Evidence-Based Interventions For Neonatal Abstinence Syndrome

Nancy J. MacMullen, Laura A. Dulski, and Paul Blobaum

Neonatal abstinence syndrome (NAS) is a group of similar behavioral and physiological signs and symptoms in the neonate caused by withdrawal from various pharmacologic agents (Hamdan, 2010). The presentation of the syndrome is unpredictable, with individual neonates displaying different symptoms and symptom severity over time (Jansson, 2008). Depending upon the etiology, type of drug, the severity of the withdrawal, and the age of the neonate, care may be provided in the NICU, the obstetrical floor, or the pediatric unit. Other hospital units may be used depending upon the institution’s preference. Neonates with NAS require specialized neonatal/pediatric nursing care based on the best evidence obtained from the literature and global benchmarking of best practices. To assist with translating research into practice, the objective of this article is to identify best nursing practice by systematically and critically reviewing the literature and expert guidelines on the topic.

Epidemiology

Maternal Incidence

Abuse of illicit and prescription drugs is a worldwide problem. In 2013, the United Nations Office on Drugs and Crime (UNODC) reported that approximately 3.6% to 6.9% of the world’s population 15 to 64 years of age abused illicit drugs at least once in the previous year (UNODC, 2013). In the United States, 5.9% of pregnant women 15 to 44 years of age used illicit drugs during the past month (Substance Abuse and Mental Health Administration [SAMHSA], 2012).

Infant/Neonatal Incidence

In the United States, approximately 225,000 infants yearly are exposed to illicit substances (Keegan, Parva, Finnegan, Gerson, & Belden, 2014). The prevalence of prenatally exposed newborns to one or more illicit drugs averages approximately 5.5%, with a range of 1.3% to 50% (Wang, 2014). Greater than 75% of infants exposed to drugs have major medical problems, compared with 27% of unexposed infants. Seventeen percent of drug-exposed versus 6% of unexposed babies are delivered prematurely (Huestis & Choo, 2002).

Cost

In addition to the personal costs in relationships, health, and the future development of neonates with NAS, there is a financial cost as well. It is common for neonates with NAS to experience longer stays in the hospital than NAS-free neonates (Oei & Liu, 2007). Data from the AHRQ Healthcare Cost and Utilization Project (HCUP) Nationwide Inpatient Sample (UNODC) reported that aggregate charges for substance-related disorders in the age category of less than one year were over 96 million dollars ($96,440, 575). The cost of keeping a drug-exposed child in a neonatal unit is estimated at $2,700 per child per day (Cooper, 2004).

Etiology

There are two major types of NAS (Hamdan, 2010). The more recognized type is prenatal NAS, which is due to prenatal maternal use of substances. The abuse may result in withdrawal symptoms in the neonate once the placental access to the substance is no longer available. Drugs commonly implicated in prenatal NAS are opiates, barbiturates, cocaine, sedatives, ethanol, marijuana, and nicotine (Davison, Worsley, & Husband, 2007; Wang, 2010). Postnatal NAS results when an abrupt discontinuation of analgesia, such as Fentanyl or morphine, occurs usually after prolonged drug exposure for post-procedure pain management and/or sedation (Hamdan, 2010). The focus of this article is on prenatal NAS.
Pathophysiology

Drugs are transferred from the mother to the fetus via the placenta. Huestis and Choo (2002) describe the mechanisms responsible for the transfer: active transport (requires energy to move fluids into the cell), passive diffusion (requires no energy for movement), and pinocytosis (moves fluids by invagination of cell membrane). The authors also report that the ease of transport depends upon the size of the drug molecule, its lipophilicity, the pKa (acid ionization constant) of the compound and the pH of the blood. At delivery, the transplacental passage of the drug is interrupted, resulting in the development of a withdrawal syndrome in the neonate (Oei & Liu, 2007). The pathophysiology and mechanisms of withdrawal are poorly understood (Jansson, 2008). It is theorized that withdrawal can cause molecular and cellular alterations that produce systemic, behavioral, and cognitive symptoms (Wang, 2010).

Effects of Drugs On the Neonate

Symptoms and length of withdrawal vary according to the amount and type of drug used. For example, cocaine withdrawal occurs over a short period of time, whereas opiates can produce a longer and more threatening withdrawal (Greene & Goodman, 2003).

