Abstract

In recent years, more hospitals nationally are offering nitrous oxide as an option to relieve labor pain. Due to a history of limited use of nitrous oxide in the United States, pregnant women may be less informed regarding this option, creating a need for better availability of educational material on this topic. During my Maternal-Newborn clinical rotation I cared for a woman in active labor who desired to use nitrous oxide for pain relief. The patient was provided with educational material to read prior to the use of the gas. She encountered difficulty processing the information while in active labor and remained confused during the administration process. My concern upon witnessing the patient's struggle fueled a desire to improve the experiences of future patients seeking to use nitrous oxide. I recognized that a simple, bulleted, organized, and concise sheet providing background information, step-by-step instructions for use, and safety considerations may aid women in using this form of labor analgesia. Information gathered from a literature review on nitrous oxide for labor pain and patient education was used to create a written information sheet designed to increase health literacy for those planning to give birth in a hospital in the Southeastern United States. The purpose of the product "*Nitrous Oxide for Labor Pain*" is to provide a quality educational tool to empower laboring women to make informed decisions, resulting in greater patient autonomy and satisfaction with care.

Key Words: labor, nitrous oxide, pain, patient education

"Nitrous Oxide for Labor Pain" A Patient Information Sheet

Heightened interest in self-administered nitrous oxide for labor pain is emerging in recent years in the United States. Nitrous oxide is the most widely utilized labor analgesic in the world. Despite its prevalent use in other developed countries, inhaled nitrous oxide to treat labor pain remains uncommon in healthcare in the United States (Stewert & Collins, 2012). According to Plenda (2014), between 50-60% of laboring women in Finland, Canada, Australia, and the United Kingdom have used nitrous oxide for generations as analgesia during labor. Despite lower costs for administration and its ease of use, a mere 1% of hospitals in the United States in 2011 offered nitrous oxide to treat labor pain (Plenda, 2014). As of 2014, only 19 hospitals and 14 birthing centers across the United States were using or in the process of offering nitrous oxide to women in labor (Plenda, 2014). Past barriers to the availability of nitrous oxide in the United States include inadequate equipment availability and lack of healthcare provider knowledge on its procedural use. With the introduction of the Porter Instruments' Nitronox® in 2013, hospitals and birth centers began to integrate inhaled nitrous oxide into their analgesic options for laboring women. As its availability increases, a growing need is emerging for patient education regarding this topic to increase understanding regarding the effects of nitrous oxide and particularly the procedural use (Starr & Baysinger, 2013).

Patients in labor seeking analgesic options deserve quality education through well-constructed patient education material (PEM). Quality patient teaching is essential for patients to understand their healthcare and treatment options to make informed decisions. Informed decisions empower patients and give laboring women a sense of control over their labor. The perception of personal control over the birth experience is a protective factor for labor pain. Additionally, the families or support persons of the patient can benefit through information.

Support is indicated as an important component of a good birthing experience, leading to feelings of safety and boosting self-efficacy. Well informed support persons are better able to confidently assist and reinforce education to the laboring women. Depriving patients of healthcare information and their options for treatment has a deleterious effect on patients' physical, emotional, social, and psychological well-being. In contrast, using a quality PEM strengthens a sense of control, facilitates support, and cultivates a trusting healthcare relationship which are all factors strongly linked to a positive birth experience (Karlstrom, Nystedt, & Hildingsson, 2015).

In an effort to provide quality patient teaching to laboring women seeking analgesia, I have created PEM to increase health literacy in this population regarding a lesser known analgesia option: nitrous oxide. The product of this honors project is PEM in the form of an information sheet called *"Nitrous Oxide Use in Labor"* (see Appendix).

No formal experimental research with participants was conducted in the creation of this resource. My literature review includes exploring research, policies, and patient educational materials regarding nitrous oxide for use in labor is limited to the United States. The content of this product is solely based on my own clinical observations with this patient population and the review of pertinent literature.

Purpose

The purpose of this research paper is to explore the history, effectiveness, safety, and nursing implications of using nitrous oxide as an analgesic during labor. Furthermore, this paper emphasizes the importance of the promotion of patient education specifically regarding nitrous oxide use in labor. The final purpose of this exploratory research paper is to garner information for use in the re-creation of an educational information sheet on the use of nitrous oxide to treat

labor pain in an effort to improve patient outcomes. The PEM is included at the end of the paper (see Appendix).

