pooled mean	10%	25%	50% (median)	75%	90%
Critical care units									
Burn	22	239	42,452	5.6	0.0	1.5	3.8	8.2	13.5
Coronary	121	373	181,079	2.1	0.0	0.0	1.3	2.8	5.3
Surgical cardiothoracic	97	397	275,194	1.4	0.0	0.0	1.2	1.9	3.4
Medical	144	1073	454,839	2.4	0.0	0.6	1.9	3.6	5.3
Medical/surgical, major teaching	104	692	342,214	2.0	0.0	0.5	1.5	3.0	4.2
Medical/surgical, all others	343	972	662,489	1.5	0.0	0.0	0.6	2.0	3.6
Pediatric medical/surgical	71	404	140,848	2.9	0.0	0.0	2.1	3.8	6.0
Pediatric medical	10	6	6256	1.0					
Neurologic	15	31	25,440	1.2					
Neurosurgical	39	173	68,550	2.5	0.0	0.0	1.9	3.8	6.2
Surgical	128	881	383,126	2.3	0.0	0.5	1.7	3.1	5.1
Trauma	32	435	107,620	4.0	0.3	1.5	4.0	5.7	7.7
Inpatient wards									
Adult step down unit (postcritical care)	24	61	24,981	2.4	0.0	0.0	0.7	2.7	3.5
Medical	40	111	60,257	1.8	0.0	0.0	0.0	2.2	3.4
Medical/surgical	82	169	132,133	1.3	0.0	0.0	0.0	1.6	4.0
Rehabilitation	11	2	3705	0.5					
Surgical	18	40	24,254	1.6					

