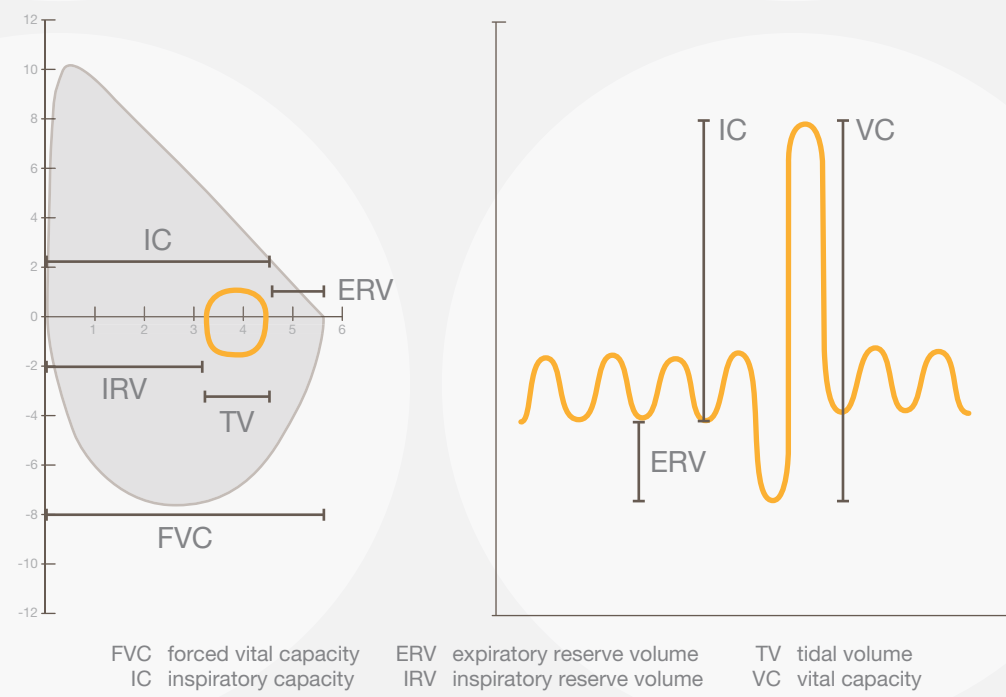
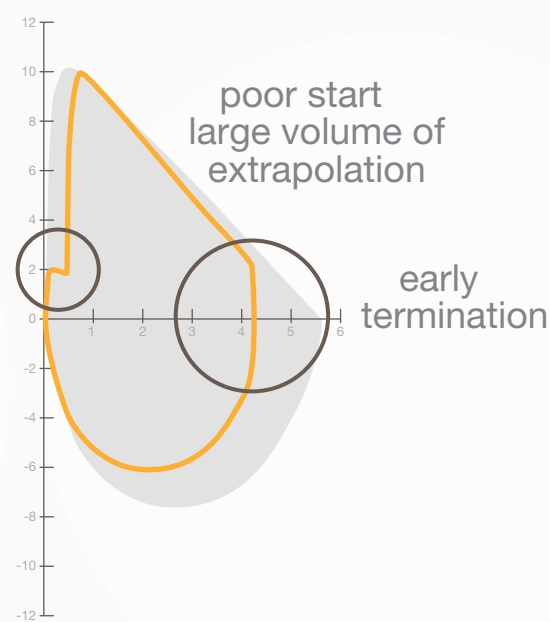


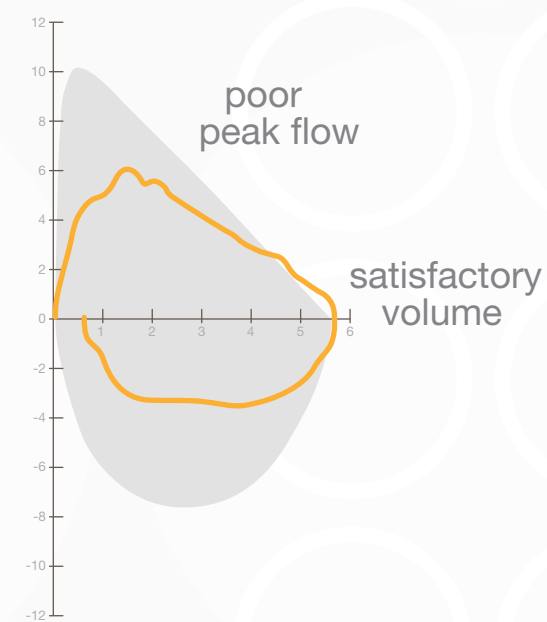
# Flow Volume Loop in Health and Disease



