

Teratogens and their Effects on Pregnancy and Development

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Definitions and Statistics

"A teratogen is an agent, which can cause a birth defect. It is usually something in the environment that the mother may be exposed to during her pregnancy. It could be a prescribed medication, a street drug, alcohol use, or a disease present in the mother, which could increase the chance for the baby to be born with a birth defect."

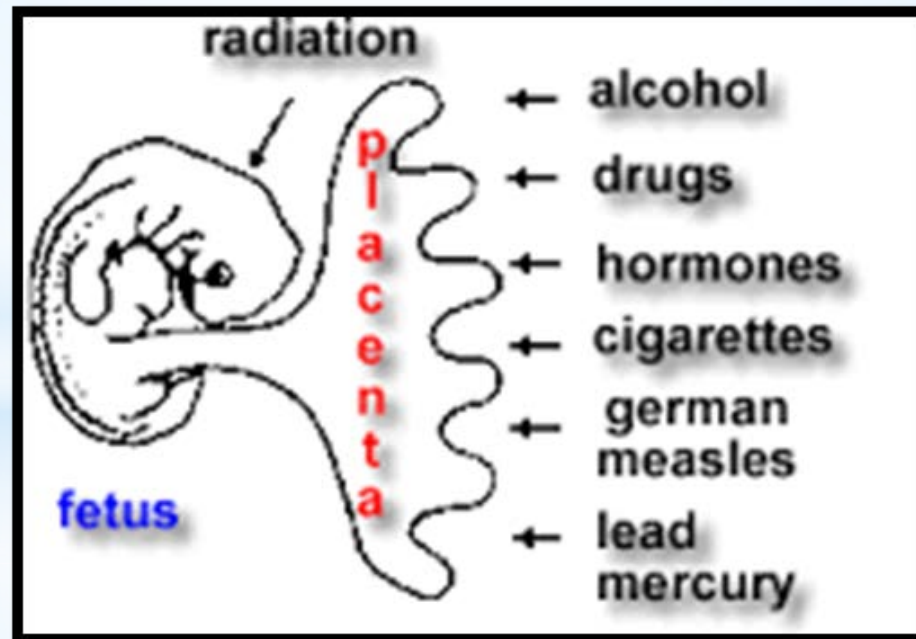
About 4-5% of birth defects are caused by exposure to a teratogen during pregnancy

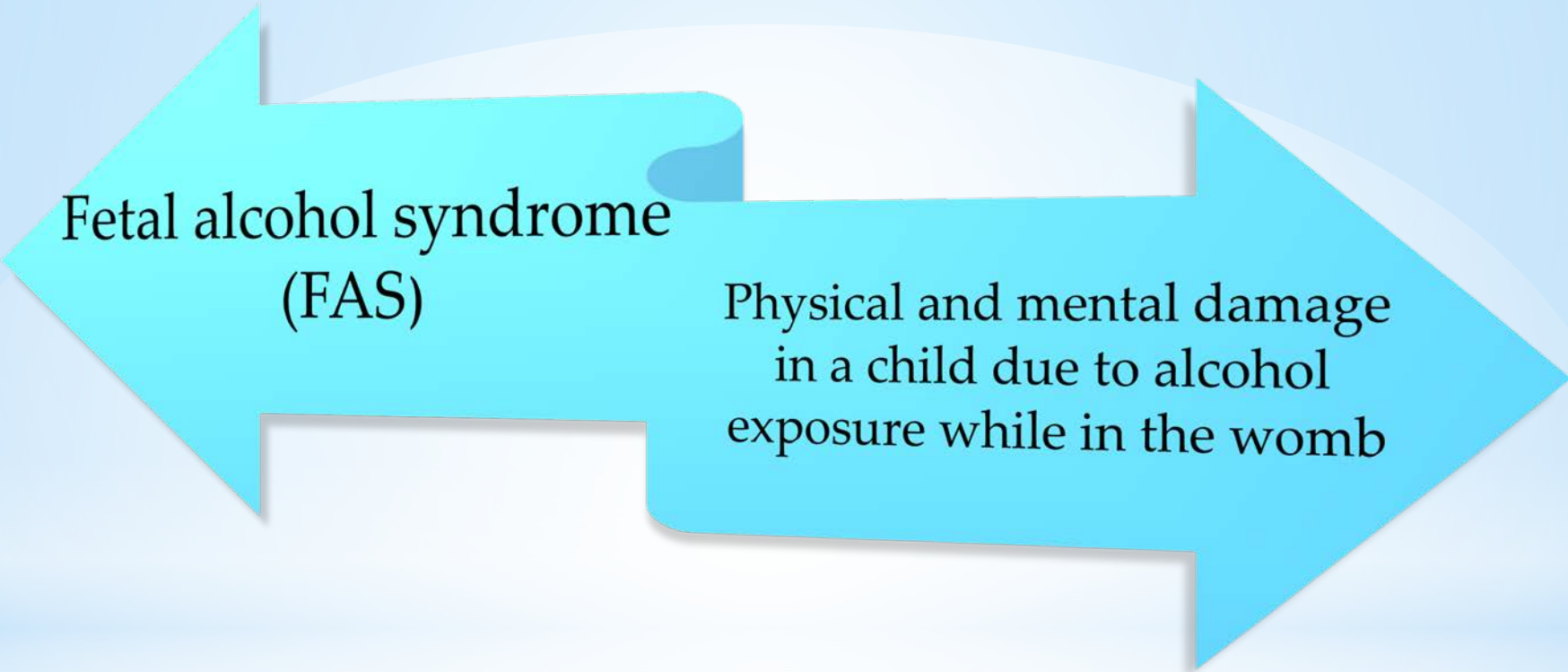
Teratogens can impact a baby's development as little as 10-14 days after conception

