Reframing the Culture of Safety: Evidence Based Practices to Reduce Patient and Caregiver Injury in the Peri-Operative setting

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Disclosures for Kathleen Vollman

- 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
Objectives

• Discuss transforming a culture that creates safety for the patient and staff while achieving evidence-based outcomes

• Create a link to fundamental nursing care practices and the health nurse

• Understand the current state of patient movement, pressure injury prevention safe handling as well as reducing the risk of pneumonia as it relates to the perioperative patients
• Safety is avoiding both short- and long-term harm to people resulting from unsafe acts and preventable adverse events.
• Current infrastructure “silos” safety programs, creating one for patients, another for workers, and yet another for others who may be at risk (Quality department, Risk Management, Employee Health, SPH).
• The organizational culture, principles, methods, and tools for creating safety are the same, regardless of the population whose safety is the focus.
• A true culture of safety—and the organization leaders who create and sustain it—will not be considered legitimate and genuine if the culture excludes some groups within the organization.
I'm looking for help on this, virtual team...

Traditional silos getting in the way?
What Does it Mean to Be in A Safe Culture for You & Your Patient?
Changing the Paradigm

Culture of Safety in Health Care

Patient Safety

Culture of Safety for Healthcare Workers

Healthcare Worker Safety

Safety Culture for the Patient & the HCW
Changing the Perception of Safety on Your Unit

• Safety for the patient and healthcare worker are integrated
• Transcends individual improvement initiatives and departmental walls
• High reliable unit/organization: engaged leadership, culture of safety, organizational processes, and infrastructure to support safe practices
• Implement and maintain successful worker and patient safety improvement initiatives within your unit & organization
• Create measurements that integrate patient safety and healthcare worker safety

Castro GM. Am J SPHM, 2015;5(1)34-35
Add ANA-
Safety Culture in Peri-Anesthesia Nursing

Peri-Anesthesia Safety Event Types

I. Improve the accuracy of patient identification
   A. Identification errors (e.g., misspelled names, missing ID)
   B. Final verification before procedures
II. Improve the effectiveness of communication among caregivers
   C. Communication errors (e.g., failure to report, failure to verify)
III. Improve the safety of using medications
   D. Medication errors (e.g., omissions, dosing, wrong route)
IV. Eliminate wrong-site, wrong-patient, wrong-procedure surgery
   E. Wrong-site surgery
V. Improve the safety of using infusion pumps/equipment
   F. Pumps/Equipment (e.g., supply issues, malfunctions)
VI. Improve the effectiveness of clinical alarm systems
   G. Monitor alarm errors
VII. Reduce the risk of health care-associated infections
   H. Health care-associated infections (handwashing, infection control practices)
III. Reduce the risk of patient harm resulting from falls
   I. Falls (e.g., extension, patient transfer)
IX. Reduce the risk of influenza and pneumococcal disease in institutionalized older adults
   J. Influenza vaccinations
X. Reduce the risk of surgical fires
   K. Fires (e.g., education, compliance with standards)
XI. Implementation of applicable National Patient Safety Goals and associated requirements by components and practitioner sites
   L. Application of Standards
XII. Encourage the active involvement of patients and their families in the patient's care as patient by components and practitioner sites
   M. Lack of family involvement
XIII. Prevent health care-associated pressure ulcers
   N. Pressure ulcers (e.g., assessments, interventions)
XIV. The organization identifies safety risks inherent in its patient population
   O. Suicide risk
XV. Other
   P. Laboratory test problems
   Q. Radiology/Imaging test problems
   R. Transfusion practices
   S. Behavioral issues (e.g., aggressive behaviors, unethical behaviors)
   T. Care coordination (transfer of care issues)
   U. Staffing-related problems
      a. Cause of harm to patient (e.g., distraction, noise, failure to assess)
      b. Contributory causes to adverse outcomes (e.g., work hours, fatigue)
V. Physician order entry–related problems
   W. Other adverse events
“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 patients host defense through proactive use of evidence based hygiene care strategies

Incontinence Associated Dermatitis Risk Reduction Program

INTERVENTIONAL PATIENT HYGIENE (IPH)

VAP/HAP

Oral Care/Mobility

HAND

Patient

HYGIENE

Catheter Care

Skin Care/Bathing/Mobility

CA-UTI

CA-BSI

SSI

Falls

HASI

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

Healthy Nurse, Healthy Nation™

Made possible in part by the generosity of the American Nurses Foundation and its sponsor
What About Staff Harm?

