

# Nitrous Oxide in Obstetrics 2016

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# Give Me the Gas!



# What is Nitrous?

- 🌐  $\text{N}_2\text{O}$ , “laughing gas” nonflammable, colorless, almost odorless and tasteless gas for inhalation
- 🌐 Fixed concentration of 50% nitrous oxide and 50% oxygen with on demand flow.
- 🌐 Used for labor ANALGESIA.....NOT SEDATION OR ANESTHESIA
- 🌐 Dental equipment concentrations are adjustable and have continuous flow



# History of Nitrous Use

- 🌐 Nitrous discovered in 1772 and used as labor anesthesia in 1881
- 🌐 Used for childbirth pain relief since the 1934 in England. Widespread use in the UK, Canada, Finland, Sweden and Australia in up to 40-60% of women
- 🌐 Widely used from 1934 through the 1970s in the US and more limited use since then in several institutions including UCSF
- 🌐 Recent increase in interest with Vanderbilt starting in 2011
- 🌐 No equipment available between 2000-2013
- 🌐 Dar a Luz Birth & Health Center was first in New Mexico to start nitrous in January 2013 when Nitronox became available.
- 🌐 UNM started in 2015

# Equipment

- 🌐 Nitronox by Porter Instruments since January 2013
- 🌐 PRO-NOX by CAREstream Medical since 2014
- 🌐 50/50 fixed blend with on demand flow
- 🌐 Wall suction vs. mini vacuum system
- 🌐 Piped gas vs individual “E” tanks



# PRO-NOX





# Pharmacology

- Increases the release of endorphins, corticotropins and dopamine that are produced in the mother's brain
- Rapid onset of 30-60 seconds and quick clearance within a few minutes
- Crosses the placenta to concentrate in the fetus at about 80% of maternal serum level
- Quickly eliminated from the newborn as respirations are initiated. Effects are completely gone in 5 minutes
- Given in the presence of B12 deficiency, inhibits production of an essential enzyme, methionine synthase, that could result in megaloblastic anemia









# Side Effects of N<sub>2</sub>O

- 🌐 Nausea and vomiting in about 5-36% of women but not statistically increased
- 🌐 Vertigo in up to 39% of women
- 🌐 Some have experienced dysphoria, restlessness and anxiety
- 🌐 Some may feel it more bothersome than helpful




# Candidates for Use

- 🌐 Laboring women who have no contraindications
- 🌐 Women who need extensive laceration repair
- 🌐 Manual removal of the placenta, uterine exploration
- 🌐 Women who are very anxious with balloon catheter placement, IV start, pelvic exam or IUD insertion

# Contraindications for Use

-  Inability to hold own face mask
-  Acute drug or alcohol intoxication or impaired consciousness or Impaired oxygenation (consistently < 95% on room air)
-  Presence of a potential space that the gas could fill such as pneumothorax, intraocular surgery, bowel obstruction or middle ear surgery.
-  Other conditions include increased intracranial pressure, increased intraocular pressure and pulmonary hypertension.
-  Current Vitamin B12 supplementation for documented B12 deficiency
-  Nonreassuring fetal status requiring transfer to hospital

# Precautions for Use

-  Side effects are not tolerable
-  Hemodynamic instability (systolic pressure consistently  $<100$ )
-  Concurrent use of narcotics with nitrous. May start nitrous 1 hour after fentanyl administration








# Maternal Benefits

- Client controls how much she wants
- Positive effect on pain relief, takes the edge off, decreased anxiety, feeling of not caring about the pain
- Remain awake and alert with complete motor and sensory function
- Laryngeal reflex is not inhibited and no aspiration risks
- No effect on uterine activity or length of first stage of labor
- Shorter active phase of labor. Can be used throughout 2nd stage of labor
- Can be used in combination with hydrotherapy, hypnosis and acupressure for more benefit
- Breastfeeding is not affected






# Fetal Benefits

- 🌐 No CNS or respiratory depression in the newborn
- 🌐 No effect on Apgar scores or cord blood gas results
- 🌐 No increased incidence of meconium stained fluid
- 🌐 No effect on fetal heart rate

# Common Questions?

-  Diet or fluid restrictions during use?
-  BMI restrictions?
-  Consents?
-  Greenhouse gas emissions?
-  Pulse oximetry?

