

Breath Carbon Monoxide Monitor – The “Stethoscope” of Tobacco Treatment ⁶

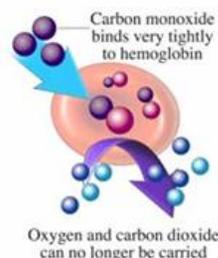
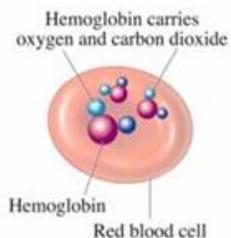
Do you know why you would use a breath CO monitor?

This document will help you understand its value as a diagnostic tool in tobacco treatment and tobacco prevention education.

What is carbon monoxide (CO)?

Carbon monoxide (CO) is a poisonous gas that you can't smell or see. It is a by-product of incomplete combustion and can be produced by car exhaust, faulty gas boilers, and from burning tobacco, marijuana, K-Spice and even cocaine. CO, tar, and nicotine are the main components of tobacco smoke. All represent some risk to health.

- Carbon monoxide affects the lungs, heart, and blood vessels. In pregnant women, CO passes into the blood of the fetus, reducing its oxygen supply.
- When tobacco smoke is inhaled, CO is absorbed into the blood through the lining of the lungs.
- Oxygen is carried around the body by red blood cells. CO binds with hemoglobin in the red blood cells to form carboxyhemoglobin (COHb), preventing red blood cells from carrying oxygen.
- CO binds with hemoglobin over 200 - 250 times more readily than oxygen.



What does CO do to the body?

This does not include the physiological harm from the 6,999 other chemical substances in tobacco smoke.

Heart: To compensate for the shortage of oxygen, the heart has to work harder (beat faster) to get enough oxygen to all parts of the body. The heart itself gets less oxygen, increasing the risk of heart damage.

Circulation: COHb causes the blood to thicken and the arteries to get coated with a thick, fatty substance. This causes circulation problems and high blood pressure, with increased risk of heart attack and stroke. Hands and feet become colder as less blood circulates to the extremities.

Breathing: With any increase in physical activity, the reduced supply of oxygen leads to shortness of breath since there is less oxygen available for the increased demand. Decreased oxygen availability can also cause tiredness and lack of concentration.

Pregnancy: Availability of oxygen, necessary for healthy fetal growth, is reduced when the pregnant mother smokes. The risk of low birthweight and cleft palate birth defect are increased. After birth, the risk of Sudden Infant Death Syndrome is higher for babies exposed to tobacco smoke.



What does the breath CO test indicate?

Two Forms of Biofeedback:

PPM (parts per million) – The breath CO test measures the number of parts of carbon monoxide in one million parts of breath air.

%COHb (percent carboxyhemoglobin) – The percent COHb indicates the percentage of vital oxygen in the bloodstream that has been replaced by CO.

- Breath CO test measures the amount of CO in the breath (**ppm**), which is an indirect, non-invasive measure of blood carboxyhemoglobin (**%COHb**), in other words, the level of CO in the blood. ¹
- The percentage of COHb is the amount of red blood cells carrying CO instead of oxygen. A COHb of 3.83% (on the average, 20 ppm, is approximately 1 pack of regular length cigarettes) indicates that 3.83% of the hemoglobin on the red blood cells is carrying CO instead of oxygen. This can lead to shortness of breath and heart damage.
- Breath CO level is highest later in the day after the smoker has consumed most, or all, of the daily ration of tobacco. CO leaves the body rapidly, with a half-life between 4 to 6 hours. Within 24 to 48 hours of no exposure to tobacco smoke or other source of incomplete combustion, CO level will return to normal, i.e., less than 6 ppm. ² Of course, accommodations must be made for those with exposure to CO in the workplace, passive smoke, or medical conditions such as inflammatory lung disease.
- Breath CO level also acts as an indicator of exposure to 7000 chemical substances present in tobacco smoke, 69 of which are known to cause cancer in humans. ³
- Breath CO level cannot be correlated to the exact amount of tobacco smoked but rather is an indicator of how *efficiently* tobacco is smoked. The tobacco user can tailor the delivery of nicotine by varying the amount of tobacco consumed, puff volume, and puff frequency. For example, a tobacco user may cut back on overall number of cigarettes but smoke each one more aggressively to extract the same amount of nicotine. Breath CO level may remain constant as fewer cigarettes are smoked more deeply. ⁴
- Breath CO level has been, however, roughly approximated to the number of cigarettes smoked per day. ⁵

What are the benefits of the breath CO testing as a diagnostic and educational tool?