- <http://www.chw.org/medical-care/genetics-and-genomics-program/medical-genetics/teratogens/>

**“You may not feel a few drinks,
but your baby could feel them
forever”**

<http://www.relatably.com/q/quotes-fetal-alcohol-syndrome>






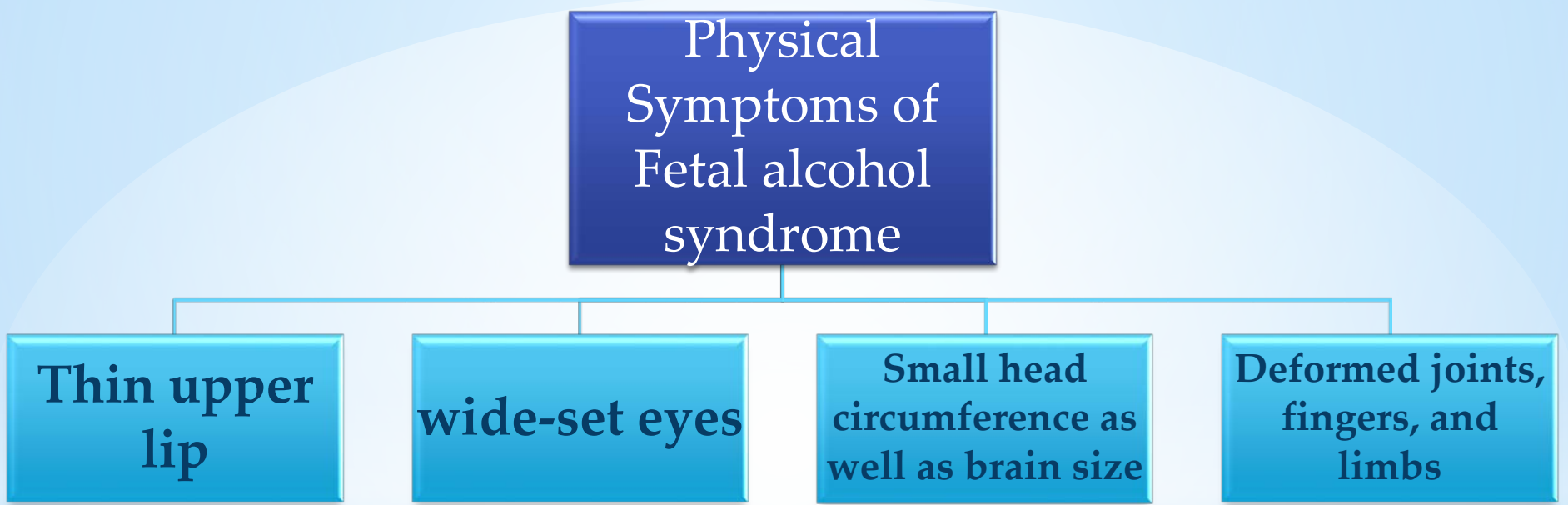
Fetal alcohol syndrome
(FAS)

Physical and mental damage
in a child due to alcohol
exposure while in the womb

http://www.mayoclinic.org/diseases-conditions/fetal-alcohol-syndrome/basics/definition/con-20021015?utm_source=Google&utm_medium=abstract&utm_content=Fetal-alcohol-syndrome&utm_campaign=Knowledge-panel



