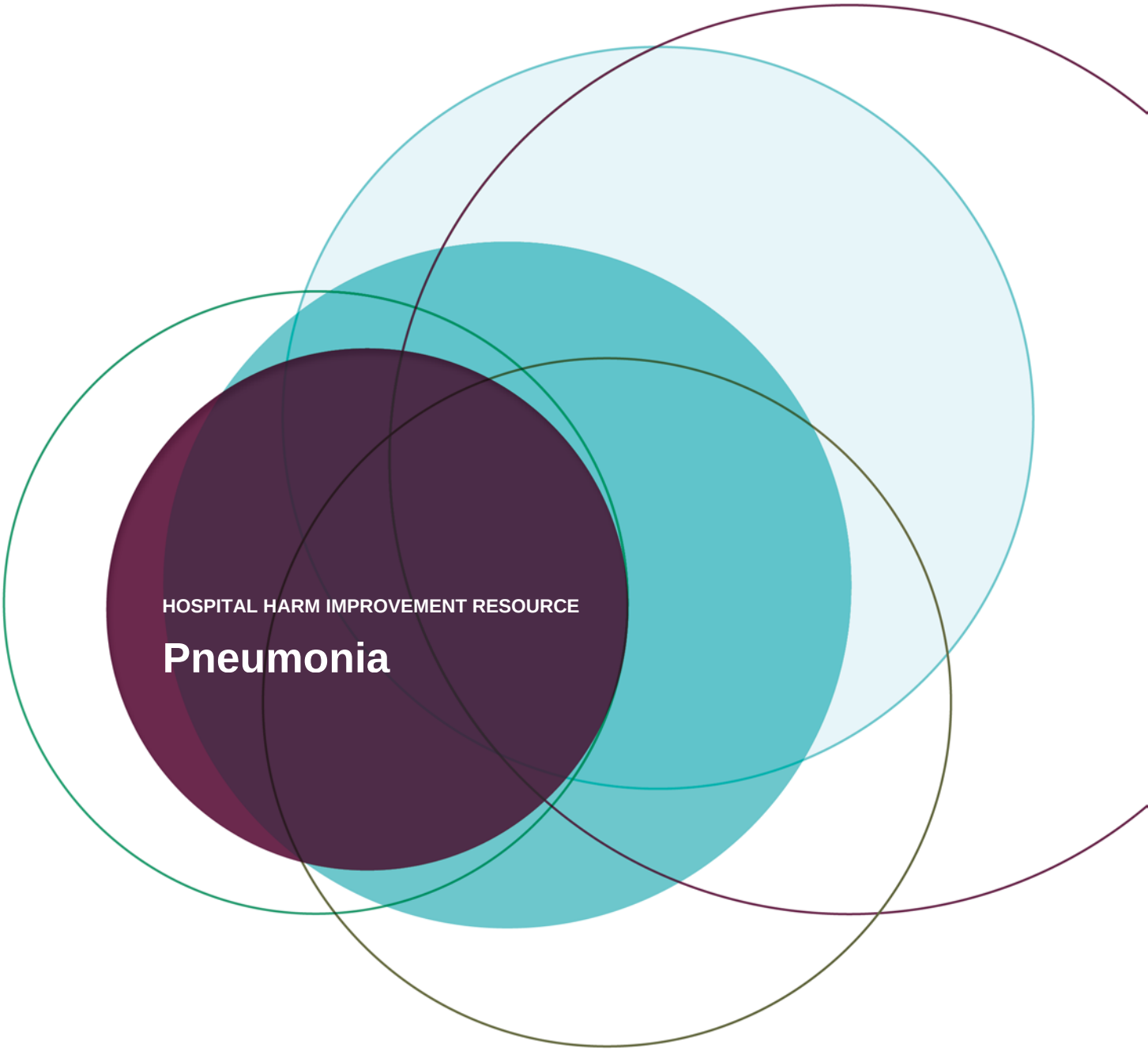

HOSPITAL HARM IMPROVEMENT RESOURCE

Pneumonia

cpsi icsp
Canadian Patient Safety Institute
Institut canadien pour la sécurité des patients

ACKNOWLEDGEMENTS

The Canadian Institute for Health Information and the Canadian Patient Safety Institute have collaborated on a body of work to address gaps in measuring harm and to support patient safety improvement efforts in Canadian hospitals.

