COPD-X Australian guidelines for the diagnosis and management of chronic obstructive pulmonary disease: 2022 update

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About one in 13 Australians over the age of 40 years is estimated to have chronic obstructive pulmonary disease (COPD).[1] In 2018, COPD was the leading cause of potentially preventable hospitalisations,[2] the third leading specific cause of total disease burden,[3] and the fifth leading cause of death in Australia.[3] This represents a significant burden in the lives of individuals living with COPD and within the Australian health care system. Importantly, the impact of COPD is even greater among Indigenous Australians compared with non-Indigenous Australians.[4]

Changes in diagnosis, assessment and management as a result of the guidelines

The significant rate of potentially preventable hospitalisations for COPD reported by the Australian Institute of Health and Welfare in the *Admitted patient care 2017–18: Australian hospital statistics* suggests that people living with COPD have inadequate access to guidelines-based care within the community setting.[5] According to the fourth Atlas of Healthcare Variation developed by the Australian Commission on Safety and Quality in Health Care, hospitalisations for COPD were 18 times higher in the local area with the highest rate compared with the area with the lowest rate,[6] suggesting inequity in resources and availability/quality of care across different geographic areas.

COPD-X was first published as a supplement to *The Medical Journal of Australia* (*MJA*) in 2003, and a major update was then published in the *MJA* in 2017.[7] The guidelines are written by a multidisciplinary group of Australian clinicians and strive to provide evidence-based recommendations relevant for Australian health care workers. The guidelines are updated quarterly, published by the Lung Foundation Australia in conjunction with the Thoracic Society of Australia and New Zealand (http://copdx.org.au). They emphasise the importance of non-pharmacological therapy for the management of COPD and promote the concept of "stepwise management", beginning with one pharmacological intervention and evaluating response before adding another agent (Box 1 and Box 2). The guidelines aspire to standardise COPD care, optimise health outcomes, and enhance the quality of life of people with COPD.

Methods

The guidelines manager at Lung Foundation Australia performs a quarterly systematic literature search (developed by a medical librarian) for COPD within PubMed for new literature (Supporting Information, appendix 1). Following screening, included articles are critically appraised by a COPD-X Guidelines Committee member with relevant expertise. If appropriate, the article is cited, and wording changed within the relevant section as recommended by the reviewer (Supporting Information, table 1). Changes are finalised through a consensus approach. Biannually, the quarterly update is reviewed for endorsement by the Thoracic Society of Australia and New Zealand.

Abstract

Introduction: Chronic obstructive pulmonary disease (COPD) is a treatable and preventable disease characterised by persistent respiratory symptoms and chronic airflow limitation on spirometry. COPD is highly prevalent and is associated with exacerbations and comorbid conditions. "COPD-X" provides quarterly updates in COPD care and is published by the Lung Foundation Australia and the Thoracic Society of Australia and New Zealand.

Main recommendations: The COPD-X guidelines (version 2.65) encompass 26 recommendations addressing:

- case finding and confirming diagnosis;
- optimising function;
- preventing deterioration;
- developing a plan of care; and
- managing an exacerbation.

Changes in management as a result of these guidelines: Both non-pharmacological and pharmacological strategies are included within these recommendations, reflecting the importance of a holistic approach to clinical care for people living with COPD to delay disease progression, optimise quality of life and ensure best practice care in the community and hospital settings when managing exacerbations. Several of the new recommendations, if put into practice in the appropriate circumstances, and notwithstanding known variations in the social determinants of health, could improve quality of life and reduce exacerbations, hospitalisations and mortality for people living with COPD.

C: Confirm diagnosis

People living with COPD experience persistent respiratory symptoms (breathlessness, cough and sputum, exacerbations) associated with chronic airflow obstruction,[8] which requires confirmation by spirometry (post-bronchodilator forced expiratory volume in one second [FEV_1] to forced vital capacity [FVC] ratio < 0.7). Access to spirometry can be challenging and has worsened during the coronavirus disease 2019 (COVID-19) pandemic, given that spirometry may be an aerosol-generating procedure. However, at the time of writing, access in some locations has improved, with respiratory scientists using personal protective equipment.

