# CHRONIC OBSTRUCTIVE PULMONARY DISEASE PROGRAM IMPLEMENTATION GUIDE


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*This Implementation Guide is supported in part by a non-educational sponsorship from Sunovion Pharmaceuticals.*

# Table of Contents

# Section I:
# Introduction

# Introduction

The Society of Hospital Medicine (SHM) is pleased to make this *Implementation Guide* available as a tool to help you to improve the care of patients who are hospitalized for an exacerbation of chronic obstructive pulmonary disease (COPD).

This *Guide* will help you make changes to COPD care at both the individual patient and the institutional levels, and is intended for use by clinicians on the front lines of patient care as well as medical directors, vice-presidents of quality, vice-presidents of medical affairs and chief medical officers. Given the interdisciplinary nature of inpatient quality improvement efforts, SHM anticipates that this *Guide* will be useful to a broad range of hospital stakeholders, including nurses, nurse practitioners, physician assistants, pharmacists, respiratory therapists and pulmonary rehabilitation nurses.

## A. Hospitalizations for COPD: Overview and Rationale for Improving Care

Chronic obstructive pulmonary disease encompasses a spectrum of progressive pulmonary disorders including emphysema and chronic bronchitis. It is estimated that 15 million adults in the U.S. are diagnosed with COPD,[1] but many experts feel that this is a gross underestimate due to underdiagnosis.[2]

COPD is a tremendous healthcare burden in the U.S. and worldwide. In 2008, COPD, as part of chronic lower respiratory diseases, became the third leading cause of death in the United States,[3] and also accounted for nearly 140,000 deaths per year as of 2012.[4] The prevalence of COPD nationwide is around six percent, but much state-to-state variability exists.[1]

The healthcare burden of COPD is also substantial from a readmission and economic standpoint. Patients hospitalized with acute exacerbations of COPD (AECOPD) account for nearly 70 percent of the estimated $50 billion in annual expenditures for COPD[3]. More than 20 percent of those admitted with AECOPD are readmitted within 30 days.[14] Readmissions related to COPD lead to costs that are nearly 20 percent higher than the index admissions.[15] Beginning in in 2014 the Centers for Medicare and Medicaid Services (CMS) added hopsitalization due to COPD to its Hospital Readmission Reduction Program.

The prevalence of COPD continues to rise, but the demographics of the disease have evolved over the past decade. While the prevalence of COPD in older patients has remained elevated (>11.6 percent among those >65), it has increased among younger populations (3.2 percent among the 18-44 age group), and >50 percent of patients with a diagnosis of COPD are under the age of 65.[1] Since 2000, COPD has been more prevalent in women than men. As the death rate has declined in men since 2000, it has persisted at nearly the same rate in women, with more women dying from COPD than men overall.[4,7]

Smoking is felt to be a major contributor to the development and progression of COPD.[5] However, a significant number of patients (10-20 percent) diagnosed with COPD are nonsmokers, suggesting genetic and other environmental factors involved in the risk of developing COPD.[6] A history of asthma is also strongly associated with COPD.[1]

The American College of Physicians (ACP), American Thoracic Society/European Respiratory Society (ATS/ERS) and the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines all recommend strategies for primary prevention and treatment including smoking cessation and early diagnosis using spirometry,[8, 9] which has become more accessible than it has been in the past.

The standard of care in the inpatient setting as recommended in these guidelines for treating AECOPD includes the use of bronchodilator therapy, oxygen, steroids and the selective use of antibiotics. While these have been shown to be effective in treating COPD and reducing inpatient mortality and readmissions, it is smoking cessation and reducing exposure to secondhand smoke that can alter the progression of lung disease.[10,11]

However, despite the longstanding availability of clinical guidelines, studies conducted in the U.S. and elsewhere have documented the persistence of large gaps in care quality[16, 17,18] and substantial variation across hospitals in the management of patients with COPD. One study found that more than half of active smokers are not offered tobacco cessation resources.[12] Nearly 60 percent of patients with severe COPD are not prescribed maintenance bronchodilator therapy[13] and 25 percent of patients with AECOPD are discharged without any bronchodilator therapy.[12]

Although opportunities to improve quality are well known, there has been less progress identifying effective strategies for translating evidence into practice.

Given the enormous clinical and economic burden imposed by COPD it is critical that hospitals begin to direct quality improvement (QI) resources to improving care for these patients. The following sections will summarize best practices in COPD and outline strategies for making changes to care that have the potential to improve patient outcomes and reduce healthcare-related costs at your institution. It is SHM's hope that this toolkit will enable providers and healthcare systems to bring evidence-based treatment to the bedside for their patients with COPD.

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# Section II:
# How to Implement and Sustain a COPD Quality Improvement Project at Your Hospital

# A. Form an Interdisciplinary Team with a Common Goal

When instituting a program to provide evidence-based COPD care at your institution, a critical initial step should be the formation of a multidisciplinary team to measure current processes, analyze baseline data and design and deploy improvement interventions. To develop or extend a COPD quality improvement (QI) program, it is essential to have representation from a diverse group of hospital constituents. These members may include, but are not limited to, hospital leadership, frontline practicing hospitalists, pulmonologists, physician assistants (PAs), advanced practice nurses (APNs), pharmacists, respiratory therapists and pulmonary rehabilitation and general medical nurses. The perspectives that each stakeholder brings to the program are unique and will lead to a more robust solution.

## 1. Quality Improvement Team Composition

A formal structure to the QI team will help delineate roles in the improvement process. Responsibilities should be established at the start of the project. An example of team organization is provided below. In many hospital settings there will be overlap between these roles. The important concept is to have the different functions and responsibilities embedded into the team.

### a. Executive Sponsor

The executive sponsor is a member of senior management who provides overall guidance and accountability for the project. For example, this could be the chairman of medicine, the vice-president of medical affairs, the CMO or the CQO of your institution. This individual approves the QI team recommendations, ensures timely implementation, secures any necessary financial support, removes organizational barriers to project success and helps ensure that the project has sustained results. This senior leader can provide the leverage necessary to secure the resources necessary to be successful.
For example, your project may involve the implementation of a new order set to facilitate evidence-based care, but the Information Technology (IT) department may have a backlog of requests to change the electronic medical record (EMR). The executive sponsor, in this situation, can provide the influence to ensure your project receives the necessary priority from the IT department.

### b. Project Sponsor

The project sponsor facilitates the timely and successful implementation of the project. This person has close contact and meets frequently with the project leader. The project sponsor reviews progress, and may be a key decision-maker for approval of final recommendations. This individual could be the chief of hospital medicine, a leader in an academic division or someone with similar oversight responsibility, and would have a detailed understanding of QI strategies and a familiarity with COPD clinical care workflows and practice standards. Depending on organizational factors (size, governance structure, etc.), the project sponsor function may be encompassed within either the executive sponsor or the project leader roles.

### c. Project Leader

The project leader is the day-to-day manager of the initiative and completes all deliverables in a timely manner. This person would typically be a frontline practitioner extending his or her scope of activity into the QI arena. Key responsibilities include coordinating project team activity (including communication of project status to all levels of the QI team) and ensuring that all project goals are met on time and on budget. From a practical standpoint, the project leader will have the most direct impact on project success, and as such, the role can require a significant investment of time and effort. Accordingly, it is recommended that the project leader has some portion of protected time away from his or her other responsibilities to engage the role meaningfully.

### d. Quality Improvement (QI) Facilitator

The QI facilitator has access to the data and personnel needed to measure the baseline metrics, as well as to track progress. Often this is a person working in the hospital's QI department who is trained in data management, basic analysis and supporting process improvement projects. These individuals will generally be comfortable with the use of data management and storage and statistical software packages. They are also typically trained in quality improvement methodologies, such as Plan-Do-Study-Act (PDSA), Six Sigma and LEAN, that can provide a framework for the team's activities.

### e. Process Owners

The process owners are the frontline personnel involved in the process of providing care to COPD patients in the hospital. Examples include practicing hospitalists, emergency medicine physicians, intensivists and pulmonologists not directly leading the project, pharmacists, respiratory therapists and nursing and pulmonary rehabilitation staff. Their input on existing workflows and ways in which care processes can be redesigned will be a critical component in the improvement process. In addition, "frontline members" on the QI team can help to achieve the necessary "buy-in" from the diverse constituencies present in the hospital.

### f. Information Technology (IT) Liaison

The IT liaison is crucial in EMR-based environments to implement the necessary changes in ordering and documentation associated with the QI program. Some examples of the IT liaison's function include: modifying current order sets, instituting electronic alerts, coding rules within the EMR environment to achieve your project goals, developing IT-based training models and trouble-shooting IT-related issues as they arise. In many systems, this individual will also provide assistance in extracting project-related data from the EMR.

## 2. Create a Shared Need for a Quality Improvement Program

A key phase for performance improvement success centers on creating a common vision of program value. If buy-in to the change effort is low, the program will not be successful. Developing awareness of a shared need forces any resistance or apathy to be addressed upfront, builds momentum to get the performance improvement program launched and validates the program's importance. The need for change can be framed both as a threat (e.g., implications of COPD-related readmissions) and an opportunity (e.g., the potential to promote patient-centered care through improvements in quality of life and functional status).

Stakeholders (considered here to be people or groups who have a vested interest in improving the current processes) can influence program success. Analysis of stakeholder positions will allow formulation of strategies on how to best initiate change.

One stepwise method of performing a stakeholder analysis is presented below (with an accompanying example in **Figure 1**):

1) List key stakeholders by name and assess their current beliefs regarding the change process.

2) For each individual, plot both the current state of belief regarding the change process ("X" in Figure 1) and the minimum level of support for the change required from the individual for program success ("Y" in Figure 1).

3) Identify gaps between current and desired states.

4) Plan action steps for closing any perceived gaps with influence strategy and coaching.

### FIGURE 1: STAKEHOLDER ANALYSIS METHOD

| Role | Against | Moderately Against | Neutral | Modestly Supportive | Strongly Supportive |
|---|---|---|---|---|---|
| ED Physician | | X----------Y | | | |
| Hospitalist | | | X----------Y | | |
| Pulmonologist | | X----------Y | | | |
| Respiratory Therapist | | | X----------Y | | |
| Pulmonary Rehabilitation | | X----------Y | | | |
| Nurse | | | | X----------Y | |
| Pharmacist | | | | X----------Y | |

## B. Obtain Institutional Support

Institutional support (at multiple levels) is critical to QI project success as it provides access to the resources required to change current hospital culture and practices. QI efforts should align with the hospital's mission and vision while addressing issues identified as care delivery and operational priorities. The clinical rationale for improving hospital-based management of COPD was presented in this *Guide's* Introduction (Section I). A compelling business case also exists, based on the high costs of care associated with COPD readmissions as well new federal initiatives intended to improve the outcomes of Medicare beneficiaries with COPD. Both rationales can be employed to obtain the hospital's senior leadership "buy-in." Gaining this high-level endorsement will help garner the core components needed for a successful QI initiative (status as something important to do, personnel, IT assistance, etc.).

### 1. COPD as a Healthcare Quality Issue That Impacts Hospital Reimbursement

Over the past decade, market forces, healthcare legislation and changing attitudes toward the need for systematic approaches to healthcare improvement have spurred healthcare delivery organizations to view the provision of care through a new lens. The Affordable Care Act (ACA) increased the use of financial incentives for improved quality by placing more dollars "at risk" according to patient outcomes, and the movement toward accountable care organizations and bundled forms of payments will accelerate the need to manage patients longitudinally across a continuum, rather than in "siloed" episodes of care.

Because it is one of the most common reasons for hospitalization among Medicare beneficiaries, measures in the Centers for Medicare & Medicaid Services' (CMS's) Value-Based Purchasing Program (VBP) pertain directly to COPD. More details about VBP are available at http://www.qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FQnetTier4&cid=1228772237361.

COPD is also one of the conditions included in the Hospital Inpatient Quality Reporting (IQR) program. Participation in the IQR is required to receive annual payment updates from CMS. Details about IQR are available at https://www.qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FQnetTier2&cid=1138115987129.

#### a. Outcome Measures: 30-Day All-Cause Mortality and Readmission Rates

Hospital performance metrics have gradually moved from process measures to a heightened emphasis on outcomes measures with two of the most important being 30-day mortality and 30-day all-cause readmissions.

In Fiscal Year (FY) 2014, the VBP includes 30-day all-cause mortality rates for acute myocardial infarction (AMI), heart failure (CHF) and pneumonia (PNA) as components of hospital quality assessments. Performance in these areas will impact receipt of incentive payments or payment reductions. It is anticipated that this list will include additional diagnoses in coming years.

Under Medicare's Inpatient Prospective Payment System (IPPS), as included in the ACA, adjustments to payments made for excessive readmissions in acute care hospitals during fiscal years began on October 1, 2012. The ACA focused initially on three conditions: AMI, CHF and PNA. Re-hospitalization within 30 days for any cause following an index stay for one of these three conditions is attributed as a readmission. In FY 2015, the policy expanded to include chronic obstructive pulmonary disease (COPD), coronary artery bypass grafting (CABG), percutaneous transluminal coronary angioplasty (PTCA) and other vascular conditions as index admission diagnoses subject to the 30-day all-cause re-hospitalization parameter. It is anticipated that this list will include additional diagnoses in coming years.

**b. The Joint Commission Disease-Specific Advanced Certification in Chronic Obstructive Pulmonary Disease**

Formal certification as Centers of Excellence for specific conditions represents a competitive advantage for hospitals to gain market share often by directly advertising to patients. In the area of pulmonary disease, The Joint Commission offers a designation of "Advanced Certification in COPD" for hospitals meeting specific criteria linked to staff education requirement, the use of spirometry, smoking cessation, risk factor reduction, patient education on self-management of COPD and coordination of care. Additional information about advanced certification can be found here: http://www.jointcommission.org/certification/chronic_obstructive_pulmonary_disease.aspx.

**c. Physician Quality Reporting System**

The national Physician Quality Reporting System (PQRS), formerly known as the Physician Quality Reporting Initiative (PQRI) (http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/PQRS/index.html?redirect=/PQRI), has been using incentive payments, and will begin to use payment adjustments in 2015, to encourage healthcare professionals to report on specific quality measures.

Currently, physicians may qualify for bonus dollars from CMS if performance targets are met. Beginning in 2015, there will be a downward payment adjustment for eligible professionals who do not satisfactorily report data for covered professional services. The PQRS includes measures specifically focused on patients with COPD, including spirometry evaluation, use of inhaled bronchodilator therapy among patients with an FEV1/FVC <60 percent, and general measures, including tobacco use screening and cessation intervention, pneumococcal and influenza immunization, which are relevant to those with COPD.

Positioning COPD management as an issue that affects hospital reimbursement by highlighting these programs to senior leadership will help prioritize your COPD QI project as something warranting institutional support.

# C. Assess the Current State of Chronic Obstructive Pulmonary Disease Management in Your Facility

Understanding the current state of inpatient COPD management in your facility will help identify targets for intervention while concurrently defining the scale of your project. This baseline knowledge can also be used to allocate project resources appropriately and to establish realistic performance improvement benchmarks. It is suggested to conduct this current state evaluation through the series of assessments described below.

## 1. Create a High-Level Process Map

Summarizing the key steps in a care delivery process is essential to understanding the scope of the QI project and identifying specific targets for improvement. The process map will allow you to identify where specific targets may be for the QI intervention to occur to improve care. Ideally, the collective expertise of the project team is utilized to create these high-level process maps by:

- Defining the major function (output) of the process
- Identifying all participants (e.g., hospitalist, pulmonologist, emergency medicine physicians, nurses, pharmacists, respiratory therapists and pulmonary rehabilitation nurses)
- Delineating beginning and ending points
- Brainstorming on critical steps and determining the process sequence
- Validating workflow by "test driving" the process

An example of a process map focusing on patients admitted for exacerbation of COPD is presented in **Figure A.**

**FIGURE A.**

| Phase of Care | Key Treatments and Decisions | Participants |
|---|---|---|
| Emergency Department of Initial Presentation | Initial Treatment<br>Management of Acute Respiratory Failure<br>Triage | ED Physicians<br>ED Nurses<br>Respiratory Therapists |

| Phase of Care | Key Treatments and Decisions | Participants |
|---|---|---|
| **Inpatient Stay** | Confirmation of AECOPD Diagnosis<br>Oxygen<br>Short-acting Bronchodilators<br>Steroids<br>Antibiotics<br>Ventilatory Support<br>Nicotine Replacement<br>Pulmonary Rehabilitation<br>Nutrition<br>Spirometry<br>Goals of Care<br>Palliative Care | Nursing<br>Respiratory Therapy<br>Pharmacist<br>Physician |
| **Discharge** | Medication Reconciliation<br>Optimization of Home Regimen<br>Patient Education<br>Action Plans<br>Home Oxygen<br>Smoking Cessation<br>Immunization<br>Follow-up Appointment<br>Communication with Outpatient Providers<br>Pulmonary Rehabilitation<br>Nutrition | Nursing<br>Respiratory Therapy<br>Pharmacist<br>Hospitalist<br>Pulmonologist<br>Primary Care<br>Pulmonary Rehabilitation |

As indicated in Figure A, multiple points in the hospital care episode are good substrates for a QI intervention (e.g., optimizing physician's admission orders through decision support; involving pharmacy to review and provide input on prescriptions for bronchodilators prior to discharge; improving patient education; enrollment in pulmonary rehabilitation programs). Once the individual areas have been selected, the recommendation is that the specific steps be mapped out in a similar, but more granular level.

## 2. Determine COPD Case Volume and Prioritize Hospital Unit Locations

The objective here is to get an estimate of the COPD population size within your facility, and determine where these patients receive their care to allow you to focus on a particular geographic area to start your COPD QI project. This information will generally be available in administrative datasets. From within the medical record, the following data points could be extracted:

- Time Period: January 1, 2014–December 31, 2014
- Admission Status: Inpatient or observation
- ICD-9 Codes: Principal diagnosis of COPD (ICD-9-CM codes 491, 492, 493.2X, 496) or Principal diagnosis of respiratory failure (ICD-9-CM codes 518.8X or 799.1) when paired with a secondary diagnosis of COPD with exacerbation (ICD-9-CM codes 491.21, 491.22, 493.21, 493.22)
- Hospital Unit Location at Time of Admission (selected to capture where care transition planning would usually occur)
- Hospital Unit Location at Time of Discharge (selected to capture where care transition planning would usually occur)
- Percent of patients receiving invasive mechanical ventilation, noninvasive ventilation

## 3. Conduct Environmental Scan for Existing Hospital COPD Resources

The aim here is to identify components within your facility that may be readily integrated into the QI project, as well as to avoid duplication of effort. Some examples include:

- Clinical decision support (CDS) tools embedded into paper documents or electronic health records: This could include order sets, alerts, forms and documentation templates. CDS tools that are "hardwired" into hospital workflow (as opposed to external applications available on the Web or individual mobile devices) are particularly helpful.
- Respiratory therapy or pulmonary rehabilitation program: Both respiratory therapy and pulmonary rehabilitation play a key role in ensuring successful treatment of patients hospitalized for exacerbations of COPD. Some hospitals may have programs already in place to ensure that patients are seen by a pulmonologist or by a pulmonary rehabilitation nurse prior to hospital discharge. In those instances it will be important to coordinate activities with those individuals or groups.
- Active and historical QI projects overlapping with COPD: These can be referenced and used in your QI project. For example, it is likely that your hospital has already been working to reduce ventilator-associated pneumonias and other complications.

## 4. Determine Data Extraction and Management Capabilities

Most hospital facilities fall somewhere within the spectrum of a fully leveraged EHR and a purely paper-based workflow. For purposes of a COPD QI project, some of the key data management issues to examine include:

- Are current data systems able to identify COPD cases in real-time and retrospectively?
- Can the data elements be obtained electronically, or is manual review required?
- Can QI team members access and manage project data, or is additional help needed?

Since the project design can be influenced by these factors, answering these questions before any active implementation phase is essential.

## 5. Determine Baseline Performance

Section IV further details potential outcome measures for a COPD QI project, with additional information on suggested data collection strategies. Whatever metrics are chosen, obtaining current performance prior to QI project initiation is essential, as it will help both confirm whether the proposed metrics are appropriate and assist with setting performance targets and tracking improvement over time. For a common condition such as COPD, looking at a small random sample of cases over a defined period of time (e.g., 10 cases a month for 12 months) is generally sufficient to establish a baseline for process measures. Baseline outcome measures (e.g., 30-day readmission of patients with a COPD diagnosis) can usually be obtained from administrative data.

Three time points during a hospital episode provide good substrate for a COPD QI program: admission, intervening hospital days and discharge transitions. **Figure B** provides an example of how baseline data could be collected in the starting phases of an initiative with a small commitment of resources (e.g., 10 minutes a chart).

### FIGURE B. EXAMPLE OF A STRUCTURED BASELINE DATA COLLECTION PROCESS FOR COPD QI

| Component of Care | Source | Examples of Data to be Extracted |
|---|---|---|
| Admission | Emergency Department<br>Admission H and P | 1. Were oral steroids prescribed at low dose<br>2. Were antibiotics prescribed for patients who were admitted to the ICU<br>3. Were antibiotics prescribed to those with two or more Anthoniensen criteria<br>4. For patients with respiratory failure and no contraindications, was a trial of noninvasive ventilation attempted before intubation |
| Hospital course | Progress notes<br>Medication orders<br>Education documents (?) | 1. Was oxygen saturation maintained at 92%<br>2. Nutrition?<br>3. Depression/Anxiety screen?<br>4. Prevention of HAC |
| Discharge transition | Discharge summary<br>Discharge medication list<br>Discharge instructions | 1. Assessment for home oxygen?<br>2. Adequacy of home regimen assessed and updated when needed<br>3. Was inhaler education provided / documented<br>4. Referral to pulmonary rehabilitation<br>5. Follow-up appointment scheduled<br>6. Was a plan for self-care provided<br>7. Smoking cessation counseling provided<br>8. Influenza immunization<br>9. Pneumococcal immunization<br>10. Were end-of-life care goals / advanced care planning documented |
| Post-discharge | Hospital and outpatient claims | 1. Did patient return to the ED within 30 days<br>2. Was patient re-hospitalized within 30 days<br>3. Did patient attend pulmonary rehabilitation appointment |

# Section III:
# Best Practices in COPD

# A. Goals of Care

## 1. Spectrum of Care Objectives for COPD

Among the goals of care in COPD is accurate diagnosis and ability to identify people who are candidates for disease modifying or palliating interventions.[1-3] As with any chronic and progressive disorder for which a cure does not exist, priorities in care include reducing mortality where possible, slowing disease progression, reducing incidence and severity of exacerbations, improving or maintaining functional and performance status, improving or maintaining health-related quality of life and mitigating symptoms and suffering related to the disease. In end-stage COPD the goals of care are focused on domains of palliative care and improving end-of-life care. Patient needs and goals for care include also addressing themes such as loss and fear besides just improving therapies.[4] Symptoms of importance include breathlessness, fatigue, loss of ability to participate in pleasurable and necessary activities of daily living, social isolation, uncertainty around prognosis, fearful experiences associated with uncontrolled breathlessness and desire for greater understanding and knowledge about treatment. Thus comprehensive management should first target prevention and harm avoidance, which for COPD especially involves avoidance of airway toxins such as cigarette smoking and burning biomass fuels. Disease management includes physiological therapies, cognitive-behavioral interventions and education and concomitant palliative-focused care. Effective management of COPD should be comprehensive and patient-centered and achieved by deliberate delivery system design and community coordination.[5,6]

## 2. Role of Diagnosis and Characterization of Disease Severity

For any approaches aimed at improving care delivery, accurate and timely diagnosis is requisite. All people suspected of COPD should have confirmatory spirometry that demonstrates a persistent obstructive physiology characterized by a post-bronchodilator FEV1/FVC <0.70. Patient history and clinical examination are not often accurate predictors of airflow limitation, and the majority of patients with airflow obstruction do not recognize or report symptoms. The prevalence of COPD in adults in the U.S. ranges from 5 percent to 20 percent, depending on specific definitions and exposures.[7-10] Analyses from the National Health and Nutrition Examination Surveys (NHANES) revealed that among those who had reported a COPD diagnosis, <20 percent had airflow obstruction on spirometry. Additionally, respiratory symptoms were poorly correlated to severity (e.g., a fifth of those with severe disease reported no symptoms).

Currently no U.S. body recommends screening asymptomatic individuals with spirometry to identify occult COPD. Case finding that uses spirometry to confirm suspected COPD is a guideline recommended practice that includes the ability to classify disease severity based on the $FEV^1$ percent predicted using post-bronchodilator testing for those with risk and breathing symptoms. Estimates

using NHANES data would suggest more than 2 percent of undiagnosed persons have severe COPD and 5 percent moderate COPD. For example, in a multicenter U.S. primary care study of 1,283 current or ex-smokers aged >40 years with self-reported cough and/or sputum, 26 percent were found to have airflow obstruction consistent on spirometry and 74 percent when asked reported dyspnea.[11] The World Health Organization (WHO) in articulating goals for a comprehensive management plan that spans four components (assess and monitor disease; reduce risk factors; manage stable COPD; manage exacerbations) recommends the following:[12]

- Diagnosis of COPD is based on a history of exposure to risk factors and the presence of airflow limitation that is not fully reversible, with or without the presence of symptoms.
- Patients who have chronic cough and sputum production with a history of exposure to risk factors should be tested for airflow limitation, even if they do not have dyspnea.
- For the diagnosis and assessment of COPD, spirometry is the gold standard as it is the most reproducible, standardized and objective way of measuring airflow limitation. FEV1/FVC <70 percent and a post-bronchodilator FEV1 <80 percent predicted confirms the presence of airflow limitation that is not fully reversible.
- Healthcare workers involved in the diagnosis and management of patients with COPD should have access to spirometry.
- Measurement of arterial blood gas tensions should be considered in all patients with FEV1 <40 percent predicted or clinical signs suggestive of respiratory failure or right heart failure.

## 3. Management of Stable COPD

Aggressive treatment can alter the natural history of COPD and should aim to provide relief of symptoms, sustain or improve activity capacity, improve quality of life, reduce the number and severity of exacerbations, prevent and treat complications and ensure appropriate end-of-life planning and palliative care.

Thus the goals for management of COPD and implementation targets include:

- non-pharmacological therapy including smoking cessation, immunization, exercise, nutrition, pulmonary rehabilitation, supplemental oxygen, consideration of surgery or non-surgical reduction of air-trapping
- pharmacological therapy that includes optimal inhaled bronchodilator therapy, inhaled corticosteroids in those who experience exacerbations and other adjuncts such as methyxanthines, oral steroids and antibiotics for exacerbations, and agents to assist in tobacco cessation
- health education and skill development that target the ability to self-manage (including having action plans for early intervention of exacerbations), ability to cope with illness and health status, and to aid in preparing for end of life.

