The Impact Of Opioid Addiction On Maternal And Neonatal Health: A Comprehensive Approach To Care In Community And Intensive Care Settings, And The Pharmacological Interventions

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Abstract

Opioid addiction constitutes a significant public health concern in the U.S., particularly impacting pregnant women and driving increased consumption among women of reproductive age. This study outlines evidence-based frameworks to support nursing practices, identifies critical knowledge gaps, and emphasizes the necessity of a multidisciplinary approach to maternal and neonatal health.

Method

This study employs a quantitative, non-experimental, correlational design to examine the impact of opioid addiction on maternal and neonatal health outcomes, including an analysis of pharmacological interventions. The research focuses on a convenience sample of 150 pregnant women with opioid use disorder (OUD) and their newborns, drawn from community and neonatal intensive care environments. Data collection, conducted over a 12-month period, involved retrospective medical record reviews and structured interviews covering demographic and clinical factors.

Results

Prolonged maternal opioid consumption was significantly associated with reduced gestational age and lower birth weights, elevated Finnegan Neonatal Abstinence Scoring System (FNASS) scores, extended hospitalizations, and higher neonatal medication dosages; notably, it did not correlate with Apgar scores. Among the substances studied, fentanyl exposure led to the most adverse neonatal outcomes. Conversely, prescription opioids and illicit methadone were correlated with higher birth weights and less severe cases of Neonatal Abstinence Syndrome (NAS). While NICU admission was associated with improved Apgar ratings, it also correlated with more severe NAS and prolonged hospital stays, underscoring the need for rigorous surveillance. Furthermore, the specific type of opioid showed a substantial correlation with socioeconomic status, administration route, prenatal care quality, delivery mode, medication-assisted treatment (MAT) regimens, and depression severity, indicating distinct risk profiles for each substance category.

Conclusion

The study underscores the urgent necessity for integrated prenatal interventions and comprehensive mental health support for this population; furthermore, it advocates for continued research to address existing knowledge gaps and refine clinical treatment methodologies.

Keywords: Maternal opioid use disorder, Prenatal opioid exposure, Neonatal abstinence syndrome (NAS), Neonatal opioid withdrawal syndrome (NOWS), Finnegan Neonatal Abstinence Scoring System (FNASS)

Introduction

Opioid addiction remains a critical public health crisis in the U.S., characterized by rising dependence among pregnant women and a corresponding surge in misuse among women of reproductive age (Goetz et al., 2021). This complex disorder poses persistent health risks to women, their pregnancies, and their newborns (McNestry et al., 2023). However, significant progress has been made in understanding substance use disorders (SUDs) and opioid use disorder (OUD) during pregnancy, leading to the development of evidence-based nursing and pharmacological strategies designed to mitigate these risks (Sanjanwala et al., 2023).

Opioid dependence during pregnancy leads to various adverse outcomes, necessitating targeted nursing interventions (Auerbach et al., 2021). Prenatal opioid use is strongly correlated with obstetric complications—such as preterm birth and low birth weight—as well as co-occurring substance use and psychiatric disorders that further compromise maternal health (Kitsantas et al., 2021). Furthermore, the stigma surrounding substance use often deters women from seeking essential prenatal care, thereby exacerbating risks to both maternal and neonatal health (Weber et al., 2021). Beyond clinical outcomes, maternal opioid use can impair parenting capacity, increasing the risk of neglect and abuse for substance-exposed children (Barry et al., 2021).

Neonatal opioid exposure leads to Neonatal Abstinence Syndrome (NAS) and significantly increases the risk of prematurity and low birth weight (Barry et al., 2021). Consequently, early identification and management of pregnant women with opioid use disorder are vital, highlighting the critical role of universal screening (Weber et al., 2021). Furthermore, continuous monitoring of neonatal growth parameters and longitudinal neurodevelopmental assessments are essential for the early detection of complications, particularly given the persistent long-term effects of prenatal exposure (Davis et al., 2023).

Pharmacological treatment during pregnancy predominantly involves agonist or antagonist therapies, with methadone and buprenorphine serving as the gold-standard medications. These therapies aim to alleviate withdrawal symptoms and stabilize maternal health, while incorporating considerations for postpartum breastfeeding (Suarez et al., 2022). Nurses are integral to this management process, providing essential assessments, coordinating care, and educating patients on the risks associated with opioid use (Schiff et al., 2022). Furthermore, interprofessional collaboration is vital to addressing the multifaceted needs of this population, supplemented by non-pharmacological and community-based interventions that provide additional layers of support (Oyovwi & Faith, 2024).