Cigarette smoking is the major cause of COPD, although many non-tobacco risk factors contribute globally,[9] including air

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pollution, occupational exposures, asthma, and submaximal lung growth.[10] Given the broad differential diagnosis for breathlessness,[11] thorough history, examination and investigations should be undertaken. In a study of 1050 smokers in 41 general practices, more than one-third of patients with a diagnosis of COPD did not meet spirometric criteria (ie, misdiagnosed), whereas one in six had undiagnosed COPD (ie, missed diagnosis).[12] Case-finding and better access to spirometry improves the diagnosis of COPD. People with COPD should undergo a multidimensional assessment for treatable traits, including airflow obstruction (spirometry), inflammation (blood eosinophil levels), and behaviour and risk factors (smoking, treatment adherence, self-management skills, physical activity, and comorbid conditions).[13,14]

O: Optimise function

Non-pharmacological therapy

The evidence for pulmonary rehabilitation in people with COPD is summarised in Box 3.

Physical activity. Individuals who meet physical activity guideline recommendations demonstrate reductions in all-cause and respiratory mortality risk,[22] providing further support for encouraging walking and structured exercise in people with COPD with the aim of reducing mortality risk (Level of Evidence [LoE] III-2, weak recommendation).

Frailty. Measuring frailty may identify vulnerable people living with COPD and allow earlier interventions such as pulmonary rehabilitation to improve breathlessness, exercise performance, physical activity level and health status[23] (LoE III-2, weak recommendation).

Pharmacological therapy

Pharmacological treatments aim to reduce symptoms, prevent exacerbations, and improve health status.[24,25] The inhalation route is primarily used for direct delivery of medicines to the lungs. Adherence to recommended treatment and optimal inhaler technique are critical.

Short- and long-acting inhaled bronchodilators and inhaled corticosteroids (ICS) should be prescribed using a stepwise approach.[24,25] Short-acting bronchodilators are used when required for short term symptom relief. Long-acting bronchodilators (long-acting muscarinic antagonists [LAMAs] and long-acting β-agonists [LABAs]) are given on a regular basis (once or twice daily) to prevent or reduce symptoms.[26] LAMAs are associated with a greater reduction in exacerbations than LABAs.[27] Dual bronchodilator therapy (LABA/LAMA) is superior to either LABA or LAMA monotherapy, with a 20% reduction in acute exacerbations and 11% reduction in hospitalisations on average[28] (LoE I, strong recommendation). In people with COPD with dyspnoea and exercise intolerance, triple therapy (ICS/LAMA/LABA) is not superior to maintenance long-acting bronchodilator therapy, except in people with a history of one or more exacerbations in the past year, in whom the benefits of reduction in exacerbations outweigh the increased risk of pneumonia.[29] Triple therapy should be limited to people with exacerbations and more severe COPD symptoms that cannot be adequately managed by dual therapy (LABA/LAMA) (LoE I, strong recommendation).

Long term oral glucocorticoid therapy is associated with severe side effects without evidence of benefit in stable COPD.

Comorbid conditions

A range of comorbid conditions in COPD (Box 4) are associated with higher readmission rates,[40] cardiac events and mortality. A large general practice dataset in the United Kingdom showed that COPD was associated with increased risks of cardiovascular disease, stroke and diabetes mellitus.[41] Box 4 summarises the most common comorbid conditions in COPD.

Lung volume reduction

All people with COPD being considered for lung volume reduction surgery and bronchoscopic lung volume reduction should be referred for pulmonary rehabilitation and discussed by an expert panel that includes a radiologist, respiratory physician, interventional pulmonologist and thoracic surgeon.[42] A meta-analysis of randomised controlled trials across all modalities of lung volume reduction (surgical and endobronchial) demonstrated improvement in lung function, exercise capacity and quality of life (LoE I, weak recommendation).[43] However, study rigour was limited by a lack of blinding, and the odds ratio for a severe adverse event, which included mortality, was 6.21 (95% CI, 4.02–9.58) following intervention.