The ACP/ACCP/ATS/ERS Guidelines make the following recommendations:[3]

- Recommendation 1: ACP, ACCP, ATS and ERS recommend that spirometry should be obtained to diagnose airflow obstruction in patients with respiratory symptoms (Grade: strong recommendation, moderate-quality evidence). Spirometry should not be used to screen for airflow obstruction in individuals without respiratory symptoms (Grade: strong recommendation, moderate-quality evidence).
- Recommendation 2: For stable COPD patients with respiratory symptoms and FEV1 between 60-80 percent predicted, ACP, ACCP, ATS and ERS suggest that treatment with inhaled bronchodilators may be used (Grade: weak recommendation, low-quality evidence).
- Recommendation 3: For stable COPD patients with respiratory symptoms and FEV1 <60 percent predicted, ACP, ACCP, ATS and ERS recommend treatment with inhaled bronchodilators (Grade: strong recommendation, moderate-quality evidence).
- Recommendation 4: ACP, ACCP, ATS and ERS recommend that clinicians prescribe monotherapy using either long-acting inhaled anticholinergics or long-acting inhaled agonists for symptomatic patients with COPD and FEV1 <60 percent predicted. (Grade: strong recommendation, moderate-quality evidence). Clinicians should base the choice of specific monotherapy on patient preference, cost and adverse effect profile.
- Recommendation 5: ACP, ACCP, ATS and ERS suggest that clinicians may administer combination inhaled therapies (long-acting inhaled anticholinergics, long-acting inhaled agonists or inhaled corticosteroids) for symptomatic patients with stable COPD and FEV1 <60 percent predicted (Grade: weak recommendation, moderate-quality evidence).
- Recommendation 6: ACP, ACCP, ATS and ERS recommend that clinicians should prescribe pulmonary rehabilitation for symptomatic patients with an FEV1 <50 percent predicted (Grade: strong recommendation, moderate-quality evidence). Clinicians may consider pulmonary rehabilitation for symptomatic or exercise-limited patients with an FEV1 >50 percent predicted. (Grade: weak recommendation, moderate-quality evidence).
- Recommendation 7: ACP, ACCP, ATS and ERS recommend that clinicians should prescribe continuous oxygen therapy in patients with COPD who have severe resting hypoxemia (Pao2 ≤55 mm Hg or Spo2 ≤88 percent) (Grade: strong recommendation, moderate-quality evidence).

Additional treatment strategies based on acute exacerbation risk, severity of illness and symptoms may be useful guides and can be found in the Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease, Global Initiative for Chronic Obstructive Lung Disease (GOLD) available at http://www.goldcopd.org.

## 4. Management Goals in Prevention and Treatment of Exacerbations

Exacerbations of respiratory symptoms requiring medical intervention are important clinical events in COPD. Exacerbations account for most of the morbidity, mortality and costs associated with COPD by leading to hospital admissions, increasing death risk, reducing quality of life, worsening pulmonary function and increasing undesirable symptoms.[1-3,13-15] A COPD exacerbation can be defined as "an event in the natural course of the disease characterized by a baseline change in the patient's dyspnea, cough and/or sputum that is beyond the normal day-to-day variations, is acute in onset and may warrant a change in regular medication in a patient with underlying COPD."[1,2] The most common causes of an exacerbation are infection of the tracheobronchial tree and air pollution, but the cause of approximately one-third of severe exacerbations cannot be identified. A recent American College of Chest Physicians (CHEST) and Canadian Thoracic Society (CTS) joint evidence-based guideline summarizes strategies for the prevention of acute exacerbations of COPD spanning non-pharmacologic therapies, inhaled therapies and oral therapies.[16] In general, the categories of therapies once an exacerbation occurs include pharmacotherapy such as inhaled bronchodilators (particularly inhaled beta 2-agonists or anticholinergics), systemic glucocorticosteroids, antibiotics when clinical signs of airway infection (e.g., increased volume/change of color of sputum or fever) and noninvasive positive pressure ventilation (NIPPV) when respiratory insufficiency is identified.

## 5. Prevention and Reducing Ongoing Lung Damage

Slowing disease progression can involve both therapeutic strategies and preventive approaches. Smoking cessation slows greatly the rate of lung-function decline in patients with COPD and is the only intervention known to be effective in preventing COPD. Reduction of risk factors principally targets inhaled toxins as detailed by the WHO recommendations.[12]

- Reduction of total personal exposure to tobacco smoke, occupational dusts and chemicals and indoor and outdoor air pollutants are important goals to prevent the onset and progression of COPD.
- Smoking cessation is the single most effective and cost-effective way to reduce the risk of developing COPD and stop its progression. Brief tobacco dependence treatment is effective and every tobacco user should be offered at least this treatment at every visit to a healthcare provider.
- Three types of counseling are especially effective: practical counseling, social support as part of treatment and social support arranged outside of treatment.
- Several effective pharmacotherapies for tobacco dependence are available, and at least one of these medications should be added to counseling if necessary and in the absence of contraindications.
- Progression of many occupationally induced respiratory disorders can be reduced or controlled through a variety of strategies aimed at reducing the burden of inhaled particles and gases.

Please refer to Figure 1 in The Natural History of Chronis Airflow Obstruction article and link to http://www.bmj.com/content/1/6077/1645/related

The Peto/Fletcher curves demonstrate the rate of loss of FEV for a non-smoker compared to a susceptible smoker, the onset of symptoms and disability and the potential effect of stopping smoking early or late in the course of COPD.[17] As suggested by the curves, symptoms may not occur until a relatively advanced reduction in lung function. The figure also stresses that nothing is more important than smoking cessation to slow the progression of COPD. Successful cessation slows the rate of decline of FEV1 to approximately that of nonsmokers. Smoking status should be assessed at every clinical interaction and current smokers should have simple brief intervention by providers with the "5 A's":

- **Ask:** identify tobacco users by asking and documenting smoking at all opportunities
- **Advise:** at every encounter encourage all tobacco users to quit
- **Assess:** determine willingness to make a quit attempt
- **Assist:** help the patient with a quit plan, access to practical counseling and social support, and offer/provide pharmacotherapy; therapy started during hospitalization with coordinated transitions after discharge
- **Arrange:** begin multidisciplinary management in hospital and schedule follow-up contact or referral to behavioral or supportive program

## 6. Palliative and Supportive Care

Clinicians should provide supportive care concomitantly with all other disease management strategies and optimize communication about preferences early in COPD. Patients desire early and honest discussions with providers, including issues about end-of-life care. Such discussions do not result in loss of hope but rather encourage planning and dispel the sense that providers will abandon patients and caregivers when interventions are less effective. Conversations about advance care planning should be among key aspects of inpatient care coordination and are essential in transitions from hospital, especially around anticipated future health. Palliative care specifically can assist with both discussions and symptom management. For those patients at the end of life, hospice coordination and comfort-focused care become the primary objectives.

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# B. Members of the Care Team and Their Role in Inpatient COPD Care

The treatment of chronic obstructive pulmonary disease relies on the expertise of professionals across many disciplines and involves many stakeholders. Adding to this complexity, this care can be provided across a variety of settings. To improve this care, an inter-professional, multidisciplinary, patient-centered approach is needed. The roles of the different experts and stakeholders are outlined below.

## 1. Hospitalists

The Society of Hospital Medicine (SHM) defines a hospitalist as "A physician who specializes in the practice of hospital medicine."[1] Although they are a relatively new profession, they currently provide the majority of inpatient care, are leaders in quality, curb length of stay and readmissions, and play a role in controlling healthcare costs.[1-4] SHM defines the field of hospital medicine as "A medical specialty dedicated to the delivery of comprehensive medical care to hospitalized patients."[1] SHM further explains that Practitioners of hospital medicine include physicians ("hospitalists") and non-physician providers who engage in clinical care, teaching, research, or leadership in the field of general hospital medicine."[1] SHM outlines ways in which hospitalists "work to enhance the performance of hospitals and healthcare systems" as quoted below:

- *"Core expertise managing the clinical problems of acutely ill, hospitalized patients*
- *"Prompt and complete attention to all patient care needs including diagnosis, treatment and the performance of medical procedures (within their scope of practice)*
- *"Employing quality and process improvement techniques*
- *"Collaboration, communication and coordination with all physicians and healthcare personnel caring for hospitalized patients*
- *"Safe transitioning of patient care within the hospital, and from the hospital to the community, which may include oversight of care in post-acute care facilities*
- *"Efficient use of hospital and healthcare resources"*[1]

By applying these core principles of hospital medicine to inpatients with COPD, hospitalists are key leaders and members of inter-professional COPD care teams.[5]

## 2. Pulmonologists

Pulmonologists are specialist physicians trained in the care of the lungs and overall respiratory system.[6] The role of pulmonologists for patients with COPD has been traditionally based in the outpatient setting in coordination with primary care physicians.[7] Patients are often referred to specialist care to perform additional diagnostics and confirm diagnosis and optimize treatments. Guidelines for referrals can be found on page 217 of the ATS-ERS guidelines (link can be found here: https://www.thoracic.org/copd-guidelines/resources/copddoc.pdf).[8] However, inpatient pulmonology consult teams can be a critical component of providing guideline-recommended coordinated inpatient care for AECOPD.[9] In one inter-professional study, a consultation provided by pulmonary medicine dramatically increased adherence with best practices for AECOPD inpatients, with comprehensive evaluation including appropriate medications, existing or need for spirometry, referral as appropriate for pulmonary rehabilitation, evaluation for oxygen therapy and appropriate palliative care consultation.[9] [See Appendix G for more information].

## 3. Respiratory Therapists/Respiratory Care Specialists

The vast majority of patients admitted for AECOPD receive care provided to them by respiratory therapists (RTs), usually through nebulizer treatments and invasive and noninvasive ventilator support therapies.[10] However, roles for RTs are growing to include patient education, such as with inhaler training,[11] and through respiratory therapy-directed treatment protocols.[12]

## 4. Pharmacists

Inpatient pharmacists provide a critical role in care transitions for inpatients with COPD, primarily through their roles in medication admission history, reconciliation and patient education (see section J3 Improving Transitions of Care for Patients with COPD: Patient/Caregiver Education and Self-Management Training).[13] Additionally, pharmacists have the capability of assisting with "real-world" medication adherence issues such as inhaler affordability due to the heterogeneity in prescription insurance plans. Inpatient pharmacists can serve as "connectors" of information between providers, patients, caregivers and community pharmacists.[14]

## 5. Nurses

Inpatient nurses are integral members of the COPD care team during hospitalization and at times of transition.[15] They are often the first to recognize deteriorations in clinical status, and the first to uncover environmental and social issues that preclude a return to health at home.[15] Beyond their direct clinical care in assessing their clinical status, providing medications and obtaining important patient information, nurses may also play a role in patient education for medication use and discharge planning.[15] Further, nurses are often the clinical care team member who provides post-discharge follow-up phone calls to patients to evaluate their status, identify barriers to care and remind patients to come in for their post-discharge follow-up appointments.[9]

## 6. Advanced Practice Nurses (APNs) and Physician Assistants (PAs)

Non-physician providers including APNs and PAs are increasingly becoming part of the inpatient care team for patients with acute exacerbations of chronic diseases due to their clinical expertise and lower cost to the health system. Advanced practice nurses, also called nurse practitioners, "assess patients, order and interpret diagnostic tests, make diagnoses and initiate and manage treatment plans."[16] Physician assistants "practice medicine on healthcare teams with physicians and other providers."[17] For the patient with COPD, APNs/PAs may be the primary provider through the hospital medicine service or serve as the lead consultant for the pulmonology service.[9,18] In one model, an APN plays the key role in transition of care, by providing both the inpatient consult as well as the post-discharge follow-up outpatient evaluation.[9] Their roles in chronic disease management and inpatient exacerbations span the spectrum of social work/case management, nursing and physicians with coordination of outpatient resources, patient education and direct clinical care.[19]

## 7. Pulmonary Rehabilitation Therapists

Pulmonary rehabilitation therapists and physiologists provide care for patients to improve their symptoms, endurance and quality of life.[20] Pulmonary rehabilitation reduces use of healthcare resources and improves quality of life.[21-22] Additionally, for those hospitalized with severe AECOPD, pulmonary rehabilitation may help prevent readmissions and improve survival.[23] Although traditionally provided to patients in the outpatient setting when they are more stable, there is a growing interest in intervening during the inpatient stay to prevent or mitigate the deconditioning caused by acute exacerbations and hospital stays.[24-26] The American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) has an outpatient pulmonary rehabilitation registry to help track patient outcomes and program performance in meeting evidence-based guidelines.[20]

## 8. Social Workers and Case Managers

There are important psychosocial factors that play a role in early readmissions.[27] For instance, patients discharged after admission have high rates of depression and anxiety,[28] though the role these conditions place on risk of readmission are unknown.[29] Other social factors, such as limited economic and social support, may play an important role in readmissions.[30] Therefore, inpatient social workers and case managers can play an important role in identifying need for and assisting with resources after discharge. The National Association of Social Workers (NASW) states that hospital-based social workers "help patients and their families understand a particular illness, work though the emotions of a diagnosis and provide counseling about the decisions that need to be made. Social workers are also essential members of interdisciplinary hospital teams."[31] The NASW further states that: "Hospital social workers use case management skills to help patients and their families address and resolve the social, financial and psychological problems related to their health condition."[31] Case management in the hospital setting is often work done by a nurse or nurse manager, who helps to coordinate care needs after discharge, often assisting with financial and placement needs, and aiming to improve quality of care and reduce length of stay.[32] Of note, patients requiring social worker care during hospitalization has been found to be linked with longer hospital stays.[33]

## 9. Hospital Quality Administrators

Due in large part to the newly implemented Centers for Medicare & Medicaid Services (CMS) Hospital Readmissions Reduction Program that places penalties on hospitals exceeding expected 30-day readmission rates for AECOPD admissions, hospital administrators are increasingly an important partner in developing inpatient COPD care teams.[34]

While they do not typically get involved in the care of individual patients, administrators can serve as executive sponsors for QI initiatives aimed at improving care and outcomes at the population level.

## 10. Information Systems Specialists

There is an increasing role for including information systems specialists (ISS) in the design of care provided for inpatients. This role can include helping to design medication reconciliation plans, developing screening algorithms to identify inpatients with AECOPD prior to discharge and helping to improve the design of discharge plans. As nearly all hospital systems utilize electronic medical records, the role of ISS continues to grow. ISS can assist providers resulting in faster care with less duplication of resources through electronic automation of routine tasks and clinical alerts. In addition, collaboration with ISS is ripe for innovation in bridging the transition to outpatient care by novel pathways for hospital systems to stay connected to patients, families and their outpatient care providers. For development of inpatient programs for AECOPD care, not only are ISS crucial in determining what existing resources can be used to lessen the human provider burden for care, but also to define a "low-labor" means to evaluate the quality of implemented interventions.

### FIGURE A: TEAM ROLES

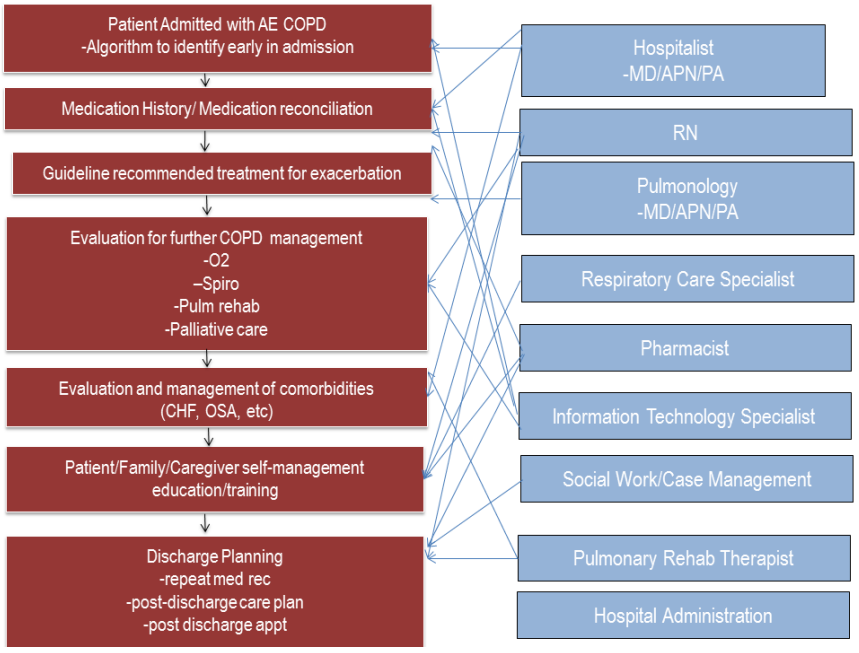

**TABLE 1**

| Team Member | Specialty Organization(s) | Website |
|---|---|---|
| Hospitalist | Society of Hospital Medicine (SHM) | http://www.hospitalmedicine.org/ |
| Pulmonologist | American Thoracic Society (ATS) | http://www.thoracic.org/ |
| Respiratory Care | American Association for Respiratory Care | https://www.aarc.org/ |
| Pharmacy | Multiple | List found at: https://www.accp.com/stunet/compass/organizations.aspx |
| Nurses | American Nurses Association | http://www.nursingworld.org/ |
| Advanced Practice Nurses | American Association of Nurse Practitioners | http://www.aanp.org/ |
| Physician Assistants | American Academy of Physician Assistants | https://www.aapa.org/ |
| Pulmonary Rehabilitation | American Association of Cardiovascular and Pulmonary Rehabilitation | https://www.aacvpr.org/ |
| Social Workers | National Association of Social Workers | http://www.naswdc.org/<br>http://workforce.socialworkers.org/studies/profiles/Hospitals.pdf |
| Case Managers | American Case Management Association | http://www.acmaweb.org/ |
| Hospital Administration | Health Care Administrators Association<br>American Academy of Medical Administrators<br>American College of Healthcare Executives<br>American Association of Healthcare Administrative Management | http://www.hcaa.org/<br>http://www.aameda.org/<br>http://www.ache.org/<br>http://www.aaham.org/ |

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## C. Initial Assessment and Risk Stratification

The initial assessment of a patient hospitalized in a non-ICU setting with an acute exacerbation of chronic obstructive pulmonary disease (AECOPD) should include the following:

1. Confirmation of AECOPD diagnosis
2. Assessment of baseline COPD status
3. Assessment of mortality/respiratory failure risk
4. Assessment of Risk for Prolonged LOS/Unplanned Readmission

### 1. Confirmation of AECOPD Diagnosis

A clinical diagnosis of COPD can be made in error, and reassessment of patients given this diagnosis is appropriate after admission. COPD is commonly diagnosed on the basis of history and physical examination findings, and "overall clinical impression" has been found to be best suited for diagnosing patients with moderate to severe disease.[1] More specifically, three items obtained from a routine H&P (patient-reported smoking history >55 pack-years, wheezing on auscultation and patient self-reported wheezing) have been found to confer a high likelihood of airway obstruction when all three are present (LR, 156), and conversely a very low likelihood when all three are absent (LR, 0.02).[1]

Further confirmation of a clinical diagnosis of COPD is typically made through spirometry. The American Thoracic Society (ATS) recommends spirometry in patients with a history of:

- Exposure to cigarettes and/or environmental or occupational pollutants
- Family history of chronic respiratory illness
- Presence of cough, sputum production or dyspnea[2]

Typically, the diagnosis of COPD requires a post-bronchodilator FEV1/FVC $\leq$0.7.[2] The critical role of spirometry in the diagnosis of COPD is described in Section 3.A: Goals of Care. In the setting of an acute hospitalization for presumed AECOPD, spirometry allows classification based on post-bronchodilator FEV1/FVC (see appendix). Although previous Global Initiative for Chronic Obstructive Lung Disease (GOLD) COPD treatment guidelines recommended that patients be "stable and free from respiratory infection"[3] before diagnostic spirometry is performed, more recent iterations have removed this language. Spirometry, if not done prior, should be considered during AECOPD hospitalizations for the following reasons:

- Many patients hospitalized with AECOPD have never had spirometric evaluation.[4]
- Spirometry has not been found to significantly change between testing during hospitalization and one month post-discharge.[4]
- Approximately 20 percent of patients hospitalized for asthma or COPD did not meet the spirometric diagnostic criteria in a 2012 study.[5]

## 2. Assessment of Baseline COPD Status

Once hospitalized, the primary treatment goal for patients with AECOPD is to return them to their baseline respiratory status. This requires knowledge of their baseline status, which is often overlooked in the initial assessment. GOLD recommends use of either the modified British Medical Research Council (mMRC) dyspnea scale or the COPD assessment test (CAT).

- CAT is an eight-element questionnaire that can be self-administered or administered by a healthcare provider, and measures health-related quality of life. It has been found to be reliable and valid, and is responsive to short-term interventions.[6]
- The mMRC dyspnea scale is a simple, validated tool that predicts likelihood of survival and is a component of the BODE index. It is not responsive over short-term interventions, making it better suited to a baseline assessment rather than response to treatment.[7]

Either can be used in combination with an exacerbation risk assessment to create a combined COPD assessment, but recent studies have shown the mMRC to be superior in assessing baseline risk.[8] However, a recent audit of outpatients with COPD found that although overall agreement in categorization between mMRC and CAT was high (0.94), utilization of CAT led to a shift to a higher risk group, particularly A to B.[9]

| Patient Group | Risk Level | Symptom Level |
|---|---|---|
| A | Low | Less |
| B | Low | More |
| C | High | Less |
| D | High | More |
| Low Risk = GOLD 1-2 or 1 exacerbation/year (not leading to hospitalization)<br>High Risk = GOLD 3-4 or ≥2 exacerbations/year (or ≥1 leading to hospitalization)<br>Less Symptoms = CAT <10 or mMRC 0-1<br>More Symptoms = CAT ≥10 or mMRC ≥2 | | |

(From Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease, 2015 Update. ©2015 Global Initiative for Chronic Obstructive Lung Disease, Inc.)

## 3. Assessment of Mortality/Respiratory Failure Risk

Estimation of a patient's risk of death or respiratory failure in AECOPD can help determine level of care and specific interventions/consultations. A variety of measures have been proposed to help estimate mortality risk in patients with COPD, including:

- **Symptom-based measurements**: CAT, mMRC[8]
- **Related to COPD severity**: long-term oxygen use, lower limb edema, cor pulmonale, GOLD Stage 4[10]
- **Pulmonary assessment**: Spirometry, six-minute walk distance[11,12]
- **Demographic or comorbidity**: age >75 yr, male sex, low weight/BMI, comorbidities of cardiac or renal failure[10,11,13]
- **Multidimensional**: BODE, ADO indices[14]
- **Quality of life**: Seattle Obstructive Lung Disease Questionnaire (SOLDQ),[15] St. George's Respiratory Questionnaire (SGRQ)[16]
- **Biologic markers**: BNP, CRP[11,17,18]
- **Acute physiologic derangement**: acidemia, confusion, elevated troponin[10]

Although multidimensional assessments of mortality risk would seem superior, as they account for the complexity of AECOPD patients, the BODE and ADO indices (see Appendix G) require information that may not be readily available during acute hospitalization. More recently, multidimensional assessments specifically tailored to the hospitalized AECOPD patient have been developed. The BAP-65 system takes into account five easily obtainable measurements:

- Elevated BUN
- Altered mental status
- Pulse >109 bpm
- Age >65 years

Patients with none of the risk factors are categorized as Class I, and those who are >65 years of age are further categorized into Class II, III, IV and V based on the presence of 0, 1, 2 and 3 additional risk factors, respectively. Use of the BAP-65 has been found to be a valid prognostic score in estimating risk of death and mechanical ventilation,[19,20] although the number of studies that have validated it is low.[10]

**FIGURE 1.**

See Figure 1. from Shorr AF, Sun X, Johanes, RS. Validation of a novel risk score for severity of illness in acute exacerbations of COPD. ***Chest.*** 2011;140(5):1177-1183: http://journal.publications.chestnet.org/article.aspx?articleid=1148903

Another scoring system, the CURB-65 score (one point each for confusion, urea >7mmol/L, respiratory rate  30/min, blood pressure systolic < 90 mm Hg or diastolic < 60 mm Hg and age > 65 years), was previously used in risk stratification of pneumonia (see Table 4), but has been also been found to be a valid prognostic score in early validation studies. It, however, also suffers from a lack of robust validation studies.21

**TABLE 2**

See Table 2 from CL, Sullivan GD, Karalys NC. Predicting early mortality in acute exacerbation of chronic obstructive pulmonary disease using the CURB65. ***Respirology.*** 2011;16(1):146-151: http://onlinelibrary.wiley.com/doi/10.1111/j.1440-1843.2010.01866.x/abstract;jsessionid=51FF840E971C8DDEEA27788F709B4071.f04t02

## 4. Assessment of Risk for Prolonged LOS/Unplanned Readmission

As part of ongoing efforts to improve outcomes in AECOPD hospitalizations, assessing the risk of prolonged length of stay and unplanned readmission can properly focus case management and transitions of care resources. Extended LOS has been associated with increasing in-hospital mortality,[13] and early readmissions following an index AECOPD hospitalization have been associated with higher mortality risk.[22] Controlling direct costs is also an important consideration of hospitals and hospital administrators (and by extension, hospitalists) in the current healthcare economic environment.

The overall number of comorbidities has been found to correlate directly with 30-day readmission rates, with the following conditions being associated specifically with an elevated odds or probability of readmission:[23]

- CHF[23,24]
- lung cancer[23]
- anxiety[23]
- depression[23]
- osteoporosis[23]
- hyperlipidemia[23]
- moderate or severe liver disease[24]

- metastatic solid tumor[24]
- diabetes mellitus[24]
- cor pulmonale*[25]
- hypercapnia at discharge*[25]

Indicators of increased levels of prior healthcare utilization also increase the odds of readmission:

- ≥2 prior hospitalizations[24]
- ≥2 prior ED visits[24]
- use of systemic corticosteroids[24]
- long-term oxygen therapy*[25]
- number of daily drugs ≥5*[25]

** increased probability of readmission at one year*

Worse quality of life as measured by the St. George's Respiratory Questionnaire (SGRQ) and depression have also been associated with increased one-year readmission rates.[25] Using the SGRQ in combination with other risk factors (previous admission, hypercapnia at discharge) has yielded a one-year readmission prediction tool, but has not yet been validated[25] (see Appendix). Also, the SGRQ is somewhat lengthy and not commonly administered during AECOPD hospitalizations in the U.S.

A recent study found the risk of prolonged LOS (>11 days vs. median LOS 6.0 days) was associated with admission between Thursday-Saturday, heart failure, diabetes, stroke, hypercapnia and hypoalbuminemia[26] (see Appendix). The BAP-65 score has also been found to correlate significantly to LOS and cost.[19]

## 5. Practical Use of Risk Stratification Tools

Hospitalists need to rapidly determine level of care and monitoring for patients admitted with AECOPD, sometimes without the benefit of even seeing the patient. The BAP-65 serves well as an initial triage tool given the need for rapid decision-making. With a 5.5 percent and 12.4 percent risk of mechanical ventilation 48 hours after admission in the validation cohort subgroups of BAP-65 Class IV and V, respectively, admission to either a IMU/PCU type step-down unit or ICU should be considered. Conversely, the low mortality rate associated with patients in the BAP-65 Class I subgroup would suggest that these patients would be appropriate for a med-surg level of care.

