Actionable Patient Safety Solutions (APSS):

Severe Community-Acquired Upper Respiratory Tract Infections

How to use this guide

This guide gives actions and resources for severe community-acquired upper respiratory tract infections. In it, you'll find:

SMART MANAGEMENT CONSULTANCY

Patient Safety MOVEMENT

Executive Summary

The Problem

Outbreaks of respiratory illness are common across the globe and are typically seasonal in nature. Influenza represents between 9 million and 45 million illnesses, 140,000-810,000 hospitalizations, and 12,000-61,000 deaths (CDC, n.d.), while Respiratory Syncytial Virus (RSV) represents an estimated 177,000 hospitalizations and 14,000 deaths in US adults (CDC, 2019). Both examples illustrate the continued healthcare worker risk and strained system capacity attributable to annual community-acquired respiratory infections. The current COVID-19 pandemic, however, has brought healthcare systems (and world economies) to their knees, with over 7 million reported cases and over 400,000 deaths worldwide in less than a year, and still growing (WHO, 2020).

The Cost

The seasonal nature of these community-acquired respiratory infections puts significant strain on the healthcare system year after year when, in general, the protocols for each year's wave should be relatively similar, standardized, and easily accessible and mobilized. Pneumonia hospitalizations result in approximately 6 million cases (AHRQ, 2018), 1.1 million hospitalizations, and nearly 50,000 deaths annually (McLaughlin, Khan, Thoburn, Isturiz, & Swerdlow, 2019). with an associated cost of $10 billion per year (Jain, et al. 2016). In the U.K., the average cost for outpatient pneumonia management is approximately £100 per individual, while the cost of hospitalization ranges from £1,700-5,100 per person, depending on the length of stay (Guest & Morris, 1997). The Global Burden of Disease study determined that respiratory tract infections were the second greatest cause of death in 2013 globally (Prina, Ranzani, & Torres, 2015).

The Solution

Many healthcare organizations have successfully implemented and sustained improvements to mitigate the organizational and clinical impacts of seasonal community-acquired respiratory infections. These organizations have focused on **developing effective surge and staffing plans, as well as implementing standardized protocols for the treatment of pulmonary infections and the resulting inflammatory response that may occur.**

This document provides a blueprint that outlines the actionable steps organizations should take to successfully manage community-acquired severe respiratory illness and summarizes the available evidence-based practice protocols. This document is revised annually and is always available free of charge on our website. Hospitals who make a formal commitment to improve the care of patients with severe respiratory illness and share their success on the PSMF website have access to an additional level of consulting services.

Leadership Checklist

On a monthly basis, or more frequently if a problem exists, the executive team should review the trends of patients admitted for community-acquired respiratory infections. Use this checklist as a guide to determine whether current evidence-based guidelines are being followed in your organization:

- ☐ Measure and report the number of patients admitted with a community-acquired severe respiratory disease. Group data by specific pathogens, such as RSV, H1N1, etc. Note trends from the community and report to the local/regional/national health department as appropriate. Routinely reassess outcomes.
- ☐ If respiratory infection rates indicate room for improvement, initiate a PI (performance improvement) project. If a problem is not identified, routinely reassess to identify gaps, and ensure integrity of the data collected.
- ☐ Ensure frontline involvement in respiratory infection improvement activities. Maintain their engagement and remove barriers to progress.
- ☐ If a PI plan is put in place, measure the associated process outcomes.
- ☐ Ensure that respiratory infection protocols are embedded into clinical workflows, whether electronic or paper.
- ☐ Ensure there are enough staff to effectively manage patient care and screening.
- ☐ Ensure adequate training and documentation of respiratory infection treatment competencies and skills.
- ☐ Eliminate barriers to making rapid changes to documentation templates and order sets.
- ☐ Debrief on a regular basis to solicit team feedback about barriers to sustained compliance. Adjust the plan quickly and nimbly as needed.
- ☐ Hold staff accountable for providing the standard of care and reward success.
- ☐ Ensure that leaders have a simple process to oversee respiratory infection improvement work while also considering how it aligns with other initiatives across the organization.

POINT OF ENTRY

- **ED: Assess need for hospitalization using:**
  - PSI/PORT score - Pneumonia Severity Index/Pneumonia Outcome Research Team
  - CURB-65 (confusion, urea, RR, BP, age) - Pneumonia severity screening assessment.
- **Direct Admit: Evaluate criteria provided for accurate diagnosis.**
- Assess need for screening of all patients and visitors for symptoms.
- If appropriate, limit visitors to reduce exposure risk.
- If appropriate, require mask coverings for anyone entering the hospital.
- Ensure proper hand hygiene before and after every patient contact.

ADMISSION

- Assess chronic conditions.
- Assess events leading up to hospitalization.
- Evaluate lab, clinical, and radiologic diagnostics.
- Implement droplet or airborne isolation precautions as appropriate.
- Assess risk for complications.
- Provide influenza and pneumococcal vaccinations if appropriate.