Health care is the only industry that considers 100 pounds to be a “light” weight

Other professions use assistive equipment when moving heavy items

On average, nurses and assistants lift 1.8 tons per shift (ANA, n.d.)
High Reliability Organization – What Does It Mean?

A Leader where we stand

Role model right behavior

Correct the wrong behavior

For the Patient and Your Peers
The Goal: Patient & Caregiver Safety

- Patient Movement
- Safe Patient Handling
- Reduce Risk of Pressure Injuries
- Falls
How Well Are We Doing?
Background of the Problem

- HAPU are the 4th leading preventable medical error in the United States
- 2.5 million patients are treated annually in Acute Care
- NDNQI data base: **critical care: 7%** med-surg: 1-3.3%
- Acute care: 0-12%, critical care: 3.3% to 53.4% (International Guidelines)
- Most severe pressure ulcer: **sacrum** (44.8%) or the **heels** (24.2%)
- Pressure ulcers cost $9.1-$11.6 billion per year in the US.
  - Cost of individual patient care ranges from $20,900 to $151,700 per pressure ulcer
  - 17,000 lawsuits are related to pressure ulcers annually
- Peri- anesthesia ulcers are increasing

http://www.ahrq.gov/professionals/systems/hospital/pressureulcertoolkit/putool1.html#11

Dornier, B., Posthauer, M.E., Thomas, D. (2009), [www.npuap.org/newroom.htm](http://www.npuap.org/newroom.htm)
Reddy, M-et al. JAMA, 2006; 296(8): 974-984
Cambridge Media: Osborne Park: Western Australia;2014
• Physiological reaction to immobility
• Blood vessels become compressed, creating poor circulation leading to O2 and nutrient deficiencies
• Risk:
  – Including preoperative preparations, waiting time, and the postoperative recovery period, even a relatively short, two-hour surgery can mean six or more hours of immobility for the patient.
  – Co-morbid conditions
  – Weight
  – vasopressors
Risk Factors

### Intrinsic
- Age > 60 years
- Albumin levels < 3.5 g/dL
- ASA score > 3
- Diabetes
- BMI < 19 or > 40
- PVD
- Cerebrovascular accident
- Sepsis
- Hypotension
- Pulmonary disease
- Renal insufficiency
- Low core temperature

### Extrinsic
- Time immobilized before surgery
- Operation planned > 3hrs
- Prone positioning
- Trauma
- Cardiac, orthopedic, vascular, transplant, or bariatric procedure
- Increased hypotensive episodes
- Use or continued use of vasopressors
- Reduced mobility on the first day postop

Scott S. Patient Safety and Quality Health Care, 2016;13(4):21-28
Clarification of Definitions:

- Pressure Injury to replace Pressure Ulcer
- Accurately describes pressure injuries of both intact and ulcerated skin

Stage I and Deep Tissue Injury (DTI) describe intact skin

Stage II through IV describe open ulcers
IF AT FIRST YOU DON'T SUCCEED, YOU'RE RUNNING ABOUT AVERAGE
What are Ergonomic Risk Factors in Healthcare?

- Force
- Repetition
- Posture
- Duration of Exposure
Oh, My Aching Back!

- 8 out of 10 nurses work despite experiencing musculoskeletal pain\(^1\)
- 62% of nurses report concern regarding developing a disabling musculoskeletal injury\(^1\)
- 56% of nurses report musculoskeletal pain is made worse by their job\(^1\)
- Nursing assistants had the 2\(^{nd}\) highest and RNs had the 6\(^{th}\) highest number of musculoskeletal disorders in the U.S.\(^2\)

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2014 - 67%-80% of people in the US were morbidly obese, obese or overweight (Flegal et al., 2014)

Overweight: Body mass index (BMI) of 25.0 to 29.9
Obesity: BMI of 30.0 to 39
Morbid Obesity: BMI 40 or higher
Oh, My Aching Back!

