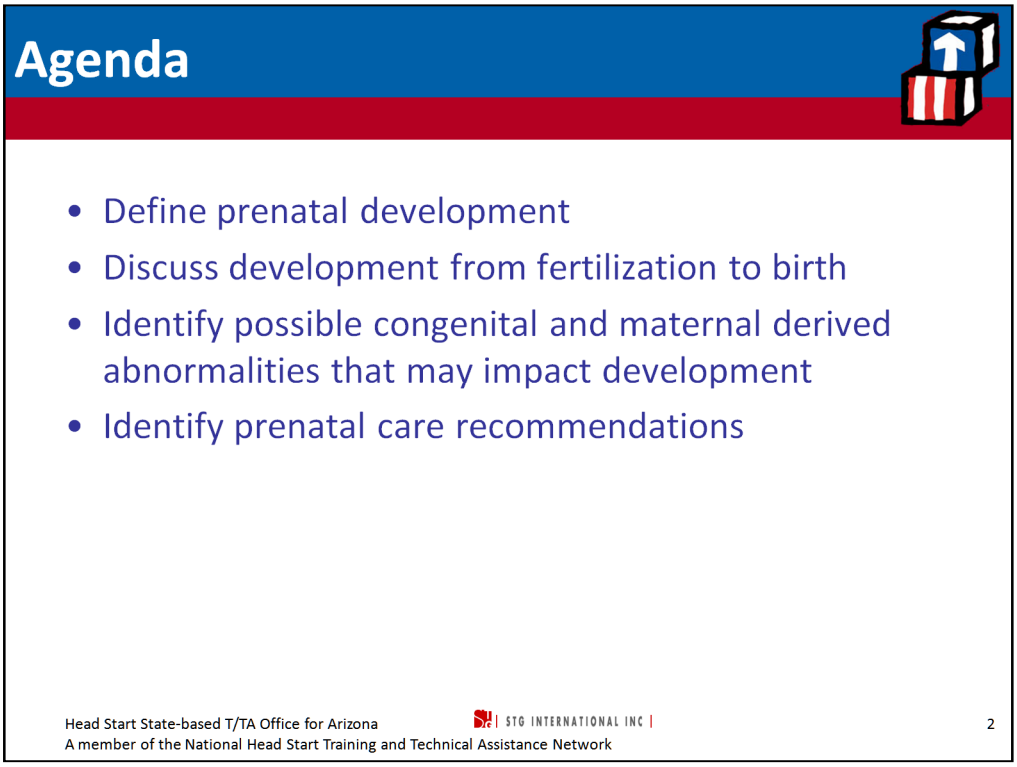
Welcome to the Arizona Head Start Training and Technical Assistance Office 2010 Summer Webinar Series. Please remember to mute your phone (*6) in order to assure the clarity of the audio portion of the program. For those who attend today's webinar, a certificate of attendance will be emailed within 48 hours. For those who are viewing this webinar as a group, the email address signed on will be the recipient of the certificate and will be that person's responsibility for forwarding the certificate to other attendees, This webinar today is on Prenatal Development, the first of a nine part Infant Toddler Webinar Series.

Slide #1: By definition, prenatal development is the process in which an embryo or fetus develops during pregnancy, from fertilization until birth. A healthy pregnancy has a direct influence on the health and development of a newborn child. Programs such as Early Head Start (EHS) strive to have the greatest impact on participating children by offering supportive services as early in life as possible. The prenatal period of growth and development has a lasting im-pact on the child's potential for healthy growth and development after birth. In order to support pregnant families, providers need to have a fundamental understanding of prenatal development.



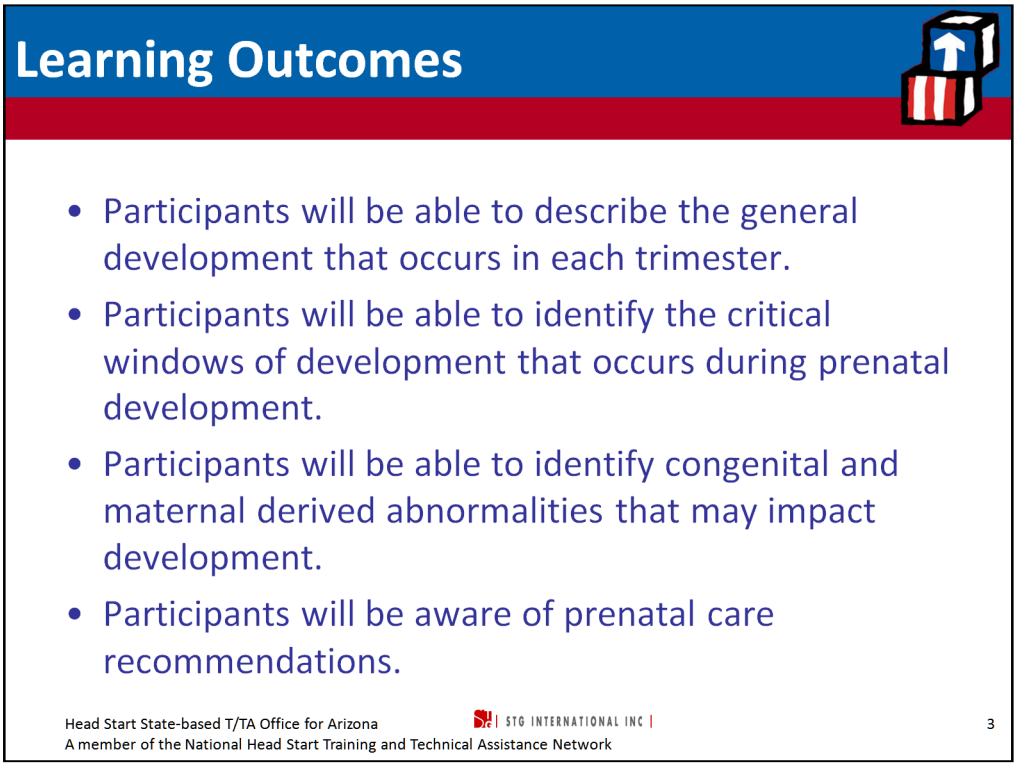
Slide #2: During today's webinar, Prenatal Development, we will:

