Ideally mother and baby should be transferred to the postnatal ward soon after delivery so that they can room in together and have ‘skin-to-skin’ contact. Separating mother and baby should be avoided wherever possible unless there are medical reasons for admission to the NICU. ‘Skin-to-skin’ contact will help the baby relax and sleep, regulate their body temperature, steady their breathing, help to facilitate mother-infant bonding and help get breastfeeding off to a good start. The development of neonatal withdrawal symptoms, even if they require treatment, is not in itself an indication for admission to the NICU and treatment can be easily administered in the postnatal ward.1,2

**BREASTFEEDING**

Much confusion surrounds the issue of whether a woman should breastfeed her baby whilst continuing to take drugs. Many women and their partners are concerned about breastfeeding whilst taking drugs or drinking alcohol and will ask for advice. Parents should be informed that for most drugs the benefits of breastfeeding far outweigh the disadvantages, even with continued drug use. It is important to reassure the mother that the actual amount of drugs passed to the baby through breast milk is usually minimal and will have little effect on the newborn baby. The sometimes small effect on the baby may even help withdrawal symptoms, if they are present.3 Babies born to substance using mothers are particularly vulnerable and have the most to gain from breastfeeding. These babies are often preterm or of low birth weight, have an increased risk of sudden infant death, and their mothers may smoke and/or come from disadvantaged backgrounds.4

Breastfeeding provides optimal infant nutrition but involves a number of additional considerations in the context of substance use. The risks and benefits of breastfeeding need to be discussed with the mother so that she can make an informed choice. If the mother and child are separated for any reason, an electric breast pump should be provided to help establish successful lactation.4

It is important that the woman is given consistent and evidence-based information that does not exaggerate the perceived risk so that any feelings of guilt and concerns they may have about possible harm to their baby are put into perspective. Advice should be tailored to each woman’s particular situation so that she can make an informed choice. Contradictory advice from different health professionals should be avoided as it is likely to reduce confidence and cause confusion.

Drug use should be stable for breastfeeding to be appropriate. Unless contraindicated, breastfeeding should therefore be encouraged regardless of the type of drug or dosage used and indeed the greater the level of drug use the greater the potential benefits of breastfeeding. Breastfeeding assists in the bonding process and can provide positive support for the mother in reinforcing the feeling that she is comforting and caring for her baby. In addition breastfeeding will benefit the long-term health of both mother and baby.1,2,5-8

Injecting drug use should be discouraged whilst breastfeeding because of the risk of mother-to-baby blood borne virus transmission. Substance using mothers should be encouraged to breastfeed in the same way as other mothers. Methadone treatment is not a contraindication to breastfeeding.9 Breastfeeding is contraindicated only if the mother is:

- HIV positive (because of the risk of transmission)
- Using large quantities of stimulant drugs, such as cocaine, or amphetamines (because of their vasoconstrictive effects)
- Drinking heavily (>8 units/day), using heroin, or taking large amounts of non-prescribed benzodiazepines (because of sedative effects).1,10

An Opinion from the American College of Obstetricians and Gynecologists on Hepatitis C transmission states:

“Studies to date evaluating the effect of breastfeeding on HCV transmission indicate that the average rate of infection is 4% in both breastfed and bottle fed infants. Therefore, it appears that breastfeeding does not appreciably increase the risk of transmitting HCV to a neonate.”11

Mothers who are Hepatitis C positive should be encouraged to breastfeed. Women who are Hepatitis B positive can also safely breastfeed as soon as their newborn baby has received the first dose of immunoglobulin and Hepatitis B vaccine, normally administered shortly after birth. While breastfeeding increases the risk of vertical transmission of HIV, there is no evidence that this is the case with HCV infection, and immunisation of the neonate will prevent HBV transmission in almost all cases. The US Centers for Disease Control and Prevention (CDC) National Center for Infectious Diseases has found no evidence to
suggest that breastfeeding spreads HCV, but recommends that HCV-positive mothers should consider abstaining from breastfeeding whilst their nipples are cracked or bleeding.\(^1\)

**FACTORS AFFECTING THE CONCENTRATION OF DRUGS IN BREAST MILK**

Nearly all drugs pass into the breast milk to some degree, with the exception of high molecular weight drugs such as heparin and insulin which are too large to cross biological membranes.\(^13\)\(^-\)\(^16\) However, almost all appear in only small amounts in the order of less than 1% of the maternal dose.\(^17\) Some of the factors that affect drug transfer and concentration in breast milk are summarised in Table 1.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Description</th>
<th>General Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal Plasma Drug Level</td>
<td>Maternal plasma level will vary with dose amount, timing and route.</td>
<td>Contrary to what many people believe, drugs do not enter breast milk and stay there indefinitely. As the mother’s plasma levels rise, levels in milk will rise too. Conversely, as mother’s plasma levels drop, drug concentration in milk will decrease. If dosing schedule is flexible, a mother can be advised to take her dose immediately after a feed, which reduces infant exposure (Hale, 2002). The lowest effective concentration in the maternal plasma would be most desirable during lactation.</td>
</tr>
<tr>
<td>T(^1)/2</td>
<td>This value is the adult half-life of the drug. A half-life is defined as the time required for the amount of drug in the body to decrease by 50% (Lehne, 2001).</td>
<td>Drugs with short half-lives are preferred for use during lactation (Hale, 2002). If the mother is prescribed a drug with a long half-life, a similar medication with a shorter half-life can sometimes be an adequate substitute if the physician deems it appropriate.</td>
</tr>
<tr>
<td>Lipid Solubility</td>
<td>Drugs that are lipid soluble tend to concentrate more in breast milk, because it is fatty.</td>
<td>CNS-active drugs, including psychotropic medications, will often be found in higher concentrations in breast milk than in the mother’s plasma (Hale, 2002).</td>
</tr>
<tr>
<td>Protein Binding</td>
<td>Drugs circulate in maternal plasma either bound to protein (albumin) or free. Only the free drug can transfer into milk (Hale, 2002).</td>
<td>A drug with high ((&gt;90%)) protein binding is preferred, because there is less free drug available to transfer into breast milk (Hale, 2002).</td>
</tr>
<tr>
<td>Days Postpartum</td>
<td>Drugs enter breast milk primarily through diffusion between maternal blood vessels and the milk buds in the breasts (Ridlan &amp; Auerbach, 1999). During the first 4 days of the postpartum period, large gaps exist between the alveolar cells in the milk buds. This permits beneficial maternal proteins to enter the milk, but also allows easier drug transfer. After day 4, surging progesterone hormone levels cause alveolar cells to swell, closing the gaps and decreasing drug transfer into breast milk (Hale, 2002).</td>
<td>It is generally agreed upon that drugs can more easily enter breast milk during the neonatal period than in mature milk (Hale, 2002). For this reason, more precaution should be taken in the early postpartum period than later.</td>
</tr>
</tbody>
</table>