• The nation is facing an impending shortage of nurses, which is expected to peak by 2020
• Average age of nurses in the US is 46
• We must improve our ergonomic environment to accommodate older nurses (Buerhaus, 2004)
<table>
<thead>
<tr>
<th>Year</th>
<th>Ownership</th>
<th>Occupation</th>
<th>Total Cases</th>
<th>Incidence Rate*</th>
<th>Median Days Away From Work</th>
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<tbody>
<tr>
<td>2009</td>
<td>private industry</td>
<td>RNs</td>
<td>8,760</td>
<td>51.6</td>
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<td>2010</td>
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<td>RNs</td>
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<td>53.7</td>
<td>6</td>
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<td>2011</td>
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<td>RN's</td>
<td>10,210</td>
<td></td>
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<tr>
<td>2012</td>
<td>Private industry</td>
<td>RN's</td>
<td>9,900</td>
<td>58.5</td>
<td>8</td>
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<td>2013</td>
<td>Private Industry</td>
<td>RN</td>
<td>9,820</td>
<td>56.2</td>
<td>7</td>
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<tr>
<td>2014</td>
<td>Private Industry</td>
<td>RN</td>
<td>9,820</td>
<td>55.3</td>
<td>9</td>
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<tr>
<td>2014</td>
<td>Private Industry</td>
<td>NA</td>
<td>18,510</td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

2005 private industry RNs 9,060 - 7
2004 private industry RNs 8,810 - 7
2003 private industry RNs 10,050 - 6

* Incidence rate per 10,000 FTE

What Does it Mean?

1. Median recovery time for registered nurses was 8 days and for nursing assistants was 7.5 days.

2. There were 11,430 registered nurses and 22,000 nursing assistants who experienced a work related musculoskeletal disorder in 2013.

3. A total of 245,440 days of missed work.
Significance of Patient Falls

• Falls are the leading cause of hospital–acquired injury and can frequently prolong or complicate hospital stays (Degelau et al., 2012)

• Between 700,000 and 1 million patients suffer a fall in U.S. hospitals each year (Dupree et al., 2014)

• 30-35% of those patients sustain an injury, and approximately 11,000 falls are fatal (Health Research & Educational Trust. 2016, October)

• Falls have been identified by the Centers for Medicare and Medicaid Services as an acquired condition that should not occur (Dupree et al., 2014)
Moisture
Pressure
Shear Friction
Deconditioning
Falls
Delirium
ICU and Hospital LOS

Clean & Protect
Reduce Pressure & Shear
In-bed Exercise & Out of Bed Mobility

Repetitive motion, Lifting
Repetitive motion, Lifting & Limb holding
Repetitive motion, Dragging, patient weight

Immobility Risk, Skin Risk Factors
Mobility, Skin & Fall Prevention Strategies
Care Giver Risk

Moisture & Protect
Reduce Pressure & Shear
In-bed Exercise & Out of Bed Mobility
The Goal: Patient & Caregiver Safety

- Safe Patient Handling
- Falls
- Reduce Risk of Pressure Injuries
- Patient Progressive Mobility
Pressure & Shear as a Risk Factor

Sacrum & Heels

&

Preventing Caregiver Injury
The Risk in Handoffs and Transition of Care For the Patient and Caregiver

Risk Factors for the Care Giver

- Operating rooms contain physical, cognitive and organizational ergonomic risk factors and OR nurses can be exposed to these risk factors.

- Multiple lifts per shift
- Lifting alone
- Manual handling of patients
- Lifting bariatric patients or un-cooperative patients
- The transfer of the patient from bed to stretcher
- Twisting while lifting
- Lateral or side lifting
- Work above shoulder height and below knee height
- Holding equipment/heavy instruments away from the body for prolonged time for example: a saw or drill
- Pushing, pulling heavy objects such as stretcher
- Moving, pushing and lowering heavy loads such as trays, monitors, patients

Additional Care Giver Risks

- Repetitive movements with hand/wrists
- Back hyperextension or flexion
- Wrong body biomechanics and posture
- Prolonged work with computer mouse
- Working in awkward postures (awkward postures need to last more than one hour continuously or several hours in the work shift)
- Standing on cold-wet floor for a long period of time
- Standing long hours (up to 10 hours for some surgical operations), fixed postures
- Twisting at the waist and bending
- Bumping against OR equipment, carts
How Do Pressure Injuries Form?

