

Implementing Practice Guidelines and Education to Improve Care of Infants With Neonatal Abstinence Syndrome

Katherine Lucas, DNP, APRN, NNP-BC; Robin B. Knobel, PhD, RN

ABSTRACT

PURPOSE: To develop and implement a program for the management of neonatal abstinence syndrome (NAS) and the use of the Finnegan Neonatal Abstinence Scoring Tool (FNAST). We evaluated knowledge gain in nurses as a result of implementation of the practice guidelines and education.

SUBJECTS: Participants included 68 nurses employed in a neonatal intensive care unit (NICU) at a single facility.

DESIGN: A nonexperimental, pretest/posttest study evaluated change in nursing knowledge about NAS and the use of the FNAST after implementation of evidence-based clinical practice guidelines and an educational project.

METHODS: Nurses were tested before and after participation in education about NAS. A subset of 10 nurses was evaluated using the FNAST with videos of infants having NAS.

RESULTS: Volunteer participation in the NAS educational project occurred in 81% of the NICU nurses. All nurses showed some improvement in scores on the posttest, with 2% to 44% improvement. All 10 nurses who participated in the interactive DVD test scored 90% or more against the FNAST criterion 1 week after participation in the educational project.

CONCLUSION: Evidence-based clinical practice guidelines and education around NAS and the FNAST equip caregivers with the necessary tools to consistently and accurately assess an infant with NAS when using the FNAST.

KEY WORDS: education, evidence-based clinical practice guidelines, Finnegan Neonatal Abstinence Scoring Tool (FNAST), neonatal abstinence syndrome (NAS), neonates, substance abuse

Exposure to substances such as opioids and opioid derivatives can result in neonatal abstinence syndrome (NAS).¹ The 2 types of NAS discussed in the literature occur as a result of iatrogenic and passive exposure. Passive exposure, the focus of this study, occurs when the fetus is exposed to opioids or opioid derivatives during the pregnancy, and the infant develops a physical dependence on the substance.²

Neonatal abstinence syndrome is defined as a multi-symptoms syndrome with abnormal symptoms of the

central nervous, gastrointestinal, autonomic nervous, and respiratory systems presenting in the infant when transfer of harmful substances from the mother to the fetus abruptly stops at the time of delivery.³ Fetal exposure usually occurs for 1 of 3 reasons: (1) mothers are addicted to opioids, either prescribed or illicit; (2) mothers require prescription opioids for another disease process; or (3) mothers receive methadone therapy or other agents to facilitate safe withdrawal from addiction to prescription or illicit opioids.⁴ Cord clamping, the catalyst necessary to initiate the cascade of events, causes the abrupt withdrawal of the substance to the infant. Infant metabolism and excretion continues resulting in decreased circulating levels of the substance. When the circulating drug levels reach a critical low, the infant begins to show signs and symptoms of NAS.³

The American Academy of Pediatrics (AAP) reported that 50% to 95% of infants exposed to opioids or opioid derivatives, including heroin and methadone, will develop NAS.⁵ More recent research describes an increasing incidence of infants exposed to harmful substances prior to birth.² The appearance

Author Affiliations: Department of Nursing, Cape Fear Valley Health System, Fayetteville, North Carolina (Dr Lucas); and Duke University School of Nursing, Durham, North Carolina (Drs Lucas and Knobel).

The work occurred at the Cape Fear Valley Health System Neonatal Intensive Care Unit, Fayetteville, North Carolina.

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Correspondence: Katherine Lucas, DNP, APRN, NNP-BC, 3937 Nikita D, Hope Mills, NC 28348 (kay@nc.rr.com).

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of symptoms in the newborn is unpredictable and is associated with many factors that may occur at birth or up to 4 weeks after delivery.⁶ Subacute symptoms of NAS can occur as late as 6 months after delivery with neurodevelopmental problems apparent up to at least 12 months of age.⁴ Adding further to the complications of caring for these infants is the lack of reliability of mothers who abuse substances when self-reporting. Furthermore, polydrug use exacerbates the signs and symptoms associated with NAS and complicate medical management that is already challenging.⁷

