Welcome…
Thanks for Attending

• Disclosures
  – Kathleen Vollman
    • Sage Products Speaker Bureau & Consultant
    • Eloquest Healthcare Speaker Bureau & Consultant
    • Hill-Rom Speaker Bureau & Consultant
Objectives

• Outline the scope of the problem
• Describe key nursing care practices based on the evidence that can reduce bacterial load and/or prevent the development of device related hospital acquired infections

Why HAI's?
Protecting Patients From Harm

<table>
<thead>
<tr>
<th></th>
<th>Estimates: 183 Hospitals in 10 States</th>
<th>SR &amp; Meta-Analysis of HAI Burden In Developing Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAI:</td>
<td>722,000/year</td>
<td>15.5 per 100 patients (3x higher)</td>
</tr>
<tr>
<td>HAI-related deaths:</td>
<td>75,000/year</td>
<td>37,000/yr Europe</td>
</tr>
<tr>
<td>Hospitalized patients develop infection:</td>
<td>1 out of 25 (4%)</td>
<td>100 hospitalized patients: 10 in developing countries will acquire a HAI</td>
</tr>
<tr>
<td>Death due to sepsis/septic shock:</td>
<td>700/day</td>
<td>700/day</td>
</tr>
<tr>
<td>Money spent:</td>
<td>$45 billion/year</td>
<td>€7 billion/year Europe</td>
</tr>
<tr>
<td>Increase risk of readmission:</td>
<td>27 days vs. 59 days</td>
<td></td>
</tr>
</tbody>
</table>

WHO accessed 08/09/2015 http://www.who.int/gpsc/country_work/gpsc_ccisc_fact_sheet_en.pdf?ua=1
### Health Care Associated Infection Data

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>VAP/per 1000 vent days</td>
<td>Range of pooled means 0.2 (Ped CVICU) -4.4 (Burn ICU)</td>
<td>Range of pooled means 0.94 (MICU)-3.52 (NSICU)</td>
<td>Range of pooled means 7.9 (Peds) – 29.6 (Trauma)</td>
</tr>
<tr>
<td>CLA-BSI/per 1000 cath days</td>
<td>Range of pooled means 0.8 (CVICU)-3.4 (Burn ICU)</td>
<td>Range of pooled means 2.52 (SCICU)-3.08 (MCICU)</td>
<td>Range of pooled means 1.02 (Surg Cardio)-6.38 (Neuro)</td>
</tr>
<tr>
<td>CA-UTI/per 1000 cath days</td>
<td>Range of pooled means 0.7 (Peds Surgical)-5.0 (Neuro ICU)</td>
<td>Range of pooled means 2.01 (MICU)-2.93 (NSICU)</td>
<td>Range of pooled means 1.29 (Surg Cardio) – 15.99 (Neuro)</td>
</tr>
</tbody>
</table>


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### Preventing Harm: Global HAI Strategy for CLABSI, CAUTI & MDRO’s

Reducing the Bacterial Load on the Patient
Evidence Based Bathing Practices
Traditional Bathing

Soap and water basin bath was an independent predictor for the development of a CLABSI

Bath Basins: Potential Source of Infection

- Multicenter sampling study (3 ICU’s) of 92 bath basins
- Identify & quantify bacteria in patients basins
- Sampling done on basins used > 2x in patients hospitalized > 48 hours & performed 2 hours post bath
- Cultures sent to outside laboratory
- Qualitative vs. quantitative measures used to exclude growth that may have occurred in transport
- Bathing practices not controlled & no antiseptic soaps used to bathe

The Evidence: Bath Basins
Potential Source of Infection

Multicenter Sample Study to Identify and Quantify Bacteria in Basins

- Enterococci 54%
- Gram negative 32%
- *S. aureus* 23%
- VRE 13%
- Less than 10% growth rates
  - MRSA 8%
  - *P. aeruginosa* 5%
  - *Candida albicans* 3%
  - *E. coli* 2%