Define prenatal development

Discuss development from fertilization to birth

Identify possible congenital and maternal derived abnormalities that may impact development

And identify prenatal care recommendations



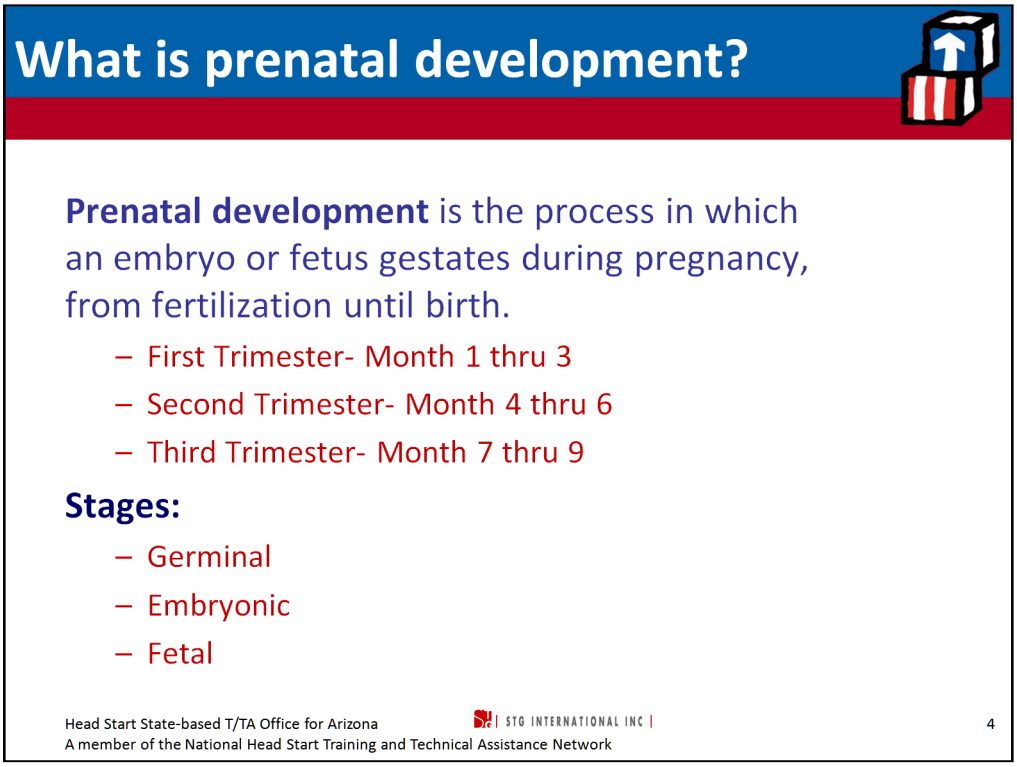
Slide #3: Information presented today should lead to the following outcomes:

Participants will be able to describe the general development that occurs in each trimester.

