

# Module 3

## Fetal Development

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## Introduction

To understand how alcohol affects the development of a fetus, a basic understanding of how an unborn baby develops in the womb throughout pregnancy is helpful. This module will describe typical fetal development, teratogens and their impact on fetal development, and the impact of both mother's and father's alcohol use on fetal development.

## Fetal Development

Between puberty and menopause, women's bodies prepare to have a baby. This process happens each month and is called the menstrual cycle. The menstrual cycle is different for all women. The menstrual cycle can range from 21 days to 35 days. Each menstrual cycle starts when the woman gets a period (which is called menstruation) and stops the day before her next period begins. Most periods last from three to five days. Some periods may be as short as two days or as long as eight days. Each woman is different.

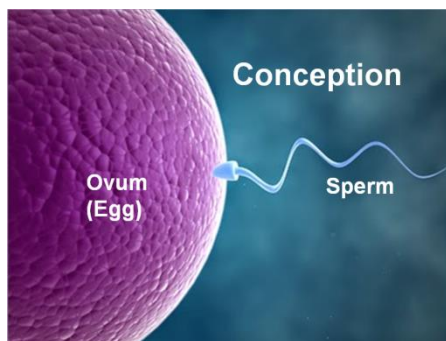


When a woman finishes her period, her uterus wall starts to thicken and gets ready to look after an unborn baby. The thickened uterus wall is called the endometrium (Mayo Clinic, 2017).

Between the second and third weeks of the menstrual cycle, the woman releases an **ovum** (egg) from the ovary. The egg travels through the fallopian tube. The egg is only healthy for 24 hours. During these 24 hours, a woman can become pregnant.

During these 24 hours, if a **sperm** from the male can penetrate the egg (implantation), **a woman can become pregnant** (Harding & Bocking, 2001).

When a man ejaculates (has an orgasm), sperm is released. These sperm have to make a long journey to get to the healthy egg. Only a few of the man's sperm might reach the egg (Sex & U, n.d.).

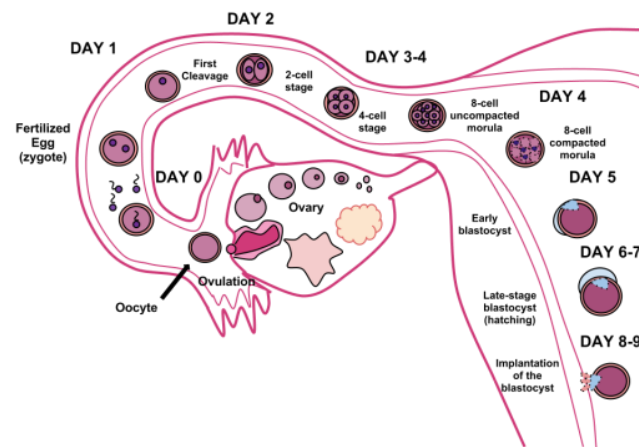


When a penis is aroused and erect, fluid containing sperm (pre-ejaculate and sometimes called precum) can be released. This can happen before ejaculation. Any contact between the vagina and semen can cause pregnancy. Fertilization can happen even if the man's penis does not enter the vagina and ejaculate.

Pregnancy can even take place if unprotected sex happens before the egg is released. That is because sperm live in the body for several days (Sex & U, n.d.).

The sperm can penetrate the egg, join its chromosomes with the egg's chromosomes (**fertilization**), and start to develop as a baby (Mayo Clinic, 2017). The fertilized egg will attach to (or implant in) the **endometrium** (thickened wall of the uterus) (Mayo Clinic, 2017). The sperm carries the genetic material of the father (23 chromosomes), and the egg carries the genetic material of the mother (23 chromosomes). With a combination of 46 chromosomes, from both the father and mother, the development of the **fetus** begins (Berk & Shanker, 2006).

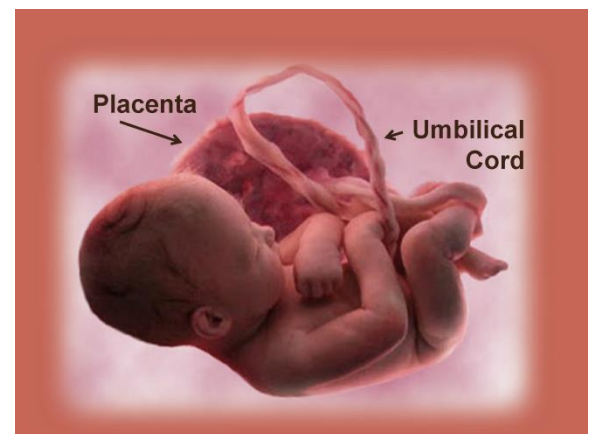
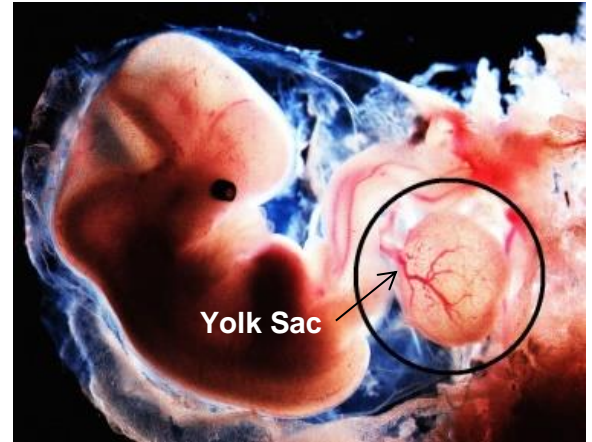
If the egg is not fertilized or implantation does not happen, the endometrium begins to break down. When a woman gets her period, she is shedding (or getting rid of) the endometrium so that the whole process can begin again (Mayo Clinic, 2017).



