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LE SAVOIR PREND FORME

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Spirometry interpretation for the diagnosis of chronic obstructive pulmonary disease

TARGET USERS

Health professionals who interpret spirometry results.

OBJECTIVES

- To guide interpretation
- To identify the values that should be taken into account
- To recognize situations that could interfere with spirometry results

TARGET POPULATION

Adults with a clinical presentation suggestive of COPD

EXCLUSION

- Follow-up spirometry
- COPD management
- The management of asthma or other lung diseases

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CONTENTS

Click here to consult all the scientific publications on this subject.

GENERAL INFORMATION

→ The diagnosis of COPD is based on a thorough assessment of the clinical presentation supported by spirometry showing persistent post-bronchodilator obstruction.

→ Analyzing spirometry results is a 4-step process:

1. Assessing the technical quality of the test based on validity and repeatability criteria;
2. Analyzing the pre- and post-bronchodilator values for the main spirometric parameters (FVC[1], FEV_1[2] and FEV_1/FVC ratio);
3. Assessing the values for the short-acting bronchodilator (SABD) response[3] to determine:
   - If the response is significant; and
   - If the airway obstruction is reversible (algorithm);
4. Determining the plausible respiratory profile based on the spirometric parameters: obstructive, restrictive pattern, or mixed.

→ Two methods[4] can be used to interpret the results:

- The fixed FEV_1/FVC ratio;
- The lower limit of normal (LLN).

→ The following situations should be taken into account when interpreting the results:

- Abdominal obesity (possible non-parenchymal restriction: underestimation of the FVC and overestimation of the FEV_1/FVC ratio);
- Large height;
- Advanced age (over 80) or under 50 (overdiagnosis and underdiagnosis, respectively, of COPD, if the fixed FEV_1/FVC ratio method is used, especially in cases of mild COPD);
- Inhaled corticosteroid not paused before the test (could mask the presence of bronchial hyperresponsiveness, such as asthma);
- Validity and repeatability criteria only partially met;
- Possible interaction of non-selective beta-blockers with salbutamol.

1. Lung capacity, or the maximum volume of air that can be exhaled in a single exhalation using maximum effort initiated after a full inhalation.
2. Volume of air expelled in the first second. It reflects the size of the airways (volume of air forcefully exhaled from fully inflated lungs during the first second of an expiratory maneuver).
3. Do not confuse "bronchodilator response" with "airway obstruction reversibility". A bronchodilator response is a significant improvement in the FVC or FEV_1 after the administration of a bronchodilator, while reversibility is the normalization of the post-bronchodilator FEV_1/FVC ratio (≥ 0.7 or the lower limit of normal).
4. The fixed FEV_1/FVC ratio method does not take into account variability in measurements related to age, sex, height or ethnicity. It can result in overdiagnosis, especially in older adults. The LLN method (5th percentile of the healthy reference population) takes age, sex, height and ethnicity into account. They constitute a standardized approach for identifying values outside the expected range for the healthy reference population.

Québec

GUIDE TO INTERPRETING RESULTS BASED ON THE FIXED RATIO METHOD

The conclusions automatically generated by the spirometer's software should not be considered final without first examining the values they are based on.

Spirometry results obtained from a person suspected of having COPD

Based on the main spirometric parameters, 8 of the 16 possible results interpretations covering most situations are presented here.

Pre-BD $FEV_1/FVC < 0.7$?
Best pre-BD value

YES

NO

Pre-BD OBSTRUCTION
Post $FEV_1/FVC < 0.7$?
Best post-BD value

NO pre-BD OBSTRUCTION
Post-BD FVC < 80% of the PV?
Post-BD % of the predicted (% of the theoretical)

NON REVERSIBLE OBSTRUCTION
Post-BD improvement in the FEV_1 **OR** the FVC[a] ≥ **12% AND 200 mL** (Post-BD – Pre-BD)?
% change

REVERSIBLE OBSTRUCTION
Post-BD improvement in the FEV_1 **OR** the FVC[a] ≥ **12% AND 200 mL** (Post-BD – Pre-BD)?
% change

RESTRICTIVE PATTERN PROFILE
Post-BD improvement in the FEV_1 **OR** the FVC ≥ **12% AND 200 mL** (Post-BD – Pre-BD)?
% change

Post-BD improvement in the FEV_1 **OR** the FVC ≥ **12% AND 200 mL** (Post-BD – Pre-BD)?
% change

OBSTRUCTIF PROFILE

• Obstruction with a significant response to the BD • No reversibility of the obstruction	• Obstruction with no significant response to the BD • No reversibility of the obstruction	• Obstruction with a significant response to the BD • Obstruction completely reversible	• Obstruction with no significant response to the BD • Still, the test shows some reversibility of the obstruction	• **RESTRICTIVE PATTERN** on spirometry • Significant response to the BD	• **RESTRICTIVE PATTERN** on spirometry • No response to the BD	• Does not present with any obstruction • Significant response to the BD	• Does not present with any obstruction • No response to the BD • **Normal pattern**[b] on spirometry
• **CONSISTENT WITH COPD AND/OR ASTHMA,** depending on clinical presentation and history	• **CONSISTENT WITH COPD** • **DOES NOT RULE OUT ASTHMA**	• **RULES OUT COPD** • **CONSISTENT WITH ASTHMA**	• **RULES OUT COPD** • **DOES NOT RULE OUT ASTHMA**	• **RULES OUT COPD** • **CONSISTENT WITH ASTHMA**	• **RULES OUT COPD** • **DOES NOT RULE OUT ASTHMA**	• **RULES OUT COPD** • **CONSISTENT WITH ASTHMA**	• **RULES OUT COPD** • **DOES NOT RULE OUT ASTHMA**