After a drug is administered (orally, intravenously or intramuscularly) it enters the maternal circulatory system, and is transported to other parts of the woman’s body including her breasts. Small water-soluble non-electrolytes pass into breast milk by simple diffusion through pores in the mammary epithelial membrane that separates plasma from milk. Equilibrium between the two fluids is rapid, and milk concentrations of drugs will be similar to plasma concentrations. In the case of larger molecules, only the lipid soluble, non-ionised forms pass through the membrane by crossing the cell wall and diffusing across the interior of the cell to reach the milk. The pH of milk is generally lower than that of plasma and milk can act as an “ion trap” for basic drugs. At equilibrium, these compounds can be concentrated in milk relative to plasma. Conversely, acidic drugs are inhibited from entering milk.\(^15\)\(^,\)\(^16\)
Because plasma proteins bind drugs to a greater extent than milk proteins, protein binding is also an important factor. Highly protein-bound drugs do not pass into milk in high concentrations. Lipid solubility favours passage of some drugs into milk because the fat component of milk can concentrate lipid soluble drugs. However, because milk contains only 3 to 5% fat, its capacity for concentrating drugs is limited.

Periodic emptying of the breast by the nursing infant and refilling with newly formed milk means that equilibrium between plasma and milk is rarely reached, so the rate of drug passage from plasma into milk is important in determining the concentration of a drug in milk. High lipid solubility and low molecular weight are factors that favour rapid passage into milk. The process is bi-directional so that when the concentration of non-ionised free drug is higher in milk than in plasma a net transfer of drug from milk to plasma occurs. As a result pumping and discarding milk does not appreciably hasten the elimination of most drugs from milk and does not have a marked effect on overall clearance of the drug from the mother's body. Milk composition is variable both within and between feeds which may also affect the transfer of drugs into breast milk. Milk at the end of a feed (hind milk) contains considerably more fat than foremilk and may concentrate fat-soluble drugs.

A number of maternal, breast, and infant factors affect the passage of a drug into breast milk:

**Maternal factors**

During pregnancy maternal plasma volume increases by 30 to 50%, and cardiac output and glomerular filtration rate also increase proportionally. These factors may result in lower circulating concentrations of some drugs, especially those that are excreted readily, towards the end of the pregnancy. An increase in body fat during pregnancy may increase the volume of distribution of fat-soluble drugs; a decrease in plasma albumin concentrations during pregnancy increases the volume of distribution for highly protein-bound drugs such as anticonvulsants and selective serotonin reuptake inhibitors (SSRIs).

In the immediate postpartum period, a woman’s body undergoes dramatic physiological changes so that the pharmacokinetics of a drug administered to a lactating woman may be quite different immediately after birth than they are several weeks or months later, as maternal blood volumes fall, cardiac output falls, and albumin concentration increase as the body returns to a pre-pregnant state.

Additional maternal factors that will affect the excretion of a drug into breast milk include:

- Dose
- Rate of absorption
- Route of drug administration
- Frequency of use
- Half-life of the drug/substance
- Time feed takes place in relation to drug administration
- Amount of subcutaneous fat
- Nutritional status
- Single versus multiple births
- Return of menses
- Stress
- Pharmacokinetics and pharmacodynamics of the drug in the lactating woman.

**Breast factors**

Factors that can influence the ability of a drug to gain access into breast milk include:

- Blood flow to the breasts
- pH of maternal plasma and milk
- Days postpartum
- Drug ionisation
- Protein binding in breast milk
• Drug metabolism in breast milk
• Possible reabsorption of the drug or its metabolites from breast milk back into the maternal circulation.

The amount of drug transferred from maternal plasma to breast milk and the rate at which this process occurs depends on a number of drug characteristics such as molecular weight, maternal plasma and breast milk protein binding, lipid solubility, pKa (which helps determine the ionisation of a drug at specific plasma and milk pHs), and the difference in pH between maternal plasma and breast milk.\textsuperscript{15}

During the first four days postpartum there are large gaps between the alveolar cells in the milk buds which permits beneficial maternal proteins to enter the milk, but also allows for easier drug transfer. A surge in prolactin hormone levels after day 4 causes the alveolar cells to swell, closing the gaps and decreasing the amount of drug transferred into the breast milk.\textsuperscript{17}

It is also important to differentiate between the passage of a drug into colostrum, transitional milk, or mature milk, since the percentage of the drug present in breast milk will vary according to the milk composition.\textsuperscript{15}

**Infant factors**

Factors that will determine the amount of maternal drug that is available for absorption by a breastfed infant include:\textsuperscript{18}

- Gestational age
- Body weight
- The infant’s sucking pattern
- The number of feeds per day
- The time the infant spends nursing
- The volume of milk consumed at each feed
- Absorption of the drug by the infant (this will depend on the infant’s gastric pH, gastric emptying time, intestinal transit time, and bile acid and pancreatic enzyme production)
- Pharmacokinetic and pharmacodynamic effects of the drug on the term or preterm infant.

Preterm, ill and low birth weight infants are more likely to be affected by drugs in breast milk due to restricted or immature renal function and metabolic processes. If absorbed by the neonate, the effect of a particular drug will depend on the dose absorbed, as well as the pharmacokinetics and pharmacodynamics of the drug.\textsuperscript{14, 15, 19}

It is not always clear whether an infant is affected by drugs in breast milk. Drugs passed through breast milk to the breastfeeding infant are metabolised in a similar way to a drug that is ingested orally. The drug must pass through the infant’s gastrointestinal tract, where it may be denatured by the acidic environment. Other drugs are poorly absorbed orally and are consequently poorly absorbed into the infant’s blood stream. Additionally, many drugs are isolated in the liver and never reach the plasma or enter the breast milk.\textsuperscript{14}

The concentration of most drugs in breast milk is exceedingly low and therefore insufficient to contraindicate breastfeeding. However, drugs that are active on the central nervous system are able to pass easily into breast milk. Cocaine, heroin, PCP, and amphetamines have all been described as having adverse effects on infants when transmitted in breast milk\textsuperscript{19} and are not recommended while breastfeeding.

