Preventing hospital-acquired pneumonia: From knowing to doing

Barbara Quinn
DNP, MSN, RN, ACNS-BC, FCNS
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- Clinical Consultant, Speaker Bureau, Stryker/Sage LLC (since 2023)
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Objectives

• Discuss the significance of Hospital-Acquired Pneumonia (HAP).

• Describe the etiology and risk factors for HAP.

• Identify updated evidence-based HAP prevention every hospital can adopt.

• Name the three (3) parts of implementation science that will move any evidence-based practice from knowing to doing.
Significance of hospital-acquired pneumonia
2 Types of hospital-acquired pneumonia

- VAP Cases
- NVHAP Cases

### Prevalence of hospital-acquired infections in the U.S.

<table>
<thead>
<tr>
<th>Infection Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumonia</td>
<td>24.3%</td>
</tr>
<tr>
<td>- VAP</td>
<td>39%</td>
</tr>
<tr>
<td>- NV-HAP</td>
<td>61%</td>
</tr>
<tr>
<td>Surgical Site</td>
<td>24.1%</td>
</tr>
<tr>
<td>Urinary Tract</td>
<td>14%</td>
</tr>
<tr>
<td>- CAUTI</td>
<td>84%</td>
</tr>
<tr>
<td>GI</td>
<td>19%</td>
</tr>
<tr>
<td>- C. diff</td>
<td>71%</td>
</tr>
<tr>
<td>Bloodstream</td>
<td>11%</td>
</tr>
<tr>
<td>- CLABSI</td>
<td>84%</td>
</tr>
<tr>
<td>Other</td>
<td>17%</td>
</tr>
</tbody>
</table>

- Total estimated number of patients/year affected: 167,000

[Magill, et al. (2018)](adapted from Table 4. Percentages of All Surveyed Patients with Specific Types of HCAIs, 2011 vs. 2015 Survey)
# Impact of NV-HAP and VAP

<table>
<thead>
<tr>
<th>Impact</th>
<th>VAP</th>
<th>NV-HAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence</td>
<td>0-4.4/1,000 vent days (1, 2)</td>
<td>0.5-2.12/100 admits; 1.23-5.9/1,000 days (3, 4)</td>
</tr>
<tr>
<td>Mortality</td>
<td>4.4-13 (1), 19.4 (3), 23% (5)</td>
<td>13.9-22% (3, 4) 7.3% of all hosp. deaths (4)</td>
</tr>
<tr>
<td>LOS</td>
<td>28 days (3) and prolongs vent &amp; ICU days (2)</td>
<td>4-15.9 days (3, 4)</td>
</tr>
<tr>
<td>Cost</td>
<td>$40,144 (2)</td>
<td>$28,000-$40,000 (3)</td>
</tr>
<tr>
<td>30-Day Readmission</td>
<td>23% (6)</td>
<td>19% (7)</td>
</tr>
<tr>
<td>Location</td>
<td>ICU only</td>
<td>ALL Units</td>
</tr>
</tbody>
</table>

# Pneumonia and sepsis

<table>
<thead>
<tr>
<th>Site of infection</th>
<th>Frequency (%)</th>
<th>Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Respiratory</td>
<td>41.8</td>
<td>25.8</td>
</tr>
<tr>
<td>Bacteremia, site unspec</td>
<td>21.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Genitourinary</td>
<td>10.3</td>
<td>18.0</td>
</tr>
<tr>
<td>Abdominal</td>
<td>8.6</td>
<td>8.1</td>
</tr>
<tr>
<td>Device-related</td>
<td>1.2</td>
<td>1.0</td>
</tr>
<tr>
<td>Wound/soft tissue</td>
<td>9.0</td>
<td>7.5</td>
</tr>
<tr>
<td>Central nervous system</td>
<td>0.7</td>
<td>0.5</td>
</tr>
<tr>
<td>Endocarditis</td>
<td>0.9</td>
<td>0.5</td>
</tr>
<tr>
<td>Other/unspec</td>
<td>6.7</td>
<td>8.6</td>
</tr>
</tbody>
</table>


Up to 50% of sepsis cases may initiate from pneumonia.
Sepsis and CMS

CMS proposing SEP-1 for VBP in 2026. ¹

Key Patient Education Campaign from CDC to “Get Ahead of Sepsis”²

Prevent infection!