At the very beginning stage of pregnancy, when the egg and sperm fuse, a single cell is formed, known as a **zygote**. Following the formation of the zygote, there is a rapid series of cell divisions (also known as cleavage). During this phase, the large zygote is subdivided into many smaller daughter cells called **blastomeres** as they pass along the uterine tube into the uterus (Moore, Persaud, & Torchia et al., 2020; Schoenwolf et al., 2015). The process of the zygote dividing into blastomeres begins about 30 hours after fertilization (Moore et al., 2020; Schoenwolf et al., 2015). When there are 12 to 32 blastomeres, the developing fetus is called a **morula**. The blastomeres continue to be produced and join together to form a hollow circular ball known as blastocyst (Moore et al., 2020; Schoenwolf et al., 2015). By day five, the blastocyst is implanted in the uterine endometrium (Schoenwolf et al., 2015). A number of different structures begin to form at this time, including the amnion, chorion, yolk sac, placenta, and umbilical cord. The roles of these structures, described below, are to nourish and protect the developing zygote (Berk & Shanker, 2006).

- The **amnion** is a membrane that forms around the zygote.
- **Amniotic fluid** fills the amnion and provides the zygote with protection. This fluid maintains a constant temperature for the zygote. It also provides a cushion against the movements of the mother.

- The **yolk sac** provides nourishment and produces blood cells until the circulatory system develops, and the liver, spleen, and bone marrow begin functioning.
- The **chorion** is a further layer of protection and surrounds the amnion. The chorion develops tiny, hair-like blood vessels that attach to the wall of the uterus.
- The **placenta** then begins to develop. The placenta is an organ that connects the fetus to the uterus of the mother. It is connected to the mother's bloodstream at the wall of the uterus, and to the fetus by the **umbilical cord**. The umbilical cord allows food and oxygen from the mother's bloodstream to reach the baby. It also removes waste products (such as pee) from the baby. Although the blood systems of mother and baby stay separate, this link allows anything in the mother's blood to cross over into the baby's blood (Moore et al., 2020).
- During this beginning stage, the zygote gets its nourishment from the yolk sac rather than the placenta. Once the zygote is 'hooked-up' to the pregnant woman through the placenta, it gets its nourishment from the mother and is then susceptible to the effects of alcohol (Berk & Shanker, 2006).
- Recent animal studies have shown that alcohol use can cause problems as early as conception. Alcohol use has been linked to poor growth of the placenta. This can cause conditions such as limiting fetal growth and low birth weight (Lim et al., 2019).
- Once the placenta and umbilical cord are formed, the yolk sac is no longer needed.



### The Stages of Pregnancy

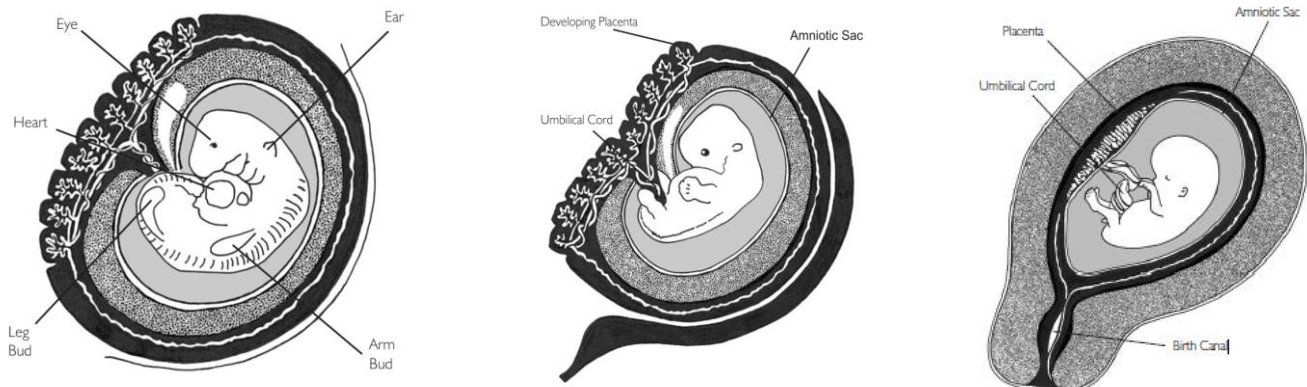
Pregnancy is approximately nine months long. To be more exact, the average length of a pregnancy is 40 weeks. Pregnancy is divided into three equal parts or trimesters. Trimesters are not exact. When 40 weeks is divided into thirds, each trimester is 13 1/3 weeks long. Rather than saying a trimester starts mid-week, it is practice to say that it starts at the beginning of a week (of pregnancy). Although there are differences within the literature as to which weeks are the transitions, several Saskatchewan obstetricians have agreed with the second trimester starting at the beginning of week 13 and the third trimester starting at the beginning of week 28.

