Notable Evidence in the Peer-Reviewed Literature involving Infection Prevention (2012 - 2013 YTD)

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**Practice Standard: Research**

Participates; evaluates; and/or applies relevant research findings to infection prevention, control, and epidemiology practice.

Critically evaluates published research and incorporates appropriate findings.
Making the Case, continued


**Domain: Research**

Access, appraise and apply robust evidence of all types from a range of research and other sources, to the domains of the role.

Share best practice through the dissemination of evidence and knowledge

**Domain: Education**

Critical analysis and evaluation of published literature and peer-reviewed research studies

**Domain: Infection Prevention & Control**

The IP must be able to critically evaluate research and apply the findings to their practice setting

**Domain: Performance Improvement & Implementation Science**

Uses literature review as an essential tool

Interprets and applies meta-analyses; interprets research findings, identifies study limitations and bias
Glad you asked... YES!


Survey of IP programs in hospitals in California, 2010

Findings:

- Programs with lead IP with board certification in infection prevention & control [CIC®] had significantly lower MRSA bloodstream infection (BSI) rates.
- Facilities participating in performance improvement collaborative correlated with significantly lower VRE-BSI rate

Research & Implementation Science are elements of The APIC Competency Model.

New tag line for AJIC; reflects competency model + filter used for identifying Top 10 Pearls of Evidence
### Requirement

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Level of evidence</th>
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</thead>
</table>
| EP 2: Insert indwelling urinary catheters according to established evidence-based guidelines that address the following:  
- Limiting use and duration to situations necessary for patient care  
- Using aseptic techniques for site preparation, equipment, and supplies | A-II |
| EP 3: Manage indwelling urinary catheters according to established evidence-based guidelines that address the following:  
- Securing catheters for unobstructed urine flow and drainage  
- Maintaining the sterility of the urine collection system  
- Replacing the urine collection system when required  
- Collecting urine samples | A-III |
| EP 4: Measure and monitor catheter-associated urinary tract infection prevention processes and outcomes in high-volume areas by doing the following:  
- Selecting measures using evidence-based guidelines or best practices  
- Monitoring compliance with evidence-based guidelines or best practices  
- Evaluating the effectiveness of prevention efforts | A-II or B-II for all |

Note: Surveillance may be targeted to areas with a high volume of patients using indwelling catheters. High-volume areas are identified through the hospital’s risk assessment as required in IC.01.03.01, EP 2.

**NPSG.07.03.01:** Implement *evidence-based practices* to prevent health care–associated infections due to multidrug-resistant organisms in acute care hospitals

**NPSG.07.06.01:** Implement *evidence-based practices* to prevent indwelling catheter-associated urinary tract infections (CAUTI)
Collect data and disseminate results

Full adherence to best practices

Recognize excellence

Identify and respond to emerging threats

Improve science for prevention through research

“Elimination will require the implementation of evidence-based practices, the alignment of financial incentives, the closing of knowledge gaps, and the acquisition of information to assess progress and to enable response to emerging threats.”

Hierarchy of Scientific Evidence: rank order of quality of findings

- Systematic Reviews
- Randomized Controlled Trials
- Cohort Studies
- Case-Control Studies
- Case Series, Case Reports
- Editorials, Expert Opinion
Example of Systematic Review and Meta-Analysis

Rate of CAUTI can be reduced by > 50% with reminders or stop orders.

System for Critical Appraisal of the Evidence; Current HICPAC methodology

**Table 1. Rating the quality of evidence for therapy or harm studies using the GRADE approach**

<table>
<thead>
<tr>
<th>Type of evidence</th>
<th>Initial grade</th>
<th>Criteria to decrease grade</th>
<th>Criteria to increase grade</th>
<th>Overall quality grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCT</td>
<td>High</td>
<td>Quality: Serious (−1 grade) or very serious (−2 grades)</td>
<td>Strong association: Strong (+1 grade) or very strong evidence of association (+2 grades)</td>
<td>High</td>
</tr>
<tr>
<td>Observational study</td>
<td>Low</td>
<td>Consistency: Important inconsistency (−1 grade)</td>
<td>Dose response: Evidence of a dose-response gradient (+1 grade)</td>
<td>Moderate</td>
</tr>
<tr>
<td>Any other evidence</td>
<td>Very low</td>
<td>Directness: Some (−1 grade) or major (−2 grades)</td>
<td>Unmeasured Confounders: Inclusion of unmeasured confounders increases the effect size (+1 grade)</td>
<td>Low</td>
</tr>
<tr>
<td>(eg, expert opinion)</td>
<td></td>
<td>Precision: Imprecise or sparse data (−1 grade)</td>
<td></td>
<td>Very low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Publication bias: High risk of bias (−1 grade)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GRADE, Grading of Recommendations Assessment, Development, and Evaluation; RCT, randomized controlled trial.