### NV-HAP a growing concern

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>CDC added HAI's to list of top 10 public health problems/concerns (1)</td>
</tr>
<tr>
<td>2019</td>
<td>APIC published first Practice Position Statement on NVHAP (2)</td>
</tr>
<tr>
<td>2020</td>
<td>APIC published Implementation Guideline for NVHAP (3)</td>
</tr>
<tr>
<td>2021</td>
<td>National Call to Action to prevent NVHAP (4)</td>
</tr>
<tr>
<td>2021</td>
<td>The Joint Commission issued a Quick Safety #61 (5)</td>
</tr>
<tr>
<td>2022</td>
<td>ECI Top 10 Patient Safety Concerns included NVHAP for the first time (6)</td>
</tr>
<tr>
<td>2022</td>
<td>SHEA/IDSA/APIC Practice Recommendation Update includes NVHAP (7)</td>
</tr>
</tbody>
</table>
Publication numbers reflect increased awareness and urgency

PubMed Search query: Non-ventilator hospital-acquired pneumonia Count
## Why hospitals should care about HAP

<table>
<thead>
<tr>
<th>Impact on Patients</th>
<th>Impact on Organizations</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leads to avoidable sepsis</td>
<td>Requires recognition &amp; treatment/resources</td>
<td>CMS-HVBP</td>
</tr>
<tr>
<td>Requires antibiotic treatment</td>
<td>Requires more antibiotic use, cost, C. diff</td>
<td>The Joint Commission Standard; CMS HAC</td>
</tr>
<tr>
<td>Contributes to high mortality rate</td>
<td>Unanticipated patient deaths</td>
<td>CMS Publicly Reported Data</td>
</tr>
<tr>
<td>Lowers surgical outcomes (1)</td>
<td>Increases postop resp failure &amp; sepsis</td>
<td>CMS HAC (PSI 11, PSI 13)</td>
</tr>
<tr>
<td>Lengthens hospital stay, increases risk of complications</td>
<td>Increases cost, decreases access, reflection of quality</td>
<td>AHRQ Quality Indicator</td>
</tr>
<tr>
<td>Increases risk for readmission (2)</td>
<td>Increases 30-day readmission rate</td>
<td>CMS-VBP</td>
</tr>
</tbody>
</table>

Etiology and risk factors for HAP
Identify the most modifiable risk factors and develop prevention programs to address them.

- **Weak host**
  - Swallow impairment
  - Saliva escapes into the trachea
  - Weakened immune system
  - Malnutrition
  - Poor cough

**Pathogens**
- Pathogens that cause pneumonia found in dental plaque

Who is at risk for HAP?

**Pathogens**
- Hospital environment
- Disruption of oral microbiome <48 hrs

**Aspiration**
- Supine position
- Decreased LOC, impaired swallow/cough
- Invasive tubes

**Weak host**
- Elderly, Surgical, > 6 meds, low albumin, abx
- Immobility, Immunocompromised, dep for ADL
- Chronic disease (DM, HF, CKD, COPD, smoker)

Although some hospital patients are at higher risk for pneumonia than others, **ALL** patients are at SOME RISK!
Pneumonia prevention strategies
Oral hygiene

Identify dysphagia
Elevate HOB
Avoid intubation
Minimize sedation

Mobilize
Adequate nutrition
Glycemic control

Reduce oral pathogens
Reduce aspiration
Strengthen host defenses

Prevent VAP, VAE, NV-HAP

Driver #1 to reduce oral pathogens: Mechanical oral hygiene

- Only intervention to address source control
- Most evidence
- Most effective compared to other interventions
- Recommended by experts
- Low risk, low-tech, low-cost
- Added as ESSENTIAL PRACTICE in the 2022 Updated SHEA Guidelines