**Factors affecting milk production**

The role of prolactin in the production of human milk is not totally understood, but it is vital to this process. Prolactin appears to stimulate the production and secretion of breast milk, whereas oxytocin stimulates the contraction of the myoepithelial cells that surround breast alveoli. Milk then enters the ducts to be ejected, the “letdown reflex” occurs, and milk is expelled from the breast. Adrenocorticotropic hormone, cortisol, growth hormone, insulin, and thyroxin are also needed for milk production and secretion, but their roles are not fully understood.\textsuperscript{15}

Maternal drug use can affect milk secretion and/or composition by affecting factors such as mammary gland development, milk secretion and hormones that control the lactation process. For example, dopamine
agonists reduce prolactin secretion and are sometimes therapeutically used to stop lactation, whereas other drugs may have the opposite effect.\textsuperscript{15}

Anxiety, stress, and pain inhibit the ejection of milk by decreasing oxytocin.\textsuperscript{15} Amphetamines also inhibit prolactin release and, in high dosages, can interfere with lactation.\textsuperscript{16}

One study that investigated the time that breastfed infants were weaned found no significant differences between marijuana users and non-users, suggesting that marijuana use did not interfere with lactation.\textsuperscript{20} However, 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{21}

**Methadone maintenance and breastfeeding**

The use of methadone for the treatment of opioid dependence in Australia was endorsed in 1985.\textsuperscript{22} Although alternatives such as buprenorphine, naltrexone and dihydrocodeine are now available, in Australia methadone remains the most commonly used pharmacotherapy for opioid dependence.\textsuperscript{23-25} Methadone is the treatment of choice for pregnant opioid using women in Australia, the United States of America (USA) and Europe.

Methadone maintenance during pregnancy reduces the effects of cycling from intoxication to withdrawal when using illicit opioids\textsuperscript{26} and improves maternal and birth outcomes.\textsuperscript{5} Methadone is a licit, long acting synthetic opioid (15-40 hours) which can be used as a substitute for shorter acting illicit opioids.\textsuperscript{27} Neonatal abstinence syndrome (NAS) occurs in 60-90% of infants born to mothers maintained on methadone during pregnancy; these infants may require pharmacotherapy to manage the clinical signs of withdrawal.\textsuperscript{5}

Daily dispensing of methadone is the usual recommendation during pregnancy and breastfeeding in order to keep blood levels consistent and decrease the risk for women to share or sell their take home doses. Single daily doses of methadone are dispensed by authorised public clinics or community pharmacists directly to the client and must be consumed under supervision. The liquid dose is administered orally and the drug action lasts for 24 to 36 hours in comparison to a heroin dose which lasts about six hours.\textsuperscript{28}

In Western Australia, methadone and buprenorphine are prescribed and dispensed under the control of the Community Program for Opioid Pharmacotherapy (C-POP). Public and private general practitioners (GPs) who wish to supply or prescribe methadone or buprenorphine must be authorised by the Commissioner of Health following a specific training program. Clients commencing a methadone or buprenorphine program must be registered with the Department of Health.\textsuperscript{29}

Three main issues have been raised as areas of concern for infants of breastfeeding mothers maintained on methadone:

- Maternal blood methadone levels and methadone excretion in breast milk vary between individuals.\textsuperscript{30}
- Infant absorption may vary, particularly if the infant receives a formula supplement.\textsuperscript{31}
- The incidence of NAS is increased following birth and when breastfeeding is discontinued at the time of weaning.\textsuperscript{32}

Varying opinions on safe methadone dose and breastfeeding compatibility abound in the literature. The American Academy of Pediatrics Committee on Drugs takes the approach that the woman may choose to breast feed if:

- Her methadone dose is < 20 mg/day
- She has no blood borne infections
- She is not actively injecting drugs or using other substances.\textsuperscript{33}

Other authorities advocate breastfeeding at any methadone dose as long as there is no other active drug use occurring and no blood borne infections present.\textsuperscript{34}

The Australian Drug Strategy guidelines\textsuperscript{35} make the following recommendations:

- Breast milk contains only small amounts of methadone and mothers can be encouraged to breastfeed regardless of methadone dose provided that they are not using other drugs.
- Breastfeeding may reduce the severity of the neonatal abstinence syndrome.
• Women receiving high doses of methadone should be advised to wean their babies slowly to avoid withdrawal in the infant.

The British Columbia Reproductive Care Program recommends that the mother should avoid breastfeeding for 2–4 hours after methadone dose when blood levels are at their highest. They suggest that milk can be pumped prior to methadone dosing to feed the baby later if hungry, or formula supplementation can be given - the key being to observe the baby for signs and symptoms of sedation or withdrawal and act accordingly. They also state that a methadone maintained woman should only breast feed for 3–5 months, after which the volume of milk consumed by the baby is large enough to contain a sedating dose which may result in the onset of NAS when the mother stops breastfeeding. When weaning occurs the baby should be watched for withdrawal symptoms. Additional information can be found in the NAS Guideline.

**WEANING**

The World Health Organisation recommends that babies should be exclusively breastfed for the first 6 months in order to achieve optimal growth, development and health. It also recommends that infants should continue to be breastfed for up to 2 years and beyond whilst gradually introducing complementary foods as part of the weaning process.

Whenever cessation of breastfeeding is desired the weaning process should be gradual. Eliminating a feeding every 2–3 days will achieve a comfortable transition for the infant and prevent engorgement in the mother. Abrupt weaning can be difficult for the mother and the infant. Formula (bottle) feeds are not a necessary part of a weaning diet. However, if a breastfeeding mother wishes to combine formula feeding with breastfeeding or to switch to formula feeding she should do this gradually, substituting one formula feed for one breast feed per day for several days, allowing her baby and her body to become accustomed to this. A second formula feed can then be introduced for another few days, then a third, fourth etc. Ideally, the weaning process should take several weeks to provide a slow drug withdrawal for the baby.