ROUTINE CARE

- Continuously monitor for pneumonia-related complications.
- Determine best method of oxygenation and ventilation.
- Continuously assess if patency of airway is at risk.
  - Monitor vital signs (O2, RR, BP, temperature).
  - Observe chest movements.
  - Perform lung auscultation.
  - Perform pulmonary hygiene and clear chest secretions by encouraging coughing, suctioning, and adjusting positioning as appropriate.
- Make the decision to intubate as early as possible.
- Continuously assess if intubation is anticipated.
- If intubated, see APSS #2D (Ventilator-associated Pneumonia), #8A (Safer Airway Management), and #8B (Unplanned Extubation).
  - Maintain optimal cuff pressure between 20-30 cm H2O.
  - Perform suctioning.
  - Perform oral hygiene every 2 hours with antiseptic and water.
  - Rotate tube regularly per hospital protocol. If the facial skin, lips or oral mucosa becomes red, rotate the tube to a different position away from the area of redness.
  - Maintain head of bed elevation between 30-45 degrees.
  - Regularly assess the need for sedation and restraints.

DISCHARGE

- Provide influenza and pneumococcal vaccinations if criteria met and if not administered upon admission.
- Anticipate continued oxygenation and ventilation needs and educate accordingly.
- Coordinate post-discharge needs.
- Encourage smoking cessation.
- Ensure full understanding of proper antibiotic use to promote compliance.

Performance Improvement Plan

Follow this checklist if the leadership team has determined that a performance improvement project is necessary:

☐ **Gather the right project team.** Be sure to involve the right people on the team. You'll want two teams: an oversight team that is broad in scope, has 10-15 members, and includes the executive sponsor to validate outcomes, remove barriers, and facilitate spread. The actual project team consists of 5-7 representatives who are most impacted by the process. Whether a discipline should be on the oversight team or the project team depends upon the needs of the organization. Patients and family members should be involved in all improvement projects, as there are many ways they can contribute to safer care.

Complete this Lean Improvement Activity: **Conduct a SIPOC analysis to understand current state and scope of the problem. A SIPOC is a lean improvement tool that helps leaders to carefully consider everyone who may be touched by a process, and therefore, should have input on future process design.**

RECOMMENDED SEASONAL RESPIRATORY INFECTION IMPROVEMENT TEAM	
• Nurses	• PPE suppliers
• Respiratory therapists	• Dietary staff
• Physicians	• Infection control specialists
• Physical and occupational therapists	• Clinical educators
• Environmental service staff	• Information technology
• Medical sociologists	• Patient/family members
• Social workers	• Admitting and registration staff
• Case managers	• Quality and safety specialists
• Primary care and outpatient healthcare workers	

Table 1: Understanding the necessary disciplines for a seasonal community-acquired respiratory infection project improvement team

☐ **Understand what is currently happening and why.** Reviewing objective data and trends is a good place to start to understand the current state, and teams should spend a good amount of time analyzing data (and validating the sources), but the most important action here is to go to the point of care and observe. Even if team members work in the area daily, examining existing processes from every angle is generally an eye-opening experience. The team should ask questions of the frontline during the observations that allow them to understand each step in the process and identify the people, supplies, or other resources are needed to improve patient outcomes.

Create a process map once the workflows are well understood that illustrates each step and the best practice gaps the team has identified (IHI, 2015). Brainstorm with the advisory team to understand why the gaps exist, using whichever root cause analysis tool your organization is accustomed to (IHI, 2019). Review the map with the advisory team and invite the frontline to validate accuracy.

RESPIRATORY INFECTION PROCESSES TO CONSIDER ASSESSING	
• Hand hygiene	• Monitoring of reactions to medications
• Intubation and extubation protocols	• Monitoring of accidental extubation
• Environmental cleaning	• Deep vein thrombosis (DVT) prophylaxis
• Equipment disinfection	• Endotracheal cuff and tube maintenance
• Frequent and routine oral care	• Continuous monitoring pulse oximetry and vital signs
• Frequent assessment of alertness	• Weaning protocols
• Suctioning protocols	• Use of PPE
• Patient positioning	• Patient and family education
• Proper oxygenation and ventilation	• Vaccinations
• Peptic ulcer (PU) prevention protocol	• Judicious and purposeful use of antibiotics
• Sedation vacations	

Table 2: Consider assessing these processes to understand where the barriers contributing to respiratory infection may be in your organization

☐ **Prioritize the gaps to be addressed and develop an action plan.** Consider the cost effectiveness, time, potential outcomes, and realistic possibilities of each gap identified. Determine which are a priority for the organization to focus on. Be sure that the advisory team supports moving forward with the project plan so they can continue to remove barriers. Design an experiment to be trialed in one small area for a short period of time and create an action plan for implementation.

The action plan should include the following:

- Assess the ability of the culture to change and adopt appropriate strategies
- Revise policies and procedures
- Redesign forms and electronic record pages
- Clarify patient and family education sources and content
- Create a plan for changing documentation forms and systems
- Develop the communication plan
- Design the education plan
- Clarify how and when people will be held accountable

TYPICAL GAPS IDENTIFIED IN COMMUNITY-ACQUIRED RESPIRATORY INFECTIONS	
• Lack of accountability	• Staffing needs
• Little organizational focus on management	• Emergent patient needs
• Lack of leadership oversight	• Difficulty in performing oral care effectively
• Inconsistent communication	• Lack of adequate supplies
• Inconsistent education of new protocols	• Lack of a standardized approach to seasonal infection waves
• Complex work environment with many distractions	• Unacknowledged socioeconomic contributors
• New or visiting staff members	• Environmental cleaning

Table 3: By identifying the gaps in community-acquired respiratory infection management and compliance, organizations can tailor their project improvement efforts more effectively

☐ **Evaluate outcomes, celebrate wins, and adjust the plan when necessary.** Measure both process and outcome metrics. Outcome metrics include the rates outlined in the leadership checklist. Process metrics will depend upon the workflow you are trying to improve and are generally expressed in terms of compliance with workflow changes. Compare your outcomes against other related metrics your organization is tracking.

