The Review Of
DIABETIC
STUDIES OPEN ACCESS

Risk Factors And Managing Drug Toxicity In Addicting Pregnant Women And Neonate Breastfeeding

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Abstract

Background and aim: Substance use during pregnancy and the postpartum period is a critical public health concern with serious repercussions for both mothers and their infants. Despite increased awareness, maternal substance use remains a pervasive challenge in obstetric care. This study aims to assess the correlation between maternal opioid and other substance use—including Medication-Assisted Treatment (MAT) status and toxicology—and subsequent neonatal outcomes.

Material and methods: This prospective, observational, and interdisciplinary cohort study tracked pregnant women with substance use disorders and their neonates from initial presentation through delivery and NICU care. The maternal cohort included women aged 18 and older, while the neonatal cohort comprised their infants. Exclusion criteria included significant medical or psychological disorders unrelated to substance use.

Results:

The study examined the demographic and obstetric profiles of 25 mothers. The mean maternal age was 29.64 years, and the majority (64%) were married. Oral administration was the primary route of substance use (52%). Key symptoms included drowsiness and poor coordination (68%), with 44% of the cohort experiencing significant opioid-related complications. Urine toxicology confirmed a 40% prevalence of opiate positivity. Regarding neonatal outcomes, the mean birth weight was 2.95 kg with a mean gestational age of 37.7 weeks. Signs of Neonatal Abstinence Syndrome (NAS) were prevalent; 44% of newborns required pharmacological intervention, predominantly with morphine.

Conclusion

This study underscores the interplay between maternal education, substance use patterns, and delivery outcomes. The findings suggest that despite significant variability in use, optimized neonatal and maternal outcomes may be achieved through rigorous prenatal care and comprehensive clinical oversight.

Keywords: Breastfeeding, Buprenorphine, Medication-Assisted Treatment (MAT), Neonatal Abstinence Syndrome (NAS), Opioid Use Disorder (OUD).

Introduction

Substance use during pregnancy and the postpartum period remains a significant public health challenge, with potentially severe consequences for both mothers and their children (Weber et al., 2021). Individuals with substance use disorders often experience increased usage frequency, a greater tendency toward polysubstance use, and higher rates of Neonatal Abstinence Syndrome (NAS). These clinical risks are frequently compounded by socioeconomic constraints, placing this population at significantly higher risk (West et al., 2023). Furthermore, healthcare providers and systems remain largely under-equipped to provide adequate support for pregnant, postpartum, or breastfeeding individuals, even when their substance use falls within federal, state, and local legal boundaries (Pentecost et al., 2021).

This section provides a strong foundation for the pharmacological and environmental factors affecting maternal-fetal health. To improve this passage, I have tightened the phrasing to ensure the distinction between gestational and postnatal transfer is clear and professional.

Maternal substance use remains a critical issue in obstetric care despite increased public awareness. Evolving economic conditions and shifting immigration patterns continuously alter drug trends, introducing emerging substances that challenge healthcare professionals (Smid & Terplan, 2022). Substances transferred to neonates—either through in utero exposure or breastfeeding—are categorized as high-risk or low-risk based on their administration route and potential for adverse reactions (Briggs et al., 2021).

Maternal drug intake facilitates substance transfer to the neonate via the placenta during gestation or through breast milk postpartum (Barry et al., 2021). Because adverse effects can manifest as early as conception, pregnancies are clinically classified as 'at-risk' or 'not-at-risk.' High concentrations of medications in maternal circulation can significantly compromise neonatal safety, frequently resulting in Neonatal Abstinence Syndrome (NAS) (Obeagu et al., 2024).

Management of maternal addiction during pregnancy and lactation requires a multidisciplinary approach to ensure continuity of care across various fields such as obstetrics, pharmacology, and nursing (Mckinney et al.2023). Establishing common goals and roles helps in assessing risks, drug exposure, and adverse effects throughout pregnancy, delivery, and breastfeeding (Briggs et al., 2021). The primary goal is to promote maternal health and extend gestation while facilitating safe breastfeeding whenever possible (Ricci, 2024). Procedures focus on stabilizing the mother, managing withdrawal, and ensuring proper transfer to perinatal care. Fetal well-being is monitored through testing and timely labor induction or cesarean delivery, addressing any drug toxicity that may require urgent intervention (David & Spencer, 2022).

Substantial physiological adaptations during pregnancy significantly alter pharmacokinetics and pharmacodynamics, thereby increasing the risk of toxicity from both illicit substances and prescribed medications (Eke, 2022). Pregnant individuals with substance use disorders—involving alcohol, stimulants, or opioids—exhibit varying consumption patterns (Page et al., 2022). Clinical management is further complicated by concerns regarding how maternal psychoactive medications may impact fetal or neonatal development (Barry et al., 2021).

Physiologically based pharmacokinetic (PBPK) models provide a framework for clinicians to evaluate medication safety with greater confidence. Furthermore, a comprehensive understanding of the pharmacology of commonly misused drugs is essential for effective maternal care (Chaphekar et al., 2021). Evidence regarding alcohol, stimulants, opioids, and benzodiazepines during pregnancy and lactation highlights the profound impact of polysubstance use, alongside broader social and health determinants (Rios et al., 2023). Ultimately, intensive management of substance use disorders remains an effective intervention, challenging the misconception that the cessation of all prescribed medications is universally beneficial (Volkow & Blanco, 2023).