Rapid consultation with case management is also critical to prevent unplanned readmissions. Based on the available literature, patients admitted with AECOPD who have multiple comorbidities, ≥2 prior hospitalizations, ≥2 prior ED visits, are on chronic systemic corticosteroids, long-term oxygen therapy or ≥5 daily drugs should be referred to case management upon admission. Further referral to transition nurse specialists, if available, would also be appropriate.

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## Additional Material:

See Table 2.5 from from Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease, 2015 Update: http://www.goldcopd.org/uploads/users/files/GOLD_Report_2015_Apr2.pdf

See Tables 3 & 4 from from Wang Y, Stavem K, Dahl FA. Factors associated with a prolonged length of stay after acute exacerbation of chronic obstructive pulmonary disease (AECOPD). ***Int J Chron Obstruct Pulmon Dis. 2014;9:99-105***: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3901775/

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See Table 2.4 from Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease, 2015 Update: http://www.goldcopd.org/uploads/users/files/GOLD_Report_2015_Apr2.pdf

See COPD Assessment Test (CAT) at http://www.catestonline.org/english/indexEN.htm

## D. Pharmacologic Management

The optimal management of patients hospitalized for acute exacerbations of COPD (AECOPD) depends on the appropriate use of pharmacologic and non-pharmacologic forms of therapy. Several guidelines developed by a variety of international and national professional societies identify evidence-based strategies for inpatient management of AECOPD. Ongoing review of these guidelines by a hospital-based QI team would provide a foundation for initiating new inpatient improvement methods providing evidence-based care of patients with COPD.

These include the following:

Global Strategy for the Diagnosis, Management and Prevention of COPD, Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2015. Available from: http://www.goldcopd.org/.

Diagnosis and Management of Stable Chronic Obstructive Pulmonary Disease: A Clinical Practice Guideline Update from the American College of Physicians, American College of Chest Physicians, American Thoracic Society, and European Respiratory Society (2011).

National Clinical Guideline Centre for Acute and Chronic Conditions. Chronic obstructive pulmonary disease. Management of chronic obstructive pulmonary disease in adults in primary and secondary care. London (UK): National Institute for Health and Clinical Excellence (NICE); 2010 Jun. 61 p. (Clinical guideline; no. 101).

Criner GJ, Bourbeau J, Diekemper RL, et al.
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When managing patients hospitalized with AECOPD, a variety of pharmacologic and non-pharmacologic modalities are available to the inpatient provider.

The main recommendations regarding the pharmacologic treatment of AECOPD include:

- Increasing the dose of short-acting bronchodilators (albuterol and/or ipratropium).
- Adding oral corticosteroids if bronchodilators are not successful.
- Oxygen and ventilatory support for respiratory failure. A recent review showed that greater use of noninvasive positive pressure ventilation is likely improving outcomes from COPD exacerbations.
- Consider theophylline for severe exacerbations.

## 1. Corticosteroids

The use of systemic corticosteroids is recommended in the treatment of AECOPD, as they have been shown to reduce the duration of the acute exacerbation, and reduce the risk of 30-day recurrence.[2] The use of oral steroids (40 mg prednisone per day) is preferred over intravenous therapy, as no difference has been shown in treatment efficacy.[3] Shorter courses of steroid therapy are also recommended, as recent literature supports a five-day course of steroids being equivalent to prior recommended 10- to 14-day courses of therapy, with a shorter length of stay observed in the five-day group.[4] The most recent GOLD guidelines now recommend a similar five-day course of steroids in AECOPD.[1] Nebulized corticosteroid therapy is an alternative therapy that has been demonstrated to also be as effective as systemic corticosteroid therapy, with the benefit of decreased hyperglycemia.[5] However, the higher costs of nebulized therapy limit its ability to be used on a more prevalent basis.

The use of inhaled corticosteroids (ICS) has not been shown to be effective in an acute exacerbation, but the initiation of maintenance ICS therapy in combination with other long-acting bronchodilator therapy should be assessed prior to discharge based on the severity of COPD.

## 2. Beta-agonists

Despite the lack of randomized trials, the use of inhaled beta-agonist (BA) therapy is acknowledged as standard of care in COPD. This is due to their known benefit as rescue therapy, specifically the use of short-acting beta-agonists (SABA). When patients with AECOPD are hospitalized, the recommendation is to increase the frequency and dose of SABA therapy to address patient severity of symptoms.[1] The literature assessing the use of nebulized vs. inhaled therapy has not found any significant difference in benefit in lung function.[6] However, providers may consider the patient's ability to effectively use inhaled therapy in the initial course of their hospitalization. Regardless of initial modality, the recommendations encourage transitioning patients to handheld therapy if possible as this may promote earlier discharge.

The use of long-acting beta-agonist (LABA) agents in the prevention of AECOPD is well established and recommended[7] and its initiation should be assessed prior to discharge if the patient is not already using them. However, evidence supporting the use of LABA therapy in the acute setting of an exacerbation is lacking. While some small studies suggest a possible benefit in reducing the rate of readmission for AECOPD[8] this is an area in need of further study.

## 3. Anticholinergics/muscarinics

Along with SABA therapy, the use of anticholinergics, specifically short-acting muscarinic antagonist (SAMA) therapy, is well accepted as first-line bronchodilator therapy in COPD.[1] Both SABA and SAMA therapy are used interchangeably as rescue therapy in COPD, and have been found to be more effective in combination therapy in stable COPD.[9] The use of SAMAs in AECOPD is also recommended and is commonly used in the hospital setting. However, the use of combination short-acting bronchodilator therapy is not as well established in AECOPD.[10,11] Instead, the current recommendations are to add SAMA therapy if patient response to SABA therapy is felt to be inadequate or delayed.

The use of nebulized vs. inhaled therapy is addressed in the beta-agonist section, with similar considerations to be made by the provider of the patient's severity of illness and ability to proceed with chosen modality.

The use of long-acting muscarinic antagonist (LAMA) therapy in AECOPD prevention (similar to LABA) is also well studied and recommended due to its observed benefit.[12] There are limited data of its use in the treatment of AECOPD, with some benefit noted in reduction of hospital cost and length of stay[13], but is also in need of further study. As with LABA therapy the initiation of LAMA therapy should be considered prior to discharge in patients where their severity of COPD would indicate its use.

## 4. Methylxanthines

While the use of methylxanthines (mainly theophylline) has been recommended in both stable COPD and AECOPD for years, current recommendations place it in a secondary role.[1] It is known for its bronchodilator effects, but further study has also revealed the adverse effects of its use, both in its noted side effects (nausea, emesis, seizures, atrial/ventricular arrhythmias) at its required doses, in addition to its interaction with multiple medications, including macrolides and ciprofloxacin.[14] While literature has shown its benefit in lung function in stable COPD, evidence is again lacking in its benefit as adjunctive therapy in AECOPD.[15] Whether oral or intravenous, current recommendations are that these be used if short-acting bronchodilator therapy is ineffective in severe exacerbations of COPD. Theophylline must be monitored closely (at least daily for treatment of AECOPD) due to its narrow therapeutic window, high level of drug interaction, potential for toxicity and noted side effects.

## 5. Antibiotics

Antimicrobial therapy in AECOPD is quite prevalent and yet remains a controversial topic in the setting of antibiotic resistance and the call for its judicious use. The use of antibiotic therapy is not recommended for all patients with AECOPD, because many exacerbations are not the result of bacterial infection and because unnecessary antibiotic therapy carries risk to the individual (e.g., allergic

reaction, *C. difficile* infection) and to society, which is commonly the case in the inpatient setting. The provider, using a variety of clinical, severity of illness and laboratory indicators, determines this likelihood in the initiation of antibiotic therapy. Promising new approaches to reducing the use of unnecessary antibiotics include the use of markers such as procalcitonin that are mentioned in the guidelines as possibly of value in determining if a patient would benefit from antibiotics. However, it is not widely established and further study is needed. Once identified, it is in this patient population that antibiotics in AECOPD have been shown to reduce mortality, treatment failure and sputum purulence.[16, 17] Meanwhile, there are data that indicate that patients without these clinical and laboratory characteristics managed without antibiotics do not have inferior treatment and mortality outcomes.[18,19]

The antibiotics to be used in AECOPD are also an area in need of further study. Current treatment guidelines do not favor any particular class of antibiotic, but have encouraged the use of local resistance patterns in choice of antibiotic.[1] Literature suggests that simple exacerbations can be treated with traditional first-line agents, (e.g., amoxicillin, TMP/SMX, doxycycline)[20] while more complicated cases of AECOPD (e.g., severe COPD, admitted to ICU, recently hospitalized) have a higher likelihood of gram-negative or resistant organisms and would benefit from extended spectrum antibiotics (e.g., fluoroquinolones, macrolides, beta-lactamase inhibitors).[21] Oral is preferred over intravenous based mainly on cost-effectiveness of therapy. Recommendations have also focused on a shorter five-day course of antibiotics being as effective as traditional longer courses.[22,23]

A final point of consideration for providers would be the issue of pneumonia in COPD. There is a common association of pneumonia in patients hospitalized with AECOPD.[24] Should the patient be found to have a concurrent diagnosis of community-acquired pneumonia (CAP) or healthcare-associated pneumonia (HCAP), antibiotic treatment guidelines for these entities should be implemented to account for the likely inciting organisms.

## 6. Mucolytics

The use of mucolytics in AECOPD is another area that is less well-studied. No literature has assessed the use of mucolytics in the acute setting of an exacerbation. Studies of mucolytics (N-acetylcysteine, erdosteine, carbocysteine) in patients with stable COPD are small and nonrepresentative, but demonstrate a reduction in the rate of AECOPD or its recurrence.[25, 26] These observed benefits in a drug with a low side effect profile would place it as a useful adjunctive therapy in patients with COPD. Recent guidelines recommend the use of mucolytic agents in patients with COPD who continue to have AECOPD recurrence despite taking standard maintenance therapy, and inpatient providers should consider the addition of this modality to their patients' medication regimen on discharge.

### 7. Opioids

The use of opioids in AECOPD is recommended in the treatment of refractory dyspnea in advanced COPD.[27] While not a treatment aimed at the underlying pathophysiology of AECOPD, opioids have been shown to provide relief for subjective feelings of breathlessness and dyspnea in advanced stage COPD[28] and should be administered as part of a regimen focused on providing palliative treatment for this patient population.

## Optimization of Maintenance Therapy in the Inpatient Setting

While treatment of the acute exacerbation is one of the main goals of care, the provider must also assess the patient's risk factors for potential recurrence. This includes the assessment of the patient's outpatient medication regimen. Using guideline-based symptom and exacerbation risk assessment in addition to any spirometry data that may be available, an outpatient regimen can be initiated or titrated while still in the inpatient setting that would provide the most appropriate therapy for the patient being prepared for discharge. The GOLD guidelines provide an approach to determine the patient's severity of illness and the appropriate maintenance therapy to be implemented.[1] Please see Tables 4.2 and 4.4 on pages 33 and 36 of the GOLD guidelines by clicking here: http://www.goldcopd.org/uploads/users/files/GOLD_Report_2015_Apr2.pdf. This would include the use of LABA therapy, with the inclusion of LAMA/ICS therapy if indicated based on the assessed severity of illness. Such combination therapy has shown benefits in terms of reducing or delaying recurrence of exacerbation. Provider assessment of this important area of discharge planning is essential in completing the care process for the patient hospitalized with AECOPD.

## E. Recommendations on the Use of Non-Pharmacologic Agents in AECOPD:

### 1. Smoking Cessation

Knowing that tobacco use is a major factor in the development and progression of COPD, it is well known that smoking cessation is the main method of slowing the progression of COPD.[29] While acute cessation of smoking is common during hospitalization for AECOPD, it is also an opportunity for providers to engage patients and provide resources for smoking cessation. This would ideally consist of a multimodal approach, using both pharmacologic agents (e.g., nicotine replacement therapy (NRT)) and non-pharmacologic modalities such as tobacco cessation counseling.[30] Literature has shown the more intensive the therapy that is provided, the greater the likelihood of its effectiveness. Further details on best practices in implementation of validated approaches such as smoking cessation are outlined in the Goals of Care section found earlier in this ***Guide***. Recommended approaches to the use of NRT are found in the Care Transition section found later in this ***Guide***.

## 2. Oxygen Therapy

AECOPD requiring hospitalization is frequently associated with the presence of hypoxemia on presentation, and in many cases also hypercarbia. The use of oxygen therapy is accepted as standard of care in the initial management of AECOPD.[1] However, oxygen therapy must be managed by the provider to avoid hyperoxia and oxygen-induced hypercapnia. Literature has demonstrated a significant mortality reduction in patients with COPD who received titrated oxygen therapy with a goal saturation of 88-92 percent as compared to traditional high-flow oxygen therapy.[31] Further detailed discussion on evidence-based approaches to oxygen therapy is found in the Care Transitions section of this ***Guide***.

## 3. Immunizations

AECOPD are commonly the result of an infectious etiology, whether bacterial or viral. While treatment for the suspected or confirmed offending agent is indicated, confirmation of appropriate immunization is also indicated. Vaccination has proven to be beneficial in patients with COPD.[32-34] Both influenza and pneumococcal immunization is recommended in patients with COPD. All patients with COPD should receive the influenza vaccine every year. The 23-valent pneumococcal vaccine is indicated for all patients with COPD 65 and older, as well as patients <65 with significant comorbid conditions or evidence of severe COPD (a documented FEV1 <40 percent predicted).[1]

## 4. Breathing Techniques

Evidence supporting the use of breathing exercises is mainly found in stable COPD. Techniques such as pursed lip breathing or breathing control have been demonstrated to improve functional exercise capacity in patients with stable COPD.[35] Less evidence is available in the acute setting, but recent studies in this setting have demonstrated improvement in subjective symptom measures such as anxiety, depression, dyspnea and fatigue.[36] Guidelines currently do not have specific recommendations on these techniques, but may be helpful for patient-related measures.

## 5. Other Modalities

Lesser-known approaches such as blowing cold air and acupuncture have been evaluated in the literature in patients with stable COPD. A single study demonstrated modest relief of patient breathlessness with blowing cold air to the patient's cheek[37] and another study showed patients with an improved Borg dyspnea scale score after a course of acupuncture.[38] While these and other modalities (neuromuscular electrical muscle stimulation (NMES), chest wall vibration) may be recommended for patients with stable advanced COPD[39] there is no evidence for their application in the AECOPD setting.

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# F. Ventilation

## 1. Noninvasive

### a. Background

Acute respiratory failure requiring ventilatory assistance is a common complication of severe exacerbations of COPD, occurring in as many as 8 to 20 percent of patients who require hospitalization.[1,2] Historically, patients who did not respond to standard therapy, including bronchodilators, corticosteroids and antibiotics, were sedated, endotracheally intubated, placed on a ventilator and transferred to the intensive care unit. Despite obvious benefits in treating acute respiratory failure, invasive ventilation is associated with a significant risk of complications, including iatrogenic pneumonia, venous thromboembolism and barotrauma, and case fatality rates for patients receiving invasive ventilation have been reported to average 30 percent.[3] In the past, patients who chose to forgo intubation were kept comfortable while medical therapy was continued, but many died.

Perhaps the most significant recent advance in the management of patients with severe exacerbations of COPD has been the development and widespread adoption of noninvasive ventilation, which uses positive pressure to deliver a mixture of air and oxygen through a face mask, nasal mask or nose plugs. Two of the most commonly used modes of noninvasive ventilation are 1) continuous positive airway pressure (CPAP) and 2) bi-level positive airway pressure (BIPAP). The use of noninvasive ventilation for managing acute respiratory failure is attractive because it is better tolerated than invasive ventilation, does not require endotracheal intubation or sedation, can be easily initiated or discontinued and is associated with a lower risk of complications.

### b. Benefits

The efficacy of noninvasive ventilation in COPD has been evaluated in more than a dozen randomized controlled trials involving hundreds of patients, and has been summarized in meta-analyses produced by Cochrane, the Agency for Healthcare Research and Quality (AHRQ) and others, and is included in all major guidelines with the strongest possible evidence rating.[4,5] Noninvasive ventilation has been shown to improve acute respiratory acidosis and decrease respiratory rate, work of breathing and dyspnea. More importantly, meta-analyses have concluded that noninvasive ventilation is effective at reducing the risk of intubation (Relative Risk {RR} 0.41; 95%CI 0.33 to 0.53), reducing mortality (RR 0.52; 95%CI 0.35 to 0.76), and shortening length of stay in the hospital (mean difference -3.24 days; 95%CI -4.42 to -2.06). Authors of these meta-analyses, reviews and guidelines recommend that noninvasive ventilation be the ventilatory modality of first choice and should be started early in the course of hospitalization. Although the use of noninvasive ventilation for patients with COPD increased roughly four-fold between 1998 and 2008 in the U.S., the level of adoption varies substantially across hospitals, suggesting important opportunities to standardize care.[1,6]

### c. Indications

Noninvasive ventilation should be considered in all patients with an acute exacerbation of COPD with evidence of respiratory acidosis (pH <7.35) despite maximal standard therapy and controlled oxygen for up to one hour (Table 1). Patients with pH <7.26 are at increased risk of deterioration and require more intensive monitoring. Studies of patients with milder exacerbations have failed to show a benefit to the use of noninvasive ventilation.[7,8] In addition to these indications, there is good evidence that noninvasive ventilation can be used to facilitate early liberation from conventional ventilation and to prevent reintubation.[9]

#### TABLE 1: INDICATIONS FOR THE USE OF NONINVASIVE VENTILATION IN COPD[10–12]

- Respiratory acidosis (pH < 7.35 and / or PaCO2 > 40 mm/Hg)
- Severe dyspnea with clinical signs suggestive of respiratory muscle fatigue, increased work of breathing or both, as manifested by the use of accessory muscles of respiration, retraction of the intercostal spaces or paradoxical motion of the abdomen

### d. Disadvantages and Contraindications

As already noted, use of noninvasive ventilation has grown steadily over the past decade, while rates of invasive ventilation have fallen. Nevertheless, there are several challenges to achieving optimal use of noninvasive ventilation. First it is resource intensive, requiring a significant amount of clinician time. Second, substantial training and experience are needed for its successful implementation. Ultimately, it is not appropriate for some patients, such as those with facial trauma, cardiopulmonary arrest or depressed levels of consciousness (Table 2). As a result, there will always be a role for invasive mechanical ventilation in some patients.

#### TABLE 2: CONTRAINDICATIONS TO THE USE OF NONINVASIVE VENTILATION

- Respiratory arrest
- Medically unstable
- Unable to protect airway
- Excessive secretions
- Uncooperative or agitated
- Unable to fit mask
- Recent upper airway or gastrointestinal surgery

*Note: Adapted from GOLD report 2015*

### e. Monitoring and Escalation

Close monitoring is required until the patient has stabilized. Coaching and encouragement are especially important in helping the patient adapt to the ventilator. Although noninvasive ventilation can be administered on general medical units, the severity of the patient's illness should inform the site of delivery. Frequent clinical monitoring of acutely ill patients is recommended every 15 minutes for the first hour, every 30 minutes in the one- to four-hour period and hourly between hours four and 12. Physiologic parameters associated with outcomes in randomized controlled trials include respiratory rate, heart rate, level of consciousness, chest wall movement, ventilator synchrony, accessory muscle use and comfort. Oxygen saturation should be monitored continuously (Table 3).

#### TABLE 3: MONITORING NONINVASIVE VENTILATION IN COPD

- Patient comfort
- Mask fit and leak
- Patient-ventilator synchrony
- Sternocleidomastoid muscle activity
- Vital signs
- Continuous pulse oximetry
- Arterial blood gases (initially, and after 30-120 minutes)

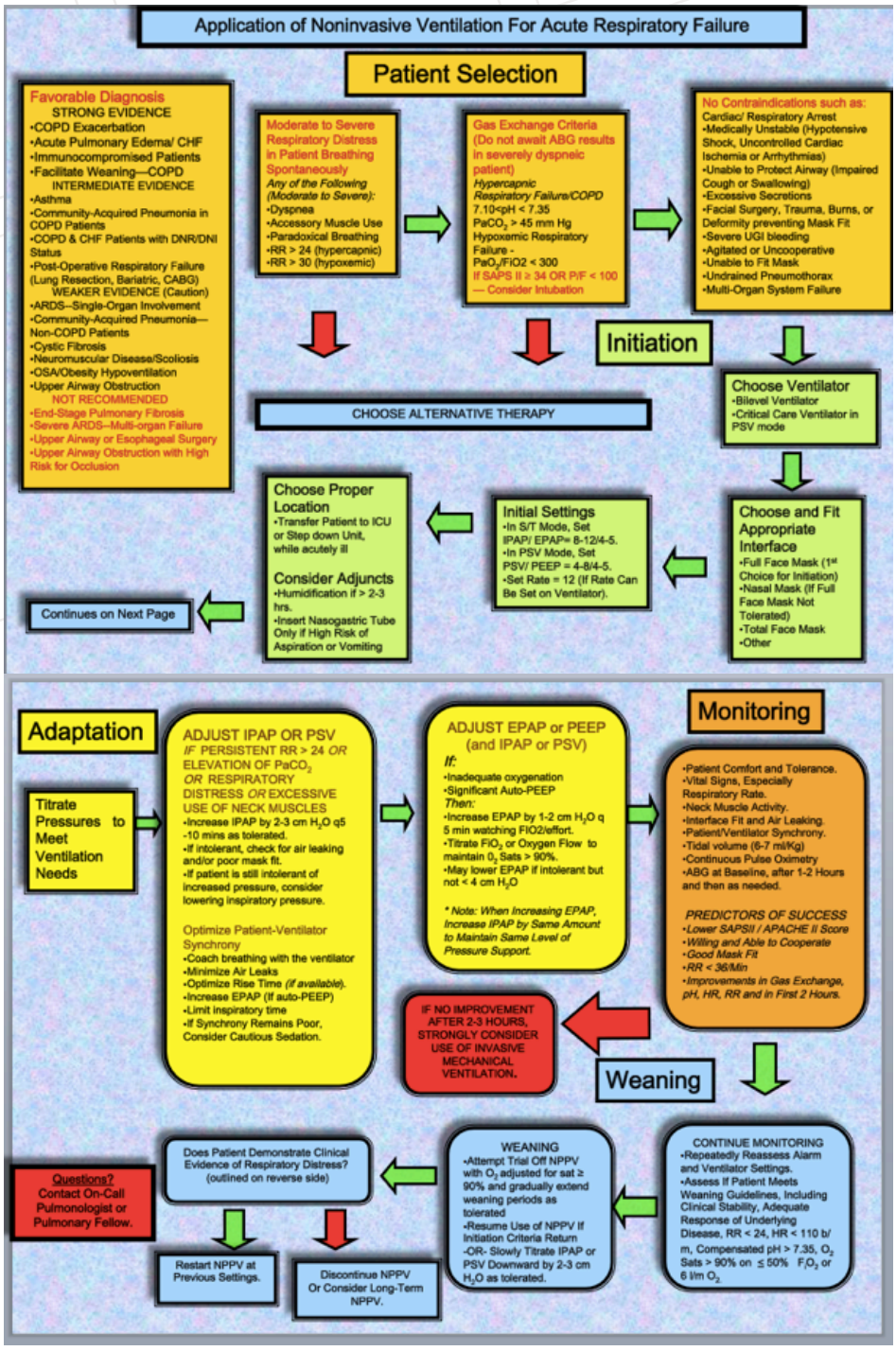
(From Broaddus, Mason, Murray, Nadel, King, Lazarus, Slutsky, Nadel. Chapter 99. Elsevier.)

Guidelines recommend that the need for escalation to invasive mechanical ventilation be assessed and recorded at the initiation of noninvasive ventilation. This should include whether noninvasive ventilation is the ceiling of therapy and whether the patient would desire resuscitation or specific palliative care and comfort measures. (BTS)

Links to sample protocols for the use of noninvasive ventilation are provided below.

Please see Appendix IV.b – Initiating BiPAP Therapy https://www.britthoracic.org.uk/document-library/clinical-information/niv/niv-guidelines/the-use-of-non-invasive-ventilation-in-themanagement-of-patients-with-copd-admitted-to-hospital-with-acute-type-ii-respiratory-failure/

## FIGURE B. APPLICATION OF NONINVASIVE VENTILATION FOR ACUTE RESPIRATORY FAILURE. COURTESY OF NICHOLAS HILL, MD, TUFTS MEDICAL CENTER



### f. Duration and Weaning

Guidelines produced by the British Thoracic Society recommend that treatment with noninvasive ventilation should last until the acute cause has resolved, typically about three days. Patients who benefit from noninvasive ventilation during the first four hours of treatment should receive noninvasive ventilation for as long as possible during the first 24 hours. In patients in whom noninvasive ventilation is successful, as evidenced by normalization of the pH, respiratory rate and symptoms, it is appropriate to start a weaning plan. This should include a gradual reduction in the duration of noninvasive ventilation, with parameters indicating tolerance document using a standardized tool.

### g. Palliation

The continued use of noninvasive ventilation may be appropriate in some cases when standard medical therapy and noninvasive ventilation has failed to reverse the signs and symptoms of respiratory failure, and where a decision has been made to not pursue intubation and mechanical ventilation. Opiates and benzodiazepines can also be used to reduce dyspnea.[13] In other cases the use of noninvasive ventilation will not be consistent with the patients goals of care (see section on Palliative and End-of-Life Care) and should be avoided.

### h. Organizing Care

Each hospital should develop and maintain a local protocol stating criteria for selection and treatment of patients and these should be adopted from national guidelines and based on inclusion criteria from RCTs.[14,15] Patients with predictors of poor outcome with noninvasive ventilation should be admitted to setting where early intubation can be facilitated. These predictors include more severe arterial blood gas abnormalities, tachycardia, lower levels of consciousness and large volume of secretions. Audit and feedback are basic tools in efforts to measure and improve quality of care.[16,17] An example of an audit tool that can be used to evaluate the processes and outcomes of care for patients treated with noninvasive ventilation can be found in Appendix vi: Example of NIV audit proforma at https://www.britthoracic.org.uk/document-library/clinical-information/niv/niv-guidelines/the-use-of-non-invasive-ventilation-in-themanagement-of-patients-with-copd-admitted-to-hospital-with-acute-type-ii-respiratory-failure/

## 2. Invasive Ventilation

Although the majority of patients requiring ventilatory assistance are now initially treated noninvasively, some 10-20 percent of patients who receive noninvasive ventilation ultimately fail and require invasive ventilation. Patients who fail a trial of noninvasive ventilation and require intubation have an even higher risk of mortality than patients who are initially treated with invasive mechanical ventilation, underscoring the importance of careful patient selection. In addition approximately 30 percent of patients have contraindications at the time of admission that make them poor candidates for noninvasive ventilation. For these reasons conventional mechanical ventilation remains an important component of therapy for patients with COPD complicated by respiratory failure who wish to pursue aggressive therapy. Indications for invasive mechanical ventilation are listed in Table 5.