Abrupt discontinuation of breastfeeding by two women receiving 70 mg and 130 mg of methadone appeared to cause their infants to develop neonatal abstinence syndrome. Women on high-dose methadone maintenance should be counselled to wean their babies gradually. Abrupt cessation of breastfeeding may result in the baby showing some signs and symptoms of drug withdrawal. Breastfeeding mothers who continue to take drugs should be advised to gradually introduce solids slowly into the breastfeeding schedule, reducing the frequency of breast feeds over a number of weeks.

**BOTTLE FEEDING**

Many substance using women choose to bottle feed rather than breast feed. Social and cultural beliefs and norms are powerful influences on decision making about early infant feeding. Substance dependent women often come from multigenerational drug using families and do not have positive role models for breastfeeding after birth. An Australian study to identify factors associated with the abandonment of breastfeeding prior to hospital discharge found it to be associated with a number of psychosocial factors, including a perception by the mother that the infant's father either preferred formula feeding or was ambivalent about how the infant was fed, and whether the mother's own mother had ever breastfed.

Low self-esteem may make some women unable to trust their own bodies to provide adequate nutrition for their infants. Women who are used to being a failure (failure at previous attempts at substance treatment programs, failure at interpersonal relationships, failure at employment, and failure at the retention of custody of previous children) will expect to fail at breastfeeding and may give up after a day or two, even with support. A surprisingly low tolerance for discomfort also discourages many substance using women from breastfeeding when they develop sore nipples or uterine cramping. Breastfeeding among survivors of domestic violence, especially those who have been sexually abused, can be fraught with difficult issues that create negative experiences. Women with histories of sexual victimisation may view their breasts as sexual objects not appropriate for contact with newborns.

Parents should be supported to make an informed choice about how to feed their newborn baby. Having made their decision they should be supported by all of the professionals involved.
HARM MINIMISATION STRATEGIES

- Injecting drug use should be discouraged whilst breastfeeding.
- Breastfeed the infant immediately prior to drug use.
- Schedule drug use for times when the infant is usually settled or before the baby's longest sleep period.
- Express milk prior to drug use to ensure that stored or frozen breast milk is available.
- Ensure that additional calories are available for the infant in the form of expressed and stored breast milk or formula.
- Do not breastfeed during the recommended non-breastfeeding period. This will vary according to the type of drug used and may be as long as 24-48 hours.
- Continue to express breast milk during the period of non-breastfeeding to maintain the milk supply. Discard all expressed breast milk.
- Monitor the infant for signs and symptoms of exposure to or intoxication from the drug.

ADDITIONAL HARM MINIMISATION STRATEGIES FOR SPECIFIC SUBSTANCES

The following section contains brief guidelines on the passage of both licit and illicit substances into human breast milk and the effects, if any, on the nursing infant. Drugs are categorised according to Hale’s lactation risk categories (Table 1A), recommendations of the American Academy of Pediatrics (AAP) and additional data from a brief review of the literature by Briggs et al (for definitions of breastfeeding recommendations see Table 1B).

Explanation of the Terms $T_{\frac{1}{2}}$ and $T_{\text{max}}$

$T_{\frac{1}{2}}$ is the most commonly recorded adult half-life of the drug. If the half-life is short enough (1-3 hours) then the drug level in maternal plasma will be declining when the infant feeds again.

$T_{\text{max}}$ (formerly PK) is the time interval from administration of the drug until it reaches the highest (peak) level in the mother’s plasma or “time to max”. The mother should wait until the peak is subsiding or has at least dropped significantly before breastfeeding her infant.

| Table 1A Categories of Risk for Medications During Lactation, adapted from Hale |
|----------------------------------|-----------------------------------------------|
| Category | Description |
| L1 Safest | Drug that has been taken by a large number of breastfeeding mothers without any observed increase in adverse effects in the infant. Controlled studies in breastfeeding women fail to demonstrate a risk to the infant and the possibility of harm to the breastfeeding infant is remote. The product is not orally bioavailable in an infant. |
| L2 Safer | Drug that has been studied in a limited number of breastfeeding women without an increase in adverse effects in the infant and/or the evidence of a demonstrated risk that is likely to follow use of this medication in a breastfeeding woman is remote. |
| L3 Moderately Safe | There are not controlled studies in breastfeeding women; however, the risk of untoward effects to a breastfed infant is possible, or controlled studies show only minimal, nonthreatening adverse effects. Drugs should be given only if the potential benefit justifies the potential risk to the infant. |
| L4 Hazardous | There is positive evidence of risk to a breastfed infant, or to breast milk production, but the benefits from use in breastfeeding mothers may be acceptable despite the risk to the infant (e.g., if the drug is needed in a life-threatening situation or for a serious disease for which safer drugs cannot be used or are ineffective). |
| L5 Contraindicated | Studies in breastfeeding mothers have demonstrated that there is significant and documented risk to the infant based on human experience, or it is a medication that has a high risk of causing significant damage to an infant. The risk of using the drug in breastfeeding women clearly outweighs any possible benefit from breastfeeding. The drug is contraindicated in women who are breastfeeding an infant. |
Table 1B  Definitions of Breastfeeding Recommendations (adapted from Briggs et al)\textsuperscript{42}

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPATIBLE</td>
<td>Either the drug is not excreted in clinically significant amounts into human breast milk or its use during lactation does not, or is not expected to, cause toxicity in a nursing infant.</td>
</tr>
<tr>
<td>NO (LIMITED) HUMAN DATA – PROBABLY COMPATIBLE</td>
<td>Either there is no human data or the human data are limited. The available animal or other data suggest that the drug does not represent a significant risk to a nursing infant.</td>
</tr>
<tr>
<td>WITHHOLD BREASTFEEDING</td>
<td>The drug may or may not be excreted into human breast milk, but the maternal benefit of therapy far outweighs the benefits of breast milk to an infant. Breastfeeding should be withheld until maternal therapy is completed and the drug has been eliminated (or reaches a low concentration) from her system.</td>
</tr>
<tr>
<td>NO (LIMITED) HUMAN DATA – POTENTIAL TOXICITY</td>
<td>Either there is no human data or the human data are limited. The characteristics of the drug suggest that it could represent a clinically significant risk to a nursing infant. Breastfeeding is not recommended.</td>
</tr>
<tr>
<td>NO (LIMITED) HUMAN DATA – POTENTIAL TOXICITY (MOTHER)</td>
<td>Either there is no human data or the human data are limited. The characteristics of the drug suggest that breastfeeding could represent a clinically significant risk to the mother (such as further loss of essential vitamins or nutrients). Breastfeeding is not recommended.</td>
</tr>
<tr>
<td>CONTRAINdicATED</td>
<td>There may or may not be human experience, but the combined data (including animal data if available) suggest that the drug may cause severe toxicity in a nursing infant, or breastfeeding is contraindicated because of the maternal condition for which the drug is indicated. Women should not breast feed if they are taking the drug or have the condition.</td>
</tr>
</tbody>
</table>

