The Impact of Patient Hygiene on Hospital-Acquired Infections

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Disclosures

- Consultant-Michigan Hospital Association Keystone Center
- Consultant/Faculty for CUSP for MVP—AHRQ funded national study
- Subject matter expert CAUTI, CLABSI, HAPU, Safety culture
- Consultant and speaker bureau for Sage Products LLC
- Consultant and speaker bureau for Hill-Rom Inc
- Consultant and speaker bureau for Eloquest Healthcare
Notes on Hospitals: 1859

• “It may seem a strange principle to enunciate as the very first requirement in a Hospital that it should do the sick no harm.”
  - Florence Nightingale

Advocacy = Safety
Protect The Patient From Bad Things Happening on Your Watch

Implement Interventional Patient Hygiene
Interventional Patient Hygiene

- Hygiene…the science and practice of the establishment and maintenance of health
- Interventional Patient Hygiene….nursing action plan directly focused on fortifying the patient’s host defense through proactive use of evidence-based hygiene care strategies
Interventional Patient Hygiene (IPH)

Achieving the Use of the Evidence

Factors Impacting the Ability to Achieve Quality Nursing Outcomes at the Point of Care

Skills & Knowledge

Resources & System

Value

Attitude & Accountability

Building Resiliency into Interventions

Forcing Functions and Constraints
Automation and Computerization
Standardization and Protocols
Checklist and Independent Check Systems
Rules and Policies
Education and Information
Vague Warning – “Be More Careful!”

Adapted from Berenholtz, S John Hopkins Patient Safety Institute, 2012
Missed Nursing Care

• “Any aspect of required patient care that is omitted (either in part or whole) or significantly delayed.”
• A predictor of patient outcomes
• Measures the process of nursing care

Hospital Variation in Missed Nursing Care

**Figure 2.** Elements of care most and least frequently missed. The solid bars represent the means across all 10 hospitals, and the range lines indicate the standard deviations.

### Patient Perceptions of Missed Nursing Care

**Table 2. Elements of Nursing Care by Ability of Patient to Report and Extent Missed**

<table>
<thead>
<tr>
<th></th>
<th>Fully Reportable</th>
<th>Partially Reportable</th>
<th>Not Reportable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequently Missed</strong></td>
<td>Mouth care</td>
<td>Ambulation</td>
<td>Patient assessment</td>
</tr>
<tr>
<td></td>
<td>Listening</td>
<td></td>
<td>Surveillance</td>
</tr>
<tr>
<td></td>
<td>Being kept informed</td>
<td></td>
<td>IV site care</td>
</tr>
<tr>
<td><strong>Sometimes Missed</strong></td>
<td>Response to call lights</td>
<td>Medication administration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Response to alarms</td>
<td>Repositioning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meal assistance</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pain medication and follow-up</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rarely Missed</strong></td>
<td>Bathing</td>
<td>Vital signs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hand washing</td>
<td></td>
</tr>
</tbody>
</table>

* IV, intravenous.
Common Routes of Transmission

1. Isolation Room Surfaces
2. Portable Equipment
3. Skin, Bedding, and Clothing
4. Unidentified Carrier

3 Main Vectors of Infection

- Hands of HCW
- Patient Flora
- Environment

Impact from the Vectors of Infection

• Patients’ endogenous flora (40% - 60%)
• Cross-infection via the hands of healthcare personnel (HCP; 20% - 40%)
• Antibiotic-driven changes in flora (20% - 25%)
Vertical vs. Horizontal

- Vertical approach refers to a narrow-based program focusing on a single pathogen (selective of the specific MDRO)
  - AST to identify carriers
  - Implementation of measures aimed at preventing transmission from carriers to other patients
    - Isolation
    - Hand hygiene

- Horizontal approach to infection prevention and control measures refers to broad-based approaches attempting reduction of all infections due to all pathogens
  - No screening
  - Universal nasal coverage
  - No isolation
  - Limit lines/tubes
  - Hand hygiene
Evidence-Based Bathing Practices
The Bath: The First Line Of Defense

Early Detection of Skin Injury

Nurse!!!

