

## Commentary

# Maternal Opioid Abuse and Neonatal Abstinence Syndrome in the United States

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### **Abstract**

*In the past decade, the United States has experienced an increase in deaths related to nonmedical and medical opioid overdose. This is due to a number of factors including an increase in recreational opioid use, and the over prescription of opioids for various conditions such as during pregnancy, injury, and illness. The over utilization of opioids during pregnancy in the United States has led to an increase in adverse neonatal birth outcomes including poor fetal growth, preterm birth, stillbirth, neonatal abstinence syndrome in neonates, and an increase in maternal mortality among mothers. These are dire consequences that should not be ignored. This paper discusses opioid abuse during pregnancy and its effects on neonates in the United States. It also discusses some challenges associated with the diagnosis of neonatal abstinence syndrome and provides recommendations for addressing the issue. Additionally, it discusses what mothers can do to prevent neonatal abstinence syndrome.*

### **Keywords**

*Neonates, neonatal abstinence syndrome, opioids abuse, prescription opioids, pregnant women*

### **1. Introduction**

The current abuse, over prescription, and addiction to opioids such as prescription pain relievers (codeine, morphine, oxycodone), and synthetic opioids (fentanyl) in the United States (US), has become a serious national public health issue, as well as an economic burden, costing the nation about \$78.5 billion a year in healthcare costs, lost productivity, addiction treatment, and criminal justice involvement (National Institute of Drug Abuse, 2020).

The medical prescription of opioids in the US began in the late 1990s when pharmaceutical companies reassured the medical community that patients would not become addicted to prescription opioids (US Department of Health and Human Services, 2019). As a result, healthcare providers began to prescribe

these medications frequently and at great rates until it became apparent that they were highly addictive (US Department of Health and Human Services, 2019). In 2012 alone, US healthcare providers wrote over 259 million opioid prescriptions (Mascola, Borders, & Terplan, 2017; Babb, Koren, & Einarson, 2010) for injuries and pain relief after surgery (Mascola, Borders, & Terplan, 2017). The trend of prolific opioid prescriptions caught the attention of the US Department of Health and Human Services, and in 2016, it declared opioid abuse a public health emergency (US Department of Health and Human Services, 2019). To date, over 47,000 people have died from overdosing on opioids, and in 2018 alone, over 10 million people, including pregnant women, abused prescription opioids (US Department of Health and Human Services, 2019).

Given their medical condition, doctors may put women on opioids while pregnant. Unfortunately, some women abuse the medications (March of Dimes, 2019). The abuse of opioids during pregnancy has led to an increase in adverse neonatal birth outcomes and particularly to a fivefold increase in neonatal abstinence syndrome (NAS) – rising from 1.2 per 1000 hospital births to 5.8 per 1000 hospital births in the past decade (Reddy, Davis, Ren, & Greene, 2017). This paper discusses opioid abuse during pregnancy, and its effects on neonates in the United States. It also discusses some challenges associated with the diagnosis of NAS and provides recommendations for addressing the issue. Additionally, it discusses what mothers can do to reduce or prevent neonatal abstinence syndrome.

## **2. Maternal Opioid Abuse in the US**

Opioid abuse during pregnancy in the US has significantly increased and parallels the national opioid epidemic statistic (US Department of Health and Human Services, 2019). Data from a 2007 study indicates that 23 percent of women who were enrolled in Medicaid programs in 46 states in the US filled a prescription for opioids while pregnant (Desai, Hernandez-Diaz, Bateman, & Huybrechts, 2014). Another study evaluating antepartum maternal opiate use in the US found that opioid usage among pregnant women increased from 1.19 per 1000 births to 5.63 per 1000 births from 2000 to 2009 (Patrick, Schumacher, Benneyworth, Krans, McAllister, & Davis, 2012).

According to the Centers for Disease Control and Prevention (CDC), between 2008 and 2012, 28 percent of women of reproductive age (15-44 years) who had access to private insurance, filled a prescription for an opioid medication (Centers for Disease Control and Prevention, 2019). An analysis of prescription claims made by women enrolled in the Tennessee Medicaid program showed that 29 percent of pregnant women filled a prescription for an opioid pain reliever between 1995 and 2009 (Yazdy, Desai, & Brogly, 2015). Opioid prescriptions for pregnant women enrolled in commercial insurance plans also saw an increase of about 14 percent between 2005 and 2011 (Yazdy, Desai, & Brogly, 2015). These reports underscore the risk for expectant mothers to become dependent on opioids. Pregnant women who abuse opioids risk exposing their unborn babies to the harmful effects of opiates.