### TABLE 5. INDICATIONS FOR INVASIVE MECHANICAL VENTILATION

- Unable to tolerate NIV or NIV failure
- Respiratory or cardiac arrest
- Respiratory pauses with loss of consciousness
- Diminished consciousness, psychomotor agitation inadequately controlled by sedation
- Massive aspiration
- Persistent inability to remove respiratory secretions
- Heart rate <50 with loss of alertness
- Severe hemodynamic instability without response to fluids and vasoactive drugs
- Severe ventricular arrhythmias
- Life-threatening hypoxemia in patients unable to tolerate NIV

***Note: Adapted from GOLD 2015***

The risk of mortality among patients requiring invasive mechanical ventilation is substantial, with studies reporting rates between 8 and 23 percent.[18,1,19,20] Risk factors for mortality include underweight, poor nutritional status, the presence of comorbidities such as cor pulmonale, cardiovascular disease and diabetes mellitus. Additional risk factors for poor outcome include length of stay in the hospital prior to intubation.[21] While these statistics are sobering, clinicians often maintain overly pessimistic beliefs about the prognosis of patients with COPD which may lead patients to be denied admission to the intensive care unit for intubation.

A full guide to the management of patients requiring invasive mechanical ventilation is beyond the scope of this *Guide*. Those wishing additional information regarding recommendations regarding ventilator modes, ventilator settings, dynamic hyperinflation and prognosis should consult standard reference texts.

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# G. Prevention of Hospital-Acquired Conditions During Hospitalization for AECOPD

## Introduction

Patients hospitalized with advanced COPD have an inherently high risk of hospital-acquired conditions (HAC) due to their high risk of reduced mobility, malnutrition and recurrent hospitalizations. These include nosocomial pneumonia, *Clostridium difficile* infection (CDI) and venous thromboembolism (VTE). Prevention of these HACs is important given their attendant morbidity and mortality, as well as penalties in the Affordable Care Act (ACA) that reduce Medicare payments to hospitals with high HAC rates.

## 1. Venous Thromboembolism (VTE)

AECOPD is a risk factor for thrombotic events during hospitalization,[1] and should warrant pharmacologic VTE prophylaxis in patients with age >40 and expected hospitalization of ≥3 days. Among COPD patients, certain patient characteristics have been found to confer a higher VTE risk:

- Male gender[2]
- Increasing age[3]
- Decreasing exercise capacity[3]
- Caucasian[3]
- High BMI[3]
- Prior oxygen use[3]
- Neoplastic disease[2]
- Peripheral arterial disease[2,3]
- Decubitus ulcer[2]
- Multiple medical comorbidities[3]

COPD patients with a history of pulmonary embolism (PE) have been found to have a significantly higher risk of subsequent PE and fatal PE compared to those with a history of DVT.[4] However a recent study found that COPD patients seem to have a lower risk of VTE when compared to other high-risk conditions such as pneumonia, heart failure and stroke.[5]

## 2. Nosocomial Pneumonia

Patients with advanced COPD are at higher risk for developing healthcare associated pneumonia, hospital-acquired pneumonia and ventilator-associated pneumonia due to their high frequency of hospitalization. COPD has also been found to be an independent risk for developing ventilator-associated pneumonia (VAP)[6] due to altered host defense mechanisms, lower respiratory tract colonization and microaspiration.[6] In addition, treatments for COPD have been associated with increased risk of pneumonia:

- Two large prospective RCTs have shown an increase in physician-reported pneumonia in patients treated with inhaled corticosteroids.[7,8]
- Use of aerosolized bronchodilators was found to be an independent risk factor for VAP in mechanically ventilated patients.[9]

The prevention of nosocomial pneumonia in COPD patients is multi-pronged, with guideline-based treatment of chronic and acute phases being paramount. Other interventions shown to reduce the risk of nosocomial pneumonia specific to this population include:

- Use of noninvasive ventilation (NIV) in the place of invasive mechanical ventilation both acutely and in weaning protocols[10] has been shown to decrease the risk of hospital-acquired pneumonia[11,12]
- Avoiding use of proton-pump inhibitors (PPI) in favor of sucralfate has been found to lower the incidence of pneumonia in mechanically ventilated patients.[13]

## 3. *Clostridium Difficile* Infection (CDI)

The frequent use of antibiotics, poor nutritional status and frequent corticosteroid use would seem to make COPD patients a high-risk population for CDI.[14] A diagnosis of COPD in a recent VA study was found to be associated with a higher risk of CDI. Conversely, a recent large retrospective cohort study of 53,900 patients found no increase in 30-day readmissions for CDI after an index hospitalization for AECOPD.[15] However, no specific evidence-based recommendations have been issued in the literature regarding prevention of CDI in patients with COPD.

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# H. Managing Comorbidities of AECOPD

## Introduction

Recent population studies have found that more than half of all patients with COPD will have at least one comorbidity.[1] Common comorbidities that affect outcomes in COPD include depression, anxiety, cardiovascular disease, cachexia, lung cancer, cerebrovascular disease and peripheral arterial disease.[1,2] Attempting to assess the impact of comorbidities on outcomes in COPD has led to three different indices of comorbidities.

- The Comorbidities in Chronic Obstructive Lung Disease (COMCOLD) index was recently developed to better quantify the correlation between comorbidities and patient-reported health status in COPD (Table 1). The index ranges from 0 (no impact of comorbidity on health status) to 19 (very large impact of comorbidity on health status).[1]
- A simplified count of comorbidities was found to correlate with patient-centered outcomes in COPD.[3]
- A simple disease-specific comorbidities index (COTE) was found to help assess mortality risk in patients with COPD[4] (Table 2).

Although it is clear that comorbidities have negative/deleterious/adverse consequences on health outcomes, research demonstrating that treatment of comorbidities improves outcomes in COPD is limited.[2]

### TABLE 1.

See Table 4 in Frei A, Muggensturm P, Putcha N, et al. Five comorbidities reflected the health status in patients with chronic obstructive pulmonary disease: the newly developed COMCOLD index. ***J Clin Epidemiol*** 2014;67:904-11 at http://www.sciencedirect.com/science/article/pii/S0895435614000912

### TABLE 2.

See Table 3 in Divo M, Cote C, de Torres JP, et al. Comorbidities and risk of mortality in patients with chronic obstructive pulmonary disease. ***American journal of respiratory and critical care medicine*** 2012;186:155-61 at http://www.atsjournals.org/doi/abs/10.1164/rccm.201201-0034OC?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%3dpubmed#.Vc0OwHgoDRw

## 1. Malnutrition

Weight loss frequently complicates advanced COPD, with between 30-60 percent of inpatients and 10-45 percent of outpatients affected by malnutrition.[5] The combination of COPD and malnutrition (BMI <20) has been defined as pulmonary cachexia syndrome, which has implications for the outcomes in COPD.[6]

- Malnutrition and weight loss have been found to negatively affect functional capacity, health status and mortality in COPD.[6, 7]
- Malnutrition during an AECOPD hospitalization has also been associated with increased 30-day readmission rates.[7]

Both body mass index (BMI), lean body mass index (LBMI) and free fat mass index (FFMI) can be used to track nutritional status in COPD, and negatively correlate with risk of COPD-related hospitalizations.[8] LBMI and FFMI are[9] difficult to assess in the inpatient setting, and BMI is more typically used although less predictive of survival.[9] Serum prealbumin can be measured to monitor nutritional status in COPD, and negatively correlates with spirometrically measured indices of severity.[10]

Addressing malnutrition and weight loss during COPD hospitalizations through oral supplementation is feasible in nutritionally depleted COPD patients,[11] yet is unlikely to improve outcomes in COPD during short hospitalizations. Coordination with outpatient nutritionist follow-up and supplementation is needed, given its possible benefits:

- Body weight and FFM have been found to increase significantly after 12 weeks of nutritional supplementation therapy combined with low-intensity exercise in COPD patients in a recent study, but most other studies of nutritional support do not show significant effects.[12]
- Nutritional supplementation with low-intensity exercise training led to improvement in exercise capacity, and health-related quality of life in the same study.[12]
- Oral nutritional supplementation was found in a recent meta-analysis to increase measures of non-respiratory (hand grip strength) and respiratory (maximal inspiratory and expiratory mouth pressure) muscle strength.[5]

- Specific vitamins (vitamin C, D, E, A, beta and alpha carotene) have been found to be associated with improvement in symptoms, exacerbations and pulmonary function in COPD, although no studies have shown benefit from vitamin supplementation in improved symptoms, decreased hospitalization or pulmonary function.[13]
- Improved malnutrition may improve survival and may decrease costs based on other single-center studies.[14]

To optimize nutritional status, hospitalists caring for COPD patients should consider:

- Serum prealbumin, weight and BMI upon admission,[14] with nutrition service consultation and implementation of recommended oral nutritional supplementation if malnutrition is found.
- Improving physical activity both during and after hospitalization, which may require referrals to physical and occupational therapy,[6] as well as pulmonary rehabilitation after discharge.
- Post-discharge referrals to outpatient nutritionist and physical/occupational therapists, with ongoing provisional of recommended nutritional supplementation.

## 2. Obesity/Overlap Syndrome

Although malnutrition is more typically associated with COPD, complications of obesity can also negatively affect COPD outcomes. The prevalence of obesity, as defined by a BMI $\geq$30 kg/m$^2$, was higher in self-reported COPD populations compared to non-COPD populations in a recent Canadian study.[15] Patients self-reporting a COPD diagnosis were also found to have a significantly higher risk of severe activity limitation and increased healthcare utilization.[15] Conversely, a recent study of patients admitted to the Spanish Public Health Service with a primary ICD-9 diagnosis of COPD showed an associated reduction in 30-day readmission rate and in-hospital mortality.[7]

Complications of obesity, such as obstructive sleep apnea (OSA) and obesity hypoventilation syndrome (OHS), can lead to worsened outcomes in COPD patients:

- The term “overlap syndrome” (OS) has been used to describe the combination of OSA and COPD in a single patient.[16] It has been associated with an increased mortality and hospitalization rates in patients with AECOPD.[16] In patients with OS, long-term non-invasive ventilation (NIV) also has been found to improve PaO2 and PaCO2 acute (after five days) and chronically (after one year of home NIV) in patients with OS.[17]
- Chronic NIV has also been found to improve survival in obese patients with COPD.[18]

## 3. Cardiovascular Disease

Ischemic heart disease (IHD), heart failure (HF) and cardiovascular disease (CVD) as a whole share close relationships with COPD due to similar lifestyle risk factors:

- IHD is the most prevalent comorbidity in COPD patients.[19]
- COPD patients suffer from a higher risk of developing IHD and acute coronary syndrome (ACS) compared to the general population.[19]
- COPD is frequent in IHD patients, with a prevalence of 4 to 18 percent.[19]
- COPD has been found to be a common comorbidity in patients hospitalized with acute diastolic heart failure (ADHF).[20]

Additionally, COPD and CVD have a synergistic effect, with the presence of one worsening outcomes in the other:

- IHD patients with concomitant COPD were found to have decreased short- and long-term survival compared to non-COPD patients.[19]
- COPD patients hospitalized for ST-segment elevation MI (STEMI) and receiving either primary percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) were found to be at higher risk of recurrent MI, HF and bleeding complications.[19]
- COPD was found to be associated with an increased risk of CVD endpoints (cardiac arrhythmias, angina pectoris, AMI, HF, stroke, pulmonary embolism)[21,22] and CVD-related hospitalization and mortality.[21]
- COPD patients have been found to have higher mortality,[23,24] readmission rates[25,26] and rates of new onset HF after MI.[24]
- CVD-related events contribute to 22-39 percent of deaths in COPD.[25]
- Patients with both COPD and chronic systolic HF have been found to have a significantly higher risk of hospitalization (both due to HF and all-cause).[27]
- GOLD Stage 2 COPD patients admitted for acute decompensated HF were found to have a higher long-term (>one year) mortality rate (both due to HF and all-cause).[28]

This association, however, often goes undertreated or unrecognized:

- Airway obstruction has been found to be underdiagnosed in 60 percent of patients with CVD and 87 percent of patients with CAD.
- COPD patients have been found to be less aggressively treated for AMI compared to those without COPD,[29] with lower rates of revascularization and/or treatment with guideline-recommended secondary prevention medications.[24]

- COPD patients have been found to have lower rates of treatment with guideline-recommended HF therapies.[31]
- COPD patients requiring mechanical ventilation commonly are afflicted by unrecognized left or right ventricular heart failure.[32]

Concerns regarding the possible bronchoconstrictive effects of beta-blockers in COPD patients may lead to undertreatment of IHD and HF. The overwhelming weight of data would suggest, however, that cardioselective (i.e., beta-1 selective) beta-blockers are safe and beneficial in patients with concurrent IHD- or HF-COPD:

- COPD patients suffering from MI were found to have improved survival when treated with beta-blockers (both initiated during and continued from prior to hospitalization).[19,33,34]
- Beta-blockers were in fact found to reduce mortality and COPD exacerbations when added to established stepwise therapy for COPD, independent of CVD and CVD-specific treatments, without adversely affecting pulmonary function.[35]
- Beta-blockers have been found to be beneficial in patients with COPD and HF by decreasing mortality after hospitalization for ADHF.[36]
- Although many experts recommend use of cardioselective (beta-1 selective) beta-blockers in COPD patients with CVD,[29,37] a recent retrospective analysis of patients from Organized Program to Initiate Lifesaving Treatment in Hospitalized Patients With Heart Failure (OPTIMIZE-HF), which enrolled 48,612 patients with new-onset or worsening HF from 249 U.S. hospitals, found that there was no evidence that beta-blocker selectivity had a significant effect on mortality and readmission. Both cardioselective and non-cardioselective beta blockers were associated with lower risk-adjusted mortality rates in patients with HF and COPD.[38]

Other medications commonly used in CVD may be beneficial in patients with COPD:

- Multiple retrospective studies have shown that administration of statins reduce the risk of COPD exacerbations, although a recent large, multicenter, RCT did not show a significant reduction in exacerbation rates in COPD patients treated with simvastatin.[19]
- ACE inhibitors have been found to have a protective effect on smokers with a rapid FEV1 decline and slowed progression to COPD in these patients.[19]

Concerns have also been raised regarding the cardiovascular effect of medications commonly used in COPD:

- New use of long-acting beta-agonists (LABA) and anticholinergics (LAMA) have been associated with increased risks of cardiovascular events in older patients with COPD.[39]
- LABA medications have been associated with increased mortality and hospitalization in HF patients, and have been recommended to be used only for clear symptom relief in patients with COPD and HF.[37]
- Inhaled corticosteroids (ICS) have been found in some observational studies to confer benefits in CV outcomes, but RCTs failed to show any significant effect on MI- or CV-related death.[40]

## 4. Psychiatric Disorders

Depression and anxiety are common conditions among patients with COPD and are well known to worsen symptoms of dyspnea etc:

- Depression and anxiety have been found to have the largest impact on patient-reported health status of COPD patients.[1]
- More than one-third of COPD patients experience symptoms of depression and anxiety.[41]
- COPD patients with anxiety and depression were found to have higher levels of fatigue, dyspnea and increased frequency of COPD symptoms.[42]
- Depression has been found to be more prevalent in COPD patients compared to smokers and nonsmokers without COPD,[43-45] but is relatively undertreated.[45]

Treatment of COPD patients with underlying depression and/or anxiety has been found to be difficult, with some hope offered by pulmonary rehabilitation:

- Guideline-concordant depression care was not found to be significantly associated with decreased hospitalization or mortality in COPD patients.[46]
- Routine prescribed oral antidepressants have not been found to significantly improve dyspnea or physiologic indices of COPD.[47]
- Pulmonary rehabilitation has been found to improve depression and anxiety, as well as measures of dyspnea and health-related quality of life.[48]

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# I. Palliative and End-of-Life Care

## 1. Discussing Plans for Care

Conversations that extend into what patients hope to achieve from care are necessary to maintain patient autonomy and align care plans with patient preferences - the primary goal of advanced care planning discussions that address acutely ill patients. During times of hospital admission for exacerbations, where the symptoms of chronic stable disease are accentuated by acute deterioration in health status and increased dyspnea, including the sensation of suffocation, discussions about the management of advance disease and end-of-life care are an important part of comprehensive care. Although it is preferable for these discussions to have occurred during a period of relative stability and during a time when patients have the opportunity to reflect on their overall goals, these conversations frequently do not occur in the outpatient setting for a variety of reasons that are attributable to both patients and providers. For this reason, the responsibility will often fall on hospitalists to engage in these conversations. Hospital admission for exacerbation can be a difficult time to engage patients who may not have had prior discussions about the trajectory of their disease or what the hospital experience could entail. Having a command of possible scenarios, including how to address uncertainty, are important skills. In addition, for the hospitalist, an admission may be the first time that he or she has had the opportunity to participate in the care of a patient, making conversations about preferences for care and, in particular end-of-life care, more challenging. Nonetheless, these discussions and interactions can have profound meaning to patients and their loved ones while ensuring that the care provided aligns with their preferences.

Although many clinicians have cited concerns over patient perception about these discussions, research over the past decade has dispelled the myth that patients will feel a loss of hope or sense of abandonment from clinicians who talk about end-of-life care. In fact, patients generally report higher quality of care for those providers who have discussed advanced wishes or end-of-life care. It is likely that patients' perception of clinicians are in part based on whether they see patients as individuals; and conversations about advance care planning are generally comprehensive discussions of patients' medical history, wishes, current health and anticipated future health. The three recommendations are ordered so that providers can understand the patient's experience with COPD, provide guidance about common situations and integrate that information into recommendations for care that align preferences and best medical knowledge.

**Step 1. Define Quality of Life, Past History with COPD, Other Complex Chronic Conditions and Patient's Goals of Care:**

Whenever possible, discussing the patient's past experiences with COPD and how it has affected their lives and their quality of life should precede questions of the need for ICU and invasive support. Taking time to understand the patient's past experience and their perspective on those

experiences helps provide context and opportunities for clinicians to help align the appropriate services to the patient's individualized goals. It is important to highlight that during the period of hospital admission, these conversations may need to be facilitated by family or friends.

### EXAMPLES OF CONTENT FOR CONVERSATION:

***Tell me a little bit about how COPD has affected you over time. Are there things that you can no longer do because of COPD? Prior to being admitted to the hospital, how has COPD affected your quality of life? What are the things in life you currently find rewarding/fulfilling?***

Questions like the one above help provide a context about the patient's prior experiences with COPD and allows them to articulate aspects of their lives that have been affected by the condition. In many instances, patients will articulate activities that they enjoyed and now can no longer freely perform such as gardening, taking walks, outdoor activities and shopping. Many will discuss the difficulty they have with activities of daily living including tying shoes, or walking to the bathroom or kitchen. Oftentimes, they will describe a situation of a retracted life. Others, however, will describe a full life — one where they are satisfied with their current situations, including being engaged with their families, friends and other activities. These conversations provide an insight and a frame to have discussion about the eventual quality of life post-hospital discharge.

For example, a possible approach to introducing concepts of quality of life: You noted that being able to be independent, and not being dependent on others for activities of daily living were important to you. Can we review some situations where you might not find it acceptable? For example, some people have very strong feelings about spending their lives in nursing homes.

In this context, the concept of assisted facilities or nursing homes may be acceptable in the context of short-term rehabilitative stays, but not as a permanent situation. It is also important to understand the context of the opinion — previous family or loved ones who had the experience, prior personal experiences or projecting based on stereotypical portrayal that may not allow a fully informed decision. In the acute setting of recent tetraplegia or paraplegia, opinions about the willingness to accept invasive therapy are known to change over time. How patients' preferences change in the setting of complex chronic conditions is less known.

### EXAMPLE QUESTIONS:

During past exacerbations, have you required care in the hospital, care in the ICU or need for mechanical ventilation? Can you tell me about those experiences? Were those experiences acceptable to you? Were there things that occurred that you would not want again?

**Step 2. Provide context on the expected and unexpected course for the hospital admission and beyond.**

***What will the experience be like for patient's hospital admission?***

For the average patient, exacerbation successfully treated will result in an approximate four-day length of stay and rarely result in in-hospital death (1.13 percent). Approximately 65 percent of patients will be discharged home, 17 percent will require home healthcare and 13.6 percent of patients will require nursing home or rehabilitation. It is common to expect that patient's baseline health status prior to exacerbation and hospital admission to represent a ceiling – that hospital treatment will not achieve health and functional status above their baseline.

Re-exacerbations are frequent with 7 percent of patients being readmitted within 30 days for COPD specifically and 20 percent being readmitted for any cause. Within six months approximately 50 percent of patients will experience a readmission for any cause. Relapsed exacerbation prior to full recovery has been associated with the inability to return to previous health status. For the majority who are successfully discharged home, many questions may be moot. For those with poor functional status or severe disease, they may be interested in discussions about future exacerbation and what they might expect in the future.

***Is my disease so severe that I will not be able to liberate from mechanical ventilation?***

The ability to predict liberation from mechanical ventilation is difficult. There is very limited evidence about how to predict how patients with COPD may liberate from mechanical ventilation. In general, FEV1 is not a reliable predictor of successful liberation from mechanical ventilation. In one large study, COPD did not predict whether the liberation process was simple, difficult (one to seven days) or prolonged (more than seven days). Penuelas AJRCCM 2011. Although being mechanically ventilated for COPD was not associated with difficulty of liberation, having COPD as a co-existing condition was strongly predictive of not being able to be easily liberated from mechanical ventilation (difficult: OR 6.0 CI95%(2.0-18.3); prolonged CI95% (OR 13.3 (3.4-51.0).

***What are the factors to consider for long-term mechanical ventilation?***

Dogmatically, tracheostomy is commonly considered after two weeks of mechanical ventilation. The primary advantage of tracheostomy is during attempts to liberate from mechanical ventilation and communication. Tracheostomies are generally more comfortable and offer the potential to talk because the cannula is inserted below the vocal cords. As with any procedures, the direct risks of the procedure need to be considered, including the risk of significant bleeding associated with early erosion into the innominate artery, a rare but potentially life-threatening complication. Tracheostomy for long-term care functionally requires artificial nutritional approaches, including PEG, because of interference of tracheostomy for swallowing.

***Can I go home with tracheostomy and mechanical ventilation?***

Being able to return to home with mechanical ventilation and tracheostomy is rare. Because of the intensity and limited margins for error, malfunction of equipment or disengagement of patients from mechanical support, most patients will require discharge to/placement in long-term rehabilitation facilities that can support mechanical ventilation. Even large, well-intentioned families will have difficulty with the 24-hour/seven days a week commitment for home support. For families considering making this choice we would encourage active discussions with a knowledgeable pulmonary-critical care physician and/or palliative care clinician.

**Step 3. Make recommendations in care that align with patients preferences.**

Preserving autonomy and maximizing quality and duration of life is the goal of high-quality care among patients with severe disease. Research consistently demonstrates that patients with COPD receive care that is more consistent with preservation of life than patients with lung cancer, despite the fact that their preferences for care are similar. As in other areas of medicine, patients may face tension making decisions between interventions that may prolong life, but come at the expense of quality of life and independence. The impact of these choices can be either short-term (limited mechanical ventilation) or long-term (long-term tracheostomy). The choices of patients are uniquely personal, but healthcare providers are often at this juncture; providing guidance in an attempt of help patients make informed decisions. For example, many patients have the goal to make a particular milestone, such as a wedding, graduation or other special event. The decision to undergo any particular treatment will be predicated on the patient's individual situation, including the likelihood that the goal can be achieved and the importance of that goal. Having an understanding of the goal will help inform decision making. For example, being alive, in the ICU, on the day of a wedding versus being able to actively participate and enjoy the day with loved ones are very different goals. In this example, if the patient's primary goal of care is to actively participate in a wedding, but that is not an achievable goal, it is the responsibility of the clinician to not only inform the patient and surrogates, but also to explore whether then the treatment that they are receiving is aligned to alternate, achievable goals. Having patients understand the likelihood of achieving their goal with different levels of intervention is an important conversation to preserve autonomy while being able to provide recommendations for care.

***What happens when patient's preferences and goals do not align with treatment options and goals?***

Having contradictory opinions and preferences for care is common. This situation can be particularly nuanced and challenging since the patient's desire for an expected outcome may not be realistic with the known effects of treatments. In this context, we recommend providing patients with appropriate information and the development of a treatment plan that is consistent with their overall goals and expected treatment outcomes. These conversations are often difficult, in part because of uncertainty about outcomes. Laying out the expected trajectories and outcomes

associated with care and then revisiting their progress over time can provide a productive dynamic that facilitates follow-up conversations. Oftentimes, patients and their families will have uncertainty about initial treatment choice and will advocate for levels of care that are higher than with described goals. Acknowledging these concerns as well as embracing the considerable difficulty in predicting individual-level patient outcomes is important and also provides opportunities. Demonstrating empiric evidence about how the treatment is consistent with expected outcomes can build trust and reassure patients/surrogates about modifying treatments to be more concordant with overall goals.

***Provide appropriate information based on goals and do not rely on physiological information.***

Patients as well as providers would like to have evidence that a treatment approach is effective. We recommend focusing these discussions and approaches on overall progress and less on intermediate outcomes such as vital signs or laboratory values. Using these values in the context of a broader conversation can provide concrete information that supports improvement or declines in status, however patients and families may not fully appreciate how these values may not reflect the overall progress of patients. When asked about how treatment is "working," we recommend discussing progress in terms of success or failure toward achieving the overall goals.

# J. Improving Transitions of Care for Patients with Chronic Obstructive Pulmonary Disease

## Transitions and Care Coordination

One of the key aspects in chronic disease management for conditions like COPD is care coordination and ensuring smooth transitions from hospital through discharge to home or other post-hospital care setting. Transitions are stressful for patients and families and can result in harm through discontinuity and fragmented care. At hospital discharge, almost half of patients experience at least one medical error after discharge, and one in five patients suffers an adverse event.[1-3] Many of such adverse events are predictable and preventable, primarily through communication among providers and improved information transfer. Fewer than 20 percent of discharging physicians have direct communication with subsequent providers, discharge summaries often lack important information and/or are unavailable at follow-up post-hospitalization visits, and many patients are discharged with test results pending.[4-6] Patients and families often lack understanding of the reasons and care plans from hospitalization and frequently miss key treatment follow-up with the sum of all these shortcomings leading to high rates of readmission.[7,8]

Conceptually, efforts to improve transitions of care can be organized into a number of domains such as is done in the Consolidated Framework for Implementation Research (CFIR).[9-12]

Please refer to Table A. Consolidated Framework for Implementation Research (CFIR) on the following site: http://effectivehealthcare.ahrq.gov/index.cfm/search-for-guides-reviews-and-reports/?pageaction=displayproduct&productid=1882

For hospital-based providers, many complex changes and innovations have been described to cross the boundaries of the practice setting and include provider and hospital networks, insurers and federal agencies. Within transitions especially from hospital-based to home or care facilities, organizational innovations have optimized team-based care, facilitation and coaching to develop skills and disease registries. The goal is that all aspects of care be coordinated with designs to improve care for individuals as part of providing care to a larger population with common needs and concerns. Thus, implementation planning is ideally structured from a systems perspective and benefits from use of a strategy like the CFIR.

Please refer to Figure B. Framework for Implementation Research on Patient-Centered Medical Homes

http://effectivehealthcare.ahrq.gov/index.cfm/search-for-guides-reviews-and-reports/?pageaction=displayproduct&productid=1882

Care transitions specifically can be defined as “the movement patients make between health care

practitioners and settings as their condition and care needs change during the course of a chronic or acute illness."[13] The purpose of this section is to focus on key transitions and aspects of care coordination for hospitalized COPD patients. These elements include: medication reconciliation, timing and use of pulmonary rehabilitation and exercise, approaches to patient/family education and self-management, components for MDI Education, guidance on nutritional recommendations, use and re-evaluation for home oxygen and spanning all transitions, the documentation and coordinated communication between care providers.