Reducing Microorganism spread

Efficiency & Effectiveness

Health/Social Wellbeing
Reasons for Bathing

- Clinical Indications
- Incontinence
- Freshen Up
- Diaphoresis

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Timing of the Bath

40% baths occur 2400 – 0600

• Timing for bathing varies globally
• Consider patient need for sleep and energy reserves
• Avoid:
  • Nurse preference
  • Organizational factors
  • Unit norms


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# Activities That Increase VO2

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dressing Change</td>
<td>10%</td>
</tr>
<tr>
<td>Agitation</td>
<td>18%</td>
</tr>
<tr>
<td>Bath</td>
<td>23%</td>
</tr>
<tr>
<td>Suctioning</td>
<td>27%</td>
</tr>
<tr>
<td>Increased work of Breathing</td>
<td>40%</td>
</tr>
<tr>
<td>Weigh on sling scale</td>
<td>36%</td>
</tr>
<tr>
<td>Position change</td>
<td>31%</td>
</tr>
<tr>
<td>Linen change – occupied bed</td>
<td>22%</td>
</tr>
<tr>
<td>Chest physiotherapy</td>
<td>35%</td>
</tr>
</tbody>
</table>

Patients At Risk

- Multi-Drug Resistant Organisms
  - Immunodeficiencies
  - Breaks in skin integrity related to invasive devices
  - Co-morbidities
  - Hand transmission
  - Equipment contamination/ Hospital environment
- Damaging the Natural Barriers to Infection… the Skin
  - Bathing techniques
  - Soaps
  - Wash cloths

Bonten MJM. Am J Respir Crit Care Med. 2011;184:991-993
Optimal Hygiene

• pH balanced (4-6.8)
  • Stable pH discourages colonization of bacteria & ↓ risk of infection
  • Bar soaps may harbor pathogenic bacteria
• Excessive washing/use of soap compromises the water holding capacity of the skin
• Non-drying, lotion applied
• Multiple steps can lead to large process variation

Voegel D. J WOCN, 2008;35(1):84-90
Traditional Bathing

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

Bath Basins: Potential Source of Infection

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

- 62% of basins were contaminated with Gram negative bacilli
- 35% of basins were colonized with VRE
- 45% of basins were Gram negative bacilli
- 3% of basins had MRSA

Total hospitals: 88
Total basins: 1,103

Mechanisms of Contamination

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


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Biofilms are Ubiquitous
Opportunistic Premise Plumbing Pathogens: Increasingly Important Pathogens in Drinking Water

Joseph O. Falkinham, III 1,*, Amy Pruden 2 and Marc Edwards 2

Healthcare Outbreaks Associated With a Water Reservoir and Infection Prevention Strategies

Hojjat Kassam,1,2 David J. Weber,1,3 and William A. Retska 2

1Divisions of Infectious Diseases, University of North Carolina School of Medicine, and 2Hospital Epidemiology, University of North Carolina Health Care, Chapel Hill

Operating-room machines test positive for Legionella at UW Medicine

Originally published September 19, 2016 at 2:19 pm | Updated September 19, 2016 at 7:31 pm
Understanding Water

• All water with the exception of sterile water and filtered water is contaminated with microbes (eg, potable water, tap water, showers, and ice).

• In healthy persons, contact or ingestion of such water rarely leads to infection.

• However, contact or ingestion of such water may cause infection in immunocompromised persons or when applied to non-intact skin.

• Transmission of these pathogens from a water reservoir may occur by direct and indirect contact, ingestion and aspiration of contaminated water, or inhalation of aerosols*

Presented at MSIPC October 6th, 2016, Lansing MI by Dorine Berriel-Cass

Water Source

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

https://www.pinterest.com/pin/332914597437828576/?l=t
Reducing UTI’s Through Basinless Bathing

- CA-UTI 7.5 per 1000 catheter days to 4.42 per 1000 catheter days, then to .46 per 1000 catheter days

Stone S, APIC 2010
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</th>
<th>No. of UTI</th>
<th>Median LOS 17 Days</th>
<th>Median Cost (4857.00)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I- Pre-Packaged Bathing Washcloths (9 months)</td>
<td>$10,530$^1 ($3.00)</td>
<td>25</td>
<td>175</td>
<td>$117,175</td>
</tr>
<tr>
<td>II- Basin/Water (9 months)</td>
<td>$3,510$^2 ($1.00)</td>
<td>48</td>
<td>336</td>
<td>$224,916</td>
</tr>
<tr>
<td>III- Additional Product Cost, UTI, LOS, COSTS</td>
<td>$7,020</td>
<td>23^3</td>
<td>151</td>
<td>$107,741</td>
</tr>
</tbody>
</table>

1Based on 3 packages of 8 towels each 2Based on product cost of towels, soap, and basin 3Difference between phase I pre-package/phase II basin water 4

Cleansing of Patients with Indwelling Catheter

- Indwelling catheter care should occur with the daily bath (basinless bathing)\textsuperscript{1} 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 basinless bathing
- Apply barrier cloth to area of skin requiring protection

**For Successful Banning of Basins for Patient Care**

- We need to provide alternatives for the other functions:

<table>
<thead>
<tr>
<th>Current</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emesis</td>
<td>Emebags being installed in every adult and ped pt. room, ACU, PACU</td>
</tr>
<tr>
<td>Storage of patient items</td>
<td>Clear plastic “baggies”</td>
</tr>
<tr>
<td></td>
<td>Trial of “Concierge List” to decrease waste of unused/unneeded products</td>
</tr>
<tr>
<td>Foot soaks</td>
<td>Shampoo caps, prepackaged</td>
</tr>
<tr>
<td>Shampoo patient’s hair</td>
<td>Shampoo caps par’d on all units</td>
</tr>
<tr>
<td>24 hour urine, ice</td>
<td>Store some basins in lab to be dispensed with each 24 hour jug</td>
</tr>
<tr>
<td>Bath cloths with no insulation, cold halfway through bath</td>
<td>Bath cloths with insulation to stay warm longer</td>
</tr>
</tbody>
</table>

Quinn B, et al. Presented at NACNS National Conference, March 5-7th, 2015, San Diego Ca
The Oral Cavity as a Risk Factor in Non-Ventilator Hospital Acquired Pneumonia (NV-HAP)
Build the Will: NV-HAP?

• 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


Slide courtesy of Barb Quinn
## Current Literature: NV-HAP is a National Problem in Hospitals

<table>
<thead>
<tr>
<th>Study</th>
<th>Incidence</th>
<th>Mortality</th>
<th>+LOS</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>J. Davis (2012)</td>
<td>5,600 /3 yrs</td>
<td>18.9%</td>
<td>Not queried</td>
<td>$28,000</td>
</tr>
<tr>
<td>HCUP National database (P)</td>
<td>2/100 pts</td>
<td>14.5%</td>
<td>4 days</td>
<td>$36,400</td>
</tr>
<tr>
<td>Magill et al. CDC (2014)</td>
<td>13% of all HAIs</td>
<td>19%</td>
<td>4-9 days</td>
<td>$40,000</td>
</tr>
<tr>
<td>Micek, Chew, Hampton &amp; Kollef (2016)</td>
<td>Matched controls 174 cases NV-HAP</td>
<td>15.5% vs. 1.6% 8.4 more likely to die</td>
<td>15.9 days vs. 4.4</td>
<td></td>
</tr>
<tr>
<td>See, et al. (2016).</td>
<td>Retrospective review 8 hospitals in PA 2011-2012 VAP excluded 30% of 838 cases reviewed by CDC</td>
<td>30.9%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Davis, Pt Safety Authority 2012 9(3).
Giuliano, K. et al. (2016) AORN Poster 2016
Magill, S.S. et al. (2014) NEJM. 370(13), p 1198-1208
Hospital-Acquired Pneumonia: 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)

Results:

- Mortality
- Incidence
- Total deaths
- Total cost
- Wide-spread

Table 1. Pennsylvania Nosocomial Pneumonia and Related Deaths

<table>
<thead>
<tr>
<th>YEAR</th>
<th>NO. OF NV-HAP CASES</th>
<th>NO. OF NV-HAP DEATHS</th>
<th>% OF NV-HAP CASES CONTRIBUTING TO DEATH</th>
<th>NO. OF VAP CASES</th>
<th>NO. OF VAP DEATHS</th>
<th>% OF VAP CASES CONTRIBUTING TO DEATH</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>1,976</td>
<td>363</td>
<td>18.4 (95% CI: 16.5 to 20.3)</td>
<td>922</td>
<td>163</td>
<td>17.7 (95% CI: 15.0 to 20.5)</td>
</tr>
<tr>
<td>2010</td>
<td>1,848</td>
<td>366</td>
<td>19.8 (95% CI: 17.8 to 21.8)</td>
<td>737</td>
<td>144</td>
<td>19.5 (95% CI: 16.3 to 22.7)</td>
</tr>
<tr>
<td>2011</td>
<td>1,773</td>
<td>315</td>
<td>17.8 (95% CI: 15.8 to 19.7)</td>
<td>640</td>
<td>127</td>
<td>19.8 (95% CI: 16.4 to 23.3)</td>
</tr>
<tr>
<td>Total</td>
<td>5,597</td>
<td>1,044</td>
<td>16.7 (95% CI: 17.5 to 19.8)</td>
<td>2,299</td>
<td>434</td>
<td>16.9 (95% CI: 17.1 to 20.7)</td>
</tr>
</tbody>
</table>

Note: NV-HAP refers to nonventilator-hospital-acquired pneumonia and VAP refers to ventilator-associated pneumonia.