**Table 3.1** outlines the development timeline over the three trimesters.

First trimester 0-12 weeks		Second trimester 13-24 weeks	Third trimester 28-38 weeks
0-3 weeks	Zygote	Fetus	Fetus
3-9 weeks	Embryo		
9-12 weeks	Fetus		

### First Trimester (1 to 12 weeks)

The first trimester is the time when the cells of the zygote divide, become implanted in the lining of the uterus, and develop the necessities to continue life. Three weeks after the sperm cell combines with the egg, the developing baby is no longer called a zygote. It is now called an **embryo**. During the five weeks the baby is called an embryo (3 to 9 weeks), the central nervous system (brain and spinal cord) and major organs develop. In fact, the heart starts to beat three weeks after conception. Brain waves can be recorded six weeks after conception. By the eighth week, the liver is making blood and the kidneys are working. The ribs, backbone, digestive tract, and muscles also begin to develop. Many of the external body structures, such as the face, arms, hands, fingers, legs, feet, and toes, are formed at this time as well (Evensen, 2002; Harding & Bocking, 2001).



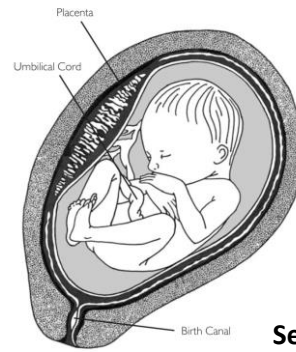
**Figures 3.1 to 3.3: Months 1, 2, and 3**

At nine weeks, the baby is now called a fetus (Berk & Shanker, 2006). This time is often described as the period of growth and finishing. The brain, spinal cord, organs, and muscles become more organized and begin to work together. These connections give the fetus the ability for movement and behaviour. An ultrasound at this time can show kicking, arm and hand movements, thumb sucking, and mouth opening. By 12 weeks, all of the fetus's body systems are operating, except for the immune system.



### Second Trimester (13 to 27 weeks)

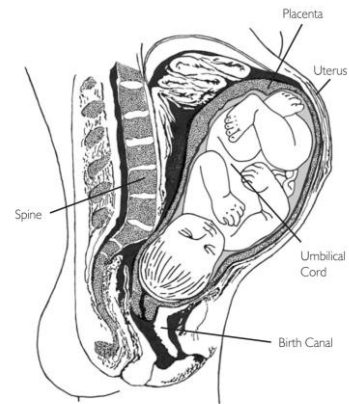
In the second trimester of pregnancy, the developing fetus continues to grow and mature. The mother can usually begin to feel her baby moving inside her at around four and a half months. By the end of the second trimester, most of the brain's neurons are present. Details such as eyelashes, eyebrows, and hair are now present (Berk & Shanker, 2006). The brain continues to develop.



**Figure 3.4:**  
**Second Trimester**

### Third Trimester (28 to 40 weeks)

In this trimester, development is mostly focused on increasing size and functional development of the fetus. The brain continues to grow. The cerebral cortex, which is sometimes called the thinking part of the brain, gets bigger. During this period of brain development, the grooves and convolutions (wrinkles and folds) typical of an adult brain begin to deepen. This allows the brain to be larger and have more volume without the head getting bigger (Berk & Shanker, 2006).



**Figure 3.5: Third Trimester**



A teratogen is NOT a dinosaur is adapted with permission from Foothills Fetal Alcohol Society.

### Teratogens

A teratogen is anything outside to the fetus that causes a physical or functional disability in the fetus during pregnancy or when the baby is born (Martin, Fanaroff, & Walsh, 2019). In other words, a teratogen is anything a woman is exposed to during pregnancy that can impact or harm her unborn baby (fetus). Teratogens can be things that she breathes in, swallows, or touches.

Teratogens can be classified into four main categories: physical agents, infectious agents, metabolic conditions, and drugs and chemicals, as shown in the table below (Chanapa, 2014; Genetic Alliance & The New England Public Health Genetics Education Collaborative, 2010).

Introductory information on teratogens can be found at [www.teratogen.ca](http://www.teratogen.ca).

**Table 3.2: Classes of Teratogens**

Physical Agents	Infectious Agents	Metabolic Conditions	Drugs & Chemicals
Ionising radiation (e.g., Uranium, X-Ray) Hyperthermia	Rubella (Measles) HIV Hepatitis Varicella (Chicken Pox) Syphilis Herpes Simplex Zika Toxoplasma	Malnutrition Diabetes Thyroid disorders	Alcohol Tetracycline Retinoid Phenytoin (antiepileptic drug) Warfarin Anti-cancer drugs Thalidomide* Mercury Lead Poly chlorinated biphenyls (PCBs) Herbicides Industrial Solvents

\*Thalidomide is a drug that was given to pregnant women in the late 1950s and early 1960s for morning sickness.

### Healthy Pregnancy

A healthy pregnancy starts before conception. Ideally, both partners will visit their healthcare provider to talk about their health and any lifestyle changes they can make to be sure they are as healthy as possible and their baby will have the best start. A woman and her doctor can decide on the best way to manage any health and/or lifestyle conditions, medications, or treatments that exist before and during a pregnancy (e.g., diabetes, high blood pressure, depression, an STI, HIV, etc.). Regular prenatal visits are very important. A woman can make healthy choices about her prenatal care and treatment when she has reliable information from a trained medical professional. If it is possible, it is strongly recommended that she seek out a healthcare provider who will support her throughout her pregnancy.

Part of healthy prenatal care is a visit to a dental health provider to make sure her teeth and gums are healthy. The section on oral health has more information.

