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Cuddling and the Born-Addicted Infant: Implementation of volunteer-based cuddling programs for babies experiencing Neonatal Abstinence Syndrome in the Neonatal Intensive Care Unit

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Abstract

Cuddling and the Born-Addicted Infant: Implementation of Volunteer-Based Cuddling Programs for Babies Experiencing Neonatal Abstinence Syndrome in the Neonatal Intensive Care Unit

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In the United States, the opioid epidemic is rising at an alarming rate and is affecting countless lives, including the lives of newborn infants. In a country that continues to be overtaken by prenatal drug use, volunteer-based cuddling programs need to be readily available in any hospital that contains a Neonatal Intensive Care Unit (NICU). Human contact via general cuddling is vital to the recovery of a born-addicted infant and the way to ensure such contact is provided is through a volunteer-based cuddling program. This project consists of literature reviews concerning former and current treatments for born-addicted infants, a survey of U.S. NICUs to determine treatment methods that are currently being applied, and the development of a volunteer-based cuddling program implementation plan that NICUs without cuddling programs can adopt. There is limited available research on the topic of utilizing nonpharmacologic methods for the treatment of withdrawal symptoms associated with Neonatal Abstinence Syndrome. The primary goal for this project was to shift the focus away from pharmacologic treatments and more towards alternative approaches that can be used to ease neonatal withdrawal symptoms primarily via human cuddling that is delivered by way of a volunteer-based cuddling

program. Data from studies in the reviewed literature suggest that nonpharmacologic mechanisms should be utilized as first-line treatments for addicted infants. Conversely, research also has determined that the most efficient treatment method was human contact via cuddling. Recommendations were made for developing and integrating a volunteer-based cuddling program into hospitals.

Keywords and phrases: Neonatal Abstinence Syndrome, Neonatal Intensive Care Unit, nonpharmacologic treatment, born-addicted infant, cuddling, volunteer-based cuddling program, withdrawal

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Background and Rationale

Across the world, there is an ongoing drug epidemic. Often when news stations report the ever-increasing incidences of drug use, the focus is primarily on the adults. Some of the most vulnerable, but most often forgotten, victims of this epidemic are the unborn babies that suffer from maternal drug usage/addiction during prenatal development. Opioid usage by pregnant women is a considerable public health concern because of the association of opioid usage with detrimental maternal and neonatal outcomes. Haight and colleagues (2018) reported that in the United States alone, the pervasiveness of opioid use

disorder more than quadrupled from 1999-2014. During that time period, incidences of opioid use disorder increased 333% since there was a vast increase in the number of cases per 1,000 deliveries in hospitals from 1.5 cases to 6.5 cases (Haight et al., 2018).

One of the severe consequences of maternal drug usage on an infant is a condition termed Neonatal Abstinence Syndrome, or NAS. NAS is a group of conditions that occur following the sudden suspension of fetal exposure to used and/or abused substances that the mother was consuming during the time of pregnancy (Kocherlakota, 2014). Often, opioids, antidepressants, barbiturates, or benzodiazepines are the reasons for development of NAS (March of Dimes 2019). During the period of NAS, babies may exhibit withdrawal symptoms and these symptoms can develop anywhere from 3 days after birth to a few weeks following birth. In less severe cases, the symptoms can last for a week, but some may persist until 6 months following birth (March of Dimes 2019).

Even though born-addicted infants are a rather popular occurrence across the globe, the available research on the topic is greatly limited. Much of what is available focuses on the short-term symptoms and consequences rather than the longer potential complications. Not only is the pathophysiology of NAS not completely understood, but the treatment for the condition is even less so understood. Much of the commonly called upon treatments involve introducing even more medications into an already fragile newborn body. The most common medications utilized in the treatment of NAS includes, but is not limited to, morphine, methadone, and buprenorphine (Wachman & Werler, 2019). Even though these are the most popular treatment choices, there is still vast variability in which pharmacologic agents are utilized in treatment facilities, which

suggests that there is no concurrence on which medication administration is the most effective (Wachmann & Werler, 2019).

Overall, around 50% to 80% of newborns experiencing NAS receive treatment in neonatal intensive care units, or NICUs, via pharmacological methods. In 2012, infants that received pharmacological treatment had an average length of stay, or LOS, of 23 days in the hospital and incurred an average hospitalization cost of $93,400 per infant (Wachmann & Werler, 2019). When treated pharmacologically, the length of stays and the resulting charges for these infants are going to be elevated due to the amount of hospital space and equipment that is being occupied by each infant with NAS. Addressing the issue of NAS with approaches other than medication administration brings about the potential to decrease the overall time of recovery, average duration of length of stays, and the costs that quickly add up. Although existing literature primarily highlights pharmacological approaches, the methods in which NAS infants are administered treatment needs to be modified. This need for change exists because in 2014, for example, a baby was born with NAS every 15 minutes, which means that nearly 100 babies per day were born with NAS and that averages to be around 32,000 babies in a year (CDC 2019). The rates of maternal drug usage/addiction during pregnancy are only continuing to rise and consequently, the number of newborns that develop NAS also is continuing to increase.

This current literature review and small-scale study will assist in better explaining the effects of maternal drug usage on infants in both the short-term and long-term, the treatments that are currently utilized, and why nonpharmacological methods are the better option in terms of treating Neonatal Abstinence Syndrome. Specifically, the following

literature review and proposed treatment regimen will highlight the importance and benefits of general cuddling for NAS infants by way of a volunteer-based cuddling program. This research will contribute to the limited available studies within this field and will hopefully encourage not only future research concerning the topic, but also provide some perspective regarding why the first line of defense should be replacing the current pharmacological treatment regimens with nonpharmacological treatments within Neonatal Intensive Care Units.

Research Questions and Thesis Statement

Extant research literature generates the following proposed research question: In what ways are nonpharmacological approaches, specifically human cuddling, more beneficial for infants experiencing Neonatal Abstinence Syndrome compared to pharmacological methods? What are the added benefits for the infant's care team including hospital staff and the family? Also, how can nonpharmacological methods via human cuddling be integrated into hospitals in which a cuddling program has yet to be established?

These questions advance the following thesis statement: Human contact via general cuddling is vital to the recovery of a born-addicted infant and the way to ensure such contact is through a volunteer-based cuddling program.