Physical Symptoms of Fetal alcohol syndrome



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graph TD; A[Physical Symptoms of Fetal alcohol syndrome] --> B[Thin upper lip]; A --> C[wide-set eyes]; A --> D[Small head circumference as well as brain size]; A --> E[Deformed joints, fingers, and limbs];
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**Thin upper
lip**

wide-set eyes

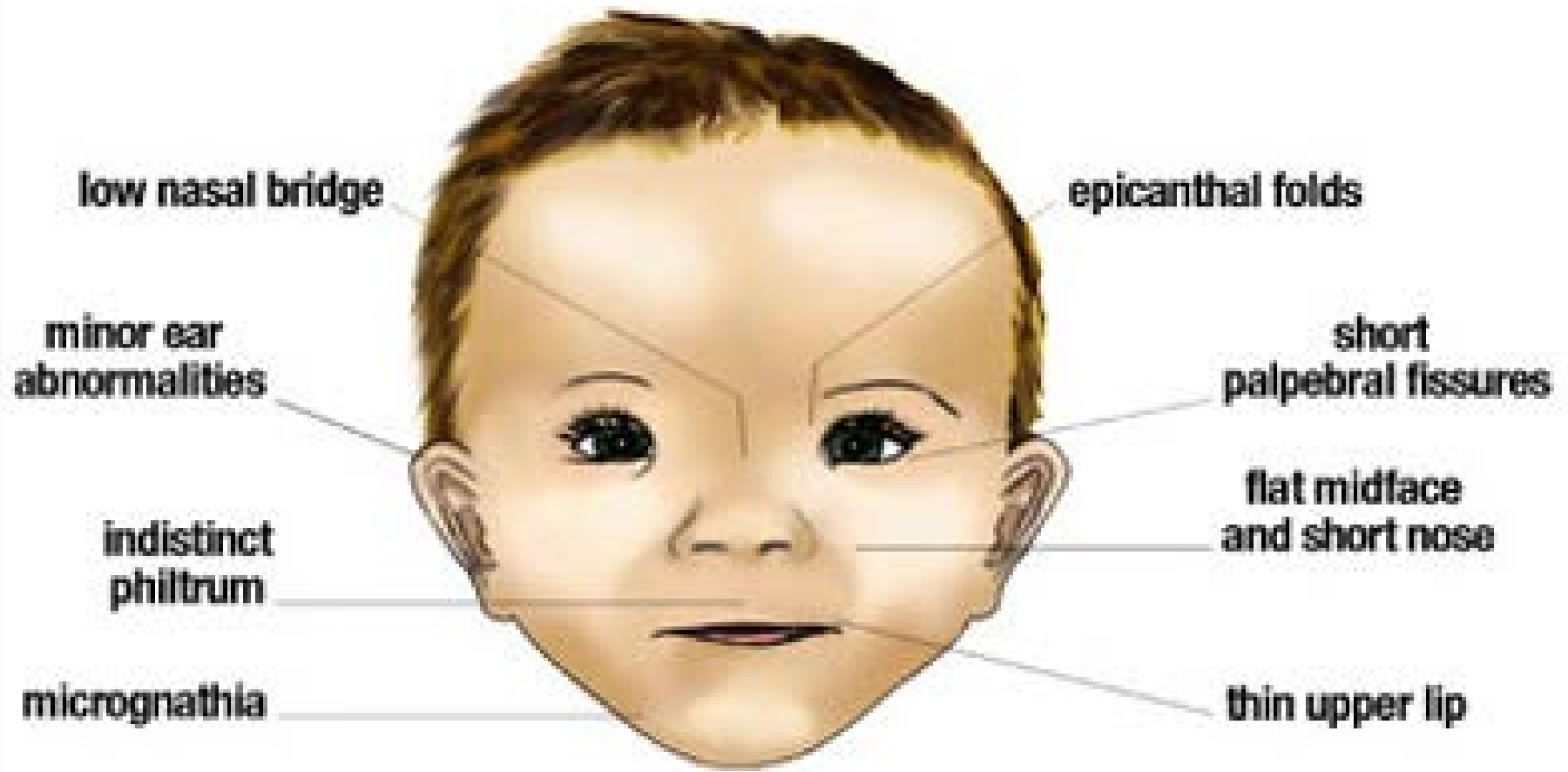
**Small head
circumference as
well as brain size**

