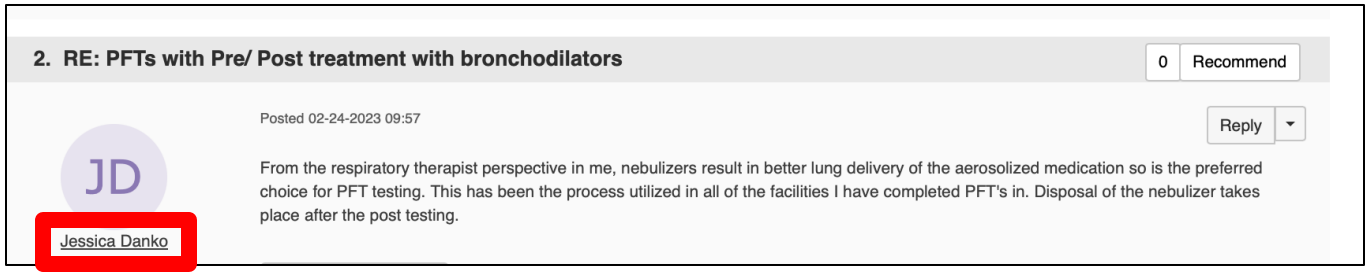
APIC 2025

The Infection Preventionist's Guide with Understanding Respiratory Therapy

Disclosures



2. RE: PFTs with Pre/ Post treatment with bronchodilators

0 Recommend

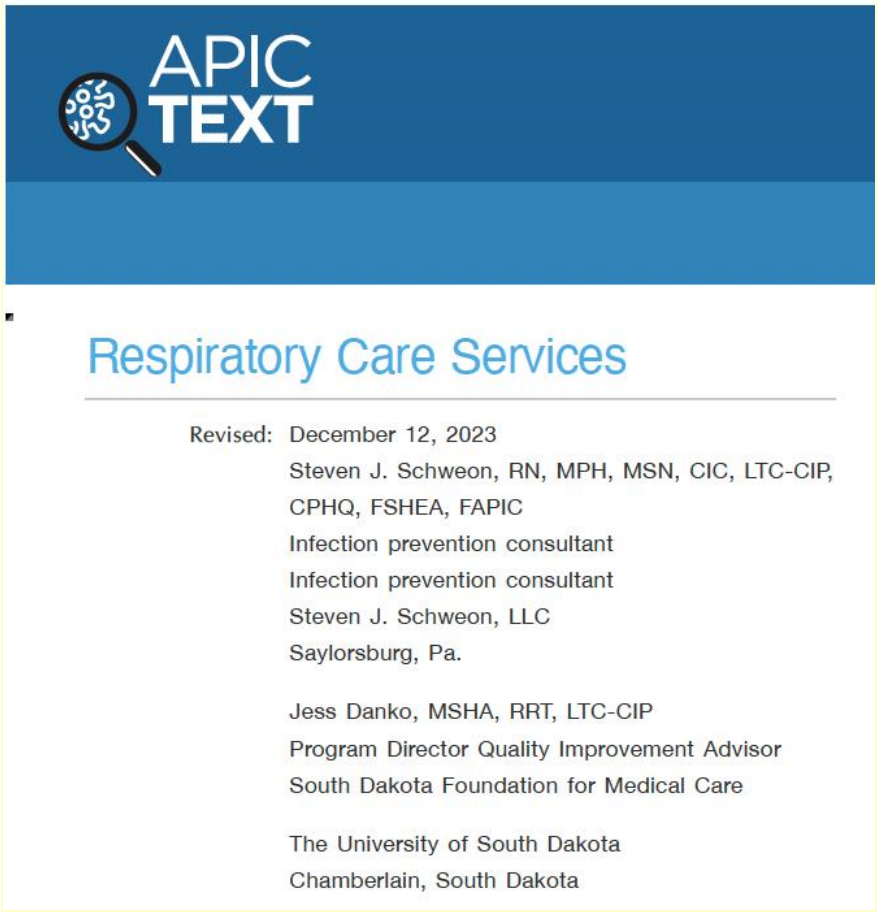
Posted 02-24-2023 09:57

Reply

JD

Jessica Danko

From the respiratory therapist perspective in me, nebulizers result in better lung delivery of the aerosolized medication so is the preferred choice for PFT testing. This has been the process utilized in all of the facilities I have completed PFT's in. Disposal of the nebulizer takes place after the post testing.



Respiratory Care Services

- Administration of medical gases/aerosolized medications
- Airway management procedures
- Blood gas sampling/analysis
- Bronchial hygiene therapies
- Cardiopulmonary diagnostics

1. Adobe stock images. https://stock.adobe.com/search?k=respiratory&search_type=autosuggest&asset_id=904170533. Accessed November 3, 2024.

Respiratory Care Services

- ✓ Lung expansion therapies such as incentive spirometer
- ✓ Mechanical ventilation
- ✓ Emergency resuscitation

➢Respiratory care services are used during an active infection and for chronic conditions.

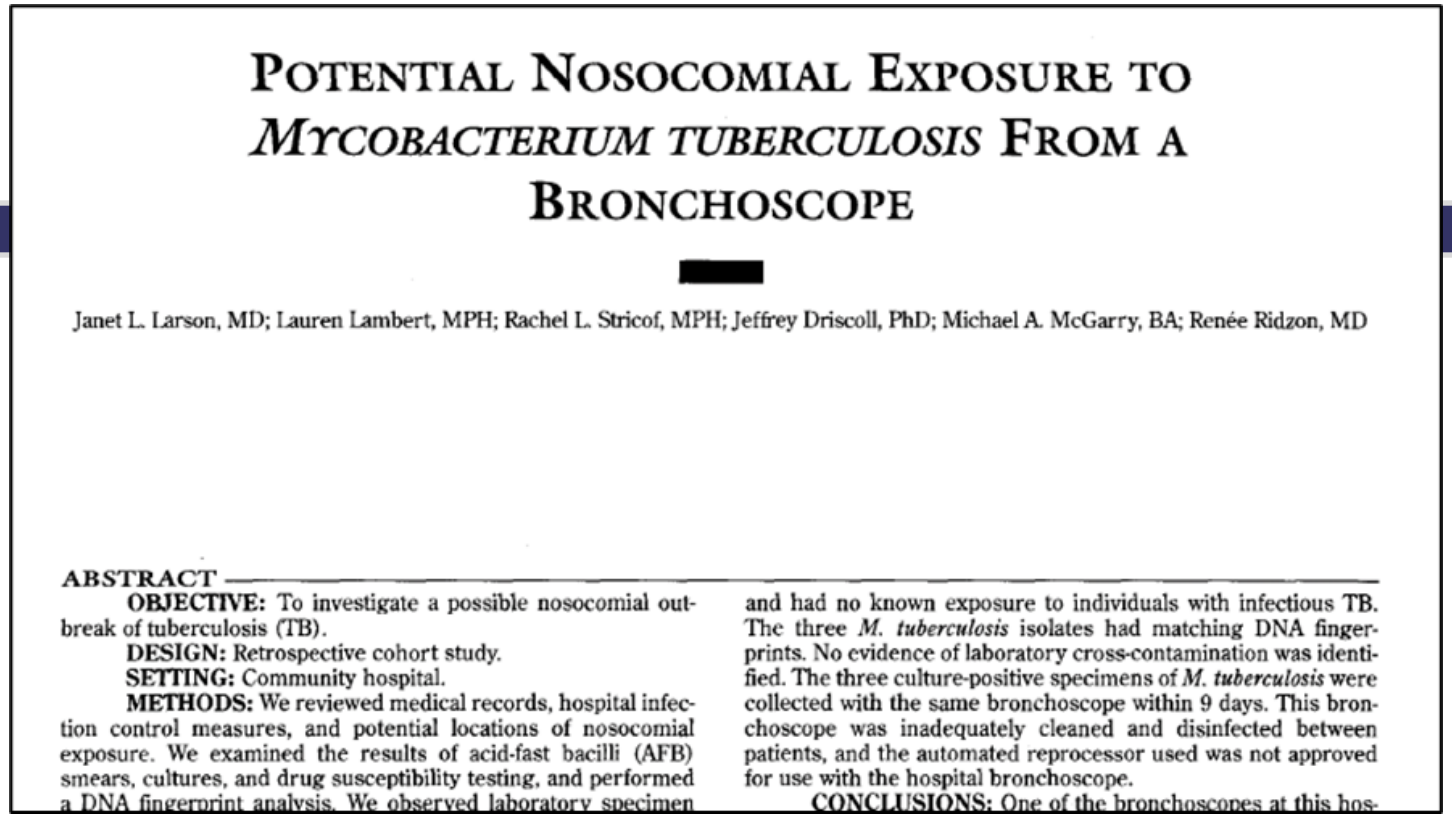
➢Each procedure is a potential source of infection for the patient or Health Care Personnel (HCP).

➢Infection risk is variable depending upon the service and equipment (intubation vs. pulmonary function tests)

1. Adobe stock images. https://stock.adobe.com/search?k=respiratory&search_type=autosuggest&asset_id=904170533. Accessed April 14, 2025

Respiratory Care Services

So what can go wrong……..



Potential Nosocomial Exposure to *Mycobacterium tuberculosis* From a Bronchoscope

[redacted]

Janet L. Larson, MD; Lauren Lambert, MPH; Rachel L. Stricof, MPH; Jeffrey Driscoll, PhD; Michael A. McGarry, BA; Renée Ridzon, MD

ABSTRACT

OBJECTIVE: To investigate a possible nosocomial outbreak of tuberculosis (TB).

DESIGN: Retrospective cohort study.

