Lung function tests

Lung function tests used in the diagnosis and management of asthma include:

- spirometry
- peak expiratory flow measurement
- bronchial challenge tests
- oscillometry.

Spirometry

Spirometry is the most established lung function test for confirming the presence of variable expiratory airflow limitation in the diagnosis of asthma and for measuring lung function when assessing asthma.

Spirometry can detect airflow limitation, measure the degree of airflow limitation compared with predicted normal airflow (or with personal best), and demonstrate whether airflow limitation is fully or partially responsive to a bronchodilator (when performed before and after administration of bronchodilator).

Spirometry should be performed by well-trained operators with well-maintained and calibrated equipment.

Spirometry can be performed in primary care if reliable equipment and appropriately trained staff are available. If not, clinicians can refer patients to an accredited respiratory function laboratory.

Table

Respiratory function laboratories providing testing in children

Location	Laboratory	Spirometry minimum age	FeNO minimum age	Bronchial provocation*	Accepts primary care referrals (wait time)†
Brisbane	Queensland Children's Hospital	3 years‡	No age restriction	Mannitol	No
Newcastle	John Hunter Hospital	5 years	5 years	Mannitol	Yes (<4 weeks)
Sydney	The Children's Hospital at Westmead	4 years	4 years	Mannitol	No
Sydney	Sydney Children's Hospital, Randwick	4 years	4 years	Mannitol	Yes (2–6 weeks)
Melbourne	Royal Children's Hospital	4 years	6 years	Mannitol Exercise	Yes (1–2 weeks)
Adelaide	The Lung Lab, Women's & Children's Hospital	5 years	5 years	Mannitol Exercise	Yes (8 weeks)
Perth	Perth Children's Hospital	5 years	7 years	Mannitol Exercise	Yes (1–2 weeks)

Additional information

Data obtained by personal communication mid-2025. This list is not exhaustive and services may change over time. Clinicians should check test availability and age restrictions with their local respiratory function laboratory before referring.

FeNO: fractional exhaled nitric oxide

*Main test(s) offered

† Estimated typical wait time for primary care referrals in May 2025. May not apply to specialist referrals and internal referrals from the affiliated or parent institution.

‡Accepted if considered able to cooperate with test procedure

Key diagnostic information from spirometry

FEV_1 below normal for the patient's sex, age, and height shows abnormal lung function.

A reduced ratio of forced expiratory volume in 1 second (FEV_1) to forced vital capacity (FVC) shows the patient has expiratory airflow obstruction, but does not prove asthma.

A positive bronchodilator responsiveness test confirms asthma if typical symptoms present.

Bronchodilator responsiveness test

The bronchodilator responsiveness test involves performing spirometry with at least three acceptable manoeuvres, and recording the highest FEV_1 reading obtained, then repeating spirometry 10–15 minutes after giving rapid-acting bronchodilator (e.g. 400 microg salbutamol).

Bronchodilator responsiveness is assessed by measuring the change in FEV_1. The spirometer software calculates the absolute and percentage increase in FEV_1 before and after the bronchodilator.

Adults and adolescents: The test is positive if there is a clinically significant increase, defined in adults and adolescents 12 years and over as a relative increase ≥12% and absolute increase ≥ 200 mL, compared with pre-bronchodilator FEV_1.[GINA 2025]

A lesser increase may suggest asthma in some circumstances. For example, an absolute increase ≥10% of the individual's predicted FEV_1 may suggest asthma in a patient with normal FEV_1 and no evidence of expiratory airflow limitation (FEV_1/FVC > 0.7).

Alternative criteria are used in some spirometry software and testing centres.[Stanojevic 2021]

Children: The test is positive if the absolute increase in FEV_1 is greater than 10% of the predicted FEV_1 value for the individual.

References

Global Initiative for Asthma (GINA). Global Strategy for Asthma Management and Prevention, 2025. Available from: www.ginasthma.org

Stanojevic S, Kaminsky DA, Miller M, et al. ERS/ATS technical standard on interpretive strategies for routine lung function tests. Eur Respir J 2021; 60: 2101499.

Resources

National Asthma Council Australia's spirometry training and tools

TSANZ's list of accredited respiratory function laboratories

Peak expiratory flow measurement

Peak flow meters are small handheld devices for measuring expiratory flow rate in litres per minute. They can be used by individuals for home monitoring, but have a limited role in asthma diagnosis because peak flow is inferior to spirometry for measuring lung function.