Routinely review all metrics and trends with both the advisory and project teams and discuss what is going well and what is not. Identify barriers to completion of action plans, and adjust the plan if necessary. Once you have the desired outcomes in the trial area, consider spreading to other areas (IHI, 2006).

It is important to be nimble and move quickly to keep team momentum going, and so that people can see the results of their labor. At the same time, don't move so quickly that you don't consider the larger, organizational ramifications of a change in your plan. Be sure to have a good understanding of the other, similar improvement projects that are taking place so that your efforts are not duplicated or inefficient.

Read this paper **from the Institute for Healthcare Improvement to understand how small local steps can integrate into larger, system changes.**

RESPIRATORY INFECTION COMPARATIVE OUTCOMES	
• Hand hygiene compliance	• Mechanical ventilator days
• Need for intubation	• Antibiotic protocols
• ICU LOS	• 30-day readmission rates
• Mortality rate	• Hospital-acquired infection rates

Table 4: Consider evaluating related metrics to better understand community-acquired respiratory infection presence and contributing factors

What We Know About Seasonal Community-acquired Upper Respiratory Tract Infections

Community-acquired Infections: Pandemics and Epidemics

From COVID-19 to the Spanish Flu, community-acquired respiratory illnesses, whether classified as pandemics or epidemics, have had consequences for local and global economies, compromised trade, uncovered systematic issues with distribution of healthcare resources, and continued to test the balance between individual rights and the wellbeing of society as a whole (Institute of Medicine, 2007).

A pandemic is an epidemic that is spread over multiple countries or continents, whereas an epidemic is a disease that affects a large number of people within a community, population, or region (Intermountain Healthcare, 2020). While use of these terms might seem extreme for day-to-day use, the annual influenza virus is a type of epidemic that is spread within the community and leads to increased hospitalizations and deaths during certain times of the year.

The seasonal distribution of microbial etiology in community-acquired pneumonia (CAP) causes this surge in patients at specific times of the year (Cilloniz, et al., 2017). While it is inaccurate to refer to CAP as a seasonal disease, as it can occur at any point throughout the year, s. pneumoniae, influenza virus, polymicrobial pneumonia, and L. pneumophila vary throughout the season and often lead to a peak in illnesses concentrated around a few months each year (Cilloniz, et al., 2017). Therefore, hospitals should always be prepared with a strategy to manage this inevitable, yearly, concentrated surge in patients with a community-acquired illness.

Hospital planning for the recurring seasonal community-acquired virus includes:

- Proper hand hygiene for everyone
- Continued education for healthcare workers
- Isolation precautions within hospitals
- Restriction and screening of hospital visitors
- Proper PPE for healthcare workers and visitors
- Diligent vaccination checks for all patients
- Plans for staffing crises and shortages

The 2019-2030 Global Influenza Strategy from the WHO outlines a global approach for a possible influenza pandemic in the future, calling for enhanced global tools, which include vaccines and antiviral treatments. This strategy highlights four key points (WHO, 2019):

- Promote research and innovation.
- Strengthen global influenza surveillance, monitoring and data utilization.
- Expand seasonal influenza prevention and control policies and programmes to protect the vulnerable.
- Strengthen pandemic preparedness and response for influenza to make the world safer.

Pandemics and Epidemics Throughout History

- **Examples of prominent pandemics include:**
  - **HIV**
    - In 2005 alone, there were 2.8 million AIDS-related deaths, 4.1 million were infected with HIV for the first time, and 38.6 million were living with HIV. Still, HIV disproportionately impacts particular geographic regions, for example, sub-Saharan Africa and the Caribbean (CDC, 2006).
  - **Influenza**
    - Pandemic influenza is distinguished from a seasonal flu because most people have little to no immunity. While a seasonal flu occurs almost annually around the same time, pandemic influenza rarely occurs. For example, pandemic influenza occurred only three times in the 20th century.
  - **COVID-19**
    - Coronavirus 2019 (COVID-19), a disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV2), first appeared in China in late 2019 and then rapidly spread to become a pandemic. COVID-19 has affected millions of people worldwide and is responsible for hundreds of thousands of deaths (WHO, 2020). Patients infected with the COVID-19 virus may remain asymptomatic for up to two weeks, which is a contributing factor to the rapid spread. This virus affects the lungs, as well as other organ systems, often resulting in hypoxia, damage to the lung mucosa, and inadequate ventilation and oxygenation that can progress to Acute Respiratory Distress Syndrome (ARDS).
      - Visit PSMF's COVID-19 resource library for information curated for clinicians, hospital administrators, patients, and the general public (PSMF, 2020).
  - **H1N1 (Swine Flu)**
    - First detected in the United States, the "swine flu" swept across the world and, unlike most seasonal influenza epidemics, 80% of deaths were in people 65 years of age and younger (CDC, 2019).

