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## Benefits of Rooming-in on Infants with Neonatal Opioid Withdrawal Syndrome

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ROOMING-IN AND NEONATAL OUTCOMES

**Benefits of Rooming-in on Infants with Neonatal Opioid  
Withdrawal Syndrome**

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NURS 4500 Nursing Research and Senior Capstone

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**Abstract**

Neonatal opioid withdrawal syndrome (NOWS) is a significant public health concern, affecting infants born to mothers who use opioids during pregnancy. Those exposed in-utero exhibit numerous signs of withdrawal after delivery including tremors, gastrointestinal distress, inconsolability, and poor feeding. Typical treatment for infants suffering from NOWS included direct admission to the neonatal intensive care unit (NICU) for close observation and pharmacological interventions. However, NICU stays can interfere with bonding and breastfeeding. They can also lead to increased lengths of stay, higher costs, and more invasive pharmacological treatments. These infants typically do not have any other concerning health issues besides NOWS and therefore should not be immediately transferred to the NICU. Rather, they should be able to room-in with their parents. Rooming-in is associated with improved neonatal outcomes, shorter length of stay, and a decrease in cost. The literature review identified limited data regarding the effectiveness of non-separation techniques when implemented in small hospitals with fewer resources. A research proposal will be discussed as well that focuses on implementing rooming-in techniques in rural hospitals located in Northern California. Infants with NOWS born at these hospitals between August 2023-December 2024 will be admitted directly to the NICU. Infants born between January 2025-May 2026 will room-in with their parents. The will be a quantitative study that utilizes a retrospective cohort design. Descriptive statistics will be used to determine if implementing non-separation techniques improves outcomes for infants suffering from neonatal opioid withdrawal syndrome.

*Keywords:* opioids, NOWS, non-separation, rooming-in, neonatal intensive care unit, neonatal outcomes

### **Problem Statement**

The current treatment used for newborns suffering from neonatal opioid withdrawal syndrome (NOWS) leads to longer stays, higher costs, decreased bonding, and poor breastfeeding outcomes. Neonatal opioid withdrawal syndrome, previously called neonatal abstinence syndrome, is seen in infants exposed to opioids during pregnancy. After they are born, they no longer receive the substance, causing them to withdraw. Signs of NOWS include tremors, inconsolability, a high-pitched cry, poor feeding, tachypnea, fever, and overactive reflexes. Typically infants with NOWS are transported immediately to the neonatal intensive care unit and pharmacological interventions are performed, however, this may not be the most effective approach. Infants with NOWS thrive in environments with decreased stimulation, which cannot always be offered in the NICU. These newborns need constant comfort through holding, non-nutritive sucking, swaddling, and rocking, which is only available when non-separation techniques are implemented. This concept focuses on keeping the baby at the mother's bedside rather than being taken to the nursery. Rooming in can only be utilized in full or near-term infants with no other concerning health issues requiring them to stay in the NICU.

NICU stays are not ideal for newborn infants with NOWS. These care settings are often over-stimulating due to loud monitors, other infants crying, and bright lighting. This high stimulus environment may worsen the severity of NOWS. These infants improve quicker when they are in a dark, quiet environment with few disruptions. In addition, infants separated from their mothers after birth tend to have difficulty bonding and feeding. Infants with NOWS require consistent comfort from their parents which can only be accomplished when rooming-in is available. Infants with NOWS tend to struggle with feeding related to poor feeding cues, irritability, and weak sucking reflexes. Rooming-in allows for improved breastfeeding through

effective skin-to-skin, bonding, and a less stimulating environment. The parents can also pick up on signs of their infant's hunger and establish a feeding schedule tailored to their newborn's needs. This is nearly impossible to do when an infant is transferred to the NICU.

Every 15 minutes, an infant is born with NOWS in the US (Novel Technologies, 2022). This contributes to \$1.5 billion in additional hospital charges. This is directly correlated to the increase in opioid consumers. Since more babies have been born addicted to opioids in recent years, neonatal intensive care units have been overwhelmed. These resources are being used and beds are occupied when these neonates do not require NICU stays. In addition, staying in the NICU often results in more pharmacological interventions, longer stays, decreased parental bonding, and higher costs. When non-separation techniques are used, length of stay, costs, and the number of pharmacological interventions decrease drastically. Rooming-in is also associated with higher breastfeeding rates and improved infant-parental bonding. A review of the available literature will be further discussed showing the strong evidence in favor of rooming-in on its ability to improve neonatal outcomes, specifically for those undergoing opioid withdrawals.