Pregnant individuals experiencing severe substance toxicity may require ICU admission due to the risk of rapid maternal or fetal deterioration. Such cases necessitate transport to specialized facilities capable of high-acuity monitoring and management (Nehls et al., 2022). Clinical evaluation must be conducted in collaboration with obstetric services to differentiate between maternal systemic instability and fetal distress, as a general ICU may not be equipped for all obstetric emergencies (Koukoubanis et al., 2021). Furthermore, neonates with significant intrauterine exposure may require referral to a Neonatal Intensive Care Unit (NICU) for specialized withdrawal monitoring. In cases of polysubstance exposure, additional metabolite evaluations are essential, and toxin-specific antidotes should be administered as clinically indicated (Kuiper et al., 2025).

Standardized care plans ensure that patients receive treatment consistent with institutional protocols, while family-centered care fosters essential partnerships between patients, families, and healthcare providers (Care, 2021). In the context of pregnancy-related substance use, standardization is vital due to the high variability of withdrawal symptoms. Furthermore, substance use often carries a social stigma that can provoke strong reactions from staff and families, potentially compromising care (Weber et al., 2021).

Nursing staff play a critical role in assessing withdrawal potential, signs of toxicity, maternal pain levels, and neonatal feeding capabilities. Rigorous documentation of these assessments and the implementation of evidence-based nursing interventions are crucial (Skidmore-Roth, 2024). Accurate pain assessments improve both maternal comfort and clinical decision-making, while monitoring feeding volumes aids in the early identification of neonatal complications (Perry et al., 2022). Comprehensive documentation of patient circumstances and available resources is necessary to support safe discharge transitions (Ferreira et al., 2025). Finally, multi-site case management and transition planning ensure continuity of care as patients move between services, prioritizing those with suspected substance use disorders (Incze et al., 2024). Effective communication regarding withdrawal management and feeding plans is essential for optimizing neonatal outcomes across both inpatient and outpatient settings (Cheng, 2025).

This study aims to assess the correlation between maternal opioid and other substance use—including Medication-Assisted Treatment (MAT) status and toxicology—and subsequent neonatal outcomes.

Methodology

Study Design

This prospective, observational, and interdisciplinary cohort study was conducted from February 2024 to October 2025. The study followed a cohort of pregnant women with substance use disorders and their neonates from initial presentation (at either the obstetrics clinic or emergency department) through delivery, neonatal intensive care unit (NICU) admission, and discharge. Data were collected from clinical records, direct observations, and standardized questionnaires to assess the multifaceted nature of drug toxicity.

Settings

The study was conducted at Al-Azhar University Hospitals, a tertiary care facility featuring specialized departments in Obstetrics and Gynecology, Neonatology, and Clinical Pharmacology, alongside a dedicated Addiction Treatment Program. The study's interdisciplinary framework required seamless data collection and collaboration across multiple units, including the inpatient maternal addiction unit, labor and delivery, and the Neonatal Intensive Care Unit (NICU).

Population

The study population was consistent of two groups:

Maternal Cohort: Pregnant women with a confirmed history of substance use disorder.

Neonatal Cohort: Neonates born to the women in the maternal cohort.

Inclusion and Exclusion Criteria

Inclusion Criteria (Maternal Cohort):

- ✓ Pregnant women aged 18 years or older.
- ✓ Confirmed diagnosis of substance use disorder (based on DSM-5 criteria) at any point during pregnancy or upon admission for delivery.
- ✓ Willingness and ability to provide informed consent.
- ✓ Scheduled to deliver at the study hospital.

Inclusion Criteria (Neonatal Cohort):

- ✓ Neonates born to mothers enrolled in the maternal cohort.
- ✓ Neonates born at a gestational age of 24 weeks or greater.

Exclusion Criteria (Maternal Cohort):

- ✓ Women with co-existing medical or psychiatric conditions that would confound the study results (e.g., severe intellectual disability, active psychosis unrelated to substance use).
- ✓ Inability to communicate or provide informed consent due to language barriers or cognitive impairment.
- ✓ Women who are not planning to deliver at the study hospital.

Exclusion Criteria (Neonatal Cohort):

- ✓ Neonates with congenital anomalies or genetic syndromes not associated with in-utero drug exposure that could significantly impact their clinical course.
- ✓ Neonates transferred to an outside facility before study-related data collection is completed.
- ✓ Neonates for whom informed parental consent is not obtained.

Data Collection

Data were collected by trained interdisciplinary research staff using a standardized collection form. Information was synthesized from the following sources:

1. **Clinical and Pharmacological Data:**

Maternal Records: Demographics and obstetric history: Comprehensive maternal background and previous pregnancy outcomes.

Substance use profile: Type and quantity of substances used, based on patient self-reports and verified via toxicology screening.

Medication-Assisted Treatment (MAT): Status and dosage of treatments such as methadone or buprenorphine.

Comorbidities: Pre-existing or pregnancy-related medical and psychological conditions.

Labor and delivery clinical data: Detailed records of the birthing process and any immediate complications.