- Assess the **severity of the bronchial obstruction and the nature and extent of the symptoms.**
- Choose the optimal treatment for COPD

Consult an experienced colleague or a respirologist if necessary, especially if concurrent asthma is suspected.

Obstruction severity (post-BD FEV_1 based on PV)
Mild: 80% or more
Moderate: 50-79%
Severe: 30-49%
Very severe: less than 30%

Continue the investigations as clinically relevant to determine the cause of the **restrictive pattern** or to **check for the presence of asthma** (beyond the scope of this tool).

LEGEND

a. In cases of an obstructive pattern, if the post-BD FVC is less than 80% of the PV, consult a respirologist.

b. Normal-flow spirometry in the presence of persistent symptoms does not rule out a lung disease and may require a respirology consult.

See column indicated in the spirometry report

STEPS TO BE TAKEN AFTER INTERPETING THE SPIROMETRY RESULTS

- In a symptomatic person with risk factors, COPD is confirmed if:
  - The absolute value for the post-bronchodilator FEV_1/FVC ratio is less than 0.7 OR
  - The FEV_1/FVC ratio is below the LLN post-bronchodilator.
- If the spirometry results confirm COPD, continue with an assessment of the severity of the bronchial obstruction and of the nature and extent of the symptoms, based on the current recommendations for guiding decision-making regarding the optimal treatment approach.
- If the spirometry test results are near the cutoff, consider repeating the test to confirm or rule out a diagnosis of COPD. If necessary, consult an experienced colleague or a respirologist.
- If the spirometry profile indicates a restrictive pattern, a baseline evaluation may be considered to determine the cause of the restriction (hyperinflation, parenchymal disease, neuromuscular disorder, etc.). If asthma is suspected and the spirometry test is normal, a methacholine challenge test may help rule it out. If necessary, consult the asthma management tool.

SITUATIONS THAT WARRANT SEEKING HELP FROM AN EXPERIENCED COLLEAGUE OR A RESPIROLOGIST FOR INTERPETRING SPIROMETRY RESULTS

- The presence of severe obstruction.
- Unexpected spirometry results, given the individual's clinical presentation.
- Spirometry results that are difficult to interpret (e.g., restrictive pattern, pseudorestriction or mixed respiratory pattern).
- Uncertainty regarding the presence of asthma concurrently with COPD or of another lung disease, based on the values for the spirometric parameters.

These recommendations were developed using a systematic approach and are supported by the scientific literature as well as by the knowledge and experience of Québec professionals with various specialties and areas of expertise. For further information, visit **inesss.qc.ca**.

For more information, and specifically to view sources, please see the **report associated** with this clinical tool.

If you have any questions regarding clinical tools, please write to: **info-outils.cliniques@inesss.qc.ca**.

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APPENDIX – SPIROMETRIC PARAMETERS

Spirometric parameters for distinguishing respiratory profile types using the fixed ratio or LLN[b] method						
PARAMETER[a]	**Obstructive Profile**		**Restrictive Pattern Profile**		**Mixed Profile** (restrictive and obstructive pattern)	
	Fixed ratio	**LLN**	**Fixed ratio**	**LLN**	**Fixed ratio**	**LLN**
FEV_1/FVC ratio (best post-BD values)	< 0.7	< LLN	≥ 0.7	≥ LLN	< 0.7	< LLN
FVC (% of the predicted) (best post-BD values)	≥ 80%	≥ LLN	< 80%	< LLN	< 80%	< LLN
FEV_1 (% of the predicted) (best post-BD values)	Normal[c] (> 80%) or ↓	Normal[c] (> 80%) or ↓	↓	↓	↓	↓
Notes	N/A		% of the predicted. Post-BD FEV_1 and FVC synchronously reduced.		% of the predicted. Post-BD FEV_1 reduced to a greater degree than that of the post-BD FVC.	
Flow-volume loop	Concave		Convex or resembles the predicted loop but is smaller		Concave with low volume	

a. The values reported for the ratio, FVC and FEV_1 are those obtained from the best measurements from three valid and repeatable post-bronchodilator breathing maneuvers.

b. Both methods (fixed ratio and LLN) can be used to interpret the results, but they have certain limitations, especially in cases of mild COPD. The fixed ratio method is associated with a risk of overdiagnosis or underdiagnosis, respectively, of COPD in persons over 80 and those under 50.

c. For individuals with mild obstructive disease, the FEV_1 is normal (≥ 80% of the predicted value), but the FEV_1/FVC ratio is reduced.