- **Examples of prominent epidemics include:** (WHO, 2018):
  - SARS
  - Cholera
  - MERS-CoV
  - H5N1
  - Ebola
  - Zika
  - Yellow fever

Etiology and Epidemiology of Community-acquired Respiratory Infections

Community-acquired respiratory infections, such as pneumonia, are contracted within the community and can cause cough, fever, shortness of breath, shallow breathing, chest pain, and often hospitalization (American Lung Association, 2020). There are two types of pneumonia: bacterial and viral. Bacterial pneumonia is the most common form of pneumonia and is often the most serious. The onset of bacterial pneumonia can be gradual or sudden, while the onset of viral pneumonia typically occurs over several days (American Lung Association, 2020).

CAP is diagnosed with clinical symptoms and chest imaging (Watkins & Lemonovich, 2011), but laboratory testing is also used.

- **Clinical diagnostics:** Clinical features include cough, fever, chills, sputum production from cough and chest pain. Additionally, oxygen saturation below 92% indicates high severity.
- **Radiologic diagnostics:** This is required for the diagnosis of CAP. Infiltrate on chest X-rays is a criteria to diagnose pneumonia. Both posteroanterior and laterolateral CT projections should be taken to increase accuracy (Prina, Ranzani, & Torres, 2015).
- **Laboratory diagnostics:** Biomarkers in the blood can demonstrate inflammation, any organ damage, and disease severity. Additionally, these biomarkers can be used to distinguish between types of upper respiratory tract infections (Prina, Ranzani, & Torres, 2015). Other tests include sputum and urine tests. Bronchoscopic testing may be necessary in patients who present with severe pneumonia.

Evaluation of the above diagnostics can be used to assess severity and can help determine if admission into the hospital is necessary.

- The Pneumonia Severity Index (PSI) and CURB-65 are tools that can be used to supplement admission decisions.

Populations at Risk

Populations at risk include older adults, those who are immunocompromised, and those with:

- Hypertension
- Chronic lung disease
- Cardiovascular disease
- Diabetes mellitus
- Cancer
- Chronic kidney disease
- HIV
- Asthma (CDC, 2020; Mcintosh, 2020).

Community Risk Factors

Pneumonia is caused by a wide variety of microorganisms, specifically viruses and bacteria. *Streptococcus pneumoniae* is the most common cause of bacterial pneumonia, but *haemophilus influenzae, mycoplasma pneumoniae*, and *Legionella pneumophilia* are also common causes of bacterial pneumonia. Influenza, rhinovirus and coronaviruses are viruses that cause about one-third of adult pneumonia cases. These microorganisms colonize in the nasopharynx and oropharynx (Prina, Ranzani, & Torres, 2015).

A healthy lung has the capacity to prevent microbe exposure from progressing to pneumonia or another infection. As such, individuals who are at risk for CAP are those with reduced effective physiological mechanisms for immunity to certain pathogenic microbes. Therefore, one of the most major risk factors for CAP is age, because inherent in the aging process is the association with increased comorbidities, immunosenescence, and exposure of mucosal proteins to which bacteria can adhere (Brown, 2012).

While the patients described above are at higher risk of complications if they have contracted the Coronavirus, this virus also affects patients with no risk factors. Since many patients are asymptomatic and infectious for up to two weeks before displaying symptoms, social distancing, hand hygiene, and the wearing of facial coverings are vital to limit spread of the virus.

Social and Environmental Determinants and Inequalities

Health inequities are systematic differences in the opportunities groups have to achieve optimal health, leading to unfair and avoidable differences in health outcomes (National Academies of Sciences, Engineering, and Medicine, 2017). The dimensions of social identity and location that organize or "structure" differential access to opportunities for health include but are not limited to:

- Race
- Ethnicity
- Gender
- Employment
- Socioeconomic status
- Disability
- Immigration status
- Geography

For example, asthma prevalence is highest among blacks. Black children have a 260 percent higher emergency department visit rate, a 250 percent higher hospitalization rate, and a 500 percent higher death rate from asthma compared to white children.

Poverty is also directly associated with higher levels of exposure to infections due to lack of resources that would allow for measures of social distancing. Additionally, those in poverty are likely to have less access to healthcare once this infection has developed. Low-income communities of color are often exposed to infections at higher rates because these populations typically live in densely-populated areas, are unable to take paid sick days, cannot work from home, have difficulty avoiding public transportation, and have difficulty finding daycare with small groups of children. These risk factors directly correlate with the higher rates of hospitalizations for low-income individuals of color.

Hospital preparedness planning for the seasonal waves of respiratory infections must take into account the inherent socioeconomic inequalities in the acquisition, treatment, and management of these conditions. During the periods between seasonal outbreaks, special attention should be given to surveillance of not only the outbreak, but the associated socioeconomic conditions. This should be conducted via an interdisciplinary team of professionals including anthropologists, linguists, epidemiologists, and the community members themselves (Quinn & Kumar, 2014).

Clinical Implications

Minor community-acquired upper respiratory infections are the most common types of infectious disease among adults. In the United States alone, each adult is predicted to experience two to four respiratory infections annually (Garibaldi, 1985). Pneumonia is the number one cause of infection-associated deaths in the US, as patients diagnosed with pneumonia are often also at risk for respiratory failure and sepsis (Wuerth, Bonnewell, Wiemken, & Arnold, 2016). Globally, 15% of child deaths are pneumonia-related, and in 2017, 2.56 million people, across all age groups, died from pneumonia worldwide (Dadonaite & Rosser, 2019).