The Hospital Harm Improvement Resource was developed by the Canadian Patient Safety Institute to complement the Hospital Harm measure developed by the Canadian Institute for Health Information. It links measurement and improvement by providing evidence-informed resources that will support patient safety improvement efforts.

The Canadian Patient Safety Institute acknowledges and appreciates the key contributions of Dr. Claudio Martin, MD FRCPC for the review and approval of this Improvement Resource.

DISCHARGE ABSTRACT DATABASE (DAD) CODES INCLUDED IN THIS CLINICAL CATEGORY:

B15: Pneumonia		
Concept	Pneumonia identified during a hospital stay, excluding aspiration pneumonia.	
Notes	1. When both aspiration pneumonitis and pneumonia are coded on the same abstract, the event will be assigned to B16: Aspiration Pneumonia. 2. Pneumonia due to methicillin-resistant *Staphylococcus aureus* (MRSA) or vancomycin-resistant enterococci (VRE) can also be included in B18: Infections due to *Clostridium difficile*, MRSA or VRE.	
Selection criteria	J10.0 J11.0 J12.– J13 J14 J15.– J16.8 J18.– J85.1	Identified as diagnosis type (2) **OR** Identified as diagnosis type (3) **AND** J95.88 (other post-procedural respiratory disorders) as diagnosis type (2) **AND** Y60–Y84 (complications of medical or surgical care)* **in the same diagnosis cluster**
	Excludes 1. Abstracts with J69.– (pneumonitis due to solids and liquids) identified as diagnosis type (2) 2. Abstracts with J69.– (pneumonitis due to solids and liquids) identified as diagnosis type (3) **AND** J95.88 (other post-procedural respiratory disorders) as diagnosis type (2) **AND** Y60–Y84 (complications of medical or surgical care)* **in the same diagnosis cluster** 3. Abstracts with a length of stay less than 2 days	
Codes	**Code descriptions**	
J10.0	Influenza with pneumonia, other influenza virus identified	
J11.0	Influenza with pneumonia, virus not identified	
J12.–	Viral pneumonia, not elsewhere classified	
J13	Pneumonia due to streptococcus pneumoniae	
J14	Pneumonia due to haemophilus influenzae	
J15.–	Bacterial pneumonia, not elsewhere classified	
J16.8	Pneumonia due to other specified infectious organisms	
J18.–	Pneumonia, organism unspecified	
J85.1	Abscess of lung with pneumonia	

Additional codes	
Inclusion	
J95.88	Other post-procedural respiratory disorders *Includes:* Ventilator associated pneumonia (VAP)
Exclusions	
J69.–	Pneumonitis due to solids and liquids
J95.88	Other postprocedural respiratory disorders *Includes:* Ventilator associated pneumonia (VAP)

For the descriptions of external cause codes of complications of medical or surgical care (Y60–Y84), please see Appendix 2 of the *Measuring Patient Harm in Canadian Hospitals: Technical Report*.

.

OVERVIEW

Pneumonia, an acute illness, is defined by the Centers for Disease Control and Prevention (2014) as: *"an infection of the lungs that can cause mild to severe illness in people of all ages."* Pneumonia can be caused by viruses, bacteria, and fungi (Centers for Disease Control, 2015). By consensus, pneumonia that develops at least 48 hours after hospital admission, (excluding those which were incubating at the time of admission) is considered to be hospital-acquired pneumonia (HAP).

The most common pathogens are gram-negative bacilli and *Staphylococcus aureus*; drug-resistant organisms are an important concern. Symptoms and signs are the same as those for community-acquired pneumonia. Diagnosis is suspected on the basis of sepsis criteria together with chest x-ray changes and cough (productive with bacterial pneumonia). Nasopharyngeal swabs for viral testing can confirm the diagnosis in cases of influenza and other respiratory viruses. Sputum cultures for bacteria should be obtained but have poor sensitivity and specificity. Cultures obtained by bronchoalveolar lavage may have better specificity but lower sensitivity. They do not alter outcomes and therefore it is recommended to not perform this procedure routinely (Muscedere, Dodek, et al, 2008). Blood cultures should be obtained but have very low sensitivity. Treatment is with antibiotics. Overall prognosis is poor, due in part to comorbidities.

