Title: Addressing Gaps in Knowledge for Infants with Neonatal Abstinence Syndrome: A literature review

Abstract:

Neonatal abstinence syndrome is a growing epidemic worldwide. Infants diagnosed with neonatal abstinence syndrome require extensive medical care and are at risk for complex health conditions. This literature review aims to identify current knowledge gaps in nursing practice in caring for infants diagnosed with NAS and their families.

This review aimed to identify and synthesize current best practice guidelines for infants with neonatal abstinence syndrome. A comprehensive search strategy was developed, and four scholarly databases (CINAHL, PubMed, Cochrane and Google Scholar) were searched. Additional articles were identified through hand searching the reference lists of key articles. Relevant articles were critically analyzed for their implications on infant and family health, family experience, health system outcomes, and nursing practice.

This literature review revealed the Eat, Sleep, Console model of care is optimal, but is not widely used in practice. Further efforts are needed to support the real-world implementation of evidence-based models of care for this population.

Keywords: Perinatal Care, Substance-Related Disorders, Nursing-Models, Neonatal-Nursing, Knowledge

Introduction

Neonatal Abstinence Syndrome (NAS) is a condition in infants, characterized by symptoms related to withdrawal from opioids exposed to them in utero (Dodds et al., 2019; Oerlemans, 2021). Symptoms of NAS vary and are often individualized to the infant depending on interrelated factors such as type of maternal drug use, exposure length and gestational age (Lacaze-Masmonteil & O'Flaherty, 2018). Clinical presentations may include irritability, poor feeding, hypertonia, changes in sleep, poor suck reflex and tremors (Anbalagan & Mendez, 2021). NAS is a growing epidemic internationally (Anbalagan & Mendez, 2021; Patrick et al., 2016). The first case of NAS was diagnosed in 1875; however, the incidence of NAS has grown substantially over the past decade (Gomez-Pomar & Finnegan, 2018). Between 2016 and 2017, in Canada, approximately 0.51% of all infants were diagnosed with NAS (Lacaze-Masmonteil, & O'Flaherty, 2018). Similar findings have been reported in the United States, where there was an observed 82% increase from 2010 to 2017 in NAS incidence rates (Centers for Disease Control and Prevention [CDC], 2021; Hirai et al., 2021).

Increased NAS incidence rates create significant implications on an all health care systems (Anbalagan & Mendez, 2021; Filteau et al., 2018). The cost of a hospital stay for an infant with NAS is eight times that of an infant without NAS (CDC, 2021). For example, in Canada, total costs of health care services to care for infants diagnosed with NAS nearly doubled between 2010 to 2014, from $15.7 to $26.9 million dollars respectively (Filteau et al., 2018). This cost is largely due to the increased length of hospital stay required to treat infants with NAS, with an average stay of 15 days (Filteau et al., 2018; Winkelman et al., 2018).

Registered nurses are the frontline care providers tasked with assessing infants who present with NAS. This requires completing frequent assessments, providing non-pharmacological support, and delivering pharmacological management (Clark, 2019; Timpson et al., 2018). Infants diagnosed with NAS were once previously cared for in a Neonatal Intensive Care Unit (NICU) (Anbalagan & Mendez, 2021). However, with emerging evidence on the importance of the birth-parent-infant dyad, there has been a shift in practice from a standard NICU admission to standardizing admissions in postpartum maternity settings (Anbalagan & Mendez, 2021).

Recent reviews reported that infants are often treated with pharmacological management, rather than the use of non-pharmacological interventions (Wachman et al., 2018). This increase in pharmacological management has implications. It has been shown to prolong length of hospital stays for infants with NAS and to lack the involvement of families in the care for their children (Wachman et al., 2018). Evidence shows that individualized NAS care can be accomplished by focusing on the birth-parent-and-infant dyad to optimize non-pharmacological management delivered by the birth-parent and thus increasing familial collaboration (Anbalagan & Mendez, 2021). The birth-parents of babies with NAS have unique health concerns and challenges that need to be addressed using a multilevel approach, including dedication to the physical, emotional, mental & spiritual wellbeing (Anbalagan, & Mendez, 2021). The wellbeing of the birth-parent is imperative to the infant's care as they are the first line of treatment for their infant as they withdraw (Anbalagan, & Mendez, 2021; Blount et al., 2019; Dodds et al., 2019). Specifically, non-pharmacological strategies delivered by the birth-parent such as skin-to-skin, breastfeeding, swaddling and increased birth-parent-infant dyad support has been cited in the literature to assist in the treatment of withdrawal symptoms in infants diagnosed with NAS (Bagley et al., 2014; Knopf, 2017; Pahl, et al., 2020)