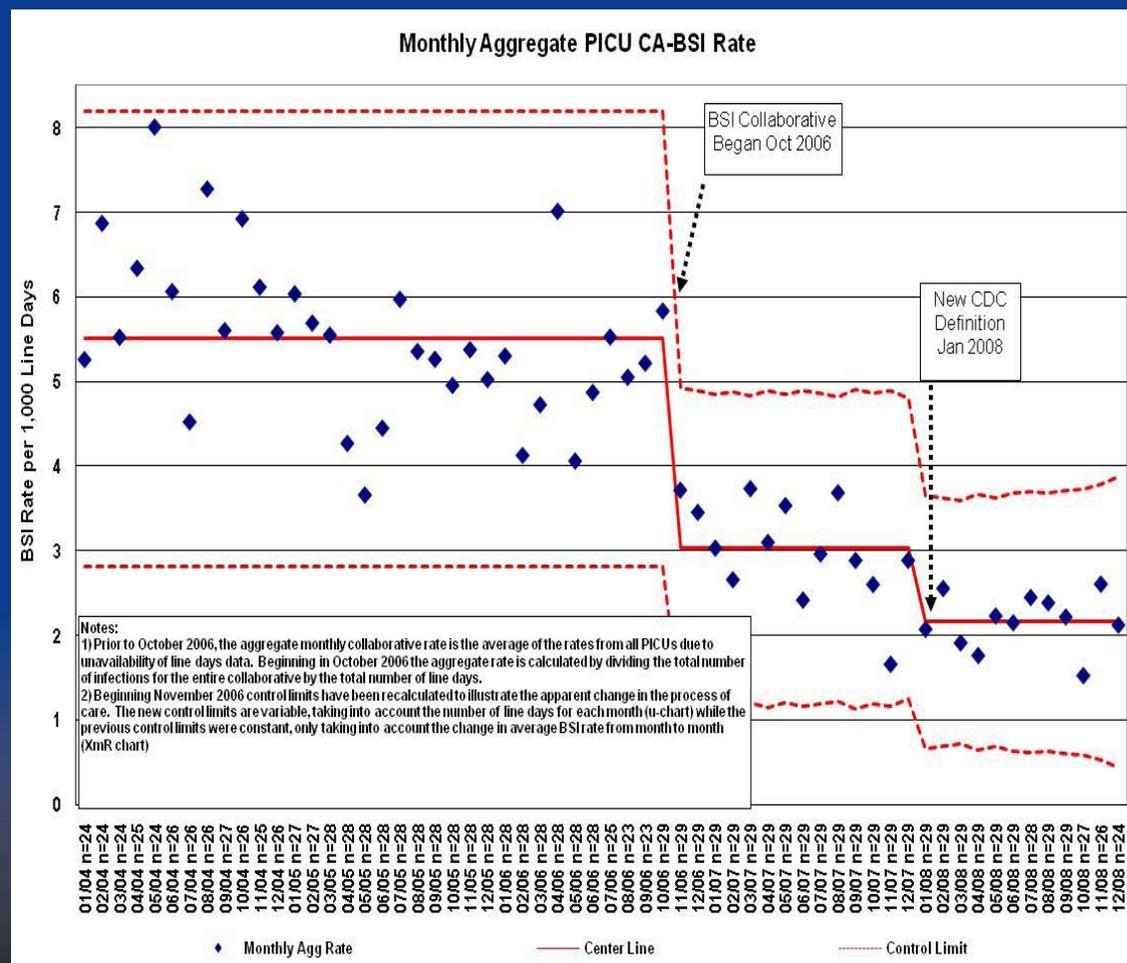
NHSN NICU BSI data



Birthweight	CVC days	Pooled mean BSI Rate
≤ 750 grams	60,850	3.7
751-1000 grams	55,455	3.4
1001-1500 grams	55,874	2.6
1501-2500 grams	44,402	2.4
> 2500 grams	42,611	2.0