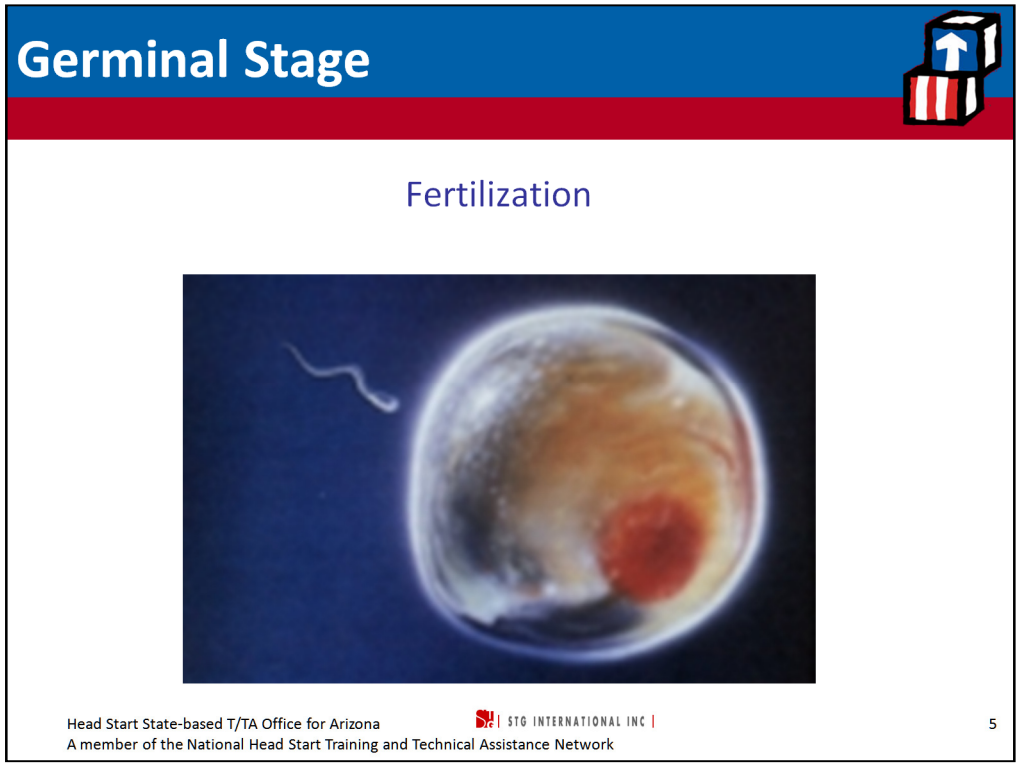
Participants will be able to identify the critical windows of development that occurs during prenatal development.

Participants will be able to identify congenital and maternal derived abnormalities that may impact development.

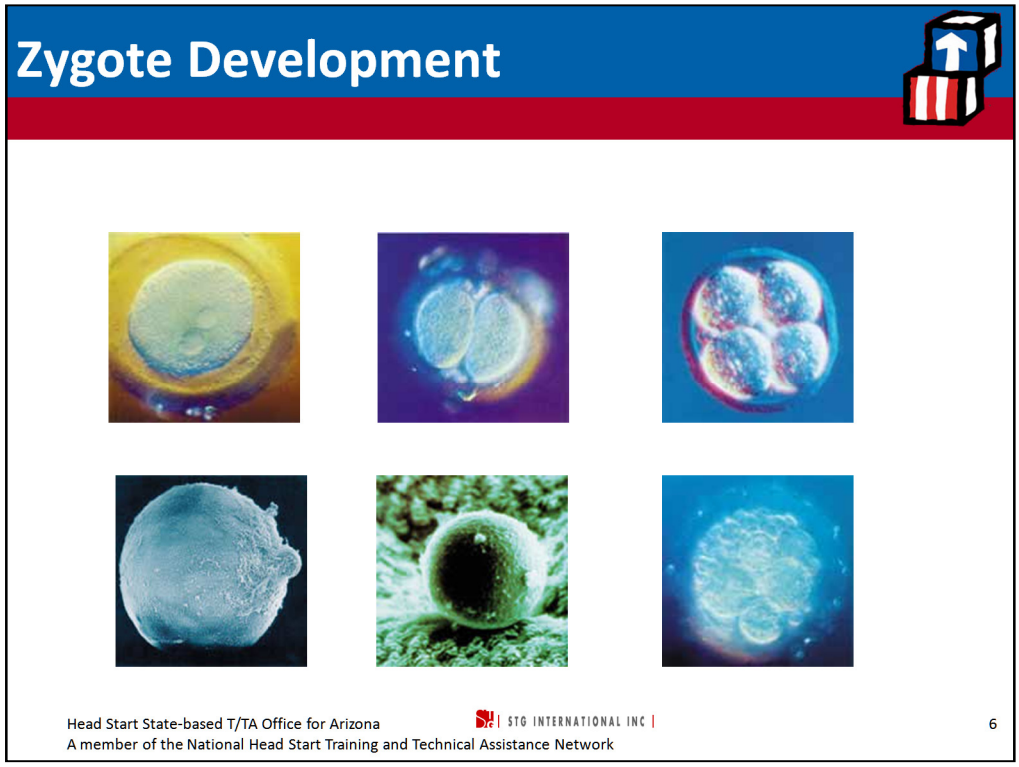
Participants will be aware of prenatal care recommendations.



Slide #4: Prenatal development refers to the process in which a baby develops from a single cell after conception into an embryo and later a fetus. The average length of time for prenatal development to complete is 38 weeks from the date of conception. The length of gestation is often broken down into trimesters, referred to as first, second, and third trimesters or three three-month periods of time. During this time, a single-celled zygote develops in a series of stages into a full-term baby. The three primary stages of prenatal development are the germinal stage, the embryonic stage, and the fetal stage.



