

Evidence that Empowers!

By Rebecca Dekker, PhD, RN of EvidenceBasedBirth.com

Question: What is nitrous oxide?

Answer: Commonly called “laughing gas,” nitrous oxide gas is a mixture of half nitrous oxide and half oxygen that is inhaled through a mask for pain management. It is a systemic drug, so it affects the whole body, but does not cause numbness or muscle weakness.

Question: How is nitrous oxide used during labor?

Answer: The laboring person holds the mask over their nose and mouth and inhales the tasteless, odorless gas as often as needed, taking care to exhale back into the mask. It is recommended to start taking breaths from the mask 30-45 seconds before a contraction begins, and stop breathing through the mask when the contraction ends (Richardson et al., 2017). If labor is irregular, inhalations can begin as soon as a contraction is sensed. Nitrous oxide is used for pain relief during labor in many countries, including the United Kingdom, Australia, and Canada, but is not routinely used during labor in the United States (Hellams et al., 2018).

Question: How might nitrous oxide work to provide pain relief during labor?

Answer: It is not clear exactly how nitrous oxide works, but researchers think the gas might have opioid-like effects in the central nervous system. It may also work by increasing the release of the body’s own endorphins and giving the user a pleasurable sense of euphoria and relaxation that helps them better cope with labor (Hellams et al., 2018). Using the mask may also provide a sense of control and help the mother to focus on breathing.

Question: Does nitrous oxide provide effective pain relief during labor?

Answer: In 2012, researchers published a Cochrane review and meta-analysis of randomized, controlled trials to look at the effects of inhaled medications for pain relief during labor (Klomp et al., 2012). Three studies compared 50% nitrous oxide with no treatment (one study, 110 participants) or oxygen placebo (two studies, 709 participants). They found that people who received nitrous oxide were less likely to report severe pain and had lower average pain scores. People who received nitrous oxide also had more side effects such as nausea, vomiting, dizziness and drowsiness.

In 2014, another systematic review included 21 studies (randomized and non-randomized) that looked at the effects of nitrous oxide on labor pain (Likis et al., 2014). They concluded that epidurals are more effective than nitrous oxide. However, researchers suggest that pain scores are not the best measure of effectiveness for nitrous oxide—

maternal satisfaction may be a better measurement. People who use nitrous oxide report similar satisfaction levels as those who use epidurals, with many stating they would choose it again for a future birth (Richardson et al., 2017).

Question: What are the risks of nitrous oxide?

Answer: In the Likis et al. (2014) review, 32 studies looked at the effects of nitrous oxide on the health of the mother. Using best quality evidence, the authors estimated that with nitrous oxide, 13% of laboring people have nausea or vomiting, 3% to 5% have dizziness, 4% feel drowsy, 18% have a reduced sense of awareness, and about 5% feel claustrophobic because of the mask being on their face (Hellams et al., 2018). Unconsciousness is very rare, and overdose can be avoided by having the mother hold the mask herself, and not permitting anyone else to hold the mask. Respiratory depression, or slowed breathing, is a possible side effect of nitrous oxide when it is combined with injectable opioids, but not commonly seen when used alone (Collins et al., 2018).

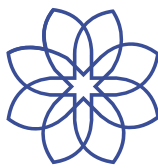
Another review included 140 studies of nitrous oxide used for a variety of clinical purposes, such as surgeries, invasive screenings, and dental procedures (Collado et al., 2007). They found that, overall, bad effects from the drug occur in about 3/10,000 individuals. The reported “serious effects” from the best quality study were one consciousness disorder, two vomiting events, one event of slowed heartbeat (bradycardia), one event of dizziness (vertigo), one headache, one nightmare, one event of excessive sweating, and one event of drowsiness. There were no long-lasting side effects.

One concern with nitrous oxide is that it damages a form of cobalamin (i.e. vitamin B12) in the body (Sanders et al., 2008). Cobalamin is a vitamin that helps to convert the amino acid *homocysteine* to the amino acid *methionine*. This conversion process is important for the production of DNA, RNA, and other products that make up normal cellular function. People are at risk when they are exposed to high concentrations of nitrous oxide over long periods of time. Certain health conditions—including Crohn’s disease, celiac disease, gluten intolerance, pernicious anemia, chronic malnutrition, or following a strict vegan diet—put people at increased risk of reduced cobalamin function and may be contraindications for nitrous oxide (Collins et al., 2018).

In addition, nitrous oxide can expand closed gas spaces so it may not be safe to use in people with certain medical conditions, such as bowel obstruction, retinal surgery, middle ear surgery, sinus infections (Richardson et al., 2017).

In the Likis et al. (2014) review, 29 studies looked at the effects of nitrous oxide exposure on the health of the





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baby. Nitrous oxide does cross the placenta, but it does not accumulate in the baby's body and any residual gas is eliminated as soon as the baby starts breathing. Using the best quality evidence, they found no difference in Apgar scores or the rate of NICU admissions between babies whose mothers used nitrous oxide and those who did not. Klomp et al. (2012) also looked at Apgar scores in two studies with 709 people and did not find a difference between babies born to mothers who used nitrous oxide vs. those who had no pain medication.

Pros of Nitrous Oxide (Hellams et al., 2018):

- An additional pain management option for people who do not have access to an epidural or do not want an epidural
- Simple and inexpensive
- Similar pain relief as injectable opioids but with fewer side effects for mother and baby
- Similar reported levels of maternal satisfaction as compared with people who use epidurals
- Very versatile—it can be used in any stage of labor, started and stopped at any time, and used to supplement other pain relief methods
- Starts working right away, in less than a minute
- Less invasive than an epidural or injectable opioids
- The user controls how often they inhale with the mask
- No loss of strength; retain freedom of movement
- It might create a sense of pleasure and relaxation and ease anxiety
- Promotes a focus on breathing
- Has not been shown to increase the risk of bad health outcomes for mother or baby

Cons of Nitrous Oxide (Richardson et al., 2017; Sanders et al., 2008):

- Less effective and less reliable pain relief than an epidural
- Requires a high level of participation (a mother who is exhausted may not want to keep holding the mask to her face for pain relief)
- Some mothers experience side effects such as detachment, sleepiness, dizziness, nausea/vomiting, or claustrophobia from the mask
- May not be appropriate for people with conditions that put them at increased risk of vitamin B12 deficiency
- May require scavenging systems and ventilation to reduce health care worker exposure (exhaling into the mask helps to contain the gas)
- Environmental effects—nitrous oxide is a potent greenhouse gas, 300 times greater than carbon dioxide

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“**Bottom line: Nitrous oxide gas should be available for laboring people to use as a less invasive medical pain relief option.**”

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