HAP, ventilator-associated pneumonia (VAP), and healthcare-associated pneumonia (HCAP) remain important causes of morbidity and mortality despite advances in antimicrobial therapy, better supportive care modalities, and the use of a wide-range of preventive measures. HAP may be managed in a hospital ward or in the intensive care unit (ICU) when the illness is more severe. VAP refers to pneumonia that arises more than 48 hours after endotracheal intubation. Although not included in this definition, some patients may require intubation after developing severe HAP and should be managed similar to patients with VAP. HCAP includes any non-hospitalized patient with pneumonia who was hospitalized in an acute care hospital for two or more days within the past 90 days; resided in a nursing home or long-term care facility; received recent intravenous antibiotic therapy, chemotherapy, or wound care within the past 30 days; or attended a hospital or hemodialysis clinic within the past 30 days of the infection.

Although this document focuses more on HAP and VAP, most of the principles overlap with HCAP. Because most of the current data have been collected from patients with VAP, and microbiologic data from non-intubated patients may be less accurate, most of our information is derived from those with VAP, but by extrapolation can be applied to all patients with HAP, emphasizing risk factors for infection with specific pathogens (American Thoracic Society and Infectious Diseases Society of America, 2005).

Based on 2002 data, nearly 80 per cent of all hospital-acquired infections are caused by four types of infections. Urinary tract infections (UTIs) comprise the highest percentage (34 per cent of all hospital-acquired infections), followed by surgical-site infections (17 per cent), bloodstream infections (14 per cent), and pneumonia (13 per cent) (Klevens et al., 2007).

"In non-intubated patients, risk factors include previous antibiotic treatment, high gastric pH (due to stress ulcer prophylaxis or therapy), and coexisting cardiac, pulmonary, hepatic, or renal

insufficiency. Major risk factors for postoperative pneumonia are age > 70, abdominal or thoracic surgery, and dependent functional status," (Sethi, 2014).

IMPLICATIONS

According to the Centers for Disease Control and Prevention (Centers for Disease Control, 2014), hospital-associated pneumonia *"has accounted for approximately 15 per cent of all hospital-associated infections."* (Tablan et al., 2003) Hospital-acquired pneumonia, and notably ventilator-associated pneumonia, developing as a consequence of lung bacterial colonization, alters clinically important outcomes, including duration of mechanical ventilation, length of stay in the intensive care unit (ICU), and mortality rates (Roquilly et al., 2015).

For the Canadian healthcare system, the incidence of VAP is 10.6 cases per 1000 ventilator days. Using conservative assumptions, we determined that VAP costs approximately $11,500 per case, is responsible for approximately 230 deaths per year (5.8 per cent), and accounts for approximately 17,000 additional ICU days per year -- around two per cent of all ICU days in Canada. This represents the equivalent of three to four ICUs completely occupied for the whole year solely to treat patients with VAP. Finally, the cost to the healthcare system is [estimated to be] CAN $46 million per year (Muscedere, Martin, et al, 2008).

Non-ventilator hospital-acquired pneumonia (NV-HAP) is an underreported and understudied disease, with potential for measurable outcomes, fiscal savings, and improvement in quality of life (Quinn et al., 2014). Many Canadian hospitals monitor ventilator-associated pneumonia; however, there is only limited monitoring and reporting of NV-HAP.

The limited studies available indicate that NV-HAP is an emerging factor in prolonged hospital stays and significant patient morbidity and mortality.

HAP:

a. Adds an estimated additional $40,000 to $65,000 to the cost of care for each affected patient in the U.S.
b. Adds seven to nine days to the length of hospital stay.
c. Significantly increases discharge to skilled nursing facilities instead of returning home.
d. Has an attributable mortality rate as high as 50 per cent.
e. Is associated with half of patients not being discharged back to their homes.

While HAP has received significant attention from healthcare quality review boards, their focus has been on intensive care unit (ICU)-level of care and ventilated patients who acquire pneumonia (Quinn et al., 2014).