Slide #5: The germinal stage is the first stage of gestation and begins with conception. Conception occurs when the female egg or ovum is fertilized by the male sperm. Under normal circumstances, one egg is released approximately once a month from a woman's ovary during a process called ovulation. The egg makes its way into a fallopian tube, a structure that guides the egg away from the ovary toward the uterus. For fertilization to occur, a sperm must penetrate the tough outer membrane of the egg. The genetic material of the sperm and egg then combine to form a single cell called a zygote and the germinal stage of prenatal development commences.



Slide #6 The zygote soon begins to divide rapidly in a process called cleavage, first into two identical cells, which further divide to four cells, then into eight, and so on. The group of dividing cells begins to move along the fallopian tube toward the uterus. About sixty hours after fertilization, approximately sixteen cells have formed. This group of cells is now referred to as a blastocyst. The outer layer of the blastocyst gives rise to the placenta and other supporting tissues needed for fetal development within the uterus. The inner cell mass cells give rise to the tissues of the body. When the blastocyst consists of 200 to 300 cells, it is ready for implantation in the uterine wall.

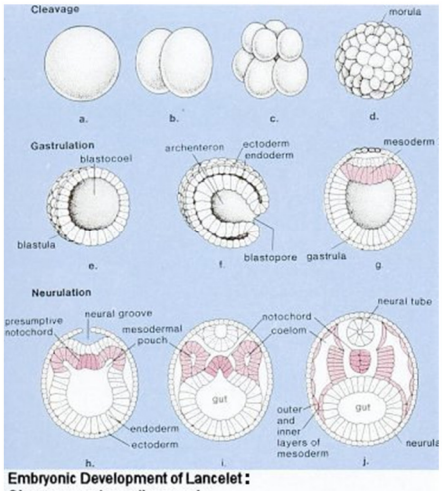
Implantation, the process in which the blastocyst implants into the uterine wall, occurs approximately six days after conception. Hormones secreted from the mother's ovaries and a chemical secreted by the outer layer of the blastocyst begin to prepare the uterine wall. The blastocyst first adheres to the wall then moves into the uterine tissue. Implantation marks the end of the germinal stage and the beginning of the embryonic stage.

Embryonic Stage

Differentiation: clusters of cells begin to take on different functions. This is called.

Gastulation:

- ectoderm (outer layer)
- mesoderm (middle layer)
- endoderm (inner layer)



Embryonic Development of Lancelet:
Cleavage produces the morula
Gastrulation by invagination produces the three germ layers
Neurulation produces the neural tube called the neurula

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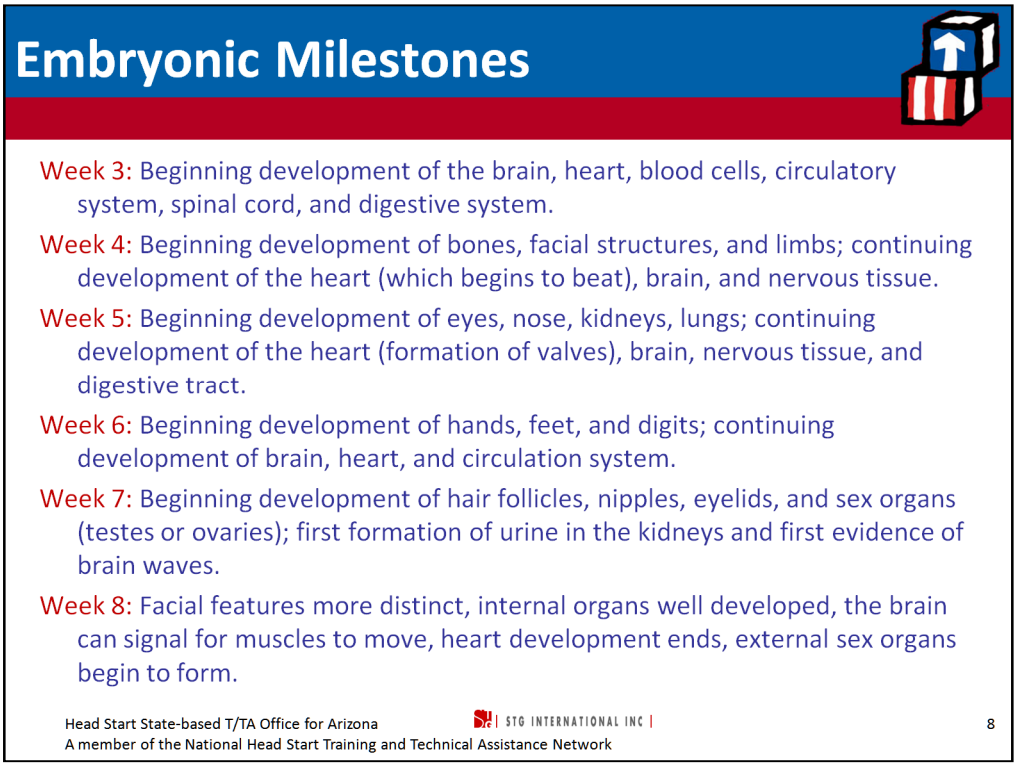
Slide #7: The embryonic stage begins after implantation and lasts until eight weeks after conception. Soon after implantation, the cells continue to rapidly divide and clusters of cells begin to take on different functions called differentiation. A process called gastrulation leads to the formation of three distinct layers called germ layers: the ectoderm (outer layer), the mesoderm (middle layer), and the endoderm (inner layer). As the embryo develops, each germ layer differentiates into different tissues and structures. For example, the ectoderm eventually forms skin, nails, hair, brain, nervous tissue and cells, nose, sinuses, mouth, anus, tooth enamel. The mesoderm develops into muscles, bones, heart tissue, lungs, reproductive organs, lymphatic tissue. The endoderm forms the lining of lungs, bladder, digestive tract, tongue, tonsils, and other organs.