When pregnant, a woman's health, well-being, and lifestyle are important for her and her baby. It helps to:

- eat healthy foods as much as possible (which can be more difficult in rural and remote locations and in conditions of poverty)



- take a multi-vitamin with folic acid
- rest
- keep a healthy weight with regular exercise, such as going for walks
- stay away from smoking and second-hand smoke, street drugs, and alcohol
- cut back on her exposure to smoking, second-hand smoke, street drugs, and alcohol as much as possible (harm reduction)  
(Dietitians of Canada, 2016)

#### Harm Reduction

It is not easy for some people to stop what they are doing even though it can hurt them. Supporting people and not judging them helps keep people safer and reduces deaths, diseases, or injuries because of high-risk behaviour.

(Adapted from HealthlinkBC, 2015)

Mother and baby are healthier when the mother is able to reduce and manage her stress and she lives in a violence-free environment. Violence and stress have been linked with poor outcomes, such as having the baby before the due date (preterm delivery) and a baby who weighs less than 5.5 pounds when born (low birth-weight) (Valladares et al., 2009; World Health Organization, 2014).

Being low birth weight can affect nearly every organ in the baby's body (Jin, 2015). Low-birth-weight babies may have problems with their lungs, intestinal tract, vision and hearing, and experience future developmental delays (Jin, 2015). Some may also need help with breathing, staying warm, protection against infection, and getting enough nutrition (Jin, 2015).

#### Prenatal Supplements (Vitamins)

Healthcare professionals may recommend certain supplements for pregnant women. A healthy diet and daily supplements will give extra nutrients for a healthy baby.

Too much of any supplement may be harmful to the baby (e.g., Vitamin A) (HealthLink BC, 2018). If a pregnant woman is already taking supplements (including herbal ones), it is good to tell her doctor. Showing the bottles/containers to her healthcare professional gives important information to make sure she and her baby are getting the right amount of nutrition.

One of the most important supplements is **folic acid**. Folic acid is the man-made form of **folate**. It is necessary for the typical development of a baby's brain, spine, and skull, and helps prevent neural tube defects (NTDs). Folate is a B vitamin and is found naturally in:

- citrus fruits
- raw leafy green vegetables
- beans
- peas
- lentils
- liver

The neural tube is the part of the developing baby that becomes the brain and spinal cord. NTDs happen when the neural tube does not fully close during the early weeks of pregnancy (Public Health Agency of Canada (PHAC), 2018a). This results in spine, brain, and skull defects that can lead to stillbirth or lifelong

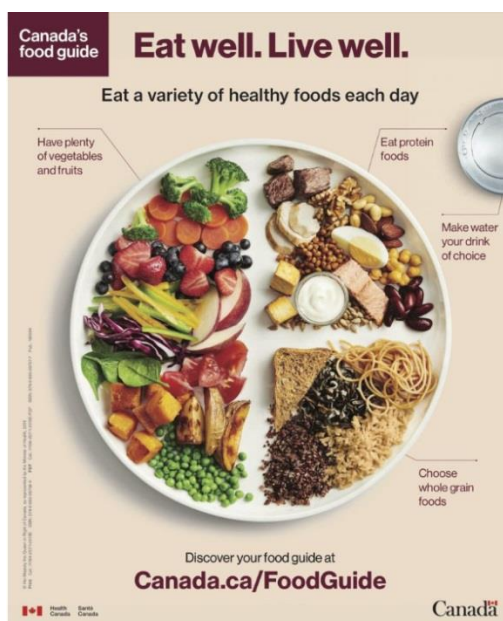
disability. Spina bifida (when the spine does not close) and anencephaly (when part of the brain and skull are missing) are the most common NTDs (PHAC, 2018a).

Folic acid is most important during the first few weeks of pregnancy (Health Canada, 2009). Women with compromised health or certain health conditions (e.g., diabetes, epilepsy, obesity) may need to take a greater amount of folic acid, which the doctor will prescribe. Other supplements that may be prescribed are iron and calcium.

Women who are sexually active and not using reliable contraception may want to take folic acid in case of unplanned pregnancy.

### Healthy Diet

Eating a nutritious diet helps keep people healthy. In pregnancy, a healthy diet prepares the mother's body for growing a healthy baby. Women who eat well during pregnancy are more likely to have a baby born at a healthy weight (British Columbia Ministry of Health, 2005). Foods rich in nutrients such as iron, folic acid, calcium, and omega-3 fats are an important part of a healthy pregnancy (Dietitians of Canada, 2018).



Canada's Food Guide (2019) gives advice on healthy eating when pregnant. Eating three meals a day, with healthy snacks in between, is recommended. Vegetables and fruits should take up half the space on the plate for meals and snacks. Vegetables and fruits, whole grain foods (e.g., whole grain bread, oatmeal, and wild rice), and protein foods:

- are all part of healthy eating during pregnancy
- add to the nutritional health of mother and her baby (Government of Canada, 2019).

Community nutritionists or public health nurses can give suggestions on healthy eating on a low budget.

Many women get caffeine through coffee, chocolate, colas, tea, and even prescription and non-prescription medications (HealthLink BC, 2018). Pregnant women are encouraged to

cut back their caffeine use to about 300 mg a day or drink decaffeinated beverages (HealthLink BC, 2018).

There are certain foods a pregnant woman should not eat. These include raw or undercooked meat, poultry, or fish; non-dried deli meats such as bologna, ham, and turkey breast; foods with raw or lightly cooked eggs; soft cheeses; unpasteurized juices; and raw sprouts (PHAC, 2018b).

## **Choline and Fetal Development**

Choline is found in foods such as whole eggs and liver. Most women do not have enough choline in their diets.