Progress toward PICU BSI Prevention: NACHRI data





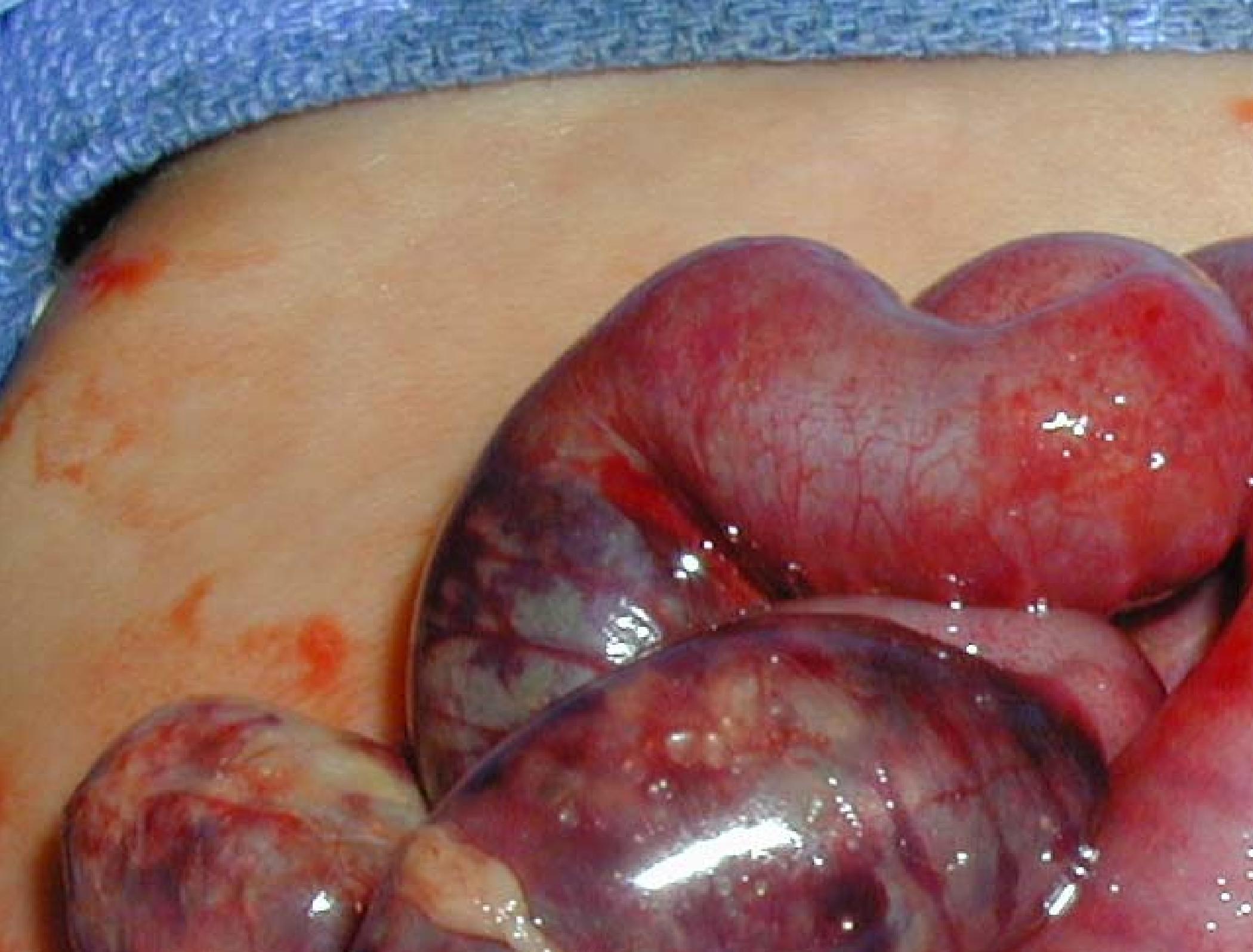
Pediatrics: Gap #3

- Proportion of CLABSIs that are preventable via meticulous attention to Central Venous Catheter insertion and maintenance



Pediatric CLABSIs

- Hypothesis: Proportion of gram negative bacteremias in NICU patients arise from translocation of bacteria across intestinal mucosa and into the bloodstream
 - Biologically plausible





NICU BSI Preventability

Relationship Between Infant and Nurse Strains Gram Negatives

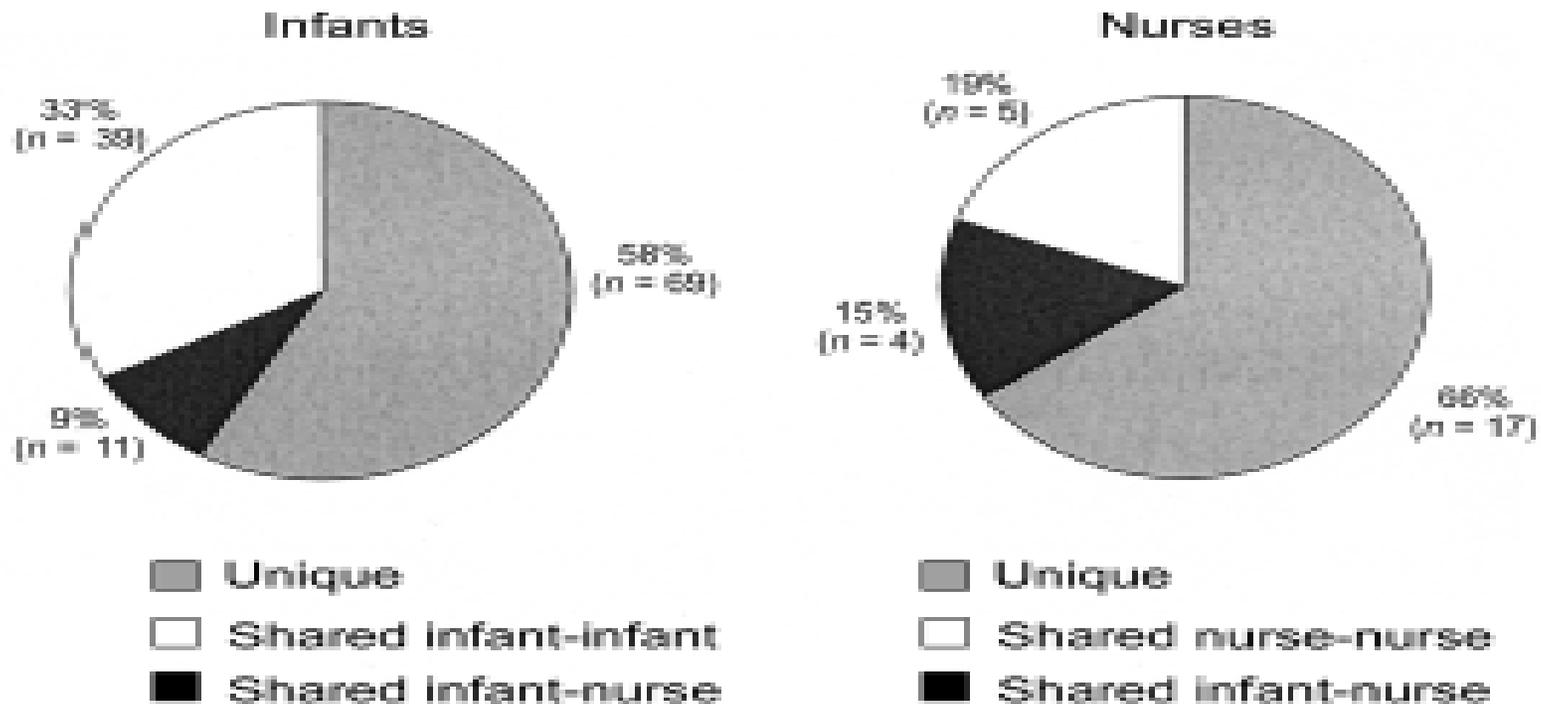


Figure 1. Distribution of infant and nurse clones identified as unique strains, strains shared between nurses and infants, and strains shared between nurses or among infants.