Community care models are essential for enhancing treatment access for pregnant individuals facing addiction. Initiatives prioritizing timely intervention reflect a commitment to reducing stigma, securing support services, and connecting mothers with appropriate care (Aidoo, 2024). In intensive care settings, specialized management is required to address the heightened emotional and physiological challenges present during the reproductive cycle. A nuanced understanding of the intersection between SUDs and reproductive health is critical for identifying patient-specific needs (Ramlakhan et al., 2021). Ultimately, the reproductive cycle presents a unique window of opportunity for intervention to mitigate opioid dependence and improve maternal and neonatal outcomes (Corsi & Murphy, 2021). This study outlines evidence-based frameworks to support nursing practices, identify knowledge gaps, and emphasize the necessity of a multidisciplinary approach to maternal and neonatal health.

Materials and Methods

Research Design

This research employs a quantitative, non-experimental, correlational methodology to examine the effects of opioid addiction on maternal and neonatal health outcomes. Additionally, the study incorporates a descriptive component to elucidate the pharmacological implemented across community and intensive care environments.

Participants and Setting

The study utilizes a convenience sample of 150 pregnant women diagnosed with opioid use disorder (OUD) and their newborns. Participants are recruited from two distinct environments: community-based treatment centers and neonatal intensive care units (NICUs).

- **Community Setting:** A local outpatient prenatal clinic providing medication-assisted treatment (MAT) and comprehensive psychosocial support for pregnant women with OUD.

- **Intensive Care Setting:** A neonatal intensive care unit (NICU) specializing in the management and care of infants diagnosed with Neonatal Abstinence Syndrome (NAS).

Inclusion and Exclusion Criteria

To ensure a focused study population, the following criteria were established:

- **Maternal Inclusion Criteria:** Participants must have a confirmed diagnosis of OUD and be at least 20 weeks into their gestation period.

- **Neonatal Inclusion Criteria:** Neonates must be born to mothers who meet the aforementioned maternal inclusion criteria.

- **Maternal Exclusion Criteria:** Individuals with documented polysubstance use—with the exceptions of tobacco and marijuana—or other significant medical comorbidities was excluded to minimize confounding variables.

Data Collection

Data was collected using a dual-method approach: retrospectively through medical record reviews and prospectively via structured interviews and clinical observations. The data collection phase was spaned a 12-month period and was encompass the following variables:

- **Maternal Health Data:**

    o Demographics (age, race, socioeconomic status)

    o Type, duration, and route of opioid use

    o Prenatal care adherence

    o Comorbidities (e.g., Hepatitis C, HIV)

    o Maternal pharmacological interventions (e.g., methadone, buprenorphine)[2]

    o Obstetric outcomes (e.g., preterm birth, mode of delivery)

- **Neonatal Health Data:**

    o Birth weight, Apgar scores, and head circumference

    o Length of hospital stay

    o Severity of NAS, measured by the Finnegan Neonatal Abstinence Scoring System (FNASS)

    o Neonatal pharmacological interventions (e.g., morphine, methadone)

    o Feeding difficulties and other clinical symptoms of withdrawal

- **Pharmacological Intervention Data:**

  o Dosage and duration of pharmacological treatments for mothers and neonates

  o Duration of tapering schedules for neonates

Statistical Analysis

Descriptive statistics—including frequencies, percentages, means, and standard deviations—was used to summarize the demographic and clinical characteristics of the sample. Pearson's correlation coefficients was employed to assess the relationships between maternal opioid use characteristics and neonatal outcomes, such as the severity of NAS and length of stay. Additionally, independent samples t-tests was utilized to compare outcomes between community and intensive care settings. Multiple regression analysis was conducted to identify predictors of neonatal outcomes while controlling for potential confounding variables. All statistical analyses was performed using SPSS software, with the level of statistical significance established at $p < 0.05$.

Ethical Considerations

This study has received approval from the Institutional Review Boards (IRBs) of Al-Azhar university (Assiut) under IRB code (RESEARCH./AZ.AST./FMT010/2/240/2/2025). all participating institutions. Written informed consent was obtained from all maternal participants prior to their enrollment. To safeguard patient confidentiality and privacy, all collected data was de-identified and stored securely. The risks to participants are categorized as minimal, as the study primarily involves the analysis of existing medical records and the conduct of non-invasive interviews.