Implementation

To create an organized and concise format, I intend for this PEM to be printed on a single, double-sided piece of paper to be dispersed to patients. The goal is for the PEM to be readily available in the physician's office or clinic during prenatal appointments or while touring the birthing facility. While the information sheet is written with the subject as the laboring woman seeking pain relief, it is appropriate to share with the patient's support persons. Education of support persons can help reinforce education to patients. The front of the sheet provides pertinent background information on nitrous oxide while the "directions to use nitrous oxide" section is separated onto the back side of the sheet with numbered steps. This layout allows for a separate focus on the directions and for the patient to not have to flip pages in order to read the step-by-step instructions. A graphic is used to aid visual learners. The intent is for the nurse to take an active role by discussing the sheet, answering questions, and through demonstrating correct usage of nitrous oxide. A consent form could be given separately or attached to the PEM.

Review of Literature

Nitrous Oxide

Definition and history. Nitrous oxide is an odorless, colorless, nonflammable gas that many Americans know as "laughing gas" and associate its use as an inhaled agent for pain relief during dental procedures. Nitrous oxide was discovered in 1771. However, the analgesic potential of nitrous oxide to be utilized to treat labor pain was recognized in 1881 (Plenda, 2014). Regular use for treatment of labor pain began in 1934 with the creation of a device that allowed

for self-administration (Plenda, 2014). Usage is more common in European countries with reports of Great Britain using nitrous oxide in 40 to 60% of labors (Stewert & Collins, 2012).

Use in United States. The use of nitrous oxide was more prevalent in the United States in the early 1900's until the 1970's. In the last several years, nitrous oxide has regained interest in the United States as an analgesic during labor. Notably, in 2010, a position statement in support of nitrous oxide as an additional analgesic option made by the American College of Nurse-Midwives further spurred interest in its application in Obstetrics (Stewert & Collins, 2012). Nitrous oxide is indicated in the use of labor pain in the first, second, and third stages of labor and for some procedures such as repairing lacerations or manual removal of the placenta (Collins, Starr, Bishop, & Baysinger, 2012). As more hospitals in the United States include inhaled nitrous oxide as a labor pain treatment option, nurses need to be knowledgeable about this analgesic.

Legal Issues. Legally, nurses work within the guidelines of institutional policies and procedures, which outline the care in those settings. Therefore, policies on nitrous oxide use in labor need to be created before nitrous oxide is offered to patients. All patient education must be designed entirely in accordance with the policy. Some institutions may require patients to read and sign a formal informed consent form. Other institutions may accept a simple verbal consent from the patient after explaining the potential risks and benefits of usage. Nurses must be familiar with the policy and procedures specific to the institution in which they are employed (Stewert & Collins, 2012).

Mechanism of action and maternal effects. Nitrous oxide is a central nervous system depressant. It is believed the analgesic effect results from the release of endorphins, dopamine, prolactin, and various endogenous opioids within the spinal cord and brain while decreasing the

release of cortisol (Rooks, 2011). Thus, nitrous oxide works by reducing the perception of pain and lowering the anxiety level. The resulting euphoria and dissociation may make pain more manageable. The laboring woman will still be aware of the pain, but the use of nitrous oxide may help her to relax. Also, the ability to self-administer may help her feel more in control of pain (Zauderer, 2016). Nitrous oxide has its effect on the mother within 30 to 60 seconds upon inhalation as it enters the lungs. Less than 1% of nitrous oxide is metabolized or stored in the body and over 99% is eliminated unchanged through exhalation (Rooks, 2011). There is no effect on uterine activity or variation in the progress of labor. The patient's sensory and motor functions are not altered, allowing her to remain alert and mobile. Unlike with the use of opioids, maternal respiratory depression is not a risk factor. Furthermore, since the gag reflex remains intact, the woman will not be more prone to aspiration (Stewert & Collins, 2012). The most common maternal side effects of inhaled nitrous oxide are nausea and vertigo. Nausea is common in labor and may be exacerbated with use of nitrous oxide. Dizziness has been reported in 6 to 23% of women but is typically tolerable and only occasionally results in discontinuation of the use of nitrous oxide (Starr & Basinger, 2013).

Effects on fetus. Nitrous oxide appears to have limited effects on the fetus. While it does cross the placenta, resulting in approximately 80% of the concentration of the maternal serum blood level accumulating in the fetus within 15 minutes, nitrous oxide quickly leaves the fetus upon the first few respirations of the newborn. Similarly to the mother, it does not result in respiratory depression. Studies have not shown an effect on fetal heart rate, breastfeeding, and APGAR or behavioral assessment scores. However, it is unclear if any residual nitrous oxide would further depress the central nervous system in situations when the infant is unable to

establish effective ventilation at birth. A need exists for further research, especially on potential long-term effects (Rooks, 2011).