Incidence, Prevalence of NV-HAP: A Local Study (2010)

- **Purpose:**
  - Determine incidence and clinical factors of NV-HAP

- **Method:**
  - Descriptive, quasi-experimental study using retrospective data
  - **Inclusion criteria:**
    - All adult discharges
    - ICD-9 codes of pneumonia not POA
    - AND met CDC definition of HAP

NV-HAP SMCS Research Findings: 2010
24,482 patients and 94,247 patient days

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

HAPPI-2 Incidence of Non-Ventilator Hospital Acquired Pneumonia

• Multicenter retrospective chart review
• Extracted NV-HAP cases as per the 2014 ICD-9-CM codes for pneumonia not POA and the 2013 CDC case definition
• 21 hospitals completed data collection
• Measured nursing care missed 24hrs before diagnosis
• Non-vent HAP occurred on every unit

Baker D, Quinn B, Amer J of Infect Control, 2018;46:2-7
HAPPI-2 Incidence of Non-Ventilator Hospital Acquired Pneumonia

Missed nursing care 24 hours prior to Non-Vent HAP dx.

Baker D, Quinn B, Amer J of Infect Control, 2018;46:2-7
HAPPI-2 Incidence of Non-Vent Hospital Acquired Pneumonia

Results:

• 1300 NV-HAP (0.12-2.28 per 1000 pt days)
  • 18.4% mortality
  • 50% < 66 yrs old
  • 63% non-surgical
  • 70.8% outside the ICU
  • 27.3 % in ICU
  • 18.8% transferred to ICU
  • 37.3% LOS >20 days
  • 57.7% LOS >15 days
  • 40.6% admitted from home were discharged back to home
  • 19.3% readmitted within 30 days
  • $36.4 - $52.56 million in extra costs

Med-Surg (43.1%; n = 560) Telemetry (8.5%; n = 111)
Progressive (7.2%; n = 93)
Oncology (4.9%; n = 64)
Orthopedic (2.8%; n = 37)
Neurology (1.5%; n = 19)
Obstetric (0.2%; n = 3)

Baker D, Quinn B, Amer J of Infect Control, 2018;46:2-7
ICU-Acquired pneumonia
VAP vs. NV-HAP

Methods:

- Prospective study of 135 consecutive episodes over 3 years of adults with ICU-acquired pneumonia
- Compared clinical and microbiological characteristics of VAP and NV-HAP

Results for VAP & NV-HAP were not statistically different:

- Pathogens,
- Comorbid conditions,
- Severity parameters,
- Mortality,
- Hospital length of stay

Among NV-HAP patients, 79 (52%) needed subsequent intubation
Preventing NV-HAP Through Evidence Based Fundamental Nursing Care Strategies
Pathogenesis → Prevention

Germs in Mouth
- Dental plaque provides microhabitat
- Bacteria replicate 5X/24 hrs

Aspirated into Lungs
- Most common route
- 50% of healthy adults micro-aspirate in sleep

Weak Defenses
- Poor cough
- Immunosuppressed
- Multiple co-morbidities

Formation of Biofilm Over 13 Hours

http://helios.bto.ed.ac.uk/bto/microbes/biofilm.htm
Loesche, W. 2012
Micro Aspiration During Sleep in Healthy Subjects

- Prospective duplicate full-night studies
- 10 normal male’s 22-55 yrs of age

Methods:
- Radioactive $^{99}$mTc tracer inserted into the nasopharynx
- Lung scans conducted immediately following final awakening
- No difference in sleep efficacy btwn 2 study nights

Results:
- 50% of subjects had tracer in the pulmonary parenchyma upon final awakening
- No difference in age, time spent in bed, efficacy of sleep, apnea-hyponea index, arousal plus awakening index or % sleep in the supine position between subjects that aspirated and those that did not.

Oral Cavity & VAP

- 89 critically ill patients
- Examined microbial colonization of the oropharynx throughout 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;126:1575-1582
SMCS HAP Prevention Plan

Phase 1: 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 Brush 1-2 minutes Rinse</td>
<td>4 X / day</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 Adhesive</td>
<td>Remove dentures &amp; soak Brush gums, mouth Rinse</td>
<td>4X / day</td>
</tr>
</tbody>
</table>

Provide Meaningful Data

- Ortho Unit had ZERO HAP cases in the last 4 months of 2013!!
- Great WORK!!
- Remember, the goal is to provide and document oral care after each meal and before bedtime.

Used with permission from Barbara Quinn
NV-HAP Incidence
50 % Decrease from Baseline

Control chart for NV-HAP
January 2010 to December 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
  - 8 lives saved

PRICELESS

Control chart for non-ventilator HAP
January 2010 to December 2014

Quinn B, Presented at AACN NTI, Houston, Tx, 2017
Post Operative NV-HAP (all adult inpatient surgery)
Incidence 6 months Pre Oral Care vs. 6 Months After

Quinn B, Presented at AACN NTI, Houston, Tx, 2017
WHEN WOULD NOW BE A GOOD TIME TO DO THIS?
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.
Contact Information

- kvollman@comcast.net
- www.Vollman.com
Questions?
Thank you!