### **Literature Review**

Neonatal opioid withdrawal syndrome is on the rise. From 2010 to 2017, there was a 131% increase in the number of women with opioid-related diagnoses at the time of delivery (CDC, 2022). Due to this crisis, neonatal intensive care units are being overwhelmed. Infants with NOWS tend to be immediately admitted to the NICU and separated from their parents or caregivers. However, the available literature suggests that this should not be the standard of care. Infants with NOWS tend to have better outcomes when non-separation techniques are utilized. Therefore, rooming-in should be implemented in infants with neonatal opioid withdrawal syndrome whenever possible.

This literature review examines research supporting the benefits of rooming-in on newborns diagnosed with neonatal opioid withdrawal syndrome. There will be a total of six articles all retrieved from Dominican University of California's databases including Iceberg, CINAHL, and PubMed. To find the articles, key terms such as *rooming-in*, *neonatal opioid withdrawal syndrome*, *NOWS*, *breastfeeding*, and *non-separation techniques* were utilized. This produced several articles which were ultimately narrowed down to focus on rooming-in and its association with parental presence, breastfeeding rates, length and cost of hospitalization as well as the need for pharmacological interventions. The purpose of this review is to examine the relationship between rooming-in and NOWS patient outcomes.

### **Parental Presence and Breastfeeding Rates**

Breastfeeding is the preferred method of feeding for all newborns. It contains immunoglobulins which provide the newborn with protection against illness and disease, is easier to digest in comparison to formula, and facilitates maternal-infant bonding. Morbidity and mortality are also reduced in infants who were breastfed. Past research has suggested that mothers who use opioids throughout their pregnancy avoid breastfeeding as it has the potential to harm their infant. However, the American Congress of Obstetricians and Gynecologists, American Academy of Pediatrics, and Academy of Breastfeeding Medicine have updated their guidelines to support breastfeeding infants with neonatal opioid withdrawal syndrome. The benefits of breastfeeding infants with NOWS include soothing the agitated infant undergoing withdrawals. Being at the breast provides the infant with comfort and a sense of security. Breast milk may also contain a small amount of the addictive substance which can lessen symptoms of NOWS. Additionally, infants with NOWS tend to suffer from significant gastrointestinal distress. Since the composition of breastmilk is easier to digest, there is greater symptom management

when compared to formula feeding (Holmes et al., 2017). In the article, *Breastfeeding Consideration for Mothers of Infants with Neonatal Abstinence Syndrome*, breastfeeding rates and effects on infants with neonatal opioid withdrawal syndrome were examined. This was a systematic review that summarized five articles. All articles involved in this study were retrospective chart reviews. In a study consisting of 295 mother-infant pairs, Holmes et al. (2017) discovered that only 12% of infants who were breastfed required pharmacological treatment in comparison to 37% of infants who were not breastfed. It was also revealed that there was a 79% decrease in the odds that an infant needed pharmacological interventions when they were being breastfed. This shows strong evidence that breastfeeding is effective in preventing more invasive treatments in most cases of NOWS. Strengths of this systematic review included the large sample sizes and supportive evidence from multiple studies. The biggest limitation of this study was the fact that it was a retrospective chart review.

Parental presence and breastfeeding rates seem to go hand in hand. When parents are able to room-in and be at their infant's bedside as much as possible, breastfeeding is much more attainable. Parents can implement a feeding schedule that is tailored to their infant's needs and pick up on the infant's feeding cues. This is nearly impossible to do when a baby is admitted to the NICU. Howard et al. (2017) conducted a study that examined 86 mother-infant dyads and looked for the impacts of parental presence on infants with NOWS. A retrospective chart review was performed of all infants born at Boston Medical Center between March 2015 and April 2016 with in-utero opioid exposure. They found a strong correlation between parental presence and breastfeeding success rates. This facility implemented a model of care that makes rooming-in much more achievable. After a woman delivers her infant, she is usually discharged from the hospital within 2-4 days depending on the type of delivery. However, infants with NOWS usually

require more monitoring. At Boston Medical Center, the infant with NOWS is transferred to the inpatient pediatric unit and monitored for signs of withdrawal symptoms for 5-7 days. These pediatric rooms are much more private than the NICU. This model of care also allows the parents to stay at the bedside at all hours of the day as there are no visiting hour restrictions. Due to this model of care, Howard et al. (2017) discovered that maximum parental presence was associated with a nine-day shorter length of stay in the hospital and eight fewer days of opioid infant therapy.