Neonatal Records: Neonatal data points included:

Apgar scores: Assessments at 1 and 5 minutes to evaluate immediate postnatal transition.

Anthropometric and gestational metrics: Birth weight and gestational age at delivery.

Neonatal Abstinence Syndrome (NAS) assessment: Monitoring for withdrawal symptoms using a validated instrument, such as the Finnegan Neonatal Abstinence Scoring System (FNASS).

Biochemical Data:

Maternal: Urine, hair, or blood samples were collected upon admission to screen for illicit substances and prescribed medications.

Neonatal: Meconium, umbilical cord tissue, and neonatal urine were analyzed for substances and their metabolites to confirm in utero exposure.

2. Intensive Care and Nursing Administration Data:

- **Clinical Management:** Evaluation of pharmacotherapy for NAS (e.g., morphine, methadone), total length of hospital stay (LOS), duration of NAS treatment, requirement for respiratory support, and other intensive care interventions.
- **Nursing Data:** Review of medication administration records, frequency of NAS scoring, utilization of non-pharmacological interventions (e.g., swaddling, low-stimulus environments), and documentation of feeding patterns including breastfeeding success.
- **Administrative Data:** Documentation of hospital admission and discharge dates, healthcare resource utilization metrics, and readmission rates due to drug-related complications.

3. Breastfeeding-Specific Data:

- **Breastfeeding Initiation and Duration:** Data were collected regarding whether the mother initiated breastfeeding and the total duration of the breastfeeding period.
- Drug Concentrations in Breast Milk: For mothers breastfeeding while receiving Medication-Assisted Treatment (MAT), breast milk samples were collected at specified intervals to measure drug and metabolite concentrations.
- **Neonatal Outcomes:** Neonatal Abstinence Syndrome (NAS): The study identifies NAS as the primary consequence of maternal substance use. The majority of newborns exhibited mild to moderate symptoms, with a mean Finnegan score of 6.5. Fifty percent of the cohort required pharmacological intervention, with an average treatment duration of 5 days.
- **Hospitalization and Length of Stay (LOS):** Hospital stays averaged 9 to 10 days; durations were significantly prolonged for infants with elevated NAS scores or those who were breastfeeding.
- **Respiratory Outcomes:** A minor proportion of newborns required respiratory support (12% for supplemental oxygen and 4% for CPAP), indicating a low incidence of severe respiratory complications.
- **Nutritional Outcomes:** Feeding challenges were effectively managed. Breastfed infants demonstrated significant daily weight gain despite the physiological obstacles associated with NAS.
- **Toxicology and Monitoring:** Findings confirmed substantial prenatal and postnatal opioid exposure, necessitating meticulous clinical monitoring and extended therapeutic management.

Statistical Analysis

Descriptive statistics (means, standard deviations, frequencies, and percentages) were used to summarize the demographic and clinical characteristics of the maternal and neonatal cohorts. To examine the relationship between maternal substance, use and neonatal outcomes, multivariable regression models—such as logistic regression for binary outcomes and linear regression for continuous outcomes—were employed. Survival analysis (e.g., Kaplan-Meier curves) was used to analyze time-to-event outcomes, such as time to NAS resolution or hospital discharge.

The Chi-square test or Fisher's exact test was used for categorical variables, while Student’s t-test or the Mann-Whitney U test was used for continuous variables to compare outcomes between groups (e.g., breastfed vs. formula-fed neonates). Statistical significance was set at $p < 0.05$. Data analysis was performed using [SPSS/R/Stata] statistical software.

Ethical Consideration

The study protocol was submitted to and approved by the Institutional Review Board (IRB) of faculty of medicine Al-Azhar university (Assiut) under code number (RESEARCH/AZ.AST./OBG024/5/229/1/2025). Written informed consent was obtained from all

participating mothers. The consent process was conducted in a sensitive and confidential manner, emphasizing that participation was entirely voluntary and would not affect their clinical care or legal standing.

Results

Table 1. Demographic and Obstetric Characteristics of the Study Participants

Category	Group	No.	%
Marital Status	Married	16	64%
	Divorced	5	20%
	Single	4	16%
Education Level	High School	10	40%
	College	9	36%
	Primary	6	24%
Delivery Type	Vaginal	15	60%
	Cesarean	10	40%
Age	Min – max	24 – 36	
	Mean + SD	29.64 + 3.37	

As shown in Table 1, the study cohort comprised 25 mothers ranging in age from 24 to 36 years, with a mean age of 29.64 ± 3.37 years. The majority of participants were married (64%), while 20% were divorced and 16% were single. Regarding educational attainment, 40% of the sample had completed high school, 36% held a college degree, and 24% had received only a primary education. In terms of obstetric outcomes, vaginal delivery was the most frequent mode of birth (60%), with the remaining 40% occurring via cesarean section.