Slide # 8: The process of differentiation takes place over a period of weeks with different structures forming simultaneously. Some of the major events that occur during the embryonic stage are as follows:

During week three, it is the beginning development of major systems. The beginning development of the brain, heart, blood cells, circulatory system, spinal cord, and digestive system occurs.

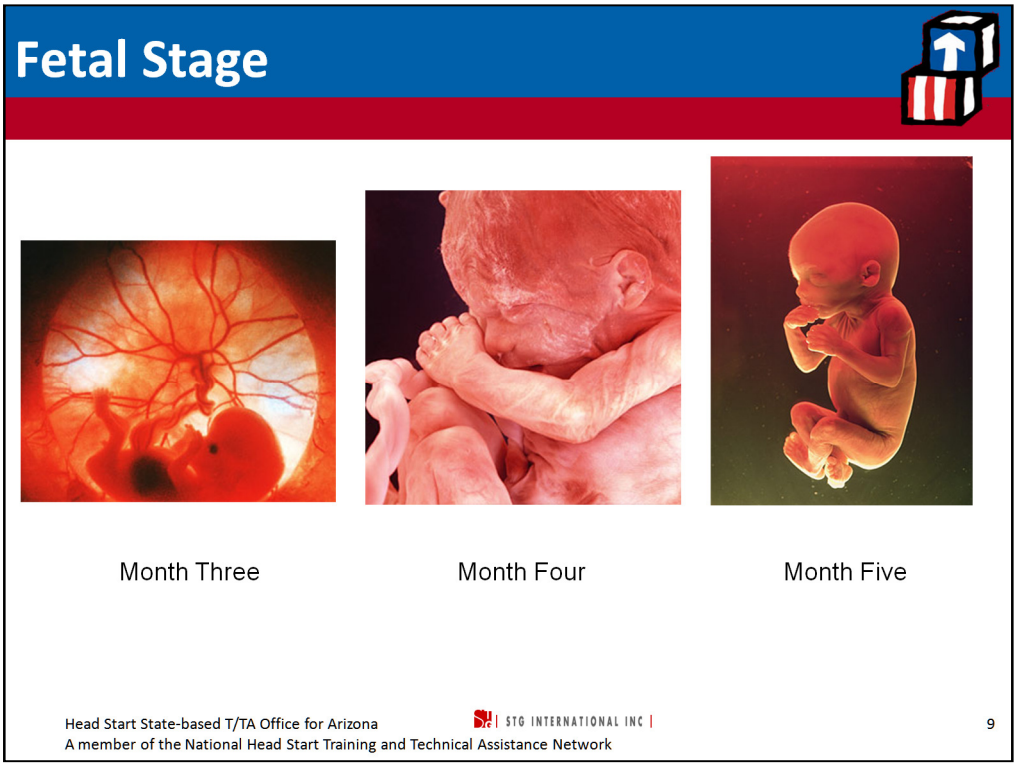
In week four, the beginning development of bones, facial structures, and limbs or at least the presence of arm and leg buds, is evident. There is continuing development of the heart which begins to beat at this time, as well as continuing development of the brain and nervous tissue.

Week 5 marks the beginning development of eyes, nose, kidneys, lungs, continuing development of the heart at which point the formation of valves occurs, emergence of the digestive tract, and continued development of the brain and nervous tissue.

During week six, the presence of arm and leg buds is now beginning to develop into hands, feet, and digits while at the same time, the brain, heart, and circulatory system continue to develop.

In week seven evidence of the hair follicles, nipples, eyelids, and sex organs, either testes in males or ovaries in females, begin to show. The first formation of urine in the kidneys and first evidence of brain waves occurs during this period as well.

And, in week 8, facial features become more distinct and internal organs are well developed. The brain can signal for muscles to move, heart development ends, and external sex organs begin to form. By the end of the embryonic stage, all essential external and internal structures have been formed. The embryo is now referred to as a fetus.

