General Considerations

Neonatal abstinence syndrome (NAS) is a condition resulting from the abrupt cessation of in-utero exposure to addictive substances. Affected infants may exhibit the onset of drug withdrawal symptoms as early as 24-48 hours or as late as 7-10 days of age depending on the timing of the mother’s last dose and the drug’s half-life. Once started, the symptoms may persist for 6-8 weeks.

Maternal histories of drug use (legal or illegal) during pregnancy are frequently inaccurate. Thus, this history should not be taken as an exclusive indicator of an infant’s in-utero exposure, especially if the infant displays withdrawal symptoms. Conversely, a negative infant or maternal drug screen should not negate a maternal admission of drug use.

It is important to coordinate a care plan with the infant’s mother and healthcare providers (Obstetrician, nurse midwife, pediatrician, social worker, drug counselors and mental health professionals). If possible, prenatal counseling about NAS, increased length of stay, discharge criteria, and post discharge issues such as SIDS risk should be offered.

There are predictor variables for NAS which effects up to 90% exposed infants:

Maternal:
- maternal maintenance dose at delivery
- maternal use of anxiolytics and/or hyosedative medications
- maternal use of psychiatric medications during pregnancy

Baby:
- infants born to women maintained on opioid agonists
- number of cigarettes/day
- maternal weight at delivery
- type of delivery
- higher maternal parity

NAS is a generalized disorder presenting as a clinical picture of irritability, gastrointestinal dysfunction, respiratory distress, and vague autonomic symptoms. In severe or untreated cases, seizures may occur. The prevalence of maternal multiple drug use complicates attempts to analyze any single agent’s contribution to the symptom complex. In addition, NAS symptoms may overlap manifestations of neonatal illnesses such as hypoglycemia, hypocalcemia, sepsis
Infants with drug exposure/dependency may exhibit signs and symptoms including:

- Irritability
- Increased tone
- Jitteriness
- Nasal stuffiness
- Excessive sucking activity
- Demand for frequent feedings
- Diarrhea
- Vomiting
- Fever
- Tachypnea
- Sneezing/yawning
- Shrill cry
- Inconsolable behavior
- Impaired maternal-infant bonding
- Altered sleep-wake cycle
- Diaphoresis

Natural History of NAS: Infants may have symptoms as early as 24 hr after delivery to as late as 10 days after delivery.

In-utero drug exposure and/or drug withdrawal may put exposed infants at risk for long-term developmental sequelae. The treatment of drug withdrawal may not alter their long-term outcome. The goal of therapy is to control withdrawal symptoms and optimize feeding and growth. While up to 90% of infants exposed to narcotics during fetal life have some symptoms, only 50-75% will require treatment. In infants exposed to selective serotonin re-uptake inhibitors
(SSRIs), 30% are reported to demonstrate withdrawal symptoms which can be severe in up to 13% of cases.

Other conditions with similar symptoms should be ruled out with appropriate tests that may include a CBC with differential, glucose, electrolytes, magnesium and calcium. In rare cases, neurological consults and neuroimaging may be necessary. Urine and meconium drug screening may be helpful for identifying the drugs from which the infant is withdrawing. Meconium drug screening is particularly important in identifying drugs that may have been taken prior to the 2-3 days preceding delivery.

Social service referral is necessary and should occur when drug exposure is diagnosed. California Children Services (CCS) requirements must be met.

Finnegan Abstinence Scoring System

The Finnegan Abstinence Scoring System is recommended to estimate the severity of NAS and to measure the infant’s optimum response to pharmacotherapy and intervention. Though the Finnegan Abstinence Scoring System was originally validated for full term infants, it is reasonable to apply it to late preterm infants.

- All infants with signs and symptoms of drug exposure or maternal history that is suggestive of drug use should be scored every 2-4 hours following feeding.

- Finnegan scores that are ≥ 8 for 3 consecutive scores, ≥ 12 for 2 consecutive scores or ≥ 15 once are considered abnormal.

- The goal of care is to maintain a Finnegan score of < 8. A Finnegan score < 8 typically allows appropriate drug weaning.

Treatment Considerations

- Drug therapy may not be necessary for infants with mild symptoms as well as babies exposed to SSRIs. In addition to breast-feeding, supportive therapy should include swaddling, holding, decreasing environmental stimuli (including light and noise) and infant massage. These actions can lessen symptoms and improve the ability to deliver appropriate care for these infants.

- A pacifier for excessive sucking should be provided.

- Infants should be monitored for sleeping habits, temperature instability, weight loss and skin excoriation (especially in the diaper area).

- Daily weight and I&O should be recorded.

- Rule out associated medical risk factors and sexually transmitted diseases. The pediatric provider should check that the appropriate prenatal screens were done to establish the
present status of the mother and infant. Screens include:

- **Syphilis**—RPR within 6 weeks of delivery/VDRL titer and FTA-AB result if previously positive.

- **Hepatitis B**—Hepatitis B surface antigen within 6 weeks of delivery unless previously known to be a positive carrier or vaccinated.

- **Hepatitis C screening**—Hepatitis C within 6 weeks of delivery if history of cocaine (any route) or intravenous drug use.

- **HIV**—Refer for HIV counseling and screening if not done within 6 weeks of delivery unless previously known to be positive.

- **Tuberculosis**—Check for documented PPD in pregnancy.

- **Hepatitis B Prophylaxis**: Drug exposed infants are in a high-risk group for both vertical and household transmission of Hepatitis B. Check that the infant received the vaccine after delivery.

---

**General Management:**

- **Establish a therapeutic relationship with the mother:**
  
  * Maintain a non-judgmental and supportive attitude.
  
  * Treat the mother as a parent first, not someone with a substance abuse problem.
  
  * Provide consistency in care providers as much as possible.
  
  * Ensure confidentiality.
  
  * Promote positive maternal attachment to the infant:
    
    - Engage the mother in the care of her infant.
    - Encourage the mother to visit and help her maintain a quiet environment for the infant.
    - Encourage maternal contact and touching of infant through bathing and infant massage.
    - Emphasize positive attributes of infant and maternal behavior.
    - Explain gaze aversion or irritability to mother and how to help infant be more responsive.
    - Involve the father/partner and other family members identified by the mother as her supports.
• Supportive care:

* Refer to PT for evaluation of the infant’s ability to tolerate sensory input (visual, tactile, auditory, spatial, and vestibular), and suggestions for environmental modification.

* Swaddle with hands near mouth (helps to reduce extensor tone, calm infant, and protect skin).

* Modify the environment:

  □ Low stimulation (avoid bright light or loud noise, cover crib with blanket if in bright environment).
  □ Minimal disturbance – time exams and procedures when infant is awake and fed.
  □ Soothing.
  □ Early response to cry – prevents escalation of withdrawal and facilitates soothing.
  □ Containment – blanket rolls alongside infant and under thighs (to help extensor tone).

* Rocking—especially vertical.

* Non-nutritive sucking (hand, pacifier).

* May use a swing (stop if infant shows signs of over-stimulation, e.g., cry, mottling, sneezing, arching).

Skin Care

• Excoriation is most common on the extremities, face, chin, knees, gluteal folds
  * Tegaderm over the knees and other body surfaces which are being rubbed can be protective
  * Mittens to decrease scratching can also be helpful.
  * Avoid friction with cleansing – no harsh wipes
  * Water only for cleansing – sitz bottle works well
  * Gentle patting to dry
  * Apply no sting barrier to areas of skin breakdown
  * Cover areas of skin breakdown with Pro Shield
  * Leave areas of skin breakdown open to air as much as possible
  * Treat areas of breakdown for at least 24 hours
* Teach mother skin care techniques

- Frequent stools increase risk of perianal breakdown. This can be prevented by:
  * Frequent diaper changes
  * Liberal application of Pro Shield /A & D ointment
  * Careful assessment with each diaper change

---

**Feeding**

- The initial treatment of a neonate with withdrawal symptoms should be supportive and should include breast-feeding unless there are concurrent contraindications (such as maternal HIV or continuing illicit drug use).