Literature Review

Each day, there are several thousand babies born around the globe. Some babies are born completely healthy without complications while some others are born with defects or illnesses that require special, prolonged attention. Much like there is an intensive care unit, or ICU, for adults with critical complications, there exists a similar structure for

neonates. This special area of a hospital is called the Neonatal Intensive Care Unit, or NICU. A NICU is comprised of newborn babies who need intensive, closely monitored medical care due to premature birth, illnesses, or other conditions. The NICU contains advanced technology and is staffed with trained, specialized healthcare professionals to provide care for the smallest patients. Several complications require a NICU stay and some of these include, but are not limited to, anemia, breathing problems, respiratory distress syndrome, septal defects, hypoglycemia, jaundice, sepsis, and Neonatal Abstinence Syndrome (March of Dimes, 2014). Medical staff in NICUs utilize various equipment to aid in taking care of a baby. Examples of the employed equipment include, but are not limited to, apnea monitors, arterial lines to monitor blood pressure and blood gases, Bili lights for jaundice, central lines for medication and fluid delivery, endotracheal tube for oxygen delivery to the lungs, incubators for warmth, nasal cannulas for assisted oxygen flow, and nasogastric tube for food delivery from the throat to the stomach (March of Dimes 2017). NICUs are an essential part of hospitals because when a baby is born, there are many physical adjustments to life apart from the mother's body that must be made. Vacating the mother's uterus means that a baby can no longer depend on the mother's blood supply and placenta to receive important nutrients. Infants who are exposed to drugs prior to birth often have more serious complications compared to infants who do not experience drug exposure. Not all NICU babies are born-addicted, but a growing number of infants are falling victim to maternal drug use. The number of addicted infants in a NICU at any given moment continues to rise. These newborns require much more intensive around-the-clock care.

Several factors determine how a drug will affect an unborn baby. Sachdeva and colleagues described the intricacies of this process in a 2009 article. A crucial structure in the delivery of drugs to a fetus is the placenta. In order for a drug to reach a developing fetus and produce adverse effects, the substance must cross from the mother's circulation to the fetal circulation via diffusion. The transfer rate is dependent upon on certain chemical properties of the drug including, but not limited to, protein binding, pH discrepancies, lipid solubility, and the molecular weight. Throughout pregnancy, the levels of albumin in the plasma of the mother decline while albumin levels increase in the fetus. Albumin contributes to the maintenance of pressure within plasma as well as transporting endogenous and exogenous ligands (Moman et al., 2020). Drugs fall under the exogenous category. Sachdeva and colleagues also explained that because the levels of albumin decrease in the mother, this allows for the concentration of free, unbound drug particles to build up and readily cross the placental barrier to reach the fetus. Differences in pH also allow for drugs to cross the placental barrier as fetal pH is slightly greater in acidity than the maternal pH, which means that weak bases can more easily cross the placental barrier. Additionally, molecular weight also plays a big role in how a drug affects fetal development as low molecular weight means that the physical size of a drug is smaller than a substance with a high molecular weight, which generally is equivalent to larger surface area. Consequently, drugs with lower molecular weights freely diffuse across the placenta because of the smaller size. Timing and dosage are two crucial aspects when determining how a substance will affect a fetus. Even though there are several different modes of delivery for drugs to reach a fetus, once those substances invade, the development of the fetus is greatly altered (Sachdeva et al., 2009).

Often, substance-exposed infants score drastically lower on developmental assessments and fail to meet developmental milestones at the pace of those infants who were not prenatally exposed to substances. One of the tools that is commonly used to assess the status of a newborn immediately after birth is the APGAR scoring mechanism (American Academy of Pediatrics 2015). The APGAR scoring system assesses five vital organs by monitoring and evaluating heart rate, breathing, color, muscle tone, and reflexive response (Rahi et al., 2011). The normal maximum score associated with this assessment tool is ten. The APGAR test is conducted at the first, fifth, and tenth minutes following birth. Rahi and colleagues (2011) noted that the neurological future for an infant is determined by the APGAR score at the fifth minute following birth and onward. Infants of addicted mothers may receive close monitoring, but even so, the morbidity and mortality of these exposed infants is 2.5 times more than normal, healthy infants. In a study conducted by Rahi et al., 49 infants of addicted mothers and 49 infants of non-addicted mothers were observed. The researchers found that the average infant weight of non-addicted mothers was significantly greater than infants of addicted mothers. Concerning APGAR scores and keeping in mind that the maximum score is a ten, the minimum scores of infants from addicted mothers were 5, 6, and 6 at the first, fifth, and tenth minutes, respectively. This is low compared to infants of non-addicted mothers who received scores of 7, 7, and 7. Low birth weight was also an important factor in this study as 75.5% of the infants from addicted mothers weighed less than 2,500 grams at birth, and this percentage was nearly five times higher compared to the birth weights of infants without an addicted mother (Rahi et al 2011).

One of the most common consequences of prenatal drug use is Neonatal Abstinence

Syndrome. NAS symptoms appear via central nervous system, autonomic/respiratory, and gastrointestinal system interruptions (Anbalagan and Mendez, 2020). Concerning the central nervous system, or CNS, symptoms usually manifest through hyperirritability, high-pitched cries, jitteriness, and violent tremors. Anbalagan and Mendez reported that hyperirritability, specifically, can cause sleep disruptions and can prevent the infant from achieving a calm state, which further promotes an inability to experience restful sleep. The most common symptoms related to the CNS involve hyperactive reflexes, elevated levels of muscle tension, tremors, and the recurrent picking of the skin, (i.e., excoriation) that results in lesions, which is a direct result of the increased jitteriness (Anbalagan & Mendez, 2020). Quick, involuntary muscle jerks and seizures also are potential consequences of NAS involving the CNS. Autonomic/respiratory disruptions are also common and usually those symptoms present as tachycardia, tachypnea, and hyper/hypothermia (Anbalagan & Mendez, 2020). Tachycardia is defined as a regular cardiac rhythm that displays a faster-than-normal heartbeat and a consequential elevation of cardiac output (Henning & Krawiec, 2020), whereas tachypnea refers to rapid breathing (Park & Khattar, 2019). Skin perfusion alterations are also common with autonomic disruptions, which trigger skin discoloration, known as mottling, and profuse sweating (Anbalagan & Mendez, 2020). Nasal irritations, stuffiness, and excessive sneezing may also manifest. Autonomic symptoms have a greater likelihood of continuing for a longer duration of time following birth. Gastrointestinal, or GI, disruption have the potential to cause the greatest amount of discomfort to an infant. These symptoms exhibited during NAS include poor feeding, vomiting, diarrhea, dehydration, and electrolyte disruptions (Anbalagan & Mendez, 2020). NAS is the infant

version of withdrawal and during the withdrawal process, there is an elevated caloric demand. This excessive demand coupled with GI functionality impairments and excessive autonomic stimulation can prevent weight gain, which can result in failure to thrive (Anbalagan & Mendez, 2020).