Researchers believe choline plays an important role in fetal development and are conducting studies to learn more about its impact on fetal development. When there is not enough choline, it can change cell growth and specialization (changing into **cells** with special jobs). This can lead to birth defects or affect brain development (even without alcohol use). Choline passes through the placenta to the fetus. Newborns have higher levels of choline in their tissue than their mothers. Babies get choline from their mothers' breast milk.

Drinking alcohol can lower choline levels in the brain (Biller et al., 2009). Research has shown that children with FASD have lower choline levels in their brains (Gonclaves et al., 2009).

Right now, researchers know that eating foods with choline may lead to a healthier pregnancy. A study on rodents showed that when choline was given to pregnant rodents, it positively altered brain functions such as memory in their juvenile, adult, and aged offspring (Zeisel, 2011). In a mouse model of Down syndrome, mice born to mothers who had extra choline during the perinatal period (22 weeks gestation to 7 days after giving birth) had large improvements in cognitive function and emotion regulation (World Health Organization, 2018).

## **Weight Gain**

Gaining weight is a natural and important part of pregnancy. However, gaining too much weight during pregnancy may lead to health problems and gaining too little weight can increase the risk of low birth-weight for the baby (HealthLink BC, 2019b). A woman's weight and Body Mass Index (BMI) before pregnancy will help to determine how much weight she should gain during pregnancy (Saskatchewan Prevention Institute, 2017).

## **Exercise**

Exercise is also important during pregnancy. If a woman is active before her pregnancy, she can continue to exercise at a comfortable level during pregnancy (HealthLink BC, 2019a). She will need to make changes as her body changes. If a woman is not active before her pregnancy, she can begin an exercise program, but do it slowly. Women should talk to their healthcare professionals about safe ways to keep active that are best for both mother and baby. Swimming and walking are good ways to stay active while pregnant (HealthLink BC, 2019a).

## **Smoking**

Smoking can harm the mother and her unborn baby. It is healthiest for both mother and baby if she can stop smoking before she becomes pregnant or as soon as she discovers she is pregnant. If she cannot stop smoking, it is healthier to cut back smoking as much as possible.

There are more than 4,000 harmful chemicals in tobacco smoke. These include nicotine, tar, ammonia, carbon monoxide, arsenic, cyanide, and lead. Seventy of the chemicals have been linked to cancers (PHAC, 2018b). **E-cigarettes** and other **nicotine**-containing tobacco products are also not healthy in pregnancy (Centers for Disease Control and Prevention, n.d.).

Pregnant women who use tobacco products have a higher risk (up to two times greater) of problems during pregnancy such as:

- miscarriage (baby has died inside mother and needs to be delivered)
- ectopic pregnancy (the fertilized egg implants outside the uterus)
- **placenta previa** (the placenta attaches to the bottom of the uterus which may cover birth canal, cause bleeding or problems in labour)
- preterm birth (having the baby too early)
- delayed wound healing (wounds heal more slowly and there is a bigger risk of infection after Caesarian)

(Saskatchewan Prevention Institute, 2010)

Risks for babies include:

- low birth-weight (about half a pound or 200 grams less than babies born to non-smokers)
- low oxygen levels
- developmental and learning problems
- visual and respiratory problems
- bleeding in the brain
- jaundice
- Sudden Infant Death Syndrome (SIDS)

(Saskatchewan Prevention Institute, 2019b).

The chemicals from smoking (environmental smoke) stay in the air for a period of time. They also stay on surfaces around the house as well as on hair and clothes. These chemicals can be passed through the placenta to the baby. Being exposed to second-hand smoke is as harmful to the fetus as smoking. Mothers who don't smoke and are exposed to environmental and second-hand smoke can give birth to smaller babies than mothers who are not around second-hand smoke (Crane et al., 2011). It is recommended that pregnant women stay away from tobacco smoke (Crane et al., 2011; PHAC, 2018b).

Carbon monoxide, nicotine, and other chemicals can cross the placenta to affect the unborn baby.

Pregnant women can get information and help to quit smoking from the Smokers' Helpline

[www.smokershelpline](http://www.smokershelpline) or 1-877-513-5333.

### **Cannabis**

Pregnant women are more likely to use cannabis than other drugs (Society of Obstetricians and Gynaecologists of Canada (SOGC), 2020). Cannabis is now legal for adults in Canada (2018), but this does

not necessarily mean it is safe to use. There is currently no amount of cannabis that is known to be safe in pregnancy (Health Canada, 2018).

There are over 400 chemicals in cannabis (SOGC, 2020). These chemicals are carried through the bloodstream to the fetus (SOGC, 2019). One of the chemicals is delta-9-tetrahydrocannabinol (THC). This is the chemical that makes people feel high.

Medical cannabis has the same active ingredients as recreational cannabis (SOGC, 2019). The fetus is exposed to these chemicals too. It is recommended not to use medical cannabis in pregnancy.

Cannabis can have impacts before, during, and after pregnancy (Saskatchewan Prevention Institute, 2018):

- Cannabis use may make it harder to get pregnant.
- Using cannabis when pregnant may harm the developing baby (e.g., baby may be smaller than normal, born too early, or have birth defects).
- Children who are exposed to cannabis during pregnancy may experience negative effects in childhood and adolescence (e.g., poorer memory and verbal skills; behavioural changes, such as increased rates of impulsivity and hyperactivity).
- Infants and children who are exposed to cannabis through breast milk may experience negative effects, such as lethargy (lack of energy), poor feeding habits, and slower motor development (the ability to move).



There is no scientific evidence to suggest that cannabis helps with morning sickness (SOGC, 2019). It is recommended to speak to a healthcare provider about other safer options (Health Canada, 2018).

