



DEPARTMENT OF HEALTH & HUMAN SERVICES

Phone: (304) 285-5751

Fax: (304) 285-5820

National Institute for Occupational
Safety and Health (NIOSH)

1095 Willowdale Road

Public Health Service

Centers for Disease Control
and Prevention (CDC)

Morgantown, WV 26505-2888

{*FIRST NAME*} {*LAST NAME*}

{*ADDRESS*}

{*CITY*}, {*STATE*} {*ZIP CODE*}

{*TODAY'S DATE*}

Dear Ms. / Mr. {*LAST NAME*}:

Thank you for participating in the health testing conducted by the National Institute for Occupational Safety and Health (NIOSH) at {*SurveySite*} between {*TestingStartDate*} and {*TestingEndDate*}. Enclosed are the results of your health testing performed during that survey. The result of your baseline spirometry testing conducted on {*SpirometryTestDate*} {*SpirometryInterp*}. The result of your impulse oscillometry test {*IOSInterp*}. The result of your exhaled nitric oxide test {*ENOInterp*}. The result of your multiple breath washout test {*MBWInterp*}. The result of your vision test {*VisionInterp*}.

The actual values from your tests are enclosed with this letter. Any abnormal test results should not be considered a diagnosis of disease; that determination can only be made by your personal physician or healthcare provider following a complete medical evaluation.

EXPLANATION OF TEST RESULTS

Spirometry Test

The purpose of the coached breathing test (known as spirometry), which you performed on {*SpirometryTestDate*}, is to determine how your lung function compares to expected normal lung function. The test includes measurements of the forced vital capacity (FVC) (this is the maximal or total amount of air you can forcefully breathe out after taking a deep breath) and the 1-second forced expiratory volume (FEV₁) (this is the amount of air that you can breathe out in the first second of exhaling), and the calculation of the ratio of FEV₁ to FVC.

In the enclosed report entitled 'Report of Spirometry Findings', your test results are compared to predicted values for a healthy, non-smoking person of the same age, height, sex, and race. Graphs of your breathing tests appear on the second page of the report. [SPIROMETRY OPTIONS]

Impulse Oscillometry (IOS) Test

The purpose of this test is to better understand the way air flows through the larger (central) airways and smaller (peripheral) airways. The IOS testing machine sends sound waves (called pressure oscillations) at many frequencies into your airways to measure how your airways respond to these small pressures. The test calculates your airway resistance at frequencies of 5 Hertz (R5Hz) and 20 Hertz (R20Hz), your airway reactance at 5 Hertz (X5Hz), and the frequency where you have no airway reactance (Fres). Abnormalities in these values may indicate airways obstruction, or blockage of the flow of air through the airways. In the enclosed report entitled 'Report of Impulse Oscillometry Testing,' your test results are compared to predicted values (labeled as Pred) provided by CareFusion, the manufacturer of the IOS testing machine.

[IOS OPTIONS]

Bronchodilator Administration

You were asked to breathe in a medication (a bronchodilator called albuterol) from an inhaler to see if your test results were changed by this medication. [SPIROMETRY BRONCHODILATOR OPTIONS] [IOS BRONCHODILATOR OPTIONS]

Exhaled Nitric Oxide Test

The purpose of the exhaled nitric oxide test is to determine the amount of nitric oxide in the air that you breathe out. Nitric oxide is a gas that is produced by the airways, and elevated levels can be a sign of airway inflammation. [ENO OPTIONS].

Multiple Breath Washout Test

The purpose of the multiple breath washout test is to determine how evenly air is delivered to the different parts of the lungs. During the test, you were asked to breathe 100% oxygen gas. The oxygen gas replaces (“washes out”) the air in your lungs, which is mostly nitrogen gas. The testing machine measures the amount of nitrogen gas in the air you breathe out. It calculates a measure of how well gases mix in your lungs, the lung clearance index (LCI). [MBW OPTIONS].

Color Vision Tests

Your color vision was tested using the Lanthony Desaturated D-15 Test, a color arrangement test. This test asked you to put 15 caps in color order. This test screens for multiple color defects, including both inherited and acquired causes. Many things can cause color blindness, including workplace exposures, frequent alcohol consumption, medications, and diseases like diabetes. A graph of your color vision test results is displayed on the enclosed report entitled 'Report of Color Vision Test'. In a perfect test, the numbers are connected in order by the line, forming a horseshoe. Major errors are indicated by lines crossing the horseshoe shape (reflecting numerical caps significantly out of order), and may be indicative of color blindness.

[COLOR VISION OPTIONS]

Again, thank you for your participation in this study. If you have further questions about these results, please feel free to contact our office at 1-800-232-2114. You can also discuss the results with your personal physician. For your information, we have enclosed a list of free and income-base medical clinics in your area.