Several factors may contribute to increased risks for HAP, including older patients with a low body mass index and signs of malnourishment; altered mental status; low albumin; dependent for activities of daily living; receiving central nervous system depressants or acid blocking medications; and presence of chronic or inadequately managed pain (Quinn et al., 2014).

Modifiable risk factors for HAP and VAP are crucial targets for prevention that can reduce patient mortality and morbidity, and also promote the cost-effective use of healthcare resources.

Effective prevention strategies include the use of strict infection control, hand hygiene, microbiological surveillance with availability of data on local drug resistant pathogens, monitoring and early removal of invasive devices, and programs to reduce or alter antibiotic prescribing practices (Rotstein, 2008).

Goal

To prevent hospital-associated pneumonia in hospitalized adult patients by implementing proven interventions.

Importance to Patients and Families

Pneumonia is an infection of the lungs that can cause mild to severe illness in people of all ages. These infections can often be prevented with vaccines and can usually be treated with antibiotics. Antiviral drugs and other specific drug therapies may also have a role. You can help prevent pneumonia and other respiratory infections by following good hygiene practices, such as washing your hands regularly and disinfecting frequently touched surfaces. You are more likely to become ill with pneumonia if you smoke or have underlying medical conditions, such as diabetes or heart disease (Centers for Disease Control, 2014).

VAP is one of the most serious complications for the most critically ill and vulnerable patients and can be avoided in the hospital by using proven strategies (IHI, 2012).

Patient Story

Claire inspires change after her passing

Claire, the nine year old daughter of an ICU nurse, died in March of 2008, after 16 days in the same intensive care, following surgery to repair a malformation in her skull. After surgery, Claire was placed in a deep sleep and on a ventilator. She eventually succumbed to complications, including pneumonia. Her mother risked everything to fight in Claire's memory. A review of Claire's care found that ventilator management was below accepted standards. It also revealed Claire's death was precipitated by an abrupt rise in carbon dioxide caused, most commonly, by a blocked endotracheal tube. The review deemed Claire's death as preventable.

Evidence-Informed Practices

With the exception of VAP, there is very little data and evidence regarding HAP. The grade of the evidence in many cases is low due to methodology, questions about generalizability from other settings or patient populations and other issues. In some instances, evidence may be upgraded based on low cost and feasibility of the intervention. The following suggestions are therefore evidence-informed practices.

Routine Precautions – All patients

Routine Practices and Additional Precautions for Preventing the Transmission of Infection in Healthcare Settings (Public Health Agency of Canada, 2012).

Healthcare-Associated Pneumonia

(Tablan et al., 2003; Davis, 2012)

1. Staff education and involvement in infection prevention.
2. Infection and microbiologic surveillance with data on local drug resistant pathogens.
3. Appropriate cleaning, sterilization or disinfection and maintenance of equipment, devices and environment.
4. Vaccinate staff and high risk patients (i.e. Flu shots).
5. Deep breathing exercises and ambulation.
6. Isolate infected patients as indicated.
7. Rapid screening with isolation as indicated.
8. Limit symptomatic staff and visitors.
9. Maintain intact, moist, and healthy oral lining and mucosa.
10. †Monitoring and early removal of invasive devices.
11. †Anti-microbial stewardship program.
12. 1‡Swallow screens.
13. ‡Lung expansion/mobilize.
14. ‡Adequate nutrition.
15. ‡Serum glucose in target range.
16. See prevention strategies for Aspiration Pneumonia.

Ventilator-Associated Pneumonia

(*Safer Healthcare Now!* 2012)

1. Elevation of the head of the bed to 45° when possible, otherwise attempt to maintain the head of the bed greater than 30° should be considered.
2. Daily evaluation of readiness for extubation.
3. The utilization of endotracheal tubes with subglottic secretion drainage.
4. Oral care and decontamination with Chlorhexidine.
5. Initiation of safe enteral nutrition within 24-48h of ICU admission.

† Rotstein et al. 2008
‡ Quinn et al. 2014

MEASURES

Vital to quality improvement is measurement, and this applies specifically to implementation of interventions. The chosen measures will help to determine whether an impact is being made (primary outcome), whether the intervention is actually being carried out (process measures), and whether any unintended consequences ensue (balancing measures).

