Provincial Clinical Knowledge Topic
Chronic Obstructive Pulmonary Disease Exacerbation, Adult
Emergency Department

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Important Information Before You Begin

The recommendations contained in this knowledge topic have been provincially adjudicated and are based on best practice and available evidence. Clinicians applying these guidelines should, in consultation with the patient, use independent medical judgment in the context of individual clinical circumstances to direct care. This knowledge topic will be reviewed periodically and updated as best practice evidence and practice change.

The information in this topic strives to adhere to Institute for Safe Medication Practices (ISMP) safety standards and align with Quality and Safety initiatives and accreditation requirements. Some examples of these initiatives or groups are: Health Quality Council Alberta (HQCA), Choosing Wisely campaign, Safer Health Now campaign etc.

This knowledge topic has incorporated information or content from the following sources:

- SCM Order Sets
- Provincial Order Set
- CTAS Guidelines

Within this knowledge topic PICO-D questions or key clinical questions that have been used to guide research using the **P**opulation/**P**roblem, **I**ntervention, **C**omparison, **O**utcome, **D**esign format. These questions are listed in Appendix A.

Links to PICO-D questions or Appendices are throughout the document (example: **(PICO 1) or Appendix**). Click on the link with your mouse to follow the link. Under the PICO-D question or Appendix heading you will find a link to return you to your initial place in the document.

Rationale

Chronic obstructive pulmonary disease (COPD) is a common chronic respiratory disease, especially in the patient population over 55 years of age. Cigarette smoking is the most common cause of COPD; however, environmental/work place exposures and genetic causes are also known causes. In 2009-2010 772,200 (4%) of Canadians aged 35 and older reported being diagnosed with COPD.

In Alberta, during the six years from 1999 – 2005, Emergency Department (ED) visits for COPD exacerbations among patients 55 years and older increased from 13,502 to 16,100 accounting for 3.2% and 3.9% of total visits for this age group.[1] The proportion of admissions amongst these patients was 32.5%.

According to the Public Health Agency of Canada 2011 Survey on Living with Chronic Diseases in Canada (SLCDC) 79% of COPD patients reported one or more health care visits for respiratory problems, 20% reported one or more ED visits, and 8% reported one or more nights of hospital stay over the past 12 months. Additionally 75% reported taking prescribed medications for their COPD and 5% reported using home oxygen. Of interest, 21% reported the physician suggested visiting a respiratory educator and 22% reported having done so. Only 7% reported having had a supervised pulmonary rehabilitation program suggested and 6% reported participating. While many Canadians with COPD are actively engaged in managing their condition and receiving appropriate care, one in three still smokes and one in five are exposed to second hand smoke.[2]

While it has been reported that 50-60% of exacerbations are secondary to respiratory infections, 10% due to pollution and 30% of unknown cause, the heterogeneous nature of these episodes suggest complex interactions between the host, infectious agents, and environmental pollution.[3]

As the aging population continues to expand, COPD prevalence will remain high and while better community management of chronic diseases may serve to decrease the frequency of COPD exacerbations, it may lead to ED presentations being more severe and refractory requiring careful planning and a consistent management approach.

Goals of Management

1. Initiate bronchodilator therapy following ED presentation.
2. Initiate systemic corticosteroids early to decrease need for admission.
3. Consider high risk causes of exacerbations such as pneumonia, pneumothorax, pulmonary embolism and congestive heart failure (CHF).
4. Identify those patients who would benefit from antibiotics.
5. Consider the early use of non-invasive pressure ventilation for patients in respiratory distress.
6. Take steps to avoid intubation and ventilation for COPD patients.
7. Identify patients who are still smoking and offer interventions.
8. Clarify the goals of care for the current visit; and if not already done try to establish goals of care with the patient and family.

Nursing Assessment and Documentation

This section contains specific considerations related to this topic. Standard assessment and documentation practices should still be followed.

1. Triage Assessment (ILI screening)
   - Canadian Emergency Department Information Systems (CEDIS) complaint: Shortness of breath; Cough / congestion; Fever unspecified[4]
   - Canadian Triage and Acuity Scale (CTAS) Modifiers: Respiratory distress modifiers most discriminatory[4]
2. Initial Assessment/Documentation
   - Presenting History: Severity and timing of increasing shortness of breath, presence or absence of increased sputum production, presence or absence of increased sputum purulence
   - Past History: Smoker, home oxygen (O_2), bi-level positive airway pressure (BiPap)/continuous positive airway pressure (CPAP), previous intubations, orthopnea/paroxysmal nocturnal dyspnea (PND)
   - Medications and Allergies: Inhaled chronic management and adherence, recent systemic corticosteroids, and antibiotic use within the last 3 months
   - Systems Review:
     - Vital Signs: elevated temperature
     - Respiratory: Focused respiratory assessment; cough; sputum production; increased work of breathing; rate and depth; breath sounds;
     - Cardiovascular: tachycardia; cyanosis; edema
     - Neurological: confusion; irritability
3. Ongoing Assessment/Documentation

Physician Assessment and Documentation

This section contains specific considerations related to this topic. Standard assessment and documentation practices should still be followed.