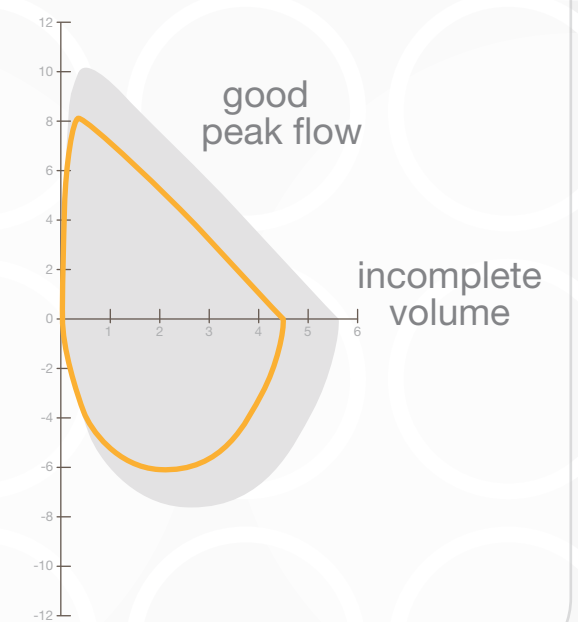
Effort-Related  
Poor start (or cough)  
Early Termination



Effort-Related  