Howard et al. (2017) also found a relationship between parental presence and lower Finnegan scores. When infants are experiencing withdrawals, a tool called the Finnegan Neonatal Abstinence Score is used to monitor their symptoms. This score should be measured every 4 hours. This tool assesses 21 symptoms including the infant's sleep, feeds, reflexes, vital signs, and cry. When 100% parental presence occurred, there was a one-point decrease in the mean Finnegan score in comparison to those infants who did not have a constant parental presence (Howard et al., 2017). Infants with full-time parental presence averaged a Finnegan score of 5.1 while those who did not have as consistent parent involvement scored on average a 6. Therefore, parental involvement and presence can help decrease the severity of neonatal opioid withdrawal symptoms. The biggest limitation of this study was nursing misdocumentation. For each infant, parental presence was documented an average of only 68.0% of the time. In addition, even if it was documented that the parents were at the bedside there is no way to assess the amount of time spent or the level of parental involvement. Lastly, this was a retrospective chart review which does allow for randomization. A strength of this study was that all infants apart of this cohort had the opportunity to room-in with their parents. The study also supported the idea that rooming-in is beneficial for infants with NOWS.

**Length of Stay and Total Hospital Costs**

Infants with Nows typically are sent to the NICU, which results in high costs and extended hospital admissions. Since neonatal opioid withdrawal syndrome is becoming more common, NICUs are often overwhelmed. At some centers, Nows patients account for about half of NICU patient days. This issue can be corrected when rooming-in is offered. Rooming-in results in significantly lower hospital bills and shorter lengths of stay. In the study conducted by Wachman et al. (2018), it was discovered that rooming-in was associated with a decrease in hospitalization length. This article focused on implementing a quality improvement program to improve patient outcomes. In order to be considered for the study, the infant must be exposed to opioids in utero and have a gestational age of 36 weeks or greater. This quality improvement program was implemented at Boston Medical Center, as this facility provides services for a high number of pregnant women with opioid use disorders. This QI program aimed to implement a non-pharmacological care bundle, improve staff education as well as implement a cuddler program. The non-pharmacologic care bundle focused on treating the infant without medications. This bundle included parental presence, skin-to-skin contact, holding, breastfeeding, and creating a low-stimulation environment. Staff education focused on teaching about the importance of parent-led care, rooming-in, and symptom prioritization. Lastly, the cuddler program allows infants to be comforted and held when their parents or other caregivers were unavailable. All of these techniques improved patient outcomes. Wachman et al. (2018) discovered that the average length of stay for those who roomed-in and had consistent parental presence was 11.3 days compared to those who were sent to the NICU which had an average of 17.4 days. In this study, infants' withdrawal symptoms were closely monitored and healthcare professionals would only intervene if there were signs of poor feeding, excessive vomiting, diarrhea, poor consolability,

and poor sleep. The first intervention would be to increase non-pharmacological care. If the infant was still not responding to this approach, then pharmacological treatment was initiated. This form of care resulted in fewer NICU admissions and drastically shorter hospital stays. Limitations of this study include the fact that replication may be challenging. Not all hospitals can modify their physical space and staffing models to allow for improved rooming-in care and parental presence. A major strength of this study was that it demonstrated the ability to institute major changes in care practices in a relatively short period of time.

Shorter lengths of stays are directly correlated with lower hospital expenses. Typically when an infant has neonatal opioid withdrawal syndrome they are sent to the neonatal intensive care unit, for close monitoring. NICU beds are costly and should be reserved for those infants who desperately need such a high level of care. Most infants with NOWS do not meet this criterion. When non-separation techniques are used, very few infants with NOWS require staying in the intensive care unit. This greatly reduces the costs of hospital admissions. According to Beckwith et al. (2021), rooming-in is beneficial for not only treating the infant with withdrawal symptoms but lowering the total cost as well. In this article, 15 infants with NOWS were treated in the special care nursery while an additional 19 infants were a part of the rooming-in group. The study population was infants at risk for developing neonatal opioid withdrawal syndrome who were born between July 2013 and July 2017. Infants a part of this study also had to be born at a gestational age of at least 36 weeks. Those born between July 2013 and June 2015 were placed in the special care nursery for observation and treatment. Those born between July 2015 and June 2017 were able to room-in with their parents. Those who were rooming-in had an average hospital cost of \$6,458.00 while those who were sent to the special care nursery had an average bill of \$17,851.00. This article also supported the fact that rooming-in is associated with

a shorter length of stay. However, there were a few limitations to the study. This was a retrospective chart review which does not allow for randomization. In addition, the sample size was very small. The biggest strength of this study was that it shows strong evidence to support the idea that rooming-in decreases pharmacological treatments, reduces the length of stay, and results in less expensive hospital bills.