1. History of Present Illness
   - Anthonisen criteria: The presence or absence of the three criteria (increased dyspnea over baseline, increased sputum volume, increased sputum purulence) may help determine the value of antibiotics as part of patient therapy.[5]
   - We suggest that risk factors for admission with an ED presentation **(PICO 1)**:
     - 2 or more COPD admissions in the past two years;
     - Receiving corticosteroids for COPD at time of presentation;
     - Canadian Triage and Acuity Scale (CTAS) 1 or 2 at presentation
     - Receiving adjunct ED treatments (oxygen and intravenous magnesium)
2. Past History
   - Smoking history
   - Comorbidities such as previous acute coronary syndrome (ACS), congestive heart failure (CHF), venous thromboembolism (VTE)
3. Medications & Allergies
   - Recent systemic corticosteroids

- Antibiotic use within the past three months

4. Physical Examination
   - As part of the respiratory system evaluation, document the Borg severity score as the patient baseline (can be recorded by nurse &/or physician)
5. Scoring Tools / Risk Scores
   - Modified Borg Scale **(Appendix D)**

Initial Decision Making

1. Is the patient in severe respiratory distress?
   - If yes, do they have an updated goals of care indicating their wishes
     - If C1 confirm with patient or family they only wish comfort measures
     - If M1 confirm they do not want intubation and ICU care consideration, but a short trial of non-invasive mechanical ventilation (NIMV) could be considered
     - If R1 consider trial of NIMV while confirming the appropriateness of the R1 designation and if concerned consider an ICU consultation to optimize care
   - Rapidly initiate bronchodilators, systemic corticosteroids, and antibiotics

2. Is the patient moderately to severely dyspneic but not yet tiring out
   - If yes initiate bronchodilator therapy and if available consider short course of NIMV to prevent fatique and support recovery
   - If patient has a history of, is becoming drowsy or you are concerned about CO2 retention do ABG
   - Unless recent CXR useful to order one looking for pneumonia, pneumothorax or signs of CHF
   - If febrile or 2 or more Anthonisen criteria initiate antibiotics **(PICO 4)**
   - Systemic corticosteroids should be given unless contraindicated

3. Is the patient mildly dyspneic
   - If yes initiate bronchodilator therapy
   - If patient has a history of or you are concerned about CO2 retention do ABG
   - A CXR should be considered looking for a pneumonia or pneumothorax
   - If febrile or 2 or more Anthonisen criteria initiate antibiotics **(PICO 4)**
   - Systemic corticosteroids should be given unless contraindicated

Order Set Components

Orders or their components have been added in **bold** text if recommended as default (e.g. ***Bedrest*** *under General Care*). All other orders and components would be selected based on the presentation needs of the patient. Orders that have more than one option for treatment have been entered in square brackets (e.g. Warfarin 5 mg [2, 2.5, 3, 4, 6, 7.5, 10 mg] PO x 1).

Order Set Components - General Care

- Goals of Care: utilize appropriate Goal of Care
- Precautions and Safety: Consider isolation if influenza like illness (ILI) is positive or suspected tuberculosis
- Activity:
  - **Bedrest**
  - Bedrest with bathroom privileges
  - Ambulate
  - Ambulate with assist
  - Activity as Tolerated
  - Restraints Mechanical (soft)
- Diet / Nutrition:
  - **NPO**
  - NPO: oral medications with sips
  - NPO: may have ice chips
  - Clear Fluids Diet
  - Full Fluids Diet
  - Regular Diet
  - Other Diet: as required

Order Set Components - Patient Care Orders

- Vital Signs: These orders need to be re-evaluated when the patient stabilizes or by two hours, whichever occurs first. Vital signs to include: respiratory rate (RR), pulse rate (P), blood pressure (BP), temperature (T), and oxygen saturation (O2 sat) with options to include:
  - **as per local standards**
  - manual or automatic
  - q_hrly
  - q_min
  -

Order Set Components - Respiratory Care

- Oxygen:
  - **O2 Therapy – Titrate to Saturation between 88-92%, unless otherwise specified**
  - O2 Therapy: at ____ LPM (litres per minute) by ____ (specify device) to maintain SpO2 greater than or equal to ____%

- Notify - physician if O_2 flow is required to be increased by greater than 2 litres(L) to maintain the same level of oxygenation, if there is a progressive increase in the work of breathing, or the patient is becoming more drowsy or lethargic

Order Set Components - Intravenous Orders

- Intravenous Cannula – Insert
- Options then include:
  - Saline Lock
  - IV bolus or rapid infusion including the following:
    - Amount (e.g., 250 mL, 500 mL, 1000 mL, 2000 mL)
    - Fluid (e.g., 0.9% NaCl infusion, lactated ringers infusion)
    - Run time (e.g., 15 min, 30 min, 45, min, 60 min)
  - IV maintenance
    - Rate in mL/hr (e.g. 75, 100,125, 150, 200, 250)
    - Fluid (e.g. 0.9% NaCl infusion, lactated ringers infusion)

Order Set Components - Lab Investigations

Comments regarding laboratory ordering and utilization for this patient group:

1. There are no indications for defaulted lab tests for these patients. These would be ordered on a case-by-case basis.
2. Acute coronary syndrome, congestive heart failure, and pulmonary embolism are all associated co-morbidities that can cause or exacerbate dyspnea in COPD patients. As such troponin, BNP, or D-Dimer may be appropriately ordered in selected patients.

- Hematology
  - Complete Blood Count (CBC)
  - PT INR
  - PTT
  - Type and Screen
- Chemistry
  - Electrolytes (Na, K Cl, CO2)
  - Glucose Random LEVEL
  - Creatinine LEVEL
  - Urea
  - Magnesium (Mg) LEVEL
  - Phosphate LEVEL
  - Calcium (Ca) LEVEL
  - Troponin**:** I or T
  - BNP (NT-ProBNP)
  - D-Dimer
- Blood Gases
  - Blood Gas Arterial
  - Blood Gas Venous (There is insufficient evidence to recommend this as a substitute for Blood Gas Arterial in managing COPD exacerbations. **(PICO 2)**

- Microbiology
  - Sputum Bacterial Culture (specify indications)
  - Blood Culture - Adult (specify indications)
- Urine Tests
  - Urinalysis Random (routine and micro)
  - Urine Bacterial Culture (specify indications)

Order Set Components - Diagnostic Imaging

It is recommended that patients presenting to the ED with an acute COPD exacerbation have a chest x-ray (GR Chest) ordered to rule out a secondary pneumonia or pneumothorax. It may not be required if they have already had a chest x-ray for this current exacerbation.