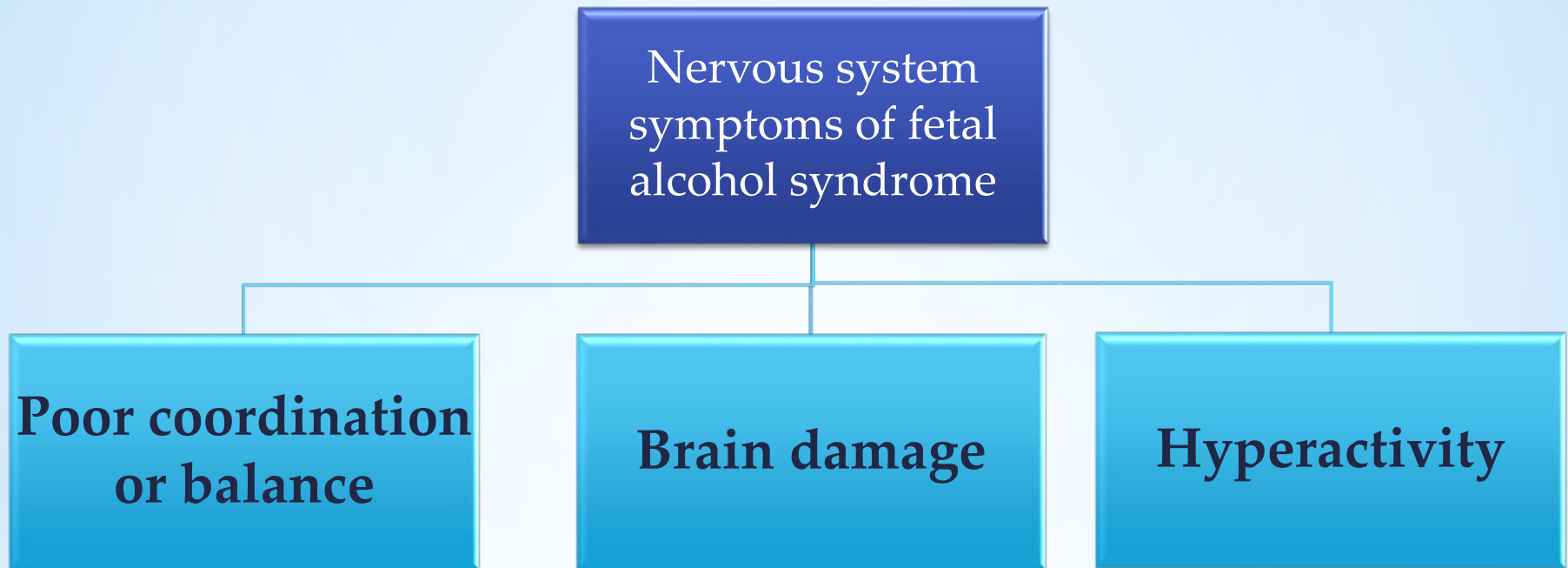
**Deformed joints,
fingers, and
limbs**

Babies can have the symptoms shown above as well as short noses and low nasal bridges.

http://www.mayoclinic.org/diseases-conditions/fetal-alcohol-syndrome/basics/definition/con-20021015?utm_source=Google&utm_medium=abstract&utm_content=Fetal-alcohol-syndrome&utm_campaign=Knowledge-panel