**ALCOHOL (ETHANOL)**

**SEDATIVE**

**American Academy of Pediatrics:** Compatible with breastfeeding\textsuperscript{19}

**Lactation Risk:** L3 (Moderately safe)\textsuperscript{41}

**Briggs et al:** Withhold breastfeeding\textsuperscript{42}

\begin{align*}
T_{1/2} & = 0.24 \text{ hours}, \\ T_{\text{max}} & = 30-90 \text{ minutes (oral)}
\end{align*}

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{19}

The Institute of Medicine of the National Academy of Sciences recommends a maximum daily consumption of 0.5g/kg of ethanol.\textsuperscript{43}

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{44}

**Effects of alcohol on breastfeeding**

1. May delay the let-down reflex and cause a reduction in supply.
2. There is some evidence that beer consumption aids in milk production by increasing serum prolactin.\textsuperscript{44}
3. Adult concerns: sedation, decreased milk supply, altered milk taste.\textsuperscript{41}

**Neonatal sequelae**

1. 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{44}
2. Infants are known to be sensitive to the hypoglycaemic effects of alcohol and fatalities have occurred when infants have been given alcohol to pacify them.\textsuperscript{44}
3. Mild sedation has been observed in breastfed infants when maternal blood alcohol levels reach 300 mg/dl.\(^{42}\)

4. May cause changes in sleep patterns such as drowsiness or deep sleep, impaired motor development, decreased milk intake, risk of alcohol-induced hypoglycaemia.\(^{44}\)

5. Paediatric concerns: sedation, irritability, weak sucking, decreased milk supply, altered milk taste.\(^{41}\)

**HARM MINIMISATION STRATEGIES**

**Additional harm minimisation strategies for breastfeeding**

1. The infant should be fed prior to maternal alcohol consumption.
2. Avoid breastfeeding during and for 2-3 hours after drinking alcohol.\(^{41}\)
3. See Table 1 for the average length of time nursing should be delayed according to the number of drinks consumed and maternal body weight, before assuming a zero level of alcohol in breast milk.\(^{44}\)
4. Withhold breastfeeding for 1-2 hours for every 30 grams of alcohol consumed (approximately two standard drinks).\(^{42}\)
5. Chronic or heavy consumers of alcohol should not breastfeed.\(^{41}\)

**Table 2: Alcohol and breastfeeding: time (h:min) until a zero level of alcohol is reached for women of different body weights**\(^{44}\)

<table>
<thead>
<tr>
<th>Maternal weight</th>
<th>Drinks</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>kg</td>
<td>lb</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>40.8</td>
<td>90</td>
<td>2:50</td>
<td>5:40</td>
<td>8:30</td>
<td>11:20</td>
<td>14:10</td>
<td>17:00</td>
<td>19:51</td>
<td>22:41</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45.4</td>
<td>100</td>
<td>2:42</td>
<td>5:25</td>
<td>8:08</td>
<td>10:51</td>
<td>13:34</td>
<td>16:17</td>
<td>19:00</td>
<td>21:43</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>54.4</td>
<td>120</td>
<td>2:30</td>
<td>5:00</td>
<td>7:20</td>
<td>10:00</td>
<td>12:31</td>
<td>15:01</td>
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<td>72.6</td>
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<td>79.3</td>
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<td>4:07</td>
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<td>81.6</td>
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<td>2:00</td>
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<td>18:15</td>
<td>20:17</td>
<td>22:19</td>
<td></td>
</tr>
</tbody>
</table>

Time is calculated from the beginning of drinking. Assumptions made: alcohol metabolism is constant at 15 mg/dl height of the women is 162.56 cm (5 feet, 4 inches). 1 drink = 340 g (12 oz) of 5% beer or 141.75 g (5 oz) of 11% wine or 42.5 g (1.5 oz) of 40% liquor.

Example 1: for a 40.8-kg (90-lb) woman who consumed 3 drinks in 1 h, it would take 8 h 30 min for there to be no alcohol in her breast milk, but for a 55.4-kg (210-lb) woman drinking the same amount, it would take 5 h 33 min.

Example 2: for a 63.5-kg (140-lb) woman drinking 4 beers starting at 8:00 p.m., there would be a zero level of alcohol in her breast milk 9 h 17 min later (i.e. at 5:17 a.m.).
HALLOUGINOGENIC AMPHETAMINES
(3, 4-METHYLENEDIOXY METHAMPHETAMINE [MDMA OR ECSTASY], MDEA, MDA, MDM [XTC, ESSENCE])

CENTRAL NERVOUS SYSTEM STIMULANT

American Academy of Pediatrics: Breastfeeding contraindicated

Lactation Risk: L5 (Breastfeeding contraindicated)

Briggs et al: Breastfeeding contraindicated

\[ T\frac{1}{2} = <8 \text{ hours, } T_{\text{max}} = 1-5 \text{ hours} \]

Ecstasy or MDMA is a synthetic, psychoactive drug chemically similar to the stimulant methamphetamine and the hallucinogen mescaline. MDMA can also be dangerous to health and, on rare occasions, lethal.

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. The number of people using illicit drugs has remained stable or decreased since 1998, with the exception of ecstasy, which rose to 3% of the population in 2004, the highest prevalence for this substance in the 13-year period. Use in Australia is mainly oral with some intravenous use.

Ecstasy tablets may contain other substances in addition to MDMA, such as ephedrine (a stimulant); dextromethorphan (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, which has also been implicated in some instances of “date rape”); caffeine; cocaine; and 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.