Approximately 80% of CAP patients are treated in the outpatient sphere and the other 20% warrant inpatient care, with 10-20% of those patients requiring an extensive ICU stay (Fine, et al., 1996). The median length of stay for patients admitted to the hospital with acute respiratory illness is 10 days. (Morris et al, 2016).

For acute respiratory disorders, the average mortality is between 40 to 45 percent (Duong, Zeki, & Louie 2017). Nearly two-thirds of survivors of acute respiratory illness will experience some impairment of pulmonary function one or more years after recovery (Duong, Zeki, & Louie 2017).

Pneumonia-related Complications (File, Ramirez, & Bond, 2020): Treatment for pneumonia may not always be successful, especially in high risk groups.

- **Pneumonia-related Sepsis:** Pneumonia is the leading cause of sepsis globally (Dellinger et al., 2013).
- **Fluid Accumulation:** A pleural effusion can develop and become infected due to pneumonia, in which case, a chest tube would be needed for drainage.
- **Abscess:** The location of the lung that was infected can collect pus, also called an abscess.
- **Bacteremia:** This is a very serious condition in which the pneumonia infection spreads beyond the lungs and into the bloodstream.
- **Cardiovascular Events:** Many studies have suggested that there is a relationship between pneumonia recovery and adverse cardiovascular events, such as a heart attack.
- **Reactions to Medications:** Although this isn't specific to pneumonia, patients can develop moderate or severe reactions to certain medications.

Standardized Protocol for Hospitals

Approximately 80% of CAP patients are treated in the outpatient sphere and the other 20% warrant inpatient care, with 10-20% of those patients requiring an extensive ICU stay (Fine, et al., 1996). **However, hospitalization is often life-saving for certain patients and, particularly during surge times, use of a standardized clinical decision making tool and comprehensive evaluation of clinical symptoms can elevate patients of particular concern so that hospital resources are used as optimally as possible.**

- **Decision Making: Inpatient Versus Outpatient Decision**

Patients with COVID-19 infection treated in the outpatient setting should observe a strict 14 day quarantine or longer if symptoms have not resolved within that period. Once diagnosed, worsening shortness of breath or hypoxia should warrant re-evaluation by a health care provider. Early treatment of hypoxia with supplemental oxygen in an inpatient setting is associated with improved outcomes.

- The Pneumonia Severity Index (PSI), a derivative of the Pneumonia Patient Outcomes Research Team (PORT), is a tool that can be used to assess the need for hospitalization based on severity. See table 3 for the PSI here (Lutfiyya, Henley & Chang, 2006).
- The CURB-65 tool assesses the severity of the infection and subsequently recommends location of care, whether hospitalization is needed or if the patient will be better suited for outpatient treatment. This tool is based on five criteria:
  - Altered mental status
  - Uremia
  - Increased respiration rate
  - Decreased blood pressure
  - 65+ years old (AHRQ, 2017)
    - **Process Map Infographic** (AHRQ, 2018): This resource outlines visually the emergency department process for patients with suspected CAP.

Upon Decision to Admit

If the decision is made to admit patients into the hospital for the community-acquired respiratory infection, often the method of treatment will include *supplemental oxygen therapy, ventilatory support, antibiotic treatment, and vaccination administration* but patients with communicable illnesses should first be identified and isolated to protect them and the caregivers.

- **Identify and isolate appropriate patients early.**
  - Guidelines suggest that upon admission, patients suspected of acute respiratory illness should undergo strict screening for viral infections by first answering a series of symptom -based questionnaires (Mulpuru, Aaron, Ronksley, Lawrence, & Forster, 2015).
    - "Are you experiencing any of the following symptoms: fever, cough, shortness of breath?
    - Have you travelled internationally within the last 14 days?
    - In the last 14 days have you come in contact with a person (or persons) with acute respiratory illness?
    - In the last 14 days have you come in contact with a person (or persons) with severe acute respiratory symptoms?
    - Would you mind if I take your temperature?
      - Proper identification of acute respiratory illness patients will decrease transmission and catch the patients more early on, subsequently giving the patient a better chance at survival if diagnosed early and treated accordingly (Mulpuru, Aaron, Ronksley, Lawrence, & Forster, 2015).

Early identification and isolation if COVID-19 suspected:

- All of the standard screening techniques should be performed.
- Any patients or visitors entering the hospital setting should be screened.
- All patients and hospital staff should practice hand hygiene and social distancing, and should wear face coverings.
- Any patient or visitor who replies yes to any of the screening questions should be:
  - Tested for the COVID-19 virus.
  - Quarantined until the test results are returned, or for 14 days or until symptoms resolve if the test is positive.
    - If the test is positive, anyone the patient/visitor has been in recent contact with should also be screened for the virus.