The effect of drugs on body systems is also influenced by the type of drug, the combination of drugs, the amount and frequency of use, the trimester in which the drug is used, the timing of withdrawal, and the genetic susceptibility of the fetus/neonate (Oei & Lui, 2007; Sun, 2004). Withdrawal symptoms relate to the type of drug ingested (see Table 1) (Davison et al., 2007; Hamdan, 2010; Huestis & Choo, 2002; Oei & Lui, 2007; Wang, 2010).

Medical Management

Medical management is aimed at treating the symptoms of withdrawal. Standardization of treatment is difficult because symptoms of withdrawal vary with each infant (Beauman, 2005). There is also a lack of double-blind controlled studies (Winklbaur et al., 2008). Most studies recommend matching the drug used to treat withdrawal to the type of drug abused (Beauman, 2005). For example, opiates should be given to the neonate if withdrawing from opiates (Kuschel, 2007; Osborn, Jeffrey, & Cole, 2005; Winklbaur et al., 2008). Expert guidelines formulated by the American Academy of Pediatrics Committee on Drugs (2012), Substance Abuse and Mental Health Services (2005) guidelines for medication-assisted treatment for opioid addiction, and the Western Australian Centre for Evidence-Based Nursing and Midwifery (2007) concur with these recommendations.

The Nursing Challenge

A number of nursing interventions are used for providing care to the neonate/infant with NAS. Many interventions are not based on a systematic review of the evidence presented in the literature, but rather, on tradition. The interventions seemed to work, so they were incorporated into practice. As research into NAS increased, tangible evidence as to best practice emerged. A thorough review of nursing and medical literature is essential to determine if current nursing practice matches the recommendations found in the literature. Consultation with practice experts will also identify best practices.

Process of Literature Review

In consultation with a medical librarian, a systematic review of the literature was conducted using CINAHL and Medline/PubMed. Key words used in the search were “neonatal abstinence syndrome,” “drug withdrawal,” “nursing care,” “nursing interventions,” “newborns,” and “neonates.” MESH and CINAHL subject headings included “neonatal abstinence syndrome,” “nursing,” “newborns,” and “substance withdrawal syndrome.” Journal articles chosen for inclusion in the literature search had to meet the following criteria: topics had to focus on nursing...
interventions for NAS; literature reviewed had to be international; and except for classic articles, the literature could be no older than 10 years. In addition, professional nursing and medical websites were used for the latest nursing, medical, and patient education information. National guidelines and systematic reviews were also consulted by searching the Health Services/Technology Assessment Texts (HSTAT), Cochrane Systematic Reviews, and Joanna Briggs Institute databases. Topics reviewed included supportive interventions, breastfeeding, and NAS scoring systems. Over 480 publications were reviewed. Synthesis of the articles was accomplished through the use of a table that contained the title, author(s), journal particulars, and a content abstract. Specific levels of evidence were used for categorizing the quality of articles for the review (see Table 2).

**Table 2. Systematic Review**

<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Document: Journal, Guideline, Chapter</th>
<th>Type of Study/Design</th>
<th>Level of Evidence</th>
<th>Intervention(s)</th>
</tr>
</thead>
</table>

**Level of Evidence**

The level of evidence for a systematic review ranges from Level I-II to Level IV (Wright, Brand, Dunn, & Spindler, 2007). Most nursing articles selected for this review were case reports/observational studies (Level IV). Seven studies were retrospective cohort studies (Level III). Two research articles reviewed were clinical trials with or without randomiza-
Table 2. (continued)  
Systematic Review

<table>
<thead>
<tr>
<th>Author</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Velez &amp; Jansson (2008)</td>
<td>The Opioid Dependent Mother and Newborn Dyad: Non-Pharmacologic Care</td>
<td>Journal of Addiction Medicine, 2(3), 113-120</td>
<td>Case series</td>
<td>IV</td>
<td>Pacifier, quiet environment, positioning in the supine position, slow vertical rocking, gentle pressure to posterior head.</td>
</tr>
</tbody>
</table>