- Lactation should be supported in mothers who fit the following criteria:
  
  * Received prenatal care
  * Have no medical or psychiatric contraindications
  * Visit and interact well with the infant and healthcare staff
  * Have received lactation support
  * Receive methadone or buphromorphine as a treatment for substance abuse in a program or receive opiates as a treatment for chronic pain under the guidance of a physician
  * Give consent for discussion with her counselor or physician
  * Whose counselor or physician agrees with plan of breastfeeding
  * Have no history of illicit drug use for 3 months prior to delivery
  * Have a negative toxicology screen at delivery

- Lactation should not be supported in mothers who fit the following criteria:
  
  * Have a medical or psychiatric contraindication to breastfeeding
  * Are continuing to use illicit drugs including chronic marijuana use
  * Have not received prenatal care
  * Lack of maternal involvement with the infant and healthcare staff
  * Refuse substance abuse treatment or are unwilling to provide consent for discussion with their counselor or physician if in treatment

- Many mothers will not meet all the criteria for supporting breastfeeding and require a detailed multidisciplinary evaluation which should focus on:
  
  * Detailed drug history with documentation of participation in substance abuse treatment programs, relapses, review of urine toxicology results during this and previous pregnancies.
  * Prenatal care (late > 24 weeks gestation or limited < 5 visits) and the evaluation of her obstetric provider
  * Maternal visitation (quality as well as frequency of visits or phone calls) and her interactions with the healthcare team.
* Support system

• There is no contraindication to breast feeding based on maternal methadone dose.

• Breast milk feedings delay the onset of NAS, reduce its severity and minimize the need for pharmacologic treatment regardless of the infant’s gestation and type of drug exposure.

• Counsel mother to avoid abrupt weaning from the breast if her daily methadone dose is > 20mg.

• Mothers should be counseled by a physician regarding the transmission of illicit drugs through breast milk and the potential negative effects on her health and mothering ability, lactation and the infant. The discussion should include the effects of alcohol, tobacco, marijuana, cocaine, methamphetamines, opiates, barbituates and benzodiazepams (See Appendix 1).

• Mothers should receive a handout with this information. In some cases, a signed contract may be helpful.

• Ensure that mothers in whom breast feeding can be supported have breast pumps and appropriate instruction on use of a pump and how to keep up the milk supply when away from their infants.

• If the mother is not available to exclusively breast feed or if she cannot provide enough breast milk to meet the infant’s needs, supplement with infant formula.

• Drug exposed infants whose mothers opt to formula feed or whose mothers do not meet criteria for breastfeeding support, should receive infant formula.

  * Lactate reduced (Similac Sensitive), hydrolyzed protein formulas (Nestle GoodStart or Similac Total Comfort) and elemental formulas (Alimentum) are often used in this population to reduce GI symptoms though there is no strong evidence to support this practice.
  * Hypercaloric feeds starting as early as day 3 of life have also been advocated to improve weight gain.

• Anticipate increased caloric needs. Infants with NAS may require up to 290 kcal/kg/day.

• Feed on early hunger cues. Feed every 3 hours if the infant is showing signs of withdrawal. Some infants may require feeds every 2 hours.

• Hyperphagia is a sign of increased caloric needs. Do not limit feedings unless the infant is vomiting.

• Provide a low stimulation environment and swaddling during feeds. Infants in withdrawal show increased activity and arousals during feeding.

• Infants with NAS may have prolonged bursts of disorganized sucking with few pauses. They
may require pacing and frequent burping.

- Refer to PT if the infant exhibits oral motor skill difficulties or exhibits poor weight gain.

Pharmacotherapy Considerations

The decision to use pharmacologic agents must be individualized and should be based on the severity of withdrawal symptoms and the risks versus the benefits of drug therapy. Pharmacological therapy is primarily based on selecting a drug from the same class as the drug causing the withdrawal symptoms. Length of treatment will vary depending on the type of drug exposure and severity of symptoms. In general, treatment should be limited to infants exposed to narcotics. Maternal ingestion of methamphetamines, cocaine, THC and benzodiazepines can cause acute toxic symptoms following delivery which resolve once the drug is eliminated from the infant’s system.

Recommended drug of choice for narcotic related withdrawals.

- **Initial therapy:** Morphine 0.05 mg/kg/dose po q3h or 0.02 mg/kg/dose IV in those infants who cannot tolerate po feeds.

- **Titration:**

  Increase by 0.025-0.04 mg/kg po or by 0.01 mg/kg IV every 3 hrs until symptoms are controlled to a maximum dose of 1 mg/kg/day.

  *Rescue Dose*: If infant has 2 consecutive scores of ≥ 12, double the previous dose given (po or IV) x 1 and then adjust accordingly:
  
  - If NAS score < 12: make the scheduled maintenance dose the same as the rescue dose that was just administered.
  - If NAS score still ≥ 12: increase next dose by 50%. Continue to do so until score is < 12. Once < 12, then follow guideline listed above.

The maximum effect is usually seen in 48-72 hours.

**Wean:**

- Once stabilized on a dose for 48-72 hours\(^1\), use this dose (i.e., original stabilizing dose) as the starting point of the wean.

- Wean the dose by 10% of the original stabilizing dose every 24-48 hours.

---

\(^1\) Finnegan scores that are ≥ 8 for 3 consecutive scores, ≥ 12 for 2 consecutive scores or ≥ 15 once are considered abnormal.
Drug may be discontinued when a single dose is < 0.02 mg/kg/dose.

Given the shorter duration of action of enteral morphine, it is best suited to be dosed on a q3hr schedule even in infants on ad lib feeds.

If infant’s NAS scores become consistently elevated during the weaning process, assure that nonpharmacological measures are optimized (ie: swaddling, holding, decreased stimuli, etc) before going back to previous dose at which patient was stable.

If infant’s scores continue to be elevated

- Physical exam to ensure nothing else is wrong
- Either weight adjust medication and/or continue to back up in a stepwise fashion until patient’s scores normalize. Once stabilized on new dose for minimum 48 hrs, resume 10% wean but consider weaning at 48-72 intervals.

**Example:**
3 kg infant was started on 0.15 mg (0.05 mg/kg) morphine q3hr po and required 2 dose increases of 0.0075 mg (0.025 mg/kg) to normalize his NAS scores. His original stabilizing dose would be 0.3 mg (0.1 mg/kg). He has now been on the dose of 0.3 mg po q3hr for 72 hours. Team would like to begin weaning. As long as his scores remain normal, he is decreased by 10% every 24-48 hrs. His weaning schedule would be:

Day 1: 0.27 mg q3hr (0.09 mg/kg)
Day 2: 0.24 mg q3hr (0.08 mg/kg)
Day 3: 0.21 mg q3hr (0.07 mg/kg)
Day 4: 0.18 mg q3hr (0.06 mg/kg)
Day 5: 0.15 mg q3hr (0.05 mg/kg)
Day 6: 0.12 mg q3hr (0.04 mg/kg)
Day 7: 0.09 mg q3hr (0.03 mg/kg)
Day 8: 0.06 mg q3hr (0.02 mg/kg)
Day 9: Stop

- Monitor in-house for minimum of 48-72hrs prior to discharge.

