Elimination of Health Care-Associated Infections
Russell Olmstead, MPH CIC, Saint Joseph Mercy Health System
A Webber Training Teleclass

Today’s Agenda -
- Describe at least one external factor influencing infection prevention & control programs in hospitals in N. America.
- List factors involved in diffusion of innovation involving application of infection prevention evidence to direct patient care.
- Identify components of infection prevention bundles for central line-associated bloodstream infection (CLABSI) & ventilator-associated pneumonia (VAP)
- Describe components of a process-focused intervention to prevent catheter-associated urinary tract infections (CA-UTIs)
- List components of an effective PI collaborative.

Calculation of estimates of HAIs in U.S. hospitals among adults and children outside of intensive care units, 2002; total = 1.7 million; 98,987 deaths

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
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<tbody>
<tr>
<td>SSI</td>
<td>129,519</td>
</tr>
<tr>
<td>UTI</td>
<td>424,060</td>
</tr>
<tr>
<td>PNEU</td>
<td>263,610</td>
</tr>
<tr>
<td>Other</td>
<td>24,385</td>
</tr>
<tr>
<td>Total</td>
<td>1,336,368</td>
</tr>
</tbody>
</table>

Calculation: 1,336,368 = 274,098 + 129,519 + 424,060 + 263,610 + 129,519 + 24,385

External Factors -
Centers for Medicare & Medicaid Services (CMS) & Value-Based Purchasing
- Payment reforms for inpatient hospital services in 2008:
  - ...ensure that Medicare no longer pays for the additional costs of certain preventable conditions (including certain infections) acquired in the hospital…
  1) Serious preventable events:
     - Object left in during surgery;
     - Air embolism;
     - Delivering ABO-incompatible blood or blood products
  2) Catheter-associated urinary tract infections
  3) Pressure ulcers (stages III, IV)
  4) Vascular catheter associated infection
  5) Mediastinitis after CABG surgery
  6) Patient falls

U.S. Legislative “Score Card” on Mandates for Public Disclosure of Health Care-Associated Infection (HAI)

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CMS & Value-Based Purchasing, 2009

1) Manifestations of poor glycemic control
2) Deep vein thrombosis (DVT) / pulmonary embolism following total knee or hip replacement
3) Surgical Site Infection following select procedures:
   a) Orthopedic – spine, neck, shoulder, elbow
   b) Bariatric – Lap. Gastric bypass, Gastroenterostomy, Lap. Gastric restrictive surgery

The Joint Commission
National Patient Safety Goals, Hospital & Critical Access Hospital, 2009

- 7c. Prevent multiple drug-resistant organisms (MDRO) infections, especially methicillin-resistant Staphylococcus aureus (MRSA) and Clostridium difficile-associated disease (CDAD).
- 7d. Prevent catheter-associated BSI (CABSI)
- 7e. Prevent surgical site infections (SSI)
- 13a. Patient involvement in their care: respiratory & hand hygiene on day of admission – pt. & family

Infectious diseases threaten the health and well-being of Canadians and lead to major social, political and economic consequences.
- One in nine Canadian hospital patients acquires an infection during their stay
- Healthcare-associated infections kill 8,000 to 12,000 Canadians a year
- Infections cost our economy an estimated $15B annually

A BATTLE WE CAN WIN: Reducing Healthcare Associated Infections by 50%
UNE BATAILLE QU’ON PEUT GAGNER : Réduction de 50% l’incidence des infections associées aux hôpitaux

New Campaign Launched 09/18/2008
Current Focus: MRSA & Clostridium difficile infection (CDI)
http://www.nidd.ca
http://www.chica.org/

Additional External Resources & Influencing Factors
International Infection Control Council
Clostridium difficile associated disease
http://www.chica.org/

Structure & elements of the IPAC program which include:
- Organizational support from leadership & adequate infrastructure – i.e. incl. adequate IPAC professionals trained & board certified
- Hand hygiene program; Surveillance program;
- Education for staff and clients/patients/residents and their families;
- Occupational Health and Safety;
- Timely access to microbiology laboratory reports;
- Product review and evaluation;
- Review of practices for reprocessing of equipment;
- Review of practices for environmental cleaning;
- Infection prevention and control input into facility design;
- Effective immunization programs;
- Outbreak detection and management; and
- Adequate resources incl. adequate IPAC professionals trained & board certified

Basic, but important principle
The Epidemiologic Triangle of Cross Transmission
Most MDROs are transmitted via hands of HCWs
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Model of Diffusion of Innovation

1847

Where do healthcare professionals in 2008 fall along this curve w/r hand hygiene?