Neonatal Abstinence Syndrome is a clinical diagnosis that is determined based on applicable signs and symptoms that are displayed in situations where there is great suspicion. A verbal history from the mother concerning drug use/abuse helps to identify a potential NAS case, but if that history is not easily accessible, infant testing may be needed (Anbalagan & Krawiec, 2020). One potential testing mechanism to confirm prenatal drug exposure and to identify the substances that the infant was exposed to involves the infant's urine. Urine testing is not the most efficient as this method can identify drug exposure only a few days prior to delivery (Anbalagan & Krawiec, 2020). Timing and dosage of the drug consumption are crucial factors for valid urine examination results. Another testing mechanism involves meconium. Meconium examination is more effective as drug exposure can be identified as far back as 20 weeks gestation, so there is greater sensitivity with this test (Anbalagan & Krawiec, 2020). NAS rates are continuing to rise and a potential reason for this is the methods utilized to identify and define NAS are variable and inconsistent. In the United States alone, the drastic surge in NAS cases over the last few years has resulted in great divergence of the processes used to identify NAS (Chiang et al., 2019). Because of the inconsistency with the NAS diagnosis, there also is inconsistency involving definitions for NAS. Discrepancies with these two areas result in ineffective guidance involving public health strategies and the interventions that are recommended (Chiang et al., 2019).

Standardizing the diagnosis of NAS has proven to be difficult, but consistent definitions to identify NAS would drastically improve the parallelism and relatability of NAS cases, which would provide a foundation for better guidance concerning prevention and more effective treatment methods for mothers and infants (Chiang et al., 2019).

Because the identification procedures for NAS are highly variable, optimal care procedures for these patients remain a controversial issue. The ultimate goals for NAS treatment include preventing NAS-associated complications as much as possible and reintroducing normal newborn milestones involving sleep, nutrition consumption, weight gain, and adjustment to a social environment (Siu & Robinson 2014). Based on the limited availability of conducted studies involving NAS infants, the primary treatment mechanisms involve pharmacological approaches. Pharmacologic agents that are often utilized to combat NAS include opioids, such as paregoric, morphine, methadone, and buprenorphine; barbiturates, such as phenobarbital; benzodiazepines, such as diazepam and lorazepam; clonidine; and phenothiazines, such as chlorpromazine (Siu & Robinson, 2014). In most clinics, healthcare providers choose morphine or methadone for the initial agents in the battle against NAS. The introduction of powerful medications into an already fragile and compromised newborn body system has the potential to create several adverse effects. For example, with opioids, potential unwanted side effects include sedation, respiratory depression, constipation, urinary retention, twitching, and hypotension (Siu & Robinson, 2014). As aforementioned, morphine and methadone are two examples of opioids that are most commonly chosen to combat NAS. The more these substances are pumped into already ill newborns, there is a much greater risk for negative side effects that could potentially worsen or prolong the symptoms associated with NAS.

While some opioid-exposed infants exhibit mild, clinically insignificant symptoms, other infants develop more severe withdrawal symptoms that have the potential to significantly disrupt growth and development if a treatment method is not introduced.

To monitor NAS infants, specific mechanisms are utilized. The most common mechanism is known as the Finnegan Neonatal Abstinence Scoring System, or FNASS (Kraft et al., 2016). This scoring instrument is introduced during treatment, and the reasons are threefold: 1) to determine which infants require pharmacologic interventions; 2) to determine how dosage should be altered; 3) to determine when the weaning process should begin (Kraft et al., 2016). The Finnegan instrument consists of a 31-item scale that is utilized for treatment guidance and is dispensed every three to four hours (Jansson et al., 2009). The individual NAS symptoms are scored anywhere from 1-5 depending upon the symptom type and the severity of that exhibited symptom. A score of eight or higher suggests that NAS is occurring with the infant (Kraft et al., 2016) and pharmacologic therapies are recommended for treatment (Jansson et al., 2009). Caring for ill newborns is a critical, complex task and many of the developed scoring techniques used to assist with making treatment decisions are very comprehensive. Another scoring method for NAS is the Lipsitz tool. This assessment involves evaluating infants twice a day, 90 minutes before feedings, and contains eleven items with scores that range from zero to three (Gomez-Pomar & Finnegan, 2018). Withdrawal signs were indicated if the infant received a score of four or greater (Gomez-Pomar & Finnegan, 2018). These scoring mechanisms have several limitations concerning observer variability that must be accounted for, and as previously mentioned, caring for NAS infants requires careful monitoring of the displayed symptoms so that the most effective treatment options are

utilized. When considering any type of drug therapy, the potential risks and benefits should be carefully considered prior to introducing the treatment to a frail newborn. Symptomatic relief is a potential benefit, but prolonged drug exposure, increased duration of hospital stays, and greater financial accumulations are serious risks that could greatly impact the maternal-infant bond.

Even though pharmacological approaches are the most common treatments utilized for NAS treatments within clinical settings, many healthcare providers should take the necessary steps toward introducing non-pharmacologic measures. In 2008, Yale New Haven Children's Hospital began a study with the goal of standardizing nonpharmacologic care to reduce the average length of stay for NAS infants (Grossman et al., 2017). The interventions of this study included standardization of nonpharmacologic treatment coupled with maximizing parental involvement within that treatment, developing a consistent assessment mechanism, administering morphine only on an as-needed basis, and transferring infants to an inpatient unit directly instead of incorporating care from the NICU (Grossman et al., 2017). Over the course of this study, four nonpharmacologic treatments were standardized and those included 1) placing infants in a minimally-stimulated environment that incorporated dimmed lights, muted televisions, and reduced noise; 2) parents were continuously engaged and involved in the care of infants through encouragement to room-in, feed their infants when needed, and console the infant if crying, and if family members were unavailable, volunteers were utilized; 3) hospital staff were trained to consider nonpharmacological approaches just as important as medications, and when more intensive treatments were needed, the approach first encouraged more parental involvement prior to the introduction of medications; 4)

communication between units was encouraged so that, if at all possible, a NICU stay could be avoided (Grossman et al., 2017).