Regardless of whether a patient is being discharged from the hospital to home or to an extended care facility (e.g., nursing home, rehabilitation center, assisted living, long-term acute care hospital), the discharge process has numerous potential pitfalls that can create harm for patients. The figure referenced on "Why You Should Act" web page illustrates, well-intentioned, hard-working clinical staff do their best to provide a safe care transition, but these efforts are hindered by various broken or failed processes within the healthcare system. When combined, the broken processes may result in adverse events going unchecked and causing harm to the patient.

### Traditional Care Transitions

It is important to recognize that the transition process does not start with the physician writing an order for the patient to be discharged. Instead, preparing patients and their families/caregivers for a safe transition starts at admission (or *before* admission, if the admission is elective). By starting the discharge care transition early in a patient's hospital stay, we have opportunities to identify more potential failure points (e.g., potential issues that may lead to adverse events) in the process such as:

- Failure to identify patients with an increased risk for adverse events after discharge … including readmission
- Failure to conduct an accurate and/or complete medication reconciliation process
- Failure to assess or anticipate what the patient and family/caregiver may need at the time of discharge
- Failure to develop an interdisciplinary care plan that incorporates the input of other members of the care team, such as the nurse, pharmacist or case manager/social worker or even the patient and family/caregiver.

During a patient's hospital stay, healthcare providers might compound their mistakes made at the start of the hospitalization by:

- Failing to initiate care processes to ameliorate readmission risk factors
- Failing to educate patients and their families/caregivers in a patient-centered manner, resulting in patients and families/caregivers who do not know how to stay healthy after discharge
- Failing to address key concerns of the patient and family/caregiver

At the time of discharge, healthcare providers might further undermine the transition of care plan by:

- Providing patients with discharge instructions full of medical jargon and failing to use "Teach Back" to confirm adequate understanding
- Inadequately communicating with primary care physicians or other aftercare providers about the patient's hospital course and ongoing diagnostic and treatment plans
- Providing a discharge summary to outpatient providers that is incomplete, delayed or missing a clear care plan for the patient after discharge
- Failing to complete an accurate medication reconciliation process, often because the medication reconciliation on admission is inaccurate
- Failing to work with patients and their families/caregivers to coordinate follow-up visits with outpatient healthcare providers soon after discharge

There are also things healthcare providers might do, or fail to do after discharge, that undermine the care transition process, including:

- Rarely checking on patients after they have left the hospital, resulting in missed opportunities to identify early warning signs of an adverse event
- Failing to give patients the resources needed to handle events if their condition worsens at home
- Failing to send completed discharge summaries with essential information to primary care physicians or other aftercare providers in a timely fashion
- Failing to connect patients to community resources that will help them achieve lasting health and wellness

***Note: Content above is derived from The Society of Hospital Medicine's (SHM's) Project BOOST® Implementation Guide www.hospitalmedicine.org/ProjectBOOST***

In general, improving the transitions in COPD care also includes targeting comprehensive guideline care and integrated approaches to patient management. The American Thoracic Society put forward a report on integrated COPD care that stresses that "optimal care of the patient with chronic obstructive pulmonary disease (COPD) requires an individualized, patient-centered approach that recognizes and treats all aspects of the disease, addresses the systemic effects and comorbidities and integrates medical care among healthcare professionals and across healthcare sectors."[14] Multiple non-pharmacologic care interventions have been shown to achieve improved quality of life for patients with COPD. Tailored, evidence-based and patient-focused approaches that include medication reconciliation, education, smoking cessation, optimizing inhaler use, pulmonary rehabilitation, nutritional assessment and appropriate oxygen use can influence the natural history of COPD, improve symptoms and reduce the likelihood of exacerbations. Additionally, palliative and anticipatory end-of-life discussions can help patients discern preferences, understand advanced directives and plan for therapies at end of life. Disease management involves partnering with nurses and respiratory therapists to assist in education, shared-decision making and improving adherence.

## 1. Medication Reconciliation

Medication reconciliation has been defined as: "the process of identifying the most accurate list of all medications a patient is taking … and using this list to provide correct medications for patients anywhere within the healthcare system."[15] National regulatory efforts encouraging medication reconciliation have existed for more than a decade. The Joint Commission, for instance, has included medication reconciliation as a National Patient Safety Goal since 2005.[16,17] The Agency for Healthcare Research and Quality and the Society of Hospital Medicine convened a medication reconciliation conference in 2009 and published a consensus statement on key principles, endorsed by 10 organizations.[18,19] Inpatient medication reconciliation involves multiple steps that include not only obtaining and documenting the pre-admission medications at the time of admission, but also identifying and resolving inpatient medication discrepancies, both compared to admission and as ongoing care is provided, then providing patients and their families with a reconciled discharge list of medications, along with education for post-discharge medication use.[19] Adverse events related to medication errors that arise during hospitalization, at time of discharge and post-hospitalization are far too common.[18,20-21] The safety and cost-related impacts on patients, their families and the healthcare system are of great and growing concern.[18,22] Readmission rates are higher at 30 days for those patients who had medication discrepancies.[23] However, despite the growing awareness and evidence of the need for high-quality medication reconciliation, efforts to implement successful processes have proved challenging.

For instance, although medication reconciliation, along with guideline-recommended assessment and education of medication knowledge and skills (see below), is particularly important for patients with COPD,[24-27] there are very few data to guide health systems on COPD-specific medication reconciliation programs. The limited studies that exist primarily evaluate pharmacy-led efforts.[28,29] For instance,

one COPD-specific study showed adding a pharmacist to the team identified more medication discrepancies.[28] Another study showed that computerized outpatient pharmacy data provided more accurate medication lists than provider-obtained lists alone.[29] However, the data are not only limited in number, but also mixed in success. One pharmacist-led intervention that included patients with COPD showed that no differences emerged between a pharmacist case manager and usual care.[29] Additionally there has been a lack of evidence describing the fiscal burden and the return on investment of costly resources to conduct quality reconciliations, calling to question the sustainability of such programs. Of note, the American Society of Health-System Pharmacists (ASHP) developed a statement and guide for pharmacists' role(s) in hospital-based medication reconciliation.[29,30]

Other COPD-specific medication reconciliation issues to consider include using the hospital setting to identify the ideal method for delivering inhaled medications. For instance, some patients may have difficulty using respiratory inhalers for mechanical (e.g., arthritis) and/or cognitive (e.g., dementia) reasons, in which case nebulizer machines may need to be considered.[31] If relying on respiratory inhalers, multiple different types exist, including metered-dose inhalers and dry powder inhalers, among others.[32] The types of steps and skill level for the inhaler devices differs and these can be important to patient adherence and adequate receipt of medication.[33-38] Additional information about this topic is presented below in the Device Education section. Medication reconciliation may also identify preventive measures including patients' need for influenza and pneumococcal vaccines, which are now inpatient quality measures.[39] Finally, medication reconciliation that is patient-centered should include decisions on cost and patients' ability to afford and access the prescribed medications.[40]

**Steps for Developing a Medication Reconciliation Program for COPD patients at your health care setting adapted from the Society of Hospital Medicine's MARQUIS conference,[41] Joint Commission Statement/Society of Hospital Medicine Consensus Statement,[42,43] Henry Siu's 10 commandments,[30] the ASHP Statement on the Pharmacist's Role in Medication Reconciliation[44] and best evidence from the literature:[17-19, 30, 44-50]**

**Step 1: Develop your sites' key definitions Consensus Statement on Medication and Medication Reconciliation and principles**

a) Define the multidisciplinary team of providers, patients, families and settings and hospital leaders with clearly demarcated identified roles for each stakeholder

b) Identify and address patient- and family-level needs, specifically language, empowerment, health literacy, age and cognition and other patient/family-level needs

c) Outline extent and type of provider education needed

d) Identify barriers and potential solutions for implementation of medication reconciliation programs

e) Confirm mechanism to ensure process is patient-centered

f) Identify available local resources and systems as well as those needing to be developed

g) Monitor and evaluate impact using process and outcome measures with feedback mechanisms to allow for ongoing improvement

**Step 2: Clearly define roles and responsibilities for medication reconciliation at your site**

a) Determine roles and responsibilities of parties involved
   1. Suggest that there be a primary reviewer with a secondary reviewer[45]
      i. E.g., admitting physician as primary with pharmacist as secondary
      ii. Be clear on specific steps, such as who will communicate with outpatient pharmacy

b) Ensure a team approach that maximizes patient-centeredness, safety and efficiency

c) Identify external community resources and develop partnerships

**Step 3: Identify or develop metrics and tools for rapid cycle improvement of medication reconciliation**

a) Use identified process and outcome metrics in combination with site-specific metrics to monitor, support and facilitate quality med rec processes

b) Include metrics to assess and address patient- and family-level needs

c) Follow the "10 Commandments" adapted from Siu's paper[30]
   1. Medication Reconciliation should be a unique component of the medical record
   2. Indicate how pre-admission med list was obtained/derived
   3. Document rationale/clinical reasoning for any changes to outpatient changes
   4. Anticipate post-discharge challenges/barriers related to med changes and reconciliation
   5. Perform some level of medication reconciliation daily at a minimum (e.g., review inpatient Medication Reconciliation daily)
   6. Assess barriers to patient adherence post-discharge
   7. Use team-based approach, consulting experts as needed
   8. Provide appropriate details including time/duration details at discharge
   9. Collate, as needed, multiple pre-admission medication lists, including outpatient or ambulatory medications along with any inpatient or other care facility (e.g., hospital transfer) prior to admission to your site
   10. Identify primary lead responsible for medication reconciliation that is clearly communicated to all providers and documented in the chart

**Step 4: Implement a pilot phase of your site's med rec process**

a) May be the most feasible to identify a single clinical service area and type of med rec (e.g., admission or discharge) to test feasibility, adherence and areas of improvement

b) For highest impact, consider identifying a population at high risk for medication-related adverse events and/or a high-risk medication

   1. Patients with COPD are the third leading group at risk for readmission within 30 days[31] and are at extremely high risk of misusing their respiratory inhalers[46,51]
   2. Include patient-centered med rec elements including type of device (nebulizer vs. inhaler), type of inhaler(s), costs, etc.[32-38]
   3. Consider including a medication reconciliation pilot program within a COPD Readmissions Reduction Program[48]
   4. Determine feasible best practice strategies for medication reconciliation that can be adapted to multiple care settings

**Step 5: Identify patient-level barriers/risks and/or system level risks to stratify effort based on need**

a) Have stratified system based on risk for extra levels of scrutiny for patients at high risk

b) Have systems in place to alert providers to high-risk system-level risks such as any patient-level risk, system-level risks or provider/multi-provider-level risks.

**Step 6: Rigorous evaluation of the med rec process is required -(Table A-tools)**

**Step 7: Disseminate**

a) Communicate with inter-professional team regarding pilot and full implementation programs

b) Evaluate, describe and publish and present findings, locally, regionally and nationally

**Step 8: Promote patient education for care transitions (see section below on Device Education – Page 101)**

| Table A: Existing Medication Reconciliation Tools and Resources | | |
|---|---|---|
| Resource | What's available | Access |
| MARQUIS Toolkit [49,50] | **Toolkit with**<br>***Implementation Guide**<br>***PowerPoint**<br>***Excel Sheet**<br>***White Paper**<br>***Pocket Cards** | **Available implementation manual at:** http://tools.hospitalmedicine.org/resource_rooms/imp_guides/MARQUIS/MARQUIS-Guide-2014-Final.pdf?utm_source=MARQUIS_Link&utm_medium=web&utm_campaign=MARQUIS_14&utm_content=MARQUIS%20Manual%20Post%20Form_Link |
| Joint Commission/SHM Statement | Background, Barriers, Step-by-Step Guide/Goals | Available at: http://www.ncbi.nlm.nih.gov/pubmed/20945473 |
| Henry Siu's 10 Commandments | http://www.ncbi.nlm.nih.gov/pubmed/20945473 | Available at: http://informahealthcare.com/doi/pdf/10.1080/21548331.2015.1023159 |
| American Society of Health-System Pharmacists Statement on the Pharmacist's Role in Medication Reconciliation | Statement and Guide | Available at: http://www.ashp.org/DocLibrary/BestPractices/SpecificStMedRec.aspx |

## 2. Pulmonary Rehabilitation

Pulmonary rehabilitation is an evidence-based, multidisciplinary and comprehensive care program for patients with chronic respiratory diseases that advances disease understanding, education and management.[24,25,27] The program targets those who are symptomatic and may have decreased activities or have limitation on exercise. Pulmonary rehabilitation is designed to reduce symptoms, optimize functional status, increase adherence and reduce healthcare costs through stabilizing systemic manifestations of disease. Pulmonary rehabilitation has been defined as "…a comprehensive intervention based on exercise training, education and behavior change, designed to improve the physical and psychological condition of people with chronic respiratory disease and to promote the long-term adherence to health-enhancing behaviors."[52] Pulmonary rehabilitation programs involve a comprehensive patient assessment, aerobic exercise training, strength training, education and psychosocial support.

Randomized controlled trials demonstrate that exercise pulmonary rehabilitation in COPD patients can relieve dyspnea and improve health-related quality of life.[53-55] Guidelines advocate pulmonary rehabilitation for patients who experience significant dyspnea or exercise limitation, regardless of severity of airflow limitation, and indicate that evidence is strong for early initiation after hospital discharge.[24,27] In a pooled analysis done for the recent American College of Chest Physicians and Canadian Thoracic Society Guideline for prevention of acute exacerbations, pulmonary rehabilitation reduced hospitalizations as compared to conventional care (odds ratio 0.45, 95% confidence interval [CI] 0.22 to 0.91, P = 0.03).[27,56] Studies categorized as given early (<1 month) following a recent COPD hospitalization demonstrated a reduction in COPD re-hospitalizations following (odds ratio 0.24, 95% CI 0.07 to 0.88, P = 0.03).

Pulmonary rehabilitation is indicated for patients with dyspnea to increase exercise tolerance and improve quality of life but should also be considered earlier around basic exercise prescription to prevent patients from using avoidance of dyspnea to lead to self-limiting their exertion and becoming sedentary.[57,58] Low-exertion lifestyle leads to deconditioning and decreased exercise tolerance which precipitates worsening shortness of breath termed "the dyspnea spiral."[59] CMS and other payers typically reimburse programs that provide rehabilitation for patients with COPD who meet the following criteria: FEV1% predicted ≤65 percent, FVC% predicted ≤65 percent, or DLCO % predicted ≤ 65 percent and stipulate that patients who continue to smoke must also be enrolled in a smoking cessation program. Patients identified in the hospital setting who meet criteria for pulmonary rehabilitation should both have referral and coaching to facilitate adherence. Although there is a low rate of referrals, underutilization of rehabilitation is fueled by low patient adherence to starting and completing programs. Barriers that patients express include limitations in transportation and feeling too dyspneic to attend.[63] Among strategies to increase patient participation in pulmonary rehab is to begin in the inpatient setting.[60] Further work is needed to develop effective patient-education and adherence methods in the hospital to ensure referred patients are receiving pulmonary rehabilitation.

## 3. Patient/Caregiver Education and Self-Management Training

Patient self-management of COPD is critical to reduce symptoms, improve quality of life and decrease use of healthcare services.[46] Although patient education is integral to this process,[51] self-management training is more than education, as it includes behavior changes and skill training.[61] The Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines state that patients and/or their home caregiver(s) should fully understand the correct use of medications and have confidence that they can manage at home successfully.[24] Patient education is often traditionally thought of as an outpatient-based element of care. Much of the evidence has focused around studying the effectiveness of COPD education in this setting.[62] "Living Well with COPD" studied with multiple RCTs found an outpatient program targeted toward previously hospitalized patients that included case management and education reduced subsequent hospitalization and improved self-management.[63,64] Further, this self-management education program was found to have positive economic benefits.[65] Most experts in the field believe there is sufficient evidence to promote self-management programs for COPD based on two further systematic reviews.[61,66,67] Although there is now evidence to support self-management education, there is still uncertainty as to which elements of various programs are most effective and the best site(s) for implementation.[61]

### Inpatient COPD Self-management education and training

While the outpatient setting has been traditionally studied for COPD self-management training, the inpatient setting is another potentially important point-of-care for higher risk patients with COPD to receive critical self-management education. There are limited data on inpatient self-management programs.[68] However, among the existing studies, the evidence is mixed about the effectiveness of hospital-based self-management education to reduce future (re)admissions.[47,63,69-71] Programs that included ongoing education were the most successful.[63, 69] Further, inpatient skill education for respiratory inhaler technique found fewer acute care utilization events.[47, 70] Other studies did not demonstrate reduced (re)hospitalizations but did have other positive findings, including increased use of medications and decreased mortality.[71] One such study included a combined nurse and pulmonary rehabilitation program.[71] Below is a summary of best available evidence for, and steps toward, improving inpatient COPD self-management education and training. A table summarizing resources is included below (Table A).

### Patient Education Topics

### General Disease Information:

Studies demonstrate that the majority of patients with COPD have low general disease knowledge, and often over-estimate their knowledge.[72,73] In fact, in one study, less than 10 percent of patients could identify the term COPD.[74] Despite the clinical implications that can be derived from this gap in patient knowledge, there is a relative dearth of work in the area of general disease education for patients with COPD. The majority of general disease information that has been studied has been in programs that have included self-management training and so will be discussed, as relevant, in the sections below. However, in a systematic review evaluating self-management education broadly, the authors found that hospital admissions are likely decreased by self-management education, but without clear data as to the form and content of which such education should be comprised.[49] Of note, most of the work evaluating providing general disease management information on COPD has been done in the outpatient setting.[75] The limited number of intervention studies to improve knowledge were summarized in a systematic review, whereby five studies including four RCTS showed improved knowledge,[57,76-80] while not improving knowledge in four other studies.[57, 81-84] Therefore, this is an area rich for further study, in general, and particularly in the inpatient setting. A first step would be to understand your sites' patient and family knowledge needs. To assess patients' knowledge or need for information, metrics exist: include the LINQ (Lung Information Needs Questionnaire)[51] that measures COPD information need and the MSHQ (Mount Sinai Hospital Questionnaire)[51] that measures COPD knowledge. A second step would be to develop and implement patient education across the spectrum of topics that are needed among your population. Although a definitive COPD general disease education program does not exist, should your site wish to provide education to patients about their disease, best practices for patient education should be performed (Table A) and/or you could utilize existing patient education resources (Table C).

### Action Plans/Self-management Plans

Action plans and self-management tools for chronic disease have been well-studied for asthma, with often but not consistently positive results.[85-89] Positive outcomes for action plans include increased knowledge, improved symptoms and some asthma-related health outcomes, including reduced acute care utilization.[87,88] Concerns around the evidence of action plans is that it is difficult to separate out the action plan from the education and therefore a Cochrane review of written asthma action plan efficacy in children and adults concluded that there was no "consistent evidence that written action plan produced better patient outcomes than no action plan or that one type of action plan was consistently more effective than another. This concern was echoed in another systematic review of adults and children.[88-90] Action plans and self-management tools for COPD self-management have been far less studied.[68] Among the existing studies, participants have been recruited in the outpatient setting, in contrast to pediatric asthma plans that are studied in multiple settings.[58, 69, 91] One program, the "Living Well Program" accessible at: http://www.livingwellwithcopd.com/, includes an action plan that has demonstrated a reduction in exacerbation recovery time, but not unscheduled healthcare utilization.[58] Another study used an action plan and found adoption of self-management skills, but not changes in quality of life or lung function.[91] Another program utilized an action plan with a nurse case manager and found improvements in accelerated recovery.[59] Although there is a dearth of literature to provide conclusive evidence for the use of COPD action plans for hospitalized patients, this is certainly an important area for study. To the extent that action plans overlap with your medication reconciliation efforts (see above), you can follow the steps outlined in that section. Otherwise, should action plans be an element that your site is interested in, best practices for patient education should be performed (Table A).

### Medication Knowledge, Skill, Titration

One key area of inpatient COPD education is around medications. Efficacious medications for control and relief of COPD symptoms exist. However, transitions of care from home to the hospital and then discharge can create confusion and misunderstanding for a topic that can already be overwhelming. Medication reconciliation efforts may or may not include patient and family education (see above section). However, regardless of the pathway by which patients and families receive it, medication education should be provided on several levels. First, it is imperative that patients, and if needed their caregivers/family, understand what each medication is that is prescribed and what that medication's indication is. This step in patient education is often missed. Once patients have a solid foundation of knowledge around the medications' names and indications, it is necessary that they can demonstrate understanding of when to take the medications. For controller medications, this includes numbers and times of day. For symptom relief, this means recognizing symptoms and understanding how much and how often to take their reliever medication(s). Although this is considered basic information by providers and is given to patients in the format of being on the packaging and prescription, patients often need specific education and opportunity to demonstrate their understanding to ensure proper adherence to the regimen. Next, another critical step to effective patient education is ensuring effective

medication skill-level. This is most salient with medications delivered around respiratory inhaler devices. It is easy to assume that if patients are prescribed and report taking their inhaler medications that they are receiving their prescribed doses. However, inhaler misuse is exceedingly common, even among high-risk hospitalized patients, and if not assessed and educated, patients are at high risk for returning to the emergency department and/or hospital for repeat exacerbations.[46,47] (See the section below.)

Finally, it is important at the time of discharge to ensure that patients are clear as to what, if any, changes are being made to their medication regimen. Medication changes, intended and unintended, often occur in the hospital. Medication reconciliation (see section above) is meant to provide clarity to providers through the transitions, including at admission, transfers and discharge, however patients need to be informed of these changes as well. For instance, patients may use one type of controller device at home, be prescribed a different controller medication while inpatient due to differences in formularies, and then be discharged home with this new inpatient controller device, but still have their old one at home. Or, patients may simply use the alternate device in the hospital, and be discharged with plans to return to their outpatient controller medication. Even if this is documented on discharge paperwork, it is critical that patients receive explanation of what the inpatient changes were, why they occurred and if/how the changes will affect their regimen at home. Patients should at all times be asked to demonstrate understanding.

One last point on medication patient education is addressing adherence. Adherence to inhaled medication has been found to be associated with reduced risk of death and admission to hospital for COPD.[75] Transparency between patients and providers can help elucidate barriers to adherence to medication regimens. For instance, patients may successfully go through the above steps: they may be able to identify their medications, explain their indication and dosing and demonstrate effective technique. However, if they cannot afford the medications, experience side effects, lack accessibility to the pharmacy, or have living situations that impede multi-day dosing schedules, lack of adherence can undermine all the efforts listed above. Identifying potential barriers in the hospital can help address these concerns. Programs to provide at least the first month of medications while inpatient can overcome several of these barriers.

**Non-medicinal treatment**

**Patient education for non-medicinal treatments, including pulmonary rehab (see Section 3.B) and smoking cessation (see Section 3.E).**

As indicated in other sections of this *Guide*, smoking cessation is a critical component of care for patients with COPD; and assisting patients who endorse understanding of the benefits of and methods for cessation and accepting cessation interventions should have transitional care coordination started in the hospital.[24,27,92,93] Tobacco cessation is the most effective intervention in reducing COPD progression and morbidity and is the only evidence-based intervention that improves the prognosis for COPD.[94-97] Smoking cessation is often not successful on initial attempts and effective smoking cessation programs need to address behavioral, physiological and psychological aspects of smoking.

In general, programs that can begin in hospital include advice to quit, pharmacological therapies (nicotine replacement therapy, antidepressants, nicotine receptor modifier therapy) and counseling with better efficacy applying combination strategies. Educating patients on the benefits of and methods for cessation can and should occur in the hospital.[93] Studies have shown that hospitalization can be a "teachable moment" whereby motivation to quit smoking may increase, perhaps in relation to severity or type of disease.[98] Further, hospitalization almost always means at least a temporary cessation of smoking for patients. However, patients often find ways to smoke while hospitalized, and if so, are less likely to successfully quit after discharge.[99] One study even found that providing brief counseling to patients about smoking cessation can be cost-effective.[100] Several early efficacy studies have demonstrated that inpatient counseling demonstrates early success, however, in many instances, relapse-prevention efforts are needed, as longer-term abstinence is harder to achieve with these efforts.[99,101,102] Of note, inpatient efforts often extend beyond education and counseling and include pharmaceutical interventions, including nicotine replacement therapy or non-nicotine smoking cessation medications as well (see Section 3E). One study with NRT found greater efficacy than counseling alone.[103] A systematic review evaluating inpatient smoking cessation programs with counseling plus or minus NRT, reiterated that the inpatient setting can be an efficacious time to assist patients with smoking cessation, but that translating these programs into practice is an ongoing challenge.[104]

**Providers of Education**

Inpatient self-management education may be best handled by a team approach. Barriers to inpatient education often include lack of time or resources and lack of provider training. By relying on a team of experts, patients may have increased access to the self-management education that is so critical to their successful transition out of the hospital.

Physicians are often the default assumed providers of self-education. However, physicians taking care of adult patients often receive little to no training on providing chronic disease education.[105,106] Therefore, physicians, even hospitalists, working in teams may provide broader reach and deeper expertise for patient education by reinforcing knowledge and skills critical to self-management.[93]

Pharmacists are obvious potential team members. Their training makes them ideal to help with medication reconciliation, as well as with skill-based training. Several studies have evaluated the use of pharmacists to provide inpatient COPD medication training. This work is highlighted above in medication reconciliation.

Respiratory therapists/Respiratory care specialties, nurses, APNs, PAs, social workers and case managers are also important members of the team who may provide patient education and/or counseling during the hospitalization.[107,108,109,110]

## Patient Education Barriers

### Health Literacy

About 80 million adults in the United States have limited health literacy.[114] Health literacy is the "degree to which individuals have the capacity to obtain, process and understand basic health information needed to make appropriate health decisions.[115] Patients with low or limited health literacy are at increased risk of poor health outcomes, including decreased self-management skills and increased emergent healthcare utilization.[114] Health literacy, however, is not static, but rather is dynamic, interfacing with patients' own literacy, efficacy and knowledge as well as health systems' input regarding educational information and patient-centered care.[116] Therefore, the health system carries significant but not sole ownership of the opportunity and responsibility to improve health literacy.[117] For instance, patients with limited health literacy are at increased risk of not taking medications correctly, from not being able to open bottles, to problems with knowledge on identifying medications, to poor skill with respiratory inhalers.[114,118,119,120] Health literacy is recognized as a national priority with several new federal policy initiatives addressing health literacy, in order to help improve the U.S. populations' health, decrease costs and minimize medical errors.[121] These policies include the Affordable Care Act, the Plain Writing Act and the National Action Plan to Improve Health Literacy.[121]

Patients with COPD who have limited health literacy are at increased risk of greater disease severity, worse quality of life, lower adherence to management regimens and higher healthcare utilization.[111-113] For patients hospitalized with COPD, the health system can improve patients' health literacy and ability to self-manage by using the hospital setting to provide assessments of knowledge and skill and then teach as needed to fill in the gaps. Patient education should follow general principles of health literacy-sensitive education. These principles include universal precautions, Teach Back and language concordant written materials at 6th grade or lower reading level, with short words, sentences, and paragraphs, diagrams as appropriate, large enough font and plenty of white space. For more information, resources and toolkits for developing and assessing patient education materials see Table A.