Poor expiratory flow  
Good volume



Effort-Related  
Good expiratory flow  
Poor volume



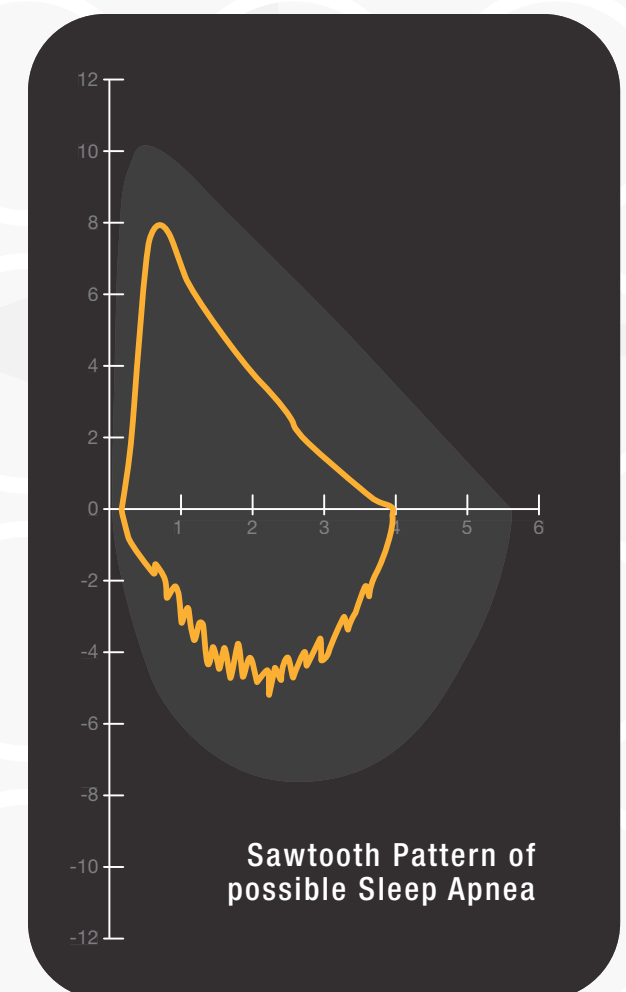
