Developing a pediatric RN administered nitrous oxide/oxygen program for a multi-state hospital system: Challenges and Lessons

Teri Reyburn-Orne, RN-BC, MSN, CCPNP, CPNP-AC
Banner Children’s

Conflict of Interest Disclosure

• Authors Conflicts of Interest;
  – Teri Reyburn-Orne, no conflict

Objectives

1. Describe the DMAIC method of process improvement
2. Identify the structures included in a clinical practice guideline
3. Predict at least two potential challenges when creating a multi-state practice guideline.
OVERVIEW OF NITROUS OXIDE

What is Nitrous Oxide (N₂O)?

• Colorless gas at room temperature
• Liquefies under pressure
• Sweet smelling
• Classified as an anesthetic
• Very weak anesthetic compared to other inhaled anesthetics
• It is always mixed with oxygen during delivery
• It is NOT nitric oxide

Uptake & Distribution

• Inhaled weak anesthetic agent
• Highly insoluble
  – Moves quickly across the alveolar membrane
  – Does not bind with any blood elements
  – Remains unchanged in the blood
  – Uptake by the body is minimal thus equilibrium (amount needed to cross the blood-brain barrier and give effect) is rapidly achieved
Mechanism of Nitrous Oxide

Possible mechanism of action
• Acts on brain and spinal cord opioid and NMDA receptors
• Related to release of endogenous neurotransmitters
• Neurotransmitters activate descending pain pathways to inhibit transmission
• Analgesia involves a direct intraspinal anti-nociceptive action rather than depression of limbic function

Outcomes of Actions

<table>
<thead>
<tr>
<th>Analgesic</th>
<th>Decreases sensation of pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiolytic</td>
<td>Increases relaxation and sense of well being</td>
</tr>
<tr>
<td>Amnestic</td>
<td>May be difficult to recall procedure</td>
</tr>
</tbody>
</table>

Onset & Elimination

• Onset of action
  – Peak effect within 3 to 5 minutes
• Elimination
  – Almost completely through the lungs
  – Due to insolubility, it is cleared within minutes
  – Must be followed by oxygen administration for at least 3-5 minutes
Our Motivation

- Safe and effective minimal sedation agent
- Quick recovery
- Helps with throughput
- Minimal side effects
- Limited NPO requirements
- Specific contraindications
- Decreases pain and suffering

STRUCTURE

Process Improvement Structure

- Clinical Consensus Group (CCG)
  - All process improvement projects that involve the electronic medical record and physician
  - Multidisciplinary group
  - Use DMAIC (Define, Measure, Analyze, Improve, Control)
  - Determine need for clinical practice guideline (CPG)
  - Provide oversight
Clinic Practice Guideline

• Improve portion of DMAIC
  – Define scope
  – Design the tools
  – Implement the process

• Control phase returns to CCG
  – CPG responsible for data collection

**DMAIC**

• Define
  – RN administration of nitrous oxide/oxygen for minimal sedation safe and effective per literature review
  – Patients suffering and traumatized by mildly painful and frightening procedures
  – Two independent programs developed within the Banner system
  – No system standard for training and administration

**GOING THROUGH THE PROCESS**
**DMAIC**

**Measure**
- Facility One:
  - Training done by outside experts from dentistry for entire group (RNs/MDs)
  - No quality or safety data being collected
  - No standardized charting
- Facility Two:
  - Training done at outside N2O/O2 leading children’s hospital for super-user RNs
  - Super-users developed training for RNs/MDs
  - Quality and safety data collected
  - Developed standardized charting

**DMAIC**

- Analyze
  - No standardization
  - Current users want to expand to other departments
  - Other facilities wanting to introduce modality

**Opportunities**

- Explore the strengths and weakness of current state at each facility
- Agreement of what the standard should be
- Alignment of practice
- Accountability to follow new guidelines
**DMAIC**

- **Improve**
  - Clinical practice guideline workgroup formed
  - Identify best practice
  - Standardize training
  - Standardize documentation
  - Standardize safety
  - Standardize data collection

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**CPG WG Membership**

- **Multidisciplinary**
  - MDs
  - RNs
  - Regulatory
  - IT
- **Multi-facility**
  - Both facilities currently using N2O/O2
  - Future users
- **Multi-departmental**
  - Medical Imaging
  - Emergency Department
  - Intensive Care
  - Anesthesiology

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**THE CLINICAL PRACTICE**
The Clinical Practice Guideline

• Overview
• Practice Statement
• Clinical approach

The CPG- “Overview”

• For pediatric inpatients and outpatients requiring minor procedures that cause anxiety and/or pain, nitrous oxide/oxygen (N₂/O₂) sedation can be used to provide minimal or procedural sedation. Evidence supports the use of nitrous oxide in children due to its rapid onset and rapid recovery. Nitrous oxide moves quickly across the alveolar membrane and does not bind with any blood elements, and remains unchanged in the blood. Also, due to its relative insolubility uptake by the body is minimal so equilibrium is rapidly achieved. Nitrous oxide acts on brain and spinal cord opioid and NMDA receptors thus decreasing the sensation of pain, increasing relaxation resulting in a sense of well being. Nitrous oxide/oxygen is an analgesic, amnestic and anxiolytic.