- Intense Pressure
- Shear
- Friction

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Connection of Perfusion to PI

- Pressure injury can occur quickly and with less pressure when tissue is ischemic
- Anemic patients may have a higher risk for PI
- Patients with hemodynamic instability may not be moved
- High doses of vasopressors will shunt blood from the extremities

Pressure Leads to Muscle Cell Death

- Intense Pressure
  - Leads to muscle cell membrane destruction
    - Elevated CPK levels
      - Start to rise during 12 hours of damage
      - Peak at 24-72 hours
    - Elevated myoglobin levels
    - Decrease in serum calcium?
  - Reperfusion injury
  - Leads to damage quickly depending on the intensity

Gefen, A review of deep tissue injury development, detection and prevention: Shear Savvy. OWM, 2013, 59(2), 26-35
The original level of injury is in the muscle

- Muscle cells are destroyed by the intense pressure

- The skin receives its nutrient blood supply via muscle

- Over the following 48 hours the skin turns purple and then blisters
High Risk Patients for DTPI

- Surgery over 3 hours
  - Open heart surgery
  - Prone cases
  - Abdominal cases in obese patients
- Paralyzed or sedated patients

Joyce Black jblack@unmc.edu
Shear Leads to Ischemia of Soft Tissue

- Shear pulls and stretches nutrient blood vessels
  - Ischemic tissue does not tolerate pressure
- Shear forces form between superficial and deep layers
  - Shear forces can be high in the sacrum when the HOB is up
    - 45 degrees is the highest shear on sacrum
  - Shear leads to undermining of wounds
- Muscle is sensitive to shear

Joyce Black jblack@unmc.edu
Perfusion

• When pressure is applied to soft tissue, it becomes ischemic
  • When pressure is removed, the tissue reperfuses with blood
  • Measured clinically as the blanche response due to hyperemia
• When perfusion is impaired (arteriosclerosis, vasopressive meds), ischemic tissue does not repair oxygen debt
  • When ischemic tissue is reperfused, further injury can develop when ischemic waste products (lactic acid, oxygen free radicals) are released
• Many diseases impair perfusion
  • Arterial limb disease, diabetes, shock
What is Safe Patient Handling?

- **Manual Patient Handling**
  - The transporting or supporting of a patient by hand or bodily force, including pushing, pulling, carrying, holding, and supporting of the patient or a body part.

- **Safe Patient Handling**
  - Evidence-based approach to reducing risk to caregivers. Includes risk assessment, use of equipment, patient assessment, algorithms, peer safety leaders, and after-action reviews.

• Establish a Culture of Safety
• Implement and Sustain a Safe Patient Handling and Mobility Program
• Incorporate Ergonomic Design Principles to Provide a Safe Environment of Care
• Select, Install, and Maintain SPH Technology
• Establish a System for Education, Training, and Maintaining Competence
• Integrate Patient-Centered SPHM Assessment Plan of Care, and Use of SPHM Technology
• Include SPHM in Reasonable Accommodation and Post-Injury Return to Work
• Establish a Comprehensive Evaluation System
NIOSH (National Institute of Occupational Safety and Health)
Recommendations for Safe Patient Handling

• Maximum recommended weight limit set for patient lifting
  • The weight being lifted can be estimated
  • When patient is cooperative
  • The lift is smooth and slow
• Maximum recommended limits set for patient push/pull activity
• Proper body mechanics alone will not prevent patient handling injury (Hignett, 2003)
• Safe Work Practices

EBP Recommendations to Achieve Offloading & Reduce Pressure (A)

- Turn & reposition every (2) hours (avoid positioning patients on a pressure ulcer)
  - Repositioning should be undertaken to reduce the duration & magnitude of pressure over vulnerable areas
  - Consider right surface with right frequency*
  - Cushioning devices to maintain alignment /30 ° side-lying & prevent pressure on boney prominences
    - Between pillows and wedges, the wedge system was more effective in reducing pressure in the sacral area (healthy subjects) (Bush T, et al. WOCN, 2015;42(4):338-345)
  - Use lifting device or other aids to reposition & make it easy to achieve the turn