**Adjunctive therapy:**
- Consider starting adjunctive therapy if polsustance exposure is suspected or confirmed or when Finnegan scores are high despite maximum opiate pharmacotherapy (i.e., morphine dose of 1 mg/kg/day).

---

2 Finnegan scores that are ≥ 8 for 3 consecutive scores, ≥ 12 for 2 consecutive scores or ≥ 15 once are considered abnormal.
• The second line agent should be Clonidine due to its demonstrated effectiveness in decreasing length of stay and the known detrimental effects of phenobarbital on neurodevelopmental outcome.

• Phenobarbital should be used only in those infants who Finnegan scores remain high after the addition of Clonidine.

• Weaning of adjunctive therapy should be started once the infant is stable off opiates.

**Clonidine:**

• Clonidine is a non-narcotic medication that effectively reduces withdrawal signs in adults. Given limited studies, clonidine is not recommended as first line therapy. In one small trial, infants with NAS were effectively treated with a first dose of 0.5-1 mcg/kg followed by a maintenance dose of 3-5 mcg/kg/day divided every 4 to 6 hours. A single dose was noted to result in some infants having immediate reversal of symptoms with the exception of poor sleeping. In addition, a recently completed randomized controlled trial indicates that clonidine in conjunction with an opioid may reduce the duration of pharmacotherapy and length of stay for infants withdrawing from methadone or heroin.

• **Loading dose:** None

• **Maintenance dose:** 1 mcg/kg po q4h (do not weight adjust)

• **Weaning:** When clinically stable for 48-72 hours off opiates:
  
  o Wean the dose to 0.5 mcg/kg po q4h for 48 hrs.
  
  o If there is no rebound effect after 48 hrs, clonidine can be discontinued.

**Phenobarbital**

• Phenobarbital is useful only if the high NAS score is primarily due to CNS disturbances (tremors, increased muscle tone, etc). It will assist in the control of hyperactivity, but will not control the gastrointestinal or other autonomic symptoms

• **Loading dose:** 10 mg/kg/dose po q12hr x 2 doses
  
  o Enteral formulation contains a high percentage of alcohol.
  
  o 2 doses rather than a single loading dose is recommended to decrease risk of emesis and/or sedation.

• **Maintenance dose:** 5 mg/kg/dose po once daily (do not weight adjust)

• **Phenobarbital levels** should not be needed for this indication unless the infant experiences seizures or seizure-like activity. The blood level necessary to control narcotic withdrawal signs is unknown.

• **Weaning:** When clinically stable for 48-72 hours off opiates, taper the dose by 10-20% per day as tolerated.

• Once narcotic weaning is completed, reasonable options include:
  
  o Stopping phenobarbital when the infant is stable at a low dose (2-3 mg/kg/d).
  
  o Due to phenobarbital’s long half-life, outpatient management for clinical follow-up
after medication stoppage or outpatient management for continued weaning are both acceptable options.

**Clonidine vs. Phenobarbitol as a second agent**

<table>
<thead>
<tr>
<th></th>
<th>Clonidine</th>
<th>Phenobarbitol</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Class</strong></td>
<td>- Alpha 2 agonist</td>
<td>- Anti-epileptic</td>
</tr>
<tr>
<td></td>
<td>- Reduces sympathetic tone</td>
<td>- Non-selective CNS depressant</td>
</tr>
<tr>
<td><strong>Primary Agent</strong></td>
<td>Unknown</td>
<td>Inferior to opioids</td>
</tr>
<tr>
<td><strong>Adjunctive Therapy</strong></td>
<td>Emerging data</td>
<td>Extensive clinical experience</td>
</tr>
<tr>
<td><strong>Cons</strong></td>
<td>- Potential for hypotension and rebound after cessation of therapy</td>
<td>- Adverse neurodevelopmental effects</td>
</tr>
<tr>
<td></td>
<td>- Limited data</td>
<td>- Drug interactions</td>
</tr>
<tr>
<td><strong>Data</strong></td>
<td>One high quality RCT</td>
<td>Long clinical use</td>
</tr>
<tr>
<td><strong>Dose?</strong></td>
<td>- 1 mcg/kg po q4h</td>
<td>- Load: 20 mg/kg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Maintenance: 5 mg/kg/day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Do not get routine drug levels</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Weaning not standardized</td>
</tr>
</tbody>
</table>

**Methadone**

Methadone is generally not recommended because of the longer half-life and the increased difficulty in assessing whether a wean in dose has been successful. However, there may be select clinical situations in which the long half-life can be useful in ensuring that a progressive slow weaning occurs.

**Pharmacotherapy Agents not Recommended**

Paregoric is not recommended because of its high alcohol content, anise oil, benzoic acid and camphor.

Diazepam is not recommended due to possible cerebral and hepatic dysfunction.

Chlorpromazine has limited use in neonates due to adverse effects such as cerebellar dysfunction, decreased seizure threshold and hematologic abnormalities.
Naloxone is contraindicated for infants exposed to in-utero opiates.

Discharge Planning for Infants with NAS

Most infants who are symptom free by the 3rd or 4th day after birth may be ready for discharge from the hospital. For this reason, it is important to closely monitor the asymptomatic drug-exposed infant during the hospital stay. For infants exposed to methadone, close follow up may be necessary for 7-10 days (either on an inpatient basis or as an outpatient if medically and socially stable) due to late presentation of symptoms resulting from the drug’s long half-life. Timing of discharge should take into consideration the last date of drug exposure in-utero.

Discharge Criteria for Infants Treated with Medication(s):

- The infant is physiologically stable.
- The infant is taking oral feeds and gaining weight appropriately.
- The infant shows neurobehavioral recovery (can reach full alert state, responds to social stimuli and can be consoled with routine measures); has NAS scores < 8 off medication for 24-72 hours; or if being considered for discharge on home medication, has NAS scores < 8 for 24-72 hours.
- All necessary assessments have been completed (i.e. hearing screen).
- A social service consult should be requested on admission. Referral to the state’s child protection agency should be made, if deemed appropriate by the social worker and/or other health care provider(s). The infant’s caregivers should be involved in the infant’s care as early as possible. Foster parents should be considered as a possible means of safe discharge.

Discharge Instructions for Infants with NAS:

- An explanation of the signs and symptoms of withdrawal should be given to caregivers.
- Instructions should be given to caregivers on infant comfort measures.
- Subacute signs of NAS may last up to 6 months.
- A follow-up appointment with the infant’s pediatrician should be arranged 24-48 hours after discharge.
- Schedule home care visit(s) by a nurse and/or social worker if this is required following the initial pediatrician’s office visit.
- Appropriate neurodevelopmental follow-up for the infant secondary to high risk perinatal drug exposure should be considered.
• If necessary, a drug treatment program referral for the infant’s parent(s) should be initiated during the hospital stay.

• In some instances, infants can be discharged and finish weaning from pharmacotherapy at home. This can be done safely and effectively when both the infant’s caregivers and physicians are in agreement with this plan. Close follow-up with physician visits and home care is needed to adjust medication doses and assess the infant’s status. This may involve pre-measured dosages with frequent physician visits to refill the prescriptions, and to account for all doses and document administration of medication to the infant.

