


“Gas and Air”; The Utility of Nitrous Oxide in Childbirth
Presentation given 6/13/19 PAC/LAC
Excluding Images

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Disclaimer***


I have no financial relationship with any company or corporation that either has manufactured, or plans to manufacture, equipment used in the delivery of nitrous oxide.

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- Nitrous Oxide
- N₂O
- Colorless, odorless, tasteless gas
- First produced in 1772 by Joseph Priestly in Great Britain



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Current non-medical use of N₂O

- Industrial applications
- Rocket motors
- Racing engines
- Whipped cream
- Abuse

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Medical use of N₂O

- Dentistry (especially in pediatrics) – *most common use in the US*
- Operating room
- Emergency medicine/ field and hospital

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Differences between use in dentistry and obstetrics

| Dentistry | Obstetrics |
|---|---|
| Continuous flow | Intermittent flow |
| Variable concentration up to 70/30 mix | Fixed 50/50 concentration |
| No scavenging system/exhaled gas into faces of dental personnel | Scavenging system; exhaled gas carried away |

Current use for labor analgesia

- Common in countries with high standards for medical care:
 - United Kingdom (60%)
 - Canada
 - Australia (50%)
 - Norway (85%)
 - Finland (48%)
 - New Zealand



In the US... that we know about

- At least **1000** hospitals
 - AK, AL, AZ, CA, CO, CT, FL, GA, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MT, NC, ND, NH, NJ, NM, NY, OH, OR, PA, RI, SC, TN, TX, UT, VA, VT, WA, WI
- Approximately **100** birth centers
 - AR, AZ, CA, CO, FL, ID, MD, MN, MO, NC, ND, NH, NM, NY, OR, SC, TN, TX, UT, WA, WI




AHRQ review 2012 key questions

- What is the **effectiveness** of N₂O when compared with other methods **for labor pain**?
- What is the **effectiveness** of N₂O on **women's satisfaction** with their birth experience and pain management?
- What is the **effect** of N₂O on **route** of birth?
- What is the nature and frequency of **adverse effects** associated with the use of N₂O including any on **maternal, fetal/neonatal, childhood health care providers** and other individuals present for labor?
- What are the **health system factors** influencing the use of N₂O?



AHRQ Results


- ❖ N₂O < effective than regional
- ❖ Studies comparing N₂O w/non-epidural methods were of poor quality; inconsistent findings
- ❖ Strength of evidence was insufficient to determine effect on birth route
- ❖ Maternal harms; unpleasant side effects (N/V, dizziness, drowsiness)
- ❖ Similar Apgar scores
- ❖ Limited evidence on occupational harms/exposure
- ❖ No studies addressed health system factors

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Final outcome of AHRQ review

▶ Research assessing N₂O is needed across all of the key questions addressed:


- effectiveness
- women’s satisfaction
- route of birth
- harms
- health system factors affecting use

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50% nitrous oxide and 50% oxygen used in labor is analgesia, not anesthesia!

- Analgesia or “minimal sedation” per American Society of Anesthesiologists (ASA)
- Minimal sedation **requires:**
 - No special regs or guidelines
 - “Entails minimal risk”
 - “Adverse effects are negligible”

By definition, should allow initiation by CNM/CM, MD, or RN with an order

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Advantages of N₂O use

- Relatively simple, safe to use
- Self-administered
- Rapid onset/offset
- Patient satisfaction
- Doesn't require IV, pulse ox, or CEFM

No evidence of:

- effects on progress of labor/ability to push
- adverse fetal/newborn effects

***May be able to postpone or avoid narcotics or epidural, if desired*


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Patient Satisfaction

6242 women, 34 months 2011 – 2014


- 81% w/neuraxial; 19% w/N₂O (60% of those used only N₂O)
- **Efficacy:** > 90% w/neuraxial "high"; N₂O users "variable" w/50% reporting "high" efficacy
- In both groups, of those reporting "poor" or "moderate" efficacy, N₂O alone users > **likely** to report **high satisfaction** than epidural alone users
- Among "high" efficacy group, satisfaction was **equal**.

Anesth Analg 2017;124:548-53

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Limitations of N₂O use


- **Side effects:** dizziness, nausea, drowsiness
- Mobility limited to apparatus proximity
- Lack of familiarity, availability
- Not all will find it helpful

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N₂O – Contraindications

Women who:


- cannot hold the mask
- have impairment of consciousness/intoxication
- have documented B12 deficiency
- potential for trapped gas

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Who is initiating N₂O at the bedside?

2015 survey of 39 hospitals/medical centers (*birth centers excluded*):

- **3** (7.7%) **initiated by any of the following:** ob or anesthesia provider, or nurse (with OB provider order).
- **4** (10.3%) **require** anesthesia personnel to initiate; others (ob providers, nurses) may not.
- **26** (66.7%) ob providers (midwife or physician) **or** bedside nurses *may* initiate, but *largely* nurse initiated w/order. **Anesthesia providers not involved in process.**
- **6** (15.4%) Policy still being written, but leaning towards nurse initiation.


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Does bedside initiator affect usage rates?

From UCSF:

- **In the 3 years prior to midwives initiating:**
 - 6-8% use of nitrous
- **In the years since:**
 - 11-12% use of nitrous
- Approximately 50% increase

**Per Judith Bishop CNM, MPH, UCSF*


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**Let's talk equipment:
Entonox versus others are they
different?**




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**"NITRONOX"
Porter Instruments**



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**"PRO-NOX"
CAREstream America, Inc**




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“SEDARA”

Lifegas/Linde


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- Either mask/
mouthpiece
- Flow initiated by
negative
pressure opening
demand valve
- Same valve
prevents further
flow when
inhalation ceases


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Instructions for use

- Informed consent
- Only patient may hold
mask
- Placement of mask
- Timed breathing for
maximum effect
- Exhaling back into mask


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Timing of inhalation for maximum effect

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What should patients expect from N₂O use?