Lung volume reduction surgery should only be considered in high volume specialised centres.[42] Bronchoscopic lung volume reduction may be appropriate in highly selected people with severe emphysema and hyperinflation. A meta-analysis of six trials of endobronchial valves (620 participants) and three trials of coils (458 participants) reported improvements in lung function, 6-minute walk distance and symptom scores with both modalities.[43] The odds ratio for an adverse event for trials of endobronchial valves was 9.58 (95% CI, 5.56–16.50), with the most frequent adverse events being pneumothorax (range, 1.4–25%) and exacerbations (range, 4–20%).

P: Prevent deterioration

Smoking cessation

Tobacco smoking is the key risk factor for development of COPD, and smoking cessation is the only intervention shown to slow decline in lung function[44] (LoE I, strong recommendation). Coexisting anxiety and depression are important barriers to successful cessation. Smoking cessation advice from health professionals has been shown to increase quit rates[45] (LoE I, strong recommendation). Hospital admission represents an opportunity to initiate smoking cessation, but support needs to continue after discharge.

Supporting smoking cessation involves behavioural support and treatment of nicotine dependence. Counselling may be structured using the five As strategy: ask, assess, advise, assist and arrange follow-up.[46] Brief advice to quit and referral to the Quitline (137848) is an alternative option. The most effective medicines approved for treating nicotine dependence are either combination nicotine replacement therapy or varenicline[47] (LoE I, strong recommendation). Longer courses of treatment may reduce relapse[46] (LoE I, strong recommendation). Nicotine vaping may assist selected patients[46] but is not approved as a medicine and long term safety is unknown.

Immunisation

Educational interventions for primary health professionals may improve influenza vaccination rates among patients with COPD and patient satisfaction with care (Box 5).[50]

1 Summary of key evidence and recommendations of the *COPD-X guidelines*

Recommendation	NHMRC level of evidence*	GRADE strength of recommendation
C: Case finding and confirm diagnosis		
Smoking is the most important risk factor in COPD development	I	Strong
Smoking cessation reduces mortality	I	Strong
COPD is confirmed by the presence of persistent airflow limitation (post-bronchodilator $FEV_1/FVC < 0.7$)	III-2	Strong
O: Optimise function		
Optimise pharmacotherapy using a stepwise approach	I	Strong
Adherence and inhaler technique need to be checked on a regular basis	I	Strong
Pulmonary rehabilitation improves quality of life and exercise capacity and reduces COPD exacerbations	I	Strong
Comorbid conditions are common in people with COPD	III-2	Strong
Palliative care (ideally from a multidisciplinary team that includes the primary care team) should be considered early, and should include symptom control and management of psychosocial issues†	II	Weak
Lung volume reduction (surgical and endobronchial) improves lung function, exercise capacity and quality of life†	I	Weak
Long term macrolide antibiotics may reduce exacerbations in people with moderate to severe COPD and frequent exacerbations†	I	Weak
Long term non-invasive ventilation should be considered in people with stable COPD and hypercapnia to reduce mortality†	I	Weak
P: Prevent deterioration		
Smoking cessation is the most important intervention to prevent worsening of COPD	II	Strong
Preventing exacerbations has a key role in preventing deterioration	III-2	Strong
Influenza and pneumococcal vaccination reduce COPD exacerbations	I	Strong
Long term oxygen therapy has survival benefits for people with COPD and hypoxaemia	I	Strong
D: Develop a plan of care		
Clinical support teams working with the primary health care team can help enhance quality of life and reduce disability for patients with COPD	III-2	Weak
Patients may benefit from self-management support	I	Strong
COPD exacerbation action plans reduce emergency department visits and hospital admissions†	I	Strong
X: Manage exacerbations		
Early diagnosis and treatment of exacerbations may prevent hospital admission and delay COPD progression	III-2	Strong
Multidisciplinary care may assist home management of some patients with an exacerbation	I	Weak
Inhaled bronchodilators are effective for initial treatment of exacerbations	I	Strong
Systemic corticosteroids reduce the severity of and shorten recovery from exacerbations	I	Strong
Exacerbations with clinical features of infection (increased volume and change in colour of sputum and/or fever) benefit from antibiotic therapy	I	Strong
When using supplemental oxygen for hypoxia in COPD exacerbations, target SpO_2 88–92% improves survival	II	Strong
Non-invasive ventilation improves survival for people with COPD and acute hypercapnic respiratory failure	I	Strong
Consider pulmonary rehabilitation at any time, including during the recovery phase following an exacerbation	I	Strong