Results

Table (1): Maternal Sociodemographic Characteristics (N=150)

Variable	Category	Study participants (n =150)	
		Frequency (n)	Percent (%)
Setting	Community	114	76.0%
	NICU	36	24.0%
Race/ Ethnicity	Arab	90	60.0%
	Caucasian	36	24.0%
	Asian	18	12.0%
	Other	6	4.0%
Socioeconomic Status	Low	72	48.0%
	Middle	48	32.0%
	High	30	20.0%
Maternal Age (years)	Min -max	20 – 39	
	Mean + SD	27.88 + 5.01	

"Table 1 outlines the baseline characterics of the study population. The majority of participants were recruited from a community setting (76%), were of Arab ethnicity (60%), and were identified as having low socioeconomic status (48%). The mean maternal age across the cohort was 27.9 years (SD = 5.01).

Table (2): Opioid Use Characteristics (N=150)

Variable	Category	Study participants (n =150)	
		Frequency (n)	**Percent (%)**
Opioid Type	Heroin	60	40.0%
	Prescription opioids	60	40.0%
	Fentanyl	12	8.0%
	Methadone (illicit)	12	8.0%
	Other	6	4.0%
Opioid Route	Oral	78	52.0%
	Intravenous	36	24.0%
	Inhalation	24	16.0%
	Unknown	12	8.0%
Opioid Duration (months)	Min -max	1 – 40	
	Mean + SD	34.04 + 4.9	

Heroin and prescription opioids were the most prevalent substances of use, each accounted for by 40% of the study participants. Regarding the route of administration, oral consumption was the most frequent (52%), followed by intravenous (IV) injection (24%). The duration of opioid use was notably prolonged, with a mean of 34 months, indicating a history of chronic dependence prior to or during the current pregnancy.

Table (3): Maternal Health Status and Treatment During Pregnancy

Variable	Category	Study participants (n =150)	
		Frequency (n)	**Percent (%)**
Prenatal Care Adherence	Poor	72	48.0%
	Good	42	28.0%
	Fair	36	24.0%
Comorbidities	None	114	76.0%
	Hepatitis C	30	20.0%
	Hep C + HIV	6	4.0%
Maternal Medication	Methadone	72	48.0%
	Buprenorphine	48	32.0%

	None	30	20.0%
Maternal Medication Dose (mg)	Min -max	5.8 - 114.0	
	Mean + SD	43.64 + 34.77	

Prenatal care adherence was suboptimal for a significant portion of the cohort, with nearly half (48%) demonstrating poor adherence. While the majority of mothers had no recorded comorbidities (76%), Hepatitis C was the most prevalent co-occurring condition (20%). Regarding pharmacological management, 80% of the participants were receiving medication-assisted treatment (MAT), with methadone being the most frequently prescribed therapy (48%). The mean maternal medication dose was 43.6 mg; however, the range was extensive (5.8 to 114.0 mg), reflecting highly individualized dosing protocols.

Table (4): Obstetric and Birth Outcomes

Variable	Category	Study participants (n =150)	
		Frequency (n)	**Percent (%)**
Obstetric Outcome	Term	114	76.0%
	Preterm	36	24.0%
Mode of Delivery	Vaginal	102	68.0%
	Cesarean	48	32.0%
Gestational Age (weeks)	Min -max	33.3 – 41.0	
	Mean + SD	38.12 +2.03	

The majority of births occurred at term (76%), while the preterm birth rate was 24%. Vaginal delivery was the predominant mode of delivery (68%). The mean gestational age for the cohort was 38.1 weeks, consistent with the high percentage of full-term pregnancies.

Table (5): Neonatal Clinical Outcomes and Management

Variable	N	Mean	Std. Deviation	Minimum	Maximum
Birth Weight (grams)	150	3034.56	701.14	901	4500
APGAR 1-min	150	7.60	1.36	4	10
APGAR 5-min	150	7.96	1.19	6	10
Head Circumference (cm)	150	33.59	1.72	29.5	36.7
Hospital Stay (days)	150	12.24	4.14	7	21
FNASS Peak Score	150	7.60	3.06	2	15
Neonatal Med Dose (mg)	54	0.055	0.077	0.018	0.270
Taper Duration (days)	54	14.56	5.95	5	27

Nursing Intervention Count	150	2.20	1.24	1	4

Neonatal outcomes demonstrated significant variability across the cohort. The mean birth weight was 3034.6 grams (range: 901 to 4500 grams), reflecting the diverse health status of the newborns. Apgar scores showed a moderate improvement from the 1-minute to the 5-minute assessment. The mean peak Finnegan Neonatal Abstinence Scoring System (FNASS) score was 7.6, while the average hospital stay was 12.2 days. A subset of 54 infants (36%) required pharmacological intervention for withdrawal, with a mean medication dose of 0.055 mg and a mean taper duration of 14.6 days. On average, infants received 2.2 specific nursing interventions during their hospitalization.

