# Spirometry and COPD

## The why, when and how

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**Chronic obstructive pulmonary disease (COPD) is a common progressive and ultimately disabling condition. It is underdiagnosed, and late recognition leads to worse outcomes. Incorporating spirometry and case finding in primary care for those at risk of COPD can improve diagnosis.**

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### Why

Globally, and in Australia, chronic obstructive pulmonary disease (COPD) remains a leading cause of mortality and poor quality of life, and it is the source of significant healthcare expenditure.[1,2] Yet findings of studies in many countries show that at least half of the burden of disease in COPD is not recognised with a doctor's diagnosis and the opportunity for diagnosis is frequently missed by clinicians in primary care.[3] Without spirometry results, doctors in primary care are also likely to underestimate COPD severity or characterise lung disease inadequately in their patients.[4] The significance and importance of symptoms such as breathlessness may be under-rated or ignored by people with undiagnosed COPD; this is compounded by the continuing low public awareness and priority of COPD.

The consequences of not diagnosing COPD are now recognised to include increased risk of exacerbations and pneumonia, as well as higher rates of hospitalisation for COPD and increased mortality compared with patients who have been diagnosed with COPD. These are in addition to the lost preventive opportunities for the individual, in terms of modifying risk factors, especially smoking, and exacerbation risk reduction.

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### Key points

- **At least half of the burden of disease in chronic obstructive pulmonary disease (COPD) is not recognised with a doctor's diagnosis.**
- **The consequences of not diagnosing COPD include increased risk of exacerbations and pneumonia, increased hospitalisations and increased mortality.**
- **Handheld devices can be used to screen at-risk patients to determine the need for spirometry.**
- **A post-bronchodilator forced expiratory volume in one second ($FEV_1$)/forced vital capacity (FVC) of less than 0.7 is required to confirm the diagnosis of COPD.**
- **Patients with a diagnosis of COPD, require regular, ongoing monitoring of $FEV_1$ because treatment recommendations change with disease progression.**

### When

Debate over screening of smokers, the population most susceptible to developing COPD, has been ongoing. Although a US review in 2008 recommended against population-based screening for COPD using spirometry,[5] case-finding tools can now be used combining symptom enquiry and/or measurement of airflow obstruction with handheld devices. Treatment strategies for patients with COPD have improved both symptom and exacerbation outcomes through

optimised use of bronchodilators, vaccination and comorbidity management. For all smokers, with COPD of any severity or without COPD, support for smoking cessation should have the highest priority.

The policy aim now is to identify undiagnosed COPD earlier in the course of the disease.[6] Correctly identifying COPD requires objective measurement of airflow obstruction with spirometry; the high misclassification rate (at least 30%) found repeatedly in primary care attests to a historical under-reliance on spirometry. A review of the evidence in primary care suggests that active case finding can increase the identification of patients with undiagnosed COPD, especially when combined with use of screening questionnaires before diagnostic assessment, and when patients are clinically suspected to have COPD.[7]

## How

Diagnosis of COPD relies on spirometry and the demonstration of airflow limitation that is not fully reversible; this is the 'gold standard' for confirming a diagnosis. Airflow limitation that is not fully reversible is defined as the ratio of forced expiratory volume in one second ($FEV_1$) to forced vital capacity (FVC), the $FEV_1$/FVC ratio, being less than 0.7 after bronchodilator administration. Both Australian and international guidelines use this definition for COPD diagnosis.[6,8] The alternative criterion, based on the lower limit of normal (LLN) of the $FEV_1$/FVC ratio, may reduce the risk of slight over diagnosis of COPD in older populations or under diagnosis in younger people, but the fixed $FEV_1$/FVC ratio is the currently preferred approach. Diagnostic airflow obstruction in COPD is recognised when the $FEV_1$ less than 80% of the predicted value.[8] Knowledge of the $FEV_1$ and its change over time indicates the degree of airflow obstruction and disease progression, and combined with symptoms and exacerbation frequency can guide appropriate selection of pharmacotherapy.

### Case finding

Because patients may not recognise or report their symptoms and many GPs deal preferentially with acute symptoms or other conditions during consultations, implementing a systematic approach to identifying COPD in general practice will improve the rates of diagnosis. The Lung Health Checklist (www.lungfoundation.com.au/patient-area/checklist; translated into Arabic, Hindi, Samoan, Spanish, Chinese and Vietnamese) identifies people aged over 35 years who are at risk of lung disease; based on smoking history, previous acute respiratory exacerbations, occupational exposure to dusts, gas or fumes, or family history of COPD. These people can then be assessed using a handheld screening device. Those whose test is positive then undergo diagnostic spirometry. This approach reduces use of the more complex, time-consuming spirometry testing and limits the risk of late diagnosis. Adopting a systematic approach to identifying COPD involves the practice team, as recommended in the 'Red book' guidelines for preventive activities in general practice.[9]

**Figures 1a to c. Handheld devices. a (left) Air Smart Spirometer. b (top right) PiKo-6. c (bottom right) COPD-6.**

Image of PiKo-6 reproduced with permission from Lung Foundation Australia. Image of Air Smart Spirometer reproduced with permission from NuvoAir. Image of COPD-6 device reproduced with permission from Vitalograph.