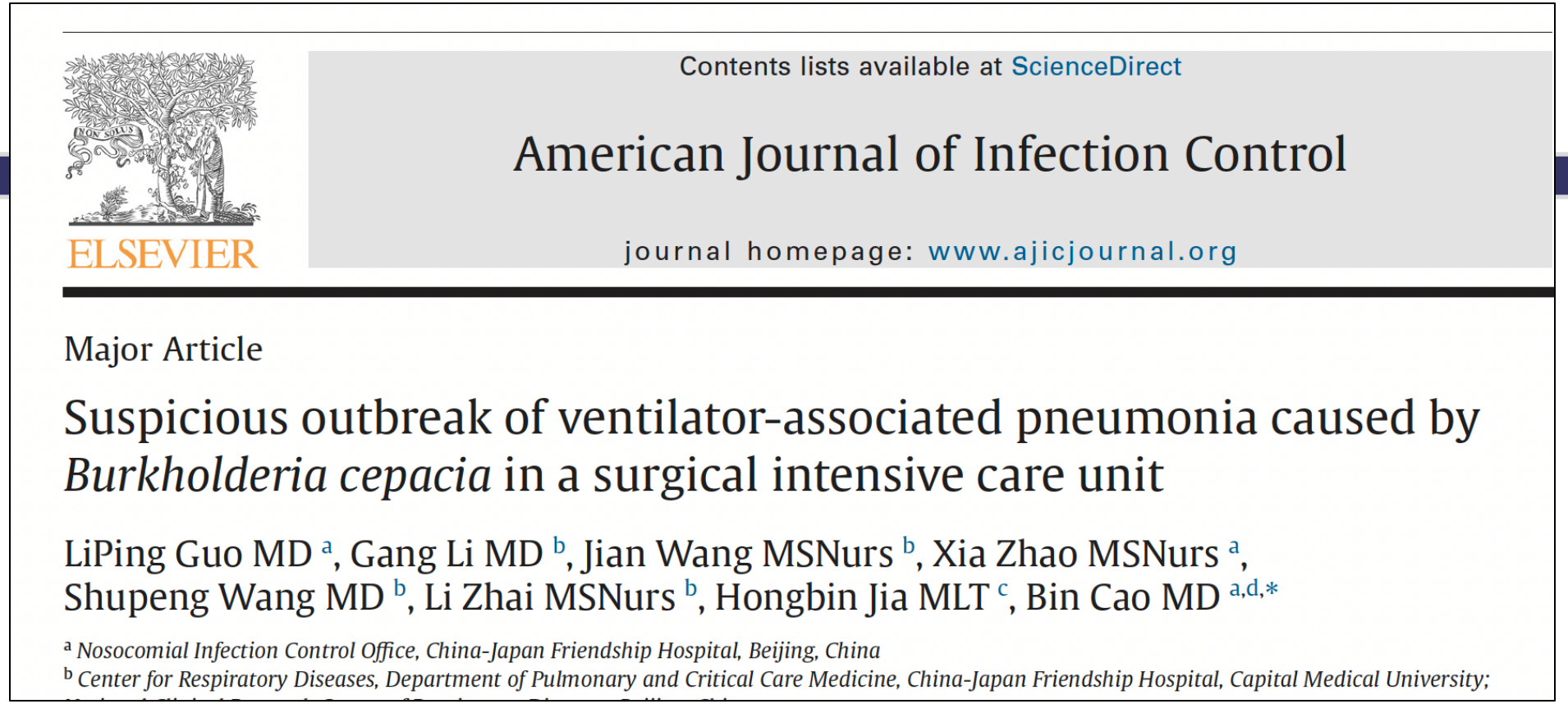
SETTING: Community hospital.

METHODS: We reviewed medical records, hospital infection control measures, and potential locations of nosocomial exposure. We examined the results of acid-fast bacilli (AFB) smears, cultures, and drug susceptibility testing, and performed a DNA fingerprint analysis. We observed laboratory specimen

and had no known exposure to individuals with infectious TB. The three *M. tuberculosis* isolates had matching DNA fingerprints. No evidence of laboratory cross-contamination was identified. The three culture-positive specimens of *M. tuberculosis* were collected with the same bronchoscope within 9 days. This bronchoscope was inadequately cleaned and disinfected between patients, and the automated reprocessor used was not approved for use with the hospital bronchoscope.

CONCLUSIONS: One of the bronchoscopes at this hos-

- Tuberculosis transmission due to inadequate bronchoscope cleaning and disinfection; automated reprocessing was incompatible with this scope



Contents lists available at ScienceDirect

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journal homepage: www.ajicjournal.org

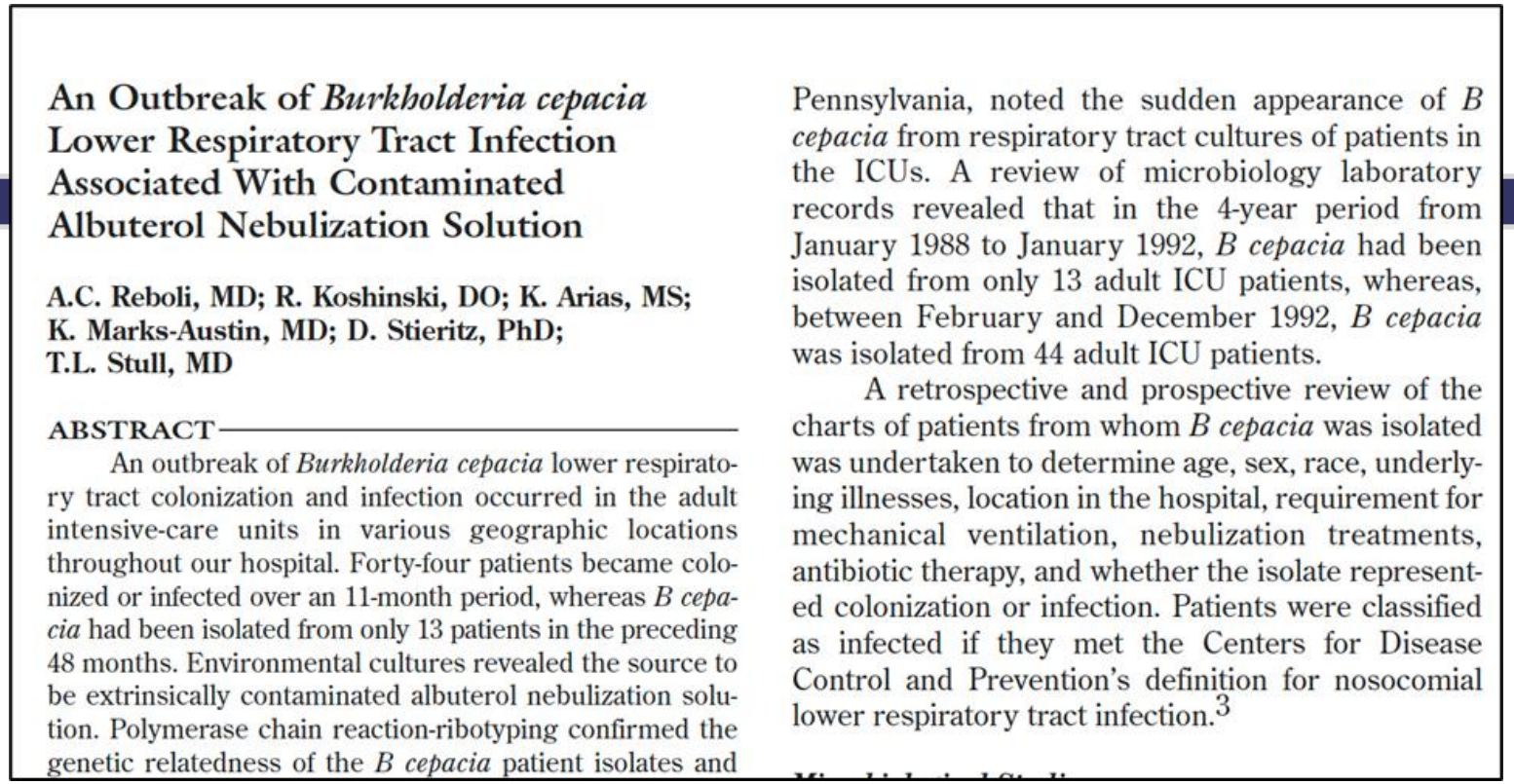
Major Article

Suspicious outbreak of ventilator-associated pneumonia caused by *Burkholderia cepacia* in a surgical intensive care unit

LiPing Guo MD [a], Gang Li MD [b], Jian Wang MSNurs [b], Xia Zhao MSNurs [a], Shupeng Wang MD [b], Li Zhai MSNurs [b], Hongbin Jia MLT [c], Bin Cao MD [a,d,*]

[a] *Nosocomial Infection Control Office, China-Japan Friendship Hospital, Beijing, China*
[b] *Center for Respiratory Diseases, Department of Pulmonary and Critical Care Medicine, China-Japan Friendship Hospital, Capital Medical University;*

- A *Burkholderia cepacia* pneumonia outbreak was due to improper ventilator cleaning and disinfection



An Outbreak of *Burkholderia cepacia* Lower Respiratory Tract Infection Associated With Contaminated Albuterol Nebulization Solution

A.C. Reboli, MD; R. Koshinski, DO; K. Arias, MS; K. Marks-Austin, MD; D. Stieritz, PhD; T.L. Stull, MD