continued on next page
Swaddling (American Academy of Pediatrics Committee on Drugs, 2012; Ballard, 2002; Beuman, 2005; Curet & Hsi, 2002; D’Apolito & Hepworth, 2001; Dodge, Brady, & Maguire, 2006; Greene & Goodman, 2003; Kuschel, 2007; Marcellus, 2007; Pitts, 2010; Velez & Jansson, 2008). Nine articles recommend a quiet environment with decreased stimulation and handling (Ballard, 2002; Beuman, 2005; D’Apolito & Hepworth, 2001; Dodge et al., 2006; Greene & Goodman, 2005; Kuschel, 2007; Pitts, 2010; Velez & Jansson, 2008; Wang, 2014). Non-nutritive sucking is supported by Beuman (2005), D’Apolito and Hepworth (2001), Greene and Goodman (2003), Wang (2014), and Velez and Jansson (2008). White-Traut et al. (2002), Greene and Goodman (2003), and Pitts (2010) choose vestibular stimulation (rocking) as a means of promoting physiological and behavioral functioning in drug-exposed infants. Positioning in supine position is recommended in accordance with guidelines for avoiding sudden infant death syndrome (SIDS), unless the infant experiences stiffness (Beuaman, 2005; Pitts, 2010; Velez & Jansson, 2008). Other recommended nursing practices are novel but not widely used. These innovative, supportive interventions include music therapy, massage, water beds, and the use of volunteers as cuddlers (Dodge et al., 2006; Fraser, Barnes, Biggs, & Kain, 2007; Greene & Goodman, 2003; Pitts, 2010). Rooming-in for neonates with NAS is a recent intervention. Several authors (Abrahams et al., 2007; Saiki, Lee, Hannam, & Greenough, 2010) compared rooming-in with traditional NICU care for infants with NAS. The authors found that newborns who roomed-in were less likely to require treatment for withdrawal and more likely to be discharged home with their mothers. They also found that rooming-in may promote more effective mothering and may reduce the prevalence and severity of neonatal withdrawal. Dodge and colleagues (2006), and Jambert-Gray, Lucas, and Hall (2009) also advocate rooming-in.

**Nutrition**

Neonates suffering from NAS may have impaired feeding behaviors, such as excessive sucking, poor feeding, regurgitation, and diarrhea,
which may result in difficulty with weight gain. For weight gain, supplementa-
tion with a high-calorie formula is recommended (Greene & Goodman, 2003; Wang, 2014). Small
frequent feeds (gavage, if necessary) are recommended to aid in tolerating feedings and improving digestion
(Ballard, 2002; Beauman, 2005; Pitts, 2010; Velez & Jansson, 2008). Should diarrhea or other gastro-intestinal dis-
turbances occur, they are treated with the administration of an opioid com-
dound (D’Apollito & Hepworth, 2001; Greene & Goodman, 2003).

Skin Care

Neonates with NAS have a poten-
tial for skin breakdown as a conse-
quence of diarrhea and diaper rash (Wang, 2014). Barrier ointments are recommended for avoidance of skin
breakdown and diaper rash. If break-
down becomes severe, clear transpar-
ent dressings over reddened or excori-
ated areas may help avoid further
problems (Beuman, 2005).

Breastfeeding

Several authors encourage breast-
feeding for mothers who are chemi-
cally dependent on drugs, if not con-
traindicated (Ballard, 2002; Jansson et al., 2008; Jambert-Gray et al., 2009; Kuschel, 2007; Oei & Liu, 2007).
Breastfeeding provides optimal nutrition, promotes bonding, and empow-
ers babies’ mothers to be effective par-
ents (Jambert-Gray et al., 2009; Jansson et al., 2008; Leggatte, 2008). Unfortunately, only 24% of opioid-de-
dependent mothers breastfeed, and 60% stop on the average after 5.9 days (Wachman, Byun, & Phillip, 2010).
Breastfeeding also may decrease the severity of NAS, delay its onset, and decrease the need for pharmacologic treat-
ment (Abdel-Latif et al., 2006)

National Guidelines

guidelines for the care of NAS. The committee advocates utilizing NAS scoring systems; drug therapy, if indi-
cated; and supportive care interven-
tions that include swaddling; high
calorie formula, as needed; breastfeed-
ing, if not contraindicated; frequent small feedings; and replacement fluids and electrolytes, if necessary. Observation of sleeping habits, tem-
perature stability, weight gain or loss, or change in clinical status should also be done to determine if there is a change in the neonate’s condition or the potential for another disease process. Additionally, HIV, hepatitis B
and C, and sexually transmitted infec-
tion (STI) screening is recommended.