Long-term exposure. Past studies regarding the safety of those with long-term exposure, such as with repeated occupational exposure, resulted in some concerns over potential adverse effects on fertility. Nitrous oxide could play a role in inactivation of methionine synthase which may affect fertility with the likelihood positively correlated with increased exposures, higher levels, and in poorly ventilated settings. A study following midwives suggests some effect on fertility for those who attended more than 30 births a month. Furthermore, another study shows a slight reduction in birth weight but no increase in spontaneous abortions in midwives who participated in the use of nitrous oxide in over 50% of attended births (Rooks, 2011). Damage may accumulate, but reduction in exposure leads to the body repairing the damage. Pregnant nurses are less at risk than those in the aforementioned study when working in well ventilated rooms and using equipment with a scavenger system (Starr & Basinger, 2013).

Assessment and contraindications. Before initiating treatment, the nurse should assess whether nitrous oxide is an appropriate treatment option. Contraindications include the following: a history of or risk for vitamin B12 deficiency, compromised oxygenation, hemodynamic instability, impaired consciousness such as from alcohol or illicit drugs, inability to independently hold the mask, history of inner ear surgery, increased intracranial pressure, or pneumothorax. According to Stewert and Collins (2012), nitrous oxide may also be contraindicated with category 2 and 3 continuous external fetal monitoring (CEFM) tracings. Also, nitrous oxide should not be initiated until more than two hours after administration of a narcotic. The nurse must evaluate whether the patient is a candidate and contact the obstetrician for verification if needed prior to use (Stewert & Collins, 2012).

Patient Education. Excellent patient education is key to proper usage. The administration of nitrous oxide is to be performed in a specific pattern to ensure optimal effectiveness. Nitrous oxide use begins before the onset of a contraction in intervals of 4-5 breaths with 30 second breaks until the end of the contraction when it is no longer used until the next contraction approaches. Research using patient self-reports indicates this pattern of inhalation beginning about half a minute before contractions begin is effective because it results in a peak in the serum level of nitrous oxide along with the peak of contraction (Collins et al., 2012). This method leads to the highest therapeutic pain relief during the strongest and most painful part of the contraction. This process differs from the recommendation to give intravenous pain medications during a contraction to limit the amount that passes to the fetus (Zauderer, 2016). Thus, it is important to teach patients to use this method and explain the purpose of following the instructions for use. Further important teaching points include telling the patient to hold the mask close to create a seal, not to talk during administration so as not to break the seal, and to discontinue use in between contractions. Teaching the correct technique by having the patient practice with the first few contractions is recommended to increase the chance for successful use and satisfaction with results. Most women are able to successfully use the technique after a few attempts. A key point is the technique for self-administration used for nitrous oxide allows the patient to be responsible for managing her own analgesia which increases feelings of control (Stewert & Collins, 2012).

Safe usage. Correct patient technique, proper equipment, and an appropriate environment are critical for preventing patient and occupational hazards. The Porter Instruments' Nitronox® system includes a demand valve which opens upon the patient inhaling with the mask held tightly against the face. This valve controls the amount of nitrous oxide the

patient receives, preventing overdose. It is beneficial to inform the patient that inhalation and activation will result in a hissing sound so the patient can expect to hear this noise. It is important to teach the patient to exhale into the mask to scavenge the exhaled nitrous oxide. The system has a scavenger system that collects exhalations into a waste receptacle system and should be used in well ventilated hospital rooms to decrease exposure to others (Stewert & Collins, 2012). Including these measures in hospital policy reduces risks to patients, support persons, and staff. Another potential way to protect staff, especially from long term exposure, is by having staff wear dosimeters which measure the level of exposure (Rooks, 2011).

Concentrations and use with opiods. Research shows that use of higher concentrations of nitrous oxide, such as 80% with 20% oxygen, especially when combined with other medications like opioids can lead to adverse outcomes. With this concentration the mother is at risk for loss of consciousness and vomiting, which may lead to aspiration. The higher concentration also puts the fetus at risk for marked respiratory depression (Stewert et al., 2012). For this reason, a ratio of 50% oxygen to 50% nitrous oxide is recommended. Furthermore, according to Starr and Basinger (2013), "Adding systemic opioids to nitrous oxide analgesia may increase the incidence of maternal hypoxemia compared with that resulting from systemic opioids alone" (p. 626). Nurses should inform the patient she must wait at least two hours after receiving an opioid before starting nitrous oxide. To increase the woman's pain treatment options, let her know she will be a candidate for opioid analgesic or an epidural if she chooses to discontinue use of nitrous oxide (Starr & Basinger, 2013).

Patient expectations. When compared with an epidural, there are advantages and disadvantageous in the use of nitrous oxide. An epidural provides strong relief of pain when compared to nitrous oxide. For women seeking pain-free labors, nitrous oxide is unlikely to

sufficiently reduce pain to meet the patients' pain goals. However, if a reduction in pain and lower anxiety levels are the expectations, then nitrous oxide may prove to meet or exceed expectations. Some women seeking significant pain relief may find that nitrous oxide effectively treats early labor pain. As their labor continues and pain intensifies, these women may opt to change to a different, stronger pain treatment option such as an opioid or epidural. Thus, it is important to assess the patient's expectations for pain management and educate the patient to have realistic expectations on the effects of using nitrous oxide for analgesia (Stewert et al., 2014).

