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Environmental Causes of Birth Defects

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Healthy babies are often taken for granted. People forget about the long nine months for the formation of a baby. Students especially do not realize that they have to start caring and nurturing the unborn child way before they first see it.

The work in this unit is planned to help students become more aware of the possibilities of birth defects and the prevention of birth defects to unborn children by environmental factors. The students will become aware of a variety of drugs, chemicals, radiation, and diseases that may have serious effects on pregnant women and their unborn children. The students will develop an understanding that a pregnant woman requires extra care for herself and the fetus. The students will become aware of substances that are passed from mother to the fetus through the placenta.

This unit is planned for use with ninth grade students as part of their sex education course, during the pregnancy and birth chapter.

The normal development of the fetus depends upon a complicated interaction of both genetic and nongenetic factors. Probably the most critical period in the developmental process occurs the first eight weeks after the formation of zygote, just when the organs of the body begin to develop. During this time, the orderly sequence of development can be disrupted severely by errors in the genetic makeup of the embryo, by conditions of the environment to which it is exposed, or by both components acting together. The environmental factors will be the ones in which we will be interested.

When one thinks of environmental or external causes of birth defects some seem to think of radiation or infections, forgetting about substances we take for granted in our society. People tend to forget about alcohol, caffeine, nicotine and commonly used medicines which can be dangerous to an unborn baby. A pregnant woman has to make a lot of personal decisions concerning the use of these commodities. We will investigate what is known and not known, what is suspected and what has been proved regarding the usage of these elements. But remembering everyone is an individual, there are no two people exactly alike, and what may effect one may do nothing to another person.

The placenta is a flat, spongy organ that lies in the cavity of the uterus, attached to the uterine wall. The umbilical cord that connects the placenta and the fetus is attached to the fetal side. In early weeks of pregnancy one cluster of cells start to develop into the placenta. The outside layer of this cell cluster develops into a membrane with hundreds of tiny roots which penetrate the uterine tissues and the other side faces the

fetus.

The placenta has two main activities. First, it acts as a route of transfer; it is the basic communication system between mother and unborn. Second, it is a sophisticated factory, taking substances from both the mother and the fetus, breaking them down into simple compounds, and then manufacturing new and complicated products. Some go to the mother and others to the fetus. One thing the placenta can not do well is to recognize substances that are harmful to the fetus. So anything that circulates in the maternal blood has the potential to cross the placenta and reach the fetus This is something that should not be forgotten by the pregnant woman so she can protect the fetus against substances that can or are suspected of causing damage to the fetus.

The placenta performs many functions that are taken over by certain organs after birth. The placenta acts as the lungs, kidneys and the liver for the fetus. It should be understood that the placenta plays a role of extreme importance and interference with how it functions may disrupt the well-being of the fetus.

A teratogen is a substance capable of producing abnormalities during intrauterine development that may show themselves before birth, at birth, or later on in life. We have to remember that a lot of evidence on teratogens has come from experimental work on animals. And sometimes the fact that a drug can cause an abnormality in an animal does not mean that it can do the same in a human. Also information is hard to gather because there are so many factors. The effect a teratogen has on a fetus can depend on the state of the woman's pregnancy, her health, her diet, what drugs she was using, if she smokes, and the genetic makeup.

We will now start to examine some teratogens a pregnant woman may be putting into her system and the effects on the fetus.

> *Alcohol* —Fetal alcohol syndrome (FAS) is a defect that is becoming more widely known. The symptoms are small head and body, a flattened face, distinctive eyes, retarded physical growth, mental retardation, shorter and lighter in weight than normal, heart defects, and poor coordination. The safe minimal dose of alcohol in pregnancy is not yet known, but because alcohol is socially accepted it is very easy to forget that its use should be restricted. It is accepted at present that with 100 proof alcohol, two ounces per day increases the risk of FAS: one ounce of alcohol probably increases the risk: and under one ounce has not been demonstrated as to its potential risk. Alcohol passes very quickly through the placenta to the fetus, and the unborn baby feels a drink almost as fast as a pregnant woman. One thing to remember with FAS is that the damage is not reversible.
> *Tobacco* —We all know that smoking is harmful to our bodies and that we should not smoke cigarettes. But whether or not the pregnant woman inhales, nicotine is still passed into her bloodstream and then into the baby's. We said before that the placenta acts as the fetus' lungs and if nicotine is passed through, it speeds up the fetal heart and interrupts the baby's respiratory movements. Smoking reduces the amount of oxygen available to the fetus, which could slow tissue growth. Mothers who smoke bear babies who weigh less than mothers who do not smoke. Smoking after the fourth month of pregnancy is a major cause of prematurity and the birth of underweight babies. Smoking can also increase the chances of bleeding during pregnancy, miscarriage, premature rupture of the membranes, hemorrhage before or early in labor, hemorrhage after delivery, congenital abnormality, stillbirth, and death of the baby in the

week following delivery. The more a woman smokes, the more likely these things are to happen. It would be very wise if the pregnant woman would stop smoking as soon as she found out she was pregnant.