# Implementation in Birth Center



-  Directors researched nitrous and potential risks and benefits to birth center clients
-  Determined nitrous would be a safe analgesia option to offer in a birth center – process took about a week
-  Decision to order equipment in January 2013 and began use in February 2013
-  Developed practice guidelines, staff orientation and annual training
-  Implemented midwife initiated policy



# Cost

Equipment	Cost
Nitronox 4 cylinder E-Stand	\$6900
Aluminum E tank Nitrous or Oxygen (total tanks – 9)	\$64 (\$576)
Disposable breathing circuit, mask or mouth piece	\$20
Nitrous tank refill	\$47
Oxygen tank refill	\$28

# Staff Competency for Birth Center

-  All CNMs & RNs will be trained on setting up Nitronox equipment, correct use, indications and contraindications as listed in practice guidelines.
-  All CNMs and RNs are required to read Nitrous Oxide training module annually and sign an acknowledgement of understanding of risks.

# N<sub>2</sub>O Exposure Limits

- 🌐 National Institute of Occupational Safety and Health (NIOSH) recommends an exposure limit of 25 ppm, as the average concentration while the gas is in use.
- 🌐 The American Conference of Government Industrial Hygienists (ACGIH) recommends a limit of 50 ppm, as the average for an 8 hr period.
- 🌐 The UK established the Occupational Exposure Standard (OES) of 100ppm(as an eight-hour time weighed average) for nitrous oxide in 1996.

# Dosimetry Badge Results





- 03/2014 with window open and no scavenger for 1.67 hr = 188 ppm
- 03/2014 with scavenger for 1.25 hr = 88 ppm
- 07/2014 with scavenger for 9.75hr = 1.2 ppm
- 10/2014 with scavenger for 2.9 hr = 32 ppm



# Set up of Nitrous

- Setup of Nitrous equipment and scavenging system by trained CNM or RN. Takes about 5 minutes.
- Nitronox stand contains 2 nitrous and 2 oxygen tanks. Open only 1 nitrous and 1 oxygen tank at a time.
- Attach disposable breathing circuit with either a mask or mouthpiece to the demand valve and the scavenger and replace after each use..
- Connect the scavenger hose from the Nitronox stand to the scavenger inlet. Scavenger is noisy and housed in a separate room.

# Administration

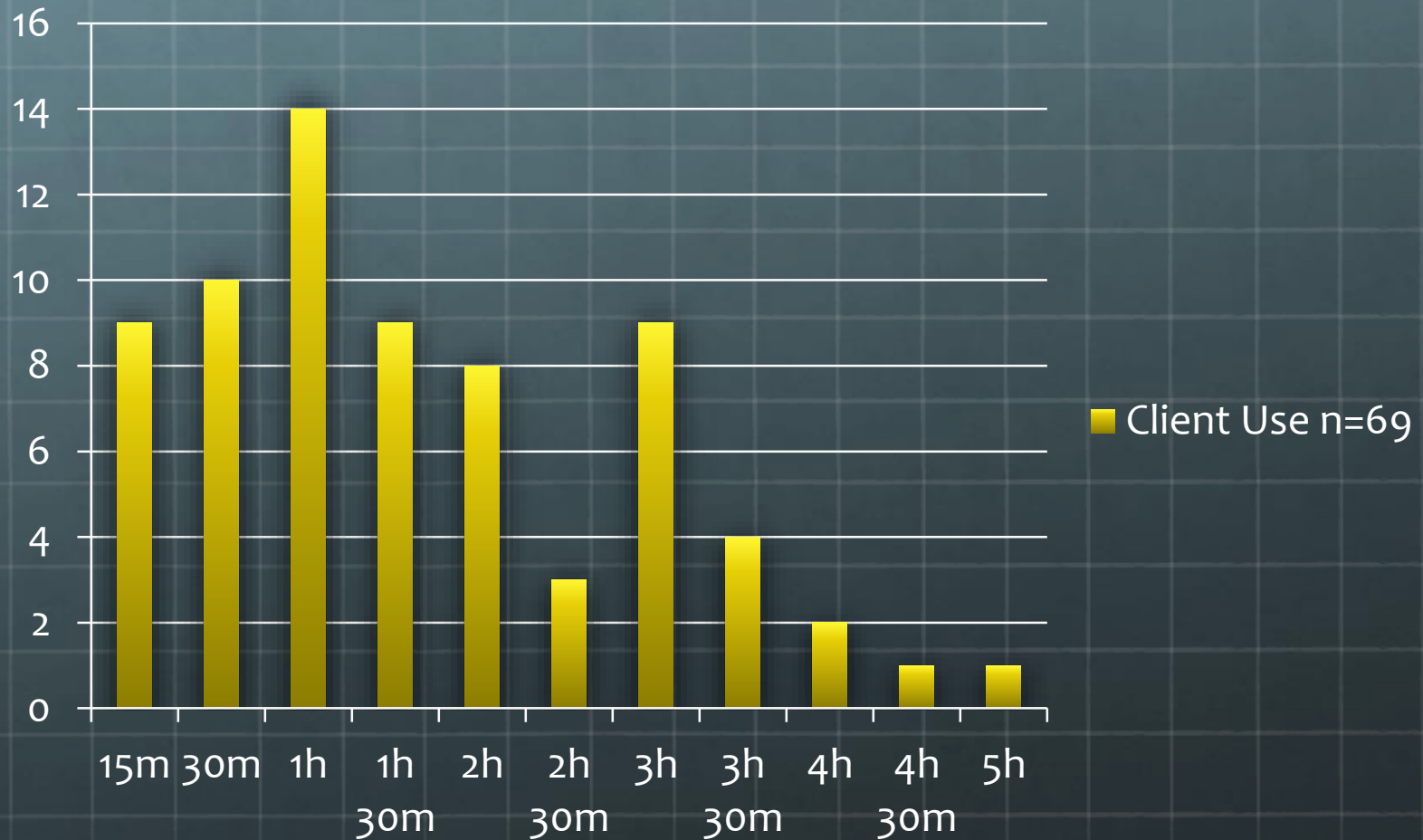
-  Assessment of client suitability and absence of contraindications
-  Educate client and family on correct use. System “Purrs” when gas is delivered. If it stops, need to change tanks.
-  Continue maternal and fetal assessments based on risk status and stage of labor. Routinely do intermittent auscultation.
-  Document initiation, effectiveness, side effects, reasons for discontinued use and time used for billing