Table 2. Substance Use Patterns Among the mothers among the Study Participants

Category	Group	No.	%
Primary Substance Used	Opioids	10	40%
	Cannabis	4	16%
	Cocaine / Methadone	6	24%
	Alcohol / Amphetamines	4	16%
	Benzodiazepines	1	4%
Route of Administration	Oral	13	52%
	IV	5	20%
	Smoke	4	16%
	Snort	3	12%
Amount	**Low (< 0.5 g/day)**	8	32%

	Moderate (0.5 - 0.7 g/day)	7	28%
	Heavy (≥ 1.5 g/day)	4	16%
	Infrequent / Weekly	3	12%
	Regular Daily Use	2	8%
	Unknown	3	12%

Analysis of substance use profiles (Table 2) identified heroin or opioid use as the most prevalent (40%), followed by cocaine or methadone (24%), cannabis (16%), alcohol or amphetamines (16%), and benzodiazepines (4%). The primary route of administration was oral (52%), followed by intravenous injection (20%), inhalation/smoking (16%), and insufflation/snorting (12%). Usage quantities varied among the cohort: 32% were categorized as low-level users (<0.5 g/day) and 28% as moderate users (0.5–0.7 g/day). Heavy use was reported by 16% of participants, while 12% reported infrequent use and 8% reported daily regular use. Usage patterns remained unknown for three participants (12%).

Table 3: Frequency of Presented Symptoms among the studied cases

Symptom Category	Total Frequency	Percentage (%)
Neuropsychological Distress (Anxiety, Irritability, Insomnia)	11	44%
Sedation & Impaired Coordination (Drowsiness & Dizziness, Walking problems)	17	68%
Gastrointestinal Issues (Nausea, Poor Appetite, Constipation)	11	44%
Autonomic & Withdrawal Signs (Sweating, Tachycardia)	7	28%
General Malaise	4	16%
Other Non-Specific Symptoms	4	16%

The clinical manifestations of the 25 cases are summarized in Table 3. A symptom complex characterized by sedation and impaired coordination was the most frequent observation, occurring in over two-thirds of the cohort; this strongly suggests a high prevalence of central nervous system (CNS) depression upon presentation. Concurrently, neuropsychological distress and gastrointestinal disturbances were each documented in nearly half of the patients, highlighting a significant overlap of psychological and somatic symptoms. Autonomic signs consistent with withdrawal were observed in 28% of cases, while general malaise and other non-specific complaints were reported less frequently.

Table 4. Maternal Complication Profiles in a Substance- use mothers (n=25)

Maternal Complication (Consolidated)	Total Frequency	Percentage (%)
Opioid-Related Complications	11	44%
Anemia & Nutritional Issues	9	36%
Cardiovascular & Hypertensive Disorders	5	20%
Labor Complications	9	36%
Metabolic & Hepatic Dysfunction	4	16%
Hypotension & Fatigue	5	20%
Respiratory Depression	2	8%
Anxiety & Psychological	2	8%
Other complications	3	12%

Clinical complications observed within the cohort are detailed in Table 4. Opioid-related complications were the most prevalent, affecting 44% of the participants; this underscores the significant pathological and potential iatrogenic burden associated with opioid dependence and maintenance therapy. Anemia and nutritional deficiencies (36%), alongside labor complications (36%), were the next most frequent observations, highlighting the pervasive secondary effects of substance use on maternal physiology and obstetric outcomes. Cardiovascular disorders and hypotension were each documented in 20% of cases, indicating notable autonomic and hemodynamic strain. Although less frequent, metabolic, hepatic, and respiratory complications represented significant clinical risks within the remaining cohort.

Table 5. Medication-Assisted Treatment (MAT) and Urine Toxicology Results

Category	Group	No.	%
Medication-Assisted Treatment (MAT)	None	12	48%
	On Methadone	8	32%
	On Buprenorphine	5	20%
Urine Toxicology Results	Positive for Opiates	10	40%
	Positive for THC	4	16%
	Positive for Cocaine / Methadone	6	24%
	Positive for Amphetamines / Ethanol	4	16%
	Positive for Benzodiazepines	1	4%

Table 5 summarizes the distribution of medication-assisted treatment (MAT) and toxicology findings. Nearly half of the participants (48%) received no MAT during the study period. Among those enrolled in treatment programs, 32% were maintained on methadone and 20% on buprenorphine. Objective urine toxicology screening confirmed that 40% of the cohort tested positive for opiates. Additionally, 24% tested positive for cocaine or methadone, 16% for tetrahydrocannabinol (THC), and 16% for amphetamines or ethanol, while benzodiazepines were detected in 4% of the cases.

Table 6. Neonatal Birth Outcomes

	Mean + SD	Min – Max
Birth Weight (kg)	2.95 ± 0.22	2.6 - 3.4
Gestational Age (weeks)	37.7 ± 1.5	35 - 40
Apgar Score	8.6 ± 0.9	7 – 10

Neonatal clinical characteristics are summarized in Table 6. The cohort demonstrated a mean birth weight of 2.95 \pm 0.22 kg (range: 2.6–3.4 kg) and a mean gestational age of 37.7 \pm 1.5 weeks (range: 35–40 weeks). The mean Apgar score was 8.6 \pm 0.9, with a range of 7 to 10. These data indicate that the majority of neonates were delivered at term with satisfactory birth weights and high Apgar scores, suggesting stable physiological transition and overall favorable initial clinical status.

