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INSPIRE

THE ESSENTIAL GUIDE TO SPIROMETRY

A guide to interpreting spirometry results

Follow the patient case study and apply to your own practice

For more information on training materials or to access the INSPIRE spirometry training programme, contact your Chiesi representative or visit the Chiesi Air website www.chiesiair.co.uk.

The case study presented is hypothetical and intended for illustrative purposes only.
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Follow the step-by-step guide on how to report spirometry results

Apply your learnings from each step to the patient case study

1

Spirometry is an essential investigation for the diagnosis and severity assessment of respiratory conditions.[1] **After performing spirometry, check the following to confirm that the results are fit for interpretation:**[1–3]

- The correct reference values have been used (usually GLI 2012)
- A minimum of 3 relaxed and 3 forced acceptable blows have been recorded
- The blows meet ARTP reproducibility criteria
- There are no errors visible on the volume-time or flow-volume curves

Do not reject results if the patient is unable to achieve the quality criteria, but do **record why this has not been possible**[1,3]

Sex: Male
Age: 72 years 1 month
Height: 175.0 cm
Weight: 74.0 kg
Predicted set: GLI Caucasian

Attempt	VC	Quality
1	4.15	Good
2	4.11	Good
3	**4.18**	Good

Attempt	FEV_1 (L)	FVC (L)	PEF (L/min)	Quality
1	1.50	3.69	**332**	Good
2	1.48	3.42	314	Good
3	**1.61**	3.72	272	Good
4	1.58	**3.78**	287	Good

Comment: Cough visible on flow-volume curve during second blow

2

Next, select the highest VC, FEV_1, FVC and PEF values across all acceptable efforts for analysis[3]

- Reproducibility criteria were not met on the forced manoeuvres until the fourth blow
- The highest values for each measurement are shown in **bold**

3

Assess the VC and FVC to determine which is largest and use the largest value to calculate the FEV_1 ratio ([FEV_1/VC or FVC]*100)[3]

- The patient's VC (4.18 L) is greater than their FVC (3.78 L), meaning **VC was used to calculate the FEV_1 ratio**

4

Analyse the VC, FVC, FEV_1 and FEV_1 ratio against the LLN to help define the type of ventilatory impairment[2,4] Obstruction, restriction and mixed disease can be detected by the following measurements:

Obstruction[2]
- Reduced FEV_1/FVC ratio

Restriction[2]
- Reduced FEV_1
- Reduced FVC

Mixed disease[2]
- Reduced FEV_1
- Reduced FVC
- Reduced FEV_1/FVC ratio

The LLN represents a cut-off to define lung function values that fall into the bottom 5% of the predicted reference range for a healthy population. Z-scores are used to quantify the difference between the patient's test value and their predicted value.[2,4]
'Reduced' means that the value is less than the LLN or a Z-score of -1.645[2]
(GOLD suggest comparing to a fixed ratio of 0.7 for the FEV_1 ratio[5]**)**

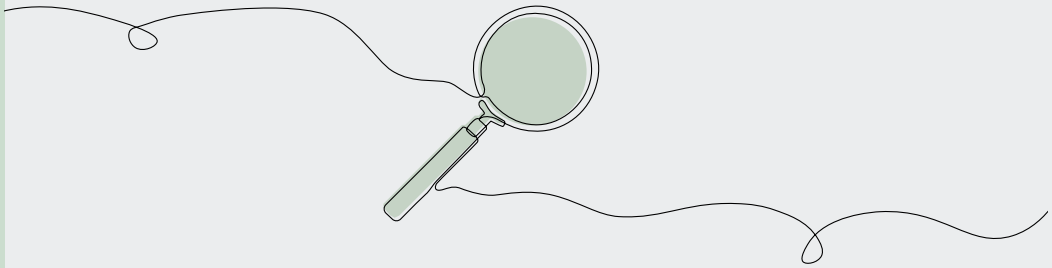
Best score with reference values for each measurement:

Index	Baseline	Predicted	% Predicted	LLN	Z-score
VC (L)	4.18	3.95	106	3.03	0.41
FVC (L)	3.78	3.81	99	2.81	-0.05
FEV_1 (L)	1.61	2.90	55	2.07	-2.54
FEV_1/VC (%)	39	74	52	62	-4.98