Table (6): Correlation between Maternal Opioid Duration with Neonatal Outcomes

Variable	Opioid Duration	
	R	P- value
Gestational Age	-0.285**	0.001**
Birth Weight	-0.179*	0.001**
APGAR 1-min	0.047	0.328
APGAR 5-min	-0.026	0.413
Hospital Stay	-0.254**	0.001**
FNASS Peak	-0.266**	0.001**
Neonatal Medication Dose	-0.291*	0.001**

A longer duration of maternal opioid use demonstrated statistically significant negative correlations with several key neonatal outcomes.1 Specifically, prolonged exposure was associated with lower gestational age (r = -0.XX, p < .05), reduced birth weight, and extended hospital stays. Furthermore, it correlated with higher peak FNASS scores and increased neonatal medication requirements. Notably, no significant correlation was observed between the duration of opioid use and Apgar scores at either the 1-minute or 5-minute assessments.

Table (7): Comparison of Neonatal Outcomes by Admission Setting (Community vs. NICU)

Variable	Community (Mean ± SD)	NICU (Mean ± SD)	p-value
Birth Weight (g)	3012.47 ± 793.08	3104.50 ± 235.60	.494
APGAR 1-min	7.32 ± 1.22	8.50 ± 1.40	<.001
APGAR 5-min	7.79 ± 1.06	8.50 ± 1.40	.002
Head Circumference (cm)	33.74 ± 1.78	33.13 ± 1.44	.066
Hospital Stay (days)	10.05 ± 1.40	19.17 ± 1.23	<.001
FNASS Peak Score	6.84 ± 2.73	10.00 ± 2.81	<.001
Neonatal Med Dose (mg)	0.029 ± 0.011	0.076 ± 0.099	.025

Neonates admitted to the NICU exhibited significantly higher Apgar scores at the 1-minute and 5-minute intervals compared to those managed in community settings. However, the NICU cohort demonstrated more severe Neonatal Abstinence Syndrome (NAS), characterized by significantly elevated peak FNASS scores and increased neonatal medication requirements. Consequently, the NICU group required a substantially longer mean hospital stay. Notably, no statistically significant differences in birth weight or head circumference were observed between the two groups.

Table (8): Neonatal Outcomes by Type of Maternal Opioid Use

Variable	Opioid Type	N	Mean	Std. Deviation	p-value (Sig.)
Birth Weight (g)	Heroin	60	2897.50	737.03	0.007
	Prescription	60	3170.40	714.81	
	Fentanyl	12	2496.00	254.85	
	Illicit Methadone	12	3148.00	21.93	
Head Circumference (cm)	Heroin	60	33.31	2.14	<0.001
	Prescription	60	33.11	1.08	
	Fentanyl	12	35.10	0.10	
	Illicit Methadone	12	34.70	0.73	
Hospital Stay (days)	Heroin	60	11.40	3.67	0.002
	Prescription	60	13.10	4.63	
	Fentanyl	12	15.50	3.66	
	Illicit Methadone	12	10.50	1.57	
FNASS Peak Score	Heroin	60	7.40	2.90	0.010
	Prescription	60	7.50	3.44	
	Fentanyl	12	10.50	1.57	
	Illicit Methadone	12	7.00	2.09	

The specific type of opioid utilized by the mother demonstrated a statistically significant association with various neonatal outcomes. Infants with prenatal exposure to fentanyl exhibited the lowest mean birth weight, the largest head circumference, the most prolonged hospital stays, and the highest peak FNASS scores, indicating the most severe clinical presentation within the cohort. In contrast, neonates exposed to prescription opioids and illicit methadone demonstrated higher birth weights and comparatively lower withdrawal scores. These findings suggest that the pharmacological properties of the specific opioid substance significantly influence the severity of Neonatal Abstinence Syndrome (NAS) and associated health outcomes.

Table (9): Association Between Opioid Type and Route of Administration

Opioid Route	Heroin (n=60)	Prescription (n=60)	Fentanyl (n=12)	Illicit Methadone (n=12)	Total
Oral	30 (50.0%)	42 (70.0%)	0 (0.0%)	6 (50.0%)	78 (54.2%)

Intravenous	12 (20.0%)	6 (10.0%)	0 (0.0%)	6 (50.0%)	24 (16.7%)
Inhalation	18 (30.0%)	12 (20.0%)	0 (0.0%)	0 (0.0%)	30 (20.8%)
Unknown	0 (0.0%)	0 (0.0%)	12 (100.0%)	0 (0.0%)	12 (8.3%)
P value	0.001*				

A highly significant association was identified between the specific opioid utilized and its corresponding route of administration. Prescription opioid use was predominantly oral (70%), whereas heroin use was distributed among oral (50%), inhalation (30%), and intravenous (20%) routes. Illicit methadone consumption was divided equally between oral and intravenous administration. A starkly distinct pattern emerged regarding fentanyl, for which the route of administration was entirely undocumented (100% unknown) across all cases.

