An Evidence-Based Pathway to Implementing Nitrous Oxide
Use in a Small Community Hospital
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“Follow the Yellow Brick Road”

Conflicts of Interest Disclosure
Karen Conley, BSN, RNC-OB
- No conflicts of interest

Objectives
- Identify available options for pain relief during labor
- Recognize the importance of research in implementing new practice
- Define nitrous oxide and its use in labor and delivery
- Identify risks and benefits of nitrous oxide
- Recognize the significance of coordinating a multidisciplinary team to comprehensively implement change
“The dreams that we dared to dream”

- Provide women with a variety of safe options to facilitate a peaceful, comfortable experience during labor
- Reduce labor pain quickly and safely
- Increase patient satisfaction by providing evidence-based, quality obstetric care
- Empower patients to make educated decisions
- Promote mobility during labor

Who we are

Newport Hospital, Newport, RI
The Noreen Stonor Drexel Birthing Center

- 10 bed LDRP unit within a 129 bed community hospital
- Level 1 Nursery
- 2016: 456 live births
- Magnet Designation by ANOC 5 consecutive times
- Baby Friendly designation by WHO and UNICEF since 2003
Pain management options

**NON-MEDICAL**
- Relaxation techniques
- Calming environment (music)
- Repositioning
- Ambulation
- BirthBall/ Peanut ball
- Hydrotherapy
- Counter pressure

**MEDICAL**
- IV/IM analgesia
- Regional anesthesia
- General anesthesia

Bridge the gap between the two with patient-administered inhaled nitrous oxide

What we were NOT trying to do

- Decrease epidural rates
- Put patients, newborns, or staff at risk

The journey

**OUR ROAD TO IMPLEMENTATION**
- Conferences/Conventions
- JOGNN and other journals
- Media
- Patient request

- Used by 30-60% of maternity wards in Great Britain and other European countries
- 200+ hospitals and birthing centers in the U.S. using nitrous oxide for labor

Collins (2012)
“If I only had a brain”

Gathering the evidence
- Medical librarian
- Literature review

Research roundtable
- Systemic search and analysis of evidence

Rooks

Collins

Research roundtable

AHRQ study: Nitrous Oxide for the Management of Labor Pain
- Systematic review, Level 5 research
- Effectiveness of nitrous oxide in labor
- Satisfaction with birth experience in relation to pain management
- Nitrous oxide effect on route of birth
- Adverse effects

Cochrane Review: Inhaled analgesia for pain management in labour
- Review of RCT's, Level 1 research

Likis study: Nitrous Oxide for Management of Labor Pain; A systematic review
- Level 5 research
- Effectiveness of nitrous oxide in labor
- Influence of nitrous on satisfaction with birth experience
- Adverse effects
- Occupational exposure

What it is

- Colorless, odorless, tasteless gas
- Used to provide analgesia during painful procedures
- Concentration used for labor analgesia is 50% nitrous and 50% oxygen
How it works

• Enters and is eliminated through the lungs
• Decreases the excitability of brain cells
• Increases prolactin and decreases cortisol
• Reduces the patient’s perception of pain

Benefits

• Easy to use
• Rapid onset/offset - 30-60 seconds
• Less than 1% nitrous oxide is metabolized
• No effect on FHR or Apgar scores
• No effect on suckling behaviors of neonates
• Continuous fetal monitoring not required
• IV access not required
• No effect on endogenous oxytocin and no effect on uterine contractions or labor progress
• May postpone use of IV/IM analgesia or regional anesthesia
• Patients stay awake and alert
• Patients maintain complete motor and sensory function

Risks

TO THE MOTHER
• Aspiration of stomach contents due to unconsciousness if too much nitrous oxide is inhaled
• Nausea and vomiting
• Dizziness
• Sedation

TO THE FETUS/NEWBORN
• Crosses the placenta
• Eliminated quickly by the neonate’s lungs, as soon as the neonate begins breathing at birth
• Does not depress respirations
Contraindications

WOMEN WHO:
- Cannot hold their own face mask or follow instructions
- Impairment from alcohol or drugs
- Documented vitamin B12 deficiency
- Have a history of recent trauma
- Have a presence of potential space gas could fill (e.g., pneumothorax, intracranial surgery, bowel obstruction, or middle ear surgery)
- Expect a pain-free labor

Beyond labor and delivery

- IV insertion
- Lumbar puncture
- Dressing changes
- Bronchoscopy
- Pediatrics

The field of poppies

OCCUPATIONAL EXPOSURE
Reproductive concerns seen in female dental workers
- California study 1980’s: each hour of unscavenged nitrous oxide per week
  - reduced 8% reduction in probability of conception
- Air in the work environments studied estimated to have 1000ppm of nitrous oxide

Screening and ventilation: FDA requirement
- Capture and eliminate exhaled gas

Dosimeter badges
- U.S. OEL 25ppm
“If I only had a heart”
Gaining support from interdisciplinary team

- Maternal Child Health Joint Practice Committee
- Obstetrics
- Anesthesia
- Pediatrics
- Midwifery
- Nursing Administration
- Risk Management
- Facilities

Provider concerns
Obstetrics:
- “Old practice”
- Monitoring
- Provider availability

Pediatrics: fetal/neonatal risk

Anesthesia: occupational exposure
- Rat study

Safe use in labor
- Analgesic effect vs anesthetic effect
- Self-administered- Nursing scope of practice
- Demand flow system- over sedation
- Approximately 5-6 breaths room air to eliminate

- Begin inhaling approximately 30 seconds prior to onset of pain
- Reaches peak concentration after approximately 30-60 seconds
- Exhale back into mask- occupational exposure
Other concerns

- Financial
- Charges
- Facility storage
- Scope of practice
- Documentation

Roles

- Who will order it?
- Who will initiate it?
- Who will administer it?
- Who will monitor use?
- Who will educate?