Diffusion of Infection Prevention Practices;

Factors:
safety
Culture
ICP-CIC

PI collaborative
= more likely to use BSI prevention practices

Max Barrier Prc.: Chlorhexidine tincture / Antimic. CL / CHG dressing

Is BSI Prevention Evidence Making it to the Bedside?

Survey of ICUs in 10 academic medical centers across the U.S.:
- In 80% of the ICUs 5 separate groups of physicians inserted 24-50% of CLs
- Written policy for CL insertion (80%)
- Policy Requires maximal sterile barriers at insertion (28%)
- Formal education program for personnel (52%)
- Policy stated hand hygiene prior to insertion (80%)
- Policy stated hand hygiene prior to accessing CL (36%)


Diffusion of Infection Prevention Practices;

ICP with CIC: more likely to use SGS

Prevention of CA-UTI: How are we doing?


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Figure 1. Trends in hospital stays associated with Clostridium difficile-associated disease, 1993-2005


Recommendations for Surveillance of Clostridium difficile Infection

Admission

Discharge

< 48 h

< 4 weeks

4-12 weeks

> 12 weeks

HO-HCFA

CO-HCFA

Indeterminate

CA-CDI

* HO: Hospital (Healthcare) onset

* CO-HA: Community Onset Healthcare-associated

* CA: Community Associated

* Depending upon whether patient was discharged within previous 4 weeks, CO-HA vs. CA


Pathogen Specific Analysis: MRSA & CLABSI

- NNIS & NHSN data, CDC
- CLABSI - ICU
- % of BSI caused by MRSA increased from 47.9 to 64.7
- However: incidence of BSI from both MRSA decreased by 44.4% since 2001

Burton DC, et al. SHEA 2008 (abstract #4)


Figure. Trends in %MRSA and Incidence of MRSA and MSSA Central Line-Associated Bloodstream Infections (CLABSI) in Intensive Care Units—United States, 1997-2007

Figure. Trends in Central Line-associated Bloodstream Infections (CLABSI) by Intensive Care Unit Type—United States, 1997-2007

Squeezing the Balloon

- "Infection Control programs that focus on one organism or only one antimicrobial agent are unlikely to succeed."


States with BI/NAP1/027 Strain of C. difficile (N=38), November, 2007

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Preventing CLABSI: System-level success
- Prospective cohort study, SICU & concurrent control ICU
- Bundled CLABSI Prevention Interventions in SICU
- CLABSI rate decreased from 11.3 to 0.0/1,000 CVC days in SICU; control ICU 5.7 to 1.6
- Estimated 42 CVC-BSIs avoided; savings of > $1.9 million


Efficacy of Network level Performance Improvement Collaborative, cont.
- Pittsburgh, Regional Health Initiative (PRHI)
  - 66 ICUs, 32 hospitals
  - Education
  - Equipment
  - Process improvement
  - 68% drop in CVC-BSI [4.31 to 1.36/1000 CVC days]
  - MMWR 2005 (Oct 14);54:1013-16.

Results from other collaboratives
- 24 NICUs, Germany
- Participation in surveillance collaboratives with feedback to participants can significantly lower BSI rates and reduce pneumonia


Other Collaboratives: Duke Infection Control Network
- 12 Community Hospitals, NC & VA
- Results:
  - HA-BSI: dropped by 23%
  - HA-Infection+Colonization with MRSA: dropped by 22%
  - VAP: dropped by 40%
  - Occupational sharps injuries: dropped by 18%


KEYSTONE-ICU PROJECT
- Statewide initiative-70 Hospitals, 127 ICUs
- In Collaboration with Johns Hopkins Quality and Research Institute
- Reduce errors and improve patient outcomes in ICUs
- Combination of evidence based medicine and quality improvement
- 5 interventions implemented over a 2 year period
  - Patient Safety Program and incident reporting
  - Eliminate Blood Stream Infections (BSIs)
  - Improve care of the ventilated patient
  - Implement Daily Goals Sheet
  - Implement and evaluate an intervention to reduce ICU mortality


Keystone ICU Project: The Results
- 66% reduction in Central Line Bloodstream Infections (CLBSI)
- Interventions:
  - Hand hygiene
  - Max. barrier precautions during insertion
  - CHG antiseptic on insertion site
  - Avoid femoral CLs
  - Remove CL when not needed