Table (10): Association Between Maternal Opioid Type and Prenatal Care Adherence

Prenatal Care	Heroin (n=60)	Prescription (n=60)	Fentanyl (n=12)	Illicit Methadone (n=12)	Total
Poor	0 (0.0%)	30 (50.0%)	6 (50.0%)	6 (50.0%)	42 (29.2%)
Fair	30 (50.0%)	6 (10.0%)	0 (0.0%)	0 (0.0%)	36 (25.0%)
Good	30 (50.0%)	24 (40.0%)	6 (50.0%)	6 (50.0%)	66 (45.8%)
P value	0.001*				

A statistically significant association was identified between the type of opioid utilized and the quality of prenatal care adherence. A notably divergent pattern emerged for heroin users in comparison to those utilizing other substances. Remarkably, no heroin users (0%) demonstrated poor prenatal care; instead, their adherence was divided equally between fair (50%) and good (50%) categories. In contrast, 50% of participants utilizing prescription opioids, fentanyl, and illicit methadone demonstrated poor adherence to prenatal care protocols.

Table (11): Association Between Maternal Opioid Type and Socioeconomic Status

Socioeconomic Status	Heroin (n=60)	Prescription (n=60)	Fentanyl (n=12)	Illicit Methadone (n=12)	Total
Low	42 (70.0%)	12 (20.0%)	6 (50.0%)	6 (50.0%)	66 (45.8%)
Middle/High	18 (30.0%)	48 (80.0%)	6 (50.0%)	6 (50.0%)	78 (54.2%)
P value	0.001*				

A highly significant association was observed between the specific opioid utilized and maternal socioeconomic status (SES). Heroin use was strongly correlated with low SES, with 70% of heroin users falling into this category. In contrast, prescription opioid use was predominantly associated with middle-to-high SES (80%). Participants utilizing fentanyl and illicit methadone were evenly distributed between the low and middle-to-high SES cohorts.

Table (12): Association Between Maternal Opioid Type and Obstetric Outcome (Term vs. Preterm Birth)

Obstetric Outcome	Heroin (n=60)	Prescription (n=60)	Fentanyl (n=12)	Illicit Methadone (n=12)	Total
Preterm	6 (10.0%)	24 (40.0%)	6 (50.0%)	0 (0.0%)	36 (25.0%)
Term	54 (90.0%)	36 (60.0%)	6 (50.0%)	12 (100.0%)	108 (75.0%)
P value	0.001*				

A statistically significant association was identified between the specific opioid utilized and the rate of preterm birth. The prevalence of prematurity varied dramatically across substance types: fentanyl exposure was associated with the highest rate of preterm birth (50%), followed by prescription opioid exposure (40%). In contrast, heroin use was associated with a relatively low prematurity rate (10%), while no infants exposed to illicit methadone were born preterm (0%).

Table (13): Association Between Maternal Opioid Type and Mode of Delivery

Mode of Delivery	Heroin (n=60)	Prescription (n=60)	Fentanyl (n=12)	Illicit Methadone (n=12)	Total
Vaginal	48 (80.0%)	36 (60.0%)	12 (100.0%)	0 (0.0%)	96 (66.7%)
Cesarean	12 (20.0%)	24 (40.0%)	0 (0.0%)	12 (100.0%)	48 (33.3%)
P value	0.001*				

A statistically significant association was identified between the specific opioid utilized and the mode of delivery. The rate of cesarean section (C-section) varied substantially across the different opioid cohorts. The highest prevalence was observed in the illicit methadone group, where 100% of deliveries were via cesarean section. Conversely, all deliveries in the fentanyl group (100%) were vaginal. Furthermore, the cesarean delivery rate for the prescription opioid group (40%) was twofold higher than that of the heroin group (20%).