**Table 2. Formulating recommendations**

<table>
<thead>
<tr>
<th>HICPAC recommendation</th>
<th>Weighing benefits and harms for critical outcomes</th>
<th>Quality of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong (category I)</td>
<td>Interventions with net benefits or net harms</td>
<td>Category IA: high to moderate</td>
</tr>
<tr>
<td>Weak (category II)</td>
<td>Interventions with trade offs between benefits and harms</td>
<td>Category IB: low to very low (established practice)</td>
</tr>
<tr>
<td>No recommendation/unresolved Issue</td>
<td>Uncertain trade offs between benefits and harms</td>
<td>Category IC: high to very low (regulatory)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High to very low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low to very low</td>
</tr>
</tbody>
</table>

Results of literature search and assessment:

4,847 potentially relevant articles identified; 434 (8.9%) retrieved

64 (1.3%) met the inclusion criteria

Only 15 (0.3%) were part of the final analysis

Reasons for elimination of studies from the pool of 64:

- Low quality score using GRADE system (31)
- > 10 years old (7)
- Only reported processes - no outcome data (5)
- Study performed outside the U.S. (11)

Conclusions: quality/strength of studies on HAI prevention = weak & most are before/after (observational) method.

Goal to eliminate HAIs difficult based on current state of the science
Sharpening Your Skills: Locating, Assessing and Grading the Evidence

Step 1. Formulate your question.

Why use a search Engine?

800,000 new manuscripts published each year
What are on the minds of infection preventionists?

“How often are people changing privacy *curtains*? Inpatient? Outpatient? How are people cleaning privacy *curtains* if you do not change them after every in-patient? Any novel methods to keep *curtains* clean of hand carried organisms?”

- Olsen-Scribner RJ. 8/24/12.

- Total number of posts to this thread = 191

- Are there any published studies of cubicle curtains to help address some of these questions?

- Go to PubMed and see; suggested MeSH term = hospital curtains
Global Perspectives: Where is new scientific evidence coming from?

Mostly the U.S. - right Russ?

au contraire - see source of submissions to AJIC

Well-recognized strategy used by clinicians to critique and keep up to date with relevant literature
On to the Hit Parade of Published Studies
<table>
<thead>
<tr>
<th>Title</th>
<th>Pub. Date</th>
</tr>
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<tbody>
<tr>
<td>Competency in infection prevention: A conceptual approach to guide</td>
<td>May 2012</td>
</tr>
<tr>
<td>current and future practice</td>
<td></td>
</tr>
<tr>
<td>The effectiveness of hand hygiene procedures in reducing the risks</td>
<td>Dec. 2007</td>
</tr>
<tr>
<td>of infections in home and community settings – hand hygiene</td>
<td></td>
</tr>
<tr>
<td>Role of hospital surfaces in the transmission of emerging health</td>
<td>June 2010</td>
</tr>
<tr>
<td>care-associated pathogens: Norovirus, C. difficile, and Acinetobacter</td>
<td></td>
</tr>
<tr>
<td>Perceived impact of the Medicare policy to adjust payment for health</td>
<td>May 2012</td>
</tr>
<tr>
<td>care-associated infections</td>
<td></td>
</tr>
<tr>
<td>An AJIC and NHSN data quality collaboration: case studies</td>
<td>June 2012</td>
</tr>
<tr>
<td>facilities, 2010</td>
<td></td>
</tr>
<tr>
<td>Nursing and physician attire as possible source of nosocomial</td>
<td>Sept. 2012</td>
</tr>
<tr>
<td>infections</td>
<td></td>
</tr>
<tr>
<td>CDC/NHSN surveillance definitions of HAIs, acute care setting</td>
<td>June 2008</td>
</tr>
</tbody>
</table>
The Evolving PIE of HAI... You’ve all seen this

274,098 TOTAL
-967 HRN
-21 WBN
-28,725 Non-newborn ICU
244,385 = SSI

263,810 Other
22%

133,368 BSI
11%

424,060 UTI
36%

129,519 PNEU
11%

HRN=High Risk Newborn, WBN=Well Baby Nursery, ICU=Intensive Care Unit, SSI=Surgical Site Infection, BSI=Bloodstream Infection, UTI=Urinary Tract Infection, Pneu=Pneumonia

SSIs are now most prevalent

Possible factors:

- Change in criteria for UTI by NHSN, 2009
- Complexity of Prevention of SSIs; multiple risk factors

Total annual costs for 5 sites of HAI, U.S. = $9.8 billion

- SSIs contributing the most to overall costs (33.7% of this total)

- Frequency:
  - SSIs are estimated as most frequent HAI (36%)
  - C. difficile infection (CDI); ranks second (30.3%)
  - Remaining ranking:
    - CAUTI (17.4%)
    - CLABSI (9.2)
    - VAP (7.1)

Zimlichman E, et al. JAMA Intern Med
Online 9/2/2013

Methods: semi-structure & in-person interviews

Findings: Barriers to CAUTI Prevention using the “Bladder Bundle”

- Problems with nurse-physician engagement
- Patients or family requested a urinary catheter (UC)
- The “virtual” appearance of a UC during Emergency Dept to inpatient admission

Gaining Knowledge from interviews:

“Nurses, I believe, truly care about the patients in...their area. [For example], on [one] unit, they’re getting [patients] out of bed sooner. ...[for] increased mobility which may in turn decrease the length of stay. ...if you let [nurses] know what the benefits could be, not just all, “Hey, our patients may not get a UTI.”