Sincerely,

{Medical Officer Name}

Medical Officer

Field Studies Branch

Respiratory Health Division

PARAGRAPH #1 OPTIONS

{*TestDate*} = date test performed

{*SpirometryInterp*} =

- (1) was within normal limits.
- (2) was interpreted as having an obstructive abnormality.
- (3) was interpreted as having a restrictive abnormality.
- (4) was interpreted as having a mixed abnormality.
- (5) showed a possible abnormality.
- (6) was not interpretable.

{*IOSInterp*} =

- (1) was within normal limits.
- (2) showed a possible abnormality.
- (3) was not interpretable.

(1)

{*ENOInterp*} =

- (1) was within normal limits.
- (2) was interpreted as abnormally high.
- (3) was not interpretable.

{*MBWInterp*} =

- (1) was within normal limits.
- (2) showed a possible abnormality.
- (3) was not interpretable.

{*VisionInterp*} =

- (1) was within normal limits.
- (2) showed a possible abnormality.
- (3) was not interpretable.

EXPLANATION OF TEST RESULTS OPTIONS

[SPIROMETRY OPTIONS]

- (1) Your lung function was within normal limits.
- (2) An obstructive abnormality indicates that air is exhaled from the lungs more slowly than normal. This can be seen in certain lung conditions such as asthma, bronchitis, or emphysema. The greater the obstruction (the lower the FEV₁), the more difficult it is to exhale the air from the lungs.
- (3) A restrictive abnormality indicates that the amount of air exhaled is smaller than normal. This can be seen in certain lung conditions such as lung scarring or fibrosis, or in people who are considerably overweight. It can also be seen in people who have a severe obstructive abnormality. The greater the restriction (the lower the FVC), the greater will be the possible physical limitation.
- (4) A mixed abnormality is the combination of obstructive and restrictive abnormalities. An obstructive abnormality indicates that air is exhaled from the lungs more slowly than normal. This can be seen in certain lung conditions such as asthma, bronchitis, or emphysema. The greater the obstruction (the lower the FEV₁), the more difficult it is to exhale the air from the lungs. A restrictive abnormality indicates that the amount of air exhaled is smaller than normal. This can be seen in certain lung conditions such as lung scarring or fibrosis, or in people who are considerably overweight. It can also be seen in people who have a severe obstructive abnormality. The greater the restriction (the lower the FVC), the greater will be the possible physical limitation.
- (5) Unfortunately, the tests were not performed in an adequate manner for us to be able to interpret your test results. In part, this may represent a failure on our part to properly train you to perform this test.

[IOS OPTIONS]

- (1) Your IOS test result was within normal limits.
- (2) Your IOS test result indicates a possible small (peripheral) airways abnormality.
- (3) Your IOS test result indicates a possible large (central) airways abnormality.
- (4) Your IOS test result indicates possible small (peripheral) and large (central) airways abnormalities.
- (5) Your IOS test result was not interpretable.

[SPIROMETRY BRONCHODILATOR OPTIONS]

- (1) % Change < 12% or Absolute Change < 200 ml
When you repeated the spirometry test your FEV₁ increased/decreased ***{BDPctChange}*** indicating an insignificant change in FEV₁ due to the bronchodilator medication.
- (2) % Change >= 12% and Absolute Change >=200 ml
When you repeated the spirometry test your FEV₁ increased ***{BDPctChange}*** indicating a significant change in FEV₁ due to the bronchodilator medication.
- (3) % Change = 0 and Absolute Change = 0 ml
When you repeated the spirometry test your FEV₁ did not change due to the bronchodilator medication.
- (4) Not Interpretable
Unfortunately, when you repeated the spirometry test it was not performed in an adequate manner for us to be able to interpret the result.

[IOS BRONCHODILATOR OPTIONS]