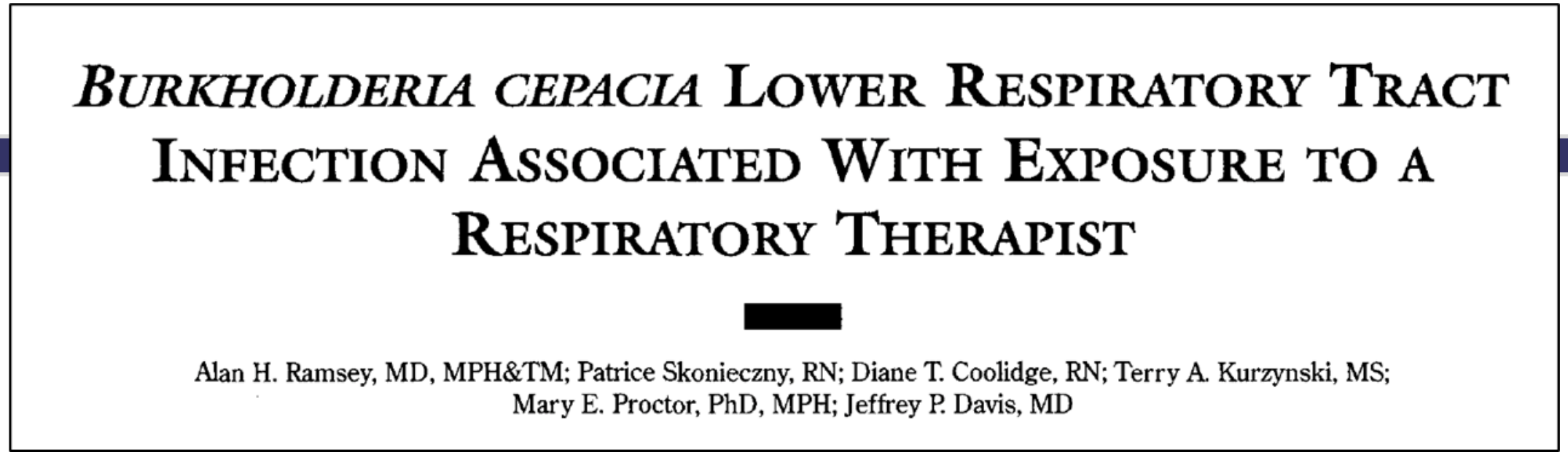
ABSTRACT

An outbreak of *Burkholderia cepacia* lower respiratory tract colonization and infection occurred in the adult intensive-care units in various geographic locations throughout our hospital. Forty-four patients became colonized or infected over an 11-month period, whereas *B cepacia* had been isolated from only 13 patients in the preceding 48 months. Environmental cultures revealed the source to be extrinsically contaminated albuterol nebulization solution. Polymerase chain reaction-ribotyping confirmed the genetic relatedness of the *B cepacia* patient isolates and

Pennsylvania, noted the sudden appearance of *B cepacia* from respiratory tract cultures of patients in the ICUs. A review of microbiology laboratory records revealed that in the 4-year period from January 1988 to January 1992, *B cepacia* had been isolated from only 13 adult ICU patients, whereas, between February and December 1992, *B cepacia* was isolated from 44 adult ICU patients.

A retrospective and prospective review of the charts of patients from whom *B cepacia* was isolated was undertaken to determine age, sex, race, underlying illnesses, location in the hospital, requirement for mechanical ventilation, nebulization treatments, antibiotic therapy, and whether the isolate represented colonization or infection. Patients were classified as infected if they met the Centers for Disease Control and Prevention's definition for nosocomial lower respiratory tract infection.[3]

- *Burkholderia cepacia* outbreak was associated with improper albuterol solution management by staff.



Burkholderia cepacia Lower Respiratory Tract Infection Associated With Exposure to a Respiratory Therapist

[redacted]

Alan H. Ramsey, MD, MPH&TM; Patrice Skonieczny, RN; Diane T. Coolidge, RN; Terry A. Kurzynski, MS; Mary E. Proctor, PhD, MPH; Jeffrey P. Davis, MD

- *Burkholderia cepacia* outbreak was likely caused by multidose albuterol vials and nebulizers not dried between uses.

Nosocomial Legionnaires' Disease and Use of Medication Nebulizers

Timothy D. Mastro, Barry S. Fields, Robert F. Breiman, Joyce Campbell, Brian D. Plikaytis, and John S. Spika

Respiratory Diseases Branch, Division of Bacterial Diseases, Center for Infectious Diseases, Centers for Disease Control, Atlanta, Georgia; Washington State Department of Social and Health Services, Seattle

Guidelines for the prevention of nosocomial pneumonia specify that only sterile fluids should be used for aerosol therapy; however, this recommendation may not be uniformly followed. Thirteen patients with nosocomial pneumonia due to *Legionella pneumophila* serogroup 3 (Lp3) were identified at a community hospital in the period from 1984 through 1988; 12 patients (92%) had chronic obstructive pulmonary disease; and 9 patients (69%) died. An epidemiologic investigation suggested that the use of nebulizers to deliver medication was associated with acquiring

- Legionnaires' Disease outbreak was linked with using the hospital water system to wash medication nebulizers.

Respiratory Infection Risk Factors

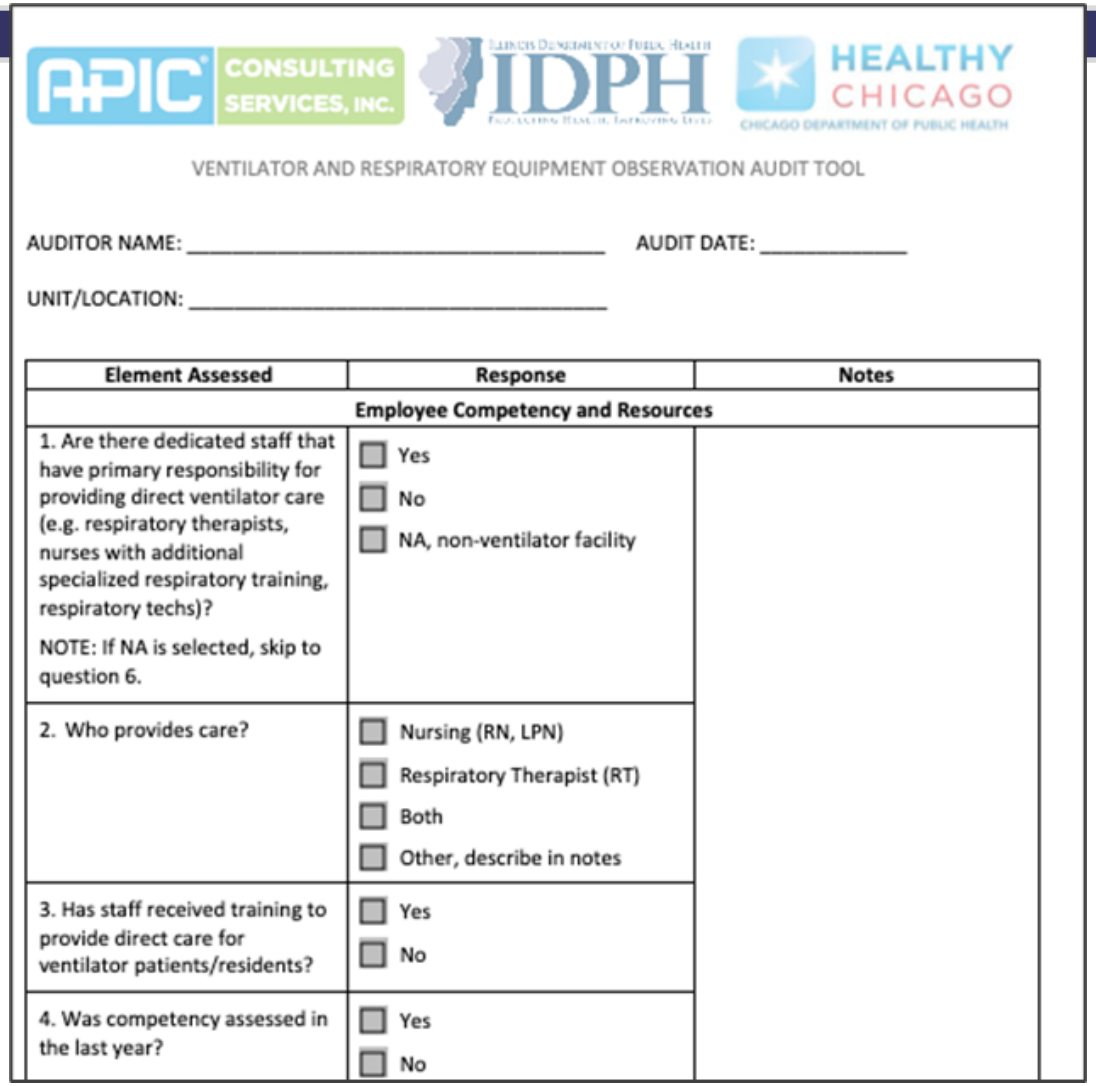
- Age (premature, young pediatrics, elderly)
- Severe underlying disease (pulmonary, cardiac, diabetes)
- Immune suppression (chronic steroids)
- Enteral feeding (aspiration risk)
- Malnourishment (impacts immune system functioning)

1. PowerPoint stock image (2025)

Respiratory Infection Risk Factors

- Invasive oral ventilation support (no protective gag reflex)
- Non-invasive ventilatory support (micro-aspiration due to poor mask fit, increased positive pressure, recline position)
- Debilitation e.g., inability to cough
- Living in a congregate care setting
- Aspiration risk e.g., neuro system disease, overdose

Monitoring Respiratory Care Processes



APIC CONSULTING SERVICES, INC. IDPH HEALTHY CHICAGO

VENTILATOR AND RESPIRATORY EQUIPMENT OBSERVATION AUDIT TOOL

AUDITOR NAME: _____ AUDIT DATE: _____

UNIT/LOCATION: _____

Element Assessed	Response	Notes
Employee Competency and Resources		
1. Are there dedicated staff that have primary responsibility for providing direct ventilator care (e.g. respiratory therapists, nurses with additional specialized respiratory training, respiratory techs)? NOTE: If NA is selected, skip to question 6.	☐ Yes ☐ No ☐ NA, non-ventilator facility	
2. Who provides care?	☐ Nursing (RN, LPN) ☐ Respiratory Therapist (RT) ☐ Both ☐ Other, describe in notes	
3. Has staff received training to provide direct care for ventilator patients/residents?	☐ Yes ☐ No	
4. Was competency assessed in the last year?	☐ Yes ☐ No	

Domains:

1. Employee competency and resources
2. Handheld nebulizers
3. Non-invasive respiratory equipment
4. Intubation equipment
5. Ventilator bundle
6. Ventilator equipment cleaning and disinfection

1. Illinois Department of Public Health. Ventilator and respiratory equipment observation audit tool. https://dph.illinois.gov/topics-services/prevention-wellness/patient-safety-quality/icar.html. Accessed October 30, 2024

Analyzing and Leveraging **Process** and Outcome Surveillance:

What is the influence, if any of:

- Audit timing; staffing challenges, vacations, etc.
- Collegial buy-in;
  - Is front-line staff/leadership not adhering to continual promotion of best practices?
  - Is the front-line staff asked what their barriers are?
- System failure; is the correct equipment, process, staff available?
- Location; are certain patient care areas more adherent than others?
- Directly watching workflow yourself?
- PPE being worn correctly

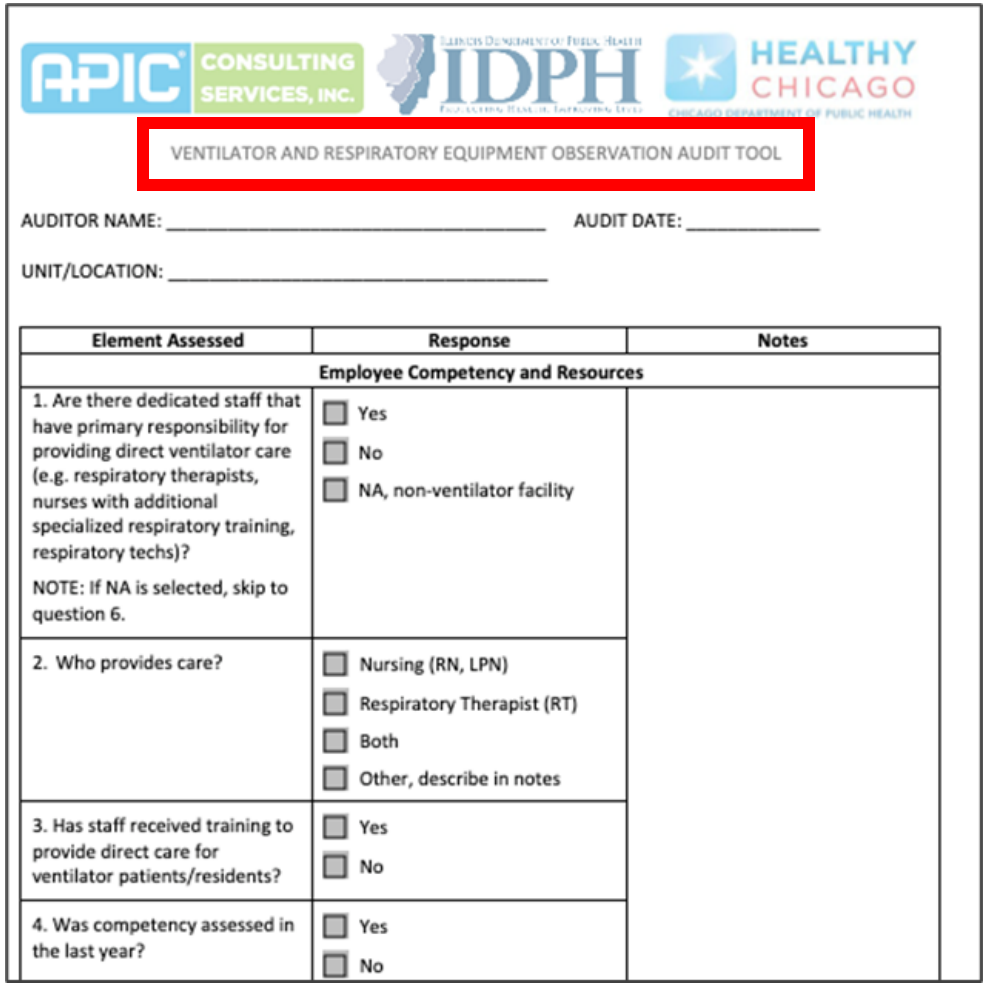
Analyzing and Leveraging **Process** and Outcome Surveillance:

- PPE is worn during the delivery of many respiratory care services e.g., bronchoscopy, AGPs, obtaining arterial blood gases, entering transmission-based precaution rooms, etc.
- “Historically, PPE has been designed around the size and shape of an average European or US white man’s face and body.”[1]
- Women complain more than men with a poor fit:[1-3]
  - Greater risk of pathogen exposure due to gaps
  - Constant adjustments increases personal contamination risk
  - Distraction can lead to impaired thinking and reactions

1. Janson DL Clift BC, Dhokia V. PPE fit of healthcare workers during the COVID-19 pandemic. Applied Ergonomics. 99.2022. https://pmc.ncbi.nlm.nih.gov/articles/PMC8516797/pdf/main.pdf. Accessed April 27, 2025.
2. TUC. Personal protective equipment and women. April 2017. https://www.tuc.org.uk/sites/default/files/PPEandwomenguidance.pdf. Accessed April 27, 2025.
PowerPoint
3. Op-ed: Personal Protective Equipment standards must respond to women’s needs to ensure the safety of all frontline workers during the COVID-19 pandemic, UN Women, https://eca.unwomen.org/en/news/stories/2020/5/op-ed-personal-protective-equipment-standards-must-respond-to-womens-needs. Accessed April 27, 2025.
PowerPoint Stock Photo (2025)

Monitoring Respiratory Care Processes

1. Share findings with key organizational leaders first
2. Then, share the data with IPC, Critical Care Committees



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Analyzing and Leveraging Process and **Outcome** Surveillance:

"Patient-level factors, such as race, income, comorbidities, disability, geographic location, and poverty, play a significant role in the development of HAIs but are frequently overlooked by standard IPC practices."[1]

Has anyone looked at HCP race, ethnicity, gender, etc., when analyzing their outcome data such as staff vaccine adherence?

1. 1. APIC. The impact of health disparities and inequities on healthcare-associated infections: A call to action. February 2025.

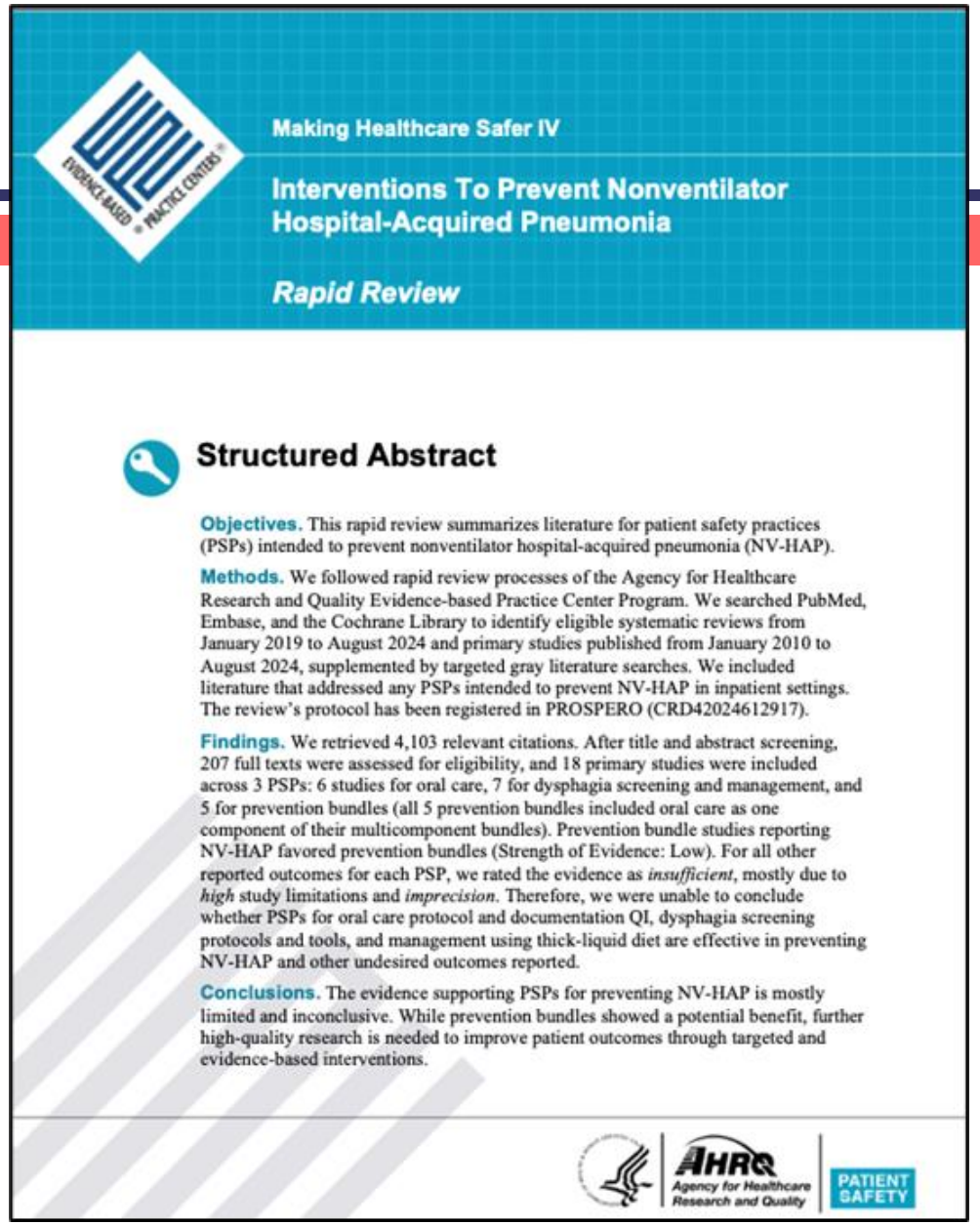
Preventing Hospital Associated Respiratory Tract infections