Effects of ecstasy on breastfeeding

1. No published information on ecstasy excretion into breast milk.
2. No published information on ecstasy use in breastfeeding mothers.
3. 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.
4. 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.
5. 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.
6. Adult concerns: hallucinations, agitation, seizures, acute paranoid psychosis, extreme hypertension, hyperthermia, tachyarrhythmia. Effects are largely dose-dependent.

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.

HARM MINIMISATION STRATEGIES

Additional harm minimisation strategies for breastfeeding

1. Breastfeed the infant prior to ecstasy use
2. DO NOT breastfeed 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\textsuperscript{19}

Lactation Risk: L4 (Possibly hazardous)\textsuperscript{41}

Briggs et al: Limited Human data – potential toxicity. Contraindicated (non-medical use)\textsuperscript{42}

\( T_{1/2} = 6-8 \text{ hours}, \ T_{\text{max}} = 1-2 \text{ hours} \)\textsuperscript{41}

Effects of amphetamines on breastfeeding

1. Inhibits prolactin release and can reduce breast milk supply.\textsuperscript{16}
2. Concentration found in breast milk is 2.8 – 7.5 times those found in maternal plasma.\textsuperscript{41}
3. Amphetamines have been detected in infant urine following maternal therapy.\textsuperscript{47}
4. 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.\textsuperscript{16}
5. Concentrations in milk have not been measured during high-dose amphetamine use; there is likely to be considerable inter-subject variation in excretion.\textsuperscript{31}
6. Adult concerns: nervousness, insomnia, anorexia, hyper-excitability.\textsuperscript{41}

Neonatal sequelae

1. Infants breastfed by amphetamine users appear to experience drug-induced behavioural abnormalities such as irritability, poor sleeping pattern,\textsuperscript{19} agitation and crying.\textsuperscript{16}
2. Paediatric concerns: possible insomnia, irritability, anorexia, poor sleeping patterns.\textsuperscript{41}
3. Amphetamines purchased on the ‘street’ contain a mixture of substances and these impurities can have unpredictable and harmful effects on mother and infant.\textsuperscript{48,49}

HARM MINIMISATION STRATEGIES

Additional harm minimisation strategies for breastfeeding

1. Do not breast feed for 24-48 hours after occasional amphetamine use.
2. Express breast milk to maintain supply, discard expressed breast milk.
BREASTFEEDING GUIDELINES FOR SUBSTANCE USING MOTHERS – LITERATURE REVIEW

BENZODIAZAPINES
SEDATIVE / HYPNOTIC

American Academy of Pediatrics: Unknown – may be of concern
Lactation Risk: L3 (Moderately safe); L4 (Possibly hazardous) if used chronically
Briggs et al: Limited Human Data – Potential Toxicity

<table>
<thead>
<tr>
<th>Benzodiazepine</th>
<th>T_1/2</th>
<th>T_max</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>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>

Australian surveys (1997-2003) of illicit drug use found the most commonly used benzodiazepines were Valium (diazepam), Serapax (oxazepam), Rohypnol (flunitrazepam) and Normison (temazepam). 30% of use was illicit and was mainly oral with some intravenous use. Benzodiazepines were used more frequently when people were unable to get heroin and/or were trying to avoid withdrawal or when coming down after amphetamine (speed) use.

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.
2. Published data on benzodiazepine use when breastfeeding are highly variable and the quality of studies is poor.
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.
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.
5. Adult concerns: sedation, drowsiness, dizziness, blurred vision, dry mouth, headache, fatigue, ataxia, slurred speech, tremors, amnesia, mental confusion.

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".\(^\text{19}\)

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 and depression.\(^\text{54}\)

4. Neonatal withdrawal symptoms have been noted after exposure to alprazolam (Xanax) during breastfeeding but the drug has a relatively short half-life.\(^\text{19, 55}\)

5. Chlordiazepoxide (Librium) appears to be safe during lactation.\(^\text{53}\)

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.\(^\text{53}\)

7. Abrupt weaning or rapid cessation of long-term treatment or use may cause infant withdrawal symptoms.\(^\text{53}\)

8. Paediatric concerns: Some reports of lethargy, sedation, poor suckling, withdrawal.\(^\text{41}\)

**HARM MINIMISATION STRATEGIES**

**Additional harm minimisation strategies for breastfeeding**

1. Breastfeeding should be withheld for 6-8 hours after a single dose of benzodiazepine.
BREASTFEEDING GUIDELINES FOR SUBSTANCE USING MOTHERS – LITERATURE REVIEW

BUPRENORPHINE
NARCOTIC AGONIST-ANTAGONIST ANALGESIC

American Academy of Pediatrics: Unknown – may be of concern
Lactation Risk: L2 (Relatively safe)
Briggs et al: Limited human data – potential toxicity

\[ T_{1/2} = 1.2-7.2 \text{ hours, } T_{\text{max}} = 15-30 \text{ minutes} \]

Buprenorphine is used as an alternative to methadone for maintenance and detoxification treatment. Dispensed as a high-dose sublingual tablet, this long-acting opioid lasts for up to 48 hours and prevents or relieves opioid withdrawal symptoms, reduces cravings, and blocks the effects of illicit opioids if used concurrently. Due to the long half-life of the product, once stabilised, it is administered on alternate days under supervised conditions, thus making the product more convenient for some users. Dispensation of buprenorphine occurs on a dose by dose model through public clinics or community pharmacists.

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**

1. 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.
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.
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.
4. A study that measured the daily buprenorphine dose ingested by a newborn in breast milk over an 8-week period found it to be very low (3.28 micrograms).
5. In another study no withdrawal signs were observed when breastfeeding was abruptly ceased due to a chest infection.