Agency for Healthcare Research
and Quality (AHRQ). The AHRQ has
published guidelines for the drug-
dependent woman on methadone
who desires to breastfeed (AHQR,
2010). Specific criteria are giv-
en to help the health care provider deter-
mine if breastfeeding the NAS patient is safe. To protect their privacy and provide confidentiality, women must
give their consent to disclose their postpartum plans for addictions
counseling and their progress in treat-
ment with health care personnel. These women should also have a neg-
ative toxicology test at delivery. They
must have received consistent prena-
tal care, have no contraindication
to breastfeeding, and have counselor-
endorsed achievement and mainte-
nance of sobriety prior to and post-
delivery. There are also criteria for
those who should be discouraged
from breastfeeding. For example,
women who did not have prenatal
care, who relapsed into substance
abuse, or who refused substance abuse treatment should be discouraged
from breastfeeding (Jansson et al.,
conclude that research suggests that
breastfeeding is not safe for neonates of chemically dependent mothers.

Western Australian Centre for
Evidence-Based Nursing and Mid-
Wifery. The Western Australian Centre for Evidence-Based Nursing and Midwifery guidelines recom-
mend that drug selection should match the type of agent causing with-
drawal. The Centre also advocates NAS scoring systems; quiet environ-
ment; swaddling; gentle, firm han-
dling; cuddling; massage; water ther-
apy; and rocking. Playing heart beat
audiotapes; small, frequent feedings
on demand of hyper-caloric formula; and non-nutritive sucking are encour-
gaged. Prevention of skin breakdown is accomplished with infants via mit-
tens, sheepskin coverings for the crib
or isolate, and frequent diaper changes.

Research and Current Practice

An informal survey of the proce-
dures of a neonatal intensive care unit
and two published articles revealed
results similar to the systematic
review: Level IV interventions (sup-
portive) are commonly used in the
nursing care of NAS-affected neonates (Croscetti, Amin, & Jansson, 2007; O’Grady, Hopewell, & White, 2009). Swaddling, dim lights, quiet environ-
ment, and nutritional support are the
majority of the interventions imple-
mented. NAS scoring systems are
becoming routine, with the Finnegan
being the most used (O’Grady et al.,
2009). The unit whose practices were
reviewed has a protocol for obtaining meconium and urine samples from
the neonate for drug testing upon admission to the NICU (S. Evankoe, personal communication, December
8, 2011). APN or MD orders are writ-
ten for medication but not for sup-
portive interventions. The timing of
the interventions depends upon the
NAS score and the onset of withdrawal
symptoms. Breastfeeding, if not contraindicated, is encouraged by a major-
ity of neonatal units (O’Grady et al.,
2009).

Interventions recommended by
the literature reviewed but not neces-
sarily used by nurses are cuddlers,
music therapy, massage, water beds,
and rooming-in. Reasons for not pro-
viding these services could be cost,
lack of personnel, hospital unit
design, and reluctance to initiate new evidence-based protocols. Improvi-
sation by nursing personnel could be
an opportunity for improvement. Audiotaped soft music, and specific
times with the mother and neonate in
her hospital room (in addition to the
times spent in the NICU visiting) are
cost-efficient solutions. Nursing stu-
dents could volunteer as cuddlers. Evidence is continually reviewed to
obtain new information and confirm-
tation of nursing practices already in
place.

Nursing Interventions

The function of nursing interven-
tions is to accomplish the objectives of
nursing care. Therefore, the follow-
ing interventions will allow best nurs-
ing practice according to the evidence from the literature:

- Do a thorough, accurate mater-

- nary history to determine if the

- neonate will be at risk. A drug

- history is included for all preg-

- nant women, not just those who

- are suspected or confirmed sub-

- stance abusers.
### Table 4. Scoring Systems for Neonatal Abstinence Syndrome

<table>
<thead>
<tr>
<th>Scoring Tool</th>
<th>Range of Scores</th>
<th>Frequency of Scoring</th>
<th>Cutoff Score for Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finnegan Neonatal Abstinence Scoring System (NASS)</td>
<td>0 to 62</td>
<td>Hourly for the first 24 hours, Every two hours for the second 24 hours, Every four hours after 48 hours</td>
<td>Greater than 8</td>
</tr>
<tr>
<td>Lipsitz Neonatal Drug Withdrawal Scoring System (NDWSS)</td>
<td>0 to 20</td>
<td>Not specified</td>
<td>Greater than 4</td>
</tr>
<tr>
<td>Neonatal Withdrawal Inventory (NWI)</td>
<td>0 to 19</td>
<td>Not specified</td>
<td>Greater than 8</td>
</tr>
<tr>
<td>Neonatal Narcotic Withdrawal Index (NNWI)</td>
<td>0 to 14</td>
<td>Not specified</td>
<td>Greater than 5</td>
</tr>
</tbody>
</table>


- Screen all infants at risk with a reliable and valid NAS scoring instrument, which typically assesses symptoms of withdrawal and assigns a score in accordance with the severity of the symptoms (see Table 4).
- Provide supportive measures, such as swaddling, decreased stimulation, supine (or others as appropriate) positioning, massage, cuddling.
- Correct nutritional deficiencies with appropriate therapy (e.g., high-calorie formula, gavage feeds, IV therapy).
- Encourage the maternal-neonatal relationship through support for breastfeeding and rooming-in if there are no contraindications.
- Administer topical ointments or barrier shields for skin breakdown.
- Administer and monitor pharmacologic treatment if withdrawal is not contained by supportive measures. Gradually wean when appropriate.
- Collect samples for laboratory testing, if ordered.
- Assess and reassess NAS symptoms; if severe, act to prevent complications.
- Communicate and provide referral to social worker or other personnel for follow up post-discharge.
- Provide parenting education to caretakers of the neonate.
- Promote sleep by clustering interventions to avoid sleep disruption.

### Objectives of Care

Nursing interventions are employed to meet the outcome objectives for the care of the neonate who has NAS. Objectives involve prevention or alleviation of withdrawal symptoms. The following are specific objectives for the nurse to achieve in providing comprehensive and quality care to the neonate with NAS:
- Provide safe, effective care.
- Avoid complications of body systems potentially affected by NAS.
- Maintain adequate nutrition.
- Promote maternal/parent infant bonding.

### Evaluation of Interventions

Evaluation involves determining if the interventions based on the evidence obtained were successful. Data derived from the evaluation are used for determining if the goals of nursing care were met. There are several areas for evaluation. Symptomatology, nutritional status, and behavior are among data reviewed. Symptom relief is determined by assessment and reassessment of infant behavior and symptomatology. Results of laboratory tests also provide information on physiologic status. The use of a neonatal scoring system upon admission provides baseline data, which are then used to evaluate the progression of symptoms, the response to pharmacotherapy, and the resolution of symptoms (Fike, 2007). As the neonate recovers, the scores become lower. Meticulous observation and recording of intake and output, weight, and length are necessary, as are appraisal of nutritional and fluid status (Hamden, 2010). Results of neurobehavioral tests should be part of the follow up (Wang, 2014).

Nurses who care for babies with NAS are motivated by the goal to provide excellent patient care. They also want to understand the rationale for the chosen nursing interventions. Toward that end, they seek evidence, not tradition, as the basis for best practices. Reading classic and translational literature, whether personally or by participating in committees to evaluate literature, determining interventions, and creating policy and procedure and/or nursing protocols for more efficient care of the neonate with NAS can help achieve that goal.

### References


Agency for Healthcare Research and Quality (AHRQ) Healthcare Cost and Utilization Project (HCUP) Nationwide Inpatient
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Instructions For Continuing Nursing Education

Contact Hours

Evidence-Based Interventions For Neonatal Abstinence Syndrome

Deadline for Submission: August 31, 2016

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1. For those wishing to obtain CNE contact hours, you must read the article and complete the evaluation through Pediatric Nursing’s Web site at www.pediatricnursing.net/cce.

2. Evaluations must be completed online by the above deadline. Upon completion of the evaluation, your CNE certificate for 1.3 contact hour(s) will be mailed to you.

Fees – Subscriber: Free Regular: $20

Goal

To provide an overview of neonatal abstinence syndrome and best practices as outlined in a literature review.

Objectives

1. Define neonatal abstinence syndrome.

2. Discuss the epidemiology of neonatal abstinence syndrome.

3. Explain supportive interventions based on this evidence-based practice literature review.

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