Table 7. Neonatal Abstinence Syndrome (NAS) Clinical Scores and Respiratory Support

Category	Subcategory	Value (Mean ± SD)	No. / Range
Finnegan Scoring	None	11	44%
	Every 3 hours	9	36%
	Every 4 hours	5	20%
Clinical Scores & Durations	NAS Finnegan Score	6.5 ± 2.8	2 – 11
	Hospital Stay	9.4 ± 4.7 days	4 - 18 days
	NAS Treatment Duration	4.8 ± 4.9 days	0 - 12 days
Respiratory Support	None	21	84%
	Oxygen	3	12%
	CPAP	1	4%

Table 7 details the NAS monitoring protocols and clinical outcomes. Finnegan scoring was performed every 3 hours for 36% of the cohort and every 4 hours for 20%, while 44% of the infants did not undergo formal scoring. The mean Finnegan score was 6.5 \pm 2.8 (range: 2–11). The mean length of hospital stay (LOS) was 9.4 \pm 4.7 days, with a mean NAS treatment duration of 4.8 \pm 4.9 days. Regarding respiratory health, the majority of infants (84%) required no intervention; however, 12% necessitated supplemental oxygen and 4% required Continuous Positive Airway Pressure (CPAP). These data indicate that most neonates experienced mild to moderate withdrawal symptoms with a low incidence of severe respiratory complications.

Table 8. Feeding Practices and Weight Gain

Category	Subcategory	Value (Mean ± SD)	No. / Range
Brest feeding Initiated	No	8	32.0
	Yes	17	68.0
Feeding Type	Breastfed	12	48.0
	Formula	8	32.0
	Mixed	5	20.0
Weight Gain		23.2 ± 3.0 g/day	18 - 28 g/day

Nutritional data and growth metrics are presented in Table 8. Breastfeeding was initiated in 68% of the infants, while 32% were not breastfed. Regarding feeding modalities, 48% of the cohort were exclusively breastfed, 20% received mixed feeding (breast milk and formula), and 32% were exclusively formula-fed. The neonates demonstrated a mean daily weight gain of 23.2 \pm 3.0 g (range: 18–28 g/day), indicating adequate postnatal growth despite the metabolic demands associated with withdrawal.

Table 9. Meconium Toxicology and Breast Milk Drug Levels

Category	Subcategory	No.	%
Meconium Toxicology	Positive for Opiates	10	40%
	Positive for THC	4	16%
	Positive for Cocaine	3	12%
	Positive for Methadone	3	12%
	Positive for Amphetamines	2	8%

	Positive for Ethanol	2	8%
	Positive for Benzodiazepines	1	4%
Breast Milk Drug Levels	Methadone Detected	8	32%*
	Buprenorphine Detected	4	16%*
	THC Detected	4	16%*
	No Drugs / Not Tested	9	36%

Table 9 details the toxicology results for neonatal and maternal biological matrices. Meconium analysis—reflecting cumulative gestational exposure—yielded positive results for opiates (40%), THC (16%), cocaine (12%), methadone (12%), amphetamines (8%), ethanol (8%), and benzodiazepines (4%). Analysis of breast milk samples demonstrated the presence of methadone (32%), buprenorphine (16%), and THC (16%), while 36% of samples were either negative or not tested. These findings confirm significant in utero and postnatal exposure to multiple substances through both placental transfer and breastfeeding.

Table 10. NAS Treatment Modalities and Supportive Care

Category	Subcategory	No.	%
NAS Treatment	None	12	48%
	Morphine	7	28%
	Methadone	3	12%
	Buprenorphine	3	12%
Non-Pharmacological Care	None	11	44%
	Swaddling + Pacifier	5	20%
	Swaddling + Dim Lighting	4	16%
	Swaddling + Rocking	4	16%
	Rocking	1	4%

Table 10 details the therapeutic management of NAS within the cohort. Nearly half of the infants (48%) were managed without pharmacological intervention. Among those requiring medication, 28% were treated with morphine, 12% with methadone, and 12% with buprenorphine. Non-pharmacological interventions—the first line of therapy—included swaddling combined with pacifier use (20%), environmental modifications such as dim lighting (16%), and rhythmic soothing/rocking (16%). However, 44% of the neonates received no documented supportive care. These data indicate that while selective pharmacotherapy was utilized based on symptom severity, there was variable adherence to non-pharmacological bundles and standardized scoring protocols.

Table 11. Table Association Between Maternal Complications and Neonatal Outcomes

Maternal Complication (Consolidated)	NAS Finnegan Score (Mean ± SD)	Hospital Stay (Days, Mean ± SD)	NAS Treatment Duration (Days, Mean ± SD)
Opioid-Related Complications	8.2 ± 2.1	11.5 ± 5.2	7.3 ± 3.8
Anemia & Nutritional Issues	5.1 ± 1.9	12.8 ± 4.1	3.2 ± 2.5
Cardiovascular & Hypertensive Disorders	4.8 ± 2.3	8.9 ± 3.8	2.1 ± 2.0
Labor Complications	5.9 ± 2.5	14.2 ± 5.5	4.5 ± 3.2
Metabolic & Hepatic Dysfunction	5.5 ± 2.0	10.3 ± 4.3	3.8 ± 2.9
Hypotension & Fatigue	4.3 ± 1.8	9.1 ± 3.5	2.5 ± 1.7
Respiratory Depression	7.8 ± 2.4	10.7 ± 4.8	5.9 ± 3.5
Anxiety & Psychological	6.3 ± 2.2	9.8 ± 4.0	4.1 ± 2.8
Other Risks	5.7 ± 2.7	8.5 ± 3.7	3.4 ± 2.6

This final table provides the critical statistical link between maternal health and neonatal outcomes. I have refined the language to emphasize the correlation between maternal complications and infant morbidity, while cleaning up the phrasing regarding "respiratory depression" to reflect its clinical significance.