- (1) R5Hz decrease $\geq 20\%$ and Fres decrease $\geq 20\%$ and AX $\geq 40\%$
When you repeated the IOS test, your R5Hz decreased by **{R5HzBDPctChange}**, your Fres decreased by **{FresBDPctChange}**, and your AX decreased by **{AXBDPctChange}**, indicating a significant fall (improvement) in R5Hz, Fres, and AX due to the bronchodilator medication.
- (2) R5Hz decrease $\geq 20\%$ and Fres decrease $\geq 20\%$
When you repeated the IOS test, your R5Hz decreased by **{R5HzBDPctChange}** and your Fres decreased by **{FresBDPctChange}**, indicating a significant fall (improvement) in R5Hz and Fres due to the bronchodilator medication.
- (3) R5Hz decrease $\geq 20\%$ and AX decrease $\geq 40\%$
When you repeated the IOS test, your R5Hz decreased by **{R5HzBDPctChange}** and your AX decreased by **{AXBDPctChange}**, indicating a significant fall (improvement) in R5Hz and AX due to the bronchodilator medication.
- (4) Fres decrease $\geq 20\%$ and AX decrease $\geq 40\%$
When you repeated the IOS test, your Fres decreased by **{FresBDPctChange}** and your AX decreased by **{AXBDPctChange}**, indicating a significant fall (improvement) in Fres and AX due to the bronchodilator medication.
- (5) R5Hz decrease $\geq 20\%$
When you repeated the IOS test, your R5Hz decreased by **{R5HzBDPctChange}**, indicating a significant fall (improvement) in R5Hz due to the bronchodilator medication.
- (6) Fres decrease $\geq 20\%$
When you repeated the IOS test, your Fres decreased by **{FresBDPctChange}**, indicating a significant fall (improvement) in Fres due to the bronchodilator medication.
- (7) AX decrease $\geq 40\%$
When you repeated the IOS test, your AX decreased by **{AXBDPctChange}**, consistent with a response to the bronchodilator medication.
- (8) R5Hz decrease $< 20\%$ and Fres decrease $< 20\%$ and AX decrease $< 40\%$

When you repeated the IOS test, your R5Hz decreased/increased by ***{R5HzBDPctChange}***, your Fres decreased/increased by ***{FresBDPctChange}***, and your AX decreased/increased by ***{AXBDDPctChange}***, indicating no significant improvement in R5Hz, Fres, or AX due to the bronchodilator medication.

(9) Not interpretable

Unfortunately, when you repeated the IOS test it was not performed in an adequate manner for us to be able to interpret the result.

[ENO OPTIONS]

(1) ENO ≤ 4

Your exhaled nitric oxide result was less than 5 parts per billion which is within normal limits.

(2) ENO > 4 and ENO ≤ 50

Your exhaled nitric oxide result was ***{ENO result}*** which is within normal limits.

(3) ENO > 50

Your exhaled nitric oxide result was ***{ENO result}*** which is higher than expected and could indicate airway inflammation. It can be seen in people with airways diseases such as asthma. You should share this information with your personal physician, particularly if you have respiratory symptoms.

(4) Unfortunately, we were not able to interpret your test result.

[MULTIPLE BREATH WASHOUT OPTIONS]

(1) Your LCI was within normal limits.

(2) Your LCI was elevated, which may indicate uneven delivery of air to some parts of the lungs. Elevated LCI can occur in people with airways diseases such as asthma and chronic obstructive pulmonary disease (COPD).

(3) Unfortunately, we were not able to interpret your test results.

[COLOR VISION OPTIONS]

If AllCapsCorrect=TRUE Then

"Your test was without errors, indicating normal color vision."

Else If ColorConfusionIndex <= 1.8 Then

"Your test showed minor errors, but your color vision is probably normal. Though you had small errors in your test, these are likely due to the difficulty of the test, and do not reflect a problem with your color vision."

Else If ColorConfusionIndex > 1.8 and -2 <= ColorAngle <= 29 Then

"Your test showed errors that may reflect red-green color blindness. Protan color blindness is a kind of red-green color blindness. In some cases, the part of the eye that detects red light is absent, leading to complete red-green color blindness. In other cases, the eye can sense the light, but it does so incorrectly, leading to confusion between the two colors that can be mild or severe."

Else If ColorConfusionIndex > 1.8 and -30 <=ColorAngle < -2 Then

"Your test showed errors that may reflect red-green color blindness. Deutan color blindness is a kind of red-green color blindness, and is the most common cause of inherited color-blindness. In some cases, the part of the eye that detects green light is absent, leading to complete red-green color blindness. In other cases, the eye can sense the light, but it does so incorrectly, leading to confusion between the two colors that can be mild or severe."

Else If ColorConfusionIndex > 1.8 and -90 <= ColorAngle <= -65 Then

"Your test showed errors that may reflect blue-yellow color blindness. Tritan color blindness is also known as blue-yellow color blindness. It is very rare and causes people to confuse blue with green and purple with yellow. In some cases, the part of the eye that detects either blue light is absent, leading to complete blue-yellow color blindness. In other cases, the eye can sense the light, but it does so incorrectly, leading to confusion between the colors that can be mild or severe."

Else If ColorConfusionIndex > 1.8 and Angle Not Listed Above Then

"There are three major color vision problems. These are an inability to 'see' green light, red light, or blue light. The first two problems primarily lead to confusion between reds and greens. The problems with blue light cause people to confuse blue with green and yellow with purple. Sometimes, people do not fall into any one category. Your doctor can further evaluate this and help you determine the cause."