- Respiratory care practices audits
- Have an awareness with sick time policies; preventing presenteeism and avoiding the ‘mucus troopers’ (HCP with a respiratory infection who come to work)
- Environmental hygiene audits
- PPE audits
- Patient hand hygiene program[1]
- Hand hygiene audits with just in time feedback

1. APIC. APIC Toolkit for patient hand hygiene. N.d. https://apic.org/patient-hand-hygiene-toolkit/. Accessed April 24, 2025
2. 2. Peters A, Otter J, Moldovan A, Parneix P, Voss A, Pittet D. Keeping hospitals clean and safe without breaking the bank: summary of the Healthcare Cleaning Forum 2018. *Antimicrob Resist Infect Control*. 2018;7:132. doi:10.1186/s13756-018-0420-3
3. S. Schweon, personal communication, May 4, 2025

Preventing Hospital Acquired Pneumonia

Essential practices	Good evidence that the intervention decreases the average duration of mechanical ventilation, length of stay, mortality, and /or costs. Benefits likely outweigh risks.	Avoid intubation and prevent reintubation • Use high-flow nasal oxygen or noninvasive positive pressure ventilation (NIPPV) as appropriate whenever safe and feasible[91–93,96,99]	HIGH
		Minimize sedation[105,106] • Avoid benzodiazepines in favor of other agents[106] • Use a protocol to minimize sedation[110] • Implement a ventilator liberation protocol[113]	MODERATE
		Maintain and improve physical conditioning[113,120–123]	MODERATE
		Elevate the head of the bed to 30–45°[125,388–390]	LOW[a]
		Provide oral care with toothbrushing but *without* chlorhexidine[126,127]	MODERATE
		Provide early enteral vs. parenteral nutrition[131]	HIGH
		Change the ventilator circuit only if visibly soiled or malfunctioning (or per manufacturers' instructions)[391–394]	HIGH
Additional approaches	Good evidence that the intervention improves outcomes in some populations, but may confer some risk in others.	Use selective oral or digestive decontamination in countries and ICUs with low prevalence of antibiotic-resistant organisms[128,134,135]	HIGH[a]
	May lower VAP rates but insufficient data to determine impact	Utilize endotracheal tubes with subglottic secretion	MODERATE



Making Healthcare Safer IV

Interventions To Prevent Nonventilator Hospital-Acquired Pneumonia

Rapid Review

Structured Abstract

Objectives. This rapid review summarizes literature for patient safety practices (PSPs) intended to prevent nonventilator hospital-acquired pneumonia (NV-HAP).

Methods. We followed rapid review processes of the Agency for Healthcare Research and Quality Evidence-based Practice Center Program. We searched PubMed, Embase, and the Cochrane Library to identify eligible systematic reviews from January 2019 to August 2024 and primary studies published from January 2010 to August 2024, supplemented by targeted gray literature searches. We included literature that addressed any PSPs intended to prevent NV-HAP in inpatient settings. The review's protocol has been registered in PROSPERO (CRD42024612917).

Findings. We retrieved 4,103 relevant citations. After title and abstract screening, 207 full texts were assessed for eligibility, and 18 primary studies were included across 3 PSPs: 6 studies for oral care, 7 for dysphagia screening and management, and 5 for prevention bundles (all 5 prevention bundles included oral care as one component of their multicomponent bundles). Prevention bundle studies reporting NV-HAP favored prevention bundles (Strength of Evidence: Low). For all other reported outcomes for each PSP, we rated the evidence as *insufficient*, mostly due to *high* study limitations and *imprecision*. Therefore, we were unable to conclude whether PSPs for oral care protocol and documentation QI, dysphagia screening protocols and tools, and management using thick-liquid diet are effective in preventing NV-HAP and other undesired outcomes reported.

Conclusions. The evidence supporting PSPs for preventing NV-HAP is mostly limited and inconclusive. While prevention bundles showed a potential benefit, further high-quality research is needed to improve patient outcomes through targeted and evidence-based interventions.

AHRQ Agency for Healthcare Research and Quality | PATIENT SAFETY

Hospital acquired pneumonia prevention by engaging nurses (HAPPEN)

Share Print

HAPPEN, or Hospital Acquired Pneumonia Prevention by Engaging Nurses supports VHA priorities by reducing the risk of non-ventilator associated hospital acquired pneumonia (NV-HAP), improving the health and quality of life of our Veterans; modernizing systems and processes with a focus on preventive care; improving

. Agency for Healthcare Research and Quality. Interventions to prevent nonventilator hospital-acquired pneumonia. https://effectivehealthcare.ahrq.gov/sites/default/files/related_files/nv-hap-rapid-research.pdf. Accessed May 28,2025

2. VA. Hospital acquired pneumonia prevention by engaging nursing (HAPPEN). October 2024. https://marketplace.va.gov/innovations/project-happen. Accessed April 25, 2025.

AGP's

Aerosol generating procedures

- Open suctioning of airways
- Sputum induction
- Cardiopulmonary resuscitation
- Endotracheal intubation and extubation
- Non-invasive ventilation such as BiPAP and CPAP
- Bronchoscopy
- Manual ventilation
- Nebulizer administration
- High flow O2 delivery

- https://www.cdc.gov/infection-control/hcp/safety/

Respiratory Care Services: Take-aways

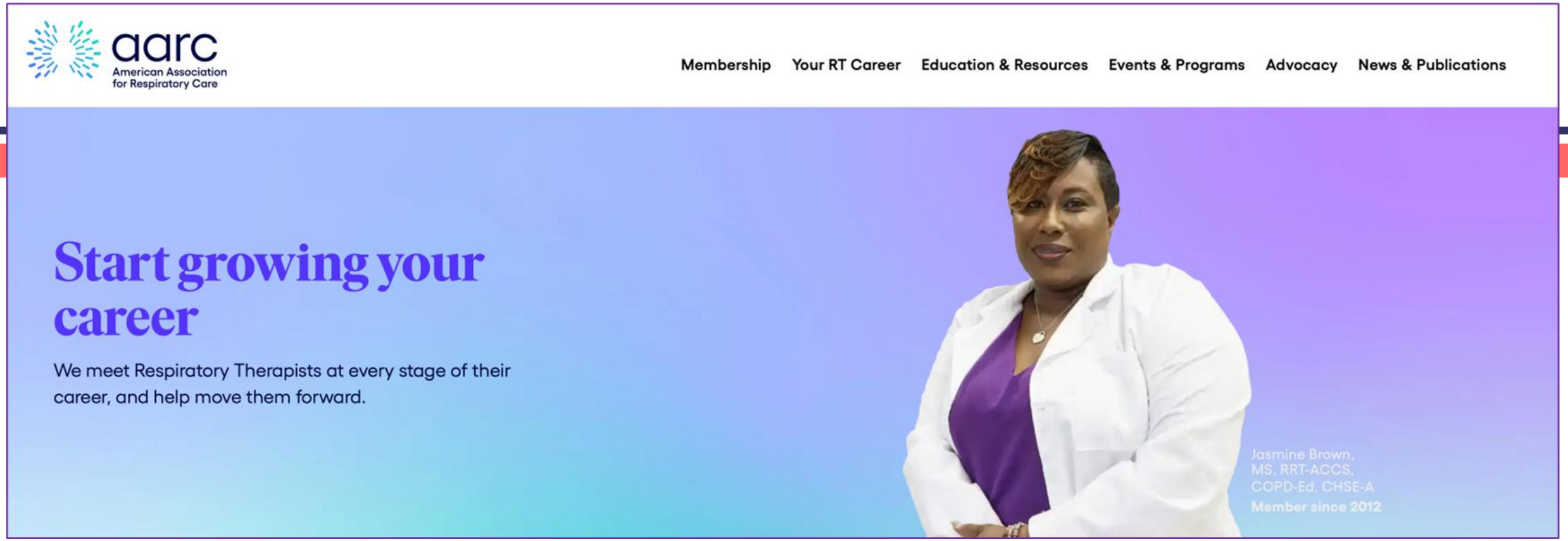
The infection preventionist must understand:

- The different equipment/devices used for respiratory support
- Non-invasive and invasive modalities
- Correct cleaning, disinfection, sterilization or replacement protocol for equipment
- The technology to provide efficient respiratory support
- How microbes are introduced into the respiratory tract e.g., aerosols, droplets, contaminated hands, etc.

Adobe stock images. https://stock.adobe.com/search?k=respiratory&search_type=autosuggest&asset_id=904170533. Accessed April 14, 2025

Respiratory Care Services Key Takeaways

- Importance of evidenced-based bundle application/adherence
- Awareness of community respiratory infections and HCP/patient vaccine adherence, correct PPE ‘fit’, and being mindful for presenteeism
- Infectious diseases exposure management e.g., pertussis
- Patients at risk
- *Outbreak management*