At its most basic, the breath CO monitor is a tool that obtains clinical measurement of body functioning - like a stethoscope, ophthalmoscope, or blood pressure cuff.

Tobacco treatment programs that use breath CO monitoring have higher abstinence rates: A recent analysis of tobacco treatment in England identified behavior change interventions that were associated better outcomes. Breath CO monitoring was associated with a significant increase in the initiation of abstinence from tobacco.¹⁴

Breath CO testing establishes a tangible link between smoking and the body: Expired breath CO, a biomarker of tobacco smoke, has been well-correlated with the percentage of CO in the blood. The clinician can provide the patient with direct evidence of how tobacco smoke, and its 7000 constituents, affects the body. It is a springboard to discuss the causal relationship between tobacco use and cancer, stroke, heart disease, and respiratory disease. The health risks of smoking are no longer abstract but personalized...a powerful motivational tool. Throughout the course of treatment, feedback can be provided through the CO level that shows abstinence, low-level smoking, or return to full-blown smoking. Expired breath CO levels can also detect the smoking of other non-cigarette tobacco products such as cigars or pipe which are sometimes perceived by patients as "safer" forms of tobacco.⁸

Correlation of carbon monoxide level with severity of tobacco dependence: Baseline expired CO measurements have been correlated with severity of addiction to nicotine, specifically the withdrawal symptoms of craving and restlessness.⁹ Experienced CTTS and providers can utilize this information to deliver treatment more effectively.

Biochemical verification of efficacy of tobacco treatment: Expired breath CO is a biochemical verification of abstinence or continued smoke exposure. Clinicians who provide tobacco treatment services can evaluate how well on-going treatment is working and confirm self reported claims of abstinence.

Tobacco use disorder is like any other chronic relapsing illness: According to the Center for Disease Control, tobacco use disorder is the leading cause of disease and death in the U.S.¹⁰ The annual economic cost in the U.S. is approximately \$193 billion dollars in health-care expenditures and lost productivity.¹¹ The assessment of expired CO level of every tobacco user at every visit is a critical component of a comprehensive, systematic approach to the treatment of tobacco use disorder. Serial breath CO levels during on-going treatment are more likely to have a motivational impact than a single CO assessment.¹² An effective system-level intervention would also include access to clinicians trained in tobacco assessment and treatment, insurance coverage of all FDA-approved medications and behavioral counseling, and the total elimination of tobacco use at the work site.



Why monitor CO?

- Breath CO monitoring gives the clinical professional an invaluable tool in the practice of tobacco treatment. It facilitates the identification, assessment, education, and treatment of tobacco-dependent patients.⁶
- With a sensitivity and specificity in the 90th percentile, carbon monoxide monitored through the breath is a reliable and accurate biomarker of tobacco smoke.^{2,13}
- Routine breath CO levels during treatment for tobacco dependence have been shown to increase motivation to quit and remain abstinent.^{6,7} Recent data shows that including CO monitoring in treatment is associated with higher initial abstinence rates.¹⁴
- CO level is measured through exhaled breath. The test is easy, quick, and non-invasive. It provides a cost-effective means of validating the smoking status of a significant number of patients. After the initial outlay of funds for the monitor and accessories, the cost of testing is minimal, i.e., approximately \$0.33 per patient.
- The breath CO test is not regulated by the Clinical Laboratory Improvement Amendment (CLIA) and can be administered by non-technical staff.

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