### Lung function screening devices

Handheld expiratory flow devices, such as the PiKo-6, COPD-6 or Air Smart Spirometer, are used to assess patients at risk of COPD and either rule out or confirm the need for diagnostic testing with spirometry (Figures 1a to c). They are relatively inexpensive, easy to use and suitable for most patients as they do not require complete emptying of the lungs. Minimal training is required to use them and interpret the results. The devices measure forced expiratory volumes at one and six seconds; threshold levels for a positive test are published and available online.

Lung Foundation Australia has online training videos for operating the PiKo-6 and Vitalograph COPD-6 devices (www.lungfoundation.com.au/health-professionals/clinical-resources/copd/targeted-copd-case-finding-using-copd-screening-devices-in-the-community). Printed material for interpreting results and following up tests can be downloaded to widely used medical software from the website.

### Spirometry testing

Spirometry may be performed in the community or before discharge from hospital if an exacerbation is the presenting event for a diagnosis of COPD. Several factors can be barriers to conducting spirometry in primary care, and practical solutions or alternatives need to be considered. Although spirometer ownership may appear high in general practice,[10] there is often a low rate of use.[11] Selection of a suitable spirometer is important; information to assist with spirometer

selection in general practice is available from National Asthma Council Australia (www.nationalasthma.org.au/living-with-asthma/resources/health-professionals/information-paper/spirometry-users-buyers-guide).

Some GPs may not feel confident performing spirometry or interpreting results; referring patients to a spirometry service or pulmonary function laboratory can be an appropriate alternative. Other factors that may contribute to a practice policy to refer patients elsewhere for testing and interpretation include costs of equipment and consumables, as well as the opportunity cost and the level of rebate for a spirometry test, which requires testing with bronchodilator reversibility (Medicare Benefits Schedule item 11506).

### *Performing spirometry*

If spirometry is performed in the practice, effective training and ongoing quality control of tests are essential. Training for GPs and practice nurses is available through the free National Asthma Council Australia comprehensive course (six hours) or refresher update (2.5 hours) across Australia (www.nationalasthma.org.au/health-professionals/spirometry-resources/spirometry-training). Other state-based organisations also offer training (www.lungfoundation.com.au/health-professionals/clinical-resources/copd/spirometry).

### *Spirometry technique*

In primary care, most adults can perform spirometry reliably and to acceptable standards with effective coaching by a trained operator; the essential point is that forced exhalation is dependent on the patient's effort. Modern spirometers assess the quality of each test and grade them against international standards for acceptability and reproducibility, thus enabling monitoring of spirometry testing within the practice.[12] Spirometers include data on age-specific predicted values for interpretation and identification of lung function relative to normal age-defined values.

Regular assessment of the quality of spirometry performed is highly recommended to ensure quality and reliability are high. An online service, Spirometry 360, which is available for a licence fee, addresses the need for quality feedback after training (www.spirometry360.org).

### *Interpretation of spirometry*

COPD is diagnosed when with three acceptable spirometry measurements of flow against volume or time, testing demonstrates the ratio $FEV_1$/FVC less than 0.7 after administration of bronchodilator medication. The online Spirometry Calculator in the Primary Care Respiratory Toolkit can help with interpreting spirometry results for an individual patient (www.lungfoundation.com.au/health-professionals/clinical-resources/copd/primary-care-respiratory-toolkit).

Patients with a diagnosis of COPD, require regular, ongoing monitoring of $FEV_1$ because treatment recommendations change with disease progression. A summary stepwise guide to pharmacological and nonpharmacological interventions according to level of severity of disease in COPD is available online (www.lungfoundation.com.au/health-professionals/guidelines/copd/stepwise-management-of-stable-copd).

**Table. Comparison of features of COPD and asthma**

| Features | COPD | Asthma |
|---|---|---|
| Age of onset | Mid-life | Often early in life |
| Progression | Symptoms slowly progress | Symptoms vary from day to day |
| Symptom trigger, diurnal variation | Dyspnoea during exercise | Symptoms at night/early morning |
| Associated atopy | May not have atopy | Allergy, rhinitis and/or eczema may be present |
| Family history | Uncommon | Common – family history of asthma and/or allergic diseases |

## Differential diagnosis and spirometry

Both asthma, characterised by reversible airflow obstruction, and COPD are common diseases of the airways. Overlap between them often causes diagnostic confusion and management challenges. Symptoms may be similar in both conditions (Table), and there is considerable overlap as many people with asthma smoke and longstanding asthma may have a degree of irreversibility.

The change in $FEV_1$ after an acute bronchodilator reversibility test indicates the degree of reversibility of airflow limitation. The reversibility is expressed as a percentage of the baseline measurement (e.g. a 12% increase). An increase in $FEV_1$ of more than 12% and 200 mL is greater than average day-to-day variability of the measurement.

The co-occurrence of COPD and asthma denotes a worse prognosis. It also provides a strong indication for the use of inhaled corticosteroids in addition to long-acting bronchodilators, without the strictures of $FEV_1$ severity and frequency of COPD exacerbations.

## Conclusion

Studies have shown that many cases of COPD are not diagnosed and this lack of diagnosis results in poorer outcomes for patients. GPs can screen susceptible patients with handheld devices during the consultation and refer for or perform spirometry when indicated. Understanding the key spirometry measurements and the overlap with asthma will help guide management. RMT

## References

A list of references is included in the website version of this article (www.medicinetoday.com.au).

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