- Standard x-rays:
  - GR Chest, 2 projections: Chest X-ray posterior/anterior ([PA] & lateral)
  - GR Chest, 1 Projection portable: Chest X-ray Portable
- Advanced Imaging
  - US Chest, Mass/Pleural Effusion
  - US Abscess Drainage Tube Insertion with Prep
  - CT Chest Enhanced (specify indications)
- Other:
  - Electrocardiogram – 12 lead (ECG)

Order Set Components - Medications

Goal: to improve respiratory mechanics in patients with a degree of reversible airway constriction and also to decrease the acute inflammatory effects.
Metered dose inhaler (MDI) with spacer is recommended as safest route of administration to prevent droplet spread of infection. Nebulizers should be reserved for patients know to be unresponsive to MDIs or some patients who are unable to use MDIs.

1. salbutamol inhaler [2,4,6,8] puffs [+/- spacer] q 20 min x 3, then reassess
   OR
2. salbutamol neb soln [2.5,5] mg via nebulizer q 20 min x 3 OR continuously x 1 hr and then reassess

   AND

3. ipratropium inhaler [2,4,6,8] puffs [+/- spacer] q 20 min x 3, then reassess
   OR
4. ipratropium neb soln [250,500] mcg via nebulizer q 20 min x 3 OR continuously x 1 hr and then reassess

   AND

5. **predniSONE tab 50 [30,40] mg PO x 1 dose (**We recommend a short dose of corticosteroids. **(PICO 3)**

   OR

6. methylPREDNISolone Na succinate inj [40,] mg IV in 100 ml of 0.9% NaCl infusion over 20 minutes x 1 dose (only indicated for patients unable to tolerate oral)

7. Antibiotics **(PICO 4)**

Consider use based on Anthonisen criteria as outlined below; however, a recent systematic review showed no outcome benefit for mild or moderate COPD exacerbations. We suggest antibiotics benefit admitted patients with 2 or 3 Anthonisen criteria.

Criteria:

1. Increased dyspnea over baseline
2. Increased sputum volume
3. Increased sputum purulence (thickness)

If all three are present (Type 1) then antibiotics are recommended; if only 2 are present (Type 2) antibiotics may be beneficial; if only 1 present (Type 3) antibiotics are not indicated

Antibiotic Selection

1. if less than 4 exacerbations / year
   - amoxicillin cap 1000 mg PO now **and then** amoxicillin cap 1000 mg PO tid x 5 to 7 days

   OR

   - doxycycline cap 200 mg PO now **and then** doxycycline cap 100 mg PO bid x 5 to 7 days

   OR

   - sulfamethoxazole / trimethoprim tab (sulfamethoxazole 800mg and trimethoprim160 mg) PO now **and then** sulfamethoxazole / trimethoprim tab [sulfamethoxazole 800mg and trimethoprim160 mg] PO bid x 5 to 7 days
2. if greater than or equal to 4 exacerbations / year OR failure of first line agents OR received antibiotics in the last 3 months (always switch class of antibiotics)
   - amoxicillin / clavulanate tab 875mg PO now **and then** amoxicillin / clavulanate tab 875mg PO bid x 5 to 10 days

   OR

   - cefUROXime tab 500 mg [1 g] now **and then** cefUROXime tab 500 mg [1 g] bid x 5 to 10 days

   OR

   - levofloxacin tab 750 mg PO now **and then** levofloxacin tab 750 mg PO daily x 5 days
3. Alternatives
   - AZIthromycin tab 500 mg PO now **and then** AZIthromycin tab 500 mg PO daily x 3 days

   OR

   - clarithromycin ER tab 1 g PO now **and then** clarithromycin ER tab 1 g PO daily x 5 to 10 days

OR

- clarithromycin tab 500 mg PO now **and then** clarithromycin tab 500 mg PO bid x 5 to 10 days

OR

- if known or suspected Pseudomonas: ciprofloxacin tab 750 mg now **and then** ciprofloxacin tab 750 mg bid x 5 to 10 days

Order Set Components - Procedures, Protocols & Guidelines

1. Physician
   - Non-invasive mechanical ventilation (NIMV). We recommend NIMV be considered early. **(PICO 5).**
     - Indications: respiratory acidosis (arterial pH less than 7.35 and/or PaCO2 greater than or equal to 6.0 kPa, 45mm Hg), or severe dyspnea with clinical signs suggestive of respiratory muscle fatigue, increased work of breathing (respiratory rate greater than 25/min), or both, such as use of respiratory accessory muscles, paradoxical motion of the abdomen, or retraction of the intercostal spaces.
     - Contraindications: too drowsy, inability to understand due to dementia or language barrier, unable to protect airway (impaired cough or swallowing)
   - Intubation (consider if all other interventions fail)

Disposition Planning

1. Considerations for admission
   - Recognizing that admission rates for COPD across the province are greater than 30% (greater than 50% in tertiary care sites and less than 15% in some rural sites), understanding that COPD is a chronic condition with limited reversibility and patients with chronic dyspnea have limited pulmonary functional reserves, patients who fail to respond to ED therapy, who have had previous admissions for the same condition, or who present on maximal outpatient therapy or outpatient corticosteroids should be considered for admission.
   - All patients with chronic, ultimately terminal conditions should have had their 'Goals of Care' discussed and an advanced directive prepared. The patient always has the right to modify these instructions; however, understanding the ramifications of the various medical interventions also helps determine which patient may be considered for intensive care unit (ICU) admission, which patient for aggressive medical care, and which patient for comfort care.
2. Considerations for discharge
   - Optimally COPD patients should have simple baseline measures recorded periodically (resting O_2 saturation walk test recording how far they can go before halting due to dyspnea or O_2 saturation dropping 2-3%) to aid treating physicians in deciding whether or not discharge is safe and appropriate.