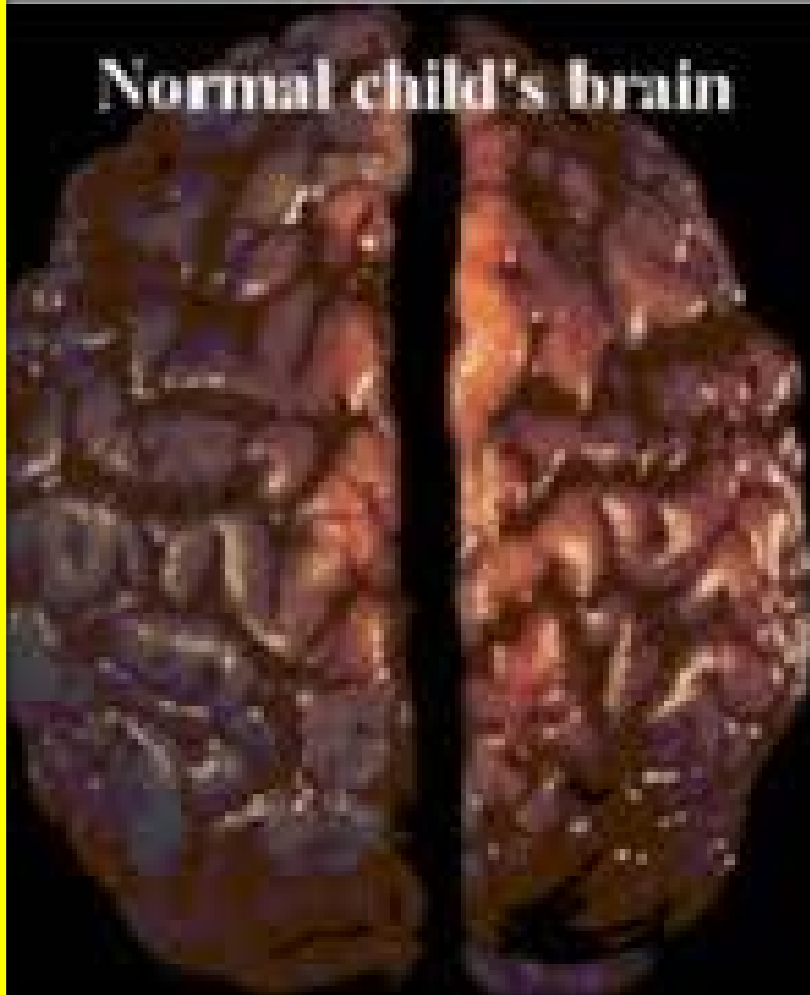
FETAL ALCOHOL SYNDROME





Babies who are born with Fetal Alcohol Syndrome can suffer from learning and intellectual disabilities as well as delayed development. They tend to have poorer memory and trouble processing information. They can often have trouble with attention and poor judgment skills.

Normal child's brain




**FAS-affected
child's brain**





Treatment of Fetal Alcohol Syndrome:



Speech therapy
Support group, Counseling psychology
If caught early this is much easier to treat (early intervention)
Medications

http://www.mayoclinic.org/diseases-conditions/fetal-alcohol-syndrome/basics/definition/con-20021015?utm_source=Google&utm_medium=abstract&utm_content=Fetal-alcohol-syndrome&utm_campaign=Knowledge-panel

* Other options for treatments can include: having a special education teacher, early intervention to help with walking, talking and other motor skills, and mothers can seek help for their alcoholism.



FAS research study: ALCOHOL CONSUMPTION, PREGNANCY, AND LOW BIRTHWEIGHT

The purpose of this study was to examine the results of alcohol exposure during different periods of pregnancy. It also looked into the affect of alcohol in relation to birth weight. 7,141 subjects participated and their alcohol consumption was assessed and monitored during all stages of pregnancy (early, mid, and late). The results showed that not associated with adverse outcomes. Analysis, however showed tendencies toward adverse effects of alcohol consumption. One or more alcoholic drinks per day consumed during early pregnancy had a correlation to birth weight.

<http://www.sciencedirect.com/science/article/pii/S0022347678804491>



The effects of radiation on the unborn and developing child

Prenatal Radiation Exposure

* Is the exposure of an unborn baby to radiation. This exposure of the fetus can occur when the mother's abdomen area is exposed to radiation (example, X-rays). From the mother, radioactive debris may pass through the umbilical cord to the baby. If the father has had exposure to radiation or lead before/during conception it can lead to birth defects as well.



Table 1: Potential Health Effects (Other Than Cancer) of Prenatal Radiation Exposure

Table 1 Potential Health Effects (Other Than Cancer) of Prenatal Radiation Exposure					
Acute Radiation Dose* to the Embryo/Fetus	Time Post Conception				
	Blastogenesis (up to 2 wks)	Organogenesis (2–7 wks)	Fetogenesis		
			(8–15 wks)	(16–25 wks)	(26–38 wks)
< 0.05 Gy (5 rads)†	Noncancer health effects NOT detectable				
0.05–0.50 Gy (5–50 rads)	Incidence of failure to implant may increase slightly, but surviving embryos will probably have no significant (noncancer) health effects	<ul style="list-style-type: none">• Incidence of major malformations may increase slightly• Growth retardation possible	<ul style="list-style-type: none">• Growth retardation possible• Reduction in IQ possible (up to 15 points, depending on dose)• Incidence of severe mental retardation up to 20%, depending on dose	Noncancer health effects unlikely	
> 0.50 Gy (50 rads) <i>The expectant mother may be experiencing acute radiation syndrome in this range, depending on her whole-body dose.</i>	Incidence of failure to implant will likely be large,‡ depending on dose, but surviving embryos will probably have no significant (noncancer) health effects	<ul style="list-style-type: none">• Incidence of miscarriage may increase, depending on dose• Substantial risk of major malformations such as neurological and motor deficiencies• Growth retardation likely	<ul style="list-style-type: none">• Incidence of miscarriage probably will increase, depending on dose• Growth retardation likely• Reduction in IQ possible (> 15 points, depending on dose)• Incidence of severe mental retardation > 20%, depending on dose	<ul style="list-style-type: none">• Incidence of miscarriage may increase, depending on dose• Growth retardation possible, depending on dose• Reduction in IQ possible, depending on dose• Severe mental retardation possible, depending on dose	Incidence of miscarriage and neonatal death will probably increase depending on dose§