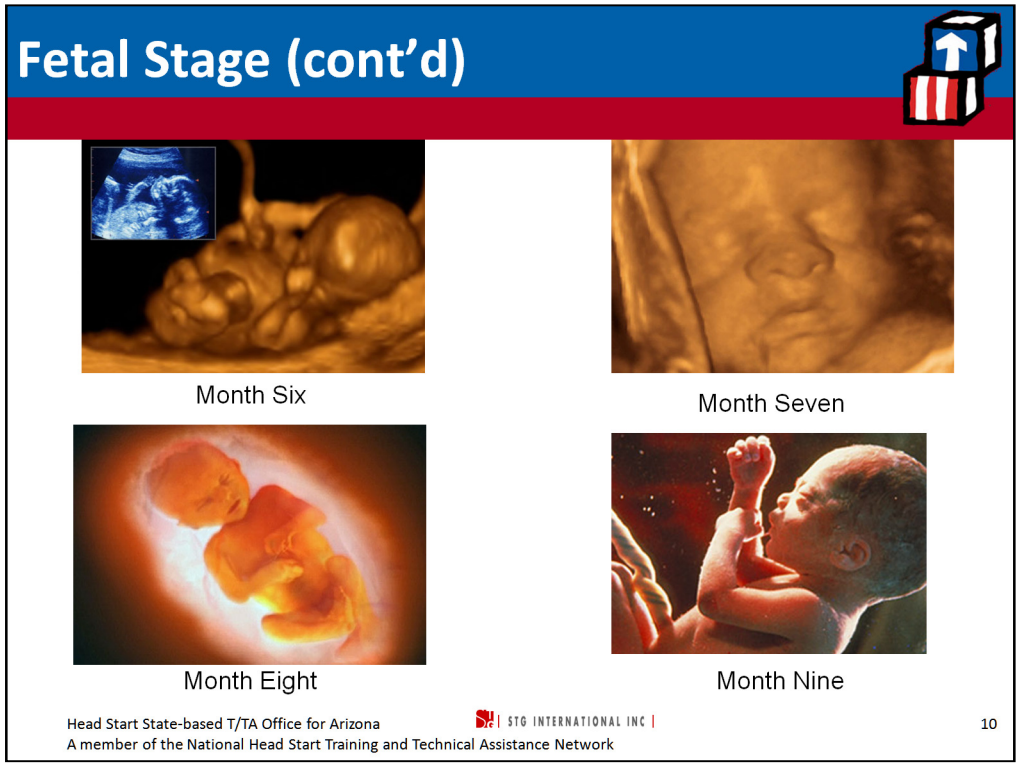


Slide #9: Prenatal development is most dramatic during the fetal stage. When an embryo becomes a fetus at eight weeks, it is approximately 1.2 inches in length from crown to rump and weighs about one tenth of an ounce. By the time the fetus is considered full-term at 38 weeks gestation, he or she averages 20 inches and 7 ½ pounds. Although all of the organ systems were formed during embryonic development, they continue to develop and grow during the fetal stage. Examples of some of the major features of fetal development by month are as follows:

Month 3 is the month of the heartbeat. Using a special tool called a Doppler monitor, doctors can detect the tiny thump-thumps of a 10-week-old fetus. This is also a time of rapid growth inside the womb. By month's end, the fetus will weight roughly 1 ounce, and it will double in length, uncurling from a tight C-position until it's about 3 inches long. The tail will disappear and its eyelids, earlobes, limbs and digits will continue to form. Other developmental milestones for this period include thumb-sucking, head-nodding and balling tiny fingers into fists. And though the fetus's reproductive organs now are under construction, it's still a bit early for the doctor's gender declaration.

In month 4 the fetus can hear its mother's heartbeat, her voice and other outside noises. The fetus is also developing quite quickly by now, all the major organs are complete. In addition, its bones are growing stronger and its muscles longer. Its reflexes also are sharpening up—it can now swallow, kick and execute an occasional somersault with relative ease. And by month's end, the fetus will weigh around 6 ounces and stretch some 7 inches long. Sweat glands will dot its palms and soles, and its wrinkly skin will shine transparent pink. At this stage, it may look like a complete package, but it still has a few more months of growing to do. By the end of month four, most doctors can perform an ultrasound test and identify the baby's gender.

By Month 5 the fetus really starts kicking! "Quickening" is when a mother senses the fetus's movement for the first time, and this milestone moment usually happens during pregnancy's fifth month. Also new in this month: hair. The fetus now has tiny white eyelashes and two arching eyebrows. Fine woolly hairs, called lanugo, blanket its body and its bare head also sports a few sprouts. In addition to lanugo, a white, waxy substance called vernix caseosa covers and protects the fetus's body. And by month's end, the fetus measures 8 to 10 inches long and tips the scales at 1 pound.



Slide #10: Month 6 marks the end of the second trimester. At this point, the fetus's essential organs—its kidneys, heart and lungs—are fully formed. The facial features are becoming more recognizable. It also can hiccup and react to loud "outside" noises by blinking, shifting or kicking. By month's end, the fetus will measure about 12 or 13 inches long and weigh roughly 2 pounds.