- Discharged patients should be prescribed a 5-7 day course of prednisone (30 to 50 mg daily) to decrease relapses **(**We recommend a short course of systemic corticosteroids; click **(PICO 6)** **(PICO 7)**
- Patients with Type 1 or Type 2 exacerbations based on their Anthonisen criteria and initiated on antibiotics in the ED should be discharged and complete a five day course (We recommend those patients initiated on antibiotics based on their Anthonisen criteria be discharged on a short course of antibiotics) **(PICO 8)**
- Most COPD patients should be discharged on salbutamol 200mcg qid PRN (or other short acting beta agonist) plus ipratropium 40 mcg qid with long acting beta agonists and long acting alpha antagonists reserved for more severe COPD patients.
- Patients who are stable and improving but deemed high risk to relapse may be candidates for a "hospital at home" program assuming that is available **(PICO 9)**

3. Outpatient follow-up
   - Generally COPD patients discharged from the ED should be 'advised to return' if symptoms return/worsen; and the majority should probably be reassessed by their primary care physician or pulmonary outpatient service provider within 48 hours.
4. Patient education / discharge instructions **(Appendix C)**
   - Appendix C is a draft of patient discharge instructions for COPD patients.
   - Smoking cessation information should be provided to COPD patients still smoking and all patients at risk for the disease; however, the logistics of that in an ED setting need to be determined.
   - Patients should also be advised to receive pneumococcal and influenza vaccine if they have not already done so.

Rural Considerations

1. Reviews of current practice standards outside of urban centers have shown inconsistencies in the use of antibiotics and systemic corticosteroids in the ED management of COPD exacerbations.
2. Very few rural hospitals have access to non-invasive mechanical ventilation. The dissemination and implementation of this knowledge in the form of clinical content and future data capture should help identify the frequency of such ED visits by site and afford the opportunity to build a business case for access to such therapy.

Patient Experience and Expectations

Based on a meeting with 8 patient advisors in Calgary January 25, 2015, we received the following feedback and general recommendations regarding approaches to communication, care and patient expectations in the emergency department (ED):

1. They hoped we would be able to improve care consistency among ED providers.

   Patient quote: "Every time I presented to the emergency department with the same condition (atrial fibrillation), each doctor provided a different treatment approach."

2. They were supporters of care pathways, checklists, protocols, etc. wherever appropriate.

> *Patient quote: "I am a strong supporter of care pathways as whenever I/my family member receive treatment using a pathway the care seems clearer and more consistent"*

3. While none of the patients liked long waits, they could accept them better if there was clearer communication and reassessments as required.

> *Patient quote: "Nobody likes to wait and I understand that sicker patients take priority, however, there needs to be improved communication and reassessments for those patients who are waiting"*

4. They pointed out the importance of having a patient advocate accompany a sick person, but also allowing the advocate to be with the patient at decision critical points (e.g. initial assessment, treatment decision making, receiving bad news, etc.) was considered paramount.

> *Patient quote: "When I accompany my family member to the ED I am often not permitted to join them when they are moved into a treatment space. I am often told this is 'policy'."*

5. They believe that improving follow up, especially for patients being discharged from the ED and being referred to a specialist is important. This was recognized as a key safety risk for patients; having to rely on faxed referrals and a call back from the consultant's office can lead to dangerous delays or failed connections to the detriment of the patient's health and well-being.

> *Patient quote: "The current health care system is poorly coordinated with lots of gaps and delays, especially with referrals from one physician to another."*

Preparation for Analytics

1. Key Outcomes

Clinical

- Avoidance of need for intubation (early ED steroid use and early non-invasive mechanical ventilation [NIMV])
- Decreased admission rate (early ED steroid use, aggressive bronchodilator therapy)
- Improved recovery rate at 30 days (short course steroids at ED discharge + short course antibiotics as indicated)

Process

- COPD treatment pathway utilized consistently
- Limited use of nebulizers and consistent deployment of metered dose inhalers (MDIs) and spacers in the ED

Patient Experience

- Received early treatment interventions to alleviate my shortness of breath
- Arranged for home O2 to be delivered as soon as I was discharged from the ED

2. Data Elements for Capture

- Patient demographics
- Canadian Emergency Department Information Systems (CEDIS) presenting complaint and Canadian Triage and Acuity Scale (CTAS) score
- ED time markers (triage to physician, physician to consult and then to admission or physician to discharge) and outcome markers (identified as clinical decision unit patient, consulted for admission, admitted to ICU or ward, died)
- ED diagnoses
- Site and zone identifiers
- Steroid use (predniSONE, methylPREDNISolone), dosage, duration
- Antibiotic use (by name), dosage, duration
- Non-invasive pressure ventilation use
- Discharge destination (home, home care, respiratory outreach, family physician)

3. Proposed Reports
    - Number (%) of ED patients triaged as COPD and frequency this order set is applied
    - Number (%) of ED patients (by site/zone/hospital type or location [e.g. inner city]) for whom this order set is applied and frequency of early steroid use
    - Number (%) of ED patients (by site/zone/hospital type or location [e.g. inner city]) for whom Anthonisen criteria were recorded
    - Number (%) of ED patients (by site/zone/hospital type or location [e.g. inner city]) who received antibiotics with or without Anthonisen criteria indicated
    - Number (%) of ED COPD patients (by site/zone/hospital type or location [e.g. inner city]) treated with non-invasive positive pressure ventilation and/or were intubated
    - Number (%) of ED COPD patients (by site/zone/hospital type or location [e.g. inner city]) admitted from the ED
    - Length of stay for admitted and discharged patients with acute exacerbations of COPD (AECOPD)
    - 72-hour ‘unplanned’ ED return visits for AECOPD

References:

1. Rosychuk RJ, Voaklander DC, Senthilselvan A, Klassen TP, Marrie TJ, Rowe BH. Presentations to emergency departments for chronic obstructive pulmonary disease in Alberta: a population-based study. *Can J Emerg Med*. 2010;12(6):500-8
2. Statistics Canada. Table 105-0501 - Health indicator profile, annual estimates, by age group and sex, Canada, provinces, territories, health regions (2013 boundaries) and peer groups, occasional. Statistics Canada CANSIM (database). http://www5.statcan.gc.ca/cansim/pick-choisir?lang=eng&p2=33&id=1050501. Updated June 17, 2015. Accessed July 14, 2015.
3. Sapey E, Stockley RA. COPD exacerbations. 2: Aetiology. *Thorax*. 2006;(61):250-258.
4. Murray M, Bullard M, Grafstein E for the CTAS and CEDIS National Working Groups. Revisions to the Canadian Emergency Department Triage and Acuity Scale Implementation Guidelines. *Can J Emerg Med*. 2004;6(6):421-7.
5. Anthonisen NR, Manfreda J, Warren CP, Hershfield ES, Harding GK, Nelson NA. Antibiotic therapy in exacerbations of chronic obstructive pulmonary disease. *Ann Intern Med.*1987;106:196-204

Appendix A – PICO-D Questions (Key Clinical Questions)

For information regarding PICO-D Methodology and GRADE Terminology please see **Appendix B**

PICO 1: ***In COPD patients presenting to the ED with an acute exacerbation are there any risk factors that help predict a higher likelihood of needing admission?***

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Search Strategy: Searched the Cochrane Library. Searched PubMed using search terms "COPD" and "risk factors" and "admission" and then searched PubMed using the search terms "COPD" and "risk factors" and "admission." 406 articles were identified.
The Rowe study was selected as it was emergency patient specific and enrolled Canadian study subjects providing greater generalizability. The systematic review study population was mixed and looked at community treated failures and hospital discharge patients in their study population.

Clinical Recommendation: We suggest that COPD patients at higher risk for needing admission are reportedly older, more often former smokers, and have had more admissions for COPD during the previous 2 years (odds ratio [OR] = 2.10; 95% CI = 1.24 to 3.56). The respiratory rate (RR) and degree of airflow obstruction were all higher in the hospitalized group. They also reported more days of activity limitation and higher use of inhaled beta2-agonists in the previous 24 hours. The median ED length of stay (LOS) of admitted patients was 13.1 hours (interquartile range [IQR] = 7.4-23.0) compared to 5.6 hours (IQR = 4.2-8.4) in discharged patients. Admission was associated with receiving oral corticosteroids for COPD (OR = 1.72; 95% CI = 1.08 to 2.74), having a CTAS score of 1–2 (OR = 2.04; 95% CI = 1.33 to 3.12), and receiving adjunct ED treatments (OR = 3.95; 95% CI = 2.45 to 6.35).[1]

Quality of Evidence: Low, GRADE C

Strength of Recommendation: Weak, GRADE 2

References:

1. Rowe BH, Villa-Roel C, Guttman A, Ross S, Mackey D, Sivilotti M LA, et al. Predictors of hospital admissions for chronic obstructive pulmonary disease exacerbations in to Canadian Emergency Departments. *Acad Emerg Med*. 2009;(16):316-324.

PICO 2: ***In adults assessed in the ED with COPD exacerbations, does the use of venous blood gases improve outcomes or aid in treatment decision making?***

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Return to Order Set Components – Laboratory Investigations

Search Strategy: Searched PubMed using the search terms "COPD" and "venous blood gas"

Clinical Recommendation: There is insufficient evidence to answer this question. A rapid search of PubMed identified one meta-analysis published in 2010 examining whether venous blood gas analysis is a viable alternative to arterial blood gas analysis.[1] Six studies that compared venous vs. arterial blood gas analysis in COPD patients in the ED were included in the review. The results revealed agreement between venous and arterial analysis on pH and HCO_3 levels, there was little agreement on pO_2 or pCO_2. Unfortunately, none of the included studies compared venous vs. arterial blood gases in regards to treatment decisions and clinical outcomes.

Quality of Evidence: Very Low, GRADE D

Strength of Recommendation: Insufficient evidence

References:

1. Lim BL, Kelly AM. A meta-analysis on the utility of peripheral venous blood gas analyses in exacerbations of chronic obstructive pulmonary disease in the emergency department. *Eur J Emerg Med.* 2010;(17):246–248.

PICO 3: ***In adults assessed in the ED with COPD exacerbations, does the use of systemic corticosteroids reduce admissions to hospital or reduce lengths of stay compared to standard care?***

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Return to Order Set Components - Medications

Search Strategy: Searched the Cochrane Library. Searched PubMed using search terms COPD and corticosteroids

Clinical Recommendation: We recommend that a short course of oral or parenteral corticosteroids significantly reduces treatment failures, the need for additional medical treatment, and shortens hospital stay in patients presenting with an acute COPD exacerbation. There are significant increase adverse drug events, primarily hyperglycemia and weight gain for patients being maintained on long term steroids[1]. Treatment with corticosteroids did not

attenuate recurrent exacerbations or relapse. No outcomes of hospitalization rates or ED length of stay were reported. An additional systematic review comparing treatments for COPD exacerbations found systemic corticosteroids reduced treatment failure, length of hospitalization, and increased the risk of hyperglycemia.[2]

Quality of Evidence: High, GRADE A

Strength of Recommendation: Strong, GRADE 1

Additional Reading and General References:

1. Walters JAE, Gibson PG, Wood-Baker R, Hannay M, Walters EH. Systemic corticosteroids for acute exacerbations of chronic obstructive pulmonary disease. *Cochrane Database Syst Rev.* 2009, Issue 1. Art. No.: CD001288. doi: 10.1002/14651858.CD001288.pub3.
2. Quon BS, Gan WQ, Sin DD. Contemporary management of acute exacerbations of COPD: A systematic review and metaanalysis. *Chest*. 2008;(133):756-766.