Caffeine —How caffeine affects unborn children is still controversial. Caffeine is a stimulant which acts upon the nervous system. It effects adults depending on the dose and the tolerance the adult body has built up from the drug. Doctors suspect caffeine creates changes in the fetal heartbeat and other functions. Tests done with animals have indicated that caffeine can cause deformities in skeletal and bone development. Women who are pregnant are encouraged to limit the amount of caffeine.

Aspirin —Most of us forget that aspirin is a potent drug since it is so widely used and easy to obtain. If a pregnant woman has a headache she should try to get rid of it by resting instead of taking an aspirin. Studies with animals show aspirin may interfere with blood clotting in the fetus with potential for brain damage. Regular aspirin takers had an increased incidence of anemia, excessive bleeding before birth and after, longer pregnancies, and a higher frequency of complicated deliveries. Aspirin or drugs containing aspirin are best avoided in pregnancy, especially during the second half.

Barbiturates and Amphetamines —Other drugs that fall in this area are tranquilizers, sleeping pills, diet pills, stimulants, antihistamines, Valium and others. The baby is doped along with the mother if she takes these drugs. The baby may be addicted and have to go through withdrawal. These drugs can trigger miscarriage and premature births. With barbiturates, the baby may have tremors, restlessness, and irritability and amphetamines may cause birth defects. If these drugs need to be taken, it should only be with strict doctor’s supervision. A drug we do know to cause a very high frequency of birth defects is thalidomide. The drug was used as a tranquilizer. It caused deformities of the arms and legs in the children of virtually every mother who took the tranquilizer during her first trimester. Some of the children were also found to have defects of the heart, eyes, intestines, ears, and kidneys. Thalidomide is no longer prescribed.

Antibiotics —Antibiotics may be prescribed during pregnancy. Penicillin seems to be the safest to take if one has to be taken. Tetracycline should not be used during pregnancy. It has been found it can effect the growth of the baby’s bones during the time when it is taken. Also it may cause yellow mottling and staining of the baby’s first teeth. Streptomycin should not be taken since it can cause deafness in the baby.

There is a lot to be learned of the effects that drugs have on adults. And there are even less known facts on what the drugs can do to the unborn baby. But people seem to be taking more and more of drugs for one reason or another. For a pregnant woman it would probably be smart to eliminate them altogether for the health of both the fetus and the mother.

Marijuana —Many studies have been done on animals with marijuana, but studies are not the same as with humans. No solid evidence has been found to indicate that marijuana smoking may lead to birth defects. Some studies do indicate that THC (the active ingredient in marijuana) may have effects on the genes, and may interfere with the response to infection. We do know that THC can pass into the placenta and to the fetus from animal studies, And nursing mothers would almost certainly pass the THC in her milk. Experts advise pregnant women to avoid marijuana, because its dangers are still unknown.

Narcotics —A pregnant woman who is addicted to heroin will also have a fetus who will be addicted to the drug. At birth the fetus will go through painful withdrawal symptoms, just like an adult. If the baby is weak or premature the baby may die, since it is too weak to fight to live. If the mother uses narcotics, there is a higher chance of premature birth, breach birth, toxemia

(poisons in the bloodstream), premature separation of the placenta, and the chance of hepatitis from unclean needles which can infect the unborn baby.

Hallucinogens —LSD and other hallucinogens are powerful drugs and should not be taken. Some studies have shown that hallucinogenic drugs affect the central nervous system of the fetus. What worries doctors are the impurities in many hallucinogenic drugs which can pose unanswered questions. No definite answers can be given about the birth defects of the fetus as of now.

Infectious diseases can cause some serious birth defects or infections in the fetus and later on in the newborn. Prevention is the key to arresting these types of birth defects.

Rubella (German Measles) —Depending on when the pregnant woman has been in contact with the virus, many unnecessary things can happen to the fetus. The virus can cause deafness, heart defects, mental retardation, cataracts, glaucoma, damage to the central nervous system, stillbirth, and miscarriage. Other defects include growth failure, failure to thrive, and skin rashes. The sad part to this is that it all can be prevented by immunization. People have to remember rubella is not the same disease as regular measles and there is a need to be immunized against both diseases.