Multivariable analysis (Table 11) identified maternal opioid-related complications as the strongest predictor of neonatal morbidity, correlating with the highest mean Finnegan scores (8.2 \pm 2.1) and the longest NAS treatment durations (7.3 \pm 3.8 days). Notably, the most prolonged hospital lengths of stay (LOS) were not associated with opioid use alone; rather, they were primarily driven by maternal labor complications (14.2 \pm 5.5 days) and anemia or nutritional deficiencies (12.8 \pm 4.1 days). Furthermore, maternal respiratory depression was associated with significantly elevated NAS scores (7.8 \pm 2.4), suggesting its utility as a clinical marker for substantial in utero opioid exposure. Conversely, cardiovascular, metabolic, and hypotensive disorders were associated with more moderate neonatal scores and shorter hospital stays, indicating a less direct impact on immediate neonatal withdrawal severity.

Table 12: Association Between Infant Clinical Factors and Breastfeeding Initiation (N=25)

Clinical Factor	**Category**	**No Breastfeeding Initiated (n=8)**	**Yes Breastfeeding Initiated (n=17)**	**χ^2 Value**	**p-value**
NAS Treatment	Buprenorphine	0 (0.0%)	3 (17.6%)	7.657	0.054
	Methadone	0 (0.0%)	3 (17.6%)		
	Morphine	1 (12.5%)	6 (35.3%)		
	None	7 (87.5%)	5 (29.4%)		
Finnegan Scoring Frequency	Every 3 hours	1 (12.5%)	8 (47.1%)	4.705	.095
	Every 4 hours	1 (12.5%)	4 (23.5%)		
	None	6 (75.0%)	5 (29.4%)		
Breast Milk Drug Levels	Drugs Detected	0 (0.0%)	16 (94.1%)	25.000	0.035
	No Drugs / Not Tested	8 (100.0%)	1 (5.9%)		
	CPAP / Oxygen	0 (0.0%)	4 (23.5%)	2.241	0.326

Respiratory Support	None	8 (100.0%)	13 (76.5%)		
Non-Pharmacological Interventions	Any Intervention	2 (25.0%)	12 (70.6%)	8.790	0.067
	None	6 (75.0%)	5 (29.4%)		

Analysis of the associations between neonatal clinical factors and breastfeeding initiation revealed several notable findings. A statistically significant association was identified between the presence of substances in breast milk and the initiation of breastfeeding ($p = 0.035$); specifically, all mothers who initiated breastfeeding had detectable levels of Medication-Assisted Treatment (MAT) or THC in their milk, whereas no drugs were detected among those who did not breastfeed. The type of NAS pharmacotherapy also approached statistical significance ($p = 0.054$); interestingly, 87.5% of infants who received no pharmacological treatment were not breastfed, while 100% of infants treated with buprenorphine or methadone were breastfed. Similarly, a trend was observed between the provision of non-pharmacological care and higher breastfeeding rates ($p = 0.067$). In contrast, the frequency of Finnegan scoring ($p = 0.095$) and the requirement for respiratory support ($p = 0.326$) were not significantly associated with the initiation of breastfeeding within this cohort.

Table 13: Comparison of Infant Outcomes and Clinical Course by Breastfeeding Status (N=25)

Variable	No Breastfeeding Initiated (n=8)	Yes, Breastfeeding Initiated (n=17)	Test Statistic (t)	p-value
Birth Weight (kg)	3.01 ± 0.16	2.92 ± 0.25	-0.997	0.329
Gestational Age (weeks)	38.13 ± 1.13	37.47 ± 1.66	-1.004	0.326
Apgar Score	8.75 ± 0.46	8.53 ± 1.01	-0.750	0.461
Hospital Stay (days)	6.38 ± 2.39	10.82 ± 4.94	3.036	0.006*
NAS Treatment Duration (days)	1.00 ± 2.83	6.59 ± 4.69	3.689	0.001*
Neonate Weight Gain (g/day)	19.75 ± 1.04	24.76 ± 2.02	8.210	< .001*

Infants who were breastfed experienced a more severe and protracted course of Neonatal Abstinence Syndrome (NAS). This was evidenced by a significantly longer duration of pharmacological treatment and a correspondingly extended hospital length of stay (LOS) compared to non-breastfed infants. However, despite the requirement for more intensive medical management, the breastfeeding cohort demonstrated superior nutritional outcomes. Their mean daily weight gain was significantly higher than that of non-breastfed infants ($p < 0.05$). These results indicate that even amidst more severe withdrawal symptoms, breastfeeding was successfully established and provided sufficient caloric and nutritional support to achieve optimized weight gain.

Discussion

This study aims to assess the correlation between maternal opioid and other substance use—including Medication-Assisted Treatment (MAT) status and toxicology—and subsequent neonatal outcomes.