Concurrent use of nonpharmacological options. Unlike with an epidural, nitrous oxide allows for the patient to be mobile. In practice, it may be helpful to incorporate the use of nonpharmacological techniques along with use of nitrous oxide. Nonpharmacological treatments such as swaying, counter pressure, and bouncing while sitting on a labor ball before use of nitrous oxide can often be continued. These measures are no longer possible after an epidural, but may result in better pain management if performed in conjunction with using nitrous oxide. Another benefit of nitrous oxide over an epidural is that nitrous oxide is an anxiolytic and may help reduce emotional or psychological stress (Stewert & Collins, 2012).

Nursing interventions. The nurse must be prepared for potential maternal side effects such as nausea and vertigo. Providing prophylactic antiemetics prior to initiation of nitrous oxide is advised for women already experiencing nausea during labor (Collins et al., 2012). Nursing implications also include to have receptacles available for emesis in the event use results in nausea. Nitrous oxide does not call for the patient to be bed bound. However, because dizziness and lethargy are possible side effects, patient safety must be taken into consideration. It is recommended that if the laboring woman wishes to ambulate, use a tub, or change positions

she should contact the nurse, assistive personnel, or support persons for assistance to reduce the risk for falls (Stewert & Collins, 2012). According to Stewert and Collins (2012), "Women using nitrous oxide while assuming positions such as squatting, sitting on birthing balls, standing in the shower or sitting in the tub, require attentive supervision" and observation (p. 406). For some women, these side effects may become overly bothersome. The patient should be instructed to remove the mask from her face and take deep breathes if the side effects become intolerable. Patients may choose to discontinue use of nitrous oxide at any time. In the event of an adverse reaction or loss of consciousness of mother or newborn, the nurse should stop the nitrous oxide and administer 100% oxygen by face mask (Rooks, 2011).

Self-administration. An important safety consideration regarding the use of nitrous oxide is to emphasize strict self-administration. This practice supports patient safety because when the woman has reached a dosage of nitrous oxide leading to reduced consciousness, she will be unable to hold the mask. Thus, she is self-regulating her dose. If another person or a strap holds the mask in place, there is a higher risk of complete loss of consciousness. Therefore, the nurse should educate the patient not to tie the mask to her face or allow others to place the mask on her face. Furthermore, policy and patient education should include that if someone is seen administering nitrous oxide other than the patient, then the nitrous oxide cart will be removed immediately. It is recommended the partner is included in this education and also that this education is repeated (Stewert & Collins, 2012).

Patient Education

Health literacy. Effective nurses are skilled educators. Nurses assess educational needs, provide multimodal educational techniques, and evaluate the effectiveness of education. Teaching needs to be individualized to the patient. Patient education increases health literacy

which is defined by Öresland, Friberg, Määttä, and Öhlen (2015), as the "knowledge and competencies to access, understand, appraise and apply information regarding health or diseases" (p. 240). The purpose of increasing health literacy is to further the patient's ability to obtain, comprehend, and apply health related information so as to prevent the deterioration of, preserve, or improve health. By helping patients receive proper information, nurses can alleviate distress, empower patients to make informed decisions regarding their health, and increase overall satisfaction with care. Because patient education reduces the anxiety associated with the unknown and aids patients to be included in the decision making process, it increases patients' perceptions of control over their health (Öresland, et al., 2015).

Patient Education Material. A common tool used by nurses to teach patients is patient education material or PEM. Öresland, et al., (2015), defines PEM as "written information, advice and counselling given to patients and relatives about medical conditions, available services, treatments and care procedures" to serve "as a complement to oral information" (p. 240-241). The purpose of PEM is to promote patient health, support informed decision making, adopt healthy behaviors, prevent injury or illness, and increase knowledge or awareness. A form of education material commonly used by nurses is written material which may be in the form of a short information sheet. Therefore, it is worthwhile to continue research on creating useful PEM and to use current evidence-based research while individualizing care when creating or using a written patient information sheet (Öresland, et al., 2015).

Hospital policy. Furthermore, the sheet should directly reflect the hospital's policy. It is essential to have a clear, accurate, and evidence-based policy in place before commencing the creation of PEM. The quality of the PEM is contingent upon the quality of the hospital's policy. Discrepancies between the sheet and policy may lead to confusion and to nonadherence to

hospital policies. Prior to implementation, the PEM must be approved by administration and then may only be used at the healthcare setting in which it was approved. Once approved, the implementation of quality written health education materials may lead to greater health literacy and improved patient outcomes (Öresland, et al., 2015).