All oral care is not created equal
Evidence-based oral care equipment

- Small, soft-bristled toothbrush
- Therapeutic toothpaste that removes plaque
  - Fluoride and/or sodium bicarbonate
- OTC alcohol-free, antiseptic mouth rinse
  - Hydrogen peroxide or Cetylpiridium chloride (CPC)
  - Chlorhexidine for basic oral care not recommended
- Petroleum-free mouth and lip moisturizer
- Suction toothbrush, as needed
- Denture care supplies

Use with caution

Driver #2: Reduce aspiration

1. Identify and treat dysphagia
2. Elevate the head of bed
3. Avoid intubation
4. Minimize sedation

Driver #2: Reduce aspiration

1. Identify and treat dysphagia
2. Elevate the head of bed
3. Avoid intubation
4. Minimize sedation

2. Klompas, et al. (2022)
Driver #2: Reduce aspiration

1. Identify and treat dysphagia
2. Elevate the head of bed
3. Avoid intubation (1-3)
4. Minimize sedation

Driver #2: Reduce aspiration

1. Identify and treat dysphagia
2. Elevate the head of bed
3. Avoid intubation
4. Minimize sedation (1, 2)

Driver #3: Strengthen host defenses

- Mobilize
- Provide adequate nutrition
- Manage glucose levels

Driver #3: Strengthen host defenses

Mobilize

Provide adequate nutrition

Manage glucose levels

- Enteral Feeding
- Nutritional Goals
  - Reduce holds & GRVs
  - Consider volume-based feeding (VBF)

Stress ulcer prophylaxis (SUP) stewardship

Driver #3: Strengthen host defenses

- Mobilize
- Provide adequate nutrition
- Manage glucose levels

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Implementation of seven (7) interventions for all hospitalized patients in a 21-hospital system over six (6) years

- Mobilization, upright feeding, swallow eval, sedation restrictions, elevated head of bed, tube care, and oral care.

- Statistical reduction in pneumonia rates, mortality, and antibiotic use.

From knowing to doing

Knowing

How to bridge the gap

Doing
Implementation science
Implementation science is a deliberate process for successful change

1. Pre-implementation

2. Project management

3. Change management

Pre-implementation
5 domains of successful pre-implementation

1. Identify a solid evidence-based intervention
2. Assess external factors
3. Assess internal factors
4. Assess individual factors
5. Choose an implementation science framework to manage the change
Identify evidence-based intervention

1. Identify a solid evidence-based intervention

- Moderate to high level of evidence
- Perceived as a good solution to a problem
- Can be adapted to a local setting
- Can start small and scale up
- Simple to complex intervention
- Consider cost


- Patient need, priority
- Pressure to improve
- Mandate

2. Quick Safety
Preventing non-ventilator hospital-acquired pneumonia

   - **IC.01.02.01** Hospital leaders allocate needed resources for the infection prevention and control program.
   - **IC.01.03.01** The hospital identifies risks for acquiring and transmitting infections.
   - **IC.01.05.01** The hospital has an infection prevention and control plan.
   - **IC.02.01.01** The hospital implements its infection prevention and control plan.
   - **IC.03.01.01** The hospital evaluates the effectiveness of its infection prevention and control plan.
4

Assess individual factors

- Knowledge and attitude
- Commitment to the organization or team
Choose an implementation science framework to manage the change

Choose a framework to manage change
Project management
2. Project management

- Defines goals and outcomes
- Has a beginning and an end
- Provides structure needed to keep the project moving to completion (timelines, milestones)
- Considers stakeholders/customers
Change management
3. Change management

- The people side of change
- Enables individuals to adopt a change
- Bridge between solutions and results
ADKAR Model: 5 change elements