Despite ample evidence in the literature regarding the etiology of NAS and the importance of the birth-parent's central role in treatment, it is unclear whether this translates to current nursing practices (Blount et al., 2019; Dodds et al., 2019). Families echo this concept as they often report not being actively engaged in family-provider partnerships resulting from the institutional barriers such as stigma, restrictive assessment tools and lack of transparency in care (Rockefeller et al., 2019). Birth-parents who have a supportive environment to bond with their infants and who are involved in their infant's care plan have been shown to experience improved health outcomes such as better adherence to maintenance therapy, increased self-care activities and adapted more readily to a parental role (Rockefeller et al., 2019).

This article aims to identify current knowledge gaps in nursing practice in caring for infants diagnosed with NAS and their families. Further, this paper will discuss potential models of care to address the current challenges of caring for the NAS population and their families and highlight potential future directions to improve the care of the NAS population.

Methods

This literature review started with a review of the current literature available on care management for infants diagnosed with NAS, specifically focusing on the Finnegan Neonatal Abstinence Scoring Tool (FNAST) and Eat, Sleep, Console (ESC) model of cares. A preliminary search identified these two models to be most relevant to the research topic as: the FNAST was previously recognized as the 'gold standard' for practice (Anbalagan & Mendez, 2021), while the ESC model is a novel approach emerging in response to criticisms of the FNAST (Anbalagan & Mendez, 2021). The search strategy included reviewing four scholarly databases (CINAHL, PubMed, Cochrane and Google Scholar) for relevant articles. Additional articles were identified through hand searching the reference lists of key articles. Keywords included: experience, mother*, ESC, eat, sleep, console, Finnegan Neonatal Abstinence Scoring Tool, FNAST, neonatal abstinence syndrome, neonatal withdrawal syndrome, NAS, neonatal abstinence, neonatal withdrawal, with Boolean operators applied as needed. Limiters included the English language and a date range from 1975-2022 to identify relevant literature. Eligibility criteria included: any study design presenting original research or discussion related to care for infants with NAS, comparisons of the FNAST and ESC model of care, and discursive articles on the FNAST and ESC models. Relevant articles were then retrieved and critically analyzed by the lead author (Author 1) who is a perinatal registered nurse experienced with caring for the NAS population. The articles were analyzed for relevance to nursing practice, for impacts of experience and health outcomes for infants and families, and for healthcare system outcomes.

Discussion

A review of available literature highlighted a disjuncture between best-evidence and clinical practice related to the care of infants with NAS and their families (Anbalagan & Mendez, 2021; Curran et al., 2020; Grossman et al., 2017; Holmes et al., 2016; Schiff & Grossman, 2019; Singh & Davis, 2021). The following section provides an overview of the strengths and limitations of the Finnegan Scoring System Tool and the Eat Sleep Console models of care, and current recommendations on what tool could be most beneficial for caring for infants with NAS.

Finnegan Neonatal Abstinence Scoring Tool

The Finnegan Neonatal Abstinence Scoring Tool (FNAST) or a modified version of such, was identified as the most widely used assessment tool in caring for infants with NAS (Chin-Foo et al., 2021; Schiff & Grossman, 2019; Verklan, 2019). The FNAST was developed in 1974 and contains a scoring system based on common opioid withdrawal symptoms an infant may experience with NAS (Wachman et al., 2018). Scoring is assessed by the primary nurse and is completed based on both nurse and family observations every two to four hours in the infant's room (Anbalagan & Mendez, 2021). The first version of this tool was developed to provide an objective measurement and assessment of symptoms experienced by an infant born with NAS (Finnegan et al., 1975).