COPD = chronic obstructive pulmonary disease; FEV_1 = forced expiratory volume in one second; FVC = forced vital capacity; GRADE = Grading of Recommendations Assessment, Development and Evaluation; NHMRC = National Health and Medical Research Council; SpO_2 = oxygen saturation measured by pulse oximetry. * NHMRC levels of evidence and grades for recommendations for developers of guidelines, 2009 (https://www.nhmrc.gov.au/sites/default/files/images/NHMRC%20Levels%20and%20Grades%20(2009).pdf; Supporting Information, appendix 1). † Denotes new recommendations not included in Yang et al.[7] ◆

2 Stepwise management of stable chronic obstructive pulmonary disease (COPD) fact sheet

STEPWISE MANAGEMENT OF STABLE COPD

	Increasing COPD severity		
	MILD	**MODERATE**	**SEVERE**
Typical symptoms	◦ few symptoms ◦ breathless on moderate exertion ◦ little or no effect on daily activities ◦ cough and sputum production	◦ breathless walking on level ground ◦ increasing limitation of daily activities ◦ recurrent chest infections ◦ exacerbations requiring oral corticosteroids and/or antibiotics	◦ breathless on minimal exertion ◦ daily activities severely curtailed ◦ exacerbations of increasing frequency and severity
Typical lung function	**FEV_1 ≈ 60-80% predicted**	**FEV_1 ≈ 40-59% predicted**	**FEV_1 < 40% predicted**

CONFIRM diagnosis. Confirm post-bronchodilator airflow limitation (FEV_1/FVC <0.70) using **spirometry**. Any pattern of cough with or without chronic sputum production may indicate COPD.

OPTIMISE function. PREVENT deterioration. DEVELOP a plan of care.

Non-pharmacological interventions

- **REDUCE RISK FACTORS** Avoid exposure to risk factors including tobacco smoke and air pollution, support smoking cessation, recommend annual influenza vaccine and pneumococcal vaccine according to immunisation handbook
- **OPTIMISE FUNCTION** Encourage regular exercise and physical activity, review nutrition, provide education, develop GP management plan and written COPD action plan (and initiate regular review)
- **OPTIMISE TREATMENT OF CO-MORBIDITIES** especially cardiovascular disease, anxiety, depression, lung cancer and osteoporosis
- **REFER** symptomatic patients to pulmonary rehabilitation
- **INITIATE** advanced care planning
- **MANAGE** advanced lung disease with domiciliary oxygen therapy, long-term non-invasive ventilation, surgery and bronchoscopic interventions, if indicated

Pharmacological interventions (inhaled medicines)**

- **START with short-acting relievers:** (used as needed):
  SABA (short-acting $beta_2$-agonist) OR **SAMA** (short-acting muscarinic antagonist)
- **ADD long-acting bronchodilators:**
  LAMA (long-acting muscarinic antagonist) **OR LABA** (long-acting $beta_2$-agonist)
  Consider need for combination **LAMA/LABA** depending on symptomatic response
- **CONSIDER adding ICS** (inhaled corticosteroids):
  Single inhaler triple therapy **(ICS/LABA/LAMA)** may be suitable*

*in patients with ≥1 severe exacerbation requiring hospitalisation or ≥2 moderate exacerbations in the previous 12 months, AND significant symptoms despite LAMA/LABA or ICS/LABA therapy; OR in patients stabilised on a combination of LAMA, LABA and ICS.

Assess and optimise inhaler device technique at each visit. Minimise inhaler device polypharmacy

REFER PATIENTS TO LUNG FOUNDATION AUSTRALIA FOR INFORMATION AND SUPPORT - FREECALL 1800 654 301

Lung Foundation Australia has a range of resources to promote understanding of COPD and assist with management.