As previously mentioned, the scoring scales used to assist with the guidance of treatment are very complicated and require careful monitoring. Because the FNASS assessment is highly intricate, Grossman and his colleagues (2017) created a unique functional assessment that focused primarily on three measurements, which involved the infant's ability to sleep, eat, and be consoled. This program was developed in 2017 and came to be known as the Eat, Sleep, Console, or ESC, approach. Interruptions in critical functions including eating and sleeping signify that the infant is unable to carry out daily life-supporting activities brought on by withdrawal; thus, pharmacologic interventions become necessary (Grisham et al., 2019). If these critical life functions are uninterrupted, pharmacologic interventions are deemed unnecessary even if FNASS scores exceed 8 points or higher (Grisham et al., 2019). Concerning the eating aspect of the ESC approach, the guideline used for evaluative criteria is that the newborn should eat an appropriate amount, which is decided by the days of age. For instance, concerning one-to-two-day old infants, this amount may fall under less than one ounce per feedings and for three-day old infants and up, this amount should be approximately one ounce or more per feeding (Grisham et al., 2019). Concerning sleep, the infant should be able to achieve uninterrupted sleep for one hour at minimum (Grisham et al., 2019). In the case of hyperactive NAS infants, holding the newborn to achieve undisturbed sleep is often required. In terms of consoling, the judgement must be made concerning if the newborn can be consoled within 10 minutes. If the newborn cannot be consoled during this allotted time frame, a second caregiver must be available to attempt consoling the newborn as a

way to postpone pharmacologic intervention for as long as possible (Grisham et al., 2019). If neither caregiver can achieve consoling, this may indicate that pharmacologic treatments need to be introduced.

In the initial study that Grossman et al. (2017) conducted after introducing the ESC model, the results were supportive of nonpharmacologic approaches taking the place of medications for first-line treatments. Two specific time windows were investigated and those were the preimplementation period, which lasted from January 2008 to February 2010, and the postimplementation period, which lasted from May 2015 to June 2016 (Grossman et al.). Preimplementation is defined as before the ESC intervention was incorporated while postimplementation is defined as after ESC was incorporated into treatment regimens. In this initial study, the average length of stay for NAS infants declined from 22.4 days during the preimplementation period to 5.9 days during the postimplementation period, which is a 74% reduction. Morphine administration during treatment also decreased from 98% to 14%, while hospitalization costs also declined from $44,824 to $10,289. Introduction of this new approach based on nonpharmacologic techniques proved to be successful. The ESC approach was introduced in another study conducted in 2018 and the results were highly comparable to the study conducted by Grossman et al. In the 2018 study, opioid-exposed infants were compared in both pre-intervention and post-intervention outcomes (Wachman et al., 2018). Non-pharmacologic care initiatives were provided, which included placing top priority on symptom management as well as introducing the ESC approach. Consequently, pharmacologic treatment initiatives declined from 87.1% to 40.0%, average length of stay declined from 17.4 days to 11.3 days, and incurred hospital charges per infant also declined from

$31,825 to $20,668 (Wachman et al., 2018). The consistent results of these studies emphasize how the prioritization of nonpharmacologic interventions, introduction of a simplified assessment of infants, reductions in morphine usage, and enhanced unit communication are not only beneficial, but essential, for the treatment of NAS infants. Unit communication plays a crucial role in improving the treatment initiatives for born-addicted infants because of the potential subsequent treatments that could follow if an infant does not develop further medical complications that require NICU interventions.

Parental involvement is a crucial aspect to the success of nonpharmacologic approaches, which means that adequate parental education on the importance of their roles in the treatment process must be provided in order to maximize the benefit. In this particular study, several weeks prior to delivery, the hospital provided prenatal counseling for parents of NAS infants and explained to them that they would be expected to stay at the infant's side for the duration of the hospitalization (Grossman et al., 2017). There was emphasis placed on the idea that the most important administered treatment during this time would focus on maximizing comfort for the infant and having a family member provide that comfort. Along with parental involvement, there was encouraged communication between hospital units so that infants could potentially be transferred to an inpatient ward instead of requiring a NICU stay. This is important because in a NICU, there may be limitations to how much a family can be involved within the treatment of an infant and the purpose of introducing this new approach was to maximize familial involvement (Grossman et al., 2017). Bypassing the NICU promotes greater interactions between mother and baby, specifically, as rooming-in approaches can become an option

for families if no unforeseen medical complications arise, in which case NICU care would be required.

A large part of nonpharmacologic approaches for treating NAS include direct parental involvement with the infant and especially, maternal involvement. One of the approaches that maximize maternal involvement is termed rooming-in. Studies have continuously shown that opioid-exposed newborns in NICUs endure more excruciating withdrawal symptoms, have longer lengths of hospital stay, and increased pharmacologic therapy interventions in comparison to infants that utilize the rooming-in technique (MacMillan et al., 2018). This technique involves the mother staying with the infant for 24 hours a day unless separation is required for medical and/or safety reasons. Increasing the maternal presence at an infant's bedside is greatly beneficial towards enhancing NAS outcomes but is more difficult to practice in the traditional NICU setting. Rooming-in is highly efficient in the process of infant withdrawal recovery because parental involvement in the processes of soothing the withdrawing infant is the primary mechanism. MacMillan et al conducted a systematic review and meta-analysis of six different studies that investigated, over a ten-year time period, the potential benefits of incorporating rooming-in into the treatment plan for withdrawing infants. These studies ranged anywhere from 2007 to 2017 and had variances in sample size, geographic locations, and clinical settings. All six studies that were investigated observed an association between rooming-in and a decreased number of infants that required pharmacologic therapies. This association was in comparison to infants who solely received traditional NICU care and were not involved with rooming-in care. All six studies also supported that rooming-in resulted in significant declines in the average

length of stay for recovering infants compared to those who only received standard NICU treatment. Not all studies involved with this meta-analysis included financial cost evaluations, but three out of the six studies did provide this information and demonstrated that rooming-in was associated with lower financial costs (MacMillan et al., 2018). Financial accumulations are a large stressor for many families, so healthcare facilities should aim to use only nonpharmacologic interventions whenever possible because the more hospital resources are utilized, the quicker those hospital charges will build up. When newborns are treated in the NICU, the daily cost of care is extremely high due to the specialized, critical care that is required.