Gut Barrier Failure and Risk of Bacteremia



TABLE 3. Final Model Which Simultaneously Considers 4 Major Predictors (Duration of Catheterization, NC-CPAP, H2 Blocker/Proton Pump Inhibitor Use and GI Tract Pathology) of Gram-Negative BSI in Infants (Birth Weight <1500 g)

Predictor	OR*	P
Catheter duration 1–9 d [†]	4.6 (0.7, 28.7) [‡]	0.13
Catheter duration 10–21 d [†]	32.4 (3.2, 323.2)	0.003
Catheter duration >21 d [†]	80.6 (6.9, 944.6)	<0.001
NC-CPAP use	5.9 (1.5, 22.6)	0.010
H2 blocker/PPI use	3.1 (0.96, 10.2)	0.059
GI tract pathology	5.2 (1.5, 18.4)	0.011

*Conditioned on study site, hand hygiene product and risk factor exposure time. Also adjusted for birth weight.

[†]Catheter duration was divided into quartiles (0, 1–9, 10–21, >21 days) with 0 days as the reference group.

[‡]Numbers in parentheses, 95% CI.



Pediatric Surgical Site Infections: Gap #4

- Not reported separately via NHSN
- No pediatric specific benchmarks



Pediatric SSI Risk Stratification: Gap #5

- NNIS risk index developed to stratify patient risk of SSI
 - ASA class 3,4,5
 - Clean/contaminated and dirty
 - Duration of procedure for specific surgery
- Original validation included small number of pediatric patients



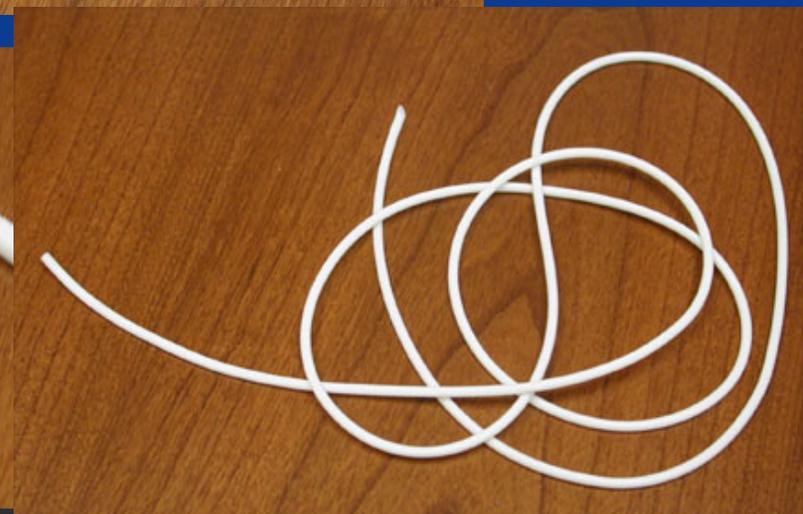
Pediatric SSI Risk Stratification: Neurosurgery

- Spinal fusions
- Myelomeningocele Repairs
 - Wounds in proximity to diaper
 - Hosts with congenital diseases limiting mobility and affecting body habitus
 - Nutrition