Optimal treatment of this NAS population is hampered by the current lack of evidence-based standardized guidelines and protocols for pharmacologic management and care that promote improved outcomes for patients with NAS.^{5,9} Successful management is dependent on a number of variables including the medication and dose chosen to facilitate safe withdrawal for the infant, the type of tool used (if any) to measure NAS, and the discretion of the attending physician. In some facilities, the pharmacologic management is dependent on the on-call neonatologist or pediatrician who proceeds without the support of any tool or protocol.¹⁰

The current tools for identifying, diagnosing, and managing NAS in infants are inclusive but, when used without suitable education, afford the caregiver too much room for subjectivity.⁷ It is imperative that the caregiver is knowledgeable about NAS, including etiology, signs and symptoms, pharmacologic management, as well as outcomes.¹¹ Caring for these infants without the necessary tools and education may result in inaccurate scores, inappropriate and ineffective treatment, increased need for pharmacologic treatment, increased length of stay, and increased incidence of poor neurodevelopmental outcomes.² The ability to provide quality care declines further when the caregiver is undereducated about NAS and the tool used to guide assessment and care.^{2,5-7} Care of these infants may improve with education about NAS, the use of the appropriate tool, and informative clinical practice guidelines.¹⁰

The prevalence of NAS and inconsistencies in care prompted the AAP to develop recommendations for monitoring and treatment of these infants.⁵ Recommendations outline standards for assessing, managing, and treating the infant with NAS, including the use of 1 of 3 scoring tools: (1) the Finnegan method, (2) the Ostrea system, or (3) the Lipsitz tool.⁵ Despite the availability of the AAP recommendations, current research suggests the inconsistent use of these standardized guidelines and tools.¹ Many facilities continue to treat infants with NAS without adequate education or documented clinical practice guidelines in place.¹²

PURPOSE

The researcher implemented an evidence-based practice research project to develop clinical practice guidelines

for care of the infant with NAS and to provide an educational session for neonatal nurses in our unit around care of the infant with NAS and using the Finnegan Neonatal Abstinence Scoring Tool (FNAST). This research evaluated the improvement in knowledge of nurses participating in the educational session through a pre- and posttest. A subset of nurses was evaluated in their use of the FNAST through completion of an interactive DVD 1 week after the educational session. The specific research questions were as follows:

1. Will delivering an educational program to the nurses in the NICU around NAS and the use of the FNAST result in increased knowledge as evidenced by a higher score on the knowledge test?
2. Will delivering an educational program to the nurses at CFVMC around NAS and the use of the FNAST result in increased accuracy in using the FNAST to score an infant with NAS?

METHODS

This evidence-based research is a nonexperimental, pretest/posttest study designed to evaluate change in nursing knowledge about NAS and the use of the FNAST after implementation of evidence-based practice clinical practice guidelines and a comprehensive educational program.

Setting

The project was implemented in a 44-bed level 3 regional referral NICU. The incidence of NAS in this unit in 2010 represented 40 of 604 admissions (9%).¹³ The NICU, labor and delivery unit, and the family-centered care (FCC) units are all located in close proximity and the units work together to provide care for these infants and the mothers. Infants who are at risk for NAS receive care initially in the FCC where the nurses, physician's assistants, and pediatricians provide care. The nurses in FCC have received limited education during their orientation in providing care for the NAS infant and many times the FNAST is inconsistently used to score the opioid-exposed infant. Pediatricians are advised to delay discharge of these infants until at least 7 days of age to provide adequate time for manifestation of signs and symptoms of NAS.¹ Neonatologists and neonatal nurse practitioners (NNPs) from the NICU are available for consult when an infant is suspected to have NAS. Request for a NICU consult is made when the FNAST score reaches 8 or greater or if the infant is exhibiting signs and symptoms with the greatest potential for adverse effects.¹⁴ The neonatologist or NNP, in consultation with the neonatologist, examines the infant to determine whether admission to the NICU is indicated. Admission to the NICU is necessary when the infant requires pharmacologic management.

Nurses, NNPs, and neonatologists provide care of the infant with NAS in the NICU in this facility.