98% grew bacteria


Bath Basins
Potential Source of Infection

Large multi-center study evaluates presence of multi-drug resistant organisms

- Contaminated 62%
  - 686 basins/88 hospitals
- Gram negative bacilli 45%
  - 495 basins/86 hospitals
- Colonized w/ VRE 35%
  - 385 basins/80 hospitals
- MRSA 3%
  - 36 basins/28 hospitals

Mechanisms of Contamination

- Skin flora
- Multiple-use basins
  - Incontinence cleansing
  - Emesis
  - Product storage
- Bacterial biofilm from tap water


Waterborne Infection

**Hospital Tap Water**

- Bacterial biofilm
- Most overlooked source for pathogens
- 29 studies demonstrate an association with HAIs and outbreaks
- Transmission:
  - Drinking
  - Bathing
  - Rinsing items
  - Contaminated environmental surfaces
- Immunocompromised patients at greatest risk

Impact on UTI with Basin Bathing

UTI Rate - Removal of Prepackaged Bath Product QTR 3 FY05

The Effect of Bathing with Basin and Water and UTI Rate, LOS and Costs

<table>
<thead>
<tr>
<th>Phases</th>
<th>Product Cost/ No. of UTI</th>
<th>Median(^4) LOS 17 Days</th>
<th>Median(^4) Cost (4857.00)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I- Pre-Packaged Bathing</td>
<td>$10,530(^1) (3.00)</td>
<td>25</td>
<td>$117,175</td>
</tr>
<tr>
<td>Washcloths (9 months)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II- Basin/Water</td>
<td>$3,510(^2) (1.00)</td>
<td>48</td>
<td>$224,916</td>
</tr>
<tr>
<td>(9 months)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III- Additional Product Cost, UTI, LOS, COSTS</td>
<td>$7,020(^3)</td>
<td>23(^3)</td>
<td>$107,741</td>
</tr>
</tbody>
</table>

1 Based on 3 packages of 8 towels each
2 Based on product cost of towels, soap, and basin
3 Difference between phase I pre-package/phase II basin water

Soap and water basin bath was an independent predictor for the development of a CLABSI

The Evidence: Impact of 2% CHG Cloth Baths
Evaluate effect of daily bathing with CHG on acquisition of MDRO’s and incidence of CLABSI

9ICU’s & Bone Marrow Transplant unit
Randomly assigned 7727 patient:
  a. No-rinse, 2% CHG impregnated washcloths
  b. Non-antimicrobial, no-rinse bath cloths

Results of 2% CHG bathing
- 23% reduction
- 28% reduction
- 50% reduction
- 90% reduction

MDROs
HAI (primary blood stream)
Gram positive CLABSI
Fungal CLABSI

**Impact of 2% CHG Cloth Baths**

Study to determine the best method for reducing spread of MRSA & MDROs

**3 protocols tested:**

a) Swab for MRSA on admission to ICU
   - Isolate if positive
b) Swab for MRSA on admission to ICU
   - Isolate if positive
   - Nasal mupropirin x 5 days
   - 2% CHG cloth bathing for entire ICU stay
c) No swab
   - Nasal mucopiricin x 5 days
   - 2% CHG bath for entire ICU stay

**Results:**

No Swab Group
Universal Decolonization Demonstrated

- 37% reduction
- 44% reduction


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**Single Center CHG Bathing Study**

- A pragmatic cluster randomized, crossover study of 9340 patients admitted to 5 adult intensive care units of a tertiary medical center
- Units performed once-daily bathing of all patients with disposable cloths impregnated with 2% chlorhexidine or non-antimicrobial cloths as a control
- Bathing treatments were performed for a 10-week period followed by a 2-week washout period during which patients were bathed with nonantimicrobial disposable cloths, before crossover to the alternate bathing treatment for 10 weeks.3x
- Results
  - No difference in CLABSI's, CAUTI's, VAP & c-diff infections were seen