See also www.catheterout.org
Methods: Parallel, 3-group, multi-center randomized controlled trial

Standard latex (control), silver alloy-latex, and nitrofural-impregnated-silicone in adults ≥ 16yr at 24 hospitals in the U.K.

Findings: Frequency of SUTI by Type of UC

- Silver alloy = 263/2097 (12.5%); not significant (NS)
- Nitrofural (NF) = 228/2153 (10.6%); 0.81(0.65-1.01; p=0.031)
- Control = 271/2144 (12.6%)

Reasons for UC: 95% perioperative use, 5% urinary retention

Additional observation: 1/9 patients with NF cath. describe discomfort from the device

Author’s conclusions: antimicrobial UCs do not provide the prestated minimum level of clinical effectiveness

Nurse-led initiative to prevent CAUTI – Implementation Science in Action


Methods: Pre/Post intervention, quality improvement project, academic medical center, Aurora, CO. Aim = reduce CAUTIs in med-surg. population

Findings:

- Decreased mean number of UC days 3.01 - 2.2 (p=0.18) [Surgery] & 3.53 to 2.7 (p= 0.076) [Medicine]
- No significant drop in CAUTI rates – baseline too low to detect significance
- Engaged patients and families in CAUTI prevention program
- Product cost savings = $52,000 USD/year

Methods: Secondary analysis of prior multi-center, randomized controlled trial, 7 ICUs in hospitals in France; dressings for central venous and arterial catheters

Findings:

- 7,347/11,036 (67%) dressings required changing because they were loose or soiled.
- Hazard Ratios (HRs) for Loose Dressings:
  - Catheter colonization (>10^3CFU). 13.99 (9.88-19.82) p <0.001
  - CRBSI; 18.11 (5.66-57.88) p<0.001
  - Major CR infection; 12.51 (3.95-39.62) p<0.001

Methods: multicenter, cluster-randomized, nonblinded crossover trial of impact of chlorhexidine gluconate (CHG) cleansing on acquisition of MDROs & BSIs in ICU patients; 9 ICUs, 1 bone marrow transplant

Findings:
MDROs: 5.1(CHG) vs. 6.6 (control) /1,000 pt.-days = 23% reduction
HA-BSI: 4.78 (CHG) vs 6.6 (control) / 1,000 CL days = 28% reduction

Methods: cluster-randomized multi-facility trial of strategies to prevent MRSA and other infections in adult ICU population; 43 hospitals/75 ICUs

Group 1 = active nasal culture for MRSA & contact precautions
Group 2 = screen for MRSA + CP + decolonization/cleaning{mupirocin & daily CHG cloth}
Group 3 = universal decolonization

Overall 37% reduction; Gp 3
44% red. BSI; Gp 3

Methods: Observational, case-control study of impact of mupirocin + CHG cleansing on MRSA SSI rates.

Findings:
Value-Based Care & Electronic Medical Record (EMR)

Eligible hospitals achieving standards for health IT incentives

Are IPs at the EMR Table?

“The results of this review suggest that electronic surveillance systems should be developed to maximize the efficacy of abundant electronic data sources existing within hospitals.”


Methods: In vitro comparison of efficacy of 8 different methods of disinfection in patient care rooms, acute care hospital, UK

Findings: 3 methods resulted in significant reduction in spore concentration:
1) H2O2 vapour [2.3 log] - most effective,
2) 1000 ppm chlorine-releasing tablets [2.23],
3) peracetic acid [2.134]

Kramer A, 2006
Potential for aerosolization of Clostridium difficile after flushing toilets: the role of toilet lids in reducing environmental contamination risk.

Methods: In situ using environmental microbiologic testing: air sampler & settle plates / $10^7$ cfu/mL spores were loaded into the toilet and then ‘FLUSH & RUN!’ technique was deployed.

Findings:

C. difficile was detected in air above the toilet as high as 25cm

Highest concentration of C. difficile from air sampling was right after flushing

Dropped 8- and 3-fold over 60 and 90 minutes respectively

Mean droplets for lid-less toilet design = 15-47 + contamination in surrounding area

Closed lid = no droplets and no contamination of surrounding environment - 21st century “pump handle?”

C. difficile spores cont. - a problematic pathogen, but air as a medium for movement?

Monette MC. CMAJ 2012
Other Problematic Pathogens: Carbapenem-Resistant Enterobacteriaceae (CRE)


Methods: Epidemiologic outbreak investigation + multi-pronged interventions, long-term acute care hospital, U.S.

Findings:

99 instances of cross transmission of CRE; 16 present on admission from 7 different acute care facilities, & 29 cases of CRE BSI

Risk factors: greater no. vent. days, on beta-lactam Abx, & diabetes

Interventions:
A. Hand hyg audits
B. Active detection
C. Pt. Cohorting
D. Daily device use check
E. Conf. calls - CDC
F. RN cohorting - ICU
Thank You... any questions?