Nurses ranging in experience from new graduates to more than 20 years of neonatal experience receive a 12-week orientation that includes limited education on providing care for the NAS infant. Further learning is achieved when the nurse provides care to the infant with NAS. The FNAST at this facility has general instructions printed on the tool; otherwise, there are no practice guidelines in place. Before beginning the project, 10 charts, representing 40% of the infants with NAS in 2010, were reviewed and inconsistencies in scoring of infants with NAS were found throughout the charts.¹³ For instance, after administration of morphine, the documented FNAST scores increased on 62% of the charts. Finnegan's studies, as well as those of other researchers, have found that inconsistencies in scoring are a common finding and a problem that can be addressed with education.^{10,14}

Sample and Consent

Institutional review board (IRB) approval was obtained through Duke University School of Nursing and Cape Fear Valley Health System (CFVHS) prior to implementation of this project. The neonatal nurses provided the sample to be evaluated for this project. All nurses employed in the NICU were invited to participate in the formal education part of this evidence-based research study. Participation in the pre- and post-NAS testing was optional. Consent was implied when the nurse submitted the completed tests to the researcher. The goal was to test at least 50% of the participants. A subset of nurses from each education session who ranged from novice to expert level in neonatal nursing experience was consented to participate in the use of an interactive DVD (NeoAdvances, Nashville, TN)^{15,16} exercise where they examined an infant with NAS, using the FNAST for additional evaluation of their performance with the new knowledge.

Procedures

The clinical practice guidelines were developed using instruments from the Appraisal of Guidelines for Research Utilization (AGREE) Collaboration,¹⁷ the Conference on Guideline Standardization statement,¹⁸ and "Instructions for Writing Clinical Practice Guidelines for the National Association of Neonatal Nurses."¹⁹ A review of the literature provided the evidence to support the information contained in the clinical practice guidelines.

Care is enhanced when the evidence-based clinical practice guidelines integrate information for all levels of providers.⁵ Now, each nurse and medical care provider has access to the necessary information to provide excellent care to an infant with NAS, from etiology to discharge. The guidelines include the information that incorporates all aspects of NAS from etiology to discharge of the patient (Table 1). Nonpharmacologic or supportive interventions to care for the infant with NAS are included, as 30% of the

infants who develop NAS will not require pharmacologic management.⁵ Furthermore, unnecessary initiation of pharmacologic management is associated with poorer neurodevelopmental outcomes and longer lengths of stay.²⁰

NAS Test

A NAS test was developed to evaluate knowledge of NAS, care of the infant with NAS, and use of the FNAST. The pre- and post-NAS tests are identical and were graded using the same criteria. There are 58 questions on the NAS test, and each has a value of 2 points lending a possibility of 116 points. The pretest assessed the knowledge level of the nurse before delivering the formal education about NAS-related care and the FNAST. A posttest assessed the level of knowledge gained during the educational session. Expert content validity of the knowledge test was obtained through consultation with Loretta Finnegan, MD. Dr Finnegan made suggestions during the development of the test and throughout the final revisions. The test was designed to challenge the caregiver's knowledge from etiology of NAS through discharge and to allow the tester some measurable evidence of knowledge gained from the educational offering. A random 4-digit number was assigned to each pair of pre- and posttest, and the tests were distributed with the numbers covered to the researcher to allow comparison of the test results, while keeping the nurse's identity concealed.

Formal Education Component

Nursing participation in the education component was voluntary and was delivered as part of the evidence-based

TABLE 1. Content for Clinical Practice Guidelines

Definition
Special considerations
Purpose
Indications/high-risk population
Substances of abuse
Initial screening
Onset of symptoms of withdrawal
Importance of early recognition
Initial neonatal workup
Neonatal abstinence score (the Finnegan Tool)
Instructions for scoring
The detoxification process
Pharmacologic management
Feeding
Treatment of withdrawal from polysubstance exposure
Discharge planning

research project. The researcher conducted the formal classroom component to groups of 2 to 17 nurses. The nurses viewed and participated in an interactive DVD¹⁵ developed to provide the caregiver an opportunity to assess and score an infant with NAS and then to evaluate those scores with those of the expert. A printed manual¹⁶ accompanies the DVD,¹⁵ and both are designed to facilitate interobserver reliability.

The DVD¹⁵ demonstration was followed by formal didactic education on NAS created with PowerPoint (Microsoft 2010, Redmond, Washington) software. The content of the formal education is specific to the care of the patient with NAS in the NICU and was developed from a literature review and the evidence-based clinical practice guidelines that were developed. Each nurse received a copy of the clinical practice guidelines as well as other handouts to keep as a resource and for review of NAS information.