Patient education level. Studies show PEM is often written for a higher educational level than is appropriate for the patient and may be laden with unfamiliar medical terminology (Heilman, 2013). If patients are unable to comprehend the educational material then those patients are at an unfair disadvantage in understanding their care. These patients will not be empowered to make choices regarding their healthcare options. Furthermore, they may inadvertently not follow critical directions which may compromise their or other's safety. According to Heilman (2013), the average adult in the Unites States reads at approximately a 7th to 8th grade level. The National Institutes of Health (NIH) and the United States Department of Health and Human Services both recommend that written health care materials are written to be appropriate for reading at the sixth-grade level (Heilman, 2013).

Readability scales. Grade level for printed material can be determined by use of readability scales. Readability formulas first emerged in the 1920's (Cutilli, 2006). The Flesch Reading Ease and the Flesch-Kincaid Grade Level are the most widely used readability scales (Heilman, 2013). These reading scales are even available to the general public through the extensively used Microsoft® Word® Office package (Badarudeen & Sabharwal, 2010). Thus, hospitals likely have access to readability scales. Hospitals should use a readability scale and edit patient education materials to no higher than a seventh-grade level or more ideally a sixth-grade level.

Limitations of readability scales. A limitation to using a readability scale is that readability formulas account for 50-80% variability in text difficulty and, therefore, are limited in their ability to predict comprehensibility (Stossel, L. M., Segar, N., Gliatto, P., Fallar, R., & Karani, R., 2012). According to Stossel et al. (2012), imperfect prediction of comprehensibility can be attributed to "readability indices do not account for some variables that influence comprehension and recall, such as visual aids, text organization, syntax, and rhetorical structure" (p. 1169). Length of words and sentences may also be insufficient in measuring difficulty of readability because they do not always correlate with familiarity. Some words with multiple syllables may be more commonly known by the general public than certain unfamiliar shorter words such as medical terms. Improvement of readability is important but should not be the only focus in improving PEMs. According to Stossel et al., (2012), "Few published studies have shown a beneficial effect on patients' health outcomes from using simplified reading materials alone" (p. 1169). Thus, while important, improving readability is only one factor in creating an effective PEM.

Medical Jargon. Medical terminology is another factor that can pose a significant barrier to learning. Regardless of education level, medical jargon may be unfamiliar to patients and their support persons. A study in an emergency department surveying 249 adult patients found that nearly 80% were unable to verbalize that "hemorrhage" was equivalent to "bleeding," "fractured" meant "broken," and a "myocardial infarction" was a "heart attack" despite more than half of those who were studied were college graduates. Thus, medical terms within PEM should be either replaced by common verbiage or clearly defined in simple terms (Stossel et al., 2012).

Learning Styles. Quality PEM supports multiple learning styles so as to be beneficial to the diverse patient population nurses encounter. Patients may be visual, auditory, or kinesthetic learners. The priority nursing assessment after establishing a readiness to learn is to determine in what ways each individual patient learns most effectively. According to Beagley (2011), "Once the learning style is established, the nurse adapts the teaching materials to the preferred style" (p. 335). Assessment followed by adaptation promotes individualized care. Having a written educational tool that already supports multiple learning styles simplifies this nursing intervention.

Visual learners. Some patients may be visual learners, acquiring information best when able to see what they are learning. An image is often more useful to help visual learners obtain and retain information than listening to a lecture or a verbal explanation (Beagley, 2011). Images should be simple, briefly captioned, and placed adjacent to corresponding text (Cutilli, 2006). According to Heilman (2013), patient comprehension can be increased by complementing written information with images, charts, and diagrams. Simple illustrations provide key information without bogging down the learner in complex details. A benefit to using simple drawings is the ability to express concepts so that they can be understood even without the written word, making them an asset to use in educational material for patients with lower literacy levels (Houts, Doak, Doak, & Loscalzo, 2006). Pictures may better portray body positioning or movement for instructions requiring action of the patient's part. When compared with reading text alone, images have been shown to significantly increase attention, comprehension, and recall of educational health information (Houts, et al., 2006).

Auditory learners. In contrast, auditory learners learn best through actively listening to verbal or recorded information. Teaching through explanation is quick and low cost. However,

teaching through verbal explanation requires the nurse to have strong communication skills. The nurse must be clear, concise, avoid medical jargon, define unfamiliar terms or concepts, and be able to provide information in a logical pattern. The nurse should use active listening and evaluate if the patient is understanding the information. One effective technique is to use the teach-back method in which after verbal explanations are given, the nurse requests patients to explain the information in their own words. Patients then relay the information back to the nurse as if teaching the nurse. The teach-back method offers an opportunity to clear up any miscommunications and allows the nurse to evaluate the effectiveness of the patient education (Beagley, 2011).