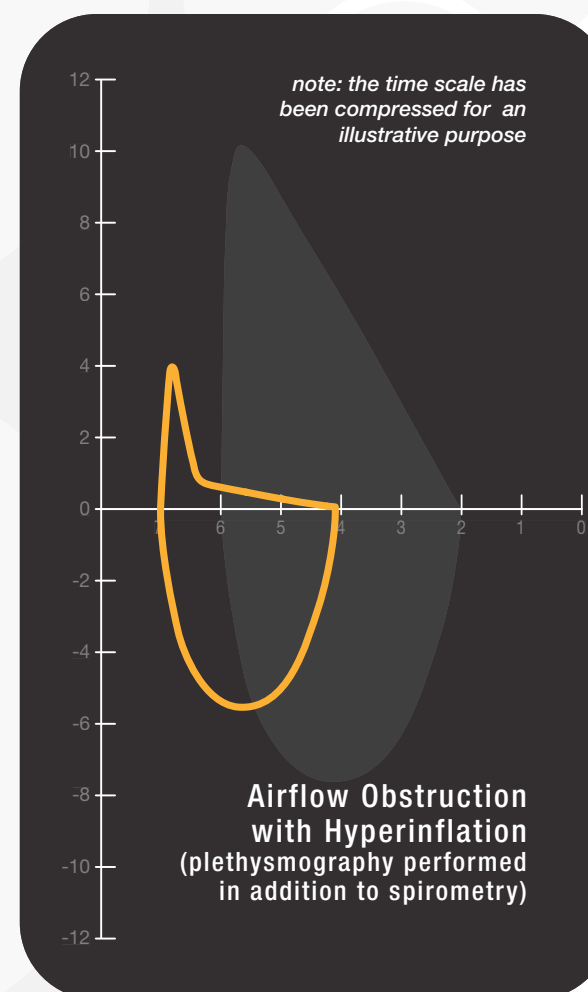
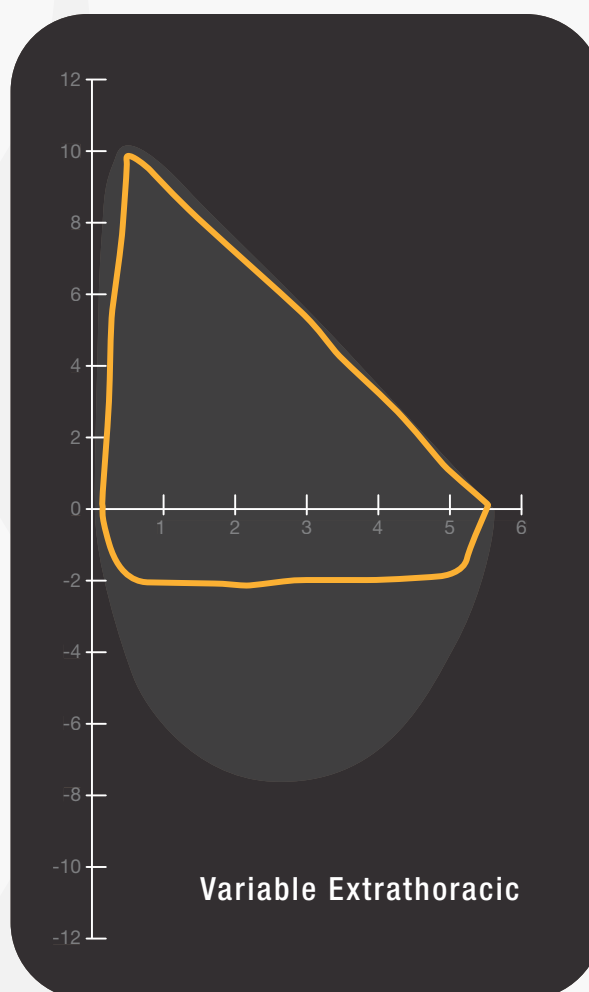
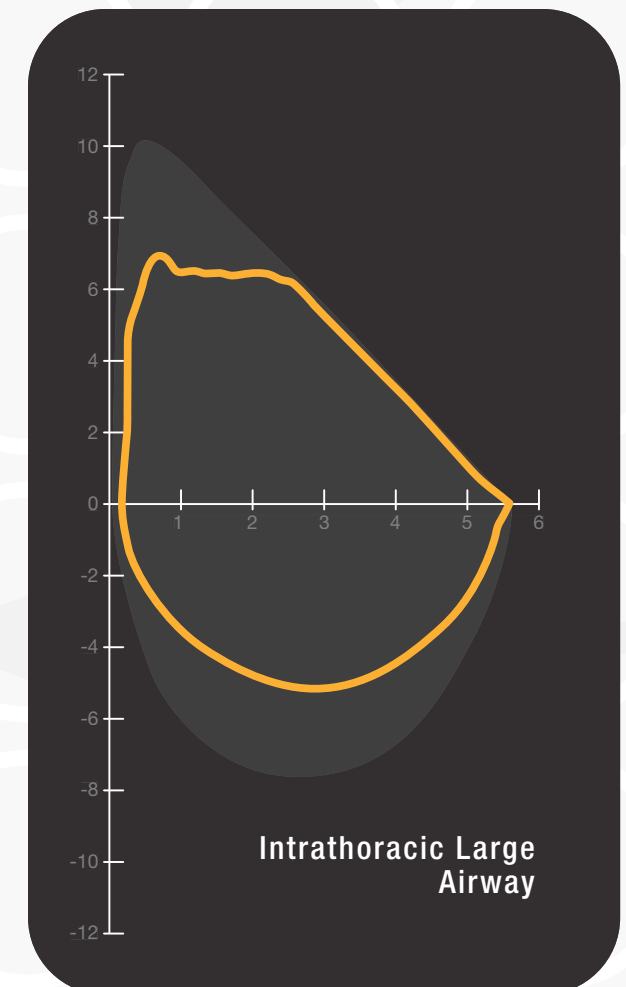