Interrater Reliability Testing

A subset of 10 nurses consented to participate in the interrater reliability testing that took place 1 week after the educational offering. Each nurse independently observed a DVD¹⁵ of an infant with NAS and scored the infant, using the FNAST. There are 2 examinations on the DVD,¹⁵ and all of the participants viewed and participated in examination 1. The scores on the FNAST are dynamic rather than static so the nurses were “given” some information such as amount of time sleeping, number of yawns and sneezes as well as some hemodynamic measures they could not assess by viewing the DVD¹⁵; otherwise, they assess the infant along with the expert and independently score the infant on the FNAST. After the examination was complete, they watched the evaluation section where the expert reviewed the assessment, evaluation, and the appropriate score. The nurses then compared their scores with the expert’s scores to determine interrater reliability¹⁶ or the ability to reproduce the same score on the same infant at the same time by different observers.

Data Collection

Results were compared for each participant’s pre- and post-NAS tests. Each question on the tests was worth 2 points and the scores for matching numbers were entered into an SPSS(19)²¹ program on a password-protected computer to analyze change in knowledge. The researcher anticipated that at least half of participants, or 34 of the nurses, would have a 10% or more increase in scores, representing an increase in knowledge. Percentage of agreement was calculated for each nurse performing the Finnegan scoring test along with the interactive DVD.¹⁵

RESULTS

After nurses completed the education program and the new clinical practice guidelines were implemented,

results of the pre- and post-NAS tests were analyzed to answer the research questions.

Research question 1: Will delivering an educational program to the nurses in the NICU around NAS and the use of the FNAST result in increased knowledge as evidenced by a higher score on the NAS test?

The researcher compared scores from the NAS test pre- and posteducation and analyzed data, using a matched paired Student *t* test for a change in knowledge. A 10% or more increase in scores was used to indicate improved knowledge.

None of the participants scored 100% correct on the pretest and 3 of the nurses (4%) scored 100% correct on the posttest. All of the participants showed some improvement (2% to 44% improvement) on the posttest scores. Sixty-one of the participants (90%) showed a 10% or more improvement in scores on the posttest, while scores of 7 of the participants (10%) increased by 10% or less (see Table 2).

Research question 2: Will delivering an educational program to the nurses at CFVMC around NAS and the use of the FNAST result in increased accuracy in using the FNAST to score an infant with NAS?

Ten nurses with less than 1 year to greater than 23 years of neonatal experience consented to participate in the interactive interrater reliability DVD¹⁵ 1 week following the educational offering. To be considered reliable when using the FNAST, the rater must obtain a score of 90% or more agreement according to the criteria set forth by the developers of the program.¹⁶ All 10 nurses achieved a score of 90% or more, which is acceptable interrater reliability according to the program guidelines.¹⁶ Four nurses (40%) scored 100% agreement, 5 nurses (50%) scored 95% agreement, and 1 nurse (10%) scored 90% agreement.

To determine the consistency or reproducibility of quantitative measurements made by different observers measuring the same quantity, intraclass correlations were run between each of the 10 nurses and the expert. The intraclass correlations were significant with a range of 0.996 to 1.00 for the 10 nurses.

The evaluations submitted by the nurses were excellent. The comments were mostly positive, and they offered suggestions that will improve future educational offerings on NAS. Many of the comments indicated that the educational opportunity supplied them with information that would enable them to assess and score infants with NAS more consistently and appropriately. They commented that the definitions of the symptoms provided them with information that make the tool a more objective means to assess and score infants with NAS.