Strengths

The FNAST was originally developed for standardized evaluation of neonatal withdrawal symptoms in research settings and was not intended to be used as a clinical assessment tool in practice (Verklan, 2019). However, it was quickly adopted into practice and was paramount in the 1970s when no formal assessments were available to provide guidance to health care providers on the care of the NAS infant population (Zimmermann-Baer et al., 2010). As clinical practices have changed over the years, so has the FNAST, leading to a variety of modified versions used by preceding researchers and clinical providers in response to changing clinical practices and emerging research (Anbalagan & Mendez, 2021; Zimmermann-Baer et al., 2010). In addition, the concept of substance use in pregnancy has also evolved over the years requiring drastic changes in assessment due to the increased complexities of substance use (Verklan, 2019). Despite these practice changes, the FNAST remains the most used tool to assess infants diagnosed with NAS (Gomez-Pomar & Finnegan, 2018). The FNAST provides the ability for nurses to quantify assessments, thus managing the treatment of pharmacological management for infants diagnosed with NAS (Kocherlakota, 2014). The score also represents the time leading up to the assessment inclusive of the assessment, thus reflecting the symptoms of the infants over time (Kocherlakota, 2014).

Limitations:

Following a synthesis and critique of current literature, three key reported limitations of the FNAST were identified: subjectivity; invasive and lengthy assessment; and lack of collaboration with the family.

Subjectivity

The level of subjectivity in the tool has been questioned by registered nurses and birth-parents due to the nature of the characteristics being assessed (Chin-Foo et al., 2021; Rockefeller et al., 2019) For example, items on the assessment list such as the extent of excoriation and the severity of tremors in the infant has shown to have poor scoring variability between nurses (Anbalagan & Mendez, 2021). This lack of consistency in how items are being assessed has created many challenges in caring for infants with NAS. For example, infants may not be receiving consistent care measures and interventions due to the variability from one observer to the next (Rockefeller et al., 2019). Unfortunately, no standardized training program is established for use of the FNAST (Verklan, 2019). With high turnover rates of nursing staff in the maternity setting, inexperienced nurses without adequate training in the FNAST may be responsible for caring for infants diagnosed with NAS (Lavoie-Tremblay et al., 2019). Without adequate training, assessments are at risk for being rushed or inappropriately completed, leading to a potential for underscoring or overscoring infants and initiating a misguided care plan (Nayeri et al., 2017). However, it is important to note that even with training on the FNAST, previous research has shown that nurses may not be accurately and consistently applying scoring measures (Clark, 2019). Therefore, infants are at risk of being treated based on inaccurate or incorrect assessments (Clark, 2019; Timpson et al., 2018). Feedback from nurses using this scoring system echo these findings, sharing that the FNAST does not always identify symptoms of NAS appropriately, and the subjectivity of the assessment items can impact the clinical care being provided (Chin-Foo et al., 2021).

Invasive and lengthy assessment

The FNAST has been critiqued for its invasive and lengthy assessment process (Anbalagan & Mendez, 2021). Items listed on the assessment require the infant to be stimulated to accurately assess multiple criteria (Anbalagan & Mendez, 2021; Grossman et al., 2017; Holmes et al., 2016; Singh & Davis, 2021). For example, the tool requires nurses to disturb the infant to assess their autonomic nervous system (e.g., tremors, posture). However, it can become unclear if the infant is demonstrating symptoms in response to the nurse's assessment or from withdrawal itself (Grossman et al., 2017; Schiff & Grossman, 2019).

In recent years, researchers have identified challenges with the length of the tool (Curran et al., 2020; Nayeri et al., 2017, Schiff & Grossman, 2019; Singh & Davis, 2021). For example, an infant needs to be disturbed every three hours to determine the presence of a hyper-Moro reflex or tremors (Verklan, 2019). Further, Zimmermann-Baer and colleagues suggest that there are some criteria listed on the 21-item scoring form that do not necessarily reflect symptoms of withdrawal (Zimmermann-Baer et al., 2010; Whalen, et al., 2019). A simplified version, with eight to ten criteria, has shown to be comparably effective (Anbalagan & Mendez, 2021; Curran et al., 2020).

Lack of collaboration with the family

Infants diagnosed with NAS often come from families with complex social dynamics that are often overlooked when caring for families (Carlson & Kieran, 2019). Birth-parents are instrumental in the care of their infant who is withdrawing; often sharing their desire to be involved and to have consistency in their infants' care (Dodds, et al., 2019; Hein, et al., 2021;

Miller, et al., 2021; Rockefeller et al., 2019; Wachman et al., 2018). The varied consistency and accuracy of the FNAST has led to birth-parents feeling a poor sense of collaboration and lack of consistency in their infant's care (Rockefeller et al., 2019). The disruption that occurs from each assessment component interrupts the natural rhythm of the birth-parent-infant dyad and can create a disrupted discourse between nurses and birth-parents (Rockefeller et al., 2019; Whalen et al., 2019). The FNAST is situated in an older biomedical model of treating the infant as an individual, rather than as part of a family unit, and therefore indirectly removes the birth-parent from important care decisions (Byrne et al., 2018).