Practice Statement

• Defines the population covered by the CPG
• States the rationale
• Summarizes the research support
Practice Statement and Rationale

• Practice statement restates the overview
• Rationale:
  Pediatric patients continue to have under treated pain as recognized by the American Academy of Pediatrics, American Pain Society and American Pain Management Nursing Society. Nitrous oxide/oxygen sedation via a nitrous oxide/oxygen blender has been shown to provide adequate pain and anxiety relief in children8, 10, 11, 16, 19, 23 with minimal adverse events. 3, 13, 16, 24, 25 for the procedures such as those listed in Appendix B. 5, 8, 10, 11, 16, 18, 19, 22 It has also been shown to be more time efficient due to its rapid onset and rapid recovery than other sedation medications used for minimal and procedural sedation. 31, 17

Clinical Approach

• Overview
  – Uses
  – Exclusion criteria
  – Safety monitoring
  – Required training for physicians, nurse practitioners and physician assistants (LIP)
  – Does not define nursing scope of practice
  – Does not give specifics of how to administer

Approval Process

• Committee approval
  – Pediatrics
  – Anesthesia
  – Emergency Department
• Clinical Consensus Group
  – Peri-op
  – Emergency
  – Pediatric
• Care management
  – Oversees all CCGs and CPGs
  – All CPGs require their approval
MAKING IT A REALITY

Design Phase

- Process flow
- Equipment to be used
  - Blender
  - Mask or nasal hood
  - Scavenging
  - Dosimetry testing
- Nursing Policy
- Nursing education
- LIP education
- Credentialing requirements for LIPs (recommendation only)
- Patient education
Challenge

- C-suite approval
- Approval from committees
- Availability of scavenging systems
- Funding
  - Construction
  - Purchase of equipment
- Fear of the unknown/unfamiliar

Equipment

- Porter blender system
- Sedation system mask vs nasal mask
- Scavenging
- Dosimetry
Nursing Policy

• Training for nurses
• Scope of practice
• Administration step-by-step
• Patient monitoring
• Documentation
• Appendix
  — Contraindications
  — Appropriate procedures for use

Education

• Nurses
  — 6 hours total education (standard set by AZBN)
    • 1 hour moderate sedation training
    • 2 hours of didactic and 2 hands-on training
    • Post-test
    • Three completed cases-observed and checked off
• LIPs
  — Receive Banner CME
    • Complete assigned reading
    • 2 hours of hand-on training
    • Post-test
  — Or
    • Provide proof of training and competency from outside program

Implementation

• Facility leads are identified
  — Responsible for roll out, oversight and compliance
• Tool kit posted on SharePoint
• Meeting held with facility leads
Challenges

• Scope of RN practice varies by state
  – Arizona within RN scope
  – Colorado within RN scope
  – Alaska not within RN scope
    • Alaska presented to board of nursing
    • Approved use at 60% maximum (CPG states 70%)
    • Nursing policy addendums needed

Challenges

• Each facility must get approvals from medical committees
  – Colorado approved but no LIP on site at all times
    (CPG required physician readily available)
  – Alaska approved with difficulty

Challenges

• Training
  – Monies to support training
    • Send nurses to AZ for initial training
    • Send trainer to outside facility
    • Hourly pay for nurses to provide and complete training
  – Nurses must have AZ license to get patient hands-on competencies completed
  – Trainer must have in-state RN license to demonstrate giving to patients
  – Physicians must be available for training when out of state trainer is present
DMAIC

• Control
  – Identify outcomes
  • Number of patients
  • Age of patients
  • Maximum concentration of nitrous oxide
  • Side effects
  • Serious complications
  • Parent/patient satisfaction

Challenges

• Data collection
  – Manual vs digital
  – Need EMR report to run
  – Not a priority for IT
  – Reporting is mandatory part of CPG

Our Outcomes
Not Dictated by CPG

- Facility specific
  - Scavenging system to be used
    - WAGD vs suction
  - Credentialing criteria
    - Medical staff structure
  - Which nurses to train
    - Focused group vs every nurse
  - Cost recovery
    - No CPT code

CCMC Credentialing Criteria

"Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has."
Margaret Mead

QUESTIONS??
References