Below are some recommended measures to use, as appropriate, to track your progress. In selecting your measures, consider the following:

- Whenever possible, use measures you are already collecting for other programs.
- Evaluate your choice of measures in terms of the usefulness of the final results and the resources required to obtain them; try to maximize the former while minimizing the latter.
- Try to include both process and outcome measures in your measurement scheme.
- You may use different measures or modify the measures described below to make them more appropriate and/or useful to your particular setting. However, be aware that modifying measures may limit the comparability of your results to others'.
- Posting your measure results within your hospital is a great way to keep your teams motivated and aware of progress. Try to include measures that your team will find meaningful and exciting (IHI, 2011).

For more information on measuring for improvement c contact the Canadian Patient Safety Institute Central Measurement Team at measurement@cpsi-icsp.ca

Healthcare-Associated Pneumonia

Outcome Measure

1. Rate of Healthcare-Associated Pneumonia per 1000 Patient Days.

Process Improvement Measures

1. Per cent Appropriate Environmental Cleaning Practice.
2. Reduction in Mean Time from Lab Notification of Positive Culture to Placement on Contact Precautions.
3. Per cent of Patients with Healthy Oral Mucosa.
4. Per cent of Staff Receiving Flu Shot.
5. Per cent of High Risk Patients Receiving Flu Shot.

Ventilator-Associated Pneumonia

Outcome Measure

1. VAP Rate per 1000 Ventilator Days.

Process Improvement Measures

1. VAP Adult Bundle Compliance.
    a. Per cent of ventilated patients with the head of bed elevation to 45 degrees when possible, otherwise 30-45 degrees.
    b. Per cent of ventilated patients with daily evaluation of readiness for extubation.
    c. Per cent of ventilated patients with initiation of safe enteral nutrition within 24-48 hours of ICU admission.
    d. Per cent of ventilated patients with the utilization of endotracheal tubes and subglottic secretion drainage (CASS).
    e. Per cent of ventilated patients with oral care decontamination with Chlorhexidine.

Standards and Required Organizational Practices

Accreditation Canada Standards

- *Critical Care Standards:* require the implementation of the *Safer Healthcare Now!* VAP bundle for all clients on ventilators.

Accreditation Canada Required Organizational Practice

- *Hand-Hygiene Compliance:* Requires the evaluation of compliance with accepted hand-hygiene practices.

Global Patient Safety Alerts

Global Patient Safety Alerts provides access and the opportunity to learn from other organizations about specific patient safety incidents including alerts, advisories, recommendations and solutions for improving care and preventing incidents. Learning from the experience of other organizations can accelerate improvement.

Recommended search terms:

- Pneumonia
- Ventilator-associated pneumonia (VAP)

Success Stories

Alberta Health Services

The Calgary Health Region (Alberta Health Services), with the support of the Canadian ICU Collaborative, has charged multidisciplinary critical care teams with the responsibility of reducing the incidence of VAP. Several interventions, including a VAP bundle, were utilized and applied across an entire health region. VAP rates have steadily declined over the last 15 months and have been largely under the goal of 9.8 cases/1000 ventilator days. The team's success in lowering VAP has not only provided the momentum for sustained improvement and spread to other areas, but has also resulted in overall improvements in health outcomes and resource utilization within the critical care units (*Safer Healthcare Now!* One Pager).

Oral Hygiene for Pneumonia Prevention

Many care-dependent clients in acute surgical settings are at risk for hospital-acquired pneumonia. A concern about high HAP rates on the neurosurgical ward at Royal Columbian Hospital (RCH) was identified by the Clinical Nurse Specialist (CNS). A multidisciplinary team was formed, led by the CNS and a Speech Language Pathologist (SLP) (Accreditation Canada, 2015).

I COUGH Program: Using ACS NSQIP Data to Develop a Standard of Care for Post-Operative Pneumonia Prevention

This practice was recognized as a Promising Practice by the Health Council of Canada using the Health Innovation Portal Evaluation Framework (Accreditation Canada, 2015).