# Dar a Luz Stats

Year	DAL Births	Used N2O	% of Clients	Labor Transfer	Used N2O	% of Clients
2013	87	13	14.9%	15	4	26.6%
2014	111	18	16.2%	16	3	18.75%
2015	112	24	21.4%	22	7	31.8%
Totals	310	55	17.7%	53	14	26.4%
B + T	363	69	20.7%			

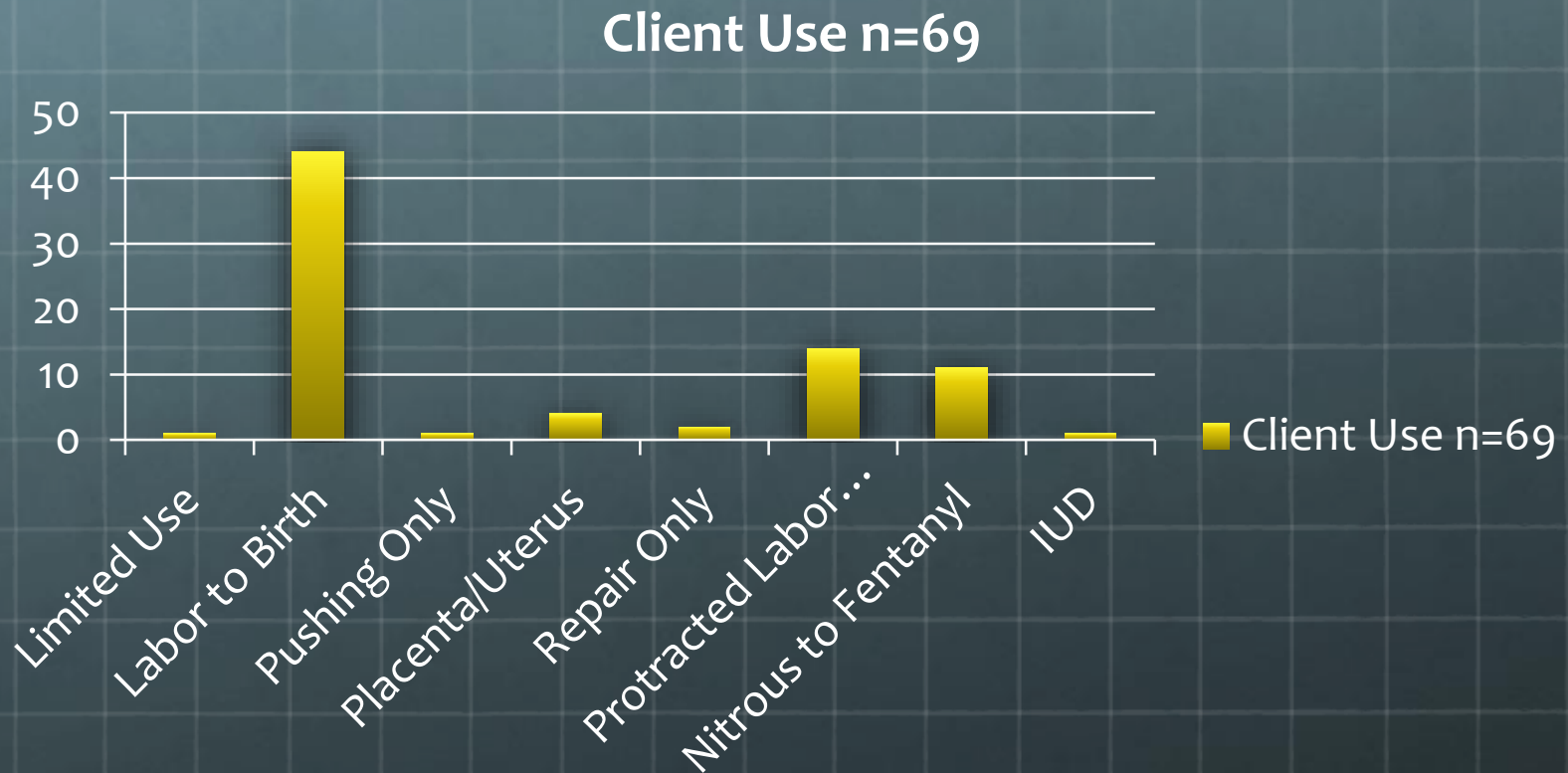
# Range of Time Used

Client Use n=69



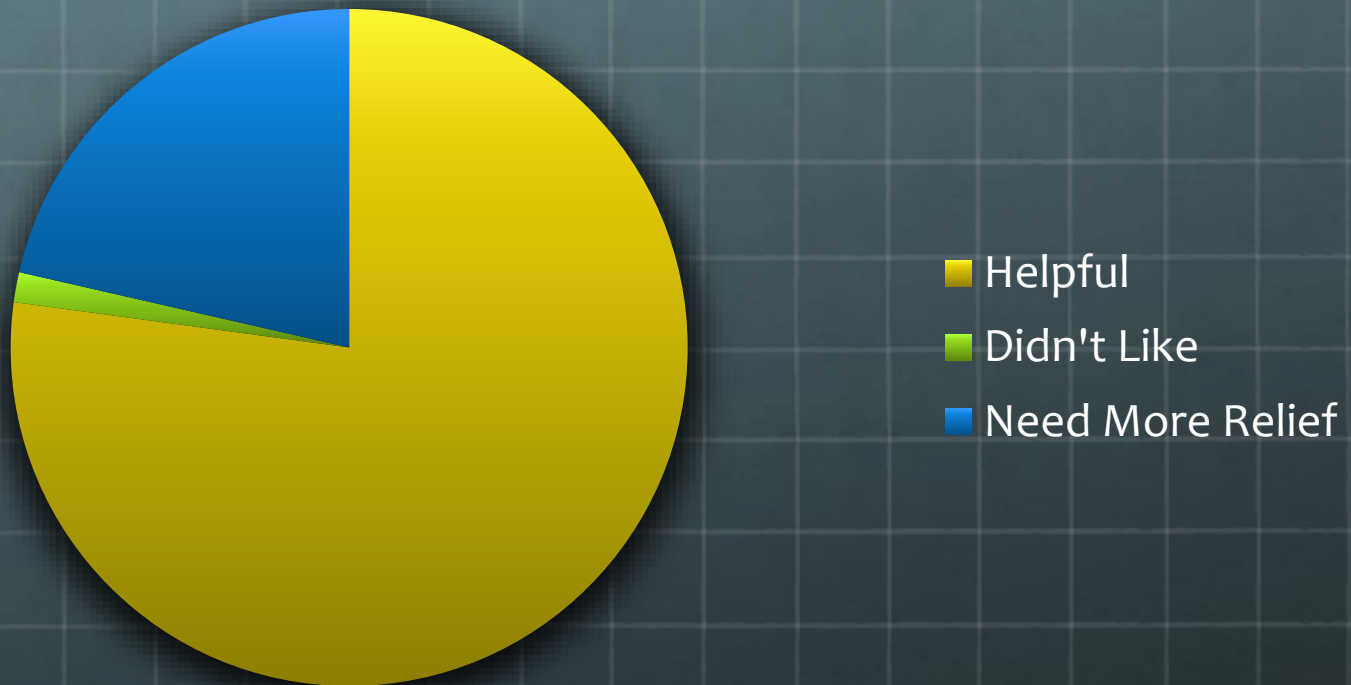


# Reasons Used



# Effectiveness

Effectiveness n=69



# Women's Comments

- 🌐 Less anxious, more relaxed
- 🌐 Loved it, helpful, satisfied
- 🌐 More focused on breathing
- 🌐 Takes the edge off
- 🌐 Positive, hopeful, able to cope better
- 🌐 Dizzy, nausea, drugged

- 🌐 “YES it helped with the pain and anxiety! As long as I was able to stay ahead of the contractions, it gave me the ability to relax a bit more, where previously I felt like I was tightening up and fighting my body due to the pain.”
- 🌐 “It was kind of like having a buzz, I was aware of what was going on, but didn't care as much.”
- 🌐 “My contractions were pretty much one right on top of the other, so I was huffing on the nitrous almost non-stop for a while in an attempt to stay ahead of them. It wears off so quickly and takes a bit to kick in, so I quickly discovered the need to breath it in consistently in order to stay ahead of the pain.”
- 🌐 “I was at the point I didn't know if I would be able to handle increased pain and intensity of contractions and I was really tired. The nitrous provided me with a coping mechanism that got me past the hump.”