**TABLE A**

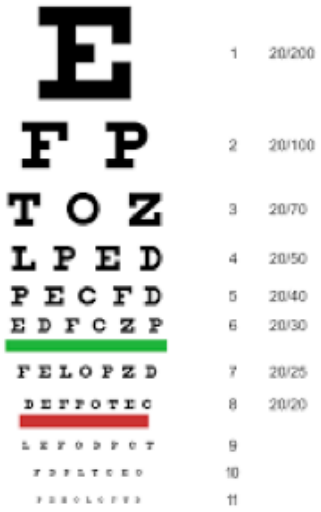
| | | |
|---|---|---|
| **AMA** | Patient Safety Monograph and Safe Communications University Precautions Tip Card | http://www.ama-assn.org/ama/pub/about-ama/ama-foundation/our-programs/public-health/health-literacy-program/health-literacy-patient.page? |
| **AHRQ** | Health Literacy Universal Precautions Toolkit | http://www.ahrq.gov/professionals/quality-patient-safety/quality-resources/tools/literacy-toolkit/healthliteracytoolkit.pdf |
| **Indian Health Service** | Health Literacy Toolkit: Patient Education Handouts | https://www.ihs.gov/healthcommunications/documents/toolkit/Tool15.pdf |

| | | |
|---|---|---|
| **CDC** | Simply Put: A Guide for Creating Easy-to-Understand Materials | http://www.cdc.gov/healthliteracy/pdf/Simply_Put.pdf |
| **National Network of Libraries of Medicine, Southeastern Atlantic Region** | Health Literacy Toolkit | http://nnlm.gov/sites/default/files/atoms/files/hltoolkit2015.pdf |
| **Harvard** | Guidelines for Creating Materials | http://cdn1.sph.harvard.edu/wp-content/uploads/sites/135/2012/09/resources_for_creating_materials.pdf |
| **Harvard** | Guidelines for Assessing Materials | http://cdn1.sph.harvard.edu/wp-content/uploads/sites/135/2012/09/resources_for_assessing_materials.pdf |
| **Harvard** | Guideline for Rewriting Materials | http://cdn1.sph.harvard.edu/wp-content/uploads/sites/135/2012/09/resources_for_rewriting_materials.pdf |
| **Multiple** | Additional Resources for Creating Materials | http://www.hsph.harvard.edu/healthliteracy/additional-resources-for-creating-and-assessing-materials/#Recommended Resources for Creating Print Materials |
| **Multiple** | Resources for Creating and Assessing Websites | List available at: http://www.hsph.harvard.edu/healthliteracy/additional-resources-for-creating-and-assessing-materials/#General Resources |
| **Readability Scores** | | |
| **G. McLaughlin** | SMOG Readability Formula (Simple Measure of Gobbledygook) | http://www.wordscount.info/wc/jsp/clear/analyze_smog.jsp |
| **G. McLaughlin** | SMOG Score (Simple Measure of Gobbledygook) | https://readability-score.com/ |
| **P. Moseenthal I., Kirsch** | The PMOSE/IKIRSCH Document Readability formula | http://cdn1.sph.harvard.edu/wp-content/uploads/sites/135/2012/09/pmose.pdf |
| **Doak, Doak, and Root** | The SAM Assesses texts | http://cdn1.sph.harvard.edu/wp-content/uploads/sites/135/2012/09/doakchap1-4.pdf |

**Vision**

In order for patients to rely on written informed consent documents, educational materials and discharge paperwork, it is essential that they not only have the appropriate literacy and health literacy, but can functionally use the materials with sufficient vision. As many as a third of hospitalized patients, including patients with COPD, do not pass basic vision screening.[122,123] Patients generally fall into one of three major categories, at about a third each: they do not have their corrective lenses with them in the hospital, they have their corrective lenses that do not sufficiently correct their vision, or they do not own or have corrective lenses.[122,124] Strategies to overcome vision-related barriers in the hospital include interventions aimed at ensuring that patients have access to their corrective lenses at all times. It is imperative that patients have confidence in the health system to ensure that their lenses will be safe from loss, theft or damage. For patients without lenses, for any reason, attempting to correct vision with non-prescription readers is a low-cost intervention.[123,124]

## TABLE B: VISION TOOLS

| Vision Tools | |
|---|---|
| Vision Screening |  |
| Corrective Lenses at Bedside |  |
| Non-prescription Readers |  |

## Language

Another critical barrier to assess for and address is patient language concordance with providers and written materials. More than 20 million Americans have limited English proficiency (LEP).[125] Barriers to language concordant care have been shown to decrease use of preventive services, increased severity of disease and higher resource utilization.[125-130] Further, patients with LEP are less likely to have informed consent for invasive procedures documented.[126] The Agency for Healthcare Research and Quality has "A Guide for Hospitals" to improve patient safety systems for patients with LEP (http://www.ahrq.gov/professionals/systems/hospital/lepguide/).[127] In addition, the Association of American Medical Colleges published their "Guidelines for Use of Medical Interpreter Services (https://www.aamc.org/students/download/70338/data/interpreter-guidelines.pdf).[128] In person, qualified, medical interpreters are the preferred translator for hospitalized patients.[129] Additional resources such as interpreter phones (two handsets better than one) and computer-based avatar interpreters are second-line. Ad hoc interpreters such as family members or medical staff with insufficient training are not encouraged.[129,130]

### Developing/Improving Patient Education and Self-management

When developing or adopting (Table C) inpatient self-management education programs, relying on the following principles can help:

| Step | Tool/Resource |
|---|---|
| 1. Identify patient/family knowledge, skill or self-efficacy need. | |
| a. information | LINQ (Lung Information Needs Questionnaire)[51] |
| b. knowledge | MSHQ (Mount Sinai Hospital Questionnaire)[51] |
| c. skill-inhaler technique | MDI, Diskus checklists[46,47] Table A |
| 2. Determine patient education opportunities that you want to provide. | |
| 3. Determine team members to provide education. | |
| 4. Determine if existing interventions exist or if programs need to be developed. | |
| 5. If developing new or adapting programs, ensure principles aligned with patient-centeredness, health literacy, language and if needed tech literacy exist. | Follow steps outlined by Bourbeau and van der Palen[61] |

| Step | Tool/Resource |
|---|---|
| 6. Pilot a program using a PDSA QI program. | |
| 7. Evaluate program. | |
| 8. Determine resources needed to scale up and implement more broadly. | |

## TABLE C: PATIENT EDUCATION RESOURCES

| Topic | Source | Resource Type | Resource Title/Link |
|---|---|---|---|
| COPD | ACP | Brochure | https://www.acponline.org/patients_families/pdfs/subspec/copd.pdf |
| COPD | ACP | DVD | Coping with COPD: A Guide for Patients DVD |
| COPD | ACP | Guidebook | Living with COPD. Available in English and Spanish as pdf free to download.<br>English: https://www.acponline.org/patients_families/products/brochures/protected/CPP3010_Living_With_COPD_Guide_2014_update.pdf<br>Spanish: https://www.acponline.org/patients_families/products/brochures/protected/COPD_Spanish.pdf |
| Inhaler/spacer | GOLD-84 | Instructions for Inhaler and Spacer Use | Available from: http://www.goldcopd.org/Other-resources/other-resources-instructions-for-inhaler-and-spacer-use.html.<br>Accessed June 14, 2015. |
| Nebulizer | U.S. National Library of Medicine[92,95] | Instructions for Nebulizer Use and Cleaning | http://www.nlm.nih.gov/medlineplus/ency/patientinstructions/000699.htm |
| Multiple COPD Topics | U.S. National Library of Medicine | Multiple Patient Hand-outs | http://www.nlm.nih.gov/medlineplus/copd.html#cat69 |
| Multiple Topics | COPD Foundation | Patient/Family/ Caregiver Materials | http://www.copdfoundation.org/Learn-More/Educational-Materials/Downloads-Library.aspx |

## 4. Device Education

Although no existing medication for COPD has been shown to conclusively alter the course of physiologic decline, several pharmacologic therapies are used to reduce symptoms, exacerbation frequency and severity, and to improve quality of life through enhanced exercise tolerance and overall health status.[24] Many of these therapeutic options are delivered through respiratory inhaler devices. Multiple devices exist and new devices are being developed regularly.[131] Device selection should be made carefully, based on the patients' dexterity, health literacy, number of different devices and cost.[131] Although nebulizer machines may be required for patients with limited dexterity, impaired cognition or patient preference, efficacy of medications delivered by respiratory inhalers is equivalent to that provided by nebulization when inhalers are used effectively.[132-134] Should a respiratory inhaler device(s) be prescribed, the GOLD guidelines for COPD indicate that use of any respiratory inhaler device prescribed to a patient for COPD should be taught and evaluated by healthcare workers.[135]

### Teach-to-Goal

Inhaler teaching should include demonstration of the device by a healthcare worker trained in its correct use and evaluation of patient understanding through patient re-demonstration or "teach back."[46,47,120,135] Because studies have shown that high-risk, frequently hospitalized patients often misuse their respiratory inhalers, teaching and evaluation should occur during hospitalization and/or at time of discharge from the hospital.[46,136] In-person use of a teach-to-goal [TTG] strategy has been demonstrated to improve patients' technique.[46,47,70,120] This TTG strategy employs a patient-centered, iterative approach to assessing, teaching and re-assessing patients' inhaler use skills. Patients should first demonstrate their baseline inhaler technique to an observer who can determine which steps patients miss. This observer can then demonstrate correct technique, emphasizing aspects that were inadequately performed initially. Then the patient can re-demonstrate use following the demonstration, whereby the observer can determine if sufficient skill has been obtained. This cycle of assessment and education can continue until the provider is assured of correct use. This TTG strategy has been compared head-to-head through randomized clinical trials demonstrating superior effect over a simple, brief intervention that included reading the instructions for the inhaler use out loud.[47,70] Further, in two of the studies, a composite outcome of 'acute care events' that included ED visits and/or hospitalization was studied. TTG had fewer acute care events within 30 days than the brief intervention in both studies.[47,70] Although inpatient inhaler technique improves using TTG and 30-day acute-care events decline in TTG cohort, important caveats exist. First, patients' inhaler skill declines within 30-days, indicating that repeated education and assessment are needed for patients after discharge.[70]

Determining who will provide the device training will differ by site/institution. A team approach may work. However, providers may need to be trained on the teach-to-goal strategy or even how to use inhalers prior to implementing a patient inhaler training program.[137,139] For instance, despite nurses' common role of providing inhaler teaching during hospitalization or at discharge, nurses often over-estimate their inhaler technique skill.[137,138] Similarly, physicians also over-estimate their confidence compared to their inhaler technique knowledge.[105,137,140] Even pharmacists' baseline inhaler skills vary across devices and among providers.[137,141] Taking a team approach may allow for broader reach for expertise. Beyond physicians, nurses, nurse practitioners,[142] respiratory therapists and pharmacists have been utilized successfully for inpatient inhaler eduation.[135] Studies have shown that nurses, pharmacists and physicians have shown that with teaching they too can obtain the skills needed.[141,143]

Although respiratory inhaler devices, when used correctly, are as efficacious as nebulized treatments, there are patients who cannot use the inhaler devices due to mechanical or cognitive reasons.[132-134] If and when it is determined that respiratory inhaler devices are not suitable for the patient, due to mechanical (e.g., arthritis) or cognitive (e.g., dementia) reasons, nebulizers should be considered, when possible, to deliver inhaled medications. Patients and their caregivers should be provided instructions on how and when to use the nebulizer machine to deliver medications, as well as how to take care of the machine (see Table D).[24,144,145]

### TABLE D: TOOLS AND RESOURCES

| Device(s) | Assessment/Education | Tool |
|---|---|---|
| MDI, Diskus | Assessment and Education | Checklist + TTG[46,47] |
| MDI, Diskus, Turbohaler, Aerolizer, Handihaler | Assessment | Checklist[146] |
| MDI, Diskhaler, Rotohaler, Turbuhaler | Assessment | Checklist[147] |
| Nebulizer Machine | Use and Cleaning | Patient Education Sheet[144] |

## MDI CHECKLIST[46] TTG[47]

### MDI with Spacer

Trained assessor to read to participant: "Please show me exactly how you use your MDI at home."

| | | |
|---|---|---|
| 1. Removes cap of inhaler and spacer | ❑ $_0$wrong | ❑ $_1$correct |
| 2. Shakes inhaler up and down | ❑ $_0$wrong | ❑ $_1$correct |
| 3. Attaches inhaler to back of spacer | ❑ $_0$wrong | ❑ $_1$correct |
| 4. Breathes OUT fully | ❑ $_0$wrong | ❑ $_1$correct |
| 5. When breathing out fully (step #4), does so away from spacer/MDI | ❑ $_0$wrong | ❑ $_1$correct |
| 6. Puts spacer mouthpiece or MDI mouthpiece (if not using spacer) into mouth, closes lips around mouthpiece. | ❑ $_0$wrong | ❑ $_1$correct |
| 7. Activates inhaler by pressing down on canister 1 time | ❑ $_0$wrong | ❑ $_1$correct |
| 8. Breathes IN SLOWLY, filling lungs with medicine. No whistle should be heard | ❑ $_0$wrong | ❑ $_1$correct |
| 9. Holds breath for at least 5 seconds (with or without spacer in mouth) | ❑ $_0$wrong | ❑ $_1$correct |
| 10. Removes spacer/MDI from mouth before breathing normally | ❑ $_0$wrong | ❑ $_1$correct |
| 11. Breathes normally for at least 30-60 seconds | ❑ $_0$wrong | ❑ $_1$correct |
| 12. Repeats sequence for second puff | ❑ $_0$wrong | ❑ $_1$correct |

**Score: ___ / 12**

### Diskus®

Trained assessor to read to participant: "Please show me ❑ exactly how you use your Diskus® at home."

| | | |
|---|---|---|
| 1. Uses thumb or finger in thumb grip to open device until the mouthpiece appears | ❑ $_0$wrong | ❑ $_1$correct |
| 2. Keeps Diskus® horizontal prior to Step #3 & until Step #7 completed | ❑ $_0$wrong | ❑ $_1$correct |
| 3. Slides lever once until it clicks | ❑ $_0$wrong | ❑ $_1$correct |
| 4. Breathes OUT fully | ❑ $_0$wrong | ❑ $_1$correct |
| 5. When breathing out fully (step #4), does so away from Diskus® | ❑ $_0$wrong | ❑ $_1$correct |
| 6. Presses lips tightly above & below mouthpiece opening | ❑ $_0$wrong | ❑ $_1$correct |
| 7. Breathers IN QUICKLY, filling lungs with medicine | ❑ $_0$wrong | ❑ $_1$correct |
| 8. Holds breath for at least 5 seconds (with or without Diskus® in mouth) | ❑ $_0$wrong | ❑ $_1$correct |
| 9. Removes Diskus® before breathing normally | ❑ $_0$wrong | ❑ $_1$correct |
| 10. Closes Diskus® by placing thumb or finger in the thumb grip & sliding it closed | ❑ $_0$wrong | ❑ $_1$correct |

**Score: ___ / 12**

## 5. Nutritional Assessment and Management

Weight loss and muscle wasting are present in one-quarter to one-third of patients with stable COPD and worsen in periods of hospitalization, contributing to increased mortality and morbidity.[24-26] A recent multidisciplinary Task Force was created by the European Respiratory Society to deliver a summary of the evidence and description of current practice in nutritional assessment and therapy in COPD.[148] The Task Force identified different metabolic phenotypes of COPD as a basis for nutritional risk profile assessment and suggests utility in clinical trial design and perhaps patient counseling. Although the evidence base is not robust enough to make strong recommendations, the Task Force indicated that nutritional intervention is probably effective in undernourished patients and probably most when combined with an exercise program. Overall, the evidence summarized in the statement indicates that a well-balanced diet is beneficial to all COPD patients, particularly when considered with proven benefits across common multi-morbid conditions common in COPD including reduction of metabolic and cardiovascular risk. Nutritional interventions are generally used when BMI is less than 21 $kg/m^2$ and/or significant involuntary weight loss has occurred (>10 percent during previous six months or >5 percent in the past month). Nutritional supplementation often includes energy-rich supplements in quantities divided during the day. Post-hospital care can consider nutritional consultation and incorporation of nutritional expertise in multidisciplinary management teams.

## 6. Home Oxygen

Long-term administration of oxygen (>15 hours per day) has been shown to improve survival in patients with COPD and severe resting hypoxemia (PaO2 <55 mm Hg or as operationalized by CMS, SaO2 <88 percent).[149,150] Long-term use of supplemental oxygen strives to maintain vital organ function by ensuring adequate oxygen delivery by increasing the baseline PaO2 to at least 60 mm Hg or to a saturation of at least 90 percent. Additional benefit has been shown to quality of life, depression, cognitive function, exercise capacity and frequency of hospitalization. Oxygen saturation of ≤88 percent is considered respiratory failure in need of oxygen therapy that is reimbursed by CMS and generally in patients with marginal oxygenation saturation in range of 89-93 percent further evaluation for activity or nocturnal desaturation is done. Additionally, air travel or ascent to high altitude exposes patients to hypobaric conditions, which increases risk of hypoxemia. For example, pressurizing of an aircraft cabin to approximately an altitude of 8,000 feet allows ascent to much higher altitudes but oxygen supplementation is indicated if the predicted PaO2 at 8,000 feet is less than 50 mm Hg.[151] Those with an SpO2 greater than 95 percent or a PaO2 greater than 72 mm Hg while breathing ambient air at sea level will most likely not require oxygen supplementation.

Oxygen therapy has not been demonstrated to improve survival or dyspnea in patients with less severe hypoxemia or in those with only nocturnal arterial desaturation. Additionally, ability to determine effectiveness of supplemental oxygen during activity in patients with COPD is complicated by variable criteria for defining exertional desaturation and lack of uniformity in standardized exercise protocols. For intermittent use, no data show symptomatic benefit from short bursts of oxygen therapy before or after exercise, although some patients may recognize an improvement in dyspnea following activity.

Despite this, CMS will reimburse intermittent oxygen use for the following criteria:

- Desaturation of PaO2 <55 mm Hg either with activity or at night
- Resting PaO2 55-59 mm Hg (SaO2 89-90 percent) with any one of the following:
  - Peripheral edema suggesting congestive heart failure
  - Evidence of pulmonary hypertension
  - Polycythemia (hematocrit >55 percent)

Use of supplemental long-term oxygen therapy by patients with COPD is common, with more than one million Medicare recipients using oxygen at an annual cost of more than $2 billion.[152,153] Oxygen therapy may be associated with adverse effects that include changes to ventilation/perfusion (V'/Q') mismatch and physical hazards during the storage and handling of oxygen, especially fire risk in those using open flames or concurrent smoking.[24,154] The major physical hazards of oxygen therapy are fires or explosions. Although oxygen tubing and cannulas are constructed of fire-retardant plastic, both the plastic and the patient's nose will burn in the presence of a flame and oxygen in high concentrations. Oxygen is also difficult for patients with both the burden of carrying devices and social stigma resulting in poor adherence or barriers to maintaining active lifestyles.

Because of potential risks, harms and substantial costs, oxygen saturation should be measured and recorded at all encounters for patients. All patients prescribed oxygen must be recertified every 12 months for Medicare and Medicaid reimbursement. If room air oxygenation has improved on therapy, oxygen may be discontinued. As part of the American Board of Internal Medicine Foundation's Choosing Wisely® campaign the American Thoracic Society (ATS) and American College of Chest Physicians (ACCP) listed oxygen use as one topic among a Top 5 list for adult pulmonary medicine: ***"For patients recently discharged on supplemental home oxygen following hospitalization for an acute illness, do not renew the prescription without assessing the patient for ongoing hypoxemia."***[155] The rationale states that hypoxemia associated with an acute illness often resolves within days to weeks. Data suggests that 30-50 percent of patients prescribed home oxygen during an acute illness no longer meet criteria when reassessed two to three months later.[156,157] Patients who had home oxygen discontinued after a two-month assessment showing they no longer met criteria had no significant decrement in health-related quality of life compared to those who continued home oxygen without reassessment. Thus during transition of care from hospital that includes the initiation of home oxygen use, clear coordination should ensure reassessment of oxygen therapy needs no later than 90 days during convalescence at a time of clinical stability.[158,159]

## 7. Communication with PCPs/Pulmonologists

The Society of Hospital Medicine (SHM) identifies communication between care providers as an essential part of medical care that influences the quality of life and effectiveness of treatment for patients.[160] Hospitalists are a growing pool of providers who often have the leadership and ownership of patients hospitalized with COPD. It is critical, however, regardless of the inpatient providers' title, that the primary provider of the inpatient with COPD communicate with the patients' outpatient

providers, both primary care and pulmonologists, to ensure safe transitions. Patients, for instance, are often discharged with laboratory and other study results still pending. Patients are often overwhelmed with the self-care tasks required of them after discharge and will therefore need reinforcement of self-management education once discharged. However, direct communication between inpatient and outpatient providers occurs less than 20 percent of the time.[5,160] Indirect communication, through discharge summaries, for instance, is also less than ideal, as the discharge summaries are often unavailable or lacking in specific and important information when the patients present to their outpatient providers.[5,160] In response to the importance of provider-to-provider communication across care transitions, several societies and guidelines provide information, guidelines and toolkits to aid in this process. Example toolkits are available in the Appendices; they include SHM Project BOOST®, the ATS: Integrated Care of the COPD Patient, ATS/ERS Task Force and the GOLD Report Guidelines.[24-25, 160-161]

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# Section IV: Deploying, Implementing and Evaluating Interventions

## A. Implementing Changes in Your System

After you have identified your COPD performance metrics and determined your baseline performance on those metrics, your QI team will need to develop solutions and intervention strategies at various points in the patient encounter. Natural options include at the time of hospital admission, during the inpatient stay and around the time of discharge.

As you evaluate opportunities for systems change, consider incorporating general principles of patient safety in your efforts:

- Reduce reliance on memory. Systems that combine clinician education with additional strategies that do not depend primarily on clinician memory to do all the necessary QI steps will provide the most comprehensive results.
- Use fail-safe systems and forcing functions. By using methods that integrate into provider workflow with fail-safe systems and forcing functions, your initiative will have a greater likelihood of success. Thus, provider-based point-of-care alerts within the EMR that require completion will ensure that the appropriate assessments will be done. Of course, electronic alerts will need to be well integrated into workflow so the requirements are easy to complete.
- Standardize and simplify processes. Assessments need to be standard across the care continuum so the same risk stratification tools are used every time. Clinicians will more likely accept processes that are simple and well designed and also not redundant.
- Enhance access to complete and timely information. To assist clinicians in completing assessments, access to a fully updated medical record will ensure that the information that is being entered is correct. For example, pop-up alerts, if within the EMR, should allow clinicians to close the alert, access clinical information and then return to the content of the reminder rather than forcing the clinician to complete the information with no opportunity to re-access the patient chart.
- Improve cycle time. Use the principles of rapid-cycle PDSA (Plan-Do-Study-Act), instead of waiting until you have a perfect solution. Be willing to attempt small tests of change. This will create continuous learning, will keep members of your QI team engaged and will reduce the time it takes to arrive at effective solutions.

Once you have determined baseline rates of performance you can develop specific interventions intended to close gaps in care. Layering multiple interventions rather than focusing on one particular intervention will improve the effectiveness of any QI initiative because redundancy is a feature of high-reliability systems. The relative effort placed on each intervention will depend on the infrastructure, barriers to change and resources at your institution.

One approach to structuring your project with the layering of multiple interventions is to consider the points in the patient encounter that are opportunities for intervention. Table A notes multiple interventions that will be discussed in more detail in this section and sorts their impact at various points in the patient encounter

**TABLE A.**

| | Admission | During Hospital Stay | Time of Discharge | Post-Discharge |
|---|---|---|---|---|
| Provider Education | X | X | X | |
| Order Sets to Help Guide Care | X | X | | |
| Tools for Risk Stratification | X | | X | |
| Protocol for Use of Noninvasive Ventilation | X | X | | |
| Discussions Regarding Patient Goals | X | X | X | X |
| Patient Education | | X | X | X |
| Discharge Bundle | | | X | X |
| Audit and Feedback | | X | X | X |
| Organizational and Operational Change | X | X | X | X |

## 1. Focus on Provider Education

The first step in a successful COPD initiative is to ensure that you have educated all providers at your institution about the clinical and economic significance of COPD and of the need to make improvements in care. Your QI team should engage providers in educational seminars and lectures and increase visibility on the need for evidence-based care. Example of approaches include:

- Development of educational programs on COPD for providers at events such as grand rounds, noon conferences or division meetings. The focus of these sessions should be to review current COPD guidelines as well as opportunities for improving care at your institution.
- Distribution of educational materials (e.g., pocket cards), that are developed locally or obtained from national organizations (e.g., COPD Foundation).
- Links to educational materials within order sets in the EMR environment. At the time of completion of an admission order set, links to the literature would be an excellent opportunity to provide valuable references that would assist in management of patients with COPD.

- Ensuring visibility of the COPD initiative on patient floors. Posters, signs and project boards at your institution provide visible reminders of the key concepts of your QI project to all constituents in the hospital.
- Development of RN education campaign that could involve all members of the interdisciplinary team. By focusing education efforts on all members of the healthcare team, your improvement efforts will be potentiated, as team members could work in conjunction with providers.
- Development of a continuing medical education (CME) program led by physician leaders with expertise in COPD. Frontline hospitalists, academic leaders and pulmonologists can provide education in structured CME formats.
- Identification of a physician champion to lead hospital-wide education efforts. An individual with visibility and respect within your institution can be used to effectively communicate the quality gap and discuss tools available to assist in provider decision-making.
- Dissemination of information about quality initiatives at medical staff meetings. Incorporating data on the COPD quality initiative at faculty meetings amongst other topics most often discussed such as value-based purchasing, patient satisfaction, readmission rates and adverse events will assist in the staff education process.

## 2. Admission Order Sets

In hospitals that have EMR and CPOE (Computerized Physician Order Entry) systems, these are among the most powerful tools for implementing change. Order sets provide clinical decision support around the appropriate use of medications and non-pharmacologic therapy, and can be used to facilitate consults to services such as nutrition (described in Sections 3.G and 3.I) and pulmonary rehabilitation. Your team will need to have an understanding of the capabilities of your individual hospital's IT systems and how the admission order entry process is structured. If your institution uses disease-specific order sets, then developing or updating an order set for COPD is a natural place to begin. On the other hand, if your institution uses generic admission order sets, then you will need to develop an alternative strategy for bringing the appropriate content to the ordering providers. For example, sometimes it can be possible to link disease-specific order sets within a larger generic admission order set. Order sets and EMR vendors also vary in their capacity to incorporate tools like risk calculators into order sets. In some cases the best you may be able to do is embed static, text-based recommendations to address matters such as risk factors for mechanical ventilation or mortality, whereas in other instances it may be possible to embed dynamic risk calculators into the order set. These dynamic calculators can automatically pull data from a patient's laboratory results or vital signs to calculate a risk score each time the order set is opened. In so doing these reduce the need for providers to navigate between sections of the EMR to fetch data and carry out manual computations. An example of a simple COPD order set is provided in the Appendix.