References: Neonatal Abstinence Syndrome


Schumacher RE, Patrick SW. Controversies in caring for infants and Families impacted by neonatal Abstinence Syndrome. iNICQ 2013 Quality Improvement Toolkit.
APPENDIX 1

ALCOHOL (ETHANOL) SEDATIVE

American Academy of Pediatrics: Compatible with breastfeeding\textsuperscript{8} Lactation
Risk: L3 (Moderately safe)\textsuperscript{7}
Briggs et al: Withhold breastfeeding\textsuperscript{9}
\(T_{1/2} = 0.24\) hours, \(T_{\text{max}} = 30-90\) minutes (oral)\textsuperscript{7}

Although alcohol is classified by the American Academy of Pediatrics (AAP) as compatible with breastfeeding, the AAP notes that adverse effects (such as drowsiness, diaphoresis, deep sleep, weakness, decrease in linear growth and abnormal weight gain) may occur in infants of mothers with a high alcohol intake; maternal ingestion of 1g/kg daily decreases the milk ejection reflex.\textsuperscript{8} The Institute of Medicine of the National Academy of Sciences recommends a maximum daily consumption of 0.5g/kg of ethanol.\textsuperscript{11} Binge drinking creates the potential for harm to mother and infant and should be avoided. Even in moderate amounts alcohol in breast milk seems to affect gross motor development in a dose-dependent manner.\textsuperscript{12}

Effects of alcohol on breastfeeding

- May delay the let-down reflex and cause a reduction in supply.
- There is some evidence that beer consumption aids in milk production by increasing serum prolactin.\textsuperscript{12}
- Maternal concerns: sedation, decreased milk supply, altered milk taste.\textsuperscript{7}

Neonatal sequelae

- There is some evidence that the presence of alcohol in breast milk has an overall effect of decreasing infant breast milk consumption by 23% but the reason for this is unknown.\textsuperscript{12}
- Infants are known to be sensitive to the hypoglycemic effects of alcohol and fatalities have occurred when infants have been given alcohol to pacify them.\textsuperscript{12}
• Mild sedation has been observed in breast fed infants when maternal blood alcohol levels reach 300 mg/dl.9

• May cause changes in sleep patterns such as drowsiness or deep sleep, impaired motor development, decreased milk intake, risk of alcohol-induced hypoglycemia12

• Pediatric concerns: sedation, irritability, weak sucking7

HARM MINIMISATION STRATEGIES

• The infant should be fed prior to alcohol ingestion.

• Avoid breastfeeding during and for 2-3 hours after drinking alcohol.7

• Chronic or heavy consumers of alcohol should not breast feed.7

HALLUGINOGENIC AMPHETAMINES

(3, 4-METHYLENEDIOXY METHAMPHETAMINE [MDMA OR ECSTASY], MDEA, MDA, MDM [XTC, ESSENCE])

CENTRAL NERVOUS SYSTEM STIMULANT

American Academy of Pediatrics: Breastfeeding contraindicated8 Lactation
Risk: L5 (Breastfeeding contraindicated)7
Briggs et al: Breastfeeding contraindicated9
T_{1/2} = <8 hours, T_{max} = 1-5 hours7

Ecstasy or MDMA is a synthetic, psychoactive drug. MDMA can also be dangerous to health and, on rare occasions, lethal.13

MDMA exerts its primary effects in the brain on neurons that use the chemical serotonin to communicate with other neurons. The serotonin system plays an important role in regulating mood, aggression, sexual activity, sleep, and sensitivity to pain.13
Ecstasy tablets may contain other substances in addition to MDMA, including:

- ephedrine (a stimulant)
- dextromethorphan or DXM (a cough suppressant that has PCP-like effects at high doses)
- ketamine (an anaesthetic used mostly by veterinarians that also has PCP-like effects)
- caffeine
- cocaine
- methamphetamine  The combination of MDMA with one or more of these drugs may be inherently dangerous; use of ecstasy with substances such as marijuana and alcohol are likely to exacerbate the risk.13

Effects of ecstasy on breastfeeding

- No published information on ecstasy excretion into breast milk.
- No published information on ecstasy use in breastfeeding mothers.
- The molecular weight is low enough to suggest that excretion into breast milk does occur. The closely related drug amphetamine is concentrated in breast milk, with milk to plasma ratios ranging from 2.8 to 7.5.9
- Because MDMA can interfere with its own metabolism (breakdown within the body), potentially harmful levels can be reached by repeated drug use within short intervals.13
- Maternal concerns: hallucinations, agitation, seizures, acute paranoid psychosis, extreme hypertension, hyperthermia, tachyarrhythmia. Effects are largely dose-dependent.7 Psychological effects on the mother include confusion, depression, sleep problems, drug craving, and severe anxiety. These problems can occur during and sometimes days or weeks after taking MDMA.13

Neonatal sequelae

Research in animals links MDMA exposure to long-term damage to neurons that are involved in mood, thinking, and judgment. A study in nonhuman primates showed that exposure to MDMA for only 4 days caused damage to serotonin
nerve terminals that was evident 6 to 7 years later. While similar neurotoxicity has not been definitively shown in humans, the wealth of animal research indicating MDMA's damaging properties suggests that MDMA is not a safe drug for human consumption.\(^{13}\)

**HARM MINIMISATION STRATEGIES**

- Breast feed the infant prior to ecstasy use
- DO NOT breast feed for 24 – 48 hours after ecstasy use.

**RACEMIC AMPHETAMINES INCLUDING DEXTROAMPHETAMINE, DEXEDRINE, METHAMPHETAMINE [SPEED, METH, CHALK, CRYSTAL, ICE]**

**CENTRAL NERVOUS SYSTEM STIMULANT**

**American Academy of Pediatrics:** Drugs of abuse - adverse effects have been reported\(^8\)  
**Lactation Risk:** L4 (Possibly hazardous)\(^7\)  
**Briggs et al:** Limited human data – potential toxicity. Contraindicated (non-medical use)\(^9\)  
\(T_{1/2} = 6-8 \text{ hours, } T_{\text{max}} = 1-2 \text{ hours}\)\(^7\)

**Effects of amphetamines on breastfeeding**

- Inhibits prolactin release and can reduce breast milk supply.\(^{16}\)
- Concentration found in breast milk is 2.8 – 7.5 times those found in maternal plasma.\(^9\)
- Amphetamines have been detected in infant urine following maternal therapy.\(^{17}\)
- Levels in the milk of a mother taking amphetamine 20 mg/day therapeutically were found to be less than those in serum and no adverse effects on the infant were noted over a 24-month period.\(^{16}\)
• Concentrations in milk have not been measured during high-dose amphetamine use; there is likely to be considerable inter-subject variation in excretion.\textsuperscript{18}

• Maternal concerns: nervousness, insomnia, anorexia, hyper-excitability.\textsuperscript{7}

**Neonatal sequelae**

• Infants breastfed by amphetamine users appear to experience drug-induced behavioural abnormalities such as irritability, poor sleeping pattern,\textsuperscript{8} agitation and crying.\textsuperscript{16}

• Amphetamines purchased on the ‘street’ contain a mixture of substances and these impurities can have unpredictable and harmful effects on mother and infant.\textsuperscript{19,20}

**HARM MINIMISATION STRATEGIES**

• Do not breast feed for 24-48 hours after occasional amphetamine use.

• Express breast milk to maintain supply, discard expressed breast milk.