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Process Indicators: CLABSI
ALL UNITS, SJMHS

<table>
<thead>
<tr>
<th></th>
<th>May-June '04</th>
<th>July-August '04</th>
<th>Sept. '04</th>
<th>Nov-Dec '04</th>
<th>April-May '05</th>
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</thead>
<tbody>
<tr>
<td>Lines inserted</td>
<td>31</td>
<td>38</td>
<td>31</td>
<td>61</td>
<td>86</td>
</tr>
<tr>
<td>Follow correct procedure</td>
<td>65% (20/31)</td>
<td>86% (30/35)</td>
<td>90% (28/31)</td>
<td>87% (53/61)</td>
<td>86% (57/66)</td>
</tr>
<tr>
<td>Required correction</td>
<td>52% (16/31)</td>
<td>65% (26/40)</td>
<td>59% (11/19)</td>
<td>28% (17/61)</td>
<td>27% (18/66)</td>
</tr>
<tr>
<td>Femoral lines inserted</td>
<td>16% (5)</td>
<td>19% (1)</td>
<td>6% (2/31)</td>
<td>8% (5/61)</td>
<td>12% (8/66)</td>
</tr>
<tr>
<td>Average insertion time</td>
<td>41.7 minutes</td>
<td>40 minutes</td>
<td>54 minutes</td>
<td>44 minutes</td>
<td>35 minutes</td>
</tr>
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</table>

Learn from a Defect Tool (LDT): One Hospital’s Experience

- Divided into three sections:
  - **Section 1** asks the users to identify what happened or the defect they want to investigate
  - **Section 2** is a framework provided for the investigators to identify any contributing factors. These factors include: patient, task, caregiver, and team related, training and education, local environment, information technology and institutional environment
  - **Section 3** asks participants to develop an action plan with assigned responsibility for task completion and follow up dates for each item.

Chart Review

- No excess blood products given on these patients
- Median blood glucose was <140 mg/dl
- All of the patients that had CLABSI had a single-lumen infusion catheter (SLIC®) that had been placed by the nursing staff into an existing cordis: (percutaneous sheath) introducer.
- Further discussion identified that maximal barrier precautions were not being used during placement of SLIC

Follow-up

- Reformat BSI checklist to ensure proper sequence of line insertion procedure
- Provide re-education to staff on basic surgical asepsis
- Educate nursing staff to use maximal barrier precautions during SLIC insertions
- Incoming residents able to take Fundamentals in Critical Care Course which includes line placement instruction and practice
- Educate staff on pre-procedure briefing process
- Line cart restocking process now 2 times per day
- Ordered ultrasonic vein finder

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August 2006
All Units BSI rate per 1000 catheter days
SJMH Compared to state of MI and NHSN

CLABSI Best Practices Bundle Implemented July 2004

The Expanding Use of Central Lines Outside
the ICU Setting:

- Climo M, et al. 2003:
  - 1 Day Point Prevalence Survey Six Medical Centers:
    - 2,459 patients; 29% with central lines (CL)
      - ICU: 43-80% had CL
      - Non-ICU: 7-39% with CL
    - Of all CLs in use 66% were in non-ICU
- Vonberg RP, et al. 2006:
  - 42 hospitals, 77 non-ICUs, July 02- June 04
  - CL utilization: 8,317 CL days in 181,401 patient days
  - Mean CLABSI rate = 4.3/1,000 CL days

Hitting the Road
with CL Kits

Other K-ICU Bundles:
VAP Prevention

- Improve care of ventilated patients
  - Elevate HOB
  - Provide DVT prophylaxis
  - Provide PUD prophylaxis
  - Hold sedation
  - Test for ability to extubate
  - Glycemic control

The Next Big Thing @ Keystone Center

- Hospital-Associated Infection (K-HAI) Prevention Project –
  [kickoff January 2007]
  - http://www.mha.org/mha_app/keystone/index.jsp
- 108 Hospitals in Michigan are participating

Components:
- Hand hygiene bundle
- The Bladder Bundle
- Expanding central line associated BSI prevention beyond
  the ICU
- Comprehensive Unit-based Safety Program (CUSP)

Hand Hygiene for Healthcare Personnel

<table>
<thead>
<tr>
<th>Good</th>
<th>Better</th>
<th>Best</th>
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</thead>
<tbody>
<tr>
<td>Plain Soap</td>
<td>Antimicrobial soap</td>
<td>Alcohol-based handrub</td>
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</table>