The 7-month-old fetus can blink, and its eyes may even remain open for short period of time. Hands and feet are becoming even more active. Also in this phase: Taste buds form and protective fat tissue makes its debut. The fetus's hearing is fully developed and, in boys, its testicles have moved to the groin. By month's end, the baby-to-be will measure 14 to 16 inches long and weigh anywhere from 2 ½ to 3 ½ pounds.

In the **eight month**, the fetus's brain develops rapidly, and all of its organs except the lungs are mature. An 8-month-old fetus stretches 16 to 18 inches long and weighs between 4 and 6 pounds. And as the baby-to-be grows larger, space in the womb becomes scarce. Expectant mothers should still count on catching a few elbows every day, but the elaborate somersault sequences should stop until delivery day. The fetus's fingernails now reach beyond its fingertips and its skin is starting to smooth.

In Month 9, the final month of development, the fetus's fat layers thicken to help keep it warm outside the womb, and the protective layers of vernix caseosa and lanugo largely disappear. By now, the fetus's lungs are mature, its skin pink and smooth, and its toenails fully grown. The baby-to-be can also execute an array of reflexes, such as head turning, blinking and grasping. At this late stage, it stretches between 20 to 22 inches long, and weighs about 7½ pounds. To prepare itself for delivery, the fetus changes position and drops down in its mother's pelvis, usually with its head pointed toward her birth canal.

Critical Periods of Development

Body System	*Especially Sensitive*	*Development up to ...*
CNS/Brain	4th to 8th weeks	Postnatal, through to adulthood
Heart	5th to 9th weeks	12th week
Upper limbs	6th to 10th weeks	12th week
Eyes	6th to 10 weeks	Term
Lower limbs	6th to 10th weeks	12th week
Teeth	9th to 11th weeks	Term
Palate	9th to 11th weeks	16th week
External Genitalia	9th to 11th weeks	Term
Ears	6th to 11th weeks	13th week