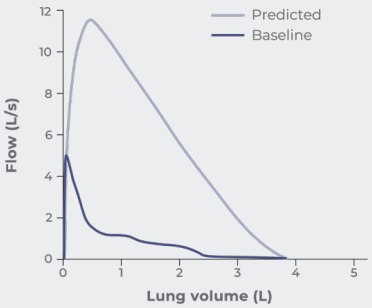
- The patient's **FVC and VC are normal**, ruling out airway restriction. However, their **VC is significantly larger than their FVC**, suggesting air trapping/hyperinflation[2]
- The **FEV_1 ratio is reduced**, suggestive of airway obstruction[2]

5

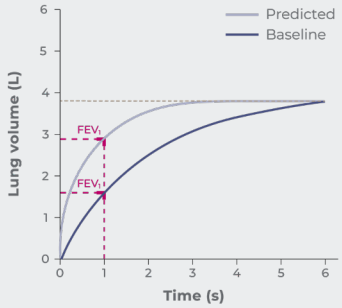
Check the volume-time and flow-volume curves for any abnormalities to help confirm your insights[1]



Flow-volume curve



Volume-time curve



The patient's spirometry traces also show features that suggest obstructive lung disease:
- The flow-volume curve has a distinctive **'church steeple' appearance**
- The volume-time curve shows a **reduced FEV_1 ratio**

6

Check the post-bronchodilator FEV_1 reversibility to help distinguish the cause of disease if baseline spirometry suggests an obstructive picture[1]
- Significant FEV_1 reversibility (defined by NICE as an improvement of >400 mL) identifies asthma as a likely underlying cause[6]

- There was **minimal FEV_1 improvement** (increase of 20 mL to 1.63 L; 57% predicted) after receiving a short-acting bronchodilator, indicating that asthma is unlikely to be causing the patient's airflow obstruction

REVEAL THE PATIENT'S DIAGNOSIS ON THE BACK PAGE

Consider how the results are used to make a diagnosis

Interpreting spirometry results in the context of the patient's clinical presentation and history is crucial to ensure an accurate diagnosis[1]

- Retired builder
- Limited daily activity due to shortness of breath
- 2 chest infections in the last 12 months
- Dry cough, no exacerbation
- Smoker, 10-a-day with 50-year history

In the appropriate clinical context (e.g., relevant symptoms, potential risk factors), **the spirometry results have confirmed a COPD diagnosis for this patient**

Use post-bronchodilator FEV_1 % predicted to assess the severity of airflow obstruction in patients diagnosed with COPD*[5,6]

- Note that this is the severity of airway obstruction and not the severity of COPD

The patient's **FEV_1 % predicted was 55%, suggesting moderate obstruction** according to NICE and GOLD guidelines[5,6]

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*The FEV_1 z-score is used to assess severity of obstruction in other respiratory conditions, including asthma.[7]

ARTP, Association for Respiratory Technology and Physiology; COPD, chronic obstructive pulmonary disease; GLI, Global Lung Function Initiative; FEV_1, forced expiratory volume in 1 second; FVC, forced vital capacity; GOLD, Global Initiative for Chronic Obstructive Lung Disease; LLN, lower limit of normal; NICE, National Institute for Health and Care Excellence; PEF, peak expiratory flow; VC, vital capacity.

References: 1. A guide to performing quality assured diagnostic spirometry. BTS. 2013. Available from: https://www.brit-thoracic.org.uk/media/70454/spirometry_e-guide_2013.pdf [Accessed November 2024]; **2.** Stanojevic S, et al. *Eur Respir J*. 2022;60(1):2101499; **3.** Performance of spirometry in adults. ARTP. 2023. Available from: https://www.artp.org.uk/resources/spirometry_sop_2023 [Accessed November 2024]; **4.** Sylvester KP, et al. *BMJ Open Respir Res*. 2020;7(1):e000575; **5.** Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease. GOLD. 2024. Available from: https://goldcopd.org/2024-gold-report/ [Accessed November 2024]; **6.** Chronic obstructive pulmonary disease in over 16s: diagnosis and management (NG115). NICE. 2019. Available from: https://www.nice.org.uk/guidance/NG115 [Accessed November 2024]; **7.** Spirometry standards document. ARTP. 2024. Available at: https://www.artp.org.uk/write/MediaUploads/Training%20and%20Development/Spirometry/ARTPSpirometryStandardsV6Feb2024.pdf [Accessed November 2024].

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