### **Non-pharmacological and Pharmacological Interventions**

Rooming-in is associated with fewer pharmacological interventions. Oftentimes infants with Nows show decreased severity of symptoms when there are high rates of parental presence, breastfeeding, and skin-to-skin contact, therefore, decreasing the need for medications and other interventions. Non-pharmacological methods should be used in symptom management whenever possible. Exceptions are made when an infant is showing signs of dehydration through excessive vomiting or diarrhea, difficulty feeding, and difficulty with being consoled. MacMillan et al. (2018) conducted a systematic review and meta-analysis to determine if there is an association with rooming-in on infants with Nows. This article looked at six studies and had a total of 549 patients. The studies included in this article were published between 2007 and 2017 and varied in sample size, geographic location, and clinical setting. In all six articles, there was consistent evidence that rooming-in is preferred over NICU admissions in reducing the use of pharmacotherapy. When looking at the data from the six articles, there were a total of 186 patients who roomed in and 266 patients who were a part of the comparison group. When rooming-in was utilized there were only 51 events that required pharmacological interventions compared to the comparison group who had 186 events (MacMillan et al., 2018). Therefore, when rooming-in is utilized there are fewer medical interventions needed. This helps keep infants with Nows out of the NICU and allows them to remain with their parents. According to

Macmillan et al. (2018), the likely limitation of this systematic review and meta-analysis is publication bias. It is unlikely that researchers would publish their results with negative findings that don't support the idea that rooming-in is beneficial. Strengths included strict adherence to The Cochrane Library and PRISMA guidelines for systematic review and meta-analysis conduct and reporting. In addition, rooming-in is a recent intervention and therefore there is limited literature available regarding this topic. MacMillan et al. (2018) believe that their search strategy allowed them comprehensively synthesize all of the available literature regarding this topic.

The Kingston Health Sciences Centre, a hospital located in Ontario, Canada, decided to see if their introduction of rooming-in care for infants with neonatal opioid withdrawal syndrome was effective, five years after it was implemented. Infants born at 36 weeks or later, between January 1, 2015, and December 31, 2019, who were also exposed to opioids in utero were eligible for rooming-in. The number of infants born between this period and that were opioid-dependent was 57. Data was examined regarding maternal and infant conditions, the need for pharmacological interventions, and the total length of stay. This data was then compared to two previous groups of patients who were treated at The Kingston Health Sciences Centre. The first group consisted of 24 healthy, opioid-dependent infants who were admitted directly into the NICU before the introduction of rooming-in. These infants were born between May 1, 2012, and May 31, 2013. The second group consisted of 20 opioid-dependent infants who were the first to room in at this hospital. These infants were born between September 1, 2013, and September 30, 2014. The purpose of this study was to assess how rooming-in has led to better patient outcomes. When looking at the infants who roomed in during the five-year study period, only 3.5% of these patients required pharmacological treatments. Of those who roomed in during the first year of the program's introduction at this hospital, 15% had pharmacological interventions. 83.3% of the

patients admitted directly to the NICU had pharmacological treatments (Newman et al., 2020).

The data presented in this article shows consistent evidence that rooming-in is an effective way of minimizing the severity of Nows while facilitating the mother-infant bond. A strength of this study was that it provides data from the past five years regarding the effectiveness of rooming-in on patient outcomes. Limitations of this study include small sample sizes and the fact that this was a retrospective chart review.

### **Research Proposal**

Implementing effective interventions for neonatal opioid withdrawal syndrome is essential for improving outcomes for infants suffering from this condition. The literature review provided evidence that when rooming-in is made available, there are shorter stays, lower hospital bills, higher rates of breastfeeding and parental presence, and fewer pharmacological interventions needed. The available literature showed rooming-in was beneficial at extensive medical facilities that were adequately staffed and had proper resources, however, would the results be the same at small, rural hospitals? This study aims to see if non-separation techniques are beneficial in decreasing the severity of Nows in smaller communities with fewer resources and funding.

### **Research Design**

For this study on the effectiveness of rooming-in on infants diagnosed with Nows, the researcher will conduct this study using a quantitative approach utilizing a retrospective cohort design. Data will be collected from three rural Northern California cities that face the highest rates of opioid use. All of these hospitals have a NICU as well. Infants with Nows born at these hospitals between August 2023-December 2024 will be admitted directly to the NICU. Infants born between January 2025-May 2026 will room-in with their parents. After implementation, a

retrospective chart review will be conducted to collect data regarding breastfeeding rates, parental presence, need for pharmacological interventions, and length of stay. This information will be compared between the NICU and rooming-in groups. The purpose of focusing on small, rural communities is to ensure diversification and inclusion.

### **Sample and Recruitment**

Recruitment for this study will focus on identifying participants who meet specific criteria. Inclusion criteria would be infants born after 36 weeks gestation, infants who do not have any other significant medical issues besides NOWS, and a maternal age of 18 or older. The infant must display signs of withdrawal to be included in the study. After eligible maternal participants are identified, the researchers will explain the study design and requirements. Patient information will remain confidential. If the mother agrees to her infant's participation in the study, their signature will be obtained.