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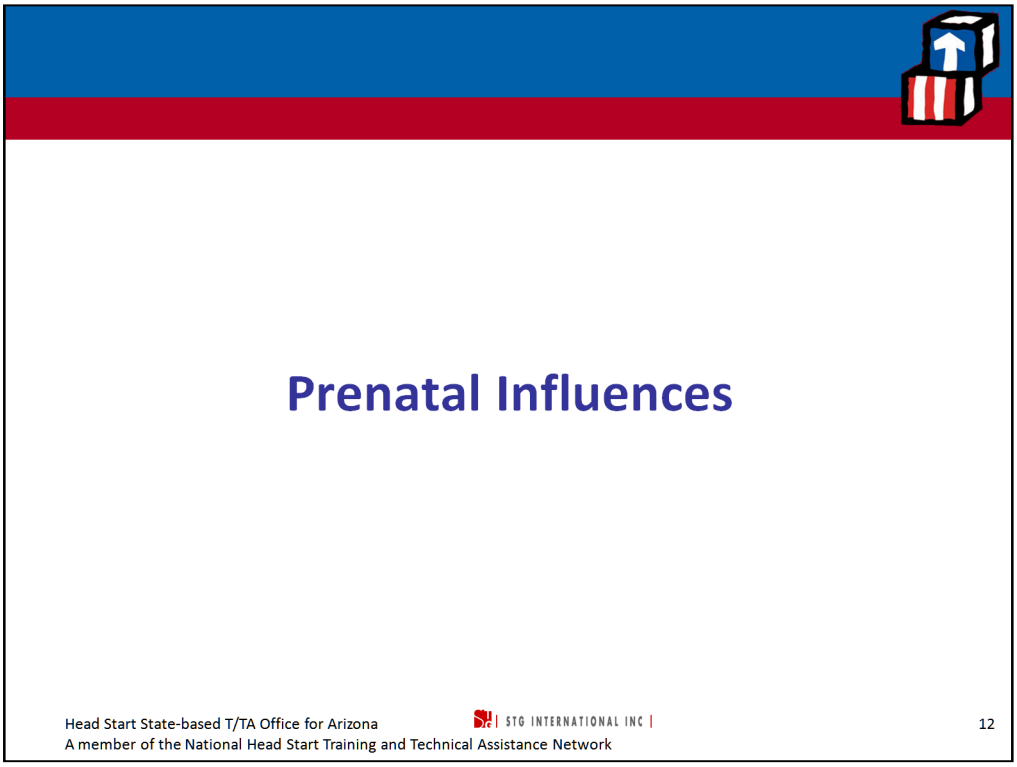
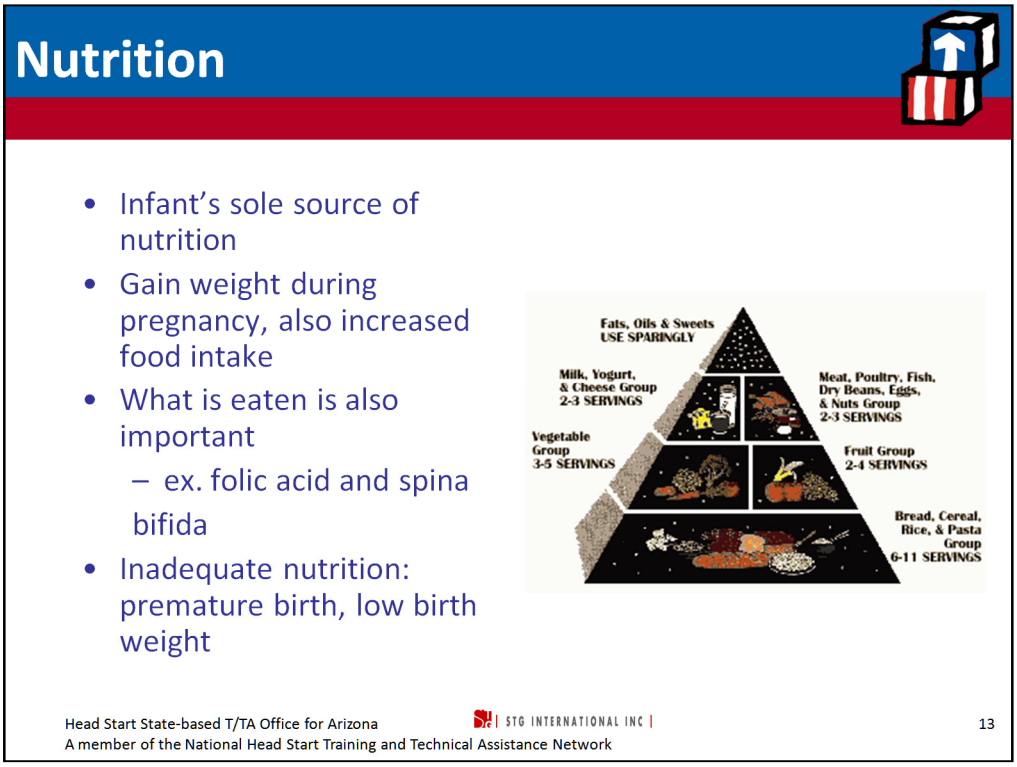
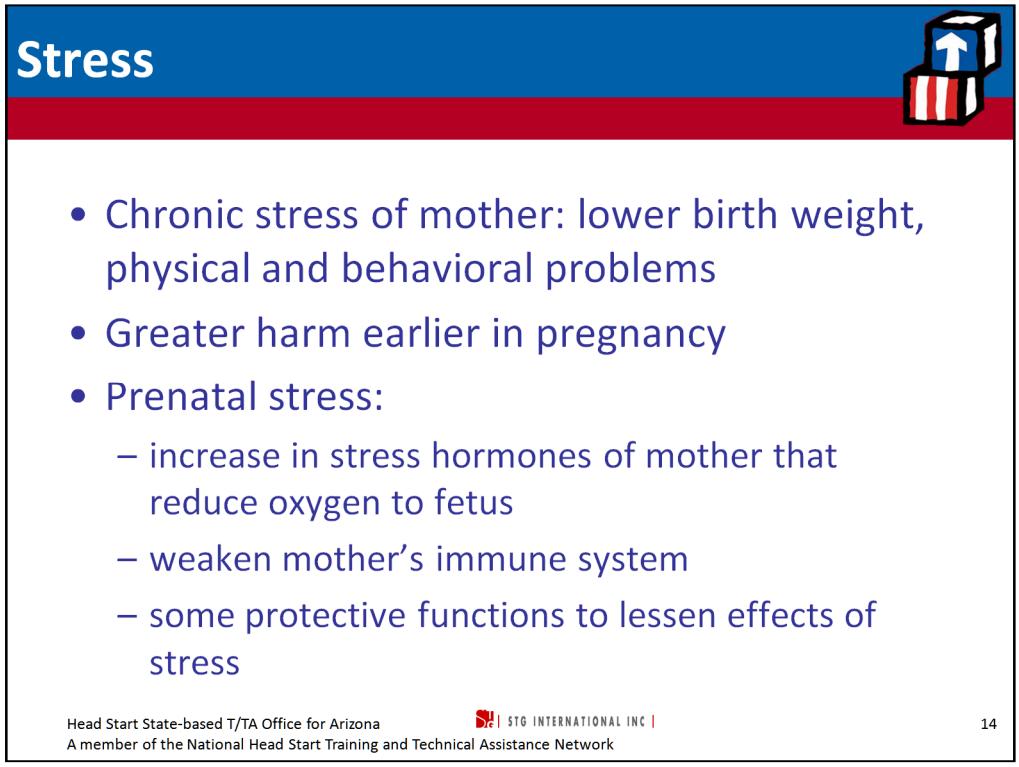
Slide #11: By looking at this chart we can see there are Critical Periods of Development.