Limitations:

- Adherence to care practice was not monitored
- Intracluster correlation nor sequence of randomization was consider in the analysis
- Used outcomes measures beyond previous studies
- Active surveillance was not perform to detect cross over transmission of MDRO’s
- Wasn’t registered on the clinical trials site
Suggestions & Implementation Strategies

- Avoid reusable bath basins and use of washcloths
  - Keep a par level of basins in central supply with washcloths or no-rinse soap in case a patient refuses a prepackaged bath.
  - Remove soaps and creams from the unit stock.
  - Replace basin with better strategies for containing emesis and keeping supplies.
  - Reduce par levels of washcloths.

- Avoid tap water for any component of bathing ICU patients
  - Use distilled or sterile water if necessary

- Use prepackaged bathing cloths to reduce process variation

- Use 2% CHG cloths for routine bathing of all ICU patients
  - Use from the jawline down
  - Use non-antimicrobial, no-rinse prepackaged cloths for routine face and perineal cleansing
    - If skin barrier is needed due to incontinence, use nursing judgment
  - Ensure 2% CHG is on the skin at all times

Nursing Care: Oral Care Impact on VAP/HAP
Healthcare Acquired Pneumonia

- Risk Factor Categories
  - Factors that increase bacterial burden or colonization
  - Factors that increase risk of aspiration

Body Position: Supine versus Semi-recumbent (30-45 degrees)

Methodology
- 19 mechanically ventilated patients
- 2 period crossover trial
- Study supine and semirecumbent positions over 2 days
- Labeled gastric contents (Tc 99m sulphur colloid)
- Measured q 30 min content of gastric secretions in endobronchial tree in each position
- Sampled ET secretions, gastric juice & pharyngeal contents for bacteria

Body Position: Supine versus Semi-recumbent (30-45 degrees)

Results

- Radioactive contents higher in endobronchial secretions in supine patients
- Time dependent:
  - Supine: 298cpm/30min vs. 2592cpm/300min
  - HOB: 103cpm/30min vs. 216cpm/300min
- Same microbes cultured in all 3 areas 32% with HOB vs. 68% supine.


Research on HOB

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>Intervention</th>
<th>Results</th>
</tr>
</thead>
</table>
| Drakulovic, et al¹    | 1999 | 45° HOB      | • Microbiologically confirmed nosocomial pneumonia was lower (5% vs 23%)  
  • Supine position and enteral nutrition were independent risk factors for VAP and patient receiving enteral nutrition in the supine position had the greatest frequency |
| van Nieuwenhoven, et al² | 2006 | 45° HOB      | • Randomly assigned to HOB 10° or 45° and average elevation ranges were measured:  
  – 10° group: 9.8°-14.8° in the first week  
  – 45° group: 29.3°-23.1° in the first week (intended elevation was not achieved 85% of the time) |

HOB=Head of bed; ROM=Range of motion.
Oral Cavity & VAP

- 89 critically ill patients
- Examined microbial colonization of the oropharynx through out ICU stay
- Used pulse field gel electrophoresis to compare chromosomal DNA
- Results:
  - Diagnosed 31 VAPs
  - 28 of 31 VAP’s the causative organism was identical via DNA analysis

- 49 elderly nursing home residents admitted to the hospital
- Examined baseline dental plaque scores & microorganism within dental plaque
- Used pulse field gel electrophoresis to compare chromosomal DNA
- Results
  - 14/49 adults developed pneumonia
  - 10 of 14 pneumonias, the causative organism was identical via DNA analysis


El-Solh AA. Chest. 2004;126:1373-1382
Formation of Biofilm Over 13 Hours

http://helios.bto.ed.ac.uk/bto/microbes/biofilm.htm
Loesche, W. 2012

What Does the Evidence Tell Us?