## 3. Tools for Risk Stratification

As described in Section 3.C, risk stratification plays an important role in clinical decision making for patients with COPD. At the time of hospital admission a clinical prediction instrument such as the BAP-65 or CURB can be used to determine a patient's risk for respiratory deterioration, or to predict the risk of mortality. Other predictive instruments can be used to estimate a patient's risk for readmission. Additionally, risk stratification is an essential component of the GOLD guidelines, in which it is used to define recommended pharmacotherapy and role of adjunctive therapies like pulmonary rehabilitation. As discussed above, strategies for the implementation of risk stratification tools will need to be developed in the context of the capabilities of the institution's EMR. Ideally, the EMR can be configured in order to minimize the amount of data entry required by clinicians, particularly if these data are already contained within the system. Other approaches for implementing risk stratification tools include the development of pocket cards and mobile apps. Forcing functions (such as requiring a score to be calculated before entering admission order) can be considered, but should be undertaken cautiously and with significant pilot testing given the lack of strong evidence that such approaches lead to better patient outcomes, and in light of the high risk of aggravating and alienating frontline clinicians.

## 4. Protocol for Use of Noninvasive Ventilation

As described in Section 3.E, noninvasive ventilation is a cornerstone of therapy for patients with acute respiratory failure. While use of noninvasive ventilation has increased in recent years, considerable variation across hospitals highlights opportunities to standardize the use of this technique. Examples of protocols for patient selection and use of noninvasive ventilation are provided in Section 3.E as well as in the Appendix. Potential strategies for implementation include development of a paper-based protocol that is physically linked to noninvasive ventilators, and incorporation into the EMR through ventilation order sets and in documentation tools used by respiratory therapists.

## 5. Discussions Regarding Goals of Care and End-of-Life Care

As described in Section 3.H

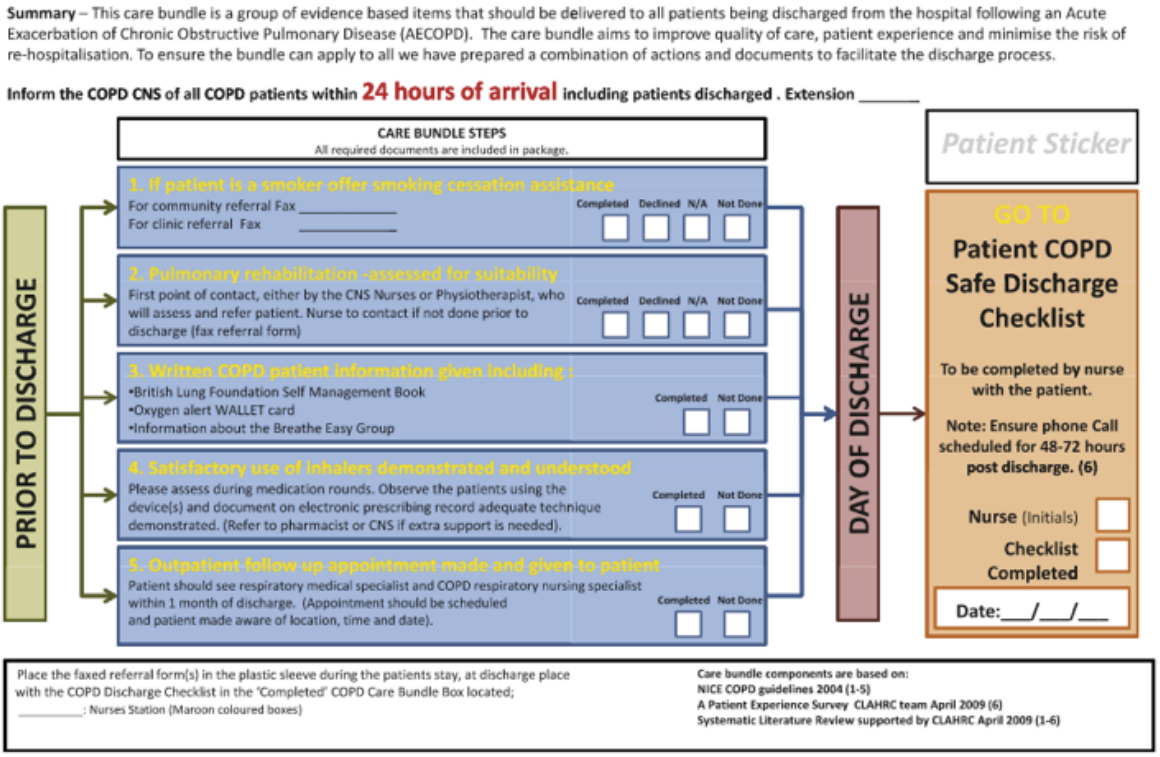
## 6. Strategies for Improving Patient Education

As described in Section 3.I, providing patients with general education about their disease, action plans for what to do in the event of an exacerbation, and proper use of respiratory inhaler medications are critical to ensuring optimal outcomes. These topics typically represent some of the lowest hanging fruit in efforts to improve care quality for patients with COPD who have been hospitalized. If your team confirms opportunities to improve the delivery of patient education you will likely need to develop new educational material (see Section 3.I and Appendix) and will want to evaluate different strategies for how to best carry out these activities. Options include nurses, pharmacists, pulmonary rehabilitation nurses and physicians, or some combination of these. Decisions will ultimately need to be tailored to

the local environment and will benefit from small tests of change and willingness to experiment and learn. A great deal of information to guide these implementation efforts is presented in Section 3.I.

## 7. Development and Implementation of a Discharge Bundle

The concept of a care 'bundle' was first popularized by the Institute for Healthcare Improvement more than a decade ago, and since then has become a popular approach to organizing care and improvement activities. A number of transitional care elements for patients with COPD lend themselves to incorporation into a bundle, including patient education (as described above), smoking cessation counseling, vaccination, referral to pulmonary rehabilitation, nutrition assessment and scheduling a follow-up appointment (as described in Sections 3.A, 3.I). Early experience in the use of bundles for COPD has been positive, however additional studies are needed to clarify the selection of bundle elements, and optimal approaches for bundle implementation. Implementation of the bundle can be done with paper-based forms, which are often preferable during an early pilot stage because they are likely to need frequent revision. Later on the bundle elements can be incorporated into electronic discharge documentation. Finally, as has been described elsewhere, triggers can be programmed into the EMR that might launch a discharge bundle documentation tool at the time a discharge order is placed. Careful consideration is needed regarding who will ultimately be responsible for completing the bundle documentation and ensuring that bundle elements are completed prior to discharge. An example of a discharge bundle is shown below:




Reproduced from Hopkinson NS. *Thorax.* 2012;67:90 e92. doi:10.1136

## 8. Organizational and Operational Change

As noted in an earlier section of this *Guide*, creating a shared need for your QI project with important constituencies in the hospital and obtaining institutional support from hospital administration will be critical to your QI group's success. Your team will need to procure resources and infrastructure to allow you to operationalize your project. As one example, you may need to develop new roles or modify existing roles to support the functions necessary for high-quality medication teaching to complete. Additional strategies for improving care that might be considered as part of the process or reengineering your COPD program include the creation of a respiratory unit where all patients with exacerbations of COPD can be treated, the purchase of additional noninvasive ventilators, the use of automated consults to pulmonary or pulmonary rehabilitation for qualifying patients (with potential increase in staffing needs) and the use of a bundle.

## 9. Audit and Feedback

Audit and feedback is an evidence-based strategy for improving adherence to guideline recommendations. Giving feedback to providers regarding progress in achieving the goals of the COPD QI project can be an effective method to support the change process. Reports detailing changes in processes of care and outcomes can be hospital-, unit- or provider-specific, although case volumes and team-based approaches to care do not usually support provider-specific reporting.

## B. Monitoring the Effect of Your Interventions

Tracking and trending process and outcomes data over time will be important to monitor the progress of your COPD QI project. Robust data collection strategies will be needed to track your performance over time through automated queries of the EMR or by random sample abstraction of electronic charts. As described in previous sections of this *Guide*, your QI team may choose to track a variety of different outcomes, including process measures (such as the percentage of patients who receive appropriate treatment with steroids and antibiotics, or appropriate medication counseling), or outcomes such as readmission. Visual methodologies, such as graphs or run charts, may enhance your ability to understand and communicate your results. You will need to analyze any possible variation from your protocol to determine methods to improve your outcomes rates. In addition, you will need to develop a control phase of your project. The control phase ensures the solution is sustained and the process will not revert to the original state. It also shares the lessons learned across the organization and helps accelerate similar improvements in other areas. The key components of a control plan include a strategy of maintaining the improved process performance over time and definition of specific actions and tools required for sustaining the process improvement or gain.

## C. Choosing Metrics and Developing a Data Collection Plan

Implementing and sustaining quality improvement requires that care teams and institutions have reasonably accurate and reliable ways to understand the level of quality of care provided and iteratively measure that care in response to deploying interventions. Despite evidence that patients with diverse health conditions, including COPD, commonly do not receive recommended care despite the proliferation of clinical practice guidelines, there is a lag to measurement strategies that facilitate the essential elements of systematic practice change.[1] Quality of healthcare can be defined as the "...degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge."[2]

Despite the burden of COPD and available guidelines, deficiencies in the delivery of recommended care have been documented for patients with hospitalized care and acute exacerbations of COPD.[3-7] Despite the morbidity, cost, prevalence and economic impact associated with COPD's clinical consequences and recognized care gaps, strategies to speed the translation of guideline-recommended treatments into the routine clinical care of patients hospitalized for COPD are minimal. In general, inadequacies of care stimulate regulatory and oversight agencies to increase provider accountability by linking the results of performance measures to value-based reimbursement and public reporting.[1,8,9] For COPD the breadth of available external metrics remains limited, and actionable measures are often better drawn from the local implementation goals and priorities of institutions.

The GOLD guidelines provide an approach to determine the patient's severity of illness and the appropriate maintenance therapy to be implemented. One approach to categorize quality metrics reflects a Donaedian's framework for quality improvement in healthcare:

- Outcome measures that evaluate the effects overall on accomplishing the aim of interventions often related to results pertaining to health or stakeholder's interest (e.g., mortality; hospital readmissions; average length of stay; satisfaction),
- Process measures that evaluate the things providers and healthcare systems do and that look at if changes targeted by implementation are occurring (e.g., percent of patients screened for ventilation failure; percent of patients undergoing assessment of MDI use; how often action plans are included in discharge instructions), and
- Structural measure that evaluate existing resources and personnel are present to support the care processes and outcomes (e.g., leadership engagement, respiratory therapists involved in ED care; patient education material available for nurses to use; practice MDIs for improving patient knowledge and adherence to inhaled medications).[10-13]

The components of the science and art of quality care should be an overarching emphasis on the legitimacy of patient values and goals on the judgment of quality leading to patient-centered care. These aspects of care evaluation for interventions aimed at improving the quality of COPD care should iteratively move toward exploring health services that are delivered within the framework of systems and oriented toward desired outcomes for patients with a reliance on the values and perspectives of patients and families as well as shared decision-making preferences as part of quality care.

## 1. No Perfect Measures: Trade-offs in Quality Assessment

If we had sufficient ability to understand the absolute relationships between structure, process and outcome measures, we could select COPD metrics that were easy to obtain and precisely and reliably determine the most important aspects of quality of care. However, easy and comprehensive determinations are unlikely, and measure selection is based on trade-offs in selecting quality assessments that approximate key areas of care that are most important, have the potential for quality improvement and are under at least some control of healthcare professionals. Quality assessment is improved by using multiple measures across structural, process and outcome components. For the most part, outcome measures are limited because most are only minimally determined by delivered healthcare services and thus either require complex methods to adjust for risks and control for other determinants to fairly assess and compare quality or are left to approximate trends from interventions. Structural components are often designed to ensure necessary aspects of the care delivery but are limited by minimally linking to outcomes of healthcare delivery. Thus, process measures generally constitute the bulk of quality assessments especially when refining desired actions of providers within quality improvement and yet are only useful if the evidence base can link delivery of care components to desired outcomes.

## 2. Measuring What Data to Support

Finally, measuring selection needs to consider the resources and data sources (survey instruments, administrative data, batched electronic medical records, provider-patient observation, medical record review, existing national/regional data collections or evaluations, and others). For the most part, the method and data source will follow the intent of the assessment and metric details. Thus, selection based on the usability of measures should include consideration of the following aspects: objectivity defined by sufficient precision and detail of measurement, stable interpretation, verifiability by external examination or other documentation, uniformity that will allow use across care settings and providers, specificity to diseases or processes to ensure consistency, pertinence in that the measures are demonstrably related to stated goals and acceptability in that measures conform with the evidence base and are agreeable among stakeholders.[14-18]

## 3. Where to Look for Previously Developed Measures for COPD

Nationally reported measures have been developed by NCQA (HEDIS) and are housed in national repositories such as the Agency for Healthcare Research and Quality National Quality Measures Clearinghouse, the National Committee for Quality Assurance, the National Quality Forum or the Physician Consortium for Performance Improvement.

In general these data might constitute ways to motivate initial implementation efforts, benchmark with regional or national trends and give long-term temporal data on care delivery. Once implementation efforts are prioritized at a care facility or across a delivery system, then quality metrics should focus on comprehensive understanding of the key steps in a care delivery process to inform identification of specific targets for improvement and determination of the baseline characteristics and performance in key locations. Part of the objective is to understand patient volume, scope of the COPD population of interest, and identification of resource needs to add or enhance care delivery strategies. Such metrics provide data for identification of the scope and sustenance within a facility, suggest targets for clinical decision support tools and ensure program planning and coordination has the data needed to integrate care goals. These demographic and frequency measures also ensure that COPD patients can be identified and that needed data elements can be obtained to inform both implementation and care delivery. Baseline process and outcome measures are then needed to guide quality implementation initiation, aid in setting performance targets, explore for unintended consequences and track improvement over time. After initial strategies are deployed, exploring a small sample of patients comprehensively can help establish needed checks in the system and then a select few target measures can track month-to-month performance.

For example, if a hospital wanted to improve care of acute exacerbation (AE) by deploying a bundle of care components for care at hospital discharge, metrics should include the key processes and reasonable outcomes expected by the interventions. Candidate measures include the weekly rates of new hospitalized patients, where the admission originated, how many were readmitted at 30 and 180 days and how many people were receiving desired care aspects of care practices (use of smoking cessation counseling; use of nicotine replacement therapy; smoking status at six months; influenza and pneumococcal vaccination; documentation of assessment and training regarding inhaler technique; use of home oxygen; use of medications, e.g., inhaled steroid, long-acting beta agonist or long-acting anticholinergic; screening for depression; structured communication with primary care physician; use of pulmonary rehabilitation; and functional/symptom assessments, e.g., CAT/mMRC). Additional metrics for more developed programs should also target mortality rates, adverse events and patient-reported HRQoL. For simpler projects focusing on just one care aspect, for example improving the use of spirometry, metrics follow the process map key steps and might be limited to only tracking use of an order set and trending an already collected HEDIS measure for incident administratively derived rates of spirometry performance.

See possible kind of potpourri Table from Heffner et al.[7]

Percentage of patients with COPD who had a spirometry evaluation documented

Percentage of patients with COPD ≥18 years old assessed for pneumococcus immunization status

Percentage of patients ≥18 years old with a diagnosis of COPD who received a pneumococcus immunization

Percentage of patients with COPD who have had influenza immunization in previous season

The number of admissions for COPD per population or time interval

Percentage of COPD exacerbations for members ≥40 years old who had an acute inpatient discharge or ED encounter a systemic corticosteroid within 14 days of the event

Percentage of patients with COPD whose physician inquired about smoking cessation

Percentage of patients ≥18 years old with a diagnosis of COPD identified as smokers who received a smoking cessation

Percentage of patients ≥18 years old with a diagnosis of COPD and an oxygen saturation less than or equal to 88 percent or equal to 55 mm Hg prescribed long-term oxygen therapy

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# Section V:
# Appendices

# Appendix A: ATS: Integrated Care of the COPD Patient[1]

The American Thoracic Society (ATS) developed and published their official workshop report on the integrated care of the COPD patient. This document can be accessed at: http://www.thoracic.org/statements/resources/copd/integrated-care-of-copd-patient.pdf.[1] Their executive summary highlights that COPD "requires an integrated approach for its optimal management." Further, they define integrated care as "a continuum of patient-centered services organized as a care delivery value chain for patients with chronic conditions …" etc. The workshop identified three key problem areas for the management of patients with COPD, two of which relate to provider communication. First, "the bringing together of all the dimensions of COPD care in a continuum through the lifetime of the patient." And second, "the integration of medical care among healthcare professionals and across healthcare sectors using a patient-centered approach." The workshop report highlights that the "current acute care model," that is more reactive than proactive, can lead to gulfs between communication and collaborations of services and providers. They highlight that this is particularly problematic during acute exacerbations, and calls for an integrated approach across providers and systems. This document further highlights how to apply the principles of integrated care to the management of COPD patients, as well as provides examples of COPD integrated care programs.

### TABLE A: PRINCIPLES OF INTEGRATED CARE

Principles of Integrated Care:

- Care should meet the individual's needs with the right care at the right time and the right place
- The specific form of integrated care will vary between countries and health economies
- The healthcare delivery system should follow the principle of anticipatory care as described in the Chronic Care Model
- Care should be planned and managed across the whole spectrum of disease from early detection to end of life
- Integrated care involves coordinated care from the patient's perspective and integration of services from a provider/commissioner perspective

Elements of integrated care for COPD

- Knowledge of the size of the problem in terms of true and expected prevalence and treatment variations by primary care and hospital practice
- Country-wide ongoing education and skills training for primary care staff
- Community provision of patient education, supported self-management, and chronic care plans for the individual patient
- A coordinated system for unscheduled care to include admission avoidance services
- Streamlined hospital admission services where necessary (to include early discharge services and comprehensive discharge planning)
- Oxygen therapy assessment and review services

### FIGURE 1? REPRINT THEIR CONCEPTUAL MODEL?[1]


*Figure 1.* Model for improvement of chronic illness care: the model suggests that patient–provider interactions result in care that improves outcomes. Reprinted with permission from Reference 49.

## ATS/ERS Task Force[2]

The American Thoracic Society and the European Respiratory Society published an update to their 1995 standards for diagnosis and treatment of patients with COPD document in 2004.[2] This updated position paper includes a section on integrated disease management for primary care in COPD, though does not provide specific recommendations for inpatient or inpatient-to-outpatient integrated care or provider-to-provider communication. They state that integrated care for patients with COPD "involves the patient and a team of clinical professionals working in primary care, cooperating with secondary care and rehabilitation services." They provide guidelines for referral to specialist care as:

- disease onset at age 40 yrs;
- frequent exacerbations (two or more per year) despite adequate treatment;
- rapidly progressive course of disease (decline in FEV1, progressive dyspnoea, decreased exercise tolerance, unintentional weight loss; severe COPD (FEV1v50% pred) despite optimal treatment;
- need for LTOT; onset of comorbid illness (osteoporosis, heart failure, bronchiectasis, lung cancer);
- evaluation for surgery

## GOLD Report[3]

The GOLD Report[3] provides detailed recommendations for care of patients with COPD. They state that the report is a "strategy document' for healthcare professionals to use as a tool to implement effective management programs based on available health care systems." It is meant to be used in "any clinical setting." There is almost no text on provider communication or care transitions. There is a short section on hospital discharge and follow-up that suggests follow-up four to six weeks after discharge from the hospital, though no citation is given to support evidence for this recommendation. They do reference discharge criteria which includes the item: "follow-up home-care arrangements have been completed" but the examples given do not include follow-up appointments. In their checklist of "items to assess at time of discharge from the hospital" they list "assure follow-up visit in four to six weeks" but do not state with whom, nor why this particular timing.

### TABLE B:

| Resource | Target population | Website/link/info |
|---|---|---|
| SHM's Project BOOST® Toolkit | Inpatient to outpatient transitions; general, focus on elderly | http://tools.hospitalmedicine.org/Implementation/Workbook_for_Improvement.pdf |
| ATS: integrated care | COPD patients | http://www.thoracic.org/statements/resources/copd/integrated-care-of-copd-patient.pdf |
| ATS/ERS Task Force | COPD patients | http://www.thoracic.org/statements/resources/copd/copdexecsum.pdf |
| GOLD Guidelines | COPD patients | http://www.goldcopd.org/uploads/users/files/GOLD_Report_2015_Apr2.pdf |

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# Appendix B: COPD Order Set (DRAFT)

## ADMIT ORDERS BASED ON CLINICAL PRACTICE GUIDELINES — Dept. of Clinical Informatics and Dept. of Healthcare Quality

Exclusion Criteria *** Respiratory decompensation secondary to – Pneumonia –Pneumothorax-Congestive Heart Failure-Dysrhythmia-Venous Thromboembolic Disease

### MDTO RN

| | |
|---|---|
| ❑ Call MD | For SBP greater than 170, for SBP less than 90, for pulse greater than 120, for RR greater than 30. |
| ❑ Call MD | O2 Sat is less than or equal to 88% despite supplemental oxygen. |
| ❑ Call MD | If supplemental O2 is greater than 4 L/min. |
| ❑ Call MD | If increased difficulty in breathing |
| ❑ Call MD | If patient started on BIPAP |

❑ Obtain sputum for gram stain, culture and sensitivity

### MEDICATIONS

**Nicotine Dosage:**

21 mg patch daily, start if greater than 10 cigarettes/day for 6 weeks, then decrease to 14 mg patch daily for 2 weeks and then decrease to 7 mg patch for final 2 weeks. 14 mg patch daily — start if less than 10 cigarettes/day for 6 weeks then decrease to 7 mg patch for final 2 weeks.

| | |
|---|---|
| ❑ Nicotine Patch Orders | Bupropion 150 mg twice a day |

**Steroids**

| | |
|---|---|
| ❑ PrednISONE (prednisone tablet) | 40 mg, tablet, By Mouth, Daily for 5 days. (Taper by 10 mg every 2-3 days after discharge) |
| ❑ Azithromycin (Azithromycin Tablet) | 500 mg, Tablet, By Mouth, Every 24 hours for 3 days |
| ❑ Doxycycline (Doxycycline Capsule) | 100 mg, Capsule, By Mouth, Every 12 hours for 5 days |

❑ Consider Levofloxacin for patients with recent use of and/or intolerance to antibiotics above :

| | |
|---|---|
| ❑ Levofloxacin (Levofloxacin Tablet) | **nested careset** ***change needs to be made to levofloxacin careset so that Acute exacerbation of chronic bronchitis duration is 5 days instead of the 7 days listed now |

**If Unable to Tolerate PO Medications:**

- ❑ Azithromycin IV — 500 mg IVPB, Injection, Every 24 hours for 3 days
- ❑ Doxycycline IV — 100 mg IVPB, Injection, Every 12 hours for 5 days
- ❑ Consider Levofloxacin for patients with recent use of and/or intolerance to antibiotics above :
- ❑ Levofloxacin IV — **nested careset**
  ***change needs to be made to levofloxacin careset so that Acute exacerbation of chronic bronchitis duration is 5 days instead of the 7 days listed now

**MEDICATION ADMINISTERED VIA RESPIRATORY CARE TREATMENTS**

**Select the following nested care sets as appropriate

**Acute exacerbation:**

Consider stopping Ipatropium.Consider starting Spiriva when patient is using minimal rescue bronchodilators.

- ❑ Albuterol/Ventolin Inhaler
- ❑ Albuterol/Ventolin Inhaler (Non Vented)
- ❑ Albuterol/Ventolin Inhaler (Vented PT)
- ❑ Budesonide-Formoterol / Symbicort Inhaler
- ❑ Budesonide-Formatoerol Inhaler BMLH (Symbicort Inhaler BMLH)
- ❑ Budesonide/Pulmicort inhaled neb
- ❑ Formoterol/Foradil Inhaler
- ❑ Ipatropium/Atrovent 0.02% Inhaled Neb.
- ❑ Mometason/Asmanex Inhaler
- ❑ Mometasone/Ashmaned Inhaler BMLH (Asmanex/Mometasone Inhlaer BMLH)
- ❑ Tiotropium/Spiriva Inhaler (Spiriva/Tiotropum Inhaler)
- ❑ Tiotropium via MDI (Spiriva HandiHaler via MDI)
- ❑ Anora Ellipta

**OXYGEN SUPLEMENTATION and Non Invasive Ventilation**

- ❑ Supplemental Oxygen via Nasal Cannula to keep SpO2 88% - 92%
- ❑ High Flow Nasal Cannula (HFNC)
- ❑ Non Invasive Ventilation (NIV)

**LABORATORY**

- ❑ Theophylline Level
- ❑ ABG
- ❑ Sputum Culture

**CONSULTS**

Pulmonary Medicine Required if admission to RICP. Consultation is indicated in patients with: Atypical presentation less than 50 years of age — Symptoms out of proportion to the measured degree of airflow limitation — Patients who fail to improve within 72 hours.

| | |
|---|---|
| ❑ Consult Physician | Consultation, Pulmonary Medicine |
| ❑ Consult Pulmonary Rehabilitation | COPD Management |
| ❑ Consult Case Management | Discharge Planning |
| ❑ OT Eval Treat | Prob: Endurance-improve, Treat: Adaptive equipment / Therapeutic Exercise, Weight Bearing: as Tolerated, Prec: Pulmonary |
| ❑ PT Eval Treat | Prob: Endurance-improve, Treat: Adaptive equipment / Therapeutic Exercise, Weight Bearing: as Tolerated, Prec: Pulmonary |

**CONSIDER THE FOLLOWING FOR DISCHARGE ACTIVITIES/PLAN**

**Vaccination:**

To be offered to all patients with COPD if not previously given, Pneumococcal, Influenza (annually October through March).