**HARM MINIMISATION STRATEGIES**

**Additional harm minimisation strategies for breastfeeding**

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 breastfeeding \(^{19}\)
Lactation Risk: L2 (Relatively safe) \(^{41}\)
Briggs et al: Limited human data – potential toxicity \(^{42}\)

\(T^{1/2} = 4.9 \text{ hours, } T_{\text{max}} = 1 \text{ hour}^{41}\)

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. \(^{42}\)
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. \(^{42}\)
2. Accumulation may occur in infants whose mothers ingest high levels of coffee or caffeinated beverages and can lead to irritability and insomnia. \(^{42}\)
3. Neonatal side effects can be avoided by limiting maternal coffee consumption to 100 mg (1 cup) a day.
4. Infant may be jittery, colicky, constipated and generally unsettled. \(^{59}\)
5. Effects are more likely in preterm and newborn infants because of a diminished ability to metabolise caffeine. \(^{16}\)

HARM MINIMISATION STRATEGIES

Additional harm minimisation strategies for breastfeeding

1. Breastfeed 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.
CANNABIS (MARIJUANA, HASHISH)

HALLUCINOGEN

American Academy of Pediatrics: Breastfeeding contraindicated\textsuperscript{19}

Lactation Risk: L5 (Breastfeeding contraindicated)\textsuperscript{11}

Briggs et al: Breastfeeding contraindicated\textsuperscript{42}

$T\frac{1}{2} = 25-57$ hours\textsuperscript{41}

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{42}
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{41, 60}
3. Some components of marijuana have very long half lives, ranging from 25 – 57 hours.\textsuperscript{19}
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{21}
5. A study that investigated the time that breastfed infants were weaned found no significant differences between marijuana users and non-users, suggesting that marijuana use did not interfere with lactation.\textsuperscript{20}
6. Mothers using marijuana often sleep heavily after use and this may mean the mother is unresponsive to her infant's needs.\textsuperscript{61}

Neonatal sequelae

1. Reports on 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{42}
2. One study\textsuperscript{20} 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, hypoglycaemia, 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{47}
4. Passive or 'side stream' smoke is a significant issue.\textsuperscript{61}
5. Infants may show signs of sedation, weakness and poor feeding habits.\textsuperscript{61}
6. The effects of long term exposure are unknown; additional research is needed to determine the outcomes.

HARM MINIMISATION STRATEGIES

Additional harm minimisation strategies for breastfeeding

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.
COCAINESYMPATHOMIMETIC / CENTRAL NERVOUS SYSTEM STIMULANT

American Academy of Pediatrics: Breastfeeding contraindicated\textsuperscript{19}
Lactation Risk: L5 (Breastfeeding contraindicated)\textsuperscript{61}
Briggs et al: Breastfeeding contraindicated (systemic) Compatible with breastfeeding (topical)\textsuperscript{42}

$T_{1/2} = 0.8$ hours, $T_{\text{max}} = 15$ minutes\textsuperscript{41}

In 2004 approximately 1% of the Australian population had used cocaine within the last 12 months.\textsuperscript{46} The normal method of administration was by injecting (42%), sniffing (37%) and smoking (11%).\textsuperscript{22} 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.\textsuperscript{47}

2. Cocaine and its metabolites have been found in the urine of nursing infants 24-36 hours after maternal use.\textsuperscript{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.\textsuperscript{16}

**Neonatal sequelae**

1. Infants are less able than adults to metabolise cocaine and may accumulate the drug as a result.\textsuperscript{47}

2. Serum cholinesterase, which is needed to metabolise the drug, is low in newborns.\textsuperscript{16}

3. Some studies have found that nursing infants exposed to cocaine can be difficult to feed.\textsuperscript{52}

4. Potential adverse effects in the infant include irritability, vomiting, diarrhoea, tremulousness, seizures and dilated pupils.\textsuperscript{19}

5. In one study an infant breastfed 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.\textsuperscript{53}

6. 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).\textsuperscript{42}

**HARM MINIMISATION STRATEGIES**

**Additional harm minimisation strategies for breastfeeding**

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.\textsuperscript{42}
GAMMA-HYDROXYBUTYRATE (GHB)

SEDATIVE/HYPNOTIC

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

$T_{1/2} = 0.3-1 \text{ hour},^{64}$ 20 minutes for 12.5 mg/kg orally increasing with dose$^{65}$, $T_{\text{max}} = 20-60 \text{ mins}^{66}$

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, Europe, the UK and Australia.$^{67, 68}$

GHB is used recreationally at raves ("liquid ecstasy") and 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 the benzodiazepines make the victim unable to describe the events after she or he has recovered. 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.$^{64}$

**Effects of GHB on breastfeeding**

1. Safety in lactation has not been established.$^{69}$
2. After ingestion, GHB is rapidly absorbed and quickly crosses the blood-brain barrier. It is not protein bound and is rapidly metabolised and excreted through the lungs.$^{70}$ Since it is not protein bound it is likely to be excreted in breast milk in significant concentrations.$^{36, 41}$
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.$^{65}$
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.$^{65}$

**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.$^{71}$
2. The effects of GHB on the neonate are not documented. In adults 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.$^{66, 71}$

**HARM MINIMISATION STRATEGIES**

**Additional harm minimisation strategies for breastfeeding**

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

American Academy of Pediatrics: Breastfeeding contraindicated\(^{19}\)

Lactation Risk: L5 (Breastfeeding contraindicated)\(^{41}\)

Briggs et al: Breastfeeding contraindicated\(^{42}\)

\(T\frac{1}{2} = 1.5-2\) hours, \(T_{\text{max}} = 0.5-1\) hour\(^{41}\)

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\(^{15, 72}\). Heroin, however, is excreted into breast milk in sufficient quantities to cause addiction in the infant\(^{42}\).

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 withdrawal syndrome in neonates when ceased.\(^{73}\)
2. Levels in breast milk can be high enough to alleviate withdrawal symptoms in the infant.\(^{2}\)
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.\(^{1, 2}\)
4. Adverse effects include sedation, withdrawal, tremors, restlessness, vomiting and poor feeding (see Modified Finnegan Neonatal Abstinence Score Sheet and Instructional Manual).\(^{19}\)
5. Infants of heroin users often have a low birth weight and require additional calories for growth.\(^{59, 74}\)

HARM MINIMISATION STRATEGIES

Additional harm minimisation strategies for breastfeeding

1. Delay breastfeeding after opiate use for 24-48 hours depending on drug/substance used and the uncertain composition of street drugs.
2. Commence treatment 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)
Briggs et al: Limited human data – depends on component compounds

<table>
<thead>
<tr>
<th>Substance</th>
<th>T½</th>
<th>Tmax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amyl Nitrite</td>
<td>1-4 minutes</td>
<td>2-20 minutes</td>
</tr>
<tr>
<td>Benzene</td>
<td>1-3 hours</td>
<td></td>
</tr>
<tr>
<td>Butane Gas</td>
<td>10 minutes</td>
<td></td>
</tr>
<tr>
<td>Nitrous Oxide</td>
<td>&lt;3 minutes</td>
<td>15 minutes</td>
</tr>
<tr>
<td>Tetrachloroethylene (PER)</td>
<td>2 hours</td>
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<tr>
<td>Toluene</td>
<td>7.5 hours</td>
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<td>Trichloroethylene</td>
<td>30-38 hours</td>
<td></td>
</tr>
<tr>
<td>Xylene</td>
<td>20-30 hours</td>
<td></td>
</tr>
</tbody>
</table>