REFERENCES

Accreditation Canada. Leading practices database. 2015. http://www.accreditation.ca/leading-practices

American Thoracic Society, Infectious Diseases Society of America. Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia. *Am J Respir Crit Care Med 2005*; 171 (4): 388–416. https://www.thoracic.org/statements/resources/tb-opi/guide1-29.pdf

Centers for Disease Control. *Pneumonia: An infection of the lungs*. 2015. http://www.cdc.gov/pneumonia/

Davis J. The breadth of hospital-acquired pneumonia: Nonventilated versus ventilated patients in Pennsylvania*. Pennsylvania Patient Safety Advisory*. 2012; 9 (3): 99-105. http://patientsafetyauthority.org/ADVISORIES/AdvisoryLibrary/2012/Sep;9(3)/Documents/sep;9(3).pdf

Institute for Healthcare Improvement (IHI). How-to Guide: Prevent Ventilator-Associated Pneumonia. Cambridge, MA: IHI; 2012. http://www.ihi.org/resources/Pages/Tools/HowtoGuidePreventVAP.aspx

Institute for Healthcare Improvement. Ventilator bundle. Improvement Map. 2012. http://app.ihi.org/imap/tool/#Process=0f029d21-a307-4663-9d64-07da43f3f857

Klevens RM, Edwards JR, Richards CL Jr, et al. Estimating health care-associated infections and deaths in U.S. hospitals, 2002. *Public Health Rep*. 2007; 122 (2): 160-166. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1820440/

Muscedere J, Dodek P, Keenan S, et al. Comprehensive evidence-based clinical practice guidelines for ventilator-associated pneumonia: prevention. *J Crit Care*. 2008; 23 (1): 126-137. doi: 10.1016/j.jcrc.2007.11.014.

Muscedere JG, Martin CM, Heyland DK. The impact of ventilator-associated pneumonia on the Canadian health care system. *J Crit Care*. 2008; 23 (1): 5–10. doi: 10.1016/j.jcrc.2007.11.012.

Public Health Agency of Canada. *Routine practices and additional precautions for preventing the transmission of infection in healthcare settings*. Ottawa, ON: Public Health Agency of Canada; 2012. http://publications.gc.ca/collections//collection_2013/aspc-phac/HP40-83-2013-eng.pdf

Quinn B, Baker DL, Cohen S, et al. Basic nursing care to prevent nonventilator hospital-acquired pneumonia. *J Nurs Scholarsh*. 2014; 46 (1): 11-19. doi: 10.1111/jnu.12050. http://onlinelibrary.wiley.com/doi/10.1111/jnu.12050/full

Roquilly A, Marret E, Abraham E, Asehnoune K. Pneumonia prevention to decrease mortality in intensive care unit: a systematic review and meta-analysis. *Clin Infect Dis*. 2015; 60 (1): 64-75. doi: 10.1093/cid/ciu740. [Erratum: Roquilly et al. Clin Infect Dis 2015; 60: 64-75]. http://cid.oxfordjournals.org/content/60/1/64.full.pdf

Rotstein C, Evans G, Born A, et al. Clinical practice guidelines for hospital-acquired pneumonia and ventilator-associated pneumonia in adults. *Can J Infect Dis Med Microbiol.* 2008; 19 (1): 19-53. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2610276/

**Safer Healthcare Now!* Prevent ventilator associated pneumonia (VAP): Getting Started Kit. Canadian Patient Safety Institute; 2012. http://www.patientsafetyinstitute.ca/en/Topic/Pages/Ventilator-Associated-Pneumonia-(VAP).aspx

Safer Healthcare Now! Prevent ventilator associated pneumonia (VAP): One-pager. Canadian Patient Safety Institute; 2012. http://www.patientsafetyinstitute.ca/en/Topic/Pages/Ventilator-Associated-Pneumonia-(VAP).aspx

Sethi S. Hospital-acquired pneumonia. *Merck Manual.* 2014. https://www.merckmanuals.com/professional/pulmonary-disorders/pneumonia/hospital-acquired-pneumonia

Tablan OC, Anderson LJ, Besser R, et al. Guidelines for preventing healthcare-associated pneumonia, 2003. Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee. Centers for Disease Control and Prevention; 2003. http://www.cdc.gov/hicpac/pdf/guidelines/HApneu2003guidelines.pdf

HEALTHCARE-ACQUIRED PNEUMONIA RESOURCES

*(key resource recommended by Dr. Claudio Martin)

HAP Clinical Practice Guidelines

American Thoracic Society, Infectious Diseases Society of America. Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia. *Am J Respir Crit Care Med 2005*; 171 (4): 388–416. https://www.thoracic.org/statements/resources/tb-opi/guide1-29.pdf

Klompas M, Branson R, Eichenwald EC, et al. Strategies to prevent ventilator-associated pneumonia in acute care hospitals: 2014 update. *Infect Control Hosp Epidemiol*. 2014; 35 (8): 915-936. doi: 10.1086/677144.