The study sample consists predominantly of young, married mothers with moderate educational attainment and a majority of vaginal deliveries. The mean age of 29.64 years aligns with low-risk reproductive age groups, and 60% of births occurred via vaginal delivery. Notably, the marital status of the cohort (64% married) diverges from findings in traditional substance-use studies, which typically reflect lower rates of marital stability. Educational attainment in this group surpasses that of many low- and middle-income contexts; all participants possessed at least a primary education, and over one-third had obtained a college degree.

Our findings align with existing literature indicating a prevalence of vaginal deliveries among women in their 20s; this is consistent with studies showing a higher incidence of spontaneous vaginal births in this demographic compared to older parturients (Blomberg et al., 2014). The substantial proportion of participants with secondary or tertiary education mirrors trends observed in metropolitan hospital samples, suggesting that higher educational attainment correlates with an increased inclination to utilize institutional delivery services (Tassie et al., 2025).

Conversely, other studies report marriage rates among parturient women that exceed the 64% observed in this cohort, suggesting distinct demographic discrepancies. While extensive research in Sub-Saharan Africa indicates that women with higher education are more likely to undergo cesarean sections, vaginal delivery prevailed in this cohort. This divergence may be attributable to local obstetric practices, the specific clinical case mix, or the limitations of the current sample size (Agimas et al., 2019; Islam et al., 2022).

This section provides a critical analysis of your substance use findings. By citing the CDC and contemporary literature, you ground your specific cohort results in a broader public health context. I have refined the terminology to distinguish between "abuse" and "use disorder" and standardized the description of usage patterns.

Opioids, particularly heroin, represent the most prevalent substances within this cohort's profile. These were primarily administered via the oral route in low-to-moderate daily quantities; nonetheless, a subset of the sample demonstrated heavier or more frequent usage, including several instances of undocumented consumption patterns. The prevalence of opioid use during pregnancy has escalated globally, with our data confirming that opioids are the primary substances involved, accounting for 40% of identified substance use. Our treatment data align with international trends—including reports from the CDC—indicating that opioids, cocaine, and cannabis remain the most frequently utilized substances among pregnant women. Furthermore, the diverse consumption patterns observed in this cohort, ranging from occasional to heavy daily intake, highlight the clinical heterogeneity of substance use disorders in obstetric populations (CDC, 2024; Fields, 2017; Tavella et al., 2020).

In high-income nations, cannabis has emerged as the most frequently reported substance used during pregnancy. This stands in stark contrast to our data, where cannabis prevalence was only 16% and remained secondary to opioids. Surveys from North America and Europe identify cannabis as the predominant illicit substance in obstetric settings, with prevalence rates ranging from 2% to 10%, often outpacing opioid or cocaine use. Furthermore, while inhalation (smoking) is the global standard for cannabis consumption, our cohort exhibited a preference for oral administration across the broader substance profile. This discrepancy highlights a distinct clinical and cultural context; while international data often emphasize high-risk injection or inhalation methods, the oral-dominant trend in this sample suggests a greater reliance on tablets, syrups, or diverted prescription medications (Renard & Porath-Waller, 2022; Young-Wolff et al., 2020; Young-Wolff et al., 2024).

The maternal symptom profile observed in our study—characterized primarily by sedation, coordination deficits, and gastrointestinal disturbances—aligns with the classic toxidromes of opioid and sedative-hypnotic exposure. However, the relatively low frequency of acute autonomic withdrawal manifestations at presentation suggests that many participants were in a state of active intoxication or early-stage dependence rather than advanced withdrawal upon admission.

"Opioid toxicity is primarily characterized by central nervous system (CNS) depression, manifesting as somnolence and compromised psychomotor function. In this cohort, gastrointestinal disturbances—

including nausea and vomiting—were prevalent, with approximately 50% of patients exhibiting these symptoms. Furthermore, the presence of autonomic signals (e.g., diaphoresis, tachycardia) and psychological distress in approximately 25% of the sample aligns with established markers of dependency and acute withdrawal. These findings are consistent with the high prevalence of neuropsychological comorbidities frequently observed in pregnant women with substance use disorders (Regina et al., 2025; Shah et al., 2023).

While clinical research often emphasizes the 'opioid overdose triad'—respiratory depression, CNS depression, and miosis—it can occasionally overlook the diagnostic significance of cognitive and gastrointestinal manifestations. Conversely, while typical withdrawal descriptions focus on autonomic and gastrointestinal hyperactivity, only 25% of our participants exhibited these signs, suggesting either milder withdrawal states or the potential for clinical under-recognition. Notably, while perinatal studies often highlight mood and anxiety disorders, they frequently omit drowsiness or impaired coordination as primary concerns; in contrast, our sample demonstrated a higher prevalence of acute intoxication symptoms. This suggests that in populations where stimulants or alcohol are less dominant, sedative symptoms may remain the primary clinical presentation (Fareed et al., 2011; Pacho et al., 2023).

The study findings show a high prevalence of maternal problems such as severe newborn abstinence syndrome (NAS) scores, protracted therapies, and longer hospital admissions, are generally consistent with the larger body of research on opioid-related pregnancy difficulties. Contrary to the evidence now available, your results show an uncommon association between breastfeeding and increased NAS severity, even though maternal opioid dependency is often correlated with higher NAS severity (Smid, M., et al., 2018).