EBP Recommendations to Reduce Shear & Friction

- Prophylactic dressings: emerging science
- Use lifting/transfer devices & other aids to reduce shear & friction.
  - Mechanical lifts
  - Transfer sheets
  - 2-4 person lifts
  - Turn & assist features on beds
- Do not leave moving and handling equipment underneath the patient

Systematic Review: Use of Prophylactic Dressing in Pressure Injury Prevention

- 21 studies met the criteria for review
- 2 RCTs, 9 had a comparator arm, five cohort studies, 1 within-subject design where prophylactic dressings were applied to one trochanter with the other trochanter dressing free

Evaluated nasal bridge device injury prevention

Evaluated sacral pressure ulcer prevention

EBP Recommendations to Reduce Shear & Friction

• Prophylactic dressings: emerging science
• Use lifting/transfer devices & other aids to reduce shear & friction.
  • Mechanical lifts
  • Transfer sheets
  • 2-4 person lifts
  • Turn & assist features on beds
  • Breathable slide stay in bed glide sheet

– Do not leave moving and handling equip underneath the patient

Current Practice:

Linen Transfer Sheets

Plastic Transfer Device

Air Lateral Transfer Device

Automated Positioning Device

Lower shear force than cotton sheet for caregiver-benefits patients skin

Meet the no lift criteria & prevents patient skin injury

Lift Device
Factors Impacting the ability to Achieve Quality Nursing Outcomes at the Point of Care

Resource & System
- Protect the patients skin from shear
- Protects the caregiver

Reducing HAPI & Patient Handling Injuries

- Compared pre-implementation turning practice: pillows/draw sheet vs turn and position system (breathable glide sheet/foam wedges/wick away pad)
- Baseline: November 2011-August 2012
- Implementation period: November 2012 to August 2015
- 3660 patients
- Compared HAPI rates, patient handling injuries and cost

74% reduction

Way H, Am JSPHM, 2016;6(4):160-165
EBP Recommendations to Achieve Offloading & Reduce Pressure

- Ensure the heels are free of the bed surface
  - Heal-protection devices should elevate the heel completely (off-load) in such a way as to distribute weight along the calf
  - The knee would be in slight flexion
  - Remove device periodically to assess the skin

Heel Protectors

Heel Pads

Miller SK, et al WOCN, 2015;42(4):346-351
Recommendations to Reduce Caregiver Injury

• Use upper extremity and leg support devices
• Rotation of the scrub and circular nurse
• Use anti-fatigue mat
• Use mechanical assistance device or transporting with the team, attend training in when and how to use mechanical assistance
  – Air assisted devices for lateral transfer
Even if you are on the right track, you will get run over if you just sit there.

Will Rogers
WHEN WOULD NOW BE A GOOD TIME TO DO THIS?

It is not enough to do your best, you have to know what to do and then do your best.

E Deming
How Do We Make It Happen?
Driving Change

- Gap analysis
- Build the Will
- Protocol Development

Structure

- Make it Prescriptive
- Overcoming Barriers
- Daily Integration

Process

Outcomes
The Goal: Patient & Caregiver Safety

- Safe Patient Handling
- Falls
- Reduce Risk of Pressure Injuries
- Patient Progressive Mobility

Leadership

- ↓ Hospital LOS
- ↓ ICU LOS
- ↓ Skin Injury
- ↓ CAUTI
- ↓ Delirium
- ↓ Time on the vent

- ↓ Repetitive motion injury
- ↓ Musculoskeletal injury
- ↓ Days away from work
- ↓ Staffing challenges
- Loss of experienced staff
- Nursing shortage

- ↓ Skin Injury
- ↓ Costs
- ↓ Pain and suffering
- ↓ Hospital LOS
- ↓ ICU LOS

- ↓ Falls
- ↓ Falls with injury
- ↓ Hospital LOS
## Why HAI's?
Protecting Patients From Harm