DISCUSSION

The FNAST is a comprehensive and objective tool developed to monitor the passively addicted infant with a method that has proven reliability and can be

TABLE 2. Neonatal Abstinence Syndrome Test Results

	N	Minimum	Maximum	Mean				
Results								
Pretest	68	54.00	104.00	85.00				
Posttest	68	88.00	116.00	104.00				
Pretest and posttest scores with < 10% improvement								
Pretest	7	88.00	104.00	96.00				
Posttest	7	96.00	108.00	102.00				
	N	Minimum	Maximum	Mean	SD			
Descriptive statistics for total scores								
Score change	68	2.00	44.00	19.3235	9.06764			
Posttest	68	88.00	116.00	104.5000	6.28075			
Pretest	68	54.00	104.00	85.1765	10.32739			
Valid N (listwise)	68							
Paired Differences								
	Mean	SD	SE Mean	95% Confidence Interval of the Difference		t	df	P (2-tailed)
Paired samples test: Pair 1 pre-post	-19.32353	9.06764	1.096764	-21.51837	-17.12869	-1.7573	67	0.000

easily taught to neonatal nurses.¹⁴ The techniques learned by using the Finnegan method are proven to guide the caregiver in assigning appropriate and consistent scores.¹⁴ If the caregiver is able to assign appropriate scores on the FNAST, then the provider will use the scores to plan effective treatment, resulting in reduced need for pharmacologic treatment, decreased length of stay, and decreased incidence of poor neurodevelopmental outcomes.⁷

Sixty-eight of 84 nurses attended the educational offering, representing 81% of the nurses employed in the NICU in this facility, even though they did not receive financial compensation for attendance and attendance was not mandatory. All of the nurses who attended consented to pre- and posttesting, and all nurses achieved improved knowledge from the education. Recent research shows that providing education to nurses can result in increased knowledge, improved professional practice, and improved patient treatment goals.²² Education can also equip nurses with the necessary knowledge to care for patients with complex medical problems like NAS.²³ Furthermore, providing nurses with specific information about a medical problem is correlated with improved adherence to best practice.²⁴

One week after the educational offerings were completed, 10 nurses participated in the interrater reliability testing, all 10 of the nurses (100%) scored 90% or more, achieving reliability status according to

the criteria.¹⁶ Practice-based learning techniques such as interactive exercises are correlated with improved practice procedures as well as improved patient outcomes.²⁵ The 1-week delay between the education offering and the interrater reliability testing offers some indication of knowledge retained as all of the participants achieved reliability status.²⁵

Strengths and Limitations

This evidence-based practice research project exemplifies a foundational program designed to improve care of infants with NAS by developing and implementing evidence-based clinical practice guidelines and an education program specific to the care of the NAS patient and use of the FNAST. Supplying caregivers with the necessary tools and providing education on the proper use of those tools are essential in providing quality care and improving outcomes for this population of patients. The expert resources utilized to support the project strengthened the content validity of the project. The posteducation evaluations were excellent offering evidence of buy-in of the staff and sustainability of the project.

A number of limitations are also recognized. First, the findings in the study may be overly positive, as the results do not represent knowledge retained over any length of time. The nurses were tested just prior to the educational offering and then again at the end of the educational offering. The interactive DVD testing was performed 1 week after the educational offering giving

limited indication of information retained. Second, the FCC staff is directly involved in caring for the NAS patients and was not included in the initial part of the study because of limited time and resources for this project. Also, we were unable to include clinical outcomes as a component of this project because of time constraints and low populations of NAS infants at the time of this project. Clinical outcomes such as consistency of scores, consistency of care, and length of stay may provide statistical evidence as to the impact this quality improvement project may have had on this patient population.

Implications for Future Practice and Research

The next phase of this project is to provide the clinical practice guidelines and education to the nurses in the FCC unit, which is currently taking place. The presentation will be offered on the intranet education server to allow the nurses an opportunity to review the information as needed and once the education is completed throughout the NICU and the FCC unit.

The IRB approval has been obtained from CFVHS to follow through with retrospective chart reviews to evaluate for any change in clinical outcomes correlated with the implementation of the clinical practice guidelines and education of the nurses. Data from the chart reviews will offer evidence as to the impact of this project on the clinical outcomes of this population of patients. The chart reviews will also offer more substantial evidence about knowledge retained as a result of the education component.