Kinesthetic learners. The kinesthetic learner does not benefit as much from imagery or lecture. Instead, this learner finds meaning and understanding through movement. The teach-back method involving physical demonstration and return demonstration is superior for this learning style (Beagley, 2011). It may be particularly helpful to use this learning method when teaching the steps of the process of self-administering nitrous oxide. The nurse can show how to hold the mask, to count respirations, and exhale into the mask, and then have the patient return demonstrate the steps.

Active teaching. Nurses should be interactive in their role as educators. It is not enough to supply the patient with an educational information sheet, no matter how well created. According to Heilman (2013), “One-on-one discussion between the physician and the patient, supplemented by printed health information with illustrations, and followed by an interchange of questions/answers, is probably the most effective means for improving patient knowledge” (p. 109). Healthcare professionals need to take an active role when educating patients with quality

PEM. This method also helps with those who are auditory learners, clears up questions, facilitates a stronger nurse-patient relationship, and reinforces important points.

Barriers to learning. It is paramount to consider individual barriers to learning such as discomfort or distress which are common barriers during labor. Pain and anxiety are well known barriers to learning regardless of education level. When pain control is inadequate, the pain serves as a barrier to learning by obstructing the patient's capacity to gain new information (Beagley, 2011). According to Beagley (2011), "anticipation, anxiety, and fear are all contributing factors in diminishing reception of knowledge" (p. 334). Therefore, a simple, concise, and clear information sheet is ideal for even highly educated clients due to this barrier. Because pain and anxiety can be such strong barriers to learning, teaching about analgesia for labor should begin before the onset of labor pain. Teaching analgesic options when the pain of labor is already present greatly disadvantages the patient. Patient education should ideally begin in the physician's office or clinic during prenatal appointments. During a tour of the hospital may also be an appropriate interval to educate patients. However, it is not always possible to educate a new patient during these time periods. Under such circumstances, education could take place during the admission process. Prioritizing education before the onset of great anxiety or pain best supports the patient's ability to learn and make informed decisions about her health.

Ethics and legality. Ethical or legal implications may present when waiting to have a patient read an information sheet and sign a consent form while in active labor and severe pain. Informed consent is determined by the individual institute. An institute's informed consent process may vary from requiring a formal detailed written document specifying potential benefits and risks that requires a signature to only a verbal review with the patient (Stewert & Collins, 2012). According to Pilegaard & Ravn (2010), informed consent requires that the patient is

"competent to decide, gets adequate disclosure of information, understands the information, decides about the treatment voluntarily and consents to the treatment on a fully informed basis" (p. 101). Earlier presentation of the information sheet can better ethically and legally ensure the patient understands the benefits and risks of a procedure requiring informed consent such as the use of nitrous oxide.

Maternal benefits for inclusion of support persons. In order to provide family-centered care, family members and support persons need to be included during patient education. According to Beagley (2011), "A family member present during key moments will assist and help the patient to remember the information" (p. 336). The support person may help reinforce the correct method to use nitrous oxide (Bäckström & Wahn, 2011). However, as previously mentioned, the support person cannot physically help administer nitrous oxide to the patient. If the support person is aware of the signs of adverse side effects and of improper usage, he or she may be helpful in preventing harm to the patient. The support person can also encourage the laboring woman by serving as emotional support if she faces difficulty in following the steps of usage. The support person is often in a position to offer continuous support, including when the nurse is not with the patient. Support persons may also have the greatest influence on patients. Research has indicated that support from those other than staff members has the most positive effect (Hodnett, Gates, Hofmeyr, & Sakala, 2015). Including the family helps the laboring woman to feel more supported, reinforces education, and encourages the continued connection with the family unit (Bäckström & Wahn, 2011).

Family-centered care and benefits to support persons. Not only does the laboring women benefit when education is extended to caregivers, but the support persons also benefit. Support persons may feel anxious, out of control, and powerless while their loved one is in labor.

These feelings could intensify, leading to levels of panic, which creates a stressful birth experience for the entire family unit. The nurse can empower support persons by including them in education and offering them a role during the labor process. According to Bäckström and Wahn (2011), "Men who play an important role during labor seem to better manage their overwhelming feelings of helplessness" and offer superior support to their partners (p. 72). By actively participating in care, a support person is more likely to strengthen his or her connection with the laboring woman. As with the patient, teaching should be individualized for the support person who may have a different learning style than the laboring woman. Re-teaching should occur until teaching objectives are achieved for both support persons and the patient (Bäckström & Wahn, 2011). Because nurses are at the bedside, they are in a special position to offer comprehensive, individualized, family-centered education.