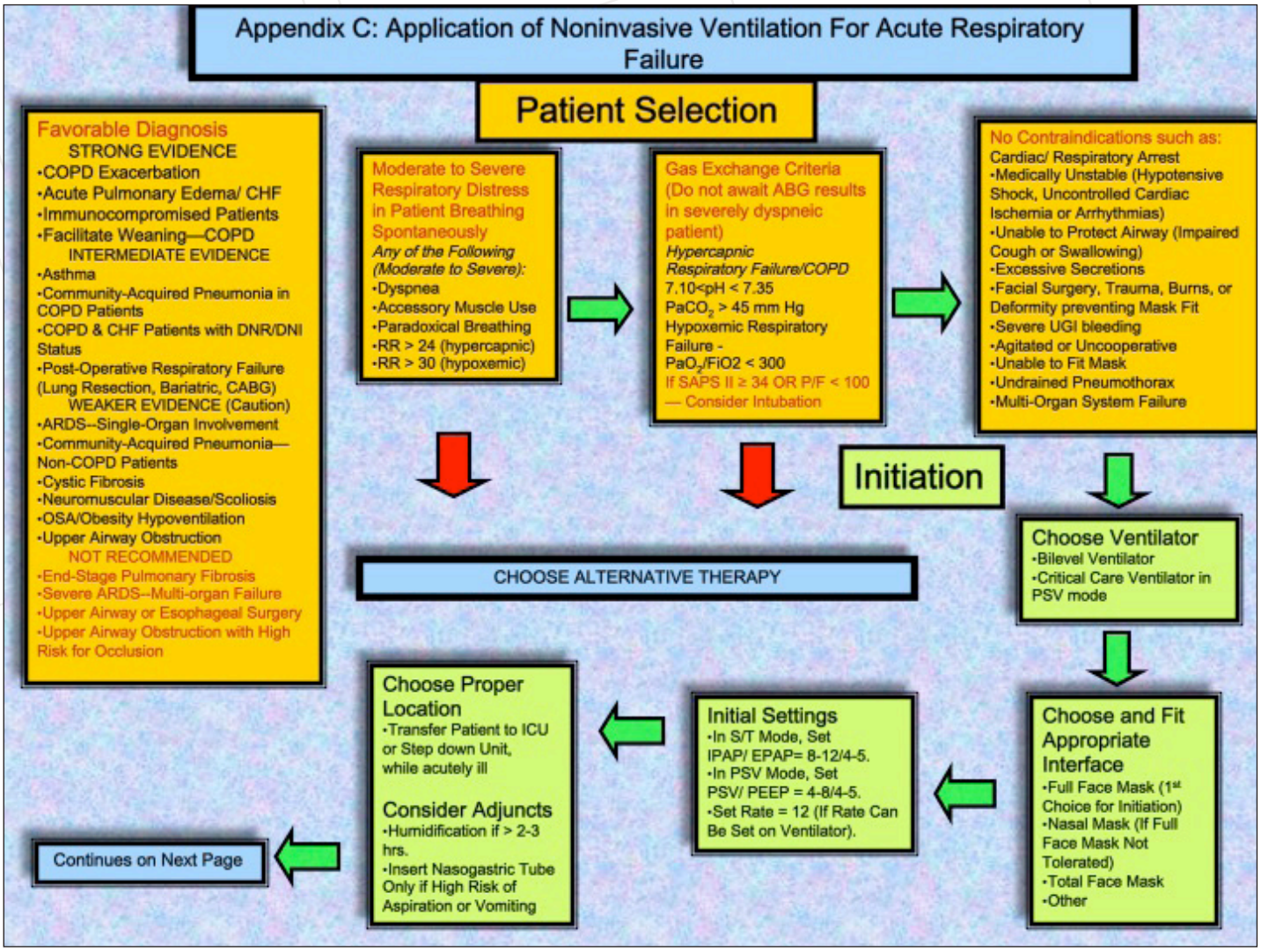
| | |
|---|---|
| ❑ MD to RN Misc Instruction | Assess patient for eligibility for Pneumococcal Vaccine to administered prior to discharge. |
| ❑ MD to RN | Assess patient for eligibility for Influenza Virus Vaccine to be administered prior to discharge. |
| ❑ Follow up outpatient COPD Clinic | |
| ❑ Follow up Outpatient Pulmonary Rehab | Medication Review and Disease Management |

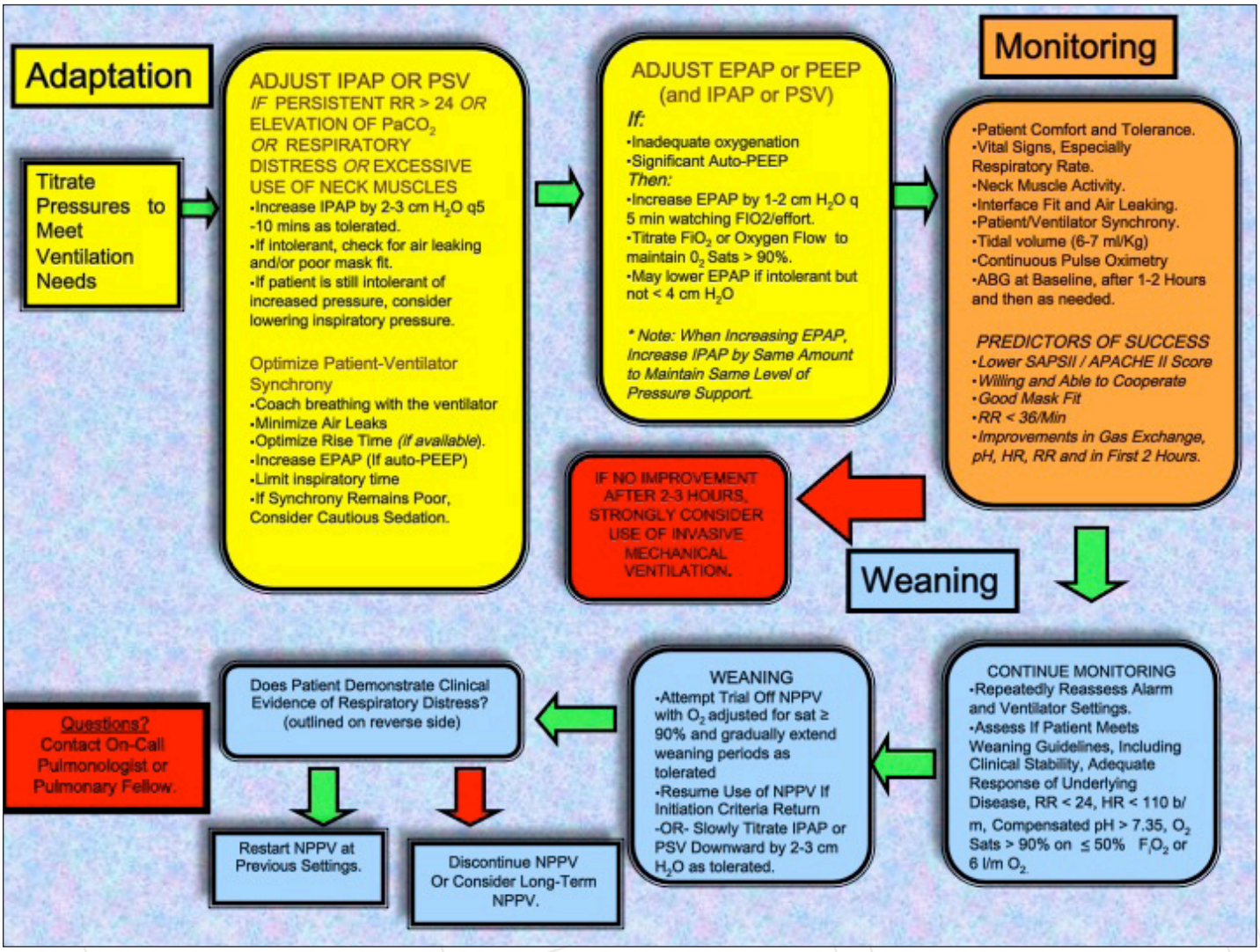
**Antibiotics should be given to patients with the following three symptoms: Increased dyspnea, increased sputum volume and increased sputum purulence or in patients requiring mechanical ventilation.

**If pathogen is known, choose specific therapy.

**If CXR suggestive of community acquired pneumonia, select antimicrobial as per CPG- Community Acquired Pneumonia.

# Appendix C: Application of Noninvasive Ventilation For Acute Respiratory Failure




Adaptation
Titrate Pressures to Meet Ventilation Needs
ADJUST IPAP OR PSV
IF PERSISTENT RR > 24 OR ELEVATION OF $PaCO_2$ OR RESPIRATORY DISTRESS OR EXCESSIVE USE OF NECK MUSCLES
•Increase IPAP by 2-3 cm $H_2O$ q5 -10 mins as tolerated.
•If intolerant, check for air leaking and/or poor mask fit.
•If patient is still intolerant of increased pressure, consider lowering inspiratory pressure.
Optimize Patient-Ventilator Synchrony
•Coach breathing with the ventilator
•Minimize Air Leaks
•Optimize Rise Time (if available).
•Increase EPAP (If auto-PEEP)
•Limit inspiratory time
•If Synchrony Remains Poor, Consider Cautious Sedation.
ADJUST EPAP or PEEP (and IPAP or PSV)
If:
•Inadequate oxygenation
•Significant Auto-PEEP
Then:
•Increase EPAP by 1-2 cm $H_2O$ q 5 min watching FIO2/effort.
•Titrate $FiO_2$ or Oxygen Flow to maintain $0_2$ Sats > 90%.
•May lower EPAP if intolerant but not < 4 cm $H_2O$
* Note: When Increasing EPAP, Increase IPAP by Same Amount to Maintain Same Level of Pressure Support.
Monitoring
•Patient Comfort and Tolerance.
•Vital Signs, Especially Respiratory Rate.
•Neck Muscle Activity.
•Interface Fit and Air Leaking.
•Patient/Ventilator Synchrony.
•Tidal volume (6-7 ml/Kg)
•Continuous Pulse Oximetry
•ABG at Baseline, after 1-2 Hours and then as needed.
PREDICTORS OF SUCCESS
•Lower SAPSII / APACHE II Score
•Willing and Able to Cooperate
•Good Mask Fit
•RR < 36/Min
•Improvements in Gas Exchange, pH, HR, RR and in First 2 Hours.
IF NO IMPROVEMENT AFTER 2-3 HOURS, STRONGLY CONSIDER USE OF INVASIVE MECHANICAL VENTILATION.
Weaning
CONTINUE MONITORING
•Repeatedly Reassess Alarm and Ventilator Settings.
•Assess If Patient Meets Weaning Guidelines, Including Clinical Stability, Adequate Response of Underlying Disease, RR < 24, HR < 110 b/m, Compensated pH > 7.35, $O_2$ Sats > 90% on ≤ 50% $F_iO_2$ or 6 l/m $O_2$.
WEANING
•Attempt Trial Off NPPV with $O_2$ adjusted for sat ≥ 90% and gradually extend weaning periods as tolerated
•Resume Use of NPPV If Initiation Criteria Return
-OR- Slowly Titrate IPAP or PSV Downward by 2-3 cm $H_2O$ as tolerated.
Does Patient Demonstrate Clinical Evidence of Respiratory Distress? (outlined on reverse side)
Restart NPPV at Previous Settings.
Discontinue NPPV Or Consider Long-Term NPPV.
Questions? Contact On-Call Pulmonologist or Pulmonary Fellow.

# Appendix D: Designing and implementing a COPD discharge care bundle



Chest clinic

RESEARCH UPDATE

## Designing and implementing a COPD discharge care bundle

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► Additional materials are published online only. To view these files please visit the journal online (http://thorax.bmj.com/content/67/1.toc).

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Received 21 March 2011
Accepted 6 July 2011
Published Online First 16 August 2011



**ABSTRACT**

National surveys have revealed significant differences in patient outcomes following admission to hospital with acute exacerbation of COPD which are likely to be due to variations in care. We developed a care bundle, comprising a short list of evidence-based practices to be implemented prior to discharge for all patients admitted with this condition, based on a review of national guidelines and other relevant literature, expert opinion and patient consultation. Implementation was then piloted using action research methodologies with patient input. Actively involving staff was vital to ensure that the changes introduced were understood and the process followed. Implementation of a care bundle has the potential to produce a dramatic improvement in compliance with optimum health care practice.

### BACKGROUND TO THE PROJECT

Chronic obstructive pulmonary disease (COPD) is a common condition[1] with acute exacerbations of COPD (AECOPD) or 'lung attacks' causing 12% of acute admissions and being responsible for more than one million bed days per annum in the UK. About a third of patients are readmitted within 90 days of discharge.[2] Significant variations in outcomes and provision of care have been noted, implying a role for a systematic quality improvement approach.[2 3] We therefore wished to develop and pilot the implementation of a COPD discharge care bundle—a list of five to six evidence-based practices that should be delivered to all patients.[4] A care bundle does not specify the entirety of care that should be delivered, but is rather a group of items that administered together should be delivered to all individuals.

### DEVELOPING THE CARE BUNDLE

Item selection was based on national and international guidelines, a systematic literature review and input from a multidisciplinary project team described in more detail in the online supplementary material. The project team undertook a process mapping exercise to map the patient pathway from admission to discharge and follow-up. A survey, undertaken to identify elements that were important to patients, identified feelings of isolation and a lack of support postdischarge and prioritised regaining physical function. To ensure coherence within the wider health community, the bundle was discussed at meetings of the Inner Northwest London Care Community integrated service improvement programme for COPD.

Bundle items selected were (figure 1; see online supplementary material for more details):

1. Notify the respiratory clinical nurse specialist of all admissions
2. If the patient is a smoker, offer smoking cessation assistance
3. Refer for assessment for pulmonary rehabilitation
4. Give written information about COPD including British Lung Foundation (BLF) self-management booklet, oxygen alert card and information about patient support groups (BLF Breathe Easy Group)
5. Demonstrate satisfactory use of inhalers
6. Follow-up appointment to be made with a specialist prior to discharge.

The care bundle pack included all the relevant referral forms/fax numbers. Referrals could be made by ward nurses, physiotherapists, clinical nurse specialists or doctors. Patients completed a 'safe discharge checklist' (online appendix 1), which would be countersigned by the nurse responsible for their discharge, providing an opportunity to address any omissions and to reinforce ward nurses' knowledge of the bundle items. Thus, for example, if at the end of several days in hospital a patient's inhaler technique had not been reviewed (despite their having used their inhalers on multiple occasions), identification of this omission would motivate the discharge nurse to ensure that this was not neglected in future. The safe discharge checklist also included a section to be completed about what to do if the patient felt they were not improving and needed further medical input once they were at home.

Patients were also offered a brief phone call 48–72 h postdischarge to check whether they were improving. If not, community input could be expedited. A script was developed with standard questions such as 'Since discharge are you same/better/worse?'; 'Is your breathing keeping you awake at night'; 'Do you have a written self-management plan'"; 'Do you know what your follow-up plan is?' (online appendix 2). The clinical nurse specialist making the call then decided whether there was an immediate cause for concern.

**Summary** – This care bundle is a group of evidence based items that should be delivered to all patients being discharged from the hospital following an Acute Exacerbation of Chronic Obstructive Pulmonary Disease (AECOPD). The care bundle aims to improve quality of care, patient experience and minimise the risk of re-hospitalisation. To ensure the bundle can apply to all we have prepared a combination of actions and documents to facilitate the discharge process.

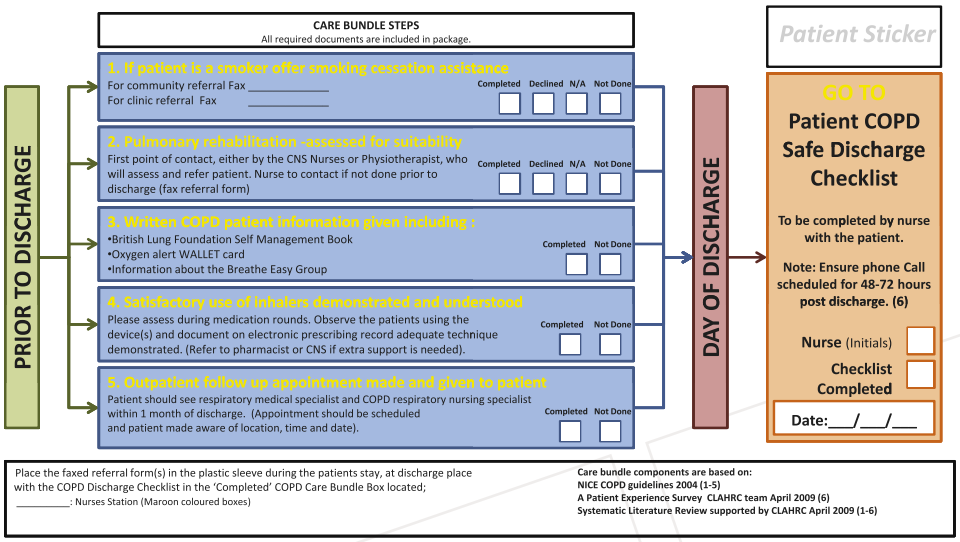


**Figure 1** The chronic obstructive pulmonary disease (COPD) discharge care bundle. CNS, clinical nurse specialist.

## IMPLEMENTATION

The care bundle was launched on the respiratory ward at a series of multidisciplinary meetings. A survey of ward staff during the development of the project had revealed low levels of confidence regarding inhaler technique, smoking cessation and pulmonary rehabilitation, so it was clear that staff education would be important. An initial barrier to this was that it was difficult for the staff to attend teaching sessions in a group without impeding clinical work. We developed an educational model where members of the team would spend time on the ward at a stand providing teaching about topics such as smoking cessation and inhaler technique in a 'drop in' way. Thus, during the course of a shift all the nurses on the ward had the opportunity to be educated with minimal disruption. This led to improved confidence in these areas, which was confirmed by a staff survey. Pharmacists involved in the project took the opportunity to teach on a daily basis and developed laminated pictorial charts to attach to the drug trolley to reinforce the correct inhaler techniques required.

Care bundle returns were assessed at the weekly project meeting, which enabled the team to refine the administrative and other processes involved, through the use of a 'plan, do, study, act' approach. To increase engagement with the project, the ward nurses completing the safe discharge checklist were entered into a draw for a small prize.

Pulmonary rehabilitation has a key role in COPD management and there is evidence that it can reduce accident and emergency attendance and readmission if delivered immediately after discharge with AECOPD.[5] In order for health professionals to refer patients and to improve patient compliance, it is important that they have a clear understanding of what it entails and are able to communicate the strength of evidence for its effectiveness. To address this, ward staff attended pulmonary rehabilitation sessions within the Hospital and physiotherapists gave informal teaching. An information leaflet for potential participants was developed with input from patients to ensure that it was written in an appropriate language and addressed typical patient concerns.

## OUTCOMES

The care bundle was initiated in 94 patients on the respiratory ward between 1 October 2009 and 30 September 2010—age 74.6 (11.2) years, 64% male, median length of stay 6 days. Compliance was compared with a random sample (n=22) from the year sampled prior to the project as part of the bundle development

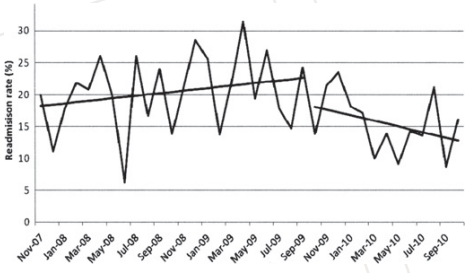


**Figure 2** The 30-day readmission rates before and after the initiation of the chronic obstructive pulmonary disease discharge care bundle.

**Key learning points**

Educational efforts must be maintained because of staff turnover and need to be delivered in a way that is easy for staff to access, enabling them to gain and maintain confidence. For the care bundle to be implemented effectively, all healthcare professionals involved in COPD care need to be able to engage with it.

process. There were significant improvements in compliance with reference to smoking cessation (18.2% vs 100%), pulmonary rehabilitation (13.6% vs 68%), administration of self-management plan (54.6% vs 97.9%) and review of inhaler technique (59.1% vs 91.2%). Follow-up arrangements were documented in 41% pre and 39% post initiation of the care bundle.

Of those in whom the bundle was used 25.5% were smokers. All were offered an appointment with smoking cessation services, although 11 (46%) of the smokers declined to be referred. In the year prior to the bundle, there were 31 referrals to pulmonary rehabilitation for Chelsea and Westminster patients compared with 81 in the year postinitiation—an increase of 158%.

Four (4%) patients declined to receive a follow-up phone call, 34 (36%) could not be contacted despite two calls and in 22 (23%) the call was not made because of staffing issues. A follow-up call was made successfully in 34 (33%) patients and a cause for immediate concern was identified in 3 (10%) of them. Contact details for many patients were wrong in the electronic patient record, so the safe discharge checklist was modified to include reviewing the contact details in an attempt to address this.

The 30-day readmission rate was 10.8% for patients where the bundle was used compared with 16.4% where it was not (n=365) (95% CI for difference −2.1% to 13.2%). After implementation of the bundle, there was a downward trend in readmissions but segmented regression analysis showed this not to be statistically significant (figure 2). The aim of this initial study was to demonstrate improvements in process (since the interventions themselves have an evidence base); however, the findings are encouraging and as this intervention is rolled out across further sites the data will become available for a more quantitative evaluation of the link between these process measures and outcomes. In addition, data for this analysis included all patients admitted to the Trust with AECOPD (n=1156) over 3 years, whereas the bundle was only piloted on the respiratory ward. Although the implementation of the bundle might have improved COPD awareness generally within the Trust, looking at total readmission rates is likely to have diluted the actual impact of the bundle.

**Acknowledgements** We would like to thank all the staff who participated in the project and the patient representatives, particularly Mr Allan Stone.

**Funding** The work was funded by the NIHR through the Collaboration for Leadership in Applied Health Research and Care (CLAHRC) for Northwest London and the NIHR Respiratory Biomedical Research Unit of Royal Brompton and Harefield NHS Trust and Imperial College.

**Competing interests** None.

**Ethics approval** The study was discussed by both the Brent Ethics Committee and the NHS Brent R&D Committee who determined that formal ethical approval was not necessary.

**Contributors** All authors were part of the project team developing the bundle. NSH wrote the first draft of the manuscript. All authors approved the final manuscript.

**Provenance and peer review** Not commissioned; externally peer reviewed.

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THORAX

# Designing and implementing a COPD discharge care bundle

Nicholas S Hopkinson, Catherine Englebretsen, Nicholas Cooley, et al.

*Thorax* 2012 67: 90-92 originally published online August 16, 2011
doi: 10.1136/thoraxjnl-2011-200233

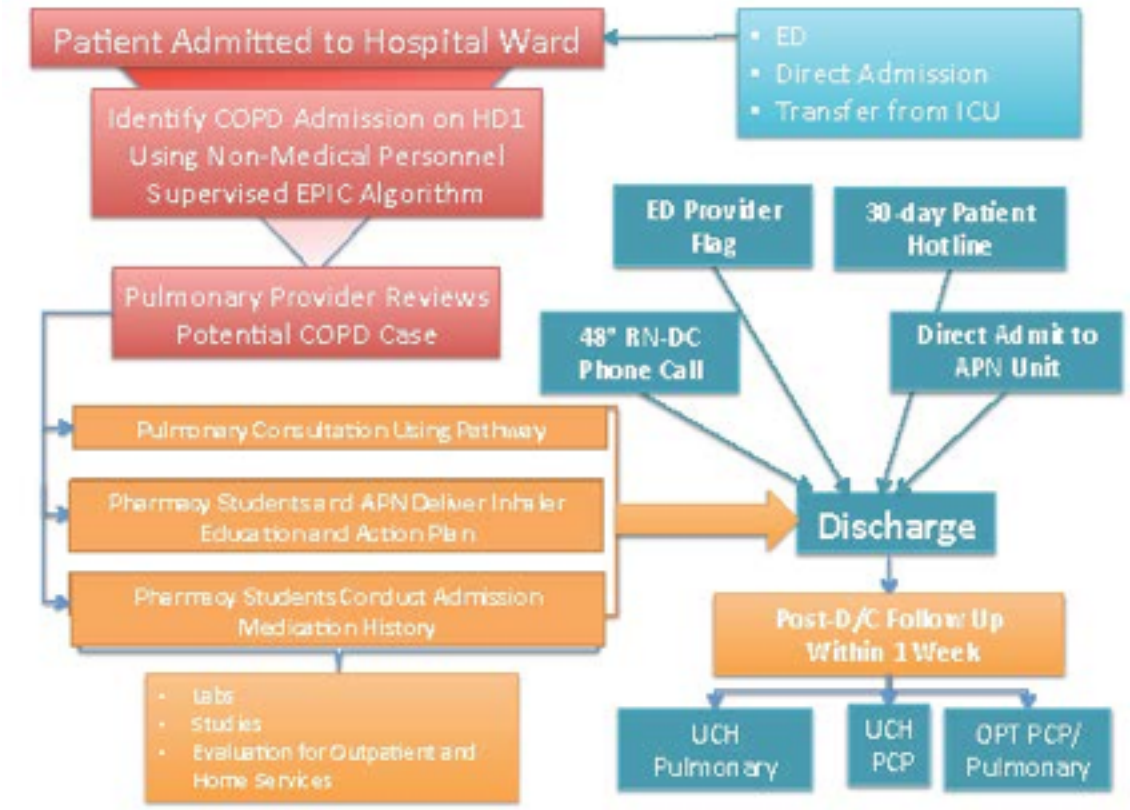
## Appendix E: University of Chicago COPD Hospital Readmissions Reduction Program

The University of Chicago Medicine's (UCM's) COPD Hospital Readmissions Reduction Program is an advance practice nurse (APN)-led, multi-setting program offered Monday to Friday. Patients are automatically enrolled if identified as "likely admitted for AECOPD" using our novel screening algorithm. This algorithm is a 15-minute non-medical-provider-supervised electronic health record (EHR) screening that identifies about two to three new patients daily.

Program enrollees are first seen by the COPD APN who uses a unique care pathway EHR template to: evaluate alternative diagnoses other than COPD, evaluate the severity of COPD and identify triggers, and to give inpatient and outpatient management recommendations. Our pharmacist-led team provides medication reconciliation and inpatient and outpatient education using the Teach-to-Goal (TTG) inhaler method to all patients inhaler teaching on prescribed outpatient inhalers. TTG is an iterative inhaler teaching approach, previously developed and validated at our institution by Dr. Valerie Press.[1,2] The APN conducts additional testing for work-up of respiratory disease, including alpha-1 antitrypsin and spirometry; coordinates the care plan with the primary service; and works with case management and social work to set up any home needs, for example, home oxygen or physical therapy.

Prior to discharge the APN schedules with the patient an outpatient appointment to see her within seven days of discharge. Patients are also given a 24-hour phone number to call if they experience worsening respiratory symptoms for the 30 days after discharge that are staffed by the APN and clinical pulmonologist lead. Additionally, this hotline is available to our emergency room providers through an EHR chart alert that appears if any program enrollee returns to the ED within 30 days of discharge to provide information about clinical status upon discharge and to assist with disposition planning.

A dedicated patient outreach nurse places a telephone call at 48 hours after discharge, using a script to troubleshoot medication or durable medical equipment challenges, and barriers to attending the follow-up appointment. Any problems identified are communicated directly to the APN for further action. Inhaler teaching is re-evaluated using TTG education in addition to addressing other medical needs, and a transition of care back to the patient's previous provider and/or connection to UCM physicians is facilitated by the APN during the outpatient visit. Lastly, should the APN decide a patient requires hospitalization, whether as an observation or true admission, the patient may bypass the emergency room and be directly admitted to an APN inpatient service, thus decreasing wait times for care.

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## Appendix F:

Please view the article ***Evaluation of a Practice Guideline for Noninvasive Positive-Pressure Ventilation for Acute Respiratory Failure*** at: http://journal.publications.chestnet.org/data/Journals/CHEST/21995/2062.pdf

## Appendix G:

Please view the article ***Improving Adherence for Management of Acute Exacerbation of Chronic Obstructive Pulmonary Disease*** at http://www.em-consulte.com/article/939127/improving-adherence-for-management-of-acute-exacer