Eat, Sleep, Console Model

Many novel approaches to care have been developed to attend to the current gaps of the FNAST. The *Eat, Sleep, Console* (ESC) model of care was identified in recent research to address the reported challenges with the FNAST (Grossman et al., 2017). The ESC model of care includes a scoring system that was developed to be supportive in nature and empower collaboration between team members across the care continuum (Anbalagan & Mendez, 2021; Blount, et al., 2019; Schiff & Grossman, 2019).

The ESC model was developed in 2017 at Yale-New Haven Children's Hospital by Dr. Grossman and colleagues in response to years of observation and care of infants with NAS (Grossman et al., 2018). The importance of eating, sleeping, and using a non-invasive approach were noted as critical tenants of the ESC model (Grossman et al., 2018). Further, the ESC model was developed through multiple plan-do-study-act studies exploring function-based assessments of babies diagnosed with NAS (Grossman, Berkwitt et al., 2017). These studies showed improved outcomes for infants, including decreased length of hospital stay, decreased need for pharmacological treatment, and increased use of non-pharmacological interventions (Grossman et al., 2017; Grossman, Berkwitt, et al., 2017; Holmes et al., 2016). The ESC model has a scoring system to guide assessments; however, instead of being symptom-focused like FNAST, it is function-focused specifically on eating, sleeping, and consoling of the newborn (Wachman et al., 2017). The eating and sleeping categories are a dichotomized yes or no assessment, while the consoling section is scored on a scale from one to three (Wachman et al., 2017).

Strengths of the ESC model

The ESC model has various strengths, as it was carefully designed to mitigate the challenges of the FNAST currently used in most health facilities (Grossman et al., 2017). The ESC model is focused on non-pharmacological treatment as a first-line response for infants diagnosed with NAS. By concentrating on non-pharmacological care such as skin to skin, swaddling and non-nutritive sucking, there was a decrease in the need for pharmacological interventions (Wachman et al., 2017). With a well-being focus, babies needs are treated quicker. For example, when babies have reached ten minutes of being inconsolable, a huddle with the multidisciplinary care team, including parents, is initiated to identify further interventions (Schiff & Grossman, 2019).

This ESC model of care is founded in collaborative practice, supporting an empowering environment for birth-parents and/or primary caregivers (National Institute for Children's Health Quality [NICHQ], 2021). The ESC model designates the birth-parent as the primary treatment method by putting an emphasis on non-pharmacological management techniques initiated by the birthing-parent and involving the care team in decision making (Anbalagan & Mendez, 2021; Blount et al., 2019; Schiff & Grossman, 2019; NICHQ, 2021). Empowering the birth-parent-infant dyad encourages confidence and involvement of the birth-parent in their infant's care.

Further, education and encouragement to be actively involved in health care team huddles can contribute to a positive care environment (NICHQ, 2021; Miller & Willier, 2021).

The ESC model has been shown to decrease hospital stays for infants with NAS and their families (NICHQ,2021). This may be a result of the increased importance in the model of care for families to achieve early independence and strengthen their abilities to care for their infant at home (NICHQ, 2021). The ESC care model promotes intuitive assessments that are easy to understand and utilize by both healthcare providers and family members (Grossman et al., 2018). Having a collaborative environment for caregivers to learn about their infant's care can promote confidence and bonding, further supporting a smooth transition from hospital to the home (NICHQ, 2021).

Limitations of the ESC Model

In the evaluation of the ESC scoring system, a relatively low inter-rater reliability between nurses was noted in the categories of sleeping and soothing (Whalen, 2018). Nursing scoring tools have historically been used to guide practice and assessment, with clinical judgment providing the ultimate decision (Curran et al., 2020). With the increased collaboration and frequent huddles with the ESC model, there is more room for clinical judgment to arise through discussion, thus clinical judgment may be a possible reason for the discrepancies in inter-rater reliability (Curran et al., 2020; Ponder et al., 2021).