PICO 4: ***In adults assessed in the ED with exacerbations of COPD, do systemic antibiotics improve the rate of recovery compared to standard care? Who benefit most?***

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Return to Order Set Components - Medications

Search Strategy: Searched Cochrane Library and PubMed using the search terms “antibiotics and COPD” and limiting the results to systematic reviews.

Clinical Recommendation: We suggest the use of antibiotics to be important for COPD exacerbations admitted to ICU where they showed large and consistent beneficial effects, however, for outpatients, emergency patients and inpatients the results were inconsistent.[1] Consideration should be given to patients presenting with 2/3 or 3/3 of the Anthonisen criteria (increased dyspnea, increased sputum volume, and increased sputum purulence).[2]

Quality of Evidence: Moderate, GRADE B

Strength of Recommendation: Weak, GRADE 2

References:

1. Vollenweider DJ, Jarrett H, Steurer-Stey CA, Garcia-Aymerich J, Puhan MA. Antibiotics for exacerbations of chronic obstructive pulmonary disease. *Cochrane Database Syst Rev*. 2012; 12:CD010257. doi: 10.1002/14651858.CD010257.
2. Anthonisen NR, Manfreda J, Warren CP, Hershfield ES, Harding GK, Nelson NA. Antibiotic therapy in exacerbations of chronic obstructive pulmonary disease. *Ann Intern Med.* 1987;(106):196-204.

PICO 5: ***In adults assessed in the ED with exacerbations of COPD, does the use of non-invasive ventilation in the ED reduce intubations and admissions compared to standard care?***

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Return to Order Set Components - Policies & Procedures

Search Strategy: Searched "COPD" and "ventilation" on the Cochrane library and PubMed (limited to systematic reviews).

Clinical Recommendation: We recommend that non-invasive ventilation (NIV) be considered early as an adjunctive first line intervention to usual medical care for the management of respiratory failure secondary to an acute exacerbation of COPD. Data from fourteen good quality randomized controlled trials showed NIV resulted in decreased mortality (Relative Risk 0.52; 95%CI 0.35 to 0.76), decreased need for intubation (RR 0.41; 95%CI 0.33 to 0.53), reduction in treatment failure (RR 0.48; 95%CI 0.37 to 0.63), rapid improvement within the first hour in pH, PaCO2 and respiratory rate[1]. Complications associated with treatment and hospital length of stay (WMD -3.24 days; 95%CI -4.42 to -2.06) was also reduced.

An additional systematic review identified 15 randomized control trials found that NIV reduced the need for intubation (RR 0.28; 95% CI 0.15 to 0.40), length of hospital stay (AR 4.57 days; CI 2.30 to 6.83 days, and in hospital mortality (0.10; 95% CI, 0.05 to 0.15) in patients with severe acute exacerbations of COPD in an inpatient, ICU, or respiratory ward[2].

Quality of Evidence: High, GRADE A

Strength of Recommendation: Strong, GRADE 1

References:

1. Ram FSF, Picot J, Lightowler J, Wedzicha JA. Non-invasive positive pressure ventilation for treatment of respiratory failure due to exacerbations of chronic obstructive pulmonary disease. *Cochrane Database Syst Rev.* 2004;3:CD004104. doi: 10.1002/14651858.CD004104.pub3.
2. Keenan SP, Sinuff T, Cook DJ, Hill NS. Which patients with acute exacerbation of chronic obstructive pulmonary disease benefit from noninvasive positive-pressure ventilation? A systematic review of the literature. *Ann Intern Med.* 2003;(138): 861-870.

PICO 6: ***In adult COPD patients discharged from the ED do systemic corticosteroids reduce relapse to additional care compared to standard care?***

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Search Strategy: Searched "COPD" and "corticosteroids" on Cochrane Library and PubMed (search limited to systematic reviews).

Clinical Recommendation: We recommend that patients with COPD exacerbations who respond to emergency department treatment and can be discharged, be prescribed a short course, 7-10 days, of systemic corticosteroids. Those patient receiving systemic corticosteroids had fewer relapses (27% vs 43%, P = 0.05) and significantly improved pulmonary function at ten days and quality of life at thirty days.[1]

Quality of Evidence: High, GRADE A

Strength of Recommendation: Strong, GRADE 1

References:

1. Walters JAE, Gibson PG, Wood-Baker R, Hannay M, Walters EH. Systemic corticosteroids for acute exacerbations of chronic obstructive pulmonary disease. *Cochrane Database Syst Rev*. 2009;(1):CD001288. doi: 10.1002/14651858.CD001288.pub3.

Additional Reading and General Resources:

1. Aaron SD, Vandemheen KL, Hebert P, Dales R, Stiell IG, Ahuja J, et al. Outpatient oral prednisone after emergency treatment of chronic obstructive pulmonary disease. *N Eng J Med.* 2003;348(26):2618–25.

PICO 7: ***In adults assessed in the ED with COPD exacerbations, is short-course (5-7 days) of systemic steroids as or more effective than long-course (10-14 days) systemic steroids?***

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Search Strategy: Searched the Cochrane Library. Searched PubMed using search terms "COPD" and "corticosteroids"

Clinical Recommendation: We suggest that 5-7 days is as effective as 10-14 days. A Cochrane review published in 2011 was identified which compared short (seven days or less) vs long (more than seven days) course systemic corticosteroids to treat acute COPD. Seven studies were selected based on the reviews inclusion criteria; however, due to a lack of data, only four studies could in included in meta-analysis. No differences between short and long course corticosteroids in regards to treatment failure, FEV_1, or frequency of side effects.[1]

Quality of Evidence: Moderate, GRADE B

Strength of Recommendation: Weak, GRADE 2

References:

1. Walters JAE, Wang W, Morley C, Soltani A, Wood-Baker R. Different durations of corticosteroid therapy for exacerbations of chronic obstructive pulmonary disease. *Cochrane Database Syst Rev.* 2011;(10):CD006897. doi: 10.1002/14651858.CD006897.pub2.