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References

- Berens RJ, Meyer MT, Mikhailov TA, et al. A prospective evaluation of opioid weaning in opioid-dependent pediatric critical care patients. *Pediatr Anesth*. 2006;102:1045-1050.
- D'Apolito K. Neonatal opiate withdrawal: pharmacologic management. *Newb Infant Nurs Rev*. 2009;9(1):62-69.
- Matic A. Neonatal abstinence syndrome—case report. *Acta Med Med*. 2008;47(1):55-59.
- Jansson LM, Velez M, Harrow C. The opioid exposed newborn: assessment and pharmacologic management. *J Opioid Manag*. 2009;5(12):47-55.
- American Academy of Pediatrics Committee on Drugs. Neonatal drug withdrawal committee on drugs. *Pediatrics*. 1998;101(6):1079-1088.
- Crocetti MT, Amin DD, Jansson LM. Variability in the evaluation and management of opiate-exposed newborns in Maryland. *Clin Pediatr*. 2007;46:632-635.
- Kuschel C. Managing drug withdrawal in the newborn infant. *Semin Fetal Neonatal Med*. 2007;2:127-133.
- Osborn DA, Jeffery HE, Cole MJ. Opiate treatment for opiate withdrawal in newborn infants. *Cochran Database Syst Rev*. 2010;(10):CD002059.
- Seligman NS, Salva N, Hayes EJ, Dysart KC, Pequignot EC, Baxter JK. Predicting length of treatment for neonatal abstinence syndrome in methadone exposed neonates. *Am J Obstet Gynecol*. 2008;199(4):396 e1-396 e7.
- O'Grady MJ, Hopewell J, White MJ. Management of neonatal abstinence syndrome: a national survey and review of practice. *Arch Dis Child Fetal Neonatal Ed*. 2009;94:249-252.
- Ebner N, Rohrmeister K, Winklbaur B, et al. Management of neonatal abstinence syndrome in neonates born to opioid maintained women. *Drug Alcohol Depend*. 2007;87:131-138.
- Sarkar S, Donn SM. Management of neonatal abstinence syndrome in neonatal intensive care units: a national survey. *J Perinatol*. 2006;26:15-17.
- Neodata. Cape Fear Valley Health System neonatal intensive care unit administrative database. Accessed January 2010.
- Finnegan LP, Connaughton JF, Kron RE, Emich JP. Neonatal abstinence syndrome: assessment and management. *Addict Dis An Int J*. 1975;2(1):141-158.
- D'Apolito K, Finnegan L. *Assessing Signs & Symptoms of Neonatal Abstinence Using the Finnegan Scoring Tool: An Inter-Observer Reliability Program* [DVD]. Nashville, TN: NeoAdvances, LLC; 2010.
- D'Apolito K, Finnegan L. *Assessing Signs & Symptoms of Neonatal Abstinence Using the Finnegan Scoring Tool: An Inter-Observer Reliability Program Instructional Manual*. 2nd ed. Nashville, TN: NeoAdvances, LLC; 2010.
- The AGREE Collaboration. Development and Validation of an international appraisal instrument for assessing the quality of clinical practice guidelines: the AGREE project. *Qual Saf Health Care*. 2003;12:18-23.
- Shiffman RN, Shekelle P, Overhage M, Slutsky J, Grimshaw J, Deshpande AM. Standardized reporting of clinical practice guidelines: a proposal from the Conference on Guideline Standardization. *Ann Intern Med*. 2003;139(6):493-500.
- National Association of Neonatal Nurses. Instructions for writing clinical practice guidelines for the National Association of Neonatal Nurses. http://www.nann.org/uploads/files/Instructions_for_Writing_Clinical_Practice_Guidelines.pdf. Published 2009. Accessed March 14, 2010.
- Velez M, Jansson LM. The opioid dependent mother and newborn dyad: non-pharmacologic care. *J Addict Med*. 2008;28(3):113-120.
- SPSS [Computer program]. Version 18. Chicago, IL: SPSS Inc; 2010.
- Forsetlund L, Bjorndal A, Rashidian A, et al. Continuing education meetings and workshops: effects on professional practice and health care outcomes (Review). *Cochrane Database Syst Rev*. 2009;(2):CD003030.
- Marzlin K. Structuring continuing education to change practice: a nurse-driven initiative. *Dimens Crit Care Nurs*. 2011;30(1):41-52.
- Insaf A, Zencirci AD. Knowledge and management of pressure ulcers: impact of lecture-based interactive workshops on training of nurses. *Adv Skin Wound Care*. 2011;24(6):262-266.
- Moore DE, Green JS, Gallis HA. Achieving desired results and improved outcomes: integrating planning and assessment throughout learning activities. *J Contin Educ Health Prof*. 2009;29(1):1-15.