Consequently, there are several ways in which interventions can be introduced in order to reduce the utilization of hospital resources and avoid the financial stressors of incurred hospital charges. Rooming-in has proved to be a successful mechanism for not only improving the quality of life for infants in less time, but also this technique does not require extensive hospital resources. The most important requirement for this mechanism to be successful is maximizing the exposure that the infant has with his/her mother or other family members if the mother is unable to be at the infant's bedside. Another study conducted over nearly three years, from March 2012 to February 2015, also showed the benefits of rooming-in for the recovery of a born-addicted infant. In this study conducted by Holmes et al. (2016), 207 newborns were observed and/or treated for NAS. Throughout the study period, the quantity of infants that required morphine intervention was reduced from 46% to 27%, as did the quantity of infants that needed follow-up support treatments involving phenobarbital or clonidine. The specific amounts of morphine exposure compared to before the introduction of rooming-in versus after were

also observed. Average morphine exposure for each treated infant declined from 13.7 milligrams during the preintervention stages to 6.6 milligrams by the study's completion. The average lengths of stay (LOS) and treatment costs were also observed within this study. Concerning the average LOS, for newborns requiring pharmacologic interventions, there was a decrease from 16.9 days to 12.3 days (Holmes et al., 2016). Average hospital charges for newborns introduced to pharmacologic treatments decreased from $19,737 to $8,755, while costs for all opioid-exposed infants, including those who received no pharmacologic interventions, drastically declined from $11,000 during the first year of the study to $5,300 by the second year of study (Holmes et al., 2016). Rooming-in mechanisms are highly beneficial because human contact is the primary motive for the introduction of these mechanisms. Gentle handling, swaddling, cuddling, and generalized holding are much more likely to be practiced in rooming-in scenarios. Human contact and soothing via cuddling, specifically, provide extensive benefits and can greatly improve the quality of life for an infant experiencing Neonatal Abstinence Syndrome.

Benefits of Cuddling

Incorporating cuddling into a Neonatal Intensive Care Unit is vital to the recoveries of infants experiencing Neonatal Abstinence Syndrome. The act of cuddling provides several benefits to both the recovering infant as well as the parents of those infants. Introducing nonpharmacologic approaches into clinical practice for the treatment of NAS is a relatively new concept that has not been extensively researched. There is limited research available on how cuddling can impact the treatment progression of a born-addicted infant, so this section will provide a discussion centered around why cuddling should be incorporated into the treatment regimens of both non-withdrawing infants and

withdrawing infants. Cuddling in the NICU is beneficial to the baby because not only is the bond between baby and parent being established from the start, but the mechanism of consoling via cuddling is a far better alternative than introducing powerful medications into an already-fragile system. Parental presence and cuddling of healthy NICU infants have shown positive outcomes in terms of development (MacMillan et al., 2018; Holmes et al., 2016; Wachman et al., 2018). Often, babies in the NICU that were not exposed to substances prior to birth require NICU stays due to premature birth. Compared to women who do not engage in substance use/abuse during pregnancy, those women who use and/or abuse substances during pregnancy are at a much higher risk for having a preterm birth (Baer et al 2017). Aside from drug usage, other factors that could result in a preterm birth include, but are not limited to, high blood pressure, placenta previa, maternal age, and diabetes (March of Dimes 2018).

Both NICU infants and parents can receive benefits that are associated with cuddling. Reynolds and colleagues (2013) studied the effects of parental presence and infant holding within the NICU on infant neurobehavior. This study incorporated 81 infants born at or before 30 weeks gestation and throughout each infant's respective stay in the NICU, nurses monitored and kept record of parental visitation, holding, and skin-to-skin contact. Increases associated with holding, or cuddling, the NICU infants resulted in overall improvements concerning movement quality as well as notable decreases in stress, arousal, and excitability (Reynolds et al., 2013). The resulting decreases in the stress, arousal, and excitability levels in preterm infants without substance exposure prior to birth are important because those are classic withdrawal symptoms exhibited by prentally-exposed infants. Since cuddling is reducing the effects of these symptoms in

non-addicted infants, the same cuddling approach should be utilized for addicted infants. Cuddling in the form of skin-to-skin contact also offers direct parental benefits. Skin-to-skin contact involves a neonate engaging in direct contact with a parent's chest. In Jones and Santamaria's study conducted in 2017, parental physiological benefits were observed following participation in skin to skin contact. Following a systematic review, the researchers reported that mothers who participated in skin-to-skin contact with their infants experienced increased feelings of attachment to the baby, increased feelings of maternal satisfaction, decreased stress and anxiety levels, and significant reductions of blood pressure and respiratory rate while the contact was occurring. Skin-to-skin contact with fathers also promotes decreases in blood pressure and heart rate during the period of contact. This decline in blood in both parents promotes reductions in stress levels for both parents, which reduces the risk for development of post-traumatic stress disorder, anxiety, postnatal depression, and potential heart conditions that are associated with high blood pressure (Jones & Santamaria, 2017). Skin-to-skin contact between a NICU infant and a parent produces many benefits for everyone involved. The infant receives warmth and comfort from his/her primary caretakers and the parents, consequently, receive added physical and mental health benefits in addition to solidifying the infant/parent bond from the first days of the infant's life.

Volunteer-Based Cuddling

Born-addicted infants may require a NICU stay for only short period of time, but depending upon the severity of the presented symptoms, the duration of that time could persist for months. If an infant requires a longer NICU stay, parents may not always be available to stay at baby's side. Parental involvement within the treatment plan for

withdrawing infants has been shown to be widely beneficial for both the infant, as well as the parent involved. Although it is recommended for a parent, or other primary caregiver, to remain at the infant's bedside throughout the recovery process, it is not always feasible. Because of the potential life demands of new parents following birth, there must be a system that can be utilized to ensure that infants continue to receive the benefits of cuddling during the recovery process. In the case of born-addicted infants, parental addiction or emotional instability may prevent the parent from attending to the infant's needs. A proposed solution to satisfy this need is the inclusion of volunteer-based cuddling programs into hospitals. A baby cuddler, or sometimes referred to as a developmental care partner, is an individual who is trained to hold critically ill infants when parents are unable to be present. These individuals are often requested by physicians as they are specially trained volunteers who visit the NICU during scheduled times each week (Clubbs et al., 2019). Cuddling programs are a necessity in any hospital that has a NICU because ensuring that infants receive adequate amounts of cuddling, even if not provided by a parent, is vital to their recoveries.