Consider Partnering with a Respiratory Therapist to Learn More

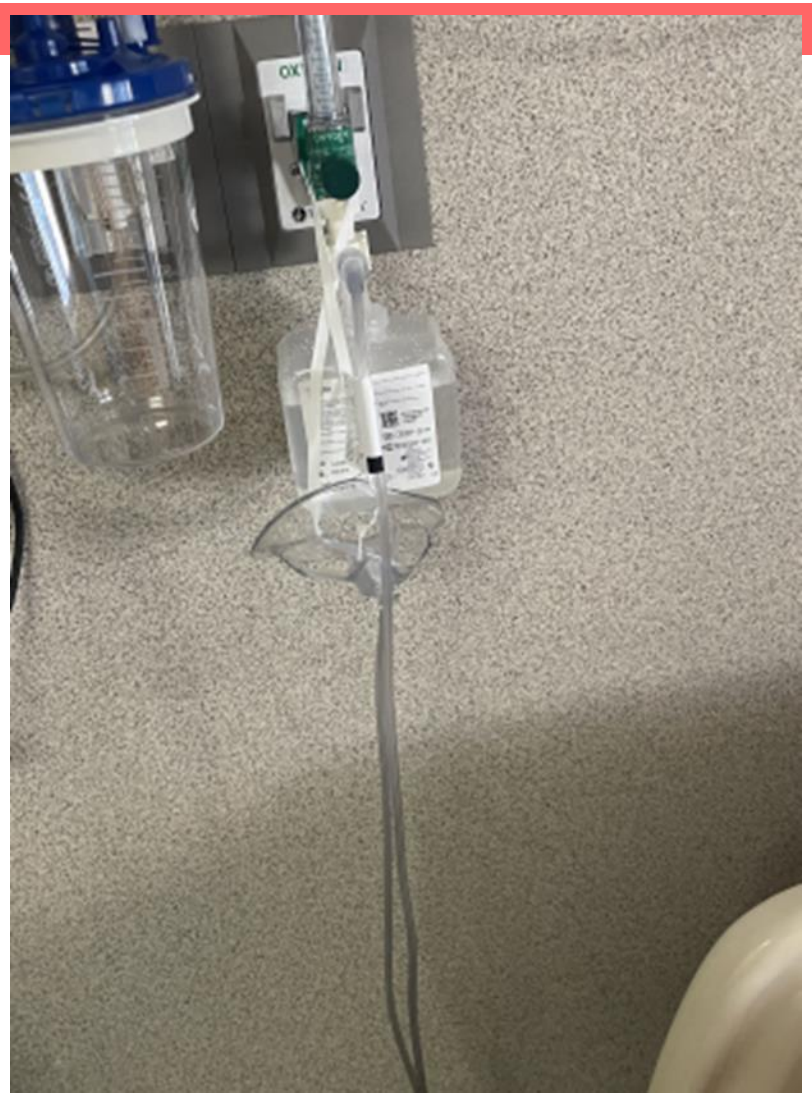
Aerosols

- **Aerosol**-Aerosol-suspension of particles or droplets in the air and includes airborne dusts, mists, fumes or smoke
- **Bio Aerosol**-Particles or droplets suspended in air that consist of or contain biological matter
- **Aerosol Generating Procedure (AGP)** -any medical procedure that can include the production of aerosols of various sizes including droplet nuclei

https://www.aarc.org/wp-content/uploads/2023/06/aerosol_guide_for_HCPs_4th_ed.pdf

https://www.ashrae.org/technical-resources/healthcare-faq

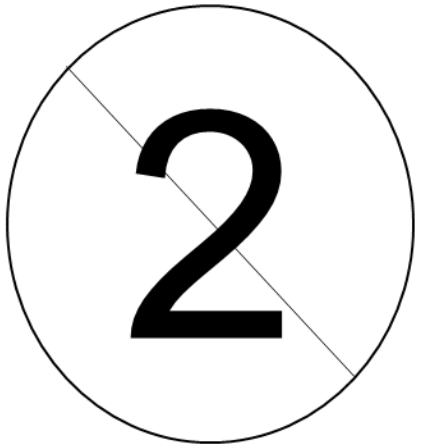
Flowmeters and Suction Regulators



https://www.aarc.org/wp-content/uploads/2022/10/cpg-clinical-mangement-adult-o2-acute-settings.pdf

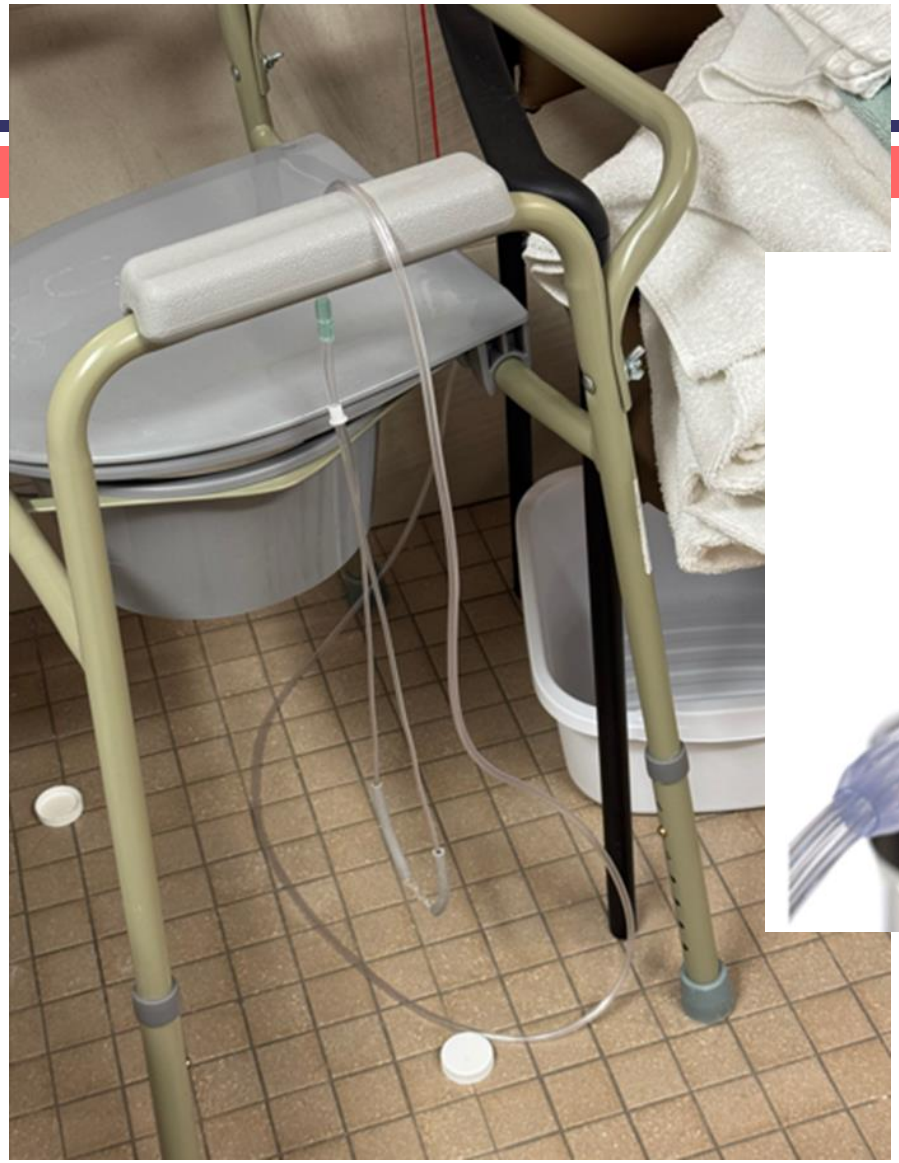
Flowmeter “Christmas Trees”

Low Level Disinfection Or Single Use?



https://pubmed.ncbi.nlm.nih.gov/31983357/

Image by kckate16, via Canva

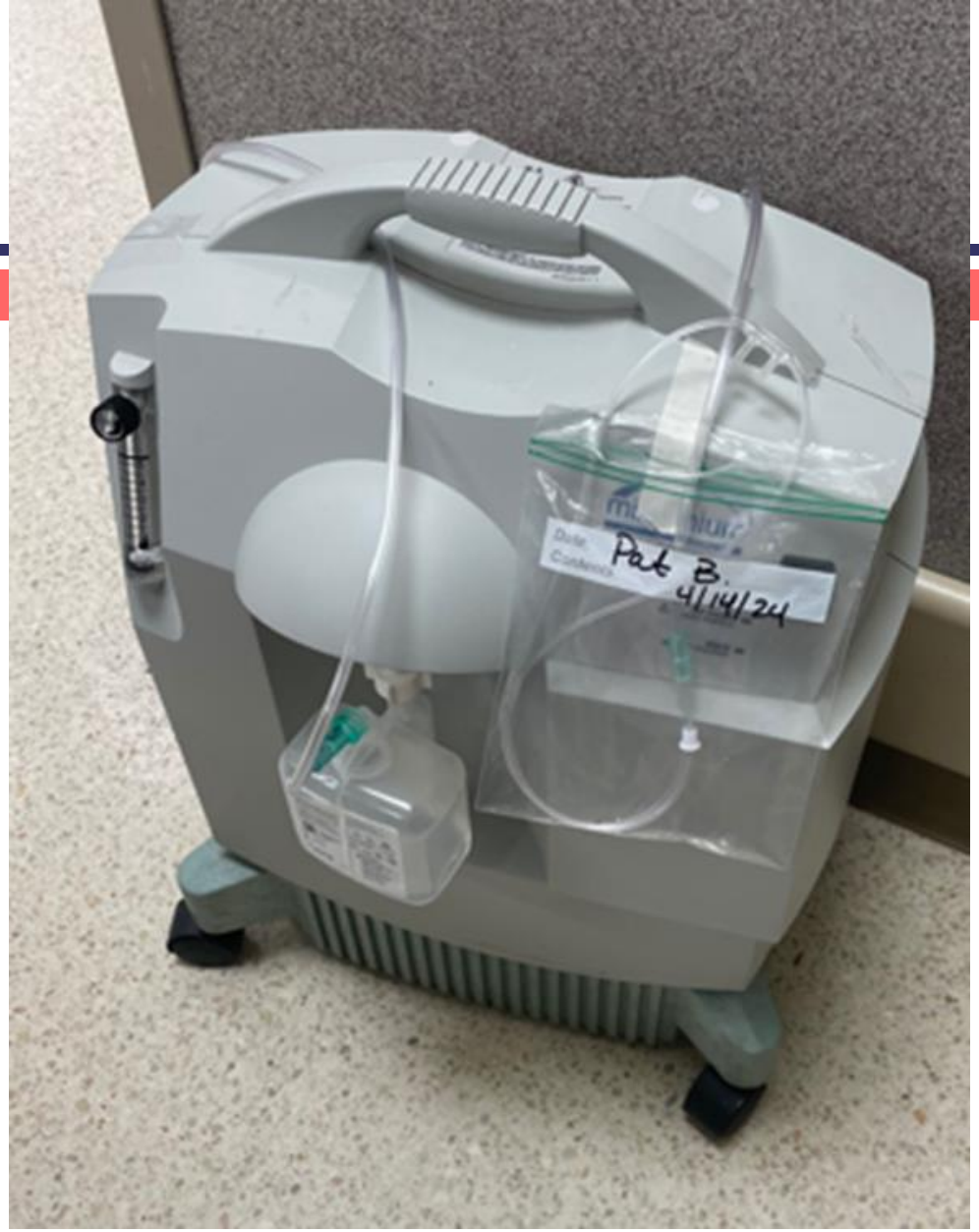


Inhaler Cleaning and Disinfection

Weekly cleaning at a minimum

- Metered Dose Inhalers
- Dry Powder Inhalers
- Aerosol Producing Inhalers
- Valved Holding Chambers or Spacers

https://www.aarc.org/wp-content/uploads/2023/06/aerosol_guide_for_HCPs_4th_ed.pdf



1. https://pmc.ncbi.nlm.nih.gov/articles/PMC5584085/
2. https://www.who.int/docs/default-source/coronaviruse/checklists-1_2022.pdf

Nebulizer Cleaning and Disinfection

What does your Policy say?