- **Manage oxygenation and ventilation effectively.** It has been shown that supplemental oxygen is effective in pneumonia treatment, with mortality rates of 39% with oxygen and 74% without oxygen (Zhang, Fang, Dong, Wu, & Deng, 2012). However, there is a general underappreciation for the harmful effects of hyperoxemia. Inappropriate use of oxygen, whether too much or too little, can quickly have detrimental clinical consequences. In the case of pneumonia, supplemental oxygen is one method to help patients who are unable to maintain adequate oxygenation and ventilation. The delivery of oxygen is available via either a nasal cannula or via mechanical ventilation. Low volume systems for oxygen delivery include nasal cannula and face masks. However, these low volume delivery systems are dependent on the patient's ability to breathe on their own. If the patient cannot breathe on their own, mechanical ventilation will likely be required. Non-invasive ventilation should be considered holistically for care of the patient before considering invasive ventilation, as invasive ventilation is associated with greater ICU stay, infections, fistula, speech impairment, inflammation, and edema (Hyzy, Manaker, & Finlay, 2019).
  - **Non-invasive Mechanical Ventilation:** Every effort should be made to administer non-invasive ventilation as early as possible. Non-invasive ventilation techniques are beneficial purely because of the avoidance of an artificial airway and the associated complications, such as infections and the need for sedative medications. However, complications associated with non-invasive ventilation techniques include development of an upper airway obstruction and hypoxemia (Noninvasive ventilation, 2019). Noninvasive ventilation is typically delivered using a full face mask or a nasal mask. Types of non-invasive ventilation methods include:

For COVID-19 patients, early treatment of hypoxia is crucial, and prolonged hypoxemia as well as persistent hypoxemia despite supplemental oxygen therapy is associated with worse outcomes.

- ◊ Continuous positive airway pressure ventilation (CPAP)
- ◊ Bi-level positive airway pressure (BiPAP).

Patients displaying signs of tachypnea and dyspnea due to low oxygen or high carbon dioxide levels are well-suited to non-invasive positive pressure ventilation. These patients should be hemodynamically stable.

Upon clinical assessment for non-invasive ventilation, staff should evaluate whether the condition warranting the use of non-invasive ventilation will be responsive to the treatment, use best judgement to predict the emergent need for intubation, and assess patient comfort (Hyzy, McSparron, Parsons, & Finlay, 2020).

- ◊ **Determination of Method of Oxygen Delivery** (King, 2003):
  - Nasal Cannula/Simple Face Mask: Should be used if the patient can keep their own airway patent and breathe independently. This is best for patients with minimal respiratory difficulty.
  - Face Mask: Like a nasal cannula, the face mask mixes the oxygen with the room air but delivers oxygen in higher concentrations of between 24-60%.
  - Reservoir Device: If the patient requires oxygen concentrations over 60%, a partial rebreather or non-rebreather device should be employed.
- ◊ **Monitoring:** Following initiation of non-invasive ventilation, the patient should be constantly monitored for changes in vital signs, specifically tachycardia and pulse oximetry, for secretions, and for tolerance of the mask (American Thoracic Society et al., 2000).

o **Invasive Mechanical Ventilation:** While non-invasive ventilation often involves less risk, if patients are unable to maintain a patent airway, endotracheal intubation should be employed. While in some cases the decision to intubate might be obvious, as in the case of, for example, a patient with a traumatic brain injury, airway management may be unclear in many other scenarios. The inappropriate deliberation to intubate can compromise patient outcomes, so healthcare professionals require a standardized clinical assessment tool that can be employed quickly and in stressful situations:

- ◊ *Is patency of the airway at risk?* Patients unable to handle their secretions may require intubation.
- ◊ *Is the oxygenation or ventilation sufficient?* Patients who are unable to adequately ventilate or oxygenate with non-invasive ventilation may require intubation. Clinical criteria such as oxygen saturation measurements (SpO2, SaO2) and measurements of ventilation (EtCO2) provide significant insight into the need to intubate. Although arterial blood gases are useful in determining the need for intubation, they should not be used alone but in conjunction with a patient's clinical picture, as waiting for results of ABGs can be detrimental.
- ◊ *Is intubation anticipated?* If there is any significant indication of patient deterioration, early intubation is highly recommended. A clinical assessment of pulse oximetry, vital signs, the patient's mental status, comorbidities, and history of their condition should be used to evaluate the need for early intubation (Brown, Walls, & Grayzel, 2019).

In the case that intubation is required, prevention of complications includes:

- ◊ **Maintaining optimal cuff pressure:** Cuff pressure check protocols are specific to the institution but should be checked daily. Although factors such as endotracheal tube size, ventilation pressure, and patient trachea size can impact the ideal cuff pressure setting, in general, the cuff pressure should remain between 20 and 30 cm H2O.
- ◊ **Performing suctioning:** Oropharyngeal suctioning should be performed routinely, depending on the amount of secretions.
- ◊ **Monitoring ventilator settings:** The ventilator should be set to provide the lowest possible pressures and volumes for optimal comfort and gas exchange.
- ◊ **Performing oral care:** Oral care with chlorhexidine is required to prevent infections, such as VAP. See APSS #2D: Ventilator-associated Infection Pneumonia.
- ◊ **Ensuring ETT stabilization:** Use of adequate stabilization techniques to prevent the unintentional removal of a patient's endotracheal tube is necessary to prevent the complications associated with unplanned extubation. See APSS #8B Unplanned Extubation. Optimal stabilization devices and methods should not cause pressure injuries. During long term mechanical ventilation the stabilization device should be rotated regularly to prevent pressure injuries of the face, lips and oral tissues. If areas of redness are noted, the ETT and stabilizer should be moved away from that area.
- ◊ **Reassessment positioning:** The position of the tube should be assessed regularly as part of both nursing and respiratory therapy rounds. Chest x-rays should be used only in the suspicion of a migrated endotracheal tube (Hyzy, Manaker, & Finlay, 2019).