- 🌐 “ I felt like I wasn't doing a completely natural labor and that I was failing myself by using an adjunct to get through labor.”

- 🌐 “Compared to a previous birth, the nitrous oxide helped me stay focused on my breathing, keep calm and rest between contractions. I never even thought about needing or wanting an epidural.”
- 🌐 “The pain felt very manageable when I was using the gas.”
- 🌐 “Yes, I had no trouble using the gas in a productive manner, in fact I used the Nitronox system for almost the entire duration of my labor. (Four hours)”
- 🌐 “ I liked that I was in total control of the nitrous oxide and I was able to regulate how much or how little I needed. I also liked the fact that the gas did not take away my ability to feel the pain or listen to what my body was telling me to do. Nitrous oxide and oxygen gave me the chance to relax during contractions, take the edge of the pain and focus on getting the baby out.”



# Tips for Use

- Clear instructions on self administration and exhaling
- Determine if mask or mouth piece is better for her
- Move nitrous to where she wants to be (tub, bed, toilet, swing)
- Encourage to breath continuously for a few contractions to get the best effect and keep coaching them to focus on breathing
- Breathe nitrous between contractions for pushing
- A nitrous tank lasts 2-3 times longer than oxygen (about 6-8 hrs). Gas stops flowing when any tank is empty.