**BENZODIAZAPINES SEDATIVE / HYPNOTIC**

\textbf{American Academy of Pediatrics:} Unknown – may be of concern\textsuperscript{8} \textbf{Lactation Risk:} L3 (Moderately safe); L4 (Possibly hazardous) if used chronically\textsuperscript{7} \textbf{Briggs et al:} Limited human data – potential toxicity\textsuperscript{9}

<table>
<thead>
<tr>
<th></th>
<th>T1/2\textsuperscript{7}</th>
<th>Tmax\textsuperscript{7}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alprazolam</td>
<td>12-15 hours</td>
<td>1-2 hours</td>
</tr>
<tr>
<td>Chlordiazepoxide</td>
<td>5-30 hours</td>
<td>1-4 hours</td>
</tr>
<tr>
<td>Diazepam</td>
<td>48 hours</td>
<td>1-2 hours</td>
</tr>
<tr>
<td>Flunitrazepam</td>
<td>20-30 hours</td>
<td>2 hours</td>
</tr>
<tr>
<td></td>
<td>Half-life (oral)</td>
<td>Half-life (intravenous)</td>
</tr>
<tr>
<td>----------------</td>
<td>------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Flurazepam</td>
<td>47-100 hours</td>
<td>0.5-1 hours</td>
</tr>
<tr>
<td>Halazepam</td>
<td>14 hours</td>
<td>1-3 hours</td>
</tr>
<tr>
<td>Lorazepam</td>
<td>12 hours</td>
<td>2 hours</td>
</tr>
<tr>
<td>Midazolam</td>
<td>2-5 hours</td>
<td>20-50 minutes (oral)</td>
</tr>
<tr>
<td>Oxazepam</td>
<td>12 hours</td>
<td>1-2 hours</td>
</tr>
<tr>
<td>Prazepam</td>
<td>30-100 hours</td>
<td>6 hours</td>
</tr>
<tr>
<td>Quazepam</td>
<td>39 hours</td>
<td>2 hours</td>
</tr>
<tr>
<td>Temazepam</td>
<td>9.4-12.5 hours</td>
<td>2-4 hours</td>
</tr>
<tr>
<td>Triazolam</td>
<td>1.5-5.5 hours</td>
<td>0.5-2 hours</td>
</tr>
</tbody>
</table>

Benzodiazepine compounds fall into three major categories: long-acting compounds (diazepam, chlordiazepoxide, chlorazepate, flurazepam, halazepam, and prazepam); intermediate-acting compounds (clonazepam, lorazepam, quazepam, and estazolam); and short-acting compounds (alprazolam, oxazepam, temazepam, midazolam, and triazolam). If regular therapy is required or use is a choice, short acting benzodiazepines are preferable when breastfeeding.

**Effects of benzodiazepines on breastfeeding**

1. Breastfeeding is not recommended with long term/high doses of long acting benzodiazepines.²⁴,²⁵

2. Published data on benzodiazepine use when breastfeeding are highly variable and the quality of studies is poor.⁷

3. Diazepam and its metabolites are excreted in the breast milk of nursing mothers in low concentrations, depending on the dosage, at concentrations of 0.2 – 2.7 times those found in maternal plasma.⁹

4. There are no reports of adverse effects associated with the use of diazepam, lorazepam or quazepam during lactation. Prazepam is concentrated in milk relative to simultaneous maternal plasma concentrations.⁸

5. Maternal concerns: sedation, drowsiness, dizziness, blurred vision, dry mouth, headache, fatigue, ataxia, slurred speech, tremors, amnesia, mental confusion.⁷
Neonatal sequelae

1. Benzodiazepines have not been tested directly on lactating women to determine the effects on the nursing infant.

2. The American Academy of Pediatrics has classified lorazepam, diazepam and temazepam as drugs "for which the effect on nursing infants is unknown but may be of concern".8

3. The WHO Working Group on Drugs and Human Lactation considers oxazepam to be compatible with breastfeeding when taken by mothers in occasional small doses. Neonatal side effects include possible sedation, depression, poor suckling, withdrawal.26

4. Neonatal withdrawal symptoms have been noted after exposure to alprazolam (Xanax) during breastfeeding but the drug has a relatively short half-life.8,25

5. Chlordiazepoxide (Librium) appears to be safe during lactation.

6. Long-acting benzodiazepines such as diazepam and its metabolites can accumulate in infants, and have the potential to cause lethargy, sedation, and weight loss in infants. These effects quickly resolve after breastfeeding is discontinued.

7. Abrupt weaning or rapid cessation of long-term treatment or use may cause infant withdrawal symptoms.

HARM MINIMISATION STRATEGIES

1. Breastfeeding should be withheld for 6-8 hours after a single dose of benzodiazepine.

BUPRENORPHINE NARCOTIC AGONIST-ANTAGONIST ANALGESIC

Due to the lack of comprehensive data on the safety of buprenorphine during pregnancy, pregnant women who conceive while on buprenorphine treatment are advised to transfer to methadone maintenance. For those women who remain on buprenorphine rather than transferring to methadone maintenance, breastfeeding is not recommended.

**Effects of buprenorphine on breastfeeding**

The number of lactation studies on buprenorphine is small, and the majority of research has taken place in Europe. Animal studies indicate that buprenorphine has the potential to inhibit lactation or milk production.

**Neonatal sequelae**

There is little research on neonatal sequelae resulting from maternal buprenorphine use, and findings vary between studies as detailed below:

1. Decreases in postnatal survival, growth and development were observed in animals treated with buprenorphine during lactation.\(^\text{27}\)

2. There is some evidence that the buprenorphine in breast milk decreases infant breast milk consumption, possibly due to central nervous depression in mother and infant, resulting in lower weight gain.\(^\text{9}\)

3. In one study the infant of a buprenorphine-maintained mother who was breastfed for six months showed normal development at six and twelve month developmental assessments.\(^\text{28}\)

4. A study that measured the daily buprenorphine dose ingested by a newborn on breast milk over an 8-week period found it to be very low (3.28 micrograms).\(^\text{29}\)

5. In another study no withdrawal signs were observed when breastfeeding was abruptly ceased due to a chest infection.\(^\text{29}\)

**HARM Minimisation Strategies**

1. If a decision is made to continue breastfeeding while the mother is on buprenorphine, neonates and infants should be regularly monitored for weight gain and developmental progress.
2. If women decide to wean their babies from breast milk, they should be advised to wean their babies slowly to avoid possible withdrawal in the infant. 

CAFFEINE  CENTRAL NERVOUS SYSTEM STIMULANT

American Academy of Pediatrics: Compatible with breastfeeding⁸ Lactation Risk: L2 (Relatively safe)⁷
Briggs et al: Limited human data – potential toxicity⁹
T₁/₂ = 4.9 hours, Tₘₐₓ = 1 hour⁷

Effects of caffeine on breastfeeding

1. The amounts of caffeine in breast milk after maternal ingestion are probably too low to be clinically significant (around 1% of that found in the mother’s plasma). Peak concentration levels of caffeine occur in breast milk about 1 hour after ingestion.⁹

2. Iron levels in breast milk may be decreased if the mother is consuming more than 300 mg (3 cups of coffee) of caffeine per day.

Neonatal sequelae

1. The elimination half-life of caffeine in term newborns and preterm babies is approximately 80 hours and 97.5 hours respectively.⁹

2. Accumulation may occur in infants whose mothers ingest high levels of coffee or caffeinated beverages and can lead to irritability and insomnia.⁹

3. A high caffeine intake may result in the infant being jittery, colicky, constipated and generally unsettled.³⁰

4. Effects are more likely in preterm and newborn infants because of a diminished ability to metabolize caffeine.¹⁶

5. Neonatal side effects can be avoided by limiting maternal coffee consumption to 100 mg (1 cup) a day.
HARM MINIMISATION STRATEGIES

1. Breast feed infant prior to ingesting caffeine.

2. Monitor infant for signs/symptoms of exposure to or withdrawal from caffeine.

3. The maximum range for caffeine consumption should be 200-336 mg (2-3 cups) per day in women who are breastfeeding.

4.