Peak flow measurement in diagnosis

The use of peak flow measurement to detect variable expiratory airflow limitation can be considered if spirometry is not accessible within a few weeks or days, according to clinical urgency.

Mean diurnal variability is calculated as follows:[GINA 2025]

1. Calculate each day's score: ([day's highest – day's lowest] / mean of day's highest and lowest) x 100

2. Add up each daily score over the monitoring period and calculate the mean.

Daily variation >10% supports the diagnosis of asthma.

An **online calculator** using the daily amplitude percent mean method is available from Asthma + Lung UK.

Serial peak expiratory flow monitoring is also used in the investigation of suspected work-related asthma,[Hoy 2020] as very frequent spirometry would be impractical.

Peak flow measurement in asthma monitoring

Self-monitoring of lung function is not necessary, but can be conducted if the patient prefers.

Asthma action plans for adults can include a reduction peak flow measurement (compared with personal best) as a prompt for adjusting treatment.[GINA 2025]

References

Global Initiative for Asthma (GINA). Global Strategy for Asthma Management and Prevention, 2025. Available from: **www.ginasthma.org**

Hoy R, Burdon J, Chen L, et al. Work-related asthma: A position paper from the Thoracic Society of Australia and New Zealand and the National Asthma Council Australia. Respirology 2020; 25: 1183-1192.

Resources

Asthma + Lung UK's **Peak flow variability calculator**

Bronchial provocation tests

Bronchial provocation (challenge) tests for airway hyperresponsiveness are available in accredited respiratory laboratories. They involve conducting serial spirometry before and after a precisely measured challenge to measure fall in FEV_1.

Bronchial provocation tests of airway hyperresponsiveness include:[Coates 2017, Hallstrand 2018]

- direct challenge tests (e.g. methacholine challenge test)
- indirect challenge tests (e.g. exercise challenge test, eucapnic voluntary hyperpnea, hypertonic saline, mannitol challenge test).

A positive bronchial provocation test demonstrates airway hyperresponsiveness, which is consistent with a diagnosis of asthma.

Positive bronchial provocation testing is generally used only if the diagnosis remains uncertain after spirometry and FeNO testing.

References

Coates AL, Wanger J, Cockcroft DW, et al. ERS technical standard on bronchial challenge testing: general considerations and performance of methacholine challenge tests. Eur Respir J 2017; 49: 1601526.

Hallstrand TS, Leuppi JD, Joos G, et al. ERS technical standard on bronchial challenge testing: pathophysiology and methodology of indirect airway challenge testing. Eur Respir J 2018; 52: 1801033.

Oscillometry

Impulse oscillometry (also called forced oscillation technique) is a non-invasive test for lung function in asthma.[Galant 2017, Ducharme 2025] Oscillometry measures the mechanical properties of the respiratory system (upper and intrathoracic airways, lung tissue and chest wall) during breathing.[King 2020]

Unlike spirometry, it is easily performed during tidal breathing, requires only minimal patient cooperation, and results are independent of effort.[Galant 2017, Ducharme 2025]

Current research focuses on its roles as an alternative to spirometry and bronchial provocation testing the diagnosis of asthma, in assessing asthma disease control and predicting exacerbations, and monitoring lung function.[Ducharme 2025]

Technical and quality standards and procedures for Australian clinical practice and respiratory laboratories are under development.[Cottee 2022]

References

Cottee AM, Thamrin C, Farah CS, et al. Quality assessment pathway for respiratory oscillometry. ERJ Open Res 2022; 8: 00569-2021.

Ducharme FM, Chan R. Oscillometry in the diagnosis, assessment, and monitoring of asthma in children and adults. Ann Allergy Asthma Immunol 2025; 134: 135-143.

Galant SP, Komarow HD, Shin HW, et al. The case for impulse oscillometry in the management of asthma in children and adults. Ann Allergy Asthma Immunol 2017; 118: 664-671.

King GG, Bates J, Berger KI, et al. Technical standards for respiratory oscillometry. Eur Respir J 2020; 55: 1900753.

Resources

University of Queensland Australian Central Over-Reading Centre's Oscillometry certification and training