### **Methodology**

After consent from the maternal participants is acquired, the time of delivery will then determine if the infant will be taken to the NICU or room-in with the parents or caregivers. Those born between August 2023-December 2024, meeting the inclusion criteria, will be admitted to the NICU for observation. Those born January 2025-May 2026, also meeting the inclusion criteria, will be kept at their mother's bedside, and non-separation techniques will be utilized.

The rooming-in group will consist of implementing nonpharmacological interventions to help manage the effects of NOWS. When signs of withdrawal or distress are observed, the first line of defense will be to provide comfort through holding, swaddling, breastfeeding, and nonnutritive sucking. It is also important that these infants are kept in a dark, low-stimulating

environment. If these methods are not effective in consoling the infant and they begin to show extreme signs such as dehydration, severe weight loss, and diarrhea a transfer to the NICU will be considered.

The NICU group will be kept in the nursery for higher observation. The parents and caregivers will be able to visit the infant but they will not be able to constantly remain at the bedside. Mothers can feed their infants and provide comfort through holding and swaddling as well. Parental presence will be highly encouraged amongst this group to help facilitate bonding and attachment.

For both the NICU group and the rooming-in group a tool known as the Finnegan Neonatal Abstinence Scoring tool will be used. This tool has a high inter-observer reliability of 0.996 and has convergent validity. The Finnegan Scoring tool will be used to document the level of severity of withdrawal symptoms seen in the infants participating in the study. This assessment will be completed once every 4 hours. This tool assesses the infant's sleep patterns, feedings, muscle tone, reflexes, cry, and other signs of withdrawal. This data will be used in an analysis to determine if rooming-in decreases signs of withdrawal in this study.

### **Analysis**

After the end date of the study in May 2026, data will be collected from all three rural hospitals. Statistical methods will be used to interpret the information. Descriptive statistics will be used to find percentages, means, and medians regarding the use of pharmacological interventions, breastfeeding rates, parental presence, total costs, and length of hospital stay. A t-test will be used to determine if the data is significantly significant. These values will be compared between the NICU and rooming-in group to see if rooming-in was effective in improving neonatal outcomes.

**Ethical considerations**

This study focuses on an extremely vulnerable population, as it looks at infants exhibiting withdrawal symptoms. These infants cannot give their consent to participate in the study. Therefore consent will be obtained from the infant's legal parents or guardians. Since this study will examine personal medical information, measures will be taken to promote safety and patient confidentiality. Before initiating this study, an application will be sent to the International Review Board (IRB) in California. The IRB will ensure that this study is safe for participants and does not pose any harm. Once approval from the IRB is received, participating mothers will sign a consent form agreeing for themselves as well as their infants to participate in the study. Participants are able to withdraw from the study at any time without any consequences.

**Theoretical Framework**

The Theory of Comfort, developed by Katharine Kolcaba in the 1990s, can be related to infants with Nows as a way to enhance their care and well-being. Kolcaba is an accomplished nurse, nursing theorist, and nursing professor. She received her nursing diploma from St. Luke's School of Nursing and her Master of Science in Nursing from Case Western Reserve University (Kolcaba, 2019). The theory emphasizes the importance of comfort as a vital aspect of healthcare, especially for patients who are experiencing pain, stress, or other discomforts. When caring for infants with Nows, the Theory of Comfort can be applied in three ways; physical comfort, environmental comfort, and social comfort. Infants with Nows experience a range of physical symptoms, including tremors, irritability, and gastrointestinal distress. Parents and caregivers can help to alleviate these symptoms by providing physical comfort measures such as swaddling, skin-to-skin contact, holding, and breastfeeding. In addition, the environment in which an infant with Nows is cared for can have a significant impact on their comfort levels

and withdrawal symptoms. Healthcare providers and parents or caregivers can create a calm and soothing environment by reducing noise, dimming lights, and maintaining a consistent routine. As a healthcare provider, it is very important to provide the family of infants undergoing withdrawal additional support. Healthcare providers can provide social comfort by offering emotional support, education, and resources to parents and caregivers, which can help to alleviate stress and anxiety. The Theory of Comfort emphasizes the importance of addressing the physical, emotional, and social aspects of comfort. When looking at NOWS, this can involve addressing the needs of the infant and their family as a whole, by allowing all individuals to participate in the care process.

### **Conclusion**

Rooming-in shows to drastically improve outcomes in patients diagnosed with NOWS. When an infant is able to stay with their parents or caregivers rather than being admitted to the NICU, there tend to be shorter hospital stays, fewer pharmacological interventions, less severe withdrawal symptoms, less costly expenses, higher rates of breastfeeding, and improved bonding. Non-separation techniques are proven to be successful in addressing the complex needs of infants and families affected by opioid use disorder, promoting healthier outcomes for both the newborn and the parent. Therefore these techniques should be implemented whenever possible. This approach to care not only benefits the patient and family but the healthcare staff as well. NICU admissions will decrease and beds will be available for those patients in critical condition. Hospitals will also save money and resources when an infant is able to room-in since fewer pharmacological interventions are needed. Overall, rooming in should be considered a first-line treatment for neonatal opioid withdrawal syndrome, and healthcare providers should prioritize the implementation of this method in clinical settings.