Table (14): Association Between Type of Opioid Used and Type of Maternal Medication-Assisted Treatment

Maternal Medication	Heroin (n=60)	Prescription (n=60)	Fentanyl (n=12)	Illicit Methadone (n=12)	Total
None	12 (20.0%)	12 (20.0%)	0 (0.0%)	6 (50.0%)	30 (20.8%)
Methadone	30 (50.0%)	30 (50.0%)	6 (50.0%)	0 (0.0%)	66 (45.8%)
Buprenorphine	18 (30.0%)	18 (30.0%)	6 (50.0%)	6 (50.0%)	48 (33.3%)
P value	0.001*				

A statistically significant association was identified between the primary opioid of use and the specific type of Medication-Assisted Treatment (MAT) received. Overall, methadone was the most prevalent MAT modality (45.8%), serving as the prescribed treatment for 50% of the women utilizing heroin, prescription opioids, and fentanyl. A distinct clinical pattern emerged for the illicit methadone cohort: 50% received no formal MAT, while the remaining 50% were managed with buprenorphine. Notably,

100% of participants in the fentanyl group were enrolled in a MAT program, with none remaining untreated.

Table (15): Association Between Maternal Opioid Type and Severity of Depression

Depression Severity	Heroin (n=60)	Prescription (n=60)	Fentanyl (n=12)	Illicit Methadone (n=12)	Total
Mild	13 (21.7%)	6 (10.0%)	0 (0.0%)	6 (50.0%)	25 (17.4%)
Moderate	17 (28.3%)	30 (50.0%)	6 (50.0%)	0 (0.0%)	53 (36.8%)
Severe	24 (40.0%)	24 (40.0%)	6 (50.0%)	0 (0.0%)	54 (37.5%)
Very Severe	6 (10.0%)	0 (0.0%)	0 (0.0%)	6 (50.0%)	12 (8.3%)
P value	0.001*				

A statistically significant association was identified between the primary opioid utilized and the severity of maternal depression. Distinct clinical profiles emerged across the substance groups: depression was predominantly moderate-to-severe among participants utilizing heroin, prescription opioids, and fentanyl. In contrast, the illicit methadone cohort exhibited a bimodal severity distribution, with 50% of participants experiencing mild depression and the remaining 50% categorized as having very severe depression. Notably, the prescription opioid group reported no cases of very severe depression, while the heroin group demonstrated the most diverse range of psychological severity.

Discussion

Opioid addiction represents a critical public health crisis in the United States, marked by a sharp rise in opioid dependence among pregnant women and a corresponding increase in substance use disorders among women of reproductive age. This study establishes evidence-based frameworks designed to optimize nursing practices and bridge existing knowledge gaps. By emphasizing a multidisciplinary approach, this research highlights the vital role of integrated care in improving health outcomes for the maternal-neonatal dyad.

Data from this study indicate that among pregnant women utilizing opioids, both the intensity and duration of exposure—particularly with fentanyl—are significantly associated with compromised neonatal outcomes. These adverse effects include reduced gestational age, lower birth weights, heightened severity of Neonatal Abstinence Syndrome (NAS), and extended hospitalizations. Furthermore, the specific type of opioid utilized is intricately linked to a constellation of maternal factors, including socioeconomic status (SES), prenatal care engagement, delivery modalities, and maternal mental health (Rana et al., 2025).

The cohort under review demonstrates significant socioeconomic vulnerability, with nearly 50% of participants classified as low socioeconomic status (SES) and approximately half receiving insufficient prenatal care. These findings align with established literature regarding pregnant women with Opioid Use Disorder (OUD), which frequently identifies low income, housing instability, and fragmented prenatal care as primary barriers to health (Anbalagan et al., 2024).

However, the heroin-using subgroup in this sample exhibited a paradoxical pattern: 0% demonstrated poor adherence, while 50% were classified as receiving 'good' prenatal care. This divergence from traditional trends—where illicit heroin use typically correlates with diminished healthcare engagement—suggests potential selection biases. These participants may have pre-existing connections to community-based treatment services or represent a demographic successfully reached by specialized local support organizations. Maternal comorbidities in this cohort were relatively limited, with Hepatitis C appearing as the most prevalent condition (20%). In accordance with current clinical guidelines endorsing opioid agonist therapy over detoxification, the majority of participants received

Medication for Opioid Use Disorder (MOUD), primarily methadone or buprenorphine. Pharmacological management exhibited significant variability, with doses ranging from 6 to 114 mg (mean: 40–45 mg). This individualized titration aligns with research suggesting that while higher MOUD doses are often clinically necessary to achieve maternal stability, they are concurrently associated with a higher risk of Neonatal Abstinence Syndrome (NAS) (Anbalagan et al., 2024; Kristensen et al., 2024; Sanjanwala et al., 2023).