The ESC model has also been criticized for its lack of independence in being implemented as a single intervention without additional supportive measures. To date, the ESC model has been primarily implemented in combination with several other family-centered initiatives (e.g. increased breastfeeding support) (Schiff & Grossman, 2019). As such, there have been questions regarding which interventions and key components are influencing the observed positive outcomes (Schiff & Grossman, 2019). While the ESC model is grounded in collaborative practices, and as such supports the use of various supportive family-centered interventions, its frequent implementation as a part of a multi-pronged strategy has made it difficult to discern which actions are influencing what change (Schiff & Grossman, 2019).

A Comparison of the FNAST and ESC Models

In response to the introduction of the ESC model into practice, several studies have assessed the effects of the model on healthcare system outcomes (Blount et al., 2019; Dodds et al., 2019; Grisham et al., 2019; Grossman et al., 2018; Hein et al., 2021; Miller & Willier, 2021; Parlaman et al., 2019). Grossman and colleagues (2018) evaluated the ESC model over a five-year quality improvement study to determine the ESC model's effectiveness in practice compared to the FNAST. Overall, the introduction of the ESC model of care decreased the average length of stay from 23 days to 6 days. Similarly, several research studies have demonstrated that the ESC model can lead to a reduction in the overall burden on the healthcare system by decreasing average length of the hospital stay (Blount et al., 2019; Dodds et al., 2019; Grisham et al., 2019; Parlaman et al., 2019).

When comparing the shift in nursing practice from a FNAST model to an ESC model of care, pharmacological interventions using opioid treatment for infants with NAS decreased from 98% to 12% (Grossman et al., 2018). Further, previous research has shown that infants who need pharmacological treatment are still being accurately identified with the ESC model (Curran et al., 2020). Several studies have reported this decrease in opioid treatment in a range of practice settings (Blount et al., 2019; Dodds et al., 2019; Parlaman et al.,2019). The increase in non-pharmacological treatment for NAS under the ESC model has been shown to improve infants' withdrawal symptoms and birth-parent-infant bonding (Whalen et al., 2019). Further, the implementation of the ESC model in comparison to the FNAST did not lead to increased adverse outcomes or undertreatment of infants (Grossman et al., 2018; Miller & Willier, 2021; Parlaman et al., 2019). It is important to note that for both models, further research is needed to determine long term outcomes for infants being managed with these care models (Grisham et al., 2019; Verklan, 2019). Additionally, there is a need for future research to elicit experiences of nurses and birthing-parents using the ESC in practice, as limited research exists.

Considerations for Clinical Practice

The emerging evidence supports the implementation of the ESC model of care into practice as it has been shown to decrease length of stay and reduce the need for pharmacological treatment (Blount et al., 2019; Dodds et al., 2019; Grisham et al., 2019; Grossman et al., 2018; Parlaman et al., 2019). Two promising implementation strategies for integrating the ESC model of care into nursing practice include ongoing education programs and standardized templates (Asti et al., 2015; Parlaman et al., 2019; Wachman et al., 2018). This ongoing education, along with supportive monthly check-ins, contributed to sustained results after 12 months of intervention and empowered a culture shift amongst healthcare providers (Parlaman et al., 2019; Wachman et al., 2018). Grossman and colleagues (2017) created an instruction manual to educate and orient staff to the ESC model. The education training program is routinely updated every three to six months, incorporating any evidence emerging from studies at multiple pilot sites for the ESC program (Grossman et al., 2017). Further, standardized protocols, guidelines, and documentation flow sheets provide structure and guidance in implementing the ESC model (Parlaman et al., 2019; Wachman et al., 2018). Nurses and health system leaders may consider these strategies when planning the implementation of ESC into practice. Future research efforts are needed to support implementation and sustainability of the ESC model to improve outcomes for infants diagnosed with NAS.

Conclusions

In conclusion, NAS is a growing epidemic internationally, creating implications for both the health care system and nurses who care for infants with NAS and their families. A review and critique of the literature identified several limitations of the FNAST, which is commonly used in current practice. The development of the ESC model is a promising alternative to the FNAST, and has led to decreased pharmacological treatment, a reduction in length of stay, and improvement in overall care for infants with NAS and their families. With this emerging evidence, the implementation of the ESC model into clinical practice should be explored as a model of care to improve the health and health care experiences of infants with NAS and their families.

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