Systematic Approach – Preventing Cross
Transmission of All Pathogens
Efficacy of Hand Hygiene Preparations in
Killing Bacteria

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The Bladder Bundle:
Nursing Intervention to Remove
Unnecessary Urinary Catheters
Mohamad Fakih, MD, MPH
St John Hospital and Medical Center

Elements of the Bladder Bundle
- Point prevalence: evaluate frequency of utilization of urinary catheters by patient care units: identify target unit(s)
- Pre-intervention Baseline: data collection
- Intervention: goal is to increase appropriate use
  - Urinary catheter order sheet;
  - automatic stop orders;
  - RN-authorized discontinuation protocol; etc.
- Post-intervention: evaluation

Where to start:
- Begin with a pilot unit then spread from there
- Project plan
  - Review materials with teams
  - Determine a timeframe for roll-out
  - Identify your cohort.

Point Prevalence Assessment
- Point prevalence: on all general medical units at your hospital to determine the units with the highest utilization of urinary catheters.
- Example: count the number of urinary catheters used per unit and the number of patients on the same unit on a single day
- Point prevalence utilization ratio
  - # of urinary catheters on unit A / total # of patients on unit

Point Prevalence- Example
- Look at multiple units and decide the most feasible unit to start (it may be highest utilization)
- Unit B has the highest utilization ratio

<table>
<thead>
<tr>
<th></th>
<th># of foleys</th>
<th># of patients</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit A</td>
<td>6</td>
<td>32</td>
<td>0.19</td>
</tr>
<tr>
<td>Unit B</td>
<td>10</td>
<td>29</td>
<td>0.34</td>
</tr>
<tr>
<td>Unit C</td>
<td>4</td>
<td>30</td>
<td>0.13</td>
</tr>
<tr>
<td>Unit D</td>
<td>8</td>
<td>32</td>
<td>0.25</td>
</tr>
<tr>
<td>Unit E</td>
<td>2</td>
<td>28</td>
<td>0.07</td>
</tr>
</tbody>
</table>

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Prevention Strategies for MDROs & Other Unwelcomed Pathogens in the Critical Care Environment

HYGIENE MODEL

Patient

Personnel

Environment

Ultraviolet Marker on Environmental Surfaces

A = surface in viable light
B = Heavy residual marker
C = Moderate residual
D = Light residual

Source: Alfa MJ, et al. BMC Infect Dis. 2008; 8: 64

Measurement of MDROs

Two options
- Multi-drug resistant organism (MDRO)
- *C. difficile*-associated disease (CDAD)

See also:

http://www.cdc.gov/ncidod/dhhp/nhsn_MDRO_CDAD.html

Tools of the Collaborative

- Engage
  - stories of harm & efficacy of prevention
- Educate
  - Original papers, fact sheet, slides, coaching calls, web-based archive, biannual workshops
- Execute
  - Standardize, create independent checks, learn
- Evaluate
  - Measure, Measure, & more measurement – web based data submission and reporting tool

To Do the Right Thing and Prevent Mistakes

- Create culture of safety:
  - completed unit education on patient safety
  - Training to senior medical staff and residents
  - Education to nurses and respiratory therapists
  - Empower nurses/RT to stop line placement

- Improve Processes
  - Reduce complexity: Line cart
  - Create independent checks for key processes: BSI checklist
  - Nurse in room during line insertion
  - Sign on door: ‘Procedure in progress’ to decrease traffic in room

- Automate: put checklist and standard documentation in new bedside computer system

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Conceptual Model for Collaboratives

**Context**
Have we created a culture of safety?

**Structure**
Have we reduced the likelihood of harm?

**Process**
How often do we do what we are supposed to?

**Outcome**
How often do we harm?


Tool kits
- Engage
  - Opportunity calculator, stories of harm
- Educate
  - Original papers, fact sheet, slides
- Execute
  - Standardize, create independent checks, learn, conference calls & workshops (2x/yr)
- Evaluate
  - Measure, report, analyze, and sustain

**Summary Points**
- Expectations for Elimination of HAIs are coming from patients, payers, & providers.
- There is increasing evidence that infection prevention collaboratives can move evidence from the literature to the bedside and are effective.
- A “checklist” is an important component of the toolkit – however engaged champions for safety & supportive culture of safety are key elements.
- Evidence Score for Collaboratives:
  - “Educational programs and multi-disciplinary teams may be effective strategies to reduce rates of HAI.” [Aboelela SW, et al. JHI 2007;66:101-8]