

Spirometry

What is spirometry?

A spirometry test measures the amount of air you are capable of exhaling during a forced breathing maneuver and the speed at which you can exhale it. The results from this test give an idea about the capacity of your lungs and the condition of your airways.

What should you expect?

The test is performed with a device called a spirometer that measures the amount and speed of the air you can blow out. Different methods of measurement lead to differently sized and shaped spirometers. A spirometer can be as small as a hair dryer, or it can be part of a large complicated device the size of a small desk, or it can be part of a glass booth that you sit inside. The test is performed the same way on all spirometers.

You will be asked to sit upright in a chair. You may be asked to loosen your bra or your belt if these could restrict your breathing. If you are using supplemental oxygen then you will be asked to take your nasal cannula off. You will probably have your nose clipped so that you will breathe only through your mouth, and you will be asked to breathe through a mouthpiece. It is important that you wrap your lips snugly around the mouthpiece in order to get a tight seal so that air does not leak.

When the spirometry test starts you will be told to breathe quietly for several breaths and then, when asked, to take as deep a breath as you possibly can and then to blow it out as fast and as long as you possibly can. The staff person giving you the test should be encouraging and coaching you the entire time you are performing the test. At the end of the test you may be asked to take another fast, deep breath in but this part is often optional.

You will probably need to perform the spirometry test at least three times but more may be necessary and this will be based on test quality and reproducibility. The staff person who is performing your test should tell you each time whether you did the test correctly, or if not, which part of the test you need to improve.

The spirometry test may make you very short of breath. This is normal. Despite this you need to blow out for at least six seconds, and to blow as hard as you can every time. If you become too tired, short of breath, or uncomfortable please take time to recover between tests. If you are using supplemental oxygen you can use it between tests if this will help you recover. You can drink water if your throat is uncomfortable or dry. Kleenex should be available if you start coughing.

What you need to know about

Spirometry

The nose clip and the mouthpiece should both be new and clean at the start of your testing session. If you are having difficulty keeping your lips snugly around the mouthpiece you should be given a flanged rubber mouthpiece to use which should also be new and clean. The staff person performing your test should be wearing gloves or at a minimum should have performed hand hygiene before your testing session.

What is a normal measurement?

While there are quite a number of values that can be measured from a spirometry test, the three most important and useful values are:

1. FVC (Forced Vital Capacity), which is the total amount of air you are able to exhale rapidly and with maximal effort, after a maximal inhalation, measured in liters.
2. FEV₁ (Forced Expiratory Volume in 1 Second), which is the amount of air you exhale in the first second of the FVC test, measured in liters.
3. FEV₁/FVC ratio, measured in percent.

These values are compared to normal values for someone that is your height, age, gender and ethnicity. These normal values will come from one of several different population studies and there are two different ways of making this comparison.

Percent predicted: an FVC or FEV₁ that is at least 80% of the predicted value is considered to be within normal limits. The normal range for the FEV₁/FVC ratio is more variable, but a value that is at least 95% of the predicted value is used most frequently.

Lower Limit of Normal (LLN): the lower limit of normal is based on a statistical analysis of the study population. An FVC, FEV₁ or FEV₁/FVC ratio above the LLN is considered to be within normal limits.

If the FVC, FEV₁ and FEV₁/FVC ratio are normal, then the test results are normal.

If the FVC is normal and the FEV₁ or FEV₁/FVC ratio are below normal, then this suggests you may have airway obstruction which includes lung diseases like asthma, COPD or bronchitis. The amount of reduction in FEV₁ reflects the severity of the disease. The FVC may also be reduced, but usually to a lesser degree than the FEV₁.