CANNABIS (MARIJUANA, HASHISH) HALLUCINOGEN

American Academy of Pediatrics: Breastfeeding contraindicated\textsuperscript{8} Lactation Risk: L5 (Breastfeeding contraindicated)\textsuperscript{7}
Briggs et al: Breastfeeding contraindicated\textsuperscript{9}
$T_{1/2} = 25$-$57$ hours\textsuperscript{7}

Effects of cannabis on breastfeeding

1. $\Delta$-9-Tetrahydrocannabinol ($\Delta$-9-THC or THC), the principal psychoactive compound in marijuana, is excreted into breast milk.\textsuperscript{9}

2. The infant ingests approximately 0.8\% of its mother’s dose/kg from one joint. In heavy users the milk-to-plasma ratio can be as high as 8:1.\textsuperscript{7, 31}

3. Some components of marijuana have very long half lives, ranging from 25 – 57 hours.\textsuperscript{8}

4. Studies on animals suggest that marijuana can decrease the amount of milk produced by suppressing prolactin production, possibly through a direct effect on the mammary glands. There are no human data to corroborate these observations.\textsuperscript{32}

5. A study that investigated the time that breast fed infants were weaned found no significant differences between marijuana users and non-users, suggesting that marijuana use did not interfere with lactation.\textsuperscript{33}
6. Mothers using marijuana often sleep heavily after use and this may mean the mother is unresponsive to her infant’s needs.\textsuperscript{34}

**Neonatal sequelae**

1. Reports of the effects of prenatal marijuana exposure on the length of gestation, fetal growth, and neurobehavioural effects are conflicting. Confounding factors such as possible impurities in the drug and concomitant tobacco smoking may be responsible for these inconsistent reports.\textsuperscript{9}

2. One study\textsuperscript{33} found no association between exposure to marijuana and neonatal complications in the period that infants were in the nursery. Apgar scores of less than seven were not more frequent among nonusers (23%) than users (light 13%, moderate 13%, heavy 22%). Complications as measured by time in the NICU, jaundice, peripheral haematocrit, hypoglycemia, weight change, presence of hypothermia, or feeding problems were no different in exposed than in non-exposed infants.

3. Short-term effects in infants have not been reported, but a decrement in motor development at age 1 yr in the infants of marijuana-smoking mothers was reported in one study.\textsuperscript{17}

4. Passive or ‘side stream’ smoke is a significant issue.\textsuperscript{34}

5. Infants may show signs of sedation, weakness and poor feeding habits.\textsuperscript{34}

6. The effects of long term exposure are unknown; additional research is needed to determine the outcomes.

**Harm Minimisation Strategies**

1. Withhold breastfeeding for several hours after occasional marijuana use and use caution to avoid exposing the infant to marijuana smoke.\textsuperscript{16}

2. Smoke outside the house or car.

3. Smoke only after feeding.
COCAINE  SYMPATHOMIMETIC / CENTRAL NERVOUS SYSTEM STIMULANT

American Academy of Pediatrics: Breastfeeding contraindicated\(^8\) Lactation
Risk: L5 (Breastfeeding contraindicated)\(^7\)
Briggs et al: Breastfeeding contraindicated (systemic)\(^9\)
\(T_{1/2} = 0.8\) hours, \(T_{max} = 15\) minutes\(^7\)

In 2004 approximately 1% of the Australian population had used cocaine within the last 12 months.\(^15\) The normal method of administration was by injecting (42%), sniffing (37%) and smoking (11%).\(^14\) Based on the toxicity exhibited in breastfed infants exposed to cocaine, maternal cocaine use should be strongly discouraged during breastfeeding.

Effects of cocaine on breastfeeding

1. Cocaine is excreted into breast milk in fairly high concentrations. Cocaine has been detected in infant serum, and toxicity has been reported in some infants.\(^17\)

2. Cocaine and its metabolites have been found in the urine of breastfeeding infants 24-36 hours after maternal use.\(^16\)

3. Based on current evidence breastfeeding is not recommended if the mother is a chronic cocaine user, and even occasional use of cocaine is discouraged during breastfeeding.\(^16\)

Neonatal sequelae

1. Infants are less able than adults to metabolize cocaine and may accumulate the drug as a result of low serum cholinesterase activity.\(^16,17\)

2. Some studies have found that nursing infants exposed to cocaine can be difficult to feed.\(^35\)

3. Potential adverse effects in the infant include irritability, vomiting, diarrhoea, tremulousness, seizures and dilated pupils.\(^8\)

4. In one study an infant breast fed 5 times over a 4-hour period during which the mother ingested cocaine, displayed symptoms three hours after the first dose. These included irritability, vomiting, diarrhoea, tremulousness, increased startle reflex and hyperactive Moro reaction.\(^36\)
5. In another study an infant exposed to cocaine through a topical application to the nipples to treat nipple soreness, experienced seizures and was found gasping, choking and blue 3 hours after feeding (acute symptoms of cocaine exposure).⁹

**Harm Minimisation Strategies**

1. Withhold breastfeeding for at least 24 hours after occasional cocaine use.

2. Mothers should be warned that it is extremely dangerous to apply cocaine topically to treat nipple soreness.⁹

---

**Gamma-Hydroxybutyrate (GHB)**

**SEDATIVE/HYPNOTIC**

**American Academy of Pediatrics:** Not reviewed  
**Lactation Risk:** Not reviewed  
**Briggs et al:** Not reviewed  

T₁/₂ = 0.3-1 hour,³⁷ 20 minutes for 12.5 mg/kg orally increasing with dose,³⁸  
Tₘₐₓ = 20-60 mins³⁹

GHB, also known as "Liquid Ecstasy" and "Grievous Bodily Harm", is the most recent addition to the sedative-hypnotic group of drugs of abuse. GHB is a rapidly acting, naturally occurring short-chain fatty acid related to gamma-aminobutyric acid (GABA). It rapidly produces effects that have been likened to a combination of alcohol (euphoria, reduced anxiety, drowsiness, loss of motor control) and ecstasy (enhanced sensuality, emotional warmth). The illicit use of GHB and its precursors gamma-butyrolactone (GBL) and 1, 4-butanediol (1, 4-BD) has steadily grown in the US.⁴⁰, ⁴¹

GHB is used to heighten sexual pleasure, as well as being used as a "health product" for sleep and bodybuilding. It has also been used in drug rape and other drink-spiking crimes. The amnesia-producing effects of GHB make the victim unable to describe the events after recovery. The effects of GHB are exacerbated when taken with alcohol or other drugs, making it especially dangerous when used to spike an alcoholic drink. GHB takes effect within 10-20
minutes and the effects last for 1-3 hours. It is thought to be eliminated from the body in around 12 hours.\textsuperscript{37}

**Effects of GHB on breastfeeding**

1. Safety in lactation has not been established.\textsuperscript{42}

2. After ingestion, GHB is rapidly absorbed and quickly crosses the blood-brain barrier. It is not protein bound and is rapidly metabolized and excreted through the lungs.\textsuperscript{43} Since it is not protein bound it is likely to be excreted in breast milk in significant concentrations.\textsuperscript{7, 16}

3. GHB exhibits non-linear elimination kinetics, which means that GHB’s half-life increases with dose. The half-life of an oral dose of 12.5 mg/kg is 20 minutes. The dose of street GHB can vary from 500 mg to 5 grams per dose, making its use potentially hazardous during breastfeeding.\textsuperscript{38}

4. Unpredictable loss-of-consciousness episodes that are frequently experienced are due to GHB’s steep dose-effect relation, dangerous variability in “street” dosages, GHB’s non-linear elimination kinetics, and interactions with other drugs.\textsuperscript{38}

**Neonatal sequelae**

1. Drugs such as GHB with short half-lives produce a rapid and severe withdrawal syndrome which is likely to be experienced by the infant.\textsuperscript{44}

2. The effects of GHB on the neonate are not documented. In mothers the most commonly experienced side effects of GHB are drowsiness, dizziness, nausea, and vomiting. Other less common side effects include weakness, loss of peripheral vision, confusion, agitation, hallucinations, bradycardia, ataxia and loss of coordination.\textsuperscript{44, 45}

**Harm Minimisation Strategies**

1. Withhold breastfeeding for at least 12 hours after occasional GHB use.
**HEROIN (DIACETYLMOEPHINE OR DIAMORPHINE) AND OTHER OPIOIDS NARCOTIC AGONIST ANALGESIC**

American Academy of Pediatrics: Breastfeeding contraindicated
Risk: L5 (Breastfeeding contraindicated)
Briggs et al: Breastfeeding contraindicated
T\(_{1/2}\) = 1.5-2 hours, T\(_{max}\) = 0.5-1 hour

**Effects of heroin & other opioids on breastfeeding**

1. At therapeutic doses, most opioids, such as morphine, meperidine, methadone, and codeine are excreted into milk in only minimal amounts compatible with breastfeeding. Heroin, however, is excreted into breast milk in sufficient quantities to cause addiction in the infant.