Based on The COPD-X Plan: Australian and New Zealand Guidelines for the Management of COPD and COPD-X Concise Guide

**Refer to PBS criteria: www.pbs.gov.au

Register at copdx.org.au
to receive an alert when the COPD-X Guidelines are updated

Lung Foundation Australia
1800 654 301 | Lungfoundation.com.au

FEV_1 = forced expiratory volume in one second; FVC = forced vital capacity. Source: Figure reproduced with permission from Stepwise Management of Stable COPD (March 2022); Lung Foundation Australia (https://lungfoundation.com.au/resources/stepwise-management-of-stable-copd/).

3 Pulmonary rehabilitation recommendations

Recommendation	NHMRC level of evidence*	GRADE strength of recommendation
People with mild to severe COPD should undergo pulmonary rehabilitation to improve quality of life and exercise capacity and to reduce hospital admissions[15]	I	Strong
Pulmonary rehabilitation can be offered in hospital gyms, community centres or at home, and can be provided with or without an education program[15,16]	I	Weak
Pulmonary rehabilitation should be offered to people with any long term respiratory disorder characterised by dyspnoea, such as bronchiectasis, interstitial lung disease and pulmonary hypertension[15]	I	Weak
Pulmonary rehabilitation should be provided after an exacerbation of COPD, commencing within 2–4 weeks of hospital discharge[15,17]	I	Strong
The provision of supplementary oxygen in people with COPD who desaturate during exercise training does not improve the benefit from training[15]	II	Weak
Tai Chi may be a potential treatment option when pulmonary rehabilitation is not available[18]	I	Weak
Elastic resistance training may be an alternative to conventional resistance training using weight machines[19,20]	I	Weak
Telerehabilitation is effective in improving exercise capacity and reducing hospitalisations[20,21] and may enable people with high symptom burden or travel restrictions to access pulmonary rehabilitation	II	Weak
More research is needed to determine the optimal model of maintenance exercise programs, but some form of regular exercise should be encouraged following completion of a pulmonary rehabilitation program to sustain the benefits gained[15]	I	Weak

COPD = chronic obstructive pulmonary disease; GRADE = Grading of Recommendations Assessment, Development and Evaluation; NHMRC = National Health and Medical Research Council. For further information on pulmonary rehabilitation please refer to the Australian guidelines.[15] * NHMRC levels of evidence and grades for recommendations for developers of guidelines, 2009 (https://www.nhmrc.gov.au/sites/default/files/images/NHMRC%20Levels%20and%20Grades%20(2009).pdf; Supporting Information, appendix 1). ◆

4 Comorbid conditions associated with chronic obstructive pulmonary disease (COPD)

Comorbid condition	Associated evidence
Cardiac events	A meta-analysis[30] and a Cochrane systematic review[31] concluded that cardio-selective β-blockers are safe in COPD and should not be withheld, even in people with severe airflow limitation, including during exacerbations[32]
Osteoporosis	Osteoporosis is common in COPD (mean prevalence 38%) and is a predictor of higher mortality and worse lung function[33]
Anxiety and depression	Anxiety and depression are important comorbid conditions, especially in females,[34] and are associated with higher readmission rates[35]
Obstructive sleep apnoea	Obstructive sleep apnoea is very common in COPD[36] and is associated with higher mortality and more frequent exacerbations[37]
Bronchiectasis	Bronchiectasis often coexists with COPD, and a high resolution computed tomography chest scan should be considered when chronic sputum production or frequent respiratory infections are present to identify clinically important bronchiectasis that should be managed[38,39]

5 Immunisations to reduce risk of chronic obstructive pulmonary disease (COPD) exacerbations

Immunisation	Recommendation
Influenza	Annual influenza immunisation has been shown to reduce the risk of exacerbations and hospitalisations in people with COPD[48] and is therefore strongly recommended (LoE I, strong recommendation)
Pneumococcal	Pneumococcal immunisation reduces exacerbations of COPD and is recommended for people with COPD[49] (LoE I, strong recommendation)*
SARS-CoV-2	COPD is associated with increased risk of severe COVID-19 and people with COPD should be encouraged to get vaccinated† (Expert opinion)