### 3. Maternal Opioid Abuse Characterization and Risk Factors

Since 1999, opioid abuse in the US has quadrupled, resulting in about 78 deaths per day (Metz, Brown, Martins, & Palamar, 2018). It has also resulted in an increase in the number of neonates born with NAS (Metz, Brown, Martins, & Palamar, 2018). NAS is a drug withdrawal syndrome in infants born to women who engage in chronic use of opioids during pregnancy (March of Dimes, 2019). It is said to manifest within the first 48 to 72 hours after birth and can persist for up to 4 weeks in some infants. According to available literature, NAS prevalence is higher among infants born to women of reproductive age and especially among White women, although infants born to African American women are most at risk. Two recent studies sponsored by the National Institute on Drug Abuse (NIDA) found that male infants had higher rates of NAS than females, and that the condition was most severe in male infants whose mothers were on buprenorphine when pregnant. It is unclear why males are more impacted. In addition to rural-urban differences in NAS cases, data from 28 states show that NAS incidence increased by 300 percent (from 1.5 to 6.0 cases per 1,000 hospital births) from 1999 to 2013 in the US, with significant increases in 25 of 27 states that had data for the last three years (Ko, Patrick, Tong, Patel, Lind, & Barfield, 2016). In 2013, Ko et al. (2016) found variations in NAS incidence rates; ranging from 0.7 per 1,000 births in Hawaii, to 33.4 per 1,000 births in West Virginia. From 2000 to 2013, NAS prevalence in South Carolina increased from 0.9 per 1000 live births, to 3.9 per 1000 live births (Ko, Patrick, Tong, Patel, Lind, & Barfield, 2016). These variations may be due to state differences in opioid prescription rates, prevalence of opioid abuse, or how ICD-9 codes were used. Hospital costs associated with NAS have risen incrementally, jumping from \$732 million in 2009, to \$1.5 billion in 2012 (Metz, Brown, Martins, & Palamar, 2018).

Risk factors commonly associated with opioid abuse and addiction among pregnant women include past or current substance abuse, young age, social or family environment (Webster, 2017), and the utilization of opioids to manage pain (Centers for Disease Control and Prevention, 2019). A study utilizing data from the National Survey on Drug Use and Health (NSDUH) to characterize drug use among pregnant women between the ages of 18-44 years in the US who reported nonmedical opioid use and or other non-opioid illegal drug use within the past year, showed that 36.8 percent of participants used opioids only, 28.2 percent were opioid polydrug users, and 35.0 percent were users of other illegal drugs (Metz, Brown, Martins, & Palamar, 2018). Results from the study also showed that majority of the participants who engaged in opioid use were White (67.6 percent), and unmarried (66.2 percent) (Metz, Brown, Martins, & Palamar, 2018). About 46 percent of participants identified as current cigarette smokers, and 21.7 percent reported alcohol use within the past month (Metz, Brown, Martins, & Palamar, 2018).

### 4. Fetal Opioid Exposure Effects

Fetal exposure to chronic maternal opioid abuse has been associated with a plethora of complications in the short and long term. These complications include pre-term birth, low birth weight, seizures, poor

cognition and developmental skills, birth defects, sudden infant death syndrome (SIDS), jaundice, vision problems that can lead to glaucoma and blindness (March of Dimes, 2019), and fetal dependency on opioids (Villa, 2019). Some of these complications are discussed in this section.

#### *4.1 Pre-term Birth and Low Birthweight*

The majority of neonates that have NAS are born preterm (<37 weeks gestation) and have higher rates of low birth weight (<2500 grams) compared with children not born with the condition (Lind et al., 2015). According to Allocco et al. (2016), about 20 to 40 percent of neonates exposed to methadone in utero, are delivered pre-term compared to 11 percent in the general population. Low birth weight neonates with NAS are poor feeders due to their inability to suck and take in breastmilk, and due to gastrointestinal dysfunctions such as diarrhea and regurgitation (Corr, Schaefer, & Paul, 2018). Neonates born with NAS need to be adequately fed in order to alleviate other symptoms associated with NAS and to prevent further weight loss. The utilization of a regular feeding schedule or a temporary gastric tube can help to improve upon neonate feeding and body weight (Kuschel, 2007).

#### *4.2 Seizures, Cognition and Developmental Skills*

When women abuse opioids during pregnancy, harmful compounds cross the fetal blood-brain barrier of the fetus and later cause neonates to experience a combination of tremors, jitters, and seizures (Palla, Khan, Haghghat, & Bada, 2019). The seizures are the result of neurotransmitter dysfunction in the brain (Palla, Khan, Haghghat, & Bada, 2019) and manifest in about 2-11 percent of neonates with NAS (Palla, Khan, Haghghat, & Bada, 2019). The seizures associated with NAS may persist for as long as two weeks (Palla, Khan, Haghghat, & Bada, 2019). To confirm seizure in neonates, an electroencephalogram is required. This test records brain activity and is typically noninvasive to the neonate (Palla, Khan, Haghghat, & Bada, 2019).