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*What California cities are the hardest-hit by opioid deaths?* What California Cities are the

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<https://www.chapmanrehab.com/post/what-california-cities-are-the-hardest-hit-by-opioid-deaths>

## APPENDIX A: LITERATURE REVIEW TABLE

Title of your paper: Benefits of Rooming-in on Infants with Neonatal Opioid Withdrawal Syndrome

Your name: Emma Ricioli Date: 3/15/23

Authors/ Citation	Purpose/Obj ective of Study	Sample - Population of interest, sample size	Study Design	Study Methods	Major Finding(s)	Strengths	Limitations
Beckwith, S. J., Vyas, M., Papadakos, P., Sears, K., & Dow, K. (2021). Reduction of need for treatment and length of hospital stay following institution of a neonatal abstinence syndrome rooming-in program in Ontario, Canada. <i>Journal of Pediatric Nursing, 61</i> , 84–89. <a href="https://doi.org/10.1016/j.pedn.2021.03">https://doi.org/10.1016/j.pedn.2021.03</a> .	To assess the impact of a rooming-in program for babies at risk of Neonatal Abstinence Syndrome (NAS) in one community hospital centre, in Belleville, Ontario.	The study consisted of 15 babies in the Special Care Nursery (SCN) group and 19 babies in the rooming-in group. The study population consisted of infants at risk of developing NAS, born between July 2013–June 2017. All infants included in the study were born at a	Retrospective Chart Review Cohort study	Cohorts were divided into two population groups: (1) infants born between July 2013–June 2015 when the standard practice was to admit them to the SCN for further management, and (2) infants born between July 2015–June 2017 after implementation of the NAS rooming-in	A significantly lower proportion of infants in the rooming-in group required pharmacological treatment for NAS when compared to the SCN group. The rooming-in group also had a significantly shorter length of stay in the hospital in comparison to the SCN group. Hospital costs are also significantly	Supports idea that rooming-in decreases pharmacological treatments, reduces length of stay and results in less expensive hospital bills.	This was a non-randomized uncontrolled design, which presents issues in terms of attributing any differences observed in the practice change of rooming-in, as differences in the cohorts could also have an impact. The study also had a small sample size.

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<a href="#">02_1</a>		gestational age of at least 36 weeks, and all mothers had singleton pregnancies.		program.	lower in the rooming-in group.		
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Authors/ Citation	Purpose/Obj ective of Study	Sample - Population of interest, sample size	Study Design	Study Methods	Major Finding(s)	Strengths	Limitations
<p>Holmes, A. P., Schmidlin, H. N., &amp; Kurzum, E. N. (2017). Breastfeeding considerations for mothers of infants with neonatal abstinence syndrome. <i>Pharmacotherapy : The Journal of Human Pharmacology and Drug Therapy</i>, 37(7), 861–869. <a href="https://doi.org/10.1002/phar.1944">https://doi.org/10.1002/phar.1944</a></p>	<p>The purpose of this study was to see if breastfeeding, when paired with rooming-in decreased NOWS symptoms and improved neonatal outcomes.</p>	<p>5 studies ranging from 124-295 patients</p>	<p>Systematic Review Cohort Retrospective</p>	<p>Studies were reviewed to see if breastfeeding rates were associated with decreased length of stays, fewer pharmacological interventions and fewer NOWS symptoms.</p>	<p>Infants with NOWS who were breastfed had shorter hospital stays, fewer pharmacological interventions.</p>	<p>Studies included large sample sizes. Data supported the fact that breastfeeding is an effective way of treating NOWS when paired with rooming in.</p>	<p>Retrospective study.</p>