If a pregnant woman cannot stop using cannabis, she should try to use smaller amounts and use less often. This may lower the risk of impact to the baby.

### **Oral Health**

The health of the mouth, teeth, gums, throat, and the associated bones is called oral health. A pregnant woman's oral health can affect her health and that of her baby. A pregnant woman has a higher risk for tooth decay and gum disease (periodontal disease). Because of this risk, it is healthy for a woman who is pregnant or thinking of becoming pregnant to see a dentist or dental care practitioner (Saskatchewan Prevention Institute, 2014).

Morning sickness increases the risk of tooth decay because vomit has acid in it (Health Canada, n.d.). Health Canada (n.d.) recommends these steps for women who experience morning sickness:

- Rinse mouth with water or a fluoride mouth wash immediately after vomiting.
- Wait 30 minutes after rinsing before brushing teeth (to further reduce the acid in the mouth).
- Brush teeth.

Poor periodontal health is also related to chronic conditions (e.g., diabetes, some respiratory diseases) (Saskatchewan Prevention Institute, 2014). In pregnancy, poor oral health may increase the risk of:

- delivering a pre-term baby
- delivering a baby with a low birth weight
- having pre-eclampsia (high blood pressure due to pregnancy and large amounts of protein in the urine)

(Health Canada, n.d.)

Before birth and after birth are important times that can influence early childhood cavities (Saskatchewan Prevention Institute, 2014). Because of this, pregnant women are encouraged to pay attention to their nutrition and dental hygiene during these periods.

### **Medications**

Medications can include prescription and over-the-counter products (medications you can purchase without a prescription). Some medications are safe to take while pregnant and others are not. A pregnant woman should not take any medication unless it is recommended and prescribed by a doctor or healthcare provider who knows she is pregnant.

The healthcare provider can work with the woman to make sure all the medications she takes are safe. If a woman needs to stop taking some medications, the healthcare provider can work with her in changing or slowly reducing the medication in a safe way.

### **Street Drugs/Illicit Drugs**

Street drugs (also known as illicit drugs) can also harm a baby. Just like alcohol, illicit drugs can pass through the placenta to the baby. Street drugs include:

- opioids (e.g., fentanyl)
- cocaine
- hallucinogens such as methylenedioxymethamphetamine (MDMA) popularly known as ecstasy, methamphetamine, and LSD (lysergic acid diethylamide)

(Merck Manuals Consumer Version, n.d.)

These drugs can increase the risk of:

- miscarriage
- stillbirth
- preterm delivery
- neonatal abstinence or withdrawal syndrome

(BC Ministry of Health, 2005; Merck Manuals Consumer Version, n.d.)

Injecting illicit drugs increases the risk of transmission of infections such as hepatitis, sexually transmitted infections (STIs) (including HIV) to the fetus (Merck Manuals Consumer Version, n.d.). STIs can impact a fetus.

Because of the fear of stigma and judgement, it may not be easy for a woman to talk about her drug use, but this is an important conversation. Stopping an opioid medication suddenly could cause her to go into withdrawal, which is not healthy for her or her baby (MotherToBaby, 2019).

If a woman is using fentanyl, she can talk to a health professional. They can discuss options that will help her to either 1) gradually stop depending on, or 2) stay on a carefully controlled dose of, an opioid medication during her pregnancy (MotherToBaby, 2019).

A person who is using codeine should reduce her use slowly with the help of a healthcare provider.

More research is needed to know how going through withdrawal might hurt a pregnancy.

### **Sexually Transmitted Infections (STIs)**

Sexually transmitted infections (STIs) are infections that can be caused by bacteria, viruses, or parasites. They are usually spread through sexual contact. Some STIs are spread through blood-to-blood transfer.

While most STIs can be treated and cured, some stay in the body forever, although there are medicines to manage symptoms. STIs include:

- Chlamydia
- Genital Herpes
- Gonorrhea
- Hepatitis B
- Hepatitis C (HCV)
- Human Immunodeficiency Virus (HIV)
- Human Papilloma Virus (HPV)
- Syphilis
- Trichomoniasis

(Saskatchewan Prevention Institute, 2016)

Anyone can get an STI and someone with an STI often does not have symptoms. This means a lot of people do not get tested. Untreated STIs can cause serious health problems such as pelvic inflammatory disease, cancer, or death (Saskatchewan Prevention Institute, 2016).

STIs can also affect:

- fertility (the ability to have a baby)
- future pregnancies
- newborn babies



Certain STIs increase the risk of miscarriage, preterm labour and delivery, and/or birth defects (Saskatchewan Prevention Institute, 2016). Newborns that have been exposed to STIs can have low birth weight, eye or lung infections, or more serious infections (e.g., meningitis) (Saskatchewan Prevention Institute, 2016). Most of these impacts can be avoided when pregnant women receive routine prenatal care. This includes STI testing before or early in the pregnancy and again close to delivery. Treatment can greatly reduce the effects on pregnancy and the newborn baby.

**Table 3.3: STIs Affect Fertility, Pregnancy, and Newborns**

STI	Affects Fertility	Affects Pregnancy	Affects Newborn
Chlamydia	✓	✓	✓
Genital Herpes		✓	✓
Gonorrhoea	✓	✓	✓
Hepatitis B	✓ (males)	✓	✓
HCV			✓
HIV	✓	✓	✓
HPV			✓
Syphilis		✓	✓
Trichomoniasis	✓	✓	✓

(Saskatchewan Prevention Institute, 2016)

For more detailed information about each of the STIs listed in the table above, see Prevention Institute’s resource 7-017 [Sexually Transmitted Infections: What You Need to Know](#) and visit [www.sexandu.ca/stis/](http://www.sexandu.ca/stis/).