Additional effects of maternal opioid abuse on neonates include abnormal motor patterns during toddlerhood, difficulty paying attention (Logan, Brown, & Hayes, 2013), cognitive deficits, poor emotional and social skills, and impulsivity later in life (Nygaard, Slinning, Moe, & Walhovd, 2016). In their study of children aged 4.5 to 8.5 years, Nygaard et al. (2016) found that children exposed to opioids during pregnancy, had more regulatory problems, especially with attention, internalized anxiety, depression, and externalized aggression than their non-exposed peers.

## **5. NAS Diagnosis Challenges and Recommendations**

Increased risk of NAS among newborns is a growing public health issue that needs to be addressed.

### *5.1 Surveillance and Case Reporting*

NAS surveillance systems have the ability to collect data on suspected NAS cases and trends (Jilani et al., 2019), and to identify maternal opioid use prior to and during pregnancy (Moore & McCabe, 2015). However, there is currently no standardized way of collecting such data across medical institutions and health care providers in the US (Jilani et al., 2019). Variations in the diagnosis and reporting of NAS cases have made data accuracy and reliability an issue. Most published NAS estimates in the country are

based on international classification of diseases (ICD), Clinical Modification (CM) diagnosis codes, specifically CD-9-CM or ICD-10-CM diagnosis codes from hospital discharge data that usually do not have case confirmations (Lind et al., 2019).

Each state in the US has its own criteria for defining and reporting NAS cases (Jilani et al., 2019). With no universally accepted case definition in place, state hospitals report NAS cases based on their own definitions. For example, Georgia's NAS case definition focuses on asymptomatic infants with positive toxicology tests (and must be reported to the state health department) (Lind et al., 2019) while Virginia's definition focuses on postnatal withdrawal syndrome primarily caused by maternal opiate use (and does not have to be reported) (Lind et al., 2019). Additionally, state laws vary when it comes to determining the required time frame for case reporting - it ranges from cataloging incidence at the time of diagnosis, to within 6 months after diagnosis (Jilani et al., 2019). The lack of a clear standard federal definition for NAS, results in some states reporting more cases than other states.

A standardized case definition of NAS coupled with consistent and structured hospital reporting guidelines are needed across the US. These will facilitate meaningful NAS comparisons between states, target prevention efforts to areas of greatest need, provide opportunities for prevention, and help to facilitate linkages to care for infants and mothers (Jilani et al., 2019). With more accurate reporting of NAS incidence, health systems and health care providers will be able to ensure that adequate resources are available to address the immediate and potential long-term needs of children born with NAS. Establishing a federal guideline and criteria for case reporting will ensure that each state is held accountable and not left to their private interpretation.

### *5.2 Routine Screening after Birth*

Several guidelines have been established to properly assess and treat babies with NAS. The need for continuous screening after birth is determined by the severity of the condition. For full term neonates, several scoring scales have been developed including the Finnegan Neonatal Abstinence Scoring System (Finnegan Scale), The Lipsitz Neonatal Drug-Withdrawal Scoring System, The Neonatal Withdrawal Inventory, and the Neonatal Narcotic Withdrawal Index (Jansson, Velez, & Harrow, 2009). The most frequently used scoring system is the Finnegan Scale (Jansson, Velez, & Harrow, 2009). This scale assesses 21 of the most common signs of NAS and requires neonates to be assessed every 2-4 hours (Schiff & Grossman, 2019). A score over 8 on this scale requires a transfer of neonates to the neonatal intensive care unit and separation from their mother (Schiff & Grossman, 2019). Although the Finnegan Scale is the most used tool by neonatal caregivers, the scale is complex and can be inconsistent among scorers (Timpson, Killoran, Maranda, Picarillo, & Bloch-Salisbury, 2018). Due to its limitations, it is important for health care providers in the US to use other methods like the Eat, Sleep, Console (ESC) approach to screen for NAS, which unlike the Finnegan Scale focuses more on maximizing non-pharmacological treatments before beginning medication cycles and comprises only three simple components for assessment (Anbalagan, 2020).

## 6. Maternal Role in NAS Prevention

Women planning to become pregnant must make an intentional decision to stop abusing opioids. Women who become pregnant and are still addicted to opioids can reduce the chances of their newborns getting NAS by doing a number of things. First, since a sudden stoppage of opioid use can lead to preterm labor, fetal distress, or miscarriage, these women need to work with their health care providers to come up with a plan that allows them to gradually wean themselves off opioids while pregnant (CDC, 2020). Second, these women can seek methadone or buprenorphine treatment. These two medications have the tendency to lower NAS incidence by 10 percent and increase gestational age, weight and head circumference at birth. While buprenorphine treatment helps, it must be noted that it does not totally prevent NAS (NIAD, 2018).

## 7. Conclusion

Chronic opioid abuse among women during pregnancy has resulted in adverse birth outcomes including increased NAS cases among neonates in the US. Establishing a standardized case definition, and putting in place mechanisms to monitor, screen and report on NAS cases are necessary to address the challenges associated with diagnosis. Women can also take certain steps prior to or during pregnancy to prevent or reduce NAS cases.

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