Table 2: Estimated Risk for Cancer from Prenatal Radiation Exposure

Radiation Dose	Estimated Childhood Cancer Incidence* †	
No radiation exposure above background	0.3%	38%
0.00–0.05 Gy (0–5 rads)	0.3%–1%	38%–40%
0.05–0.50 Gy (5–50 rads)	1%–6%	40%–55%
> 0.50 Gy (50 rads)	> 6%	> 55%

<http://emergency.cdc.gov/radiation/prenatalphysician.asp>

Radiation on the Fetus

-Before about 2 weeks - health effect of concern from an exposure of 10 rads results to death of embryo. If the embryo survives radiation-induced noncancerous health effects are unlikely, no matter what the radiation dose. Because the embryo is made up of only a few cells, damage to one cell, the progenitor of many other cells, can cause the death of the embryo, and the blastocyst will fail to implant in the uterus. Embryos that survive, however, will exhibit few congenital abnormalities.

-Researchers agree that a dose of 5 rads represents no measurable noncancerous risk to the embryo or fetus at any stage. Research states this causes a small risk for malformations, as well as effects on the central nervous system in 5–10 rads range for some stages. Threshold for congenital effects in the embryo or fetus is most between 10–20 rads.

-Researchers suggest that impaired brain function is at risk above 10 rads in the 16- to 25-week stage of gestation.



Smoking while Pregnant

Infertility &
Birth
defects

Smoking while pregnancy
increases the chances of
having complications
while pregnant

Possibilities of
death of mother
and child or
even early
miscarriage or
stillbirth

*Smoking while pregnant significantly increases the chances of having complications during pregnancy. Cigarettes contain chemicals such as nicotine, carbon monoxide, and tar that are harmful to not only adults, but definitely to growing babies as well (Carlson, 2016). These chemicals can prevent the development of a healthy baby.

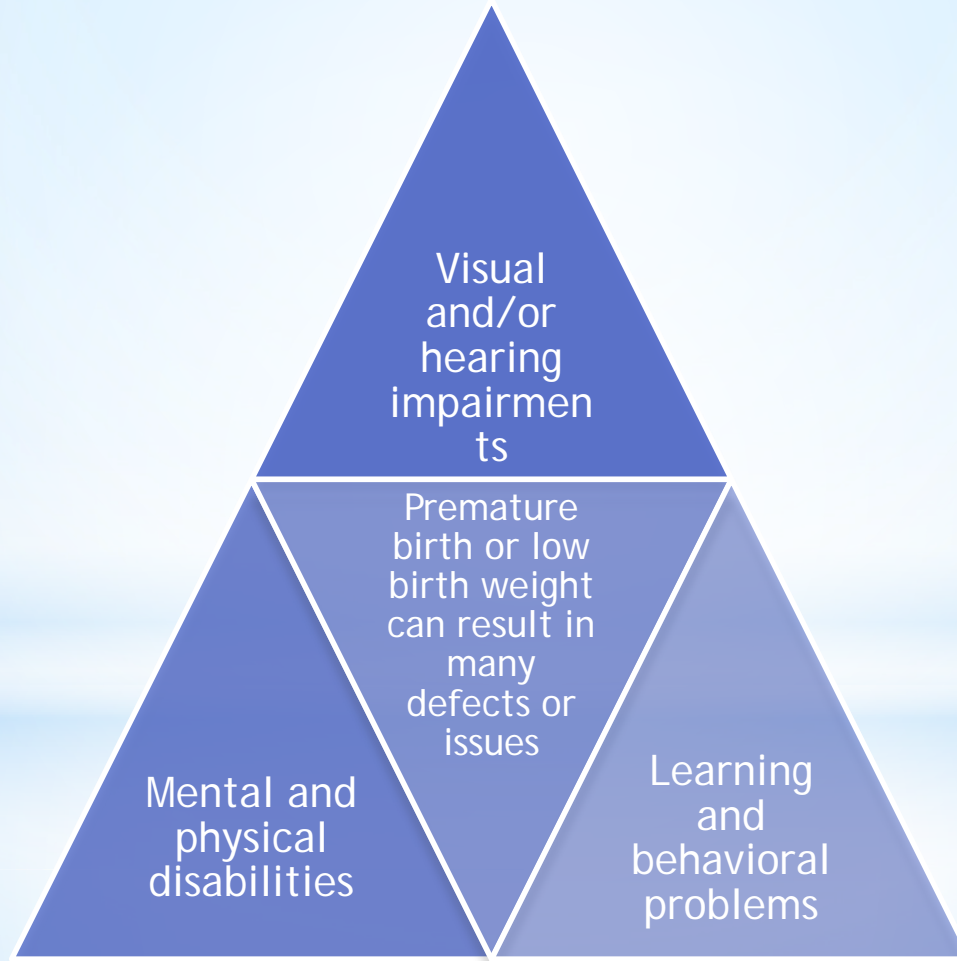
Infertility

- * According to a recent study, both male and female smokers are about twice as likely to be infertile as nonsmokers