- **Administer antibiotics in a timely manner.** Administration of antibiotics should be initiated as soon as there is a working diagnosis of community-acquired infection, which is typically within four hours of presentation to the hospital. Antibiotics are typically administered intravenously until signs of clinical improvement are evident enough to warrant a transition to oral administration (File, Ramirez, & Bond, 2020). As always, hospitals should employ antimicrobial stewardship programs to use antibiotics as judiciously and appropriately as possible and to ensure best patient outcomes.
  - o CDC: Core Elements of Hospital Antibiotic Stewardship Programs, 2019.

- APSS 3B: Antimicrobial Stewardship.

- **Ensure patient has received all appropriate vaccinations.** Any patient admitted into the hospital should be assessed for updated vaccinations, including pneumococcal vaccination and influenza vaccination.
  - CDC: Advisory Committee on Immunization Practices 2020.
- **Encourage plenty of rest and fluid.** As always, patients should receive appropriate fluids and should be able to sleep uninterrupted as much as possible. This means no unnecessary disturbances between the hours of 22:00 and 5:00.
- **Reduce the Transmission.**
  - **Isolation Protocols**
    - The primary goal of the hospital is to prevent the spread of disease inside the facility ("Hospital Preparedness", 2020). To abide by this guideline, hospitals should aim to promptly identify and isolate patients that can potentially spread their respiratory infection to others. ("Hospital Preparedness", 2020).
    - Test results should guide the decisions regarding isolation precautions. Depending on the pathogenesis of the bacterial or viral agent, standard, contact and/or droplet precautions may be required.
      - CDC: Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in the Healthcare Setting 2019.
    - For highly infectious diseases, such as COVID-19, full aerosol precautions should be required, including use of negative pressure rooms when available, full personal protective equipment including PAPR or N95 masks, gowns, and gloves. Personnel providing care for these patients should remain isolated to that clinical location whenever possible (CDC, 2020).
  - **Hand Hygiene**
    - Medical providers should wash their hands with soap and warm water after toileting or when hands are visibly dirty (do not use hot water to avoid drying hands) by religiously applying soap, wetting the hands, and scrubbing hands and upper wrists for at least 20 seconds ("Clean Hands Count", 2020). Make sure hands are thoroughly dry after rinsing is complete. If soap and water are not readily available and hands are not visibly soiled, health care providers should use an alcohol-based hand sanitizer before and after every patient interaction by covering hands for at least 20 seconds ("Clean Hands Count", 2020). See APSS #2A: Hand Hygiene for more information.
  - **Cleaning Protocols**
    - Hospitalized rooms housing patients with respiratory infections, including pneumonia, should be cleaned twice daily and at the time of admission and discharge.
      - CDC: Guidelines for Environmental Infection Control in Health-care Facilities, 2003.
    - Respiratory equipment needs to be cleaned and sanitized regularly. See the guidelines below for specifics based on the type of equipment used.
      - CDC: Guideline for Disinfection and Sterilization of Healthcare Facilities, 2008.

For highly infectious diseases such as COVID-19, consider the use of disposable equipment whenever available.

Resources

Please visit the Patient Safety Movement Foundation's COVID Library for educational materials and resources for patients, the general public, clinicians, and hospital administrators. This PSMF Library includes videos, webinars with key experts, blogs, worksheets, and links to additional resources.

For Community-acquired Respiratory Infections:

- American Family Physician: Diagnosis and Management of Community-acquired Pneumonia in Adults
- Supplemental Oxygen Therapy: Important Considerations in Oral and Maxillofacial Surgery
- CDC: Advisory Committee on Immunization Practices
- The Effectiveness of Oxygen for Adult Patients with Pneumonia

For General Improvement:

- CMS: Hospital Improvement Innovation Networks
- IHI: A Framework for the Spread of Innovation
- The Joint Commission: Leaders Facilitating Change Workshop
- IHI: Quality Improvement Essentials Toolkit
- SIPOC Example and Template for Download
- SIPOC Description and Example

Education for Patients and Family Members

Please visit the Patient Safety Movement Foundation's COVID Library for educational materials and resources for patients, the general public, clinicians, and hospital administrators. This PSMF Library includes videos, webinars with key experts in the field, blogs, worksheets, and links to additional resources.

The outline below illustrates all of the information that should be conveyed to the patient and family members by someone on the care team in a consistent and understandable manner.

Indicate what to watch out for. Family members can serve as an extra pair of eyes and ears and can alert medical staff if something might be wrong. Family members should have an understanding of what to look for that may indicate deterioration, such as abnormal vital signs or a change in patient alertness. In order to adequately welcome patients and family members into the care team, it is not enough to explain "what" patients and family members should look for or "what" is going to happen in their care. The "what" must always be followed with a "why" to aid in genuine understanding.

Additionally, family members should know exactly when to call for help, where to go for help, and with whom they should speak. It is essential that patients and family members understand that they should not be ashamed to ask any of their questions and that many patients in similar situations often have similar questions.

Instead of employing a directive conversation style, an active, engaging conversation should take place, leaving capacity for questions and repeat-back strategies. When patients and family members understand the signs and symptoms that could be indicative of a problem, they are able to serve as an extra set of eyes in order to elevate this concern as early as possible.

It is important to keep in mind that in cases of severe respiratory illnesses, patients are vulnerable to further infection and visitors may be limited or restricted. See PSMF's "Plan of Care" form to aid in care coordination from a distance.