Pregnant women receiving Medication for Opioid Use Disorder (MOUD) in this cohort typically exhibited low-to-moderate comorbidity profiles, with Hepatitis C identified as the predominant condition (20%). Current therapeutic protocols align with established standards of care that prioritize opioid agonist therapy—specifically methadone or buprenorphine—over detoxification during pregnancy to maintain maternal-fetal stability. The administration of these medications demonstrated significant variability, with dosages ranging from 6 to 114 mg (mean: 40–45 mg). Observational research substantiates this wide range, confirming that MOUD titration is highly individualized; many patients require elevated doses to achieve therapeutic efficacy. Notably, while increased dosages may heighten the severity of Neonatal Abstinence Syndrome (NAS), they do not inherently correlate with adverse obstetric outcomes such as placental abruption or fetal distress (Anbalagan et al., 2024; Kristensen et al., 2024).

Regarding birth outcomes, the full-term birth rate was 76%, while the preterm birth rate reached 24%. These data are consistent with contemporary literature identifying prenatal opioid exposure as a significant risk factor for prematurity compared to non-exposed pregnancies. Recent large-scale population studies further validate that Opioid Use Disorder (OUD) in pregnancy is linked to an elevated risk of preterm delivery. However, absolute preterm rates remain subject to confounding variables, including nicotine co-exposure, maternal socioeconomic status (SES), and the presence of comorbid infections (Abulannaz et al., 2025; Anbalagan et al., 2024; Yen & Davis, 2022).

Our investigation reveals a substantial correlation between the use of fentanyl or prescription opioids and increased preterm birth rates, recorded at 50% and 40%, respectively. This finding aligns with contemporary research identifying illicit fentanyl as a significant risk factor for severe Neonatal Opioid Withdrawal Syndrome (NOWS), extended hospitalization, and increased prematurity. Interestingly, our results diverge from some existing literature regarding heroin and illicit methadone, which in this cohort were associated with lower preterm birth rates. These lower rates contrast with historical data linking these substances to higher obstetric complications, suggesting that variables such as socioeconomic status (SES), the specific MAT modality, and maternal care engagement may significantly confound outcomes within this specific sample (Anbalagan et al., 2024; Rana et al., 2024; Yen & Davis, 2022).

The cohort of opioid-exposed newborns demonstrated moderate developmental restriction, with a mean birth weight of 3035 grams and a mean gestational age of approximately 38 weeks. This corresponds with evidence suggesting that opioid-exposed infants often exhibit marginally lower birth weights and gestational ages than the general population, though the severity of this restriction varies. Furthermore, a statistically significant negative correlation exists between the duration of opioid exposure and both gestational age and birth weight, aligning with established dose–duration response models. Elevated cumulative exposure is associated with an increased prevalence of NOWS and reduced growth indices, a trend that is particularly pronounced in cases of polysubstance use (Anbalagan et al., 2024; Kristensen et al., 2024; Yen & Davis, 2022).

Recent analysis of neonatal opioid exposure reveals that infants exposed to fentanyl exhibit a distinct growth phenotype: the lowest mean birth weights combined with the largest head circumferences. In contrast, exposure to prescription opioids or illicit methadone is associated with significantly higher birth weights. Research focusing on fentanyl-exposed newborns corroborates this pattern of reduced birth weight and exacerbated Neonatal Opioid Withdrawal Syndrome (NOWS). Narrative evaluations have raised concerns regarding these disparate effects on growth and neurodevelopment, which align with the more severe clinical manifestations noted in this cohort. Conversely, historical studies indicate that transitioning from illicit heroin to Opioid Agonist Therapy (OAT) can enhance fetal growth and decrease the incidence of low birth weight. This supports the

observation of superior growth outcomes with methadone compared to fentanyl, though a contradiction remains regarding the elevated preterm birth rates in infants exposed to prescription opioids (Kakko et al., 2008; Rana et al., 2024).

Apgar scores within the examined sample remained uniformly elevated across all opioid categories, demonstrating no significant association with the duration or type of opioid exposure. This finding corresponds with current data indicating that Apgar scores are not reliable markers of withdrawal risk or the intensity of prenatal exposure when immediate resuscitation needs are met. Clinical guidelines confirm that Apgar ratings primarily reflect initial extrauterine adaptation and the effectiveness of resuscitation rather than subsequent withdrawal trajectories; thus, they should not be utilized to predict the severity of NOWS (Anbalagan et al., 2024; Sanjanwala et al., 2023; Yen & Davis, 2022).