Pediatric SSI Risk Stratification: Neurosurgery

- VP shunts
 - Intracranial hemorrhage in NICU pt, prior reservoir





Pediatric SSI Risk Stratification

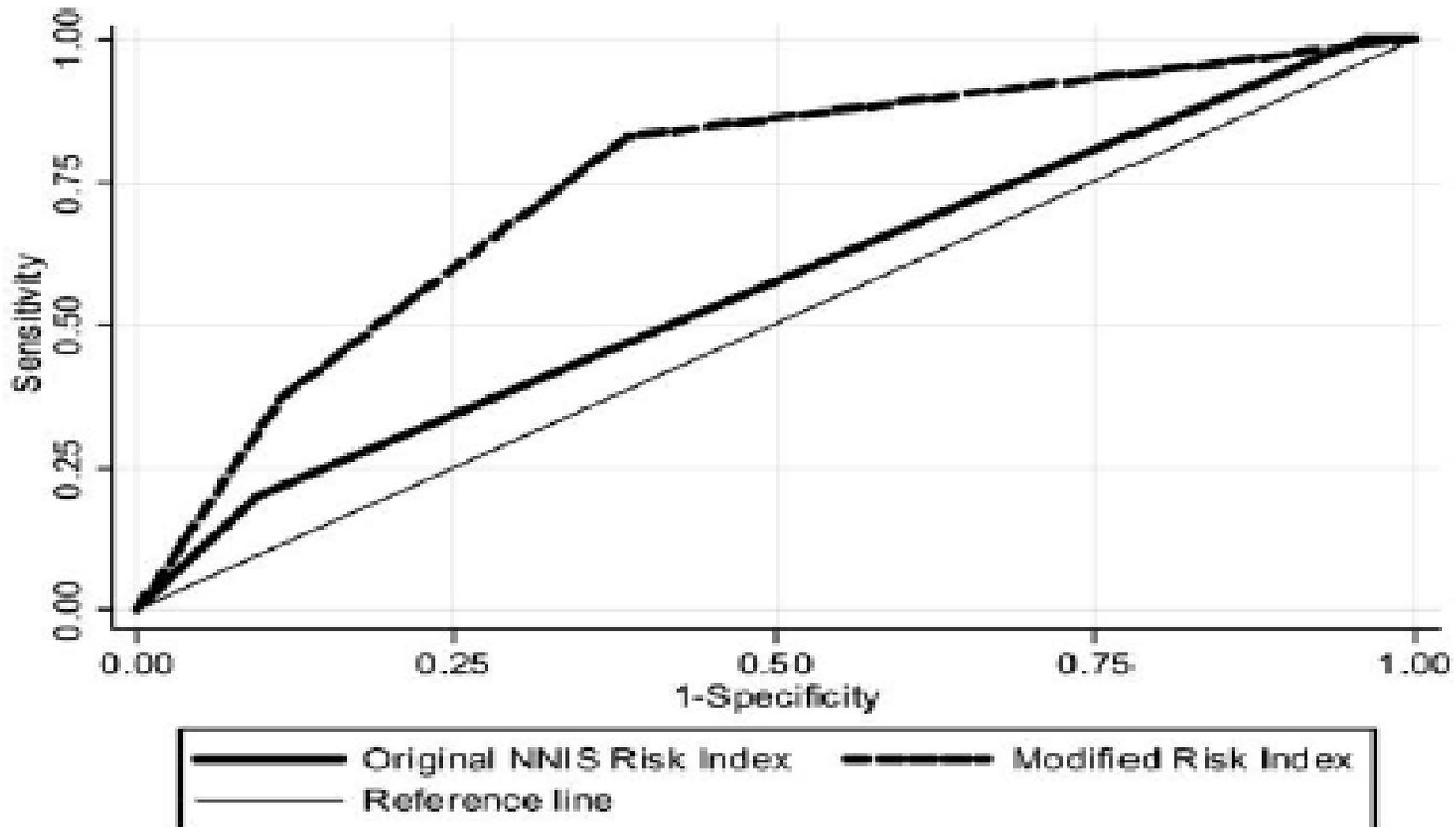
- Cardiothoracic
 - Delayed sternal closure
 - Sternal wound in close proximity to trachea
 - ECMO



NNIS Risk Index in Pediatric Cardiothoracic Surgery

- Objective: To determine whether the NNIS risk index adequately stratified population of pediatric patients undergoing cardiac surgery
- Design: Case-control
 - Case= patient with mediastinitis
 - Deep infections only included
 - Control= Uninfected patient
 - N=38 cases mediastinitis , n=172 controls

Comparison of Receiver-Operating Characteristic Curves: NNIS Risk Index v. a Modified Risk Index Among Pediatric CT Surgery Patients





MRSA Colonization and Infection in the NICU: Gap #6

- Varying methods for surveillance in NICUs
- Site of culture
- Frequency of cultures
- Natural history of colonization
 - NICU patients return 10 years later for elective surgery—what is the probability they are still colonized with MRSA?