Venereal Diseases A venereal disease, or VD is a communicable disease that is spread by an infected person to another through sexual contact. Gonorrhea and syphilis are the two venereal diseases that are causing epidemics all over the United States. They are different diseases caused by different organisms. These diseases are spread directly by an infected person during sexual intercourse or direct bodily contact involving the sex organs. Because many victims do not know that they are infected, they spread the disease to others without knowing it.

Herpes simplex II is caused by a virus that is introduced into the body through sexual contact. Herpes infections may appear after treatment. The reappearance is not always caused by sexual contact. But remember, there is no cure for herpes simplex II.

Gonorrhea that has gone untreated can infect a baby during birth. The baby may contract a severe eye infection, that can cause blindness if it is not treated immediately with eye drops.

Syphilis can be passed during birth from active sores in the birth canal or from the mother’s bloodstream to the fetus after the fourteenth to eighteenth week of pregnancy. The baby can be born with congenital syphilis. The baby may seem fine at first, but heart defects, joint deformity, blindness, deafness, sores, and mental retardation may appear later on in life. Genital herpes can not be cured. A baby can become infected during birth if the disease is active, so caesarean

section is often used. A herpes infection of a newborn usually results in death or brain damage. Venereal diseases should be treated immediately, because the baby can also suffer when it is unnecessary.

Radiation —It is a good idea to avoid x-rays or radiation exposure during pregnancy. There is no safe threshold for radiation wherein there is no harm or damage. One of the critical times for exposure to x-rays or other radiation for the fetus is during the second month of pregnancy, often before a woman knows she is pregnant. Radiation in high doses can partially destroy the genetic material that acts as a blueprint for normal cell development Badly affected embryos are likely to be aborted spontaneously It has been known that exposure of the fetus to very high levels of x-rays can lead to serious abnormalities like small heads (microcephaly) with associated retardation, bone defects in the skull, spinal and eye defects, cleft palate, and severe limb deformities X-rays are associated with a higher than usual chance of developing diseases of the respiratory system, blood disorders and infectious illnesses in childhood. Studies made on the children of Japanese women who were pregnant in Hiroshima during the time of the atomic bomb explosions showed an increased rate of mental retardation and microcephaly. Some survivors of Hiroshima developed leukemia months or years later after being exposed to radiation.

When discussing radiation and x-rays, prevention of exposure of pregnant women is the key. Women should take certain precautions regarding x-rays: do not have discretional dental x-rays until after giving birth; check with the doctors to see if the x-rays are really necessary; always wear a lead shield apron before x-rays are taken; and make sure there aren't any dangers at work of radiation.

Although radiation is to be avoided in general, pregnant women should be reassured that careful use of medically indicated x-rays carry only a very small risk to the unborn baby and this can be accepted when it is important to investigate the mother's health needs.

In conclusion, the full range of substances to which the embryo and fetus may be vulnerable is not yet known. We have only touched the tip of the iceberg of what could happen; there is still much, much more to discover. It is wise to weigh the risks versus the benefits of taking any foreign substance during pregnancy, especially in the first eight weeks when the embryo is forming and the placenta is only starting to be active. We used to think the placenta acted as a barrier to all poisons in the mother's bloodstream, but we now know that this is not true.

Student Activities and Lesson Plans

#1 *Pretesting*

Give the following vocabulary words to the class. See what words they know and do not know. The words will be covered in the unit. Then after this unit is completed, re-test them to see which words they have come to know and understand.

1. birth defect
2. March of Dimes
3. fetus
4. genetics
5. zygote
6. embryo
7. environment
8. placenta
9. umbilical cord
10. prenatal diagnosis
11. amniocentesis
12. teratogen
13. stimulant
14. depressant

#2 *Thankful Activity*

Discuss with student certain birth defects and what these defects prevent children from doing, especially everyday activities that we take for granted. Then take 5-10 minutes for each of the following activities.

—Have students write their names, address and phone number without the use of their hands.
—communicate with classmates without talking
—Choose a student to move around the classroom with a blindfold on.
—Borrow a wheelchair from the nurse's office and have one student at a time move around the classroom, and ask if a student wanted to use the chair for the day.

Discussion after all the activities. Some questions that could be asked: How did they get their task done? What were they feeling? Did they need help from others to perform the task?