Describe what can be anticipated. In addition to explaining when to call for help in the case of a potential emergency, healthcare providers should also thoroughly explain the typical treatment that can be expected before, during, and after their hospital stay. Additionally, it is important to discuss potential complications.

Clinicians should provide a high-level overview of the processes in place at their organization to ensure safe care. This demonstrates competence of the organization, will likely bolster patient and family comfort, and will provide the patient and family members with information for which to reference if they may be suspicious of a problem post-hospital stay.

By engaging in these conversations before a problem arises, family members can be prepared in the circumstance of necessary treatment and will have an understanding of where to go to find out more information about their loved one's condition.

Explain what is expected of them during their care. By giving patients and family members a "job" while they are in the hospital, they can be immersed fully in the routine care, can hold other team members accountable, can feel more confident voicing their concerns or opinions, and can serve as an extra set of informed and vigilant eyes to optimize surgical safety. This team involvement can also reduce their anxiety by transforming concern into proactive action.

Patients and family members can:

- Engage in conversations around current potential health conditions such as diabetes.
- Ask for clarification of intubation standards and duration.
- Make sure the patient receives frequent and thorough oral care.
- Help prevent blood clots by asking about mobility or pharmacological and/or mechanical prophylaxis.
- Monitor temperature and speak up if there are any abnormalities.
- Encourage the patient to stop smoking.
- Monitor for hand hygiene in all healthcare providers and visitors.
- Ensure that people do not touch the patient if unnecessary. If necessary, ensure that they have performed proper hand hygiene.
- Ask frequently about ventilator duration and when the patient can try breathing independently.
- Make sure the patient's head of bed is elevated whenever possible.

Explore next steps. Planning for life after the hospital, whether in assisted living, returning home, or another option, should begin as early as possible between the healthcare providers and the patient and family.

- If the patient is a smoker, the healthcare team should encourage smoking cessation and provide additional resources for further information, groups, or strategies for smoking cessation.
    - Try to understand what specific barriers that patient as an individual faces in cessation.
- Describe the organization's infection control standards that were followed.
    - If any of the protocols changed due to this specific patient's circumstance, articulate that to the patient and family members.
- Have a discussion with the patient and family around end of life care and advanced directives.
    - Make an attempt to thoroughly understand the religious or cultural nuances in any of the patient's or family members' decisions or questions.

- Ensure thorough explanation of necessary post-discharge appointments, therapies, medications, and potential complications.
    - Assess for patient preference in time and location of follow-up appointments, if possible.
- Provide patients and family members resources, including direct contact phone numbers, to the hospital for post-discharge questions.
    - Make sure the resources are in their own language and are easy to understand.
- Provide thorough instructions to the patient and family members in the days leading up to discharge regarding recovery after discharge (What you should know, 2020).
    - If additional maintenance is required after discharge, set aside time with the patient and family member more than once to ensure their understanding and confidence.

Prepare for discharge. Clinicians should communicate to patients what to expect upon discharge, including:

- Information about common post-pneumonia symptoms.
- Instructions on breathing exercises.
- Methods to mitigate disrupted sleeping and eating patterns.
- When to seek help if symptoms worsen (Icahn School of Medicine, 2020).
- If oxygen therapy is needed and if so, how to administer.
- If monitoring at home is needed and if so, how to administer.
- If nebulizer therapy is needed at home and if so, how to administer.
- Smoking cessation programs.

Each conversation with a patient and family member should be inclusive and void of bias. Additionally, these conversations should leave ample time for discussion and the facilitator should encourage questions from the patient and family members.

Patients and family members should understand that, although all clinicians in the hospital do their best, no one is ultimately coordinating their care. Patients and family members should understand that they are the managers of their care and as such, should demand to be an active part of the care team including conversations and decisions.

Resources for Patient Education

- Patient Education: Pneumonia in Adults 2020
- Supporting Communication with Patients Who Have COVID-19 2020

Measuring Outcomes

Both process and outcome metrics should be assessed. Key performance indicators you can use within the protocol should be:

- *Process Metric:* Antibiotic protocol and oxygenation delivery
- *Outcome Metric:* Mechanical ventilation days, 30-day readmission rate, and mortality rates

Endnotes

Conflicts of Interest Disclosure

The Patient Safety Movement Foundation partners with as many stakeholders as possible to focus on how to address patient safety challenges. The recommendations in the APSS are developed by workgroups that may include patient safety experts, healthcare technology professionals, hospital leaders, patient advocates, and medical technology industry volunteers. Workgroup members are required to disclose any potential conflicts of interest.

Workgroup

Sudha Anand	Advocate
Steven J. Barker	Patient Safety Movement Foundation; Masimo
Lauren Berkow	University of Florida College of Medicine; Society for Airway Management
Robin Betts	Kaiser Permanente
Anganette Cisneros	University of California, Irvine
Michael Durkin	Imperial College, London
Arthur Kanowitz	Airway Safety Movement
Mitchell Goldstein	Loma Linda University
Jerika Lam	Chapman University, School of Pharmacy
David Mayer	Patient Safety Movement Foundation, MedStar Health
Donna Prosser	Patient Safety Movement Foundation
Olivia Lounsbury	Patient Safety Movement Foundation
Michael Ramsay	Patient Safety Movement Foundation, Baylor, Scott & White Health

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