<table>
<thead>
<tr>
<th>Estimates: 183 Hospitals in 10 States</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAI: 722,000/year</td>
</tr>
<tr>
<td>HAI-related deaths: 75,000/year</td>
</tr>
<tr>
<td>Hospitalized patients develop infection: 1 out of 25 (4%)</td>
</tr>
<tr>
<td>Death due to sepsis/septic shock: 700/day</td>
</tr>
<tr>
<td>Money spent: $45 billion/year</td>
</tr>
<tr>
<td>Increase risk of readmission: 27 days vs. 59 days</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of Infection</th>
<th>Rank</th>
<th>No. of Infections</th>
<th>Percentage of All Health Care–Associated Infections (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumonia†</td>
<td>1 (tie)</td>
<td>110</td>
<td>21.8 (18.4–25.6)</td>
</tr>
<tr>
<td>Surgical-site infection</td>
<td>1 (tie)</td>
<td>110</td>
<td>21.8 (18.4–25.6)</td>
</tr>
<tr>
<td>Gastrointestinal infection</td>
<td>3</td>
<td>86</td>
<td>17.1 (14.0–20.5)</td>
</tr>
<tr>
<td>Urinary tract infection‡</td>
<td>4</td>
<td>65</td>
<td>12.9 (10.2–16.0)</td>
</tr>
<tr>
<td>Primary bloodstream infection§</td>
<td>5</td>
<td>50</td>
<td>9.9 (7.5–12.8)</td>
</tr>
<tr>
<td>Eye, ear, nose, throat, or mouth infection</td>
<td>6</td>
<td>28</td>
<td>5.6 (3.8–7.8)</td>
</tr>
<tr>
<td>Lower respiratory tract infection</td>
<td>7</td>
<td>20</td>
<td>4.0 (2.5–6.0)</td>
</tr>
<tr>
<td>Skin and soft-tissue infection</td>
<td>8</td>
<td>16</td>
<td>3.2 (1.9–5.0)</td>
</tr>
<tr>
<td>Cardiovascular system infection</td>
<td>9</td>
<td>6</td>
<td>1.2 (0.5–2.5)</td>
</tr>
<tr>
<td>Bone and joint infection</td>
<td>10</td>
<td>5</td>
<td>1.0 (0.4–2.2)</td>
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<tr>
<td>Central nervous system infection</td>
<td>11</td>
<td>4</td>
<td>0.8 (0.3–1.9)</td>
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<tr>
<td>Reproductive tract infection</td>
<td>12</td>
<td>3</td>
<td>0.6 (0.2–1.6)</td>
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<tr>
<td>Systemic infection</td>
<td>13</td>
<td>1</td>
<td>0.2 (0.01–1.0)</td>
</tr>
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</table>
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

**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>
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<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>
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<tr>
<td>HCUP National database (P)</td>
<td>2/100 pts</td>
<td>14.5%</td>
<td>4 days</td>
<td>$36,400</td>
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<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, Hamptom &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</td>
<td>30.9%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Magill, S.S. et.al. (2014) NEJM. 370(13), p 1198-1208
Micek, et. al. CHEST 2016 Online first
See, et. al. ICHE, 37, pp 818-824
doi:10.1017/ice.2016.74
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

IMPACT HAPPI-2 Preliminary Analysis

- 22 U.S. hospitals
- 1300 NV-HAP
  - 18.4% mortality
  - 60% occurred on Med/Surg units
  - 26% transferred to ICU *
  - 33% transferred to ICU died
  - 34% admitted from home were discharged to a higher level of care*
  - 20% readmitted within 30 days*
  - * All cost factors

Quinn & Baker, Publ Pend 2016
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

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.

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.

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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
http://helios.bto.ed.ac.uk/bto/microbes/biofilm.htm
Loesche, W. 2012
Who is “at-risk”? ALL patients in the hospital – therefore a standard of care is required

Scatter plot example not from our data
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>

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

NV-HAP 70% from baseline!

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

Oral care for all adult pts
NGT standards revised
Pharmacy starts PPI protocol
Started oral care prior to surgery
Mandatory Education for Nurse Assistants

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
Contact Kathleen Vollman at kvollman@comcast.net
www.Vollman.com