#3 *Awareness of Outside Factors*

A Have the students write down everything that is put into their bodies that would come under an external factor. This could be a day's assignment or could be a week's assignment. Discuss in class what people put into their bodies, most of the time without thought.
B Interview people in school about what they put into their bodies. Some questions that could be asked: How many smoke cigarettes? Do they have friends and/or family that do? How many smoke marijuana? How many drink alcohol? How many have had an x-ray or x-rays this past month, six months, or year? Have you taken a prescribed drug in the past month, six months, or year? What was the drug and for what problem. Discuss if these people were pregnant, what could they be doing to their unborn baby?

#4 What If . . .

This activity has a lot of thought and feelings involved with it. The teacher could make up cards with different birth defects on them. Then choose partners for the activity playing the role of a mother and a father. The people who are the parents of the defective baby then have to decide what will happen to the baby in the future and why? The subject of abortion may creep into the discussion.

 # 5 Reports

Someone could always do an extra credit report on any of the following subjects; victims of Hiroshima, rubella babies, Thalidomide babies, and many more.

Films for Loan

Contact March of Dimes Chapter in New Haven or March of Dimes Birth Defects Foundation

Public Health Education

1275 Mamoroneck Avenue

White Plains, N.Y. 10605

These films are all 16 mm, color and sound.

Alcohol: Crisis for the Unborn . 15:50 minutes. Dealing with the FAS, the film shows the tragic outcome of drinking alcohol during pregnancy.

Born Hooked . 13:30 minutes. Stresses the need for prenatal care of mothers addicted to heroin or methadone and deals with the impact of withdrawal on the unborn.

Little Marty . 5 minutes. Highlights in a day with Marty, age eight, born with no arms and a short leg. With artificial arms and a

built up shoe he is able to feed himself, paint, type, swim and play ball, revealing great determination and courage.

The Case Against Rubella . 8 Minutes. The effects of rubella on a baby whose mother contracts it during pregnancy and the development and successful use of a vaccine to prevent rubella are discussed and illustrated

Pamphlets

Alcohol and Your Unborn Baby. National Institute of Alcohol Abuse and Alcoholism Rockville, Maryland.: 1978.

Be Good to Your Baby; Before It Is Born. March of Dimes Defects foundation. White Plains, N.Y.: 1980

Birth Defects, Tragedy and Hope. March of Dimes Birth Defects Foundation. White Plains, N.Y.: 1977.

Drugs, Alcohol, Tobacco Abuse During Pregnancy. March of Dimes Birth Defects Foundation. White Plains, N.Y.: 1979.

Pregnant? Before you Drink, Think . . . March of Dimes Birth Defects Foundation. White Plains, N.Y.: 1980

Preventing Birth Defects Caused by Rubella. March of Dimes Birth Defects Foundation. White Plains, N.Y.: 1979.

Radiation and Birth Defects: Science News Information File. March of Dimes Birth Defects Foundation. White Plains, N.Y. 1979.

Venereal Disease Hurts You and the Unborn. March of Dimes Defects Foundation. White Plains, N.Y.: 1979.

Student and Teacher Bibliography

Annis, Linda, *The Child Before Birth* , New York: Cornell University Press, 1978. Concise and general introduction to the many factors influencing the unborn child during the nine months from conception to birth.

Apgar, Virginia and Beck, Joan, *Is My Baby All Right? A Guide to Birth Defects* , New York: Simon and Schuster, 1972. A guide to genetic defects caused from genetic diseases or environmental factors.

Begley, Sharon, “What Can Go Wrong?”, *Newsweek,* January 11, 1982,;. 42. A short article on some birth defects from environmental factors.

Edelson, Edward, “Can Drinking, Smoking and Pills Harm Your Unborn Baby? An Update On The Risks”, *Glamour* , October, 1981, pp. 176182 This article is a summary of what is known and what isn’t known on the environmental causes of birth defects.

Kitzinger, Sheila. *The Complete Book of Pregnancy and Childbirth* , New York: Alfred A. Knopf, 1980. An especially helpful book if pregnant or if not, a modern and up to date guide of pregnancy from conception up to two years old. Covers areas such as nutrition, exercise, drugs and other environmental elements.

Lifton, Betty Jean *Return to Hiroshima* , New York: Atheneum., 1970 Interviews with victims from the atomic bomb.

Milunsky, Aubrey *Know Your Genes* , Boston: Houghton Mifflin Company: 1977 Everything you need to know about genes, including heredity, genetic disorders.

Nilsson, Lennart *A Child is Born* , New York: Delacorte Press., 1976. Astonishing photographs of human reproduction from conception to birth. Excellent book to have.