- Tap Water not recommended
- Distilled or Sterile Water for Healthcare Facilities

https://www.aarc.org/wp-content/uploads/2023/06/aerosol_guide_for_HCPs_4th_ed.pdf

Breath Acuated Nebulizer Treatments

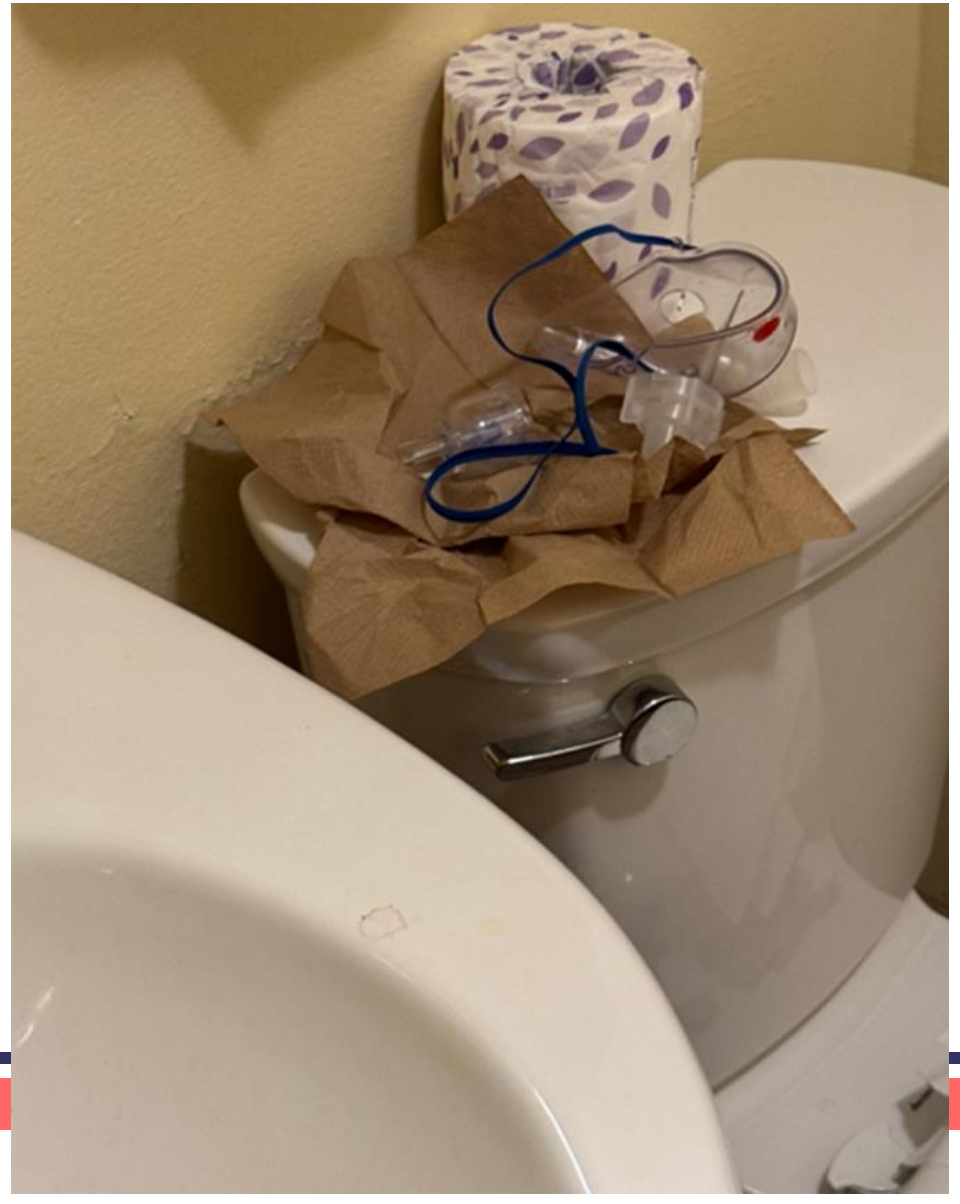
- Medication delivery enhanced
- Healthcare Provider Protection from AGP's

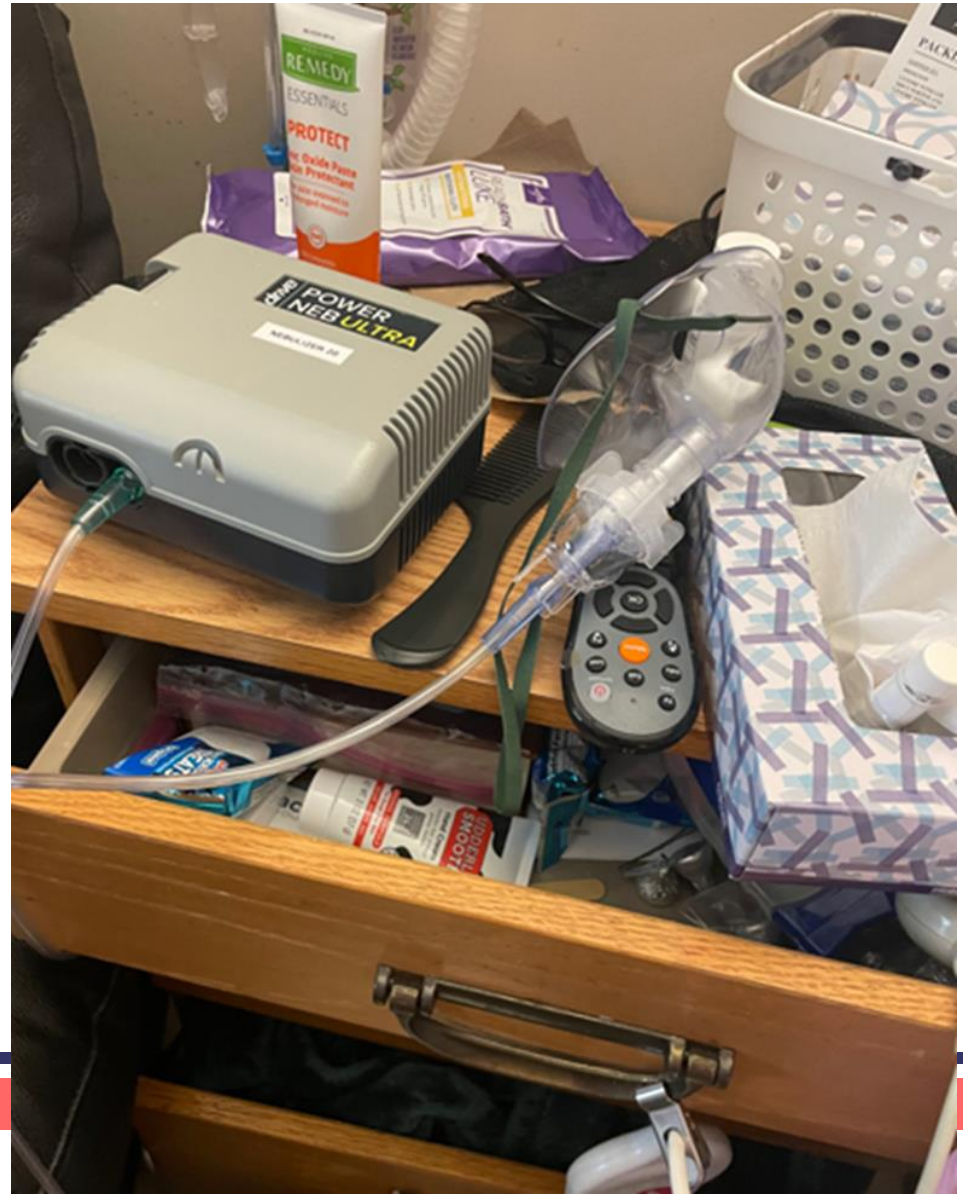
https://www.aarc.org/wp-content/uploads/2023/06/aerosol_guide_for_HCPs_4th_ed.pdf