Summary

Satisfaction with the labor experience is tied to more than pain relief. Evidence supports a positive childbirth experience is related to how well expectations are met, quality of support systems, and feeling a sense of control which includes the ability to take an active role in decision making such as in methods of pain treatment (Zauderer, 2016). Women remember their birth experiences for a lifetime and negative memories are linked to posttraumatic stress disorder, depression, and a higher correlation with caesarian sections in subsequent births (Takehara, Noguchi, Shimane, & Misago, 2014). Nurses play a central role in their patients' births and labor pain management. Education on nitrous oxide assists patients to explore an additional pain relief option. Proper education and additional options for analgesia support the patient's ability to make her own informed decisions and increases her sense of control during labor. Nurses play a primary part in patient education as it is a critical role within their scope of

practice. The use of informative, accurate, and simplified PEM on nitrous oxide use as labor analgesia may aid women in more effective and safe usage. Increased availability, more research, and adequate education regarding nitrous oxide use in labor would increase pain relief options for laboring women.

Content for Creation of PEM

The content of the created patient information sheet on nitrous oxide use to treat labor pain is based upon the above the review of literature which includes scholarly articles, educational books, and a Southeastern hospital's policy on nitrous oxide as an analgesic during labor. The content on nitrous oxide focuses on the topics of the history, mechanism of action, maternal side effects, infant side effects, safety considerations, legal factors, and procedural use. Research on patient education includes types of learning styles, barriers to learning, recommendations for creating written PEM, and family-centered care.

Graphics/Layout & Implementation

The information sheet is written entirely in sizes 12 and 15 point Humanist 777BT font for consistency with a Southeastern hospital's style guidelines and strategically spaced for legibility. The readability is 5.7 on the Flesch-Kincaid Grade Level, meaning a 6th grader should be able to understand the document (Refer to Table 1). The readability was also evaluated by the Flesch Reading Ease Score which considers the average sentence length and syllables per word. This scale rates text on a 100-point scale with the higher the score, the easier it is to understand the document. For most standard documents to have an adequate readability one aims for at least a score of 70. The Flesch Reading Ease Score for my product was 79.1 (refer to Table 1). The

readability was further verified to be appropriate for the intended patient population by a Southeastern hospital's marketing department. The instructions for use are located separately on the back of the sheet in a numbered step-by-step format. Important points are in italics. Headings are separated from the rest of the text and use the larger 15 point font and blue color to highlight these sections clearly. Key words are either underlined or capitalized to draw the reader's attention. While one source indicated to avoid capitalized words because they tend to slow down reading, it referred to long headings and running text. Because the sheet may be printed in black and white rather than color at times, it was imperative to use another method to bring focus to important words. Bold font and the larger text size of 15 point were already used to delineate headings. The use of underlining or capitalizing single words in this case is appropriate for the above reasons. The use of a "remember to NOT…" section with bullet points at the conclusion of the sheet helps separate and reinforce important safety points. Finally, for visual learners, a graphic with permission from Praxair Technology (n.d.) is included of a woman using nitrous oxide to aid readers in understanding proper body mechanics during use. The sheet may be read aloud by the nurse for auditory learners and information reinforced through asking and answering questions. Nurses may also demonstrate use and ask the patient to

Table 1 Readability Statistics

Counts	
Words	680
Characters	2975
Paragraphs	51
Sentences	38
Averages	
Sentences per Paragraph	1.3
Words per Sentence	14.0
Characters per Word	4.2
Readability	
Passive Sentences	5%
Flesch Reading Ease	79.1
Flesch-Kincaid Grade Level	5.7

Readability Statistics using Microsoft® Word® Office 2010. This table illustrates the Flesch Reading Ease and Flesch-Kincaid Grade Level scores for the patient information sheet *"Nitrous Oxide for Labor Pain."*

practice use for kinesthetic learners. A multimodal learning approach is recommended for optimal learning (Cutilli, 2006).

Results

At the time of completion of this thesis paper, I forwarded the redesigned patient information sheet "*Nitrous Oxide Use in Labor*" to a nurse manager for approval to use with the clients in their Southeastern hospital's labor and delivery unit. My goal is that my PEM will be approved and will aid future laboring women at the hospital in the use of nitrous oxide to treat labor pain. I hope it will serve as a helpful educational tool and will lead to an increase in patient satisfaction and health outcomes with this patient population.

Future Considerations

While the patient information sheet is specific to the policy of one hospital in the Southeastern United States, the information is supported by my review of literature and may serve as a guide that may be adapted for other healthcare settings who are adding nitrous oxide as an analgesic for labor pain. Perhaps, information from this project and the format of the patient information sheet that I designed could be applied or adapted for the creation of other educational materials on additional health conditions, medications, or treatments.