“If I only had the nerve”

Gaining the courage to go forward with implementing a nurse-led evidence-based change of practice

Tremendous support within the facility
- Nursing Administration with experience in implementing nitrous oxide use
- MCH Joint Practice Committee

Support from CAREstream and Porter representatives
Creating the policy

- Benchmarking with Newton-Wellesley Hospital and South Shore Hospital
- Evidence gathered from literature review
- Sample policies provided by manufacturer
- Review by multidisciplinary team

Educating patients

- Risks and benefits
- Self-administration only
- Exhaling into mask
- Holding mask vs. propping or strapping
- Visitor/support person involvement

Pain management brochure
Consent: Written vs. Verbal

- Based on facility preference
- CAREstream and Porter both support either
- Written consent form
- Pain management brochure

Documentation

- Ordered by physician or midwife in our system under medications, detailing patient self-administration
- Documented by nursing
  - Indication for use
  - Education/verbal
  - Frequency of use
  - Effectiveness/side effects

The fork in the road

- Porter Nitrosonox
- CAREstream ProfNox
The hourglass

- Waiting for the purchase order approval
- Waiting for the equipment

Educating staff

- Porter Nitronox® online video
- Face-to-face servicing with representative from Porter Nitronox®
Educating staff

- Review of policy
- Short written test
- Visual aide

Patient satisfaction

SURVEY- ONGOING FOR LARGER SAMPLE SIZE
- Offered to all patients who have used nitrous oxide in the labor and delivery department at Newport Hospital
- Voluntary responses
### Survey details

<table>
<thead>
<tr>
<th>SATISFACTION RATING</th>
<th>QUESTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Hated it</td>
<td>1. Would you recommend nitrous oxide to someone you know?</td>
</tr>
<tr>
<td>2. Did not like it</td>
<td>2. Do you feel you had control over your pain management?</td>
</tr>
<tr>
<td>3. Neutral</td>
<td>3. Do you feel you had enough options for pain management?</td>
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<tr>
<td>4. Liked it</td>
<td>4. Side effects</td>
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<td>5. Loved it</td>
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### Preliminary results

**ALL NITROUS OXIDE USERS**
- 31% loved it
- 35% liked it
- 17% reported neutral
- 17% did not like it

- 0% hated it
- 73% felt they had control over their pain management
- 98% felt they had enough options for pain management
- 88% would recommend it

*Results as of August 30, 2017*

Overall, 67% of patients who used nitrous oxide during their labor reported they liked it or loved it, while 17% did not like it very much, and another 17% reported they had neutral feelings about it. No patients reported they hated it.

*Results as of August 30, 2017*
### Preliminary results by group

<table>
<thead>
<tr>
<th>NITROUS OXIDE ONLY</th>
<th>NITROUS OXIDE &amp; EPIDURAL</th>
<th>NITROUS OXIDE &amp; IV ANALGESIA ONLY</th>
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</thead>
<tbody>
<tr>
<td>85% either liked it or loved it</td>
<td>65% either liked it or loved it</td>
<td>44% either liked it or loved it (33% reported neutral feelings)</td>
</tr>
<tr>
<td>100% would recommend it</td>
<td>88% would recommend it</td>
<td>78% would recommend it</td>
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*Results as of August 30, 2017*
The most common side effects reported were dry mouth and dizziness; however, many patients reported they did not experience any side effects while using nitrous oxide.
## Patient comments

- "Helped relax me!"
- "Enjoyed having the option available."
- "Kept me focused on my breathing to remain calm."
- "Saved my life!"
- "Nitrous oxide didn't take my pain away, but it calmed me down and helped me manage it as well as stay relaxed."
- "Overall great experience and it took the edge off and allowed me to have a natural birth, which was ultimately my goal."

## Patient comments cont.

- "Made the decision to use nitrous oxide too late in labor for effective use. Enjoyed having the option available."
- "Dreaded the needle."
- "Felt the mask made me claustrophobic."
- "Did not like the mask."
- "Was good for moderate pain, but not enough for high pain."
- "Had difficulty coordinating the inhalation with the timing of contractions, so I am not sure I was using it effectively. I still appreciate having options to avoid an epidural."

## Our latest data
On average, 28% of all laboring patients are now using nitrous oxide.

76% of nitrous users are also using IV analgesia and/or epidural anesthesia, along with nitrous oxide during labor.

Epidural rate has remained steady.
Non-medicated labors have decreased

Primary Cesarean Sections are unchanged

“What did you learn, Dorothy?”

- Nitrous oxide is not to replace any existing pain management method
- Patients want options
- Research helps to ensure options are safe
- Collaboration is key in implementation
Michelle Collins, PhD, CNM et al outlined the implementation process at VUMC:

“Feedback at every step of the process and from all involved participants was the last important key to success... This feedback from key members at every step along the way in guideline and policy formation and implementation was a major contributing factor to the smooth transition from policy to practice.”

References

Nursing for Women’s Health, 16 (5), 400-409.