COVID-19 = coronavirus disease 2019; LoE = Level of Evidence; SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2. * For details of the immunisation schedule please refer to the Australian Immunisation Handbook (https://immunisationhandbook.health.gov.au/). † Please refer to https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-care/underlyingconditions.html. ◆

6 Dedicated resources aligned with the *COPD-X Guidelines*

	Resources
For health professionals	Stepwise Management of Stable COPD: https://lungfoundation.com.au/resources/stepwise-management-of-stable-copd
	COPD-X Concise Guide: https://lungfoundation.com.au/resources/copd-x-concise-guide/
For people living with COPD and their support network	My COPD Checklist: https://lungfoundation.com.au/resources/my-copd-checklist/
	COPD Action Plan: https://lungfoundation.com.au/resources/copd-action-plan/

COPD = chronic obstructive pulmonary disease. ◆

Oxygen therapy

Oxygen therapy may be of benefit in people with significant hypoxaemia but is not recommended for individuals who continue to smoke (due to risk of burns and injury). Continuous or long term oxygen therapy (> 15–18 h/day) can improve survival in people with severe hypoxaemia (arterial partial pressure of oxygen [PaO_2] ≤ 55 mmHg or PaO_2 ≤ 59 mmHg with pulmonary hypertension) (LoE I, strong recommendation).[51,52] No benefits in quality of life, lung function, exercise capacity or mortality were demonstrated with long term oxygen therapy in a large study of people with moderate resting hypoxaemia (oxygen saturation measured by pulse oximetry [SpO_2], 89–93%) or modest exercise-induced desaturation[53] (LoE II, strong recommendation). Nocturnal oxygen in individuals who desaturated for more than one-third of the night did not improve survival or progression to long term oxygen therapy[54] (LoE II, strong recommendation). The benefits of ambulatory oxygen are unclear, and the associated burden may outweigh the limited benefits observed in laboratory-based studies.[55,56]

Prophylactic antibiotics

Macrolide antibiotics given daily or three times a week may reduce exacerbations in people with moderate to severe COPD and frequent exacerbations[57] (LoE I, weak recommendation). However, this benefit comes with increased risks of gastrointestinal side effects, potential cardiac toxicity, ototoxicity, and the development of antibiotic resistance. COPD-X recommends maximal inhaled and other preventive therapies, including smoking cessation, pulmonary rehabilitation, vaccination, and review of inhaled therapies, before consideration of prophylactic antibiotics, with careful weighing of risk and benefit. A network meta-analysis comparing long term treatment with tetracyclines or quinolones for prevention of exacerbations found they were no better than placebo[58] (LoE I, strong recommendation).

Biologic therapies

There is evidence to suggest that eosinophil may be an important biomarker for both increased exacerbations and corticosteroid responsiveness in COPD. Studies aimed at depleting eosinophils with anti-interleukin-5 therapies (mepolizumab and benralizumab) have had variable results, but these treatments likely reduce moderate and severe exacerbations in subgroups of people with higher blood eosinophil levels.[59] Further studies with cost-effectiveness analyses are needed to assist in determining the role of these monoclonal antibody therapies.

Palliative care

Palliative care from a multidisciplinary team should be considered early, to address symptom control and psychosocial issues. An Australian study found that in the last two years of life, only 18% of people with severe COPD accessed specialist palliative care, with only 6% prescribed opioids, despite severe breathlessness.[60] Extended-release morphine can improve health status in people with COPD who have uncontrolled breathlessness.[61] Advanced care planning should occur early.

Home bilevel ventilation

Long term nocturnal bilevel non-invasive ventilation (NIV) delivered by a face mask is a technique to support ventilation. Long term NIV should be considered in people with stable COPD and hypercapnia (LoE I, weak recommendation). These people should be referred to a centre with expertise in home NIV. A 2021 meta-analysis found that when NIV is used in people with stable severe COPD and daytime hypercapnia, there is a short term improvement in health-related quality of life and a reduction in mortality.[62] However, when NIV is commenced after an exacerbation, there is an improvement in rate of hospital admissions but no improvement in health-related quality of life.