- Variable pain relief
- “I don’t care” factor
- Feeling of euphoria/bliss
- Decreased anxiety

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N₂O – health and safety concerns

- Mother
- Baby
- Staff

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N₂O Safety for mother

- Desaturation – no evidence of increase
- O₂ saturation should be *higher*
- Safe to maintain mobility

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N₂O Safety for fetus/neonate


- No neonatal depression
- No known effect on breastfeeding
- Paucity of adequate research, but no noted ill effects after extensive use (75+ years) in other countries

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Apoptosis of Fetal Brain Cells

Apoptosis happens with use of:

- Anesthetic gases including N₂O
- Sedatives
- Hypnotics
- Narcotics


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- Relevance of findings from rat model studies unknown
- FDA advisory committee 2007: no changes recommended

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N₂O Safety for staff

- No harmful exposure levels when used at 50/50, intermittently and with:
 - scavenging equipment
 - demand valve
 - proper instruction and use

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Environmental exposure

- NIOSH standards for exposure: suggests **25 ppm** limit for duration of use
- ACGIH standards: **50 ppm** over 8 hour time weighted average limit
- UK, Finland, Germany, Sweden limit = < **100 ppm**
- Dosimetry Badges

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Exposure Monitoring

- Yearly evaluation if desired, or required
 - Dosimeter badges from Advanced Chemical Sensors Co, Boca Raton, FL (AIHA accredited)
 - Results
- *Remember exposure limit ACGIH= 50 ppm, NIOSH = 25 ppm*



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N₂O use at Vanderbilt June 1, 2011 – present

- Epidural rate 30-35% NM practice, ~85 – 90% in remaining population
- Initiation rate: 15-22% overall (~26% in NM population)
- Conversion to epidural: ~ 30 - 35%
- Initiator *does* make a difference in usage



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Conversion to epidural does not equate to failure of the modality!



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Key steps to implementing N₂O program...

- 1**
Identify those sharing passion
- 2**
Have a vision statement
- 3**
Dialogue with ALL involved initially (midwifery, Ob, MFM, anesthesia, peds, neo, nursing, nursing management, risk management)

Silverstein, J., & Koracki, M. J. (2003)

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Addressing team's concerns

- **Anesthesia:** diversion by staff, family; monitoring of woman using nitrous
- **Neo/peds:** fetal effects
- **Nursing:** workload, role; storage of gas unit
- **Risk management:** verbiage of consent/pt ed. documents, nurse practice act issues

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Implementing N₂O program

- 4**
Be prepared
- 5**
Expect give and take
- 6**
Ensure visible sponsorship
- 7**
Feedback

Silverstein, J., & Koracki, M. J. (2003)

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Lessons learned along the way...

Anesthesia/obstetric services **MUST** work together




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Everyone on the same page




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Ensure staff competency...



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Inform women in the prenatal period




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Positioning during use




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May use it for several hours...



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Billing...


- Nitrous Oxide only with vaginal birth - ASA code 01960 with the base of 5 plus time (CPT Codes 59400- 59410)
- Nitrous Oxide converts to an epidural with vaginal birth– ASA code 01967 with the base of 5 plus time (CPT Codes 59610 – 59614)
- Time starts with the N₂O therapy administration



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Resources; don't reinvent the wheel...


- Nitrous listserve: N2Oduringlabor-subscribe@yahoogroups.com
- AHRQ review (2012) available at: www.effectivehealthcare.ahrq.gov/reports/final.cfm
- Cochrane review (2012)
- AWHONN Practice Brief Number 6
- ACNM Position Statement on Nitrous



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N₂O Pubs...

- ▶ Safety and risks of nitrous oxide labor analgesia: a review. (2011). *JMWH*, 56 (6)
- ▶ Nitrous oxide for labor analgesia: expanding analgesic options for women in the United States. (2013). *Reviews in Obstetrics & Gynecology*, 5 (3/4)
- ▶ Nitrous oxide as labor analgesia: clinical implications for nurses. (2012). *Nursing for Women's Health*, Oct/Nov, (CE article)
- ▶ Nitrous oxide for pain relief in labor. Share with Women in *Journal of Midwifery & Women's Health*, 58 (6), 2013
- ▶ Nitrous oxide for the management of labor pain: a systematic review. *Anesthesia & Analgesia*, 118 (1) Jan 2014; 153-167
- ▶ Nitrous in labor: A case report on the valuable anxiolytic properties. *Journal of Obstetric, Gynecologic and Neonatal Nurses*, 44, 87-92, 2015
- ▶ Initiating intrapartum nitrous oxide in an academic hospital: considerations and challenges. (2017). *Journal of Midwifery & Women's health*, 62(3), 358-362.
- ▶ Nitrous Oxide Analgesia for Labor and Birth: A Guide for Implementation, First Edition. (2018). American College of Nurse-Midwives.
- ▶ Should nitrous oxide be used for laboring patients? (2017). *Anesthesiology clinics*, 35(1), 125-143.
- ▶ Informed consent and nitrous oxide for labor analgesia. (2017). *Anesthesia & Analgesia*, 125(3), 1082-1083
- ▶ Nitrous oxide utility in labor and birth: a multipurpose modality. (2017). *Journal of Perinatal & Neonatal Nursing*, 31(2):137-144.

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In summary...

- safe & effective
- inexpensive
- no anesthesia oversight req'd
- should be widely available!

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