

A Guide to Performing Spirometry

Spirometry is the most common lung function test available with well established guidelines for both adults and children. It plays an important role in the assessment of both children and adults with known or suspected asthma, is useful in quantifying the impact of therapies and interventions and measuring the degree of impairment.

It is important that spirometry must be quality-assured when being used to aid diagnosis and is recommended that anyone performing spirometry has been trained and consequently assessed to ARTP (Association of Respiratory Technology & Physiology) standards³ or equivalent standards by recognised training bodies.

Spirometry is recommended in the BTS/SIGN and NICE Guidelines as a first line investigation for aiding the diagnosis of asthma in adults and children aged 5 years and above. Therefore, attempting spirometry in school-aged children is encouraged to aid in diagnosis and correct management of their asthma.

Equipment, Calibration & Cleaning

There are a huge range of spirometers available to health care professionals; some of the more simple hand-held spirometers measure only FEV₁ and FVC, others will also produce a wide range of flow measurements and have graphical displays and/or print-out facilities.

IT IS IMPORTANT TO KNOW YOUR EQUIPMENT, HOW IT WORKS AND WHAT PARAMETERS IT IS CAPABLE OF MEASURING!

The ATS/ERS re-issued equipment specifications and standardised guidelines in 2005².

Calibration of spirometers should be performed using a certificated calibration/verification syringe following the manufacturer's guidelines. Calibration should be verified prior to use in each clinic/session and for the device to be within acceptable limits the volume must read +/- 3% of the true value.

Cleaning and maintenance should be carried out on a regular basis according to manufacturer's instructions and in conjunction with local guidelines/protocol.

Pre-test Requirement

- Height and weight should be measured wearing light clothing and without shoes (arm span can be used as an estimation of height if this cannot be measured).
- Age, gender and ethnicity should be recorded and entered into the spirometer if this data is requested as part of the set-up.

Performing Spirometry

It is important to explain the procedure to the patient, focusing on the required technique and the fact they will have to perform the manoeuvre more than once.

Demonstrating the technique, particularly to young children, can be helpful so they are able to see exactly what is expected of them and how much effort is required.

If your equipment has any incentives games as part of the spirometry program – USE THEM! Whether you are attempting spirometry on a 5 year old child for the first time, or a teenager you know is more than capable of performing the technique, incentive interaction can be extremely helpful in giving them something to focus on during the manoeuvre.

Spirometry step-by-step

- Attach a clean disposable mouthpiece/filter to the spirometer.
- Instruct the patient to breathe in as deeply as possible to full inspiration, then place their lips tightly around the mouth piece maintaining an air tight seal (NB – Some equipment may allow the patient to put their mouth around the mouthpiece and breathe in through this prior to the forced expiratory manoeuvre).
- The patient should blow out with force, as fast as they can and continue until there is nothing left to expel. (Encouraging the patient not to give up too soon and coaching in between attempts to perfect the technique is essential).
- At this point, the patient should remove the mouthpiece from their mouth.
- A minimum of 30 seconds should be allowed between repeated attempts and patients should only be asked to make a further attempt when fully recovered.
- The test should be repeated at least three times, with no set maximum number of tests.

Things to consider

- The patient should ideally produce at least two acceptable manoeuvres, within recommended limits of each other¹. If only one satisfactory attempt is recorded, then these results should not be excluded. They can be reported with the addition of a technical comment noting the difficulties the patient may have had in achieving reproducible results.
- The highest FEV1 and FVC should be reported even if they do not come from the same manoeuvre, as long as both manoeuvres were technically sound.
- If this is the child's first attempt at spirometry it is important to allow extra time so they are able to familiarise themselves with the equipment, the required technique and the healthcare professional.
- A first attempt may not result in any data being obtained; it may not even result in the child attempting the test! The child may need time to explore/play with the mouthpiece and observe others attempting the test – involving parents/carers can be extremely beneficial and will help the child gain confidence to attempt the technique.
- Age appropriate descriptions and stories can be used to explain to the child what is required. For example; blowing out candles on a birthday cake, blowing up balloons, blowing bubbles etc.
- Software/equipment with interactive incentives can be extremely useful; if incentives are available it is worth using them on a wide range of patients to encourage their best efforts
- Posture and nose clip use should be recorded for comparison of future attempts.
- If available, both volume–time and flow–volume curves should be visually inspected. Attempts should be disregarded if the flow–volume curve does not demonstrate a rapid rise to peak flow and a smooth descending limb. There should be no evidence of cough during the manoeuvre.

Reference Values

Some spirometers have pre-programmed reference equations and will calculate predicted values when you enter patient details. It is important to be aware of the reference values used to calculate this normative data – check your equipment/equipment manual so you know which references equations are being used.

In 2012 the Global Lung Initiative¹¹ published multi-ethnic reference values for spirometry for the 3–95 year age range.



Predicted values and normal range can be calculated from an online spreadsheet at <http://www.ers-education.org/guidelines/global-lung-function-initiative/spirometry-tools/desktop-individual-calculator.aspx>

Guidelines/References

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2. Miller MR, Hankinson J, Brusasco V, Burgos F, Casaburi R, Coates A, Crapo R, Enright P, van der Grinten CP, Gustafsson P, Jensen R, Johnson DC, Macintyre N, McKay R, Navajas D, Pedersen OF, Pellegrino R, Viegi G, Wanger J. Standardisation of spirometry. *Eur Respir J* 2005;26(2):319-338.
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