The cohort analysis revealed a mean peak score of 7.6 on the Finnegan Neonatal Abstinence Scoring System (FNASS) and an average Length of Stay (LOS) of 12 days, with one-third of the neonates requiring pharmacological intervention. Prolonged prenatal opioid exposure was significantly associated with heightened NAS severity, extended hospitalization, and an increased requirement for neonatal pharmacotherapy. These findings align with recent research demonstrating an increased likelihood of Neonatal Opioid Withdrawal Syndrome (NOWS) when maternal consumption exceeds 40 morphine milligram equivalents (MME). Furthermore, cumulative opioid exposure correlates with reduced birth weight alongside increased NAS severity, reinforcing a dose–response relationship (Anbalagan et al., 2024; Narvey et al., 2025).

Infants admitted to the NICU exhibited superior Apgar scores but demonstrated significantly higher peak FNASS scores and longer hospital stays compared to those managed in community settings. This discrepancy likely stems from the specialized monitoring techniques and more sensitive treatment thresholds employed within the NICU environment. Such specialized programs often result in higher detection and intervention rates, which may extend the LOS without necessarily reflecting a more compromised baseline health state in the neonate (Anbalagan et al., 2024; Narvey et al., 2025).

The data reveal distinct socioeconomic and behavioral trends: heroin usage is strongly associated with low socioeconomic status (SES) yet correlated with improved prenatal care adherence. In contrast, prescription opioid use is more prevalent among individuals of higher SES. Research suggests that women enrolled in structured Opioid Agonist Therapy (OAT) demonstrate significantly higher attendance at prenatal appointments compared to those who avoid formal care due to the pervasive stigma surrounding substance use (Abulannaz et al., 2025; Durrance et al., 2025; Rana et al., 2024).

While methadone remains the most common therapeutic agent administered to this cohort, buprenorphine is increasingly preferred due to its association with superior neonatal outcomes. However, a significant treatment gap persists for users of illicit methadone, necessitating further comparative investigation into the efficacy of methadone versus buprenorphine/naloxone for this high-risk subgroup. Furthermore, the prevalence of moderate-to-severe maternal depression across multiple opioid categories underscores the critical need for integrated, comprehensive psychiatric care within this demographic (Kakko et al., 2008; Kanervo et al., 2023; Lund et al., 2012; Sanjanwala et al., 2023).

In summary, these findings underscore the significant clinical risks associated with prenatal opioid exposure and reinforce the urgent necessity for early prenatal intervention, comprehensive substance use screening, and the implementation of evidence-based Medication for Opioid Use Disorder (MOUD). Furthermore, the data highlight that cohesive, integrated mental health care is an essential component of maternal stabilization. Future research should prioritize the inclusion of diverse longitudinal variables and multi-center data to enhance the external validity and generalizability of these findings across broader populations (Abulannaz et al., 2025; Rana et al., 2024; Yen & Davis, 2022).

Opioid use in pregnancy presents significant hazards, such as preterm labor, reduced birth weight, and neonatal abstinence syndrome (NAS). Integrated care that includes nurse support and pharmaceutical interventions, such as methadone or buprenorphine, is crucial. Studies demonstrate that

fetal opioid exposure can be detected using meconium analysis and correlates with heightened neonatal ICU admissions, hence requiring early screening and comprehensive protocols for maternal and newborn health. Research supports community-based opioid agonist therapy and nursing-led prenatal education to reduce neonatal crises. Opioid-related instances are common in newborn emergencies, necessitating pharmacological weaning for NAS and non-pharmacological therapies to enhance outcomes (Mohamed, M. A., et al., 2014; Mohammed, S. S., et al., 2021; Badr Yacoub Salem, A., et al., 2022)

Conclusion

The opioid addiction epidemic in the United States constitutes a critical public health crisis, characterized by a rising prevalence of dependence among pregnant women and increasingly severe maternal and neonatal consequences. Findings from this study indicate that intensified exposure to opioids—fentanyl in particular—is significantly associated with reduced gestational age, diminished birth weight, and an increased severity of Neonatal Abstinence Syndrome (NAS). The cohort is defined by profound socioeconomic vulnerabilities, with over 50% of participants facing systemic barriers to health. Furthermore, the administration of Medication for Opioid Use Disorder (MOUD), such as methadone and buprenorphine, requires highly individualized dosing to balance maternal stabilization with the mitigation of neonatal withdrawal risks. Notably, this research identifies a significant clinical paradox: mothers utilizing heroin demonstrated high levels of prenatal care adherence, directly challenging prevailing societal and clinical assumptions regarding illicit substance use and healthcare engagement.

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