Image by stockbyte via Canva

Nebulizer Assembly

Nebulizer Storage



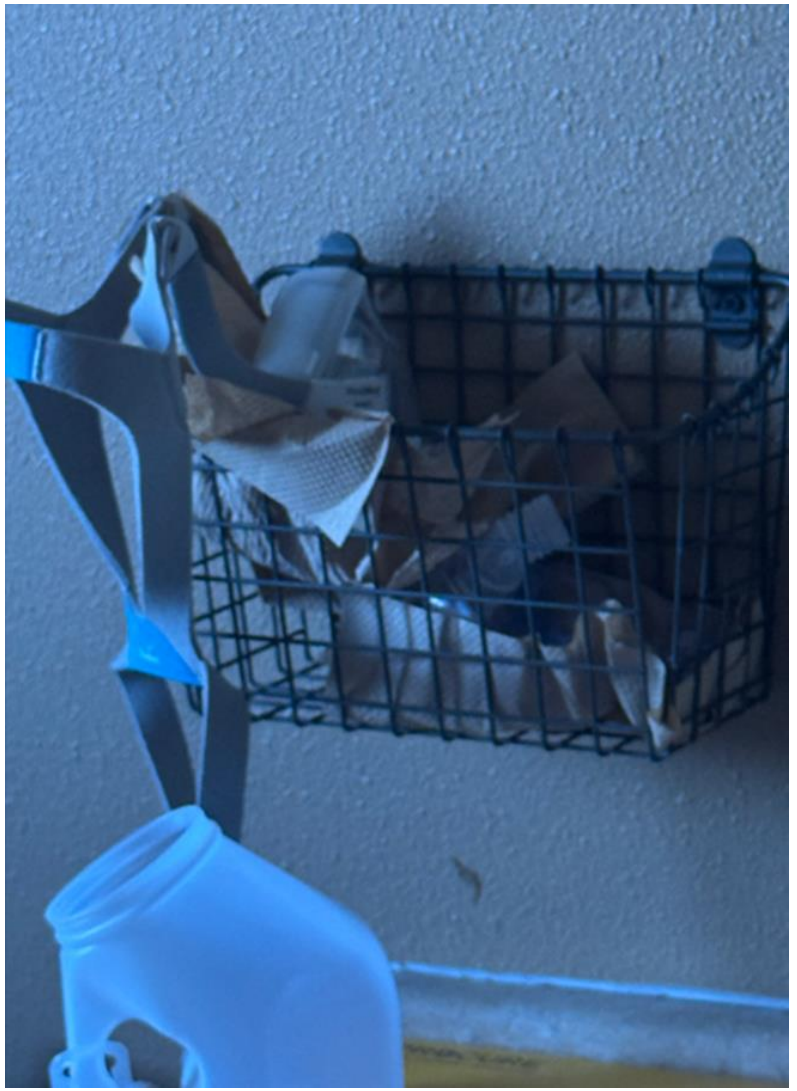


High Flow Oxygen

IPC Concerns

- Cannula/Mask storage when not in use
- Cleaning Processes
  - Requires Special Tubing for internal cleaning

Continuous Positive Airway Pressure (CPAP)/Bilevel Positive Airway Pressure (BiPAP) Machines



https://www.who.int/publications/m/item/care-cleaning-and-disinfection-of-respiratory-equipment-in-sterile-services-department

CPAP/BiPAP Self Cleaning Systems

- Intended for home use
- Still must follow regular cleaning process for CPAP/BiPap
- Additional step for healthcare staff as the self-cleaning system also must have a cleaning schedule
- FDA approval for only one device on the market and only for specific CPAP systems

Intubation

- Avoid intubation and reintubation
  - Hi-flow or Non-Invasive Ventilation (NIV)
- Laryngoscope Blade and Handle
  - Semi Critical Device
- Endotracheal Tube cuff pressure greater than 20 cm H2O

https://www.cec.health.nsw.gov.au/__data/assets/pdf_file/0007/505996/Information-Sheet-for-Clinicians-Laryngoscopes.pdf

https://pmc.ncbi.nlm.nih.gov/articles/PMC5495683/

https://www.aarc.org/wp-content/uploads/2023/11/CPG2024SpontaneousBreathingTrial.pdf

https://www.aarc.org/wp-content/uploads/2022/10/cpg-artificial-airway-suctioning.pdf

Ventilator Best Practices for VAE/VAP Prevention

- Weaning trials
- Head of bed elevation
- Oral Hygiene-brushing, no Chlorhexidine
- Tube condensation-avoid emptying to ET tube or in line nebulizers
- Sedation to allow cough
- Early mobility
- Closed suctioning
- Staffing levels in ICU

- https://www.cambridge.org/core/journals/infection-control-and-hospital-epidemiology/article/strategies-to-prevent-ventilatorassociated-pneumonia-ventilatorassociated-events-and-nonventilator-hospitalacquired-pneumonia-in-acutecare-hospitals-2022-update/A2124BA9B088027AE30BE46C28887084
- https://www.thoracic.org/statements/resources/mtpi/guide1-29.pdf

Ventilator Associated Pneumonia (VAP)

Time of pneumonia onset

- Within the first 4 days of hospitalization antibiotic sensitive bacteria
- Day 5 and beyond likely multi drug resistant pathogen

Early indicator of VAP

- Acute Respiratory Distress Syndrome (ARDS)
- Hemodynamic Instability
- Arterial Blood Gas Deterioration

https://www.thoracic.org/statements/resources/mtpi/guide1-29.pdf

Bronchoscopy

- **Performed in negative pressure room**
- **Aerosol Exposure for HCP**
- **Manufacturer Instructions for Use (MIFU)**
- **Reprocessing –High Level Disinfection**
  - Pre-cleaning
  - Leak testing
  - Manual cleaning
  - Visual inspection
  - Terminal reprocessing
  - Rinsing and Drying

https://www.ccjm.org/content/early/2020/07/29/ccjm.87a.ccc054

Single Use Bronchoscope

- Not ideal for advanced bronchoscopy procedures
- Cost Considerations
- Staffing for reprocessing must be considered

Image by Yuriy via Canva

https://www.researchgate.net/publication/365317413_Infection_control_in_the_bronchoscopy_suite_effective_reprocessing_and_disinfection_of_reusable_bronchoscopes

Considerations for IPC Best Practice

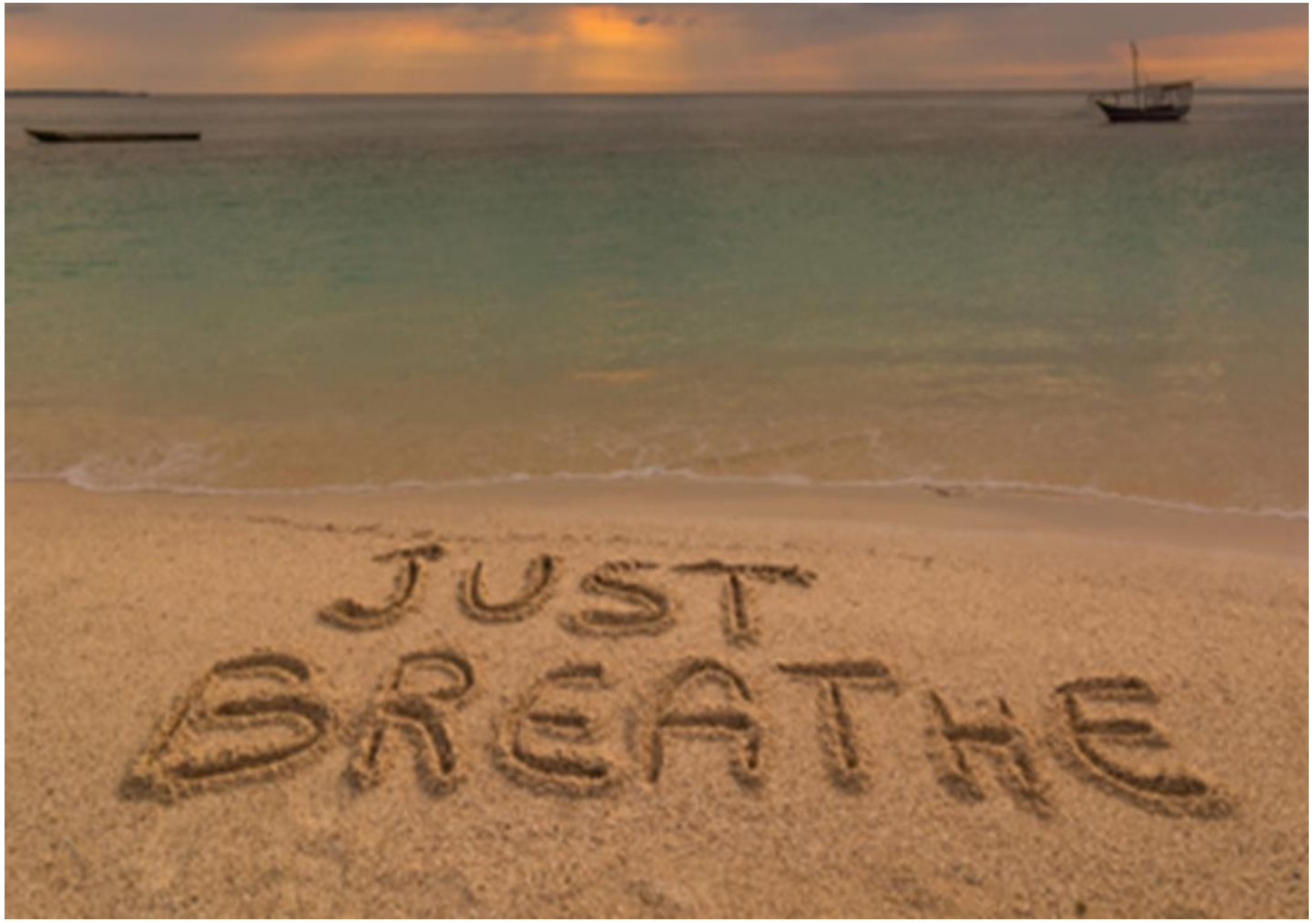
- **Suction Supplies**
  - Pre-opened
  - Tubing change to suction canister
- **Resuscitation Mask and system**
  - Pre-opened and hooked up
- **Oxygen Saturation Sensor**
  - Opened
  - Sticker exposed

Objectives

1. Describe how improperly cleaned and disinfected respiratory therapy equipment can pose a risk to a patient. *Met*
2. Identify one strategy to mitigate the aerosol pathogen risk to healthcare personnel. *Met*
3. Discuss the importance of process and outcome data with ensuring safe respiratory care services. *Met*

In Summary

- Look at Respiratory Care Practices with “New Eyes”
- Utilize audit tools
- Review and update policies
- Educate all staff on early signs of respiratory infections
- Monitor procedures and practices through observations



Questions?

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Thank You!

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