Brush
CHX rinse alone
CHX rinse in Combination
Swab/Clean/Moisturize
Suction

All of the above
**H₂O₂, Cetylpyridium Chloride (CPC) & Biotene**

**H₂O₂**
- >3% may cause harm, <1% no benefit in plaque removal.
- Must be diluted properly, not with normal saline.
- 3x a day mouth rinse with 1.5% H₂O₂ revealed no mucosal damage, improved plaque scores and overall gingival health.

**CPC**
- Cetylpyridium chloride had significant antigingivitis effects in several individual studies
- Used in some over the counter plaque reduction rinses (Crest rinse)

**Biotene**
- Contains salivary enzymes
- Moisturize, Some oral care kits

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**Prevention of VAP with Oral Antisepsis: A Systematic Review & Meta-analysis**

- 17 studies evaluated from 1996-2014
- 4249 patients
- All randomize trials
- 15 trails assessed the effectiveness of CHG (51% were CABG pts)
- 2 trials evaluated Povidone-iodine (140pts)
- No difference in morality, LOS or VFD
- Variation of additional interventions,*
  - toothbrushing,
  - oropharyngeal aspiration
  - mechanical cleaning of the mouth
  - Frequency of antiseptic

ICU Oral Care Studies

- Before & after design
- Comprehensive oral care
- Comprehensive defined: Q 2-4hr cleansing, suctioning and moisturizing, brushing twice a day with or without CHG & deep oral cleansing q6hrs
- Results:
  - Reduction in VAP rates from 63% to 100%
  - Protocol variation is significant


Why NV-HAP?: DO NO HARM

- HAP 1st most common HAI in U.S.
  - Increased morbidity → 50% are not discharged back home
  - Increased mortality → 18%-29%
  - Extended LOS → 4-9 days
  - Increased Cost → $28K to $109K
  - 2x likely for readmission <30 day
- Understudied, under-addressed
- Focus has been on the other HAP → VAP
- Surveillance not required….yet

HAP: Non-Ventilated versus Ventilated Patients in Pennsylvania

• Purpose:
  – Compare VAP and NV-HAP incidence, outcomes
• Methods:
  – Pennsylvania Database queried
  – All nosocomial pneumonia data sets (2009-2011)


NV-HAP SMCS Research Findings: 2010

Inclusion criteria:
  All adult discharges, ICD-9 codes of pneumonia not POA
  AND met CDC definition of HAP

Incidence:
• 115 adults
• 62% non-ICU
• 50% surgical
• Average age 66
• Common comorbidities:
   CAD, COPD, DM, GERD
• Common Risk Factors:
   Dependent for ADLs (80%)
   CNS depressant meds (79%)

Cost:
• $4.6 million
• 23 deaths
• Mean Extended LOS 9 days
• 1035 extra days

Impact of Oral Care on HAP


SMCS HAP Prevention Plan

Phase 2: Oral Care

- Formation of new quality team: Hospital-Acquired Pneumonia Prevention Initiative (HAPPI)
- New oral care protocol to include non-ventilated patients
- New oral care products and equipment for all patients
- Staff education and in-services on products
- Ongoing monitoring and measurement – Monthly audits

## Protocol – Plain & Simple

<table>
<thead>
<tr>
<th>Patient Type</th>
<th>Tools</th>
<th>Procedure</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self Care / Assist</td>
<td>Brush, paste, rinse, moisturizer</td>
<td>Provide tools</td>
<td>4 X / day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Brush 1-2 minutes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rinse</td>
<td></td>
</tr>
<tr>
<td>Dependent / Aspiration Risk</td>
<td>Suction toothbrush kit (4)</td>
<td>Package instructions</td>
<td>4 X / day</td>
</tr>
<tr>
<td>Dependent / Vent</td>
<td>ICU Suction toothbrush kit (6)</td>
<td>Package instructions</td>
<td>6 X / day</td>
</tr>
<tr>
<td>Dentures</td>
<td>Tools + Cleanser</td>
<td>Remove dentures &amp; soak</td>
<td>4X / day</td>
</tr>
<tr>
<td></td>
<td>Adhesive</td>
<td>Brush gums, mouth</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rinse</td>
<td></td>
</tr>
</tbody>
</table>