### Domestic Violence

Domestic Violence (DV) is also known as Intimate Partner Violence (IPV). It includes physical, psychological, verbal, sexual, spiritual, and financial abuse and aggression that is committed by a spouse, common-law partner, or romantic partner (Arroyo et al., 2016). Women may not report DV because of stigma, shame, or fear (Saskatchewan Prevention Institute, 2019a).

Women are more likely to experience DV in pregnancy than high blood pressure, gestational diabetes, or premature rupture of membranes (Saskatchewan Prevention Institute, n.d.). Women who are abused during pregnancy experience more frequent violence and more severe forms of violence. Pregnant women are four times as likely as other women to say they experienced very serious violence including:

- beating
- choking
- gun/knife threats
- sexual assaults

(Saskatchewan Prevention Institute, n.d.; Saskatchewan Prevention Institute, 2019a).

Pregnant women who are abused are at a higher risk for long-term health problems than women who are abused and not pregnant. Abuse in pregnancy can impact a woman’s health – now and in the future (Saskatchewan Prevention Institute, 2019a). A pregnant woman and her unborn baby can die from IPV. This includes death by murder or suicide. Other health outcomes are listed in the chart below. They happen because of the direct physical trauma and its impact on her body and its functions and the growth and development of the fetus (World Health Organization, 2011).

**Table 3.4: Non-fatal but serious consequences of IPV**

Maternal/Perinatal Health	Physical/Mental Health	Negative Health Behaviour
Low birth weight	Injury	Alcohol and drug use during pregnancy
Pre-term labour	Physical impairment	Smoking during pregnancy
Miscarriage	Physical symptoms	Delayed prenatal care
Unsafe abortion	Depression	
Insufficient weight gain	Difficulties with attachment	
Obstetric complications	Effects on the child	
STIs/HIV		

**Source: (World Health Organization, 2011)**

Women who experience DV are less likely to breastfeed (Silverman et al., 2006).

Women who are in abusive situations may not be ready to leave a relationship. There are ways they can be helped. These include the following:

- Suggest she see a counsellor.
- Remind her to make sure she is not isolated from friends and family who can help her.
- Help her to teach her children how to call a neighbour or police for help.
- Remind her to have an emergency plan.
- Tell her there are laws within the Victims of Domestic Violence Act that allow the police to remove the abusive partner from the home.
- Let her know she does not have to testify against her partner in order to lay charges against him or her.

For more information or to get help:

- Saskatchewan Services for People Experiencing Violence and Abuse <http://abuse.sk.211.ca/>
- Provincial Association for Transitional Housing <https://pathssk.org>
- First Nations and Inuit Hope for Wellness Help Line 1-855-242-3310

### **Sensitive and Critical Periods of Fetal Development**

A sensitive period, or **critical period**, is an amount of time when a certain body part or system is quickly developing. Teratogens, like alcohol, can impact the development of this body part at this time (Moore, Persaud, & Torchia, 2020; National Research Council, 2015). The timing of alcohol use is especially important because of the concept of sensitive periods of development (Berk & Shanker, 2006).

Brain development takes place in all nine months of pregnancy. The critical period for brain development is from 3 to 16 weeks. Brain development may be interrupted after this time (Moore et al., 2020). The brain continues to develop after the baby is born and continues until the mid-twenties.

The development of the face takes place in the first few weeks of pregnancy. Alcohol can impact typical development of the face only at this time. Effects on growth (head circumference, birth weight, and length) take place much later in pregnancy (Coles, 1994).

Earlier research suggested that alcohol has minimal impact when the developing baby is in the zygote stage (before implantation). A recent animal study showed that drinking alcohol during conception can significantly reduce the growth of the placenta (Kalisch-Smith, 2019). Generally, if alcohol does have an effect at this stage, it usually causes the death of the developing cells. The woman may not even realize she was pregnant (had a potential pregnancy). The greatest harm happens in the embryo stage because the foundations for all body parts are being developed (Berk & Shanker, 2006). In the fetal stage of development, alcohol can cause more harm to the brain, eyes, and genitals.

Although the early stage of pregnancy is a particularly critical time, prenatal alcohol exposure can affect the fetus and the developing fetal brain at any point during the pregnancy (Centers for Disease Control and Prevention, 2018). Because of this, current Canadian guidelines recommend that no alcohol is best when planning a pregnancy and while pregnant (PHAC, 2009).

There is not enough evidence about fetal safety or harm at low levels of alcohol use during pregnancy to define any threshold for low-level drinking in pregnancy. Not using alcohol is the most prudent choice for a woman who is, or may become, pregnant (Carson et al., 2017).

Please refer to **Module 4: Brain Anatomy, Development, and Function** for a more detailed description of the impact of prenatal alcohol exposure on the fetal brain.

### **A Father's Alcohol Use and FASD**

A father's alcohol use before pregnancy cannot directly cause FASD. Studies have shown that a father's drinking can affect several generations of family because of changes to the male sperm (Liyanage-Zacharia & Harding, 2019). Genes inherited from the father may make the fetus more vulnerable to maternal alcohol use (Liyanage-Zacharia & Harding, 2019).