MRSA Surveillance in NICU

Author	Year	N	Nares	Umbilicus	Rectum	Nares + umbilicus	Nares + rectum
Singh	2003	33	97%	0%	29%	-----	----- -
Back	1996	28	11%	ND	32%	ND	57%
Jernigan	1996	16	88%	56%	ND	ND	ND
Rosenthal	2006	50	68-72%	61-72%	21-60%	92-100%	71-84%



MRSA in the NICU: Gap #7

What is the source?

- Case Reports of transmission from parents to infants
 - Al-Tawfiq, ICHE 2006 Dad and infant with indistinguishable strains by PFGE, 93 HCWs and 26 patients all negative for MRSA
 - Sax, Journal of Hospital Infection, 2006, Mother with mastitis, MRSA positive, subsequently her infant and five others became colonized with MRSA
 - Morel, AJIC 2006, Mother and $\frac{3}{4}$ quadruplets with MRSA matching by PFGE
 - Shiojima, 2003, Mother index case for nursery outbreak, 19 NICU patients



MRSA in NICU: Gap #8 Control Measures

- Contact precautions for visitors (?)
- Chlorhexidine baths
 - Absorption in preterm infants
 - Long term neurotoxicity
- Nasal Bactroban



Exposure of immunocompromised host to viral infections

■ Varicella

- Attack rates of 70-80% in susceptible hosts
- Pneumonitis in up to 32% of immunocompromised hosts
- Mortality up to 50% in immunocompromised hosts
- Varizig, replacing VZIG, available under investigational status for postexposure prophylaxis
 - IRB approval at each institution required
 - Signed informed consent and assent
 - Data collection under study protocol with



RSV in the NICU: Synagis Post Exposure Prophylaxis

- RSV highly prevalent in winter months
- Outbreaks in NICUs occur
- Palivizumab used in case reports, with other infection control measures to decrease risk of transmission
- Cost of surveillance and control:

¹Halasa N, Williams J, Wilson M, Mason T, Shafer W, Wright E. Medical and Economic Impact of a Respiratory Syncytial Virus Outbreak in a Neonatal Intensive Care Unit. The Pediatric Infectious Disease Journal 2005; 24:1040-1044.

\$1.15 million for a 56 bed NICU with 9 cases of RSV



Pediatric Infection Prevention: Patients

- Family Centered Care
- Child Centered Care



Family Centered Care

- Contact with parents and siblings vital for chronically ill patients
 - NICU skin to skin
- Challenges: viral illness
- Opportunities:
 - Fiercest advocates for infection prevention
 - Families have influence over healthcare providers
 - Bridge the gap where there is little data



For the protection of patients, The Family Advisory Council urges caregivers and parents alike to always wash their hands.



Pediatric Infection Prevention

Child Centered Care



- Chronically hospitalized child with MRSA or VRE
 - Need physical therapy
 - Need change of scenery
 - Need social interaction
- Child Life
 - Playroom/Toy Cleaning
 - Pet therapy
 - Horticultural therapy



Pediatrics: Challenges for Guideline Development



- Rare events
 - Paucity of studies upon which to write evidence-based guidelines
- Smaller proportion of population BUT
- Productive years of life lost is high



Pediatric Infection Prevention: Gap Summary

- Denominators
- Attributable Mortality
- Preventability of CLABSI in select pediatric subpopulations
- Benchmarks for pediatric SSI
- Risk stratification for pediatric SSI
- MRSA colonization
- Family and patient education



Next Steps

- Benchmarks for pediatrics
 - NICU BSI stratified by intestinal pathology
 - Spinal fusions
 - VP shunts
 - Cardiothoracic surgery
 - Dialysis
- Research on interventions



Existing Data

- NHSN
- NACHRI
- Vermont Oxford Network
- Child Health Corporation of America
 - Pediatric Health Information Systems (PHIS)



Stakeholders

- Pediatric Special Interest Group, Society for Healthcare Epidemiology of America
- Pediatric Special Interest Group, Association for Professionals in Infection Control
- Child Health Corporation of America Infection Prevention Forum
- Pediatric Infectious Diseases Society
- Pediatric Cardiac Intensive Care Society
 - 24 hospitals
- Society for Critical Care Medicine



HICPAC Guidelines: Informal Consensus from the Stakeholders



- Address pediatric specific issues within a separate section of guideline
- New format with detailed tables will facilitate generalizability of primary data for pediatrics
- Consider expert consensus recommendations where there are a paucity of data