I hope my project will increase awareness of this option, provide accurate information, and result in an educational tool that will increase patient autonomy and satisfaction with care during labor. I would also like to encourage use of the sheet before the onset of labor because pain can be a barrier to optimal learning. However, I recognize women who may have not considered nitrous oxide until after the pain of labor has begun may also benefit from a clear and direct patient information sheet to aid them in learning despite this barrier.

Labor is painful and women may feel out of control, anxious, afraid, and vulnerable during this time. I hope to alleviate stress in this patient population by increasing patient autonomy through assisting clients in making informed decisions and strengthening their feelings of support. To accomplish this goal I suggest advocating for interdisciplinary use of the patient information sheet to strengthen the patient's support system with caregivers and the nurse. It is imperative that nurses be prepared to provide supportive, quality care which includes superior patient education with a focus on family-centered care. Further research is needed on effective creation of PEM for nitrous oxide as labor analgesia.

Conclusion

With expanding use of nitrous oxide as labor analgesia in the United States and limited research on hospital implementation, policy creation, and patient education standards, I hope this project will create interest and spur further research on this topic. More research in needed on nitrous oxide use in the United States to treat labor pain and on effective educational methods to promote patient autonomy.

Upon graduation, I wish to pursue a career in obstetrics and neonatal nursing. I aspire to offer safe family-centered care while empowering women with a sense of control and providing emotional support during such momentous life experiences. I will continue my research on patient education and serve as an advocate for improving patient education in all fields of nursing I pursue.

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Appendix

Nitrous Oxide for Labor Pain

What is Nitrous Oxide?

Nitrous oxide is a gas with no color or smell. Many Americans know it as "laughing gas" that is breathed in through a mask for pain relief at dental offices. Rex is now offering this pain relief option as half nitrous gas and half oxygen to reduce discomfort during or after labor.

How it Works:

- Nitrous oxide reduces the perception of pain and may reduce anxiety.
- You will still be aware of the pain, but the use of nitrous oxide may help you to relax.
- You will hold the mask yourself and breath in the nitrous oxide as needed to help you feel more in control of pain.
- You will feel the effects in 30 seconds to 1 minute.
- Removing the mask and breathing in room air will quickly stop the effects.

Praxair Technology

Benefits:

- You will be conscious or aware of what is happening during your labor
- You will be able to move around with help
- You may start pain control with nitrous oxide and then decide to have an epidural or narcotic pain medication.

Effects on Labor and Baby:

Research has found that nitrous oxide has no negative effects on laboring moms or their babies before or after birth.

Possible Mild Side Effects:

- Dizziness
- Nausea
- Tiredness or sleepiness

**Please ask for help from family or the nurse before trying to get up or walk.*

You Cannot Use Nitrous Oxide if:

- You cannot hold the mask by yourself
- You were given narcotics within the past 2 hours
- You have pernicious anemia or B-12 deficiency and take B-12 supplements
- You have had ear surgery within last 6 months
- All nitrous oxide machines are unavailable or if you are being cared for in an area where nitrous oxide cannot be used.

Directions to Use Nitrous Oxide During Labor:

The nurse will help you to use nitrous oxide. It may take a few tries to use it correctly.

1. Begin use 30 to 60 seconds BEFORE the start of a contraction or pain.
2. Hold the mask tightly to your face by yourself so that you feel the mask make a tight seal.
3. Breathe in deeply through your nose and out through your mouth for 4 to 5 breaths.
4. You will hear a hissing sound when you breathe in as the nitrous oxide is released from a demand valve. This valve prevents you from getting too much nitrous oxide.
5. Exhale **into** the mask. Do NOT talk or take off the mask when breathing in nitrous oxide.
6. After 4 to 5 breaths, pull the mask away from your face and breathe room air normally for 30 seconds.
7. Repeat sets of 4 to 5 breaths with 30 second breaks during the contraction.
8. Stop use BEFORE the end of your contraction by pulling the mask away from your face and breathing room air normally until you expect the next contraction.
9. If you are pushing, take 2-3 deep breaths of nitrous oxide before each push.
10. Repeat as needed.
11. Please take the mask off and breathe room air deeply if you feel dizzy or nauseous. Also, you may ask to stop use of nitrous oxide at any time.

When using Nitrous Oxide remember to NOT...

- Tie the mask to your face or let anyone else hold the mask for you.
- Let anyone else use nitrous oxide or it will be removed from the room.
- Attempt to stand or walk without first asking for help.
- Remove the mask and exhale nitrous oxide into the room air.

PLEASE ONLY EXHALE NITROUS OXIDE INTO THE MASK.