

What you need to know about

Static Lung Volume Measurements

What is it?

This test measures your static or absolute lung volumes. The most important are the total lung capacity (TLC) and residual volume (RV). The RV is the volume of air remaining in the lungs at the end of a maximal exhalation. The TLC is the volume of air in the lungs at the end of a maximal inhalation.

What should you expect?

This test requires complicated equipment and will always be performed in a pulmonary function laboratory.

There are three different ways to measure static lung volumes, each requiring different equipment and different breathing maneuvers. They are all equally accurate and for all of these tests 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 have your nose clipped so that you will breathe only through your mouth and you will be asked to breath through a flanged rubber mouthpiece. It is important that you keep your lips snug on the mouthpiece in order to get a tight seal so that air does not leak.

Helium Dilution Test:

When the helium dilution test starts you will be told to breathe quietly and steadily. After a short period of time a valve will switch you into a breathing circuit and you will continue to breathe quietly and steadily for several minutes. At the end of this quiet breathing period you will be asked to steadily take as deep a breath as you possibly can and then to steadily blow out as much air as you can. The test will be over when this breath has been completed. The staff person giving you the test should be coaching you the entire time you are performing the test. You will probably need to perform this test at least twice.

If you require supplemental oxygen an oximeter should be used to monitor your blood oxygen levels during this test and the test should be stopped if your oxygen levels decrease below 84%.

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Nitrogen Washout Test:

When the nitrogen washout test starts you will be told to breathe quietly and steadily. After a short period of time you will be asked to steadily take as deep a breath as you possibly can and then to steadily blow out as much air as you can. When you have finished blowing out as much as you can a valve will switch you into a breathing circuit and you will be asked to breathe steadily and deeply. This breathing period will continue for one to two minutes and you will be told when the test is over. The staff person giving you the test should be coaching you the entire time you are performing the test. You will probably need to perform this test at least twice.

You will be receiving oxygen during most of this test so even if you require supplemental oxygen you do not need to be monitored with an oximeter.

Plethysmography:

You will be seated in a booth with a clear plexiglass door and plexiglass walls and the door will be closed. You will be asked to place your hands on your cheeks and to press in lightly so your cheeks are supported by your hands. When the plethysmography test starts you will be told to breathe quietly and steadily. At the end of a breath you will be alerted and a valve will be closed and your air will be cut off. You should continue to try to breathe in and out even though no air is moving. These breathing efforts should be moderate, steady and not abrupt. The valve will open after several of these breaths and you will be told to return to quiet, steady breathing. After a short period of time you will be asked to steadily take as deep a breath as you possibly can and then to steadily blow out as much air as you can. The test will be over when this breath has been completed. The staff person giving you the test should be coaching you the entire time you are performing the test. You will probably need to perform this test at least three times.

If you use supplemental oxygen this test usually lasts less than a minute so you will probably not need to be monitored with an oximeter.

These tests may make you short of breath and maybe even claustrophobic. This is normal. Despite this you need to keep your lips snug on the mouthpiece during the entire test so that air does not leak. All of these tests are safe and there will be no lasting effects.

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

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recover. You can drink water if your throat is uncomfortable or dry. Kleenex should be available if you start coughing.

The nose clip and the mouthpiece should both be new and clean at the start of your testing session. 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 several different static lung volumes measured during these tests the most important and useful value is the total lung capacity (TLC) which is measured in liters. The TLC is 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: a TLC that is at least 80% of the predicted value is considered to be within normal limits.

Lower Limit of Normal (LLN): the lower limit of normal is based on a statistical analysis of the study population. A TLC that is above the LLN is considered to be within normal limits.

What affects test quality?

TLC will be overestimated if there are any leaks during helium dilution or nitrogen washout tests. The effect of leaks during plethysmography testing are less predictable but TLC will not be accurate.

TLC will be underestimated if you do not take as deep a breath as you possibly can when asked to.

Your predicted TLC is 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.