### NV-HAP Incidence
50 % Decrease from Baseline

![Control chart for NV-HAP January 2010 to December 2013](attachment:control_chart.png)

- Baseline
- Oral Care
- Average
- UCL
- LCL

Month/Year:
- JAN 2010
- FEB 2010
- MAR 2010
- APR 2010
- MAY 2010
- JUN 2010
- JUL 2010
- AUG 2010
- SEP 2010
- OCT 2010
- NOV 2010
- DEC 2010
- JAN 2012
- FEB 2012
- MAR 2012
- APR 2012
- MAY 2012
- JUN 2012
- JUL 2012
- AUG 2012
- SEP 2012
- OCT 2012
- NOV 2012
- DEC 2012
- JAN 2013
- FEB 2013
- MAR 2013
- APR 2013
- MAY 2013
- JUN 2013
- JUL 2013
- AUG 2013
- SEP 2013
- OCT 2013
- NOV 2013
- DEC 2013
Return on Investment

- 60 NV-HAP avoided Jan 1 – Dec. 31 2013
- $2,400,000 cost avoided
- -$117,600 cost increase for supplies
- $2,282,400 return on investment

• 12 lives saved

PRICELESS

Making it Happen: Comprehensive Oral Care with and Antiseptic

• Create visual cues to show evidence of compliance
• Products and processes that make it easier for staff to do the right thing
• Include oral care in order sets and on flow sheets
• Teach family and patient to assist if appropriate
It is not enough to do your best; you must know what to do, and THEN do your best.

~ W. Edwards Deming
Central Line - Associated Blood Stream Infections

Blood Stream Infection (BSI) Prevention Bundle (IB)

- Remove/Avoid unnecessary lines (IA)
- Hand hygiene (IB)
- Maximal barrier (IB)
- Chlorhexadine for skin prep (IA)
- Avoid femoral lines (IA)

Education & Culture of Safety
Maintenance Bundle

- Dressing Care
- Accessing the line
- Administration set changes
- Assessing each day if line is necessary

Beyond the Bundle

- CHG Baths
- Dressing care
- Accessing the site
- Antimicrobial impregnated CVC
- Antimicrobial locks
- Appropriate nursing staff levels in ICUs.
**Dressing Care**

- Use a transparent or gauze dressing to cover site (IA)
- Change transparent dressing and perform site care with a CHG based antiseptic every 7 days (IB) or more frequent if the dressing is soiled, loose, or damp; (IB)
- Change gauze dressings every 2 days or more frequent if the dressing is loose, soiled or damp (II)
- Use a chlorhexidine-impregnated sponge dressing or CHG dressing for temporary short-term catheters in patients older than 2 months of age if the CLABSI rate is not ↓ despite EBP (1B)

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**Beyond the Bundle**

- CHG Baths
- Dressing care
- Accessing the site
- Antimicrobial impregnated CVC
- Antimicrobial locks
- Appropriate nursing staff levels in ICUs.

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Technical details:

SHEA and IDSA. Infection Control and Hospital Epidemiology. Oct 2008
Prevention of Catheter Infection. MMWR 2002;51 (No. RR-10);1-29

Continuous Passive Disinfection of Catheter Hubs Prevents Contamination and Bloodstream Infection

- 3-phased, multi-facility, quasi-experimental study
- 3 periods
  - Period 1 (P1) baseline: standard disinfection of hub before accessing
  - Period 2 (P2): passive disinfection cap on all central lines
  - Period 3 (P3): standard disinfection of hub before accessing
- Assessed intraluminal contamination in PICC patients only, with PICC lines in > 5 days
- CAUTI used as a concurrent control