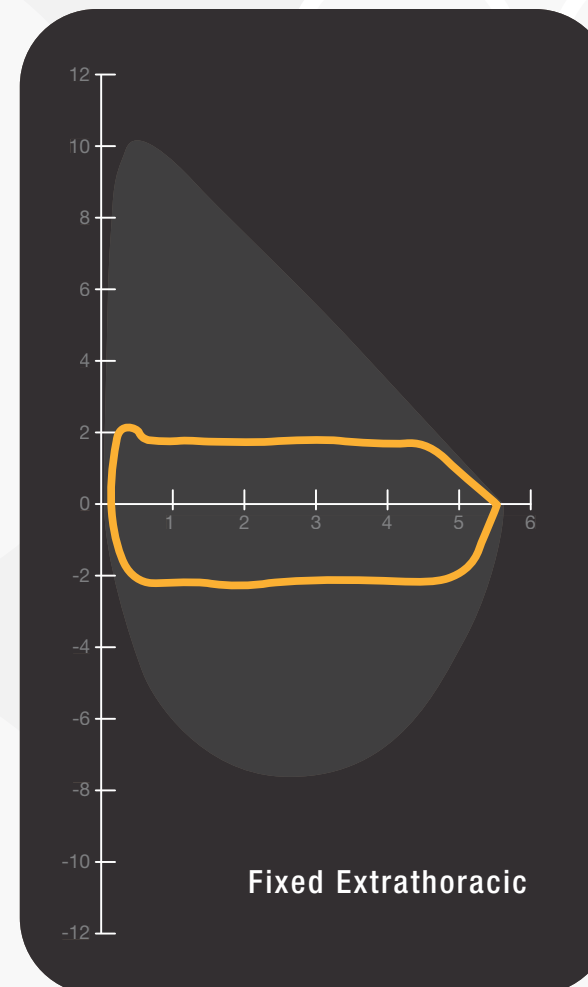
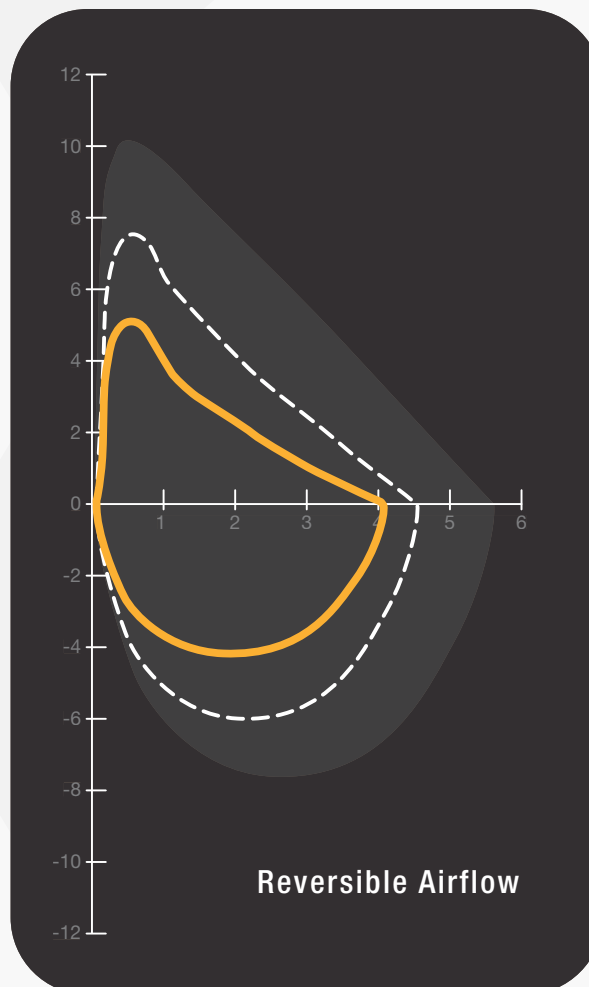
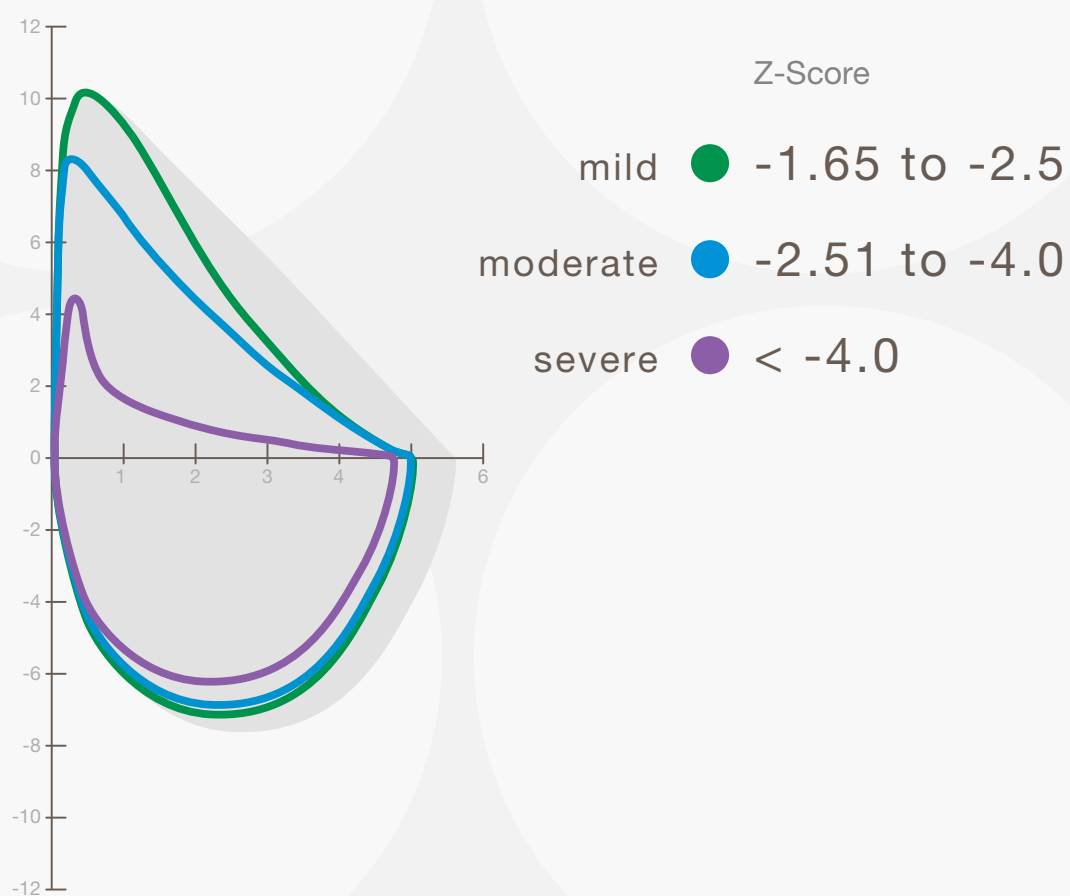
## Obstructive