Types of Inhalants

Inhalants are breathable chemical vapours 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 deodoriser" "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

Additional harm minimisation strategies for breastfeeding
1. Breastfeeding should be avoided if the mother is intoxicated on inhalants.
LYSERGIC ACID DIETHYLAMIDE (LSD)
HALLUCINOGEN

American Academy of Pediatrics: Breastfeeding contraindicated

Lactation Risk: L5 (Breastfeeding contraindicated)

Briggs et al: Breastfeeding contraindicated

T₁/₂ = 3 hours, Tₘₐₓ = 30-60 minutes (oral)

Effects of LSD on breastfeeding

1. Little or no data are 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.

Neonatal sequelae

1. LSD is likely to enter the milk and produce hallucinogenic effects in the infant.
2. Adverse effects in the infant include hallucinations, dilated pupils, salivation and nausea.
3. Mother’s ability to care for her infant following use of LSD is highly questionable.

HARM MINIMISATION STRATEGIES

Additional harm minimisation strategies for breastfeeding

1. Breastfeed the infant prior to using LSD.
2. DO NOT breastfeed after LSD use for 34-120 hours.

3, 4- METHYLENEDIOXY METHAMPHETAMINE (MDMA OR ECSTASY) - SEE HALLUCINOGENIC AMPHETAMINES
METHADONE
NARCOTIC AGONIST ANALGESIC

American Academy of Pediatrics: Compatible with breastfeeding\(^19\)

Lactation Risk: L3 (Moderately safe)\(^41\)

Briggs et al: Limited human data – probably compatible\(^42\)

\[ T_{1/2} = 13-55 \text{ hours, } T_{\max} = 0.5-1 \text{ hour} \]

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.\(^35\) Other experts consider breastfeeding to be safe provided the maternal methadone dose is low\(^82\) or where methadone maintenance doses are less than 80 mg/day.\(^16\)

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 baby and may produce NAS when breastfeeding is ceased.

Neonatal sequelae

1. Breast milk contains only small amounts of methadone and mothers can be encouraged to breastfeed regardless of methadone dose provided that they are not using other drugs.\(^35\)
2. Advantages of breastfeeding to the mother/infant pair may outweigh any risk\(^83\)
3. Breastfeeding may reduce the severity of the neonatal abstinence syndrome.\(^35\)
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.\(^34\) Additional information can be found in the NAS Guideline.

HARM MINIMISATION STRATEGIES

Additional harm minimisation strategies for breastfeeding

1. Maintain methadone treatment regime.
2. Breastfeed infant prior to using daily methadone dose.
3. Avoid breastfeeding for 2-4 hours after methadone dose when blood levels are at their highest\(^34\)
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\(^\text{19}\)
Lactation Risk: Nicotine patches or gum L2 (Relatively safe)\(^\text{41}\)
Briggs et al: Not reviewed
\(T_{1/2} = 2 \text{ hours, } T_{\text{max}} = 2-4 \text{ hours}\)\(^\text{41}\)

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.\(^\text{19}\)

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.\(^\text{19}\)

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.\(^\text{19}\)

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.\(^\text{16}\)
3. The milk of smokers contains higher concentrations of cadmium than the milk of non-smokers; other toxins from smoke have not been measured.\(^\text{16}\)
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.\(^\text{16}\)
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.\(^\text{16}\)
6. Nicotine alters the taste of breast milk.\(^\text{84}\)

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.\(^\text{16}\)
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.\(^\text{85}\)
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.\(^\text{41}\)
4. The risk of using nicotine patches whilst breastfeeding is much less than the risk of formula feeding.\(^\text{41}\)
5. There is some evidence to suggest that breastfeeding and smoking is less detrimental to the child than bottle feeding and smoking.\(^\text{19}\)
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.\(^\text{86}\)
7. Breastfeeding reduces the risk of respiratory illness by half that of formula-fed infants of smokers.\(^\text{16}\)
8. Nicotine poisoning may occur.61

**HARM MINIMISATION STRATEGIES**

Additional harm minimisation strategies for breastfeeding

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.41
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 maximise 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\(^\text{19}\)

Lactation Risk: L5 (Breastfeeding contraindicated)\(^\text{41}\)

Briggs et al: Breastfeeding contraindicated\(^\text{42}\)

\(T\frac{1}{2} = 24\text{-}51\) hours, \(T_{\text{max}} = \text{Immediate}\)\(^\text{41}\)

PCP was developed in the 1950s as an intravenous anaesthetic. Its use in humans was discontinued in 1965, because patients often became agitated, delusional, and irrational while recovering from its anaesthetic 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.\(^\text{87}\)

At low to moderate doses, physiological effects include a pronounced rise in blood pressure and pulse rate. Breathing becomes shallow; flushing and profuse sweating occurs. Generalised numbness of the extremities and loss of muscular coordination may also occur.\(^\text{87}\)

PCP has sedative effects and interactions with other central nervous system depressants such as alcohol and benzodiazepines can lead to coma.\(^\text{87}\)

**Effects of PCP on breastfeeding**

1. PCP is stored in fatty tissue.\(^\text{88, 89}\)
2. In animal studies milk concentrations of PCP were 10 times those of plasma.\(^\text{90}\)
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.\(^\text{41, 91}\)

**Neonatal sequelae**

1. Irritability, jitteriness, hypertonicity and poor feeding are common features in infants born to PCP-using mothers.\(^\text{42}\)
2. PCP is extremely dangerous to a breastfed infant and nursing mothers should be encouraged to avoid it.\(^\text{41, 91}\)

**HARM MINIMISATION STRATEGIES**

**Additional harm minimisation strategies for breastfeeding**

1. Avoid breastfeeding after PCP use as a sufficient duration of abstinence has not been defined.\(^\text{16, 81}\)
2. Advise PCP-using mothers not to breastfeed.\(^\text{19}\)
REFERENCES