D: Develop a care plan

The data from systematic reviews suggest that COPD self-management programs improve health-related quality of life.[63-67] However, the effect of these interventions on exacerbations remains unclear. Some studies report positive outcomes, although increased rates of exacerbations are reported in another large self-management intervention randomised controlled trial.[68] Due to the heterogeneity of the study designs, setting and outcomes, and conflicting results, essential elements of COPD self-management programs cannot be recommended.

Even though, overall, the essential elements remain unknown, some components of self-management are consistently associated with improved outcomes. Optimising inhaler technique is one such element. However, despite recognition of its importance, inhaler technique in people with COPD is consistently poor,[69] and poor technique is associated with adverse health outcomes. Furthermore, the number of inhaler devices prescribed is also important. People with COPD who use multiple but similar style devices have been found to experience fewer exacerbations compared with a mixed device cohort.[70]

Suboptimal adherence is also associated with adverse health outcomes.[71] To improve adherence and inhaler technique, it is recommended to minimise the number of different devices by prescribing medications via the same or similar inhaler platform where appropriate (LoE II, weak recommendation). COPD-X also recommends patient education that involves demonstration of correct inhaler technique and observation, as well as interventions to improve adherence, and that these be performed regularly (LoE I, strong recommendation).

A key element of self-management is COPD exacerbation action plans. Exacerbation action plans reduce emergency department visits and hospital admissions[72] (LoE I, strong recommendation). A comprehensive, intensive health coaching intervention led to reduced COPD-related admissions in the short term (up to 6 months, but not at 12 months).[73] In contrast, several more recent randomised controlled trials of telehealth self-management have failed to demonstrate benefits in exacerbation reduction or health care utilisation.[74-77]

X: Manage exacerbations

A COPD exacerbation is a worsening of dyspnoea, cough and/or sputum beyond normal day-to-day variations which is acute in onset and may warrant additional treatment or hospital admission. A history of COPD exacerbations is the best predictor of subsequent exacerbations.[78,79] A COPD exacerbation should be considered a sentinel event with a 12-month mortality rate of over 25%.[80] Exacerbations can be caused by bacterial or viral infections, heart failure, air pollution and social stressors. Pulmonary embolism should be excluded when there are no signs of infection.[81] Effective communication between hospital teams and primary care is essential, particularly after a hospital admission.

Pharmacological management of exacerbations

Salbutamol four to eight puffs (400–800 μg) should be administered via a metered dose inhaler with spacer every 3–4 hours. Nebulisers are not superior,[82] but if used, they should be driven by air and not oxygen.[83] Oral prednisolone (30–50 mg) should be given for 5 days[84] (LoE I, strong recommendation). Intravenous corticosteroids and prolonged courses of corticosteroids are not superior,[85] with prolonged courses associated with increased mortality rates.[86] People with COPD with signs of a chest infection (increased sputum volume/purulence or fever) should be treated with an oral antibiotic (LoE I, strong recommendation). First line antibiotics are amoxicillin or doxycycline for 5 days.[87] A chest x-ray should be performed if hospital admission is required or if pneumonia is suspected.

Oxygen therapy and non-invasive ventilation

Oxygen therapy should be administered only if hypoxaemia is present, with the target SpO_2 of 88–92%.[88] This can usually be achieved with oxygen via nasal prongs at 0.5–2 L/min. Over-oxygenation leads to increased mortality (LoE II, strong recommendation).[89] People presenting to hospital with a severe exacerbation of COPD should be assessed with an arterial blood gas test. If hypercapnic respiratory failure is present (pH < 7.35 and $PaCO_2$ > 45 mmHg), NIV is indicated. NIV leads to reductions in mortality, length of stay and endotracheal intubation rates[90] (LoE I, strong recommendation).

Further resources

For full details of the evidence, references, and regular updates, please refer to the *COPD-X guidelines* at http://copdx.org.au. COPD resources are available from the Lung Foundation Australia (www.lungfoundation.com.au) (Box 6).

Acknowledgements: We thank Pamela Gabrovska for contributing to the bibliography.

Competing interests: No relevant disclosures.

Provenance: Not commissioned; externally peer reviewed.

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Supporting Information

Additional Supporting Information is included with the online version of this article.