PICO 8: ***In adults assessed in the ED with COPD exacerbations, is a short-course (5-7 days) of systemic antibiotics as or more effective than long-course (10-14 days) systemic antibiotics?***

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Search Strategy: Searched Cochrane Library and PubMed using the search terms "antibiotics and COPD" and limiting the results to systematic reviews.

Clinical Recommendation: We recommend that short course antibiotics in COPD exacerbations are as effective as long course. One systematic review examined randomized controlled trials which compared short course (five or fewer days) to long course (greater than 5 days) antibiotics in an inpatient or outpatient setting to treat patients with acute exacerbations of chronic COPD. Overall, 21 studies were included in the review. Clinical cure rates were similar after short and long course antibiotics at early follow-up (8-21 days; OR 0.99, 95% CI 0.90 to 1.08) and late follow-up (17 – 45 days; OR 1.0, 95 % CI 0.91 to 1.10). Bacteriological cure rates were not different after treatment with short or long course antibiotics (OR 1.05, 95% CI 0.87 to 1.26).[1] The review concluded that a short course of antibiotics for five days or less were equally effective as a long-course antibiotic treatment.

Quality of Evidence: High, GRADE A

Strength of Recommendation: Strong, GRADE 1

References:

1. Moussaoui RE, Roede BM, Speelman P, Bresser P, Prins JM, Bossuyt PMM. Short-course antibiotic treatment in acute exacerbations of chronic bronchitis and COPD: a meta-analysis of double-blind studies. *Thorax.* 2008;(630):415-422.

PICO 9: ***In adults assessed in the ED with COPD exacerbations, does a hospital at home model safely reduce length of stay compared to standard care?***

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Search Strategy: Searched the Cochrane library and PubMed using the search terms "COPD" and "hospital at home."

Clinical Recommendation: We recommend 'hospital at home' as an option for uncomplicated COPD exacerbation patients requiring hospital admission. A Cochrane review published in 2012 included patients with acute exacerbation of COPD who were randomized to either "hospital at home" care or inpatient hospital care. The review identified eight randomized controlled trials which found that "hospital at home" care reduced hospital readmission compared to patients receiving inpatient care (RR 0.76; 95% CI 0.59 to 0.99). No significant differences between patients receiving "hospital at home" care or inpatient care were seen regarding mortality (RR 0.65; 95% CI 0.40 to 1.04) or lung function (MD -0.03 L; 95 % CI -0.14 to 0.08).[1]

Quality of Evidence: High, GRADE A

Strength of Recommendation: Strong, GRADE 1

Additional Reading and General Resources:

1. Jeppesen E, Brurberg KG, Vist GE, Wedzicha JA, Wright JJ, Greenstone M, Walters JAE. Hospital at home for acute exacerbations of chronic obstructive pulmonary disease. *Cochrane Database Systematic Rev.* 2012;(5):CD003573. doi: 10.1002/14651858.CD003573.pub2.

Appendix B - PICO-D Methodology and GRADE Terminology

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Key components of high quality and trustworthy clinical guidance include: i) recommendations that are clearly stated and based on scientific evidence of benefits, harms and where possible, costs, and ii) a guideline rating system that is used to communicate quality and reliability of both the evidence and the strength of its recommendations. In the development of these guidelines, clinical questions were formulated based on the PICO-D format as supported by Sackett[1] and Guyatt[2] in their User's Guide to the Medical Literature to define the clinical question. The GRADE terminology, where possible, is used to address the questions regarding Quality of Evidence and Strength of Recommendations. The components of PICO-D format and the GRADE methodology are described below.

PICO-D

P - Population, Patient, or Problem: This element defines the group of patients or characteristics of the patients.
I - Intervention, Prognostic Factor, Exposure: This element defines the main intervention being considered.
C - Comparison: This element defines the main alternative to compare with the intervention, such as comparison of two drugs or tests, or a medication to no medication or placebo.
O - Outcome: This defines what you are trying to accomplish, measure, improve or affect.
D - Design: The type of question (related to diagnosis, harm/etiology, prognosis, or therapy) will define which study design is best suited to provide evidence to answer the clinical question.

Definitions of Study Types[2,3]

1. **Meta-analysis:** a statistical technique that summarizes the results of several studies in a single weighted estimate, in which more weight is given to results of studies with more events and sometimes to studies of higher quality.
2. **Systematic Review:** attempts to collate all empirical evidence that fits pre-specified eligibility criteria to answer a specific research question using explicit, systematic methods selected with a view to minimizing bias. This provides more reliable findings from which to draw conclusions. (Antman 1992, Oxman 1993). The key characteristics of a systematic review are: i) clearly stated objectives with pre-defined eligibility criteria for studies; ii) an explicit and reproducible methodology; iii) a systematic search that attempts to identify all studies meeting the eligibility criteria; iv) an assessment of validity for the included studies, (e.g. through the assessment of risk of bias; and v) a systematic synthesis and presentation, of the characteristics and findings of the included studies.[4]
3. **Randomized Controlled Trial (RCTs):** a trial in which participants are randomly assigned to two or more groups: at least one (the experimental group) receiving an intervention that is being tested and another (the comparison or control group) receiving an alternative treatment or placebo. This design allows assessment of the relative effects of interventions.
4. **Controlled Clinical Trial (CCTs):** a trial in which participants are assigned to two or more different treatment groups in a non-randomized or quasi-randomized method. Examples of quasi-randomized allocation are birthdate and medical record numbers.