- Awareness
- Desire
- Knowledge
- Ability
- Reinforcement
## Influencer model

<table>
<thead>
<tr>
<th></th>
<th>Motivation (why)</th>
<th>Ability (how)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal</strong></td>
<td>Make the undesirable desirable.</td>
<td>Surpass your limits.</td>
</tr>
<tr>
<td></td>
<td>“Why do I want to change?”</td>
<td>“I want to be a better ____”</td>
</tr>
<tr>
<td></td>
<td>Unit data, case studies</td>
<td>Step-by-step procedures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oral care protocol, inclusive policy</td>
</tr>
<tr>
<td><strong>Social</strong></td>
<td>Harness peer pressure.</td>
<td>Find strength in numbers.</td>
</tr>
<tr>
<td></td>
<td>Why do we want to change?</td>
<td>Engaged non-licensed staff</td>
</tr>
<tr>
<td></td>
<td>Enlisted unit practice council to decide where oral care supplies should be located</td>
<td>Self-audits</td>
</tr>
<tr>
<td><strong>Structural</strong></td>
<td>Design rewards and design accountability.</td>
<td>Change the environment.</td>
</tr>
<tr>
<td></td>
<td>Bulletin board dashboard</td>
<td>Linked oral care with existing routine (food trays)</td>
</tr>
<tr>
<td></td>
<td>Celebration cake</td>
<td>Documentation on MAR</td>
</tr>
</tbody>
</table>

**Unit case study:**

- 64 y.o. male admitted for esophagectomy d/t cancer, s/p chemo. No other medical history.
- POD 8 pt developed leukocytosis, productive cough, increased work of breathing and O2 demand.
- CXR “hazy opacity w/small pleural effusion”.
- DC home POD 11 on PO abx for NVHAP.

**Example: Personal motivation**
## Example: Personal ability

<table>
<thead>
<tr>
<th>Patient Type</th>
<th>Tools</th>
<th>Procedure</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self Care/assist</strong></td>
<td>Brush, paste, rinse,</td>
<td>Provide tools</td>
<td>4x/day</td>
</tr>
<tr>
<td></td>
<td>moisturizer</td>
<td>Brush 1-2 minutes, Rinse</td>
<td></td>
</tr>
<tr>
<td><strong>Dependent/aspiration risk/ non-vent</strong></td>
<td>Suction toothbrush kit (4)</td>
<td>Brush 1-2 minutes, suctioning as needed. Apply moisturizer.</td>
<td>4x/day</td>
</tr>
<tr>
<td><strong>Dependent/vent</strong></td>
<td>ICU Suction toothbrush kit (6)</td>
<td>Brush/swab 1-2 minutes, suctioning as needed. Apply moisturizer.</td>
<td>6x/day CHG 2x/day</td>
</tr>
<tr>
<td><strong>Dentures</strong></td>
<td>Tools + Cleanser Adhesive</td>
<td>Brush dentures with warm water after each meal. Brush/swab gums, mouth. Remove dentures and soak at night.</td>
<td>4x/day</td>
</tr>
</tbody>
</table>

*Approved by ADA Board of Trustees, July 2017*

Example: Social motivation and ability

- Classes for unlicensed staff
- Team member
- Value added for patient outcomes
- Self-audits
Example: Structural motivation

![Non-Ventilator HAP Cases (C-chart)](image)

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

Example: Structural ability
All success is a lagging indicator. Nothing comes from nowhere...Of years and years of working, trying, and failing, of enduring. Of whether or not you keep going when most would give up. So, keep going.

Ryan Holiday
1. HAP is the most significant and deadly harm our patients are experiencing when under our care.

2. Patients are at risk in the hospital because of ubiquitous healthcare pathogens, inevitable aspiration, and a weakened host defense system. All patients are at some risk.

3. Pneumonia prevention strategies focus on source control, aspiration reduction and strengthening host defenses.

4. For successful change and moving evidence from knowing to doing, include the three (3) parts of implementation science: Pre-implementation assessment, Project Management, and Change Management for the people side of change.
References

Deacon, J., Sutherland, I., & Skillman, L. (N.D.). The Microbial World: Biofilms. Retrieved 11.17.23 from Biofilms (ed.ac.uk)


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