Birth Defects



- * Premature birth, also known as Preterm birth, can cause major complications for the baby during and after birth. The baby can be born with visual and/or hearing impairments, mental disabilities, and learning and behavioral problems. In severe cases, these complications eventually result in death. (Carlson, 2016)
- * Smoking cigarettes can also cause a low birth weight in newborns. This doesn't necessary mean just giving birth to a "small" baby, it can have severe consequences such as developmental delays, cerebral palsy, and just like premature births, it can result in hearing and vision ailments, and death as well (Carlson, 2016).
- * Other health issues such as cleft lips, cleft palate, congenital heart defects, and problems with the structure of the heart have all been linked to smoking during pregnancy as well. (Carlson, 2016)

Dangers to Mother

* Smoking is not only dangerous to a growing and developing fetus; it is also dangerous to the mother.

Complications include but are not limited to:

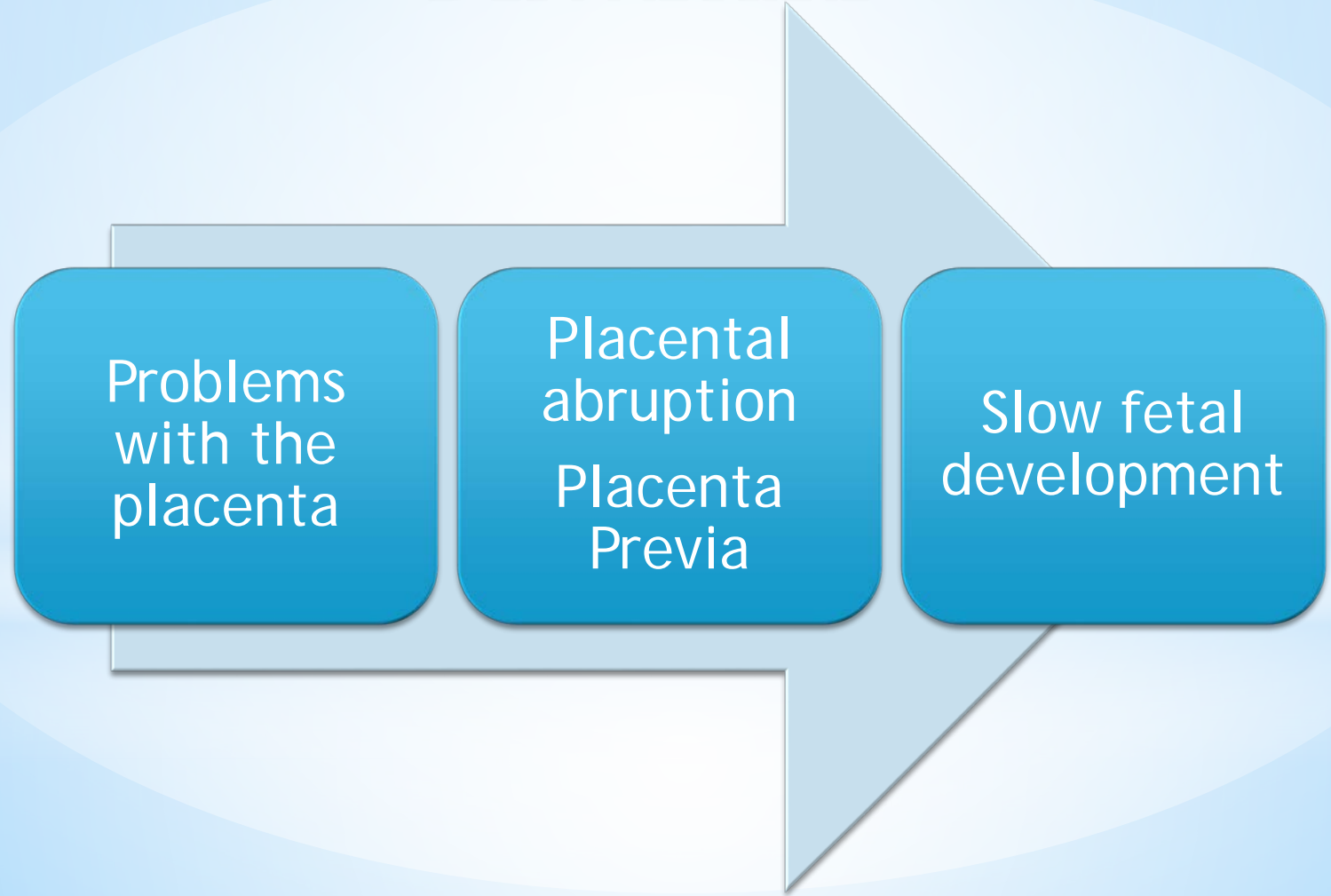
* Cancer

* Ectopic Pregnancy





Early Miscarriage or Stillbirth



Problems
with the
placenta

Placental
abruption
Placenta
Previa

Slow fetal
development

- * Smoking cigarettes while pregnant isn't just going to affect the mother, it can, and usually does, have negative effects on the baby as well. It raises the likelihood of an early miscarriage or stillbirth because of all the chemicals entering the mother's body.
- * A couple quotes from Jessica Carlson and medically reviewed by Jenine Kelbach that I found interesting and full of information:
- * "Smoking is a major risk factor for several problems with the placenta. The placenta is the "lifeline" structure that forms during pregnancy to provide the fetus with nutrients and oxygen. One such problem is placental abruption, a condition when the placenta separates from the uterus before childbirth. Placental abruption can cause severe bleeding and threaten the life of both the mother and baby. There's no surgery or treatment to reattach the placenta, but immediate medical attention can help increase the chance of a healthy birth despite the abruption." (Carlson, 2016)
- * "Smoking is also a risk factor for placenta previa. During pregnancy, the placenta normally moves with the uterus towards the top of the womb, leaving the cervix open for delivery. Placenta previa is when the placenta stays in the lower part of the uterus, partially or fully covering the cervix. The placenta often tears, causing excessive bleeding and depriving the fetus of vital nutrients and oxygen." (Carlson, 2016)

Prescription Drugs and Antibiotics



- * Many prescription drugs have been proven to be safe for pregnancy. Many antibiotics and antidepressants, for example have pregnancy safe options.