Furthermore, studies have demonstrated the effectiveness of implementing cuddler programs into NICUs. In one study conducted in 2010, 75 NAS infants were admitted into a Pennsylvania NICU over the time span of one year from May 2009 to May 2010 (Kraynek et al., 2012). The average length of stay was monitored six months prior to implementation of a cuddling program as well as six months following the initiation of the program. In the first half of the study, from May 2009 to October 2009, the average length of stay for NAS infants was 26.2 days. This average was without the inclusion of a cuddling program. In the second half of the study, when a cuddler program was

introduced, the average length of stay was approximately 22.4 days, which is a reduction of 3.8 days. More recently, in 2019, an Ontario-based study also investigated the effectiveness of volunteer cuddling of NAS infants. This program was introduced in October 2015 and consisted of volunteers that were scheduled to be in the NICU for four hour shifts to ensure that there was at least one volunteer present each day of the week from 8:00 in the morning to 4:00 in the afternoon (Hignell et al., 2019). The average length of stay for NAS infants not involved within the cuddling program was 30.4 days compared to infants who did participate within the cuddling program, which was 24.0 days (Hignell et al., 2019). This is an average difference of 6.36 days, which demonstrates the effectiveness of introducing cuddling programs into NAS treatment protocols.

Not only are cuddling programs beneficial for the infants who are receiving care, but there are also benefits included that involve the parents as well as the infant's medical team. For NICU nurses, time needs to be efficiently utilized when providing specialized critical care for sick babies. In a world that is experiencing a consistent rise in prenatal drug usage, specifically, NICU care teams must be equipped to efficiently manage surges in NAS cases. When there are constant demands for specialized care, burnout rates among nurses skyrocket (Clubbs et al., 2019). Following implementation of cuddling programs, some of the stress and emotional exhaustion are removed from the demanding responsibilities of the nurses. Incorporating volunteer cuddlers into the treatment plans for NAS infants allows for other individuals to be involved with treatments instead of relying solely on nursing staff to attend to the newborn's around-the-clock needs, including the provision of human contact. While nurses are attending to addicted

newborns, other sick infants occupying space in the Neonatal Intensive Care Unit also require the attention and care of nursing staff. Consequently, the addicted infant is not receiving an adequate amount of human contact in order to benefit and advance the recovery process through withdrawal. Because hospital staff cannot solely focus attention and care to one sick infant, cuddling programs play an essential role in making sure that infants receive the high-quality care that will improve, and drastically shorten, their recovery times.

Methods

An additional component of this thesis project was to investigate the prevalence of volunteer-based cuddling programs across the United States. These data were compiled via independent online research in which Google searches were conducted to analyze the availability of cuddling programs across the country. These independent searches were combined with information gathered from an extensive, continuously updated list of hospitals across the country that offer programs. This list is compiled and maintained by pediatrician, Dr. Charlene Fernandez and is available through serenitychildren.com (Fernandez, 2020). The information was collected and assessed during the spring of 2020. Specific details on each program advertised by the state was not included within this assessment, and no photographs of cuddlers could be included as consent was not provided.

Results

Overall, the majority of states in the United States utilize cuddling programs.

Table 1.1 Summary of primary findings

Number of available cuddling programs	States
0	Hawaii, Wyoming, Mississippi
1	Arkansas, Maine, Minnesota, Nevada, North Dakota, South Dakota
2	Alaska, Connecticut, Delaware, Kansas, Missouri, Montana, New Mexico, Rhode Island, Utah
3	Alabama, Arizona, Idaho, Illinois, Nebraska, New Hampshire, Ohio, South Carolina, Vermont, Washington, West Virginia, Wisconsin
4	Indiana, Louisiana, Oklahoma, Oregon
≥ 5	California (17), Colorado (6), Florida (12), Georgia (5), Kentucky (5), Maryland (7), Massachusetts (8), Michigan (5), New Jersey (6), New York (8), North Carolina (5), Pennsylvania (13), Texas (8), Virginia (5)

Table 1.1, displays the number of cuddling programs that are available within each state in the United States. While Hawaii, Wyoming, and Mississippi currently lack cuddling programs, California, Florida, and Pennsylvania have the greatest number of offered cuddling programs with 17, 12, and 13 programs available in each state, respectively.

Recommendations

Even though the concepts of NAS and treatments associated with the condition are not abundantly researched, the effects of human contact on sick infants has been clearly demonstrated in medical case studies. Evidence that has been presented in those cases emphasize how powerful cuddling can be during the treatment process. One strategy that hospitals can employ to maximize the benefits of human contact for infants is the implementation of a volunteer-based cuddling program for NICU patients. Several requirements must be met before a volunteer-program can be introduced into clinical practice. One of the most important initial steps is obtaining consent. Cuddling programs require volunteers to directly interact with patients and/or families of those patients. Medical centers that introduce a volunteer-based cuddling program must obtain parental consent while ensuring already-established guidelines set forth by the medical provider. Consequently, all parents should be given the option to not allow their infant to participate in the cuddling program and should always be provided with an opt out option during involvement with the program. Providers that establish a cuddling program should also establish a structured method by which consent is obtained and documented, which also aligns with current practice policies. After consent has been obtained, the volunteer screening process can occur. Practices that consider implementing a cuddling program should also incorporate a screening process that serves to identify and choose the highest-quality volunteers that will participate in such a vital program. Some of the screening criteria that volunteers should be evaluated on include prior experience with handling newborns; comfort when handling premature infants; strong communication skills; reliability and enthusiasm; comfort levels in dealing with anxious and emotionally

exhausted families; and certain physical capabilities such as assessing the ability to remain seated for prolonged periods of time.

After designated volunteers have been determined, those participants would have to complete a training concerning the Health Insurance Portability and Accountability Act of 1996 (HIPAA), pass a background check, complete a test involving emergency hospital procedures and code situations, and be trained on proper safety boundaries and policies to prevent the spreading of further illness and disease to the vulnerable infants. As for the HIPAA certification, prospective volunteers should be provided with a test that not only asks questions concerning what types of information are protected by HIPAA's privacy rule, but also presents the individual with various scenarios that require knowledge of HIPAA policies by picking the best way to handle each situation that complies with HIPAA standards. In addition to successful completion of this test, volunteers should provide a signature on a confidentiality agreement, which clearly explains that volunteers must only utilize confidential information that is essential to carrying out job responsibilities, take reasonable precautions and follow the policies set forth by the medical provider, and never share confidential information with anyone who is unauthorized by the medical provider and involved parents. An additional test that must be administered to potential volunteers concerns the safety policies set forth by the medical facility. Volunteers should be tested on what various code situations can occur in a hospital, how to appropriately handle unsafe situations involving the hospital, in general, or with specific patients, and how to handle any natural disasters that may occur in the hospital area during a volunteer shift. Successful completion of a HIPPA regulations test, background check, and safety policies test are the three fundamental

criteria that must be met prior to implementing a cuddling program These guidelines are utilized during the volunteer-application process at Saint Joseph Hospital in Lexington, Kentucky.