# Birth Center Billing

- 🌐 No reimbursement codes for birth centers.
- 🌐 Additional out of pocket charges of \$50 for set up and \$50/hr for gas
- 🌐 Expect 3-5 years of birth center use to pay off equipment depending on volume and billing practices

# Resources



-  [N2Oduringlabor@yahoogroups.com](mailto:N2Oduringlabor@yahoogroups.com)
-  <http://www.porterinstrument.com>
-  <http://www.cmedintl.com>
-  Local Gas suppliers: Airgas and Argyle
-  <https://www.airgas.com>
-  [http://www.argylesupply.com/medical\\_gases.php](http://www.argylesupply.com/medical_gases.php)

# References

-  Rooks J. Safety and Risks of nitrous oxide labor analgesia: a review. *Journal of Midwifery and Women's Health* 2011; 56(6): 557-565.
-  Likis FE, Andrews JA, Collins MR, Lewis, RM, Seroogy JJ, Starr SA, Walden RR, McPheeters ML. Nitrous Oxide for the Management of Labor Pain. Comparative Effectiveness Review No. 67. (Prepared by the Vanderbilt Evidence-based Practice Center under Contract No. 290-2007-10065-I.) AHRQ Publication No. 12-EHC071-EF. Rockville, MD: Agency for Healthcare Research and Quality. August 2012.



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-  Stewart, L.S., & Collins, M. (2012) Nitrous Oxide as Labor Analgesia: Clinical Implications for Nurses. *Nursing for Women's Health*, 2012; 16(5): 398-408. 16(5)
-  ACNM Position Statement: Nitrous Oxide for Labor Analgesia. August 2011