Authors/ Citation	Purpose/Obj ective of Study	Sample - Population of interest, sample size	Study Design	Study Methods	Major Finding(s)	Strengths	Limitations
Howard, M. B., Schiff, D. M., Penwill, N., Si, W., Rai, A., Wolfgang, T., Moses, J. M., & Wachman, E. M. (2017). Impact of parental presence at infants' bedside on neonatal abstinence syndrome. <i>Hospital Pediatrics</i> , 7(2), 63–69. <a href="https://doi.org/10.1542/hpeds.2016-0147">https://doi.org/10.1542/hpeds.2016-0147</a>	To examine the association between rates of parental presence and NAS outcomes	86 mother-infant dyads	Retrospective, single-center cohort study	Parental presence was documented every 4 hours along with a Finnegan score. Data was extracted from medical records regarding length of stay, pharmacological interventions, withdrawal symptoms and breastfeeding status.	Maximum (100%) parental presence was associated with a 9 day shorter LOS (r 5 –0.31; 95% CI, –0.48 to –0.10; P , .01), 8 fewer days of infant opioid therapy (r 5 –0.34; 95% CI, –0.52 to –0.15; P , .001), and 1 point lower mean Finnegan score (r 5 –0.35; 95% CI, –0.52 to –0.15; P ,	The evaluation of a cohort of infants who all had the opportunity for rooming-in with their parents. Supported the idea that rooming in is beneficial for infants with NAS.	This was a retrospective chart review of clinical data, with parental presence being a new metric for nurses to document after transitioning to a new electronic medical record. As a result, for each infant, parental presence was documented an average of only 68.0% (95% CI, 64%–72%) of the time.

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					.01). After adjusting for breastfeeding, parental presence remained significantly associated with reduced NAS score and opioid treatment days.		Additionally, the way parental presence was documented does not allow us to assess the amount of time spent or the level of parental involvement, only that they were present at the time the scoring took place.
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Authors/ Citation	Purpose/Obj ective of Study	Sample - Population of interest, sample size	Study Design	Study Methods	Major Finding(s)	Strengths	Limitations
<p>MacMillan, K. D., Rendon, C. P., Verma, K., Riblet, N., Washer, D. B., &amp; Volpe Holmes, A. (2018). Association of rooming-in with outcomes for neonatal abstinence syndrome. <i>JAMA Pediatrics</i>, 172(4), 345. <a href="https://doi.org/10.1001/jamapediatrics.2017.5195">https://doi.org/10.1001/jamapediatrics.2017.5195</a></p>	<p>To systematically review and meta analyze if rooming-in is associated with improved outcomes for newborns with NAS.</p>	<p>6 studies, a total of 549 patients</p>	<p>Systematic Review and Meta Analysis This investigation included randomized clinical trials, cohort studies, quasi experimental studies, and before-and-after quality improvement investigations comparing rooming-in vs standard NICU care for newborns with NAS.</p>	<p>Electronic databases such as MEDLINE and CINAHL were used to find studies. 482 total records were identified and it was narrowed down to 6 based on eligibility.</p>	<p>Rooming-in was associated with a reduction in the need for pharmacologic treatment and a shorter hospital stay when rooming-in was compared with standard neonatal intensive care unit admission for neonatal abstinence syndrome.</p>	<p>Strengths included strict adherence to The Cochrane Library and PRISMA guidelines for systematic review and meta-analysis conduct and reporting. Since rooming-in is a recent intervention, it is believed that the search strategy for this study comprehensively synthesized all the available data regarding this topic.</p>	<p>Limitations of this systematic review and meta analysis is the likely publication bias favoring rooming in because it would be unlikely for researchers to publish their results with negative or insignificant findings.</p>

Authors/ Citation	Purpose/Obj ective of Study	Sample - Population of interest, sample size	Study Design	Study Methods	Major Finding(s)	Strengths	Limitations
<p>Newman, A. I., Mauer-Vakil, D., Coe, H., Newton, L., Wilkerson, E., McKnight, S., &amp; Brogly, S. B. (2020). Rooming in for infants at risk for neonatal abstinence syndrome: Outcomes 5 years following its introduction as the standard of care at one Hospital. <i>American Journal of Perinatology</i>, 39(08), 897–903. <a href="https://doi.org/10.1055/s-0040-1719182">https://doi.org/10.1055/s-0040-1719182</a></p>	<p>The practice of rooming-in for opioid-dependent infants was introduced as the standard of care at our hospital following a pilot study which demonstrated that such infants had shorter lengths of stay and were less likely to require pharmacological treatment. We sought to determine whether these benefits have continued, and whether outcomes</p>	<p>57 mother-infant dyads</p>	<p>Retrospective Chart Review</p>	<p>Opioid-dependent infants delivered at 36 weeks gestation or later between January 1, 2015, and December 31, 2019, were eligible for rooming-in. Charts were reviewed and data were extracted regarding maternal and infant conditions, whether neonatal pharmacological treatment was required, and total length of hospital stay. Outcomes were compared</p>	<p>Only 3.5% of 57 infants who roomed-in during the 5-year study period required pharmacological treatment, compared with 15% who roomed-in during the first year of the program's introduction and 83.3% who had been admitted directly to the NICU. The median length of stay remained 5 days for infants rooming-in, compared with 24 days for</p>	<p>Results from the past 5 years of rooming-in being implemented at this hospital. Supports the idea that rooming-in is beneficial.</p>	<p>The study was limited by the small cohort size. Finally, the fact that 11 of the infants observed were born to women taking opioid medication for a chronic pain diagnosis and who did not have a primary diagnosis of OUD is a potential limitation.</p>