An obstructive ventilatory impairment is defined by FEV1/FVC below the Lower Limit of Normal (LLN), which is defined as the 5th percentile of a normal population. The degree of abnormality can be defined using the Z-Score, which is the number of standard deviations from the reference value.

step 1:  
identify presence of obstruction

ratio of FEV1 divided by VC (FEV1/VC)  
is reduced or below the lower limits of normal

step 2:  
identify degree of obstruction



## Restrictive

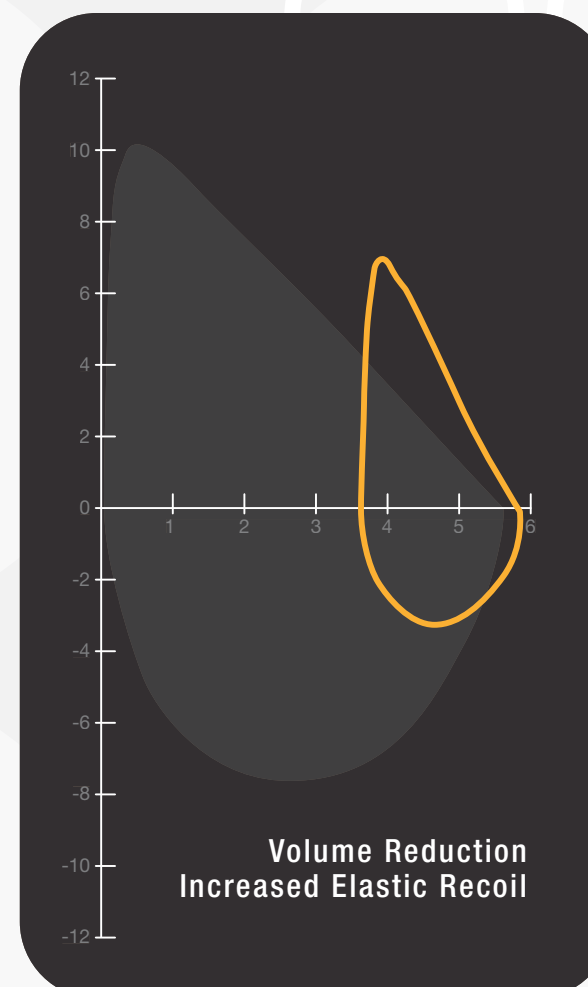
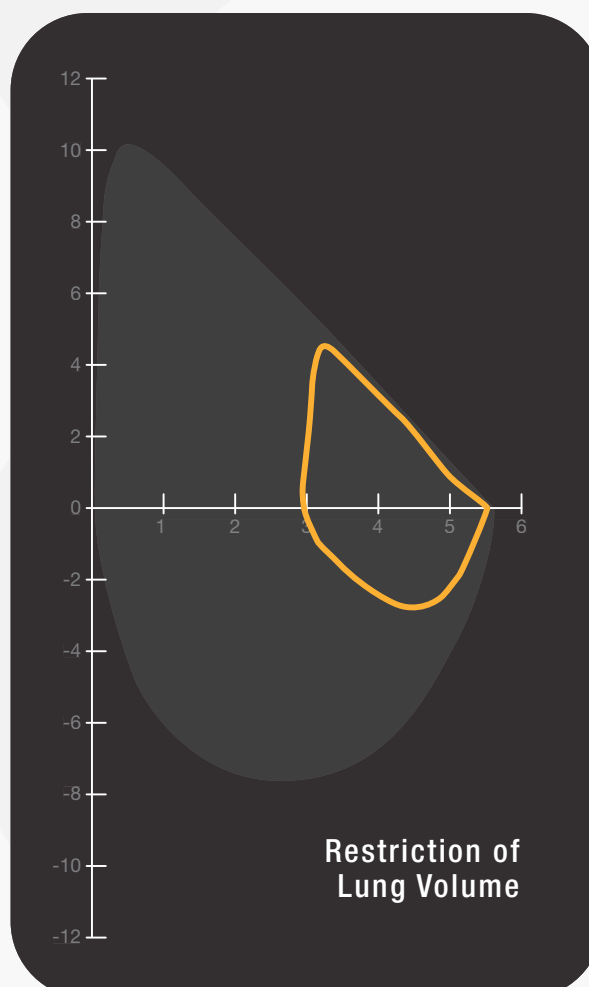
A restrictive ventilatory defect is the reduction of total lung volume. Since the airways may be normal, the flow volume loop can have a normal shape, only smaller with a lower pointed peak flow and volume.



To obtain an accurate diagnosis and eliminate the opportunity for effort-related results, spirometry and plethysmography or nitrogen washout is strongly recommended.

Spirometry alone may only "suggest" a restrictive ventilatory impairment.

If restriction is present, plethysmography or nitrogen washout can confirm the degree.



For additional information on pulmonary diagnostics, please consult the ATS/ERS guidelines:  
[www.thoracic.org](http://www.thoracic.org) || [www.ers-education.org](http://www.ers-education.org)

references:  
Standardization of Spirometry 2019 Update, ATS/ERS Technical Statement, American Journal of Resp & Critical Care Medicine 2019; Volume 200 Number 8  
ERS/ATS Technical Standard on Interpretive Strategies for Routine Lung Function Tests, Eur Respir J 2022; 60: 2101499

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