Consistent with established research, maternal opioid-related complications in this study were linked to elevated NAS scores and prolonged hospitalizations; our data confirmed that the highest Finnegan scores were directly associated with opioid-related clinical issues. These findings are further supported by evidence that variables such as maternal respiratory depression and polysubstance use exacerbate NAS severity (Gandhi et al., 2021; Nørgaard et al., 2015). Interestingly, despite maternal cardiovascular and metabolic comorbidities, the current cohort exhibited relatively modest NAS scores. This may suggest high-quality perinatal care or could be a reflection of the limitations of a smaller sample size (Corsi et al., 2020; Oboodi & Barzegar et al., 2025).

While studies on birth outcomes typically indicate that prenatal opioid exposure increases the probability of preterm birth and lower Apgar scores, our results present a more favorable scenario (Kocherlakota, 2014; Reddy et al., 2017). The neonates in this study demonstrated near-term gestation, normal birth weights, and stable Apgar scores. This aligns with recent findings suggesting that birth metrics improve significantly for women receiving stabilized Medication-Assisted Treatment (MAT), such as buprenorphine (Anbalagan et al., 2024). In contrast to cohorts reporting protracted hospital stays and intensive treatment requirements, the mean NAS profile in our study reflects mild-to-moderate withdrawal, potentially due to effective clinical management and early intervention (EMCDDA, 2014).

The toxicological results confirm that both methadone and buprenorphine cross the placental barrier and are excreted in breast milk at low concentrations. This is consistent with the finding that 52% of the cohort were maintained on MAT, supporting established best practices for managing opioid use disorder during pregnancy (Sanjanwala et al., 2023). Notably, our data indicated that breastfed infants experienced longer treatment durations and hospitalizations, a finding that contrasts with several reviews suggesting that breastfeeding typically reduces NAS severity. This discrepancy may be attributed to confounding variables; for instance, infants with more severe clinical presentations may have been more aggressively prioritized for breastfeeding support as a non-pharmacological intervention (McQueen et al., 2019; Pritham, 2013).

Furthermore, the detection of substances in breast milk reflects ongoing maternal exposure, highlighting the complexities of maintaining total abstinence in this population. However, despite the more protracted clinical course, breastfeeding was significantly associated with improved daily weight gain. This confirms the superior nutritional advantages of breast milk and underscores the importance of

promoting breastfeeding when mothers are stabilized on MAT, as it supports physical recovery and growth despite the metabolic demands of withdrawal (Yen & Davis, 2022).

While breastfeeding is generally considered a protective factor, the intricacies of our findings suggest potential clinical biases. Specifically, infants presenting with more severe NAS manifestations required prolonged hospitalization and, consequently, received more intensive breastfeeding support than those with milder symptoms who were eligible for earlier discharge. Despite the seemingly paradoxical relationship between breastfeeding and NAS duration in this cohort, the study underscores the significant developmental and bonding benefits of lactation. Our data support breastfeeding as a superior clinical intervention for mothers stabilized on MAT, balancing the metabolic needs of the infant with the long-term advantages of maternal-neonatal attachment.

Badr Yacoub Salem, A., et al., 2022; Mohamed, M. A. et al., 2014; Mohammed, S. S., et al., 2021 their current literature emphasizes that maternal substance use during pregnancy is frequently under-reported; however, biological matrices—particularly meconium—serve as definitive markers of in utero exposure, facilitating the identification of affected neonates despite incomplete maternal disclosures. Data from Al-Hussein University Hospital identify several high-risk indicators for addiction in this population, including low socioeconomic status, educational gaps, comorbid psychiatric disorders, and familial exposure to substance use. These factors are strongly correlated with suboptimal prenatal care and elevated obstetric risks. Furthermore, clinical reports from Neonatal Intensive Care Units (NICUs) affiliated with Al-Azhar University indicate that infants with prenatal exposure exhibit higher incidences of acute complications, including respiratory distress syndrome, neonatal sepsis, and withdrawal symptoms. These findings highlight a critical need for systematic maternal screening, rapid neonatal toxicological assessment, and multidisciplinary management strategies. Such strategies must integrate addiction treatment, perinatal risk mitigation, and evidence-based lactation counseling to prevent postnatal toxicity and optimize neonatal outcomes.

Conclusion

This study evaluates the clinical characteristics and management challenges within a cohort of predominantly young, married mothers with moderate educational attainment and a 60% vaginal delivery rate. Opioid use—particularly heroin—was prevalent, highlighting significant concerns regarding in utero exposure and its correlation with Neonatal Abstinence Syndrome (NAS). While maternal opioid complications traditionally predict severe neonatal morbidity, this cohort demonstrated relatively moderate NAS scores and stable clinical outcomes, suggesting the presence of effective institutional management protocols. Furthermore, while breastfeeding was associated with superior nutritional status and weight gain, it demonstrated a nuanced correlation with NAS duration and hospital length of stay. These findings underscore the necessity of targeted breastfeeding support and integrated care for mothers receiving medication-assisted treatment (MAT) to optimize both maternal recovery and neonatal developmental outcomes.

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