Once volunteers are allowed to enter into a NICU, the next fundamental principle is that of controlling the spread of illnesses and infections. Upon arrival for each shift in the NICU, volunteers must sign a waiver that states there are currently no symptoms of any illnesses, even those associated with allergies. These waivers should require a signature and a date/time that indicates when the shift occurred in the event that NICU patients contract an illness that was brought in from the outside. If volunteers are ill with even allergies or slight colds, it is best that these individuals take the necessary precautions to take care of themselves and stay at home to prevent the spread of germs to infants who are already immunocompromised. Volunteers should be knowledgeable of set procedures regarding how to inform the appropriate person should an illness prevent the shift from being fulfilled. Additionally, upon arrival, before directly contacting any patients, volunteers should prioritize handwashing and be aware of the locations of hand sanitizer dispensers and handwashing facilities. To further prevent the spread of germs, cuddlers should wear gloves and smocks to minimize the skin-to-skin interactions between volunteers and patients. Throughout the entire duration of a shift, appropriate identification and/or ID badges should be worn without any obstructions.

Limitations

There were a few limitations associated with this study. Due to the global pandemic with COVID-19, the goals of this project had to be slightly modified. The data compiled

concerning the available cuddling programs across the United States are not conveyed in as much detail as was originally preferred. Additionally, the provided guidelines on how to introduce a cuddling program into a hospital are highly generalized and may not be suitable or appropriate for medical practices in all areas. A section that covers implementation plans for practices in widely various locations with diverse resource allocations may have allowed this study to be applicable to a greater amount of practices.

Significance/Implications for Future Research

Across the globe, there is an ongoing drug epidemic that is not only impacting the lives of adults, but also the lives of newborn infants that are victims of maternal drug usage during pregnancy. As mentioned throughout this project, there is a significant lack of research associated with Neonatal Abstinence Syndrome and methods by which this is treated without involving further medication exposure. Because maternal drug usage during pregnancy is an ever-growing issue, there have been several different proposed treatment options that highlight pharmacologic treatment mechanisms. After reviewing extant-reseach literature, it becomes clear that nonpharmacologic treatments are just as impactful as medication interventions and result in more benefits for not only the infant that is receiving treatment, but for the families and care teams of these infants, as well. One area in which current research is lacking concerns country-by-country breakdowns and, in the case of the United States, state-by-state analyses that explain why there are surges in cases of NAS infants. Detailed analyses would allow for the production of more specialized implementation plans for areas where there is demonstrated need for cuddling programs. Another area where research is significantly lacking involves how to achieve the goal of cuddling-involved treatment when immediate family members are not able to

be by the infant's bedside, and when nurses cannot set aside the time to focus on one child when others need care. This type of research might help to convince more medical practices to adopt and implement a volunteer-based cuddling program. Following implementation of such a program, nonpharmacologic approaches are promoted, families can have greater involvement in the treatments of the infants, average length of hospital stays are declined, incurred hospital charges are decreased, parental health is improved. These benefits demonstrate the need for more therapies focused on nonpharmacologic methods. One way to satisfy this need, as well as provide the aforementioned benefits, is implementing a volunteer-based cuddling program. Every day, there is another story in the news that mentions the usage of drugs in some fashion, but rarely are the tiniest victims of this epidemic mentioned. Better treatment protocols concerning the care of born-addicted infants need to be established and put into practice.

Works Cited

American Academy of Pediatrics. 2015. The Apgar score. Pediatrics [internet]. [cited 2020 Apr 19]; 136(4):819-822. DOI: https://pediatrics.aappublications.org/content/136/4/819.

Anbalagan S, Mendez MD. 2020. Neonatal abstinence syndrome [internet]. [cited 2020 Apr 19]. Accessed from https://www.ncbi.nlm.nih.gov/books/NBK551498/.

Baer RJ, Chambers CD, Ryckman KK, Oltman SP, Rand L, Jelliffe-Pawlowski LL. 2017. Risk of preterm birth by subtype for mothers with drug use during pregnancy by subtype for mothers with drug use during pregnancy. Am J Obstet Gynecol [internet]. [cited 2020 Apr 19]; 216(1): S192-S193. DOI: https://doi.org/10.1016/j.ajog.2016.11.572.

CDC. 2020. Pregnancy data and statistics [internet]. [cited 2020 Apr 18]. Accessed from https://www.cdc.gov/pregnancy/opioids/data.html.

Chiang KV, Okoroh EM, Kasehagen LJ, Garcia-Saavedra LF, Ko JY. 2019. Standardization of state definitions for neonatal abstinence syndrome surveillance and the opioid crisis. Am J Public Health [internet]. [cited 2020 Apr 19]; 109(9): 1193-1197. DOI: 10.2105/AJPH.2019.305170.

Clubbs, BH, Barnette AR, Gray N, Weiner L, Bond A, Harden J, Pineda R. 2019. A community hospital NICU developmental care partner program: feasibility and association with decreased nurse burnout without increased infection rates. Adv neonatal care [internet]. [cited 2020 Apr 20]; 19(4): 311-320. DOI: 10.1097/ANC.0000000000000600.

Fernandez C. How to volunteer to cuddle babies [internet]. [cited 2020 Apr 20]. Accessed from: https://serenitychildren.com/volunteer-to-hold-and-cuddle-nicu-babies/.

Grisham LM, Stephen MM, Coykendall MR, Kane MF, Maurer JA, Mohammed Y. 2019. Eat, sleep, console approach: a family-centered model for the treatment of neonatal abstinence syndrome. Adv in Neonatal Care [internet]. [cited 2020 Apr 19]; 19(2): 138-144. DOI: 10.1097/ANC.0000000000000581.

Grossman MR, Berkwitt AK, Osborn RR, Xu Y, Esserman DA, Shapiro ED, Bizzarro MJ. 2017. An initiative to improve the quality of care of infants with neonatal abstinence syndrome. Pediatrics [internet]. [cited 2020 Apr 19]; 139(6): e1-e8. DOI: https://doi.org/10.1542/peds.2016-3360.

Haight SC, Ko JY, Tong VT, Bohm MK, Callaghan WM. 2018. Opioid use disorder documented at delivery hospitalization-United States, 1999-2014. Weekly [internet]. [cited 2020 Apr 18]; 67(31): 845-849. DOI: http://dx.doi.org/10.15585/mmwr.mm6731a1.