Klompas M. Evidence vs instinct for pneumonia prevention in hospitalized patients. *Clin Infect Dis*. 2015; 60 (1): 76-78. doi: 10.1093/cid/ciu744. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4264582/

Livorsi D, Eckerle MK. Developing local treatment guidelines for healthcare-associated pneumonia. *Clin Infect Dis.* 2014; 59 (4): 609-610. doi: 10.1093/cid/ciu332. http://cid.oxfordjournals.org/content/59/4/609.long

Muscedere J, Dodek P, Keenan S, et al. Comprehensive evidence-based clinical practice guidelines for ventilator-associated pneumonia: prevention. *J Crit Care*. 2008; 23 (1): 126-137. doi: 10.1016/j.jcrc.2007.11.014.

Roquilly A, Marret E, Abraham E, Asehnoune K. Pneumonia prevention to decrease mortality in intensive care unit: a systematic review and meta-analysis. *Clin Infect Dis.* 2015; 60 (1): 64-75. doi: 10.1093/cid/ciu740. [Erratum: Roquilly et al. Clin Infect Dis 2015; 60: 64-75]. http://cid.oxfordjournals.org/content/60/1/64.full.pdf

Public Health Agency of Canada, Centre for Communicable Diseases and Infection Control. *Infection control guideline for the prevention of healthcare-associated pneumonia*. Ottawa, ON: Public Health Agency of Canada; 2010. http://publications.gc.ca/collections/collection_2012/aspc-phac/HP40-54-2010-eng.pdf

**Safer Healthcare Now!* Prevent Ventilator Associated Pneumonia (VAP): Getting Started Kit. Canadian Patient Safety Institute, 2012. http://www.patientsafetyinstitute.ca/en/Topic/Pages/Ventilator-Associated-Pneumonia-(VAP).aspx

Rotstein C, Evans G, Born A, et al. Clinical practice guidelines for hospital-acquired pneumonia and ventilator-associated pneumonia in adults. *Can J Infect Dis Med Microbiol*. 2008; 19 (1): 19-53. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2610276/

Tablan OC, Anderson LJ, Besser R, et al. Guidelines for preventing healthcare-associated pneumonia, 2003. Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee. Centers for Disease Control and Prevention; 2003. http://www.cdc.gov/hicpac/pdf/guidelines/HApneu2003guidelines.pdf

HAP Prevention Quality Improvement Resources

El-Rabbany M, Zaghlol N, Bhandari M, Azarpazhooh A. Prophylactic oral health procedures to prevent hospital-acquired and ventilator-associated pneumonia: a systematic review. *Int J Nurs Stud*. 2015; 52 (1): 452-64. doi: 10.1016/j.ijnurstu.2014.07.010. http://www.journalofnursingstudies.com/article/S0020-7489%2814%2900196-5/abstract

Friedman ND, Sexton DJ. General principles of infection control. *UpToDate*. 2015 Aug 19.

File TM. Risk factors and prevention of hospital-acquired, ventilator-associated, and healthcare-associated pneumonia in adults. *UpToDate*. 2015 Dec 28.

Office of Disease Prevention and Health Promotion (ODPHP), US Department of Health and Human Services. Framework. National action plan to prevent health care-associated infections: Road map to elimination. ODPHP; 2013. http://www.health.gov/hcq/pdfs/hai-action-plan-framework.pdf

Prasad P, Fedorowicz Z, Bond S. Hospital-acquired pneumonia. *DynaMed*. 2015 Dec 23.

Thorner AR. Infection control measures to prevent seasonal influenza in healthcare settings. *UpToDate.* 2015 March 25.