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	<p>support continuing to use rooming-in as standard care.</p>			<p>with two historical groups reported in a previous pilot study: 24 healthy near-term opioid dependent newborns who were admitted directly to the neonatal intensive care unit (NICU) prior to the introduction of rooming-in (May 1, 2012–May 31, 2013), and 20 similar opioid dependent infants who were the first to room-in at our hospital (September 1, 2013–September 30, 2014).</p>	<p>opioid dependent infants in the cohort admitted to the NICU.</p>		
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Authors/ Citation	Purpose/Obj ective of Study	Sample - Population of interest, sample size	Study Design	Study Methods	Major Finding(s)	Strengths	Limitations
Wachman, E. M., Grossman, M., Schiff, D. M., Philipp, B. L., Minear, S., Hutton, E., Saia, K., Nikita, F. N. U., Khattab, A., Nolin, A., Alvarez, C., Barry, K., Combs, G., Stickney, D., Driscoll, J., Humphreys, R., Burke, J., Farrell, C., Shrestha, H., & Whalen, B. L. (2018). Quality Improvement Initiative to improve inpatient outcomes for neonatal abstinence syndrome. <i>Journal of</i>	To improve NAS/ NOWS inpatient outcomes through a comprehensive quality improvement program were rooming-in was utilized.	240 infants total 101 infants in the pre-intervention group (April 2015- April 2016) 54 in the intervention group (May 2016- December 2016) 85 in the post intervention group (January December 2017)	Quality improvement Retrospective chart review	Inclusion criteria was opioid-exposed infants >36 weeks. QI methodology included stakeholder interviews and plan-do-study-act cycles were used. Pre and post intervention NAS/ NOWS outcomes were compared after implementing a non pharmacological bundle, function	Pharmacologic treatment decreased from 87.1 to 40%; hospitalization length decreased from a mean of 17.4 to 11.3 days and opioid treatment days decreased from 16.2 to 12.7 (p < 0.0001 for all)	The study demonstrated the ability to institute major changes in care practices in a relatively short period of time.	Replication may be challenging since not all hospitals are able to modify their physical space and staffing models to allow for improved rooming-in care and parental presence.

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<p><i>Perinatology</i>, 38(8), 1114–1122. <a href="https://doi.org/10.1038/s41372-018-0109-8">https://doi.org/ 10.1038/ s41372-018-010 9-8</a></p>				<p>based assessments consisting of symptom prioritization and the “Eat, Sleep, Console” tool.</p>			
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**Appendix B: Finnegan NAS Tool**

**NEONATAL ABSTINENCE SCORING SYSTEM**

Modified Finnegan Neonatal Abstinence Score Sheet <sup>11</sup>													
System	Signs and Symptoms	Score	AM				PM				Comments		
Central Nervous System Disturbances	Excessive high-pitched (or other) cry <5 mins	2											
	Continuous high-pitched (or other) cry >5 mins	3											
	Sleeps <1 hour after feeding	3											
	Sleeps <2 hours after feeding	2											
	Sleeps <3 hours after feeding	1											
	Hyperactive Moro reflex	2											
	Markedly hyperactive Moro reflex	3											
	Mild tremors when disturbed	1											
	Moderate-severe tremors when disturbed	2											
	Mild tremors when undisturbed	3											
	Moderate-severe tremors when undisturbed	4											
	Increased muscle tone	1											
	Excoriation (chin, knees, elbow, toes, nose)	1											
	Myoclonic jerks (twitching/jerking of limbs)	3											
Generalized convulsions	5												
Metabolic/Vasomotor/ Respiratory Disturbances	Sweating	1											
	Hyperthermia 98.96-100.94° F	1											
	Hyperthermia >101.12° F	2											
	Frequent yawning (>3-4 times/scoring interval)	1											
	Mottling	1											
	Nasal stuffiness	1											
	Sneezing (>3-4 times/scoring interval)	1											
	Nasal flaring	2											
	Respiratory rate >60/min	1											
	Respiratory rate >60/min with retractions	2											
Gastrointestinal Disturbances	Excessive sucking	1											
	Poor feeding (infrequent/uncoordinated suck)	2											
	Regurgitation (≥2 times during/post feeding)	2											
	Projectile vomiting	3											
	Loose stools (curds/seedy appearance)	2											
	Watery stools (water ring on diaper around stool)	3											
	<b>Total Score</b>												
	<b>Date/Time</b>												
<b>Initials of Scorer</b>													

Adapted from Finnegan LP. In: Nelson N, editor. Current therapy in neonatal-perinatal medicine. 2ed. Ontario: BC Decker;1990.