

Reading your Pulmonary Function Report

A typical Pulmonary Function report usually has four and sometime five sections.

- Demographics
- Test results
- Graphs
- Interpretation
- Trends (less commonly included)

Although the order that these sections are placed on a report will vary a lot from one Pulmonary Function Lab to another, demographics will always be first.

Demographics:

At the very least the demographics section of your report should include:

- Patient identification (your name and hospital identification number)
- Gender
- Age and/or date of birth
- Height and weight
- Race or ethnicity

In order to make sense of your test results they must be compared with normal values. Your normal values will be based on your gender, age, height and race or ethnicity. Do not hesitate to speak up if any of the demographic values on your report are incorrect because this may cause your expected normal values to be incorrect and could lead to your test results being mis-interpreted.

There are sound physiological reasons why these values matter. Gender matters because men have bigger lungs than women do. Age matters because lung function peaks around age 20 and declines thereafter. Height matters because taller people have bigger lungs. Although race/ethnicity is a sensitive subject for many people, it matters because Caucasians tend to have larger lungs than Asiatics and blacks. Surprisingly enough, while weight can have an effect on lung capacity it is not useful in determining normal values for lung function.

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Test Results:

Test results are always placed in a table. Specific tests are always in rows and the way they are assessed is always in columns. There is no standard for the order of either the rows or the columns. For every test there will be columns for:

- **Observed test result** (what your test results actually were)
- **Predicted test result** (what should be normal for you)

There are two ways to assess the relationship between your observed and predicted results; percent predicted and Lower Limit of Normal (LLN). Depending on which of these the Pulmonary Function lab has chosen to use, there will be a column for:

- **Percent predicted** (what percent the observed test result was of the predicted result)

or:

- **Lower Limit of Normal** (how low the observed test result can be and still be considered normal)

Since tests can be repeated after you have been given a medication like an Asthma inhaler, there may also be columns for:

- **Post-medication test result**
- **Post-medication percent predicted**
- **Percent change** (how the post-medication test result differs from the baseline result)

For example, a table in a report with Spirometry test results could look like this:

	Observed:	%Predicted:	Predicted:	Post-Drug:	Post %Predicted:	%Change:
FVC (L):						
FEV ₁ (L):						
FEF ₂₅₋₇₅ (L/sec)						
FEV ₁ /FVC:						
Peak Flow (L/sec)						

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Or it could look like this:

	Predicted:	Observed:	LLN:	%Change:	Post-Drug:
FVC (L):					
FEV ₁ (L):					
FEV ₁ /FVC:					
Peak Flow (L/sec):					
FEF ₂₅₋₇₅ (L/sec):					

What's normal?

Normal values come from population studies from many different parts of the world with different mixes of ages, genders and races or ethnicities. For every Pulmonary Function test there are always a number of different population studies to choose from. Although the organizations that set standards for Pulmonary Function testing (the American Thoracic Society and the European Respiratory Society) have made recommendations concerning the selection of population studies every Pulmonary Function Lab will choose a set of studies that it believes best matches the people it tests.

As already mentioned, there are two different ways to determine whether test results are normal:

LLN:

The Lower Limit of Normal (LLN) is a concept based on statistical analysis. Any test result that is above the LLN is considered to be normal. Although there are many reasons why the LLN is a scientifically valid way to assess test results this is still an area of debate in Pulmonary Medicine.

When a test result is below the LLN, then the severity of the decrease is usually assessed by the result's percent predicted value.

Percent Predicted:

Normal results are based on the percent of the expected (predicted) normal value, which for most tests is 80% and above. This is to some extent quite arbitrary but several decades of experience has shown that it does seem to match individual clinical conditions quite well.

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What's normal for Spirometry?

The most important results from a Spirometry test are:

- FVC (the total amount of air you were able to blow out)
- FEV₁ (the amount of air you were able to blow out in the first second)
- FEV₁/FVC ratio (the ratio between the amount of air you were able to blow out in the first second versus the total amount of air you could blow out)

	FVC:	FEV ₁ :	FEV ₁ /FVC ratio:
Elevated:	Above 120%	Above 120%	Above 105%
Normal:	80% to 120%	80% to 120%	95% to 105%
Mildly reduced:	60% to 79%	70% to 79%	85% to 94%
Moderately reduced:	40% to 59%	60% to 69%	65% to 84%
Moderately severely reduced:		50% to 59%	
Severely reduced:	Below 40%	35% to 49%	Below 40%
Very severely reduced:		Below 35%	

What's normal for Static Lung Volumes:

The most important results from a Static Lung Volume test are:

- TLC (the total amount of air inside your lungs at the end of a maximal inhalation)
- RV (the amount of air left in your lungs after a maximal exhalation)

	TLC:	RV:
Elevated:	Above 120%	Above 120%
Normal:	80% to 120%	80% to 120%
Mildly reduced:	79% to 60%	79% to 60%
Moderately reduced:	40% to 59%	40% to 59%
Severely reduced:	Below 40%	Below 40%

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What's normal for Diffusing Capacity (DLCO)?

The most important value from a Diffusing Capacity test is the DLCO, corrected for hemoglobin.

	DLCO
Elevated:	Above 120%
Normal:	80% to 120%
Mildly reduced:	79% to 60%
Moderately reduced:	40% to 59%
Severely reduced:	Below 40%

Graphs:

The results from most Pulmonary Function tests can be shown as a graph. The most important purpose for these graphs is that they can assist the technician performing tests and the physician reading tests to quickly assess test quality. The way the results look in graphs can also occasionally assist in diagnosing specific lung diseases.

Reading the graph for a test often requires extensive technical knowledge and experience. This can be quite complicated and there are no simple rules.

Interpretation:

When test results are below normal, they can be used to indicate one or more of several conditions:

Airway Obstruction:

When airway obstruction is present this will mean that you can't blow your air out as fast as you should be able to. Airway obstruction can be a symptom of Asthma, Emphysema, Chronic Bronchitis and many other conditions.

Lung Restriction:

When lung restriction is present this means that you can't expand your lung as much as you should be able to. Lung restriction can be a symptom of Pulmonary Fibrosis, Sarcoidosis, ALS and many other conditions.

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Gas exchange defect:

When a gas exchange defect is present this means that your lung is not able to exchange oxygen and carbon dioxide as effectively as you should be able to. A gas exchange defect can be a symptom of a Pulmonary emboli, Emphysema, Pulmonary Fibrosis and many other conditions.

Diagnosis:

As much as you may want a clear and definitive diagnosis, it is often not possible to be specific. There is a great deal of overlap between different lung diseases and often the best that a Pulmonary Function test can do is to rule out certain conditions.

Computerized interpretations:

Many of the test systems used in doctor's offices and in clinics will include a computer interpretation of your test results. These interpretations are necessarily simplistic and their accuracy is very dependent on the quality of the test results. A computerized interpretation should be reviewed by a qualified professional before it becomes part of your medical record.

Trends:

Pulmonary Function reports occasionally include trends which allows current results to be compared to prior results. This is particularly important when an individual needs to have regular testing.

When reading a trend report it is important to realize that results normally change by small amounts from visit to visit. In general a change that is less than 10% from a prior visit is not considered to be significant.

It is also important to realize that all test results decline naturally with age. The amount of change within a single year is small but this becomes an important consideration when results from 10 or more years apart are compared.

Trending is a less common addition to Pulmonary Function reports because many of the simpler testing systems do not store their test results. It is also important to remember that it is not possible, at least at the present time, to trend results from tests performed at different Pulmonary Function labs.