Henning A, Krawiec C. 2020. Sinus tachycardia [internet]. [cited 2020 Apr 18]. Accessed from https://www.ncbi.nlm.nih.gov/books/NBK553128/.

Hignell A, Carlyle K, Bishop C, Murphy M, Valenzano T,Turner S, Sgro M. 2019. The infant cuddler study: evaluating the effectiveness of volunteer cuddling in infants with neonatal abstinence syndrome. Pediatrics & Child Health [internet]. [cited 2020 Apr 20]; 1-5. DOI: doi: 10.1093/pch/pxz127.

Holmes AV, Atwood EC, Whalen B, Beliveau J, Jarvis JD, Matulis JC, Ralston SL. 2016. Rooming-in to treat neonatal abstinence syndrome: improved family-

centered care at lower cost. Pediatrics [internet]. [cited 2020 Apr 19]; 137(6): e1-e9. DOI: 10.1542/peds.2015-2929.

Jannson LM, Velez M, Harrow C. 2009. The opioid exposed newborn: assessment and pharmacologic management. J Opioid Manag [internet]. [cited 2020 Apr 19]; 5(1): 47-55. Accessed from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2729086/#__ffn_sectitle.

Jones H, Santamaria N. 2018. Physiological benefits to parents from undertaking skin-to-skin contact with their neonate, in a neonatal intensive special care unit. Scandinavian J of Caring Sciences [internet]. [cited 2020 Apr 19]; 32(3): 1012-1017. DOI: http://dx.doi.org.libproxy.eku.edu/10.1111/scs.12543.

Kocherlakota P. 2014. Neonatal abstinence syndrome. Pediatrics [internet]. [cited 2020 Apr 18]; 134(2): 547-561. DOI: 10.1542/peds.2013-3524.

Kraft WK, Stover MW, Davis JM. 2016. Neonatal abstinence syndrome: pharmacologic strategies for the mother and infant. Semin Perinatol [internet]. [cited 2020 Apr 18]; 40(3): 203-212. DOI: 10.1053/j.semperi.2015.12.007.

Kraynek MC, Patterson M, Westbrook C. 2012. Baby cuddlers make a difference. J of Obstet, Gynecol, and Neona Nurs [internet]. [cited 2020 Apr 20]; 41(1): S45. DOI: https://doi.org/10.1111/j.1552-6909.2012.01360_25.x.

MacMillan KD, Rendon CP, Holmes AV. 2018. Association of rooming-in with outcomes for neonatal abstinence syndrome. JAMA Pediatr [internet]. [cited 2020 Apr 19]; 172(4): 345-351. DOI: 10.1001/jamapediatrics.2017.5195.

March of Dimes. 2014. Common conditions treated in the NICU [internet]. [cited 2020 Apr 18]. Accessed from https://www.marchofdimes.org/complications/common-conditions-treated-in-the-nicu.aspx.

March of Dimes. 2017. Common NICU equipment [internet]. [cited 2020 Apr 18]. https://www.marchofdimes.org/complications/common-nicu-equipment.aspx.

March of Dimes. 2018. Preterm labor and premature birth: are you at risk? [internet]. [cited 2020 Apr 2019]. Accessed from https://www.marchofdimes.org/complications/preterm-labor-and-premature-birth-are-you-at-risk.aspx#.

March of Dimes. 2019. Neonatal abstinence syndrome [internet]. [cited 2020 Apr 18]. Accessed from https://www.marchofdimes.org/complications/neonatal-abstinence-syndrome-(nas).aspx#.

Moman RN, Gupta N, Varacallo M. 2020. Physiology, albumin [internet]. [cited 2020 Apr 19]. Accessed from https://www.ncbi.nlm.nih.gov/pubmed/29083605.

Park S, Khattar D. 2019. Tachypnea [internet]. [cited 2020 Apr 19]. Accessed from https://www.ncbi.nlm.nih.gov/books/NBK541062/.

Gomez-Pomar, E, Finnegan LP. 2018. The epidemic of neonatal abstinence syndrome, historical references of its' origins, assessment, and management. Front Pediatr [internet]. [cited 2020 Apr 19]; 6: 33. DOI: 10.3389/fped.2018.00033.

Rahi E, Baneshi MR, Mirkamandar E, Maghsoudi SH, Rastegari A. 2011. A comparison between APGAR scores and birth weight in infants of addicted and non-addicted

mothers. Addiction & Health [internet]. [cited 2020 Apr 19]; 3(1/2): 61-67. Accessed from https://web-b-ebscohost-com.libproxy.eku.edu/ehost/detail/detail?vid=5&sid=60f49ce9-37b0-4724-9598-17cd4b33acfd%40pdc-v-sessmgr03&bdata=JkF1dGhUeXBlPWlwJnNpdGU9ZWhvc3QtbGl2ZSZzY29wZT1zaXRl#AN=83447885&db=a9h.

Reynolds LC, Duncan MM, Smith GC, Marthur A, Neil J, Inder T, Pineda RG. 2013. Parental presence and holding in the neonatal intensive care unit and associations with early neurobehavior. J of perinatology [internet]. [cited 2020 Apr 19]; 33: 636-641. DOI: https://doi.org/10.1038/jp.2013.4.

Sachdeva P, Patel BG, Patel BK. 2009. Drug use in pregnancy; a point to ponder! Indian J Pharm Sci [internet]. [cited 2020 Apr 19]; 71(1): 1-7. DOI: 10.4103/0250-474X.51941.

Siu A, Robinson CA. 2014. Neonatal abstinence syndrome: essentials for the practitioner. J Pediatr Pharmacol Ther [internet]. [cited 2020 Apr 19]; 19(3): 147-155. DOI: 10.5863/1551-6776-19.3.147.

Wachman EM, Werler MM. 2019. Pharmacologic treatment for neonatal abstinence syndrome: which medication is best? JAMA Pediatr [internet]. [cited 2020 Apr 18]; 173(3): 221-223. DOI: 10.1001/jamapediatrics.2018.5029.

Wachman EM, Grossman M, Schiff DM, Philipp BL, Minear S, Hutton E, Saia K, Nikita F, Khattab A, Nolin A, Alvarez C, Barry K, Combs G, Stickney D, Driscoll J, Humphreys R, Burke J, Farrell C, Shrestha H, Whalen BL. 2018. Quality

improvement initiative to improve inpatient outcomes for neonatal abstinence syndrome. J perinatology [internet]. [cited 2020 Apr 19]; 38: 1114-1122. DOI: https://doi.org/10.1038/s41372-018-0109-8.