Studies in which the randomization process is not explicitly stated as randomized are considered CCTs. CCTs are more likely to suffer from bias than RCTs.

5. **Observational Studies:**
    a. **Cohort Study[2]:** an observational study in which a defined group of people (the cohort) is followed over time. The outcomes of people in subsets of this cohort are compared, to examine people who were exposed or not exposed (or exposed at different levels) to a particular intervention or other factor of interest. A prospective cohort study assembles participants and follows them into the future. A retrospective (or historical) cohort study identifies subjects from past records and follows them from the time of those records to the present.
    b. **Case control study:** a study design that examines a group of people who have experienced an event (usually an adverse event) and a group of people who have not experienced the same event, and looks at how exposure to suspect (usually noxious) agents differed between the two groups. This type of study design is most useful for trying to ascertain the cause of rare events, such as rare cancers.
    c. **Case Series:** analysis of series of people with the disease (there is no comparison group in case series).

GRADE Methodology

Whenever possible answers are identified from recent high quality guidelines or high quality systematic reviews and recommendations provided are based on GRADE definitions. Where guidelines or systematic reviews are not available to answer certain questions rapid reviews are undertaken and/or a consensus approach used to try to answer clinically relevant questions. **Only where the evidence is supportive and the benefits clearly outweigh the harm is a "we recommend" strength of recommendation applied.**

Table 1. GRADE Quality of Evidence[2]

High GRADE A	We have high confidence that the true effect lies close to that of the estimate of the effect.
Moderate GRADE B	We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low GRADE C	Our confidence in the effect estimate is low: The true effect may be substantially different from the estimate of the effect.
Very low GRADE D	We have very low confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect.

Table 2. GRADE Strength of Recommendations[2]	
Strong GRADE 1	Strong recommendation, with desirable effects clearly outweighing undesirable effects/burdens (or vice versa). **Wording of Recommendation:** We recommend in favor of / We recommend against…..
Weak GRADE 2	Weak recommendation, with desirable effects closely balanced with undesirable effects. **Wording of Recommendation:** We suggest in favor of / We suggest against …..
Insufficient evidence or no consensus	**Wording of Recommendation:** There is insufficient evidence or the confidence in the effect estimates is so low that the panel is unable to make a recommendation regarding….

References:

1. Sackett D, Richardson WS, Rosenburg W, Haynes RB. *How to practice and teach evidence based medicine.* 2nd ed. Churchill Livingstone; 1997.
2. Guyatt GH, Oxman AD, Vist GE, et al; for the GRADE Working Group. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ*. 2008; 336(7650):924-926.
3. Clinical Questions, PICO & Study Designs: Formulating a Well Built Clinical Question. Dahlgren Memorial Library/ Georgetown University Medical Center. http://researchguides.dml.georgetown.edu/ebmclinicalquestions. Updated February 3, 2015. Accessed January 2015.
4. Higgins JPT, Green S (editors). *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0 [updated March 2011]. The Cochrane Collaboration, 2011. Available from www.cochrane-handbook.org.

Appendix C - Patient Education and Discharge Material

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Healthwise Patient Education - COPD
https://myhealth.alberta.ca/health/AfterCareInformation/pages/conditions.aspx?HwId=uf7119

Appendix D – Other

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Table 1. **Modified Borg Scale**

Score	Description
0	No breathlessness at all
0.5	Very Very Slight
1	Very Slight
2	Slight Breathlessness
3	Moderate
4	Somewhat Severe
5	Severe Breathlessness
6	
7	Very Severe Breathlessness
8	
9	Very Very Severe
10	Maximal

Mild = modified Borg Scale 0-1
Moderate = modified Borg Scale 2-3
Severe = modified Borg Scale greater than 3

References:

1. Heart Foundation. Modified Borg Dyspnoea Scale. Heart Online Heart Education Assessment Rehabilitation Toolkit: Borg's Scales of Perceived Exertion. www.heartonline.org.au/resources. Updated November, 2014. Accessed July 14, 2015.

Appendix E - Clinical Working Group Membership

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We would like to acknowledge the contributions of the Provincial Clinical Knowledge Working Group members as follows. Your participation and time spent is appreciated.

Emergency Department Chronic Obstructive Pulmonary Disease Knowledge Topic Working Group

Name	Title	Zone
Knowledge Lead		
Michael Bullard	Physician	Provincial
Topic Lead		
Brian Rowe	Physician	Provincial
Working Group Members		
Alexis Mageau	Registered Nurse	Calgary Zone
Louise O'Shaunessy	Registered Nurse	Calgary Zone
Laura Fowler	Registered Nurse	Central Zone
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Marguerite Dorchak	Registered Nurse	South Zone
Eddy Lang	Emergency Physician	Calgary Zone
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Collette Flegal	Emergency Physician	Central Zone
Gerhard Benade	Emergency Physician	North Zone
Paul Parks	Emergency Physician	South Zone
Shona MacLoughlin	Emergency Physician	Edmonton Zone
Kirstie McLelland	Emergency Physician	Edmonton Zone
Sergiu Clubotaru	Family Physician	South Zone
Mohit Bhutani	Pulmonologist	Edmonton Zone
Anita Au	General Internist	Edmonton Zone
Lynora Saxinger	Infectious Disease	Edmonton Zone
Christopher Naugler	Laboratory	Provincial
Susan Fryters	Pharmacy	Edmonton Zone
Karen Horon	Pharmacy	Provincial
Carol A Connolly	Knowledge Management	Provincial
Erica Lenton	Knowledge Management	Provincial
Mauro Chies	Diagnostic Imaging	Provincial
Janice Mandolesi	Calgary SCM	Calgary Zone
Jason Scarlett	Data Integrity MR	Provincial
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For questions or feedback related to this knowledge topic please contact Clinical Knowledge Topics by emailing ClinicalKnowledgeTopics@albertahealthservices.ca