- * “The average woman takes between three and five medications during her pregnancy making reproductive toxicity a very important topic for healthcare professionals” (Holmes, 2013). Taking certain medication however, or abusing them can cause extremely negative effects to the mother and fetus.

- * Some effects are: withdrawal after birth, low birth weight, and malformations. With some ADHD medications there have been many cases of birth malformations. “An example of a medication class that can cause different effects on the fetus depending on when the exposure occurs is non-steroidal anti-inflammatory medications. Taken in the first trimester these medications have been associated with orofacial clefts and cardiac septal defects. Administration in the third trimester causes concern for the potential to close the ductus arteriosus prematurely” (Holmes, 2013). The ductus arteriosus that allows the baby to breathe in the womb and closes after birth.
- * Some antibiotics taken during pregnancy can be linked to cerebral palsy. Other medication such as doxycycline and minocycline have been proven to cause birth defects. Some drugs such as trimethoprim and sulfamethoxazole (used to treat UTIS) have been linked with harm to the mother (liver) and links to birth defects. “Taking higher doses of aspirin during the third trimester increases the risk of the premature closure of a vessel in the fetus's heart. Use of high-dose aspirin for long periods in pregnancy also increases the risk of bleeding in the brain of premature infants” (Harms, 2014).

Illegal Substances

3% of women who
are pregnant use
illegal substances

Cocaine,
Marijuana,
Ecstasy, Heroin

March of Dimes
Organization

<http://www.marchofdimes.org/index.aspx>

Facts

Low birth weight

Addiction/withdrawal

Learning or behavioral
problems

Heart Defects

Premature birth

Effects




Cocaine's Effects Research

- * National Institute on Drug Abuse
 - * Funded two separate studies to show the negative impacts of cocaine on children who had been exposed in the womb



https://archives.drugabuse.gov/NIDA_Notes/NNVol14N3/Prenatal.html



Dr. Vincent Smeriglio

- Conducted a longitudinal study
- Concluded that cocaine exposure impaired a child's alertness, IQ, attention, and motor skills

Dr. Eyler and Dr. Behnke

- Did a study at the University of Florida with 300 infants
- Half had been exposed to cocaine in the womb half had not
- They concluded that it impacted babies attention and overall responsiveness

Conclusion

- * There are many different types of Teratogens
- * They can have many negative harmful effects to both mother, fetus, and the child after its born
- * Mothers need to be careful about what they surround themselves with or ingest while they are pregnant
- * Teratogens can affect babies anytime during the pregnancy and can even affect conception

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