Getting the Basics Right

Why a carbon monoxide test is an essential part of a GP and practice nurse's kit

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Carbon monoxide (CO) monitoring is a valuable motivational tool for smokers. It provides them with visible proof of the harm caused by smoking and it gives them a measure with which to chart their progress after they stop smoking.

Research shows that smokers are more likely to make a successful quit attempt if a CO breath monitor is used as part of a supported and structured quit plan.[1]

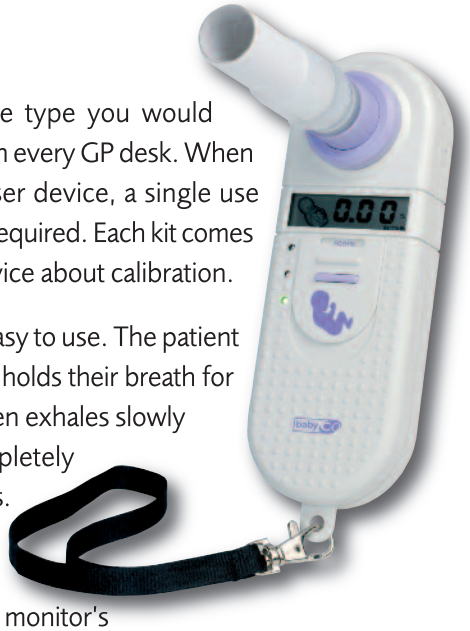
The monitor will be used to best effect when introduced by a health professional trained to support people to make a quit attempt through very brief advice. Having the right conversation with every patient who smokes opens up the opportunity to introduce this motivational change tool. The finding of a raised reading emphasises the measurable harm of smoking. Any subsequent reduction following treatment and behaviour change provides motivation, reward and immediate feedback on health gains. As part of the treatment protocol, praise can then be provided and a reinforcement of the 'not-a-puff' rule.

How to use the monitor

Exhaled breath CO monitors measure levels of CO in the blood. CO is a toxic gas found in tobacco smoke which binds to the haemoglobin in red blood cells almost 200 times more readily than oxygen.

CO has a short half-life, with elimination slowing as the concentration decreases and is usually undetectable around 24 hours after the last cigarette. This makes it a useful marker of regular smoking. Smokers can be unreliable when self-reporting their smoking so, if a smoker claims they have not smoked in the preceding 24 hours, an exhaled air test can confirm this.

CO monitors are handheld, easily portable and no more expensive than high quality electronic blood pressure monitors of the type you would expect to see on every GP desk. When using a multiuser device, a single use mouthpiece is required. Each kit comes with simple advice about calibration.



The device is easy to use. The patient inhales deeply, holds their breath for 15 seconds, then exhales slowly aiming to completely empty the lungs. The results are instantly available on the monitor's screen and can be interpreted with the charts supplied.

How to interpret the reading

All devices give a CO reading in parts per million (ppm). 9 ppm is generally considered to be the highest acceptable level of CO in the exhaled breath of an individual who reports not smoking, though CO arising from airways inflammation in chronic obstructive pulmonary disease (COPD) can result in levels up to 11 ppm.[2] In practice, colleagues who have considerable experience of using CO monitors would say that any value above 5 ppm usually suggests exposure to tobacco smoking.

NICE recommends that success in stopping smoking should be validated by a CO monitor reading of less than 10 ppm at the four-week point after the quit date. This does not imply that treatment should stop at four weeks.[3] Heavier tobacco smoking or smoking with a waterpipe or use of other smoking products such as cannabis can result in higher CO levels. Correctly interpreting the reading can positively impact on the conversation with the smoker and the subsequent choice of intervention.

The CO test result can also be used to measure success in a harm reduction approach where the patient wishes to cut down rather than quit.

It is also useful to Read code the intervention as with other biometric measures such as blood pressure or HbA_{1c} readings so that change over time at individual level can be seen. Understanding your population of people with tobacco dependency whether at practice or higher organisational level can be enhanced by having this objective measure as well as any self reported statement about tobacco use.

Use in pregnancy

NICE guidelines for pregnant smokers stipulate a level of 7 ppm as the identification of a non-smoker.[4] The guidance says: "Some suggest a CO level as low as 3 ppm, others use a cut-off point of 6–10 ppm. It is important to note that CO quickly disappears from expired breath. As a result, low levels of smoking may go undetected and may be indistinguishable from passive smoking. When trying to identify pregnant women who smoke, it is best to use a low cut-off point to avoid missing someone who may need help to quit."

What else can cause a raised CO?

For people who haven't been smoking, a high reading can be caused by:

- Exposure to CO fumes from a faulty gas boiler, car exhaust or paint stripper
- Lactose intolerance where the high reading is a consequence of consuming dairy products which can produce gases in the breath.
- Passive smoking, although readings above 10 ppm are not normally caused by being in the company of smokers.
- Unusually high ambient CO concentrations due to weather conditions or air pollution.

Conversation tips

The following lines might be useful for healthcare professionals who haven't had much experience of testing for CO to use with patients. It is useful to have a colour coded CO level chart when explaining the result.

- "Carbon monoxide is a gas inhaled by smokers when they smoke a cigarette and it is a harmful substance that we can measure with this machine. Our bodies produce small amounts of carbon monoxide and so the reading will probably not be zero; it will also fluctuate slightly depending upon what air you have been exposed to in the last few hours."
- "The monitor is showing a reading of over x parts per million which is a level consistent with light/moderate/heavy or possibly joint (cannabis and tobacco) or Shisha smoking ..."

Approximate costs

- Purchase of each machine – approximately £129 plus VAT (negotiation possible when ordering higher volume)
- Disposable mouth tubes – £15 for 250
- D pieces (filter device) – change monthly per machine: £20 for 12
- Calibration – buy a new model that doesn't need calibration. Historically, calibration costs £400 per year

Key learning points

- Measurement of CO in exhaled air is a valuable motivational tool in showing smokers the level of CO in their bodies.
- Keep a CO monitor on your desk – make CO testing routine. Ask all patients who smoke: "Would you like to know your level?"
- Make sure you are Very Brief Advice trained. This will enable you to have a conversation with every patient who smokes to potentially open up an opportunity to quit.

References

1. Shahab L, West R, McNeill A. A randomized, controlled trial of adding expired carbon monoxide feedback to brief stop smoking advice: evaluation of cognitive and behavioral effects. *Health Psychol* 2011;**30**:49–57.
2. Sato S. Optimal cutoff level of breath carbon monoxide for assessing smoking status in patients with asthma and COPD. *Chest* 2003;**124**:1749–54.
3. Stop smoking services. Public health guideline. NICE 2008. https://www.nice.org.uk/guidance/ph10/resources/stop-smoking-services-1996169822917
4. Smoking: stopping in pregnancy and after childbirth. NICE, June 2010. https://www.nice.org.uk/guidance/PH26