Results:
- Contamination:
  - P1: 12.7%
  - P2: 5.5% (p=0.002)
  - P3: 12% (p=0.88)
- CLABSI rate
  - P1: 1.43/1000 catheter days
  - P2: 0.69/1000 catheter days (p=0.04)
  - P3: 1.31/1000 catheter days
- CAUTI rates
  - P1: 1.42/1000 urinary catheter days
  - P2: 1.41/1000 urinary catheter days
  - P3: 1.04/1000 urinary catheter days (p=0.03)

*P=0.05

Use of a Cap resulted in a 40% reduction in CLABSI's

Wright, M et al  Am J Infect Control, 2013;41:33-8
Beyond the Bundle

- CHG Dressings/Dressing Integrity/Site Securement
- Accessing the site
- CHG Baths
- Antimicrobial impregnated CVC
- Antimicrobial locks
- Appropriate nursing staff levels in ICUs.

CA-UTI Bundle
“Bladder Bundle”

- CA-UTI Bundle ( “Bladder Bundle”)
  - Avoid unnecessary urinary catheters
  - Insert urinary catheters using aseptic technique
  - Maintain urinary catheters based on recommended guidelines.
  - Review urinary catheter necessity daily and remove promptly

http://www.bestcare.org.za/docs/Prevent%20Catheter%20CA-UTI.pdf

Disrupting the Lifecycle of the Urinary Catheter

1. Preventing Unnecessary and Improper Placement
2. Maintaining Awareness & Proper Care of Catheters
3. Prompting Catheter Removal
4. Preventing Catheter Replacement

(Meddings. Clin Infect Dis 2011)
CDC, SHEA, IDSA and NHS: Indications for Placement

- Perioperative use for selected surgical procedures
- Urine output in critically ill patients
- Management of acute urinary retention and urinary obstruction
- Assistance in pressure ulcer healing for incontinent patients
- At a patient request to improve comfort (SHEA) or for comfort during end of life care (CDC)

Core Recommendations

- Insert catheters only for appropriate indications (1B)
- Leave catheters in only as long as needed (1B)
- Ensure that only properly trained persons insert and maintain catheters (1B)
- Insert catheters using aseptic technique and sterile equipment (acute care settings) (1C)
- Consider use of alternatives (II)
- Maintain a close drainage system (1B)
- Secure the system (1B)
- Maintain unobstructed urine flow (1B)
- Key the collecting bag below the level of the bladder at all times (1B)

Cleansing of Patients with Indwelling Catheter

- Indwelling catheter care should occur with the daily bath (basinless bathing)*, as a separate procedure using clean technique
- There is no evidence to support 2x a day indwelling catheter care
- If a large liquid stool occurs, bathe the patient with basin less bathing
- Use separate cloths to clean front to back in the perineal area and 6 inches of the catheter**
- Apply barrier cloth to area of skin requiring protection


* Sage recommends following hospital policy

Additional Recommendations: SHEA Compendium Update 2014

- Replace the catheter and the collecting system using aseptic technique when breaks in aseptic technique, disconnection, or leakage occur (quality of evidence: III).
- For examination of fresh urine, collect a small sample by aspirating urine from the needleless sampling port with a sterile syringe/cannula adaptor after cleansing the port with disinfectant (quality of evidence: III).
- Unresolved
  - Antiseptic or sterile saline for meatal cleaning before insertion

Nurse Directed Catheter Removal

• 300 bed community teaching hospital
• Implementation of a nurse directed urinary catheter removal protocol
  – Protocol linked to physician catheter order
  – Physician documentation of catheter insertion criteria & device specific charting in progress notes
  – Bi-weekly unit specific feedback
• Results: 50% ↓ in catheter use & 70% ↓ in CAUTI

Parry MF, et al. AM J Of Infect Control, 2013;41:1178-81

WHEN WOULD NOW BE A GOOD TIME TO DO THIS?

Prevention Bundles Work
Forbid yourself to be deterred by poor odds just because your mind has calculated that the opposition is too great. If it were easy, everyone would do it.