2. Intravenous substance use increases the risk of the mother contracting blood borne viruses through shared equipment and engaging in unprotected sex. The risk of infection of the infant through transmission of blood borne viruses via breast milk is therefore increased.

**Neonatal sequelae**

1. With prolonged use all narcotics may produce neonatal abstinence syndrome in neonates when ceased.

2. Levels in breast milk can be high enough to alleviate withdrawal symptoms in the infant.

3. Chaotic substance use by a breastfeeding mother may result in the infant receiving fluctuating doses of opioids. Fluctuating levels may mean that breastfeeding is not reliable enough to be used as a method for preventing withdrawal.

4. Adverse effects include sedation, withdrawal, tremors, restlessness, vomiting and poor feeding.

5. Infants of heroin users often have a low birth weight and require additional calories for growth.

**HARM MINIMISATION STRATEGIES**

1. Delay breastfeeding after opioid use for 24-48 hours depending on
drug/substance used and the uncertain composition of street drugs.

2. Commence treatment substitution regime if possible, e.g. methadone program.

**INHALANTS AND VOLATILE SUBSTANCES**
(PETROL, GLUE, AEROSOL CANS, BUTANE GAS, ETC) VARIOUS (PSYCHOACTIVE, ANAESTHETICS, VASODILATORS, ETC.)

*American Academy of Pediatrics:* Not reviewed  
*Lactation Risk:* L2 - L5  
(Depends on component compounds)\(^7\)  
*Briggs et al:* Limited human data – depends on component compounds\(^9\)

<table>
<thead>
<tr>
<th>Substance</th>
<th>T1/2</th>
<th>Tmax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amyl Nitrite</td>
<td>1-4 min</td>
<td>2-20 min(^7)</td>
</tr>
<tr>
<td>Benzene</td>
<td>1-3 hrs(^50)</td>
<td></td>
</tr>
<tr>
<td>Butane Gas</td>
<td>10 min(^51)</td>
<td></td>
</tr>
<tr>
<td>Nitrous Oxide</td>
<td>&lt;3 min(^7)</td>
<td>15 min(^7)</td>
</tr>
<tr>
<td>Tetrachloroethylene (PER)</td>
<td>2 hrs(^52)</td>
<td></td>
</tr>
<tr>
<td>Toluene</td>
<td>7.5 hrs(^52)</td>
<td>15-30 min(^53)</td>
</tr>
<tr>
<td>1,1,1-Trichloroethane</td>
<td>10-12 hrs(^52)</td>
<td></td>
</tr>
<tr>
<td>Trichloroethylene</td>
<td>30-38 hrs(^52)</td>
<td></td>
</tr>
<tr>
<td>Xylene</td>
<td>20-30 hrs(^52)</td>
<td></td>
</tr>
</tbody>
</table>

**Types of Inhalants**
Inhalants are breathable chemical vapors that are intentionally inhaled because of their psychoactive or mind-altering effects. These substances are often common household products that contain volatile solvents or aerosols and fall into three categories:

**Solvents**

Solvents such as benzene, toluene and xylene used in industrial or household solvents or present in solvent-containing products (such as paint thinners or removers, degreasers, dry-cleaning fluids, petrol, and glue); or art or office supply solvents containing substances such as trichloroethylene (such as correction fluids, felt-tip marker fluid, and electronic contact cleaners).

**Gases**

Can be either those used in household or commercial products (including butane lighters and propane tanks, whipped cream aerosols or dispensers, and refrigerant gases); household aerosol propellants and associated solvents (in items such as spray paints, hair or deodorant sprays, fabric protector sprays, and aerosol computer cleaning products); or medical anaesthetic gases, such as ether, chloroform, halothane, and nitrous oxide ("laughing gas").

**Nitrites**

Can be either organic nitrites (such as cyclohexyl, butyl, and amyl nitrites, commonly known as "poppers") or volatile nitrites often sold in small brown bottles and labelled as "video head cleaner" "room deodorizer" "leather cleaner" or "liquid aroma".

**Effects of inhalants on breastfeeding**

1. Many solvents pass readily into breast milk.
2. Generally most solvents have short half-lives.

**Neonatal sequelae**

1. The neonate’s nervous system continues to develop after birth and nursing infants may be more sensitive to the neurotoxic effects of solvents.

**HARM MINIMISATION STRATEGIES**

1. Avoid breastfeeding if the mother is intoxicated on inhalants.
LYSEROIC ACID DIETHYLAMIDE (LSD)
HALLUCINOGEN

American Academy of Pediatrics: Breastfeeding contraindicated\(^8\) Lactation Risk: L5 (Breastfeeding contraindicated)\(^7\)
Briggs et al: Breastfeeding contraindicated\(^9\)
\(T_{1/2} = 3\) hours, \(T_{\text{max}} = 30-60\) minutes (oral)\(^7\)

Effects of LSD on breastfeeding

1. Little or no data is available on the transfer of LSD into breast milk. Because the drug has a low molecular weight, which should allow transfer into breast milk, and because hallucinogenic effects are produced at extremely low concentrations, the use of LSD during lactation is contraindicated.\(^9\)

Neonatal sequelae

1. LSD is likely to enter the milk and produce hallucinogenic effects in the infant.\(^7\)

2. Adverse effects in the infant include hallucinations, dilated pupils, salivation and nausea.\(^7\)

3. Mother’s ability to care for her infant following use of LSD is highly questionable.\(^56\)

HARM MINIMISATION STRATEGIES

1. Breast feed the infant prior to using LSD.

2. DO NOT breast feed after LSD use for 34-120 hours.\(^7\)
METHADONE  NARCOTIC AGONIST ANALGESIC

American Academy of Pediatrics: Compatible\textsuperscript{6} Lactation Risk: L3 (Moderately Safe)\textsuperscript{7}
Briggs et al: Limited human data – probably compatible\textsuperscript{9}
\(T_{1/2} = 13-55\) hours, \(T_{\text{max}} = 0.5-1\) hour\textsuperscript{7}

Daily dispensing is the usual recommendation during pregnancy and breastfeeding in order to keep blood levels consistent and decrease the risk of women sharing or selling their take home doses. Breast milk contains only small amounts of methadone and mothers can be encouraged to breast feed regardless of methadone dose provided that they are not using other drugs.\textsuperscript{57} Other experts consider breastfeeding to be safe provided the maternal methadone dose is low\textsuperscript{58} or where methadone maintenance doses are less than 80 mg/day.\textsuperscript{16}

Effects of methadone on breastfeeding

1. Maternal blood methadone levels and methadone excretion in breast milk vary between individuals with up to 5% of the maternal dose detected in breast milk.