Generally, a father's alcohol use in the preconception period could result in:

- reduced sperm quality and quantity, alterations in shape and ability to penetrate the egg
- changes to the genetic contribution of the sperm
- epigenetic changes (i.e., changes to the gene regions that are inherited by children from the father)

(Liyanage-Zacharia & Harding, 2019)

Fathers play a role in making the fetus more vulnerable to Prenatal Alcohol Exposure and contributing to FASD.

Liyanage-Zacharia & Harding, (2019)

The father's genes can, therefore, decide genetic susceptibility or resiliency to the harmful effects of alcohol and may contribute to the likelihood of a child's development of FASD (Liyanage-Zacharia & Harding, 2019).

Along with less-healthy sperm, male alcohol use before conception has been associated with:

- higher levels of spontaneous abortion
- lower levels of live births
- lower infant birth weight and gestational age
- higher rates of heart malformations

(McBride & Johnson, 2016)

Research has been done using animals. Earlier research with animals found that paternal alcohol exposure before conception can result in:

- lower birth weight
- increased hyperactivity
- changes in motor activity
- learning and memory deficits
- hyper responsiveness to stressors

(Abel, 1993; Abel, 2004; Bielawski & Abel, 1997; Cicero, 1994; Ledig et al., 1998).

Other animal research has found connections between paternal preconception alcohol use and:

- reductions in paternal fertility
- fewer pregnancies carried to term
- fetal developmental abnormalities and defects
- higher levels of infant mortality

(Cicero, 1994; Gearing et al., 2005; Tanaka, Suzuki, & Arima, 1982)

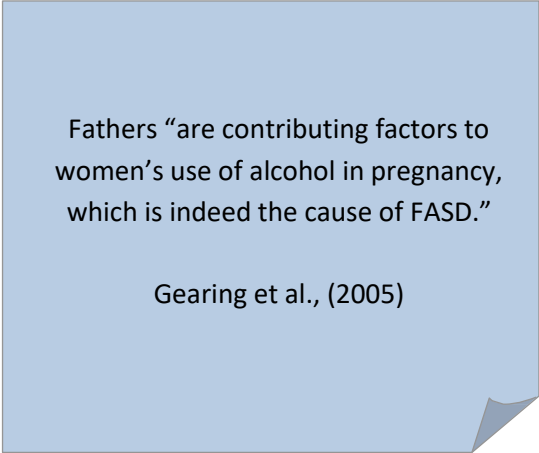
When all the research is viewed together, including human population studies, sperm quality and epigenetic studies, and animal models, it is safe to say that fathers play an important role. This includes, making the fetus more susceptible to prenatal alcohol exposure and influencing the amount of prenatal alcohol exposure. Male partners contribute to the potential for developing FASD. Therefore, it is

recommended that both mother and father avoid at-risk alcohol consumption in the preconception and prenatal period to prevent the possibility of FASD.

### **Importance of Father's Role in FASD Prevention**

A father's alcohol use has been associated with negative effects, but there are no documented cases of FASD where the mother has not used alcohol during pregnancy (Clarren & Smith, 1978). In other words, for FASD to happen, there must be maternal alcohol use during pregnancy (Gearing et al., 2005). More specifically, FASD is caused when a pregnant woman uses alcohol during pregnancy.

Although a father's use of alcohol does not directly cause FASD, male partners can and do play a role in a pregnant woman's drinking. The quality of the relationship between the pregnant woman and her partner influences a woman's drinking. Women who reported less relationship satisfaction and less ability to talk about relationship problems were more likely to continue drinking (Bakhireva et al., 2011). If the male partner does not support an expectant mother's plan to stop drinking alcohol, she can find it more difficult to do so (Astley et al., 2000).



Fathers “are contributing factors to women’s use of alcohol in pregnancy, which is indeed the cause of FASD.”

Gearing et al., (2005)

The father's role can either contribute to or protect against maternal alcohol use. Therefore, this role should not be ignored. As suggested by Gearing et al., (2005), fathers “are contributing factors to women’s use of alcohol in pregnancy, which is indeed the cause of FASD” (pp. 5).

Fathers also play a very important role in supporting their partners to stay healthy during pregnancy. Higher levels of maternal alcohol consumption during pregnancy were found when women had live-in partners who drank alcohol (McBride & Johnson, 2016). Research suggests that partners tend to have similar drinking patterns, and that having a male partner that drank heavily and frequently increased the likelihood that a woman would drink during pregnancy (Bakhireva et al., 2011). Pregnant women may find it more difficult to quit drinking or cut back their use if their partner continues to drink (May, 1980, as cited in Bailey et al., 2008). If the partner has drug and alcohol-related problems, the expectant mother is more likely to drink alcohol or use drugs during pregnancy (Teitler, 2001). Interestingly, research has also shown that a husband's drinking pattern is more influential on his wife than vice versa (Chang et al., 2006).

For more information about the male role in maternal drinking, please refer to **Module 6: Prevention of FASD**.

**Conclusion**

Because alcohol is a teratogen, it can affect normal fetal development if a woman uses alcohol at any time during pregnancy (from conception to birth). Paternal alcohol consumption before conception has also been shown to affect children through alcohol's effect on sperm, but this alone cannot cause FASD.

Alcohol can be harmful to the fetus at any point in the pregnancy, but there are critical periods where it has the potential for the greatest impact to the developing baby. One of these periods is the embryo period, when a woman may not even know she is pregnant. The first trimester is also a period of intense change in the fetus, and alcohol use at this time can affect the baby's eyes, brain, and genitals.

It is, therefore, very helpful for people to understand the impacts of alcohol use during pregnancy, and the role of men in preventing FASD.

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