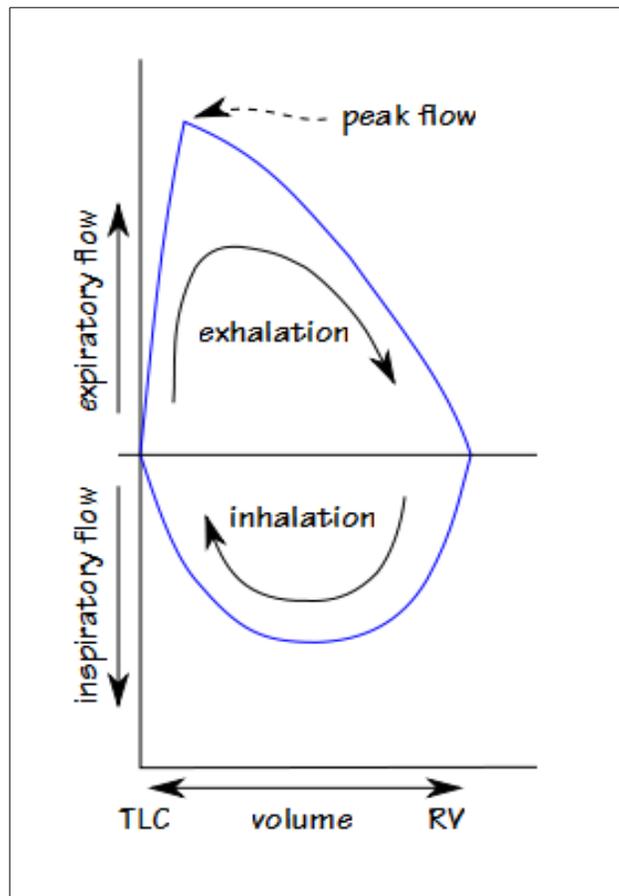
If the FEV₁ is normal and the FVC is below normal, then this suggests you may have a restrictive lung disease which includes lung diseases like pulmonary fibrosis, pneumonitis or sarcoidosis.

What you need to know about
Spirometry

If both the FVC and FEV₁ are below normal, then a below normal FEV₁/FVC ratio suggests an obstructive process, and a normal FEV₁/FVC ratio suggests a restrictive process. The diagnosis of a restrictive process cannot be made with confidence without evidence of a decreased total lung capacity (TLC).

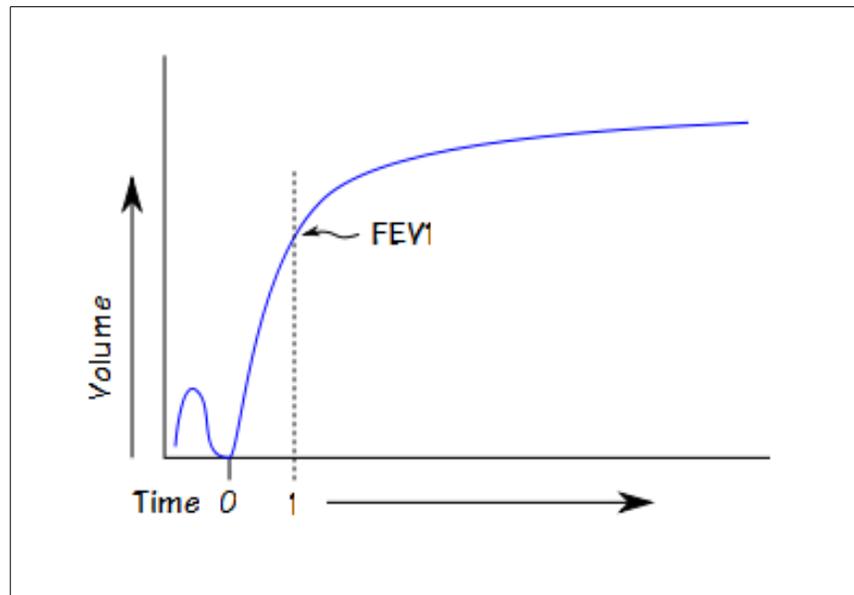
Spirometry graphs:

Spirometry test results usually include graphs of your tests. These graphs are flow-volume curves or loops and volume-time curves. A flow-volume curve compares the speed at which you blew out the air in your lungs with how much air you blew out. Different lung diseases have distinct flow-volume curve shapes and these shapes can reveal specific problems that are not shown by the numerical results from the spirometry test.



What you need to know about
Spirometry

Although volume-time curves also show patterns, these patterns are very subtle and the curves are most useful for assessing the quality of the spirometry test.



What affects test quality?

Your FVC can be underestimated:

1. if you do not take as deep a breath as you possibly can;
1. when you stop blowing out too soon;
2. when you leak air around the mouthpiece.

Your FEV₁ can be underestimated:

1. when you do not blow hard enough;
2. if you hesitate when you start blowing.

Your predicted FVC and FEV₁ are directly related to your height so your test results cannot be assessed correctly if your height has not been measured accurately. Your height should be measured regularly and it should be measured with your shoes off, with you standing straight while looking directly ahead.