2. Women on methadone maintenance should only breast feed for 3–5 months, after which the volume of milk consumed by the baby is large enough to supply a sedating dose of methadone to the baby and may produce NAS when breastfeeding is ceased.\textsuperscript{59}

Neonatal sequelae

1. Advantages of breastfeeding to the mother/infant pair may outweigh any risk.\textsuperscript{59}

2. Breastfeeding may reduce the severity of the neonatal abstinence syndrome.\textsuperscript{57}

3. Infant absorption may vary, particularly if the infant receives a formula supplement.

4. Advise the mother to seek medical advice if her child appears sedated.

5. The baby may experience withdrawal symptoms when breastfeeding is discontinued at the time of weaning and should be closely monitored.\textsuperscript{60} Additional information can be found in the NAS Guideline.
HARM MINIMISATION STRATEGIES

1. Maintain methadone treatment regime.

2. Breast feed infant prior to using daily methadone dose.

3. Avoid breastfeeding for 2-4 hours after methadone dose when blood levels are at their highest.\(^{60}\)

4. Inform mothers about the possible effects of higher methadone doses or resumed polydrug use whilst breastfeeding.

5. Educate mothers to recognise the symptoms of NAS.

6. Monitor the infant for signs/symptoms of withdrawal from methadone (NAS).

7. Women receiving high doses of methadone should be advised to wean their babies slowly to avoid withdrawal symptoms in the infant.

NICOTINE (INCLUDING NICOTINE PATCHES AND GUM) CENTRAL NERVOUS SYSTEM STIMULANT

**American Academy of Pediatrics:** Recommendation under consideration\(^8\)

**Lactation Risk:** Nicotine Patches or Gum L2 (Relatively safe)\(^7\)

**Briggs et al:** Not reviewed

\(T_{1/2} = 2\) hours, \(T_{\text{max}} = 2-4\) hours\(^7\)

The American Academy of Pediatrics (AAP) Committee on Drugs placed nicotine (smoking) in Table 2 “Drugs of Abuse-Contraindicated During Breastfeeding” in its previous (2001) statement, due to a documented decrease in milk production and a decrease in subsequent weight gain in the infant of the smoking mother and exposure of the infant to environmental tobacco smoke as demonstrated by the presence of nicotine and its primary metabolite, cotinine, in human milk.\(^8\)

The 2001 position was considered controversial due to the presence of hundreds of compounds in tobacco smoke. Nicotine is not necessarily the only component that might cause an increase in respiratory illnesses and otitis media in the nursing infant as a result of ingestion or environmental exposure. Nicotine is
present in milk in concentrations of between 1.5 and 3.0 times the simultaneous maternal plasma concentration and elimination half-life is 60 to 90 minutes in both milk and plasma. There is no evidence to document whether this amount of nicotine presents a health risk to the nursing infant.  

The AAP Committee on Drugs supports the emphasis of the American Academy of Pediatrics on increasing breastfeeding in the United States and considers that pregnancy and lactation are ideal occasions for physicians to urge cessation of smoking.

Effects of nicotine on breastfeeding

1. Nicotine is quickly absorbed after maternal smoking.  

2. Nicotine and its metabolite cotinine are excreted into breast milk in amounts proportional to the number of cigarettes smoked by the mother.  

3. The milk of smokers contains higher concentrations of cadmium than the milk of non-smokers; other toxins from smoke have not been measured.  

4. Smokers produce lower milk volumes, have lower milk fat content, use formula supplements more often, and wean their infants from breastfeeding earlier than non-smokers, partly due to nicotine lowering maternal basal prolactin concentrations.  

5. The use of oral or transcutaneous nicotine substitutes (chewing gum, topical patches, or nasal sprays) during lactation have not been extensively studied. Although they are not recommended by the manufacturer during nursing, these products may be less hazardous to the nursing infant than maternal smoking.  

6. Nicotine alters the taste of breast milk.  

Neonatal sequelae

1. Infants of smoking mothers have increased infantile colic and decreased respiratory rates and oxygen saturation following breastfeeding, as well as being more prone to respiratory infections.

2. Findings from one study in which mothers used a 7-mg patch to assist tobacco cessation suggest that the absolute infant dose of nicotine and its metabolite cotinine decreased by approximately 70% of that observed when the mothers were smoking or using a 21-mg patch.
3. Nicotine gum appears to reduce maternal serum nicotine levels to around 30-60% that of cigarette smokers but produces large variations in peak levels when the gum is chewed rapidly in comparison to the sustained and lower level of release observed with the patches.  

4. The risk of using nicotine patches whilst breastfeeding is much less than the risk of formula feeding.  

5. There is some evidence to suggest that breastfeeding and smoking is less detrimental to the child than bottle feeding and smoking.  

6. Infants that are smoked over (passive smoking) are more likely to experience respiratory, gastrointestinal illnesses (colicky, irritable, vomiting, poor growth), squint, hearing impairment, and unexplained death.  

7. Breastfeeding reduces the risk of respiratory illness by half that of formula-fed infants of smokers.  

8. Nicotine poisoning may occur.  

**HARM MINIMISATION STRATEGIES**

1. Quit smoking tobacco if possible.  

2. Advise mothers to limit smoking as much as possible and smoke only after the infant has been fed, or switch to nicotine patches.  

3. Smoke outside the house or car.  

4. Avoid vegetables that contain considerable amounts of nicotine – eggplant, cauliflower and tomato puree.  

5. Breastfeed exclusively for the first six months to maximize the infant’s protection against respiratory disease.  

6. Avoid smoky environments.
PHENCYCLIDINE (PCP, ANGEL DUST, OZONE, ROCKET FUEL) HALLUCINOGEN

American Academy of Pediatrics: Breastfeeding contraindicated\(^8\) Lactation
Risk: L5 (Breastfeeding contraindicated)\(^7\)
Briggs et al: Breastfeeding contraindicated\(^9\)
\(T_{1/2} = 24-51\) hours, \(T_{\text{max}} = \text{Immediate}\)\(^7\)

PCP was developed in the 1950s as an intravenous anesthetic. Its use in humans was discontinued in 1965, because patients often became agitated, delusional, and irrational while recovering from its anesthetic effects. Illegally manufactured PCP is sold on the street by such names as angel dust, ozone, wack, and rocket fuel. Killer joints and crystal super grass are names that refer to PCP combined with marijuana.\(^64\)

At low to moderate doses, physiological effects include a pronounced rise in blood pressure and pulse rate. Breathing becomes shallow and flushing and profuse sweating occurs. Generalized numbness of the extremities and loss of muscular coordination may also occur.\(^64\)

PCP has a sedative effect, and interaction with other central nervous system depressants such as alcohol and benzodiazepines can lead to coma.\(^64\)

Effects of PCP on breastfeeding

1. PCP is stored in fatty tissue.\(^65,66\)
2. In animal studies milk concentrations of PCP were 10 times those of plasma.\(^67\)
3. PCP has been found in breast milk several weeks after maternal dosing. This is attributable to its long half-life and is therefore contraindicated.\(^7,68\)

Neonatal sequelae

There are virtually no data on neonatal sequelae resulting from maternal PCP use, although the following findings have been reported:

1. Irritability, jitteriness, hypertonicity and poor feeding were common features in infants born to PCP-using mothers.\(^9\)
2. PCP is extremely dangerous to a breastfed infant and nursing mothers should be encouraged to avoid it.\(^7,68\)
HARM MINIMISATION STRATEGIES

1. Avoid breastfeeding after phencyclidine (PCP) use. Sufficient duration of abstinence has not been defined.\textsuperscript{16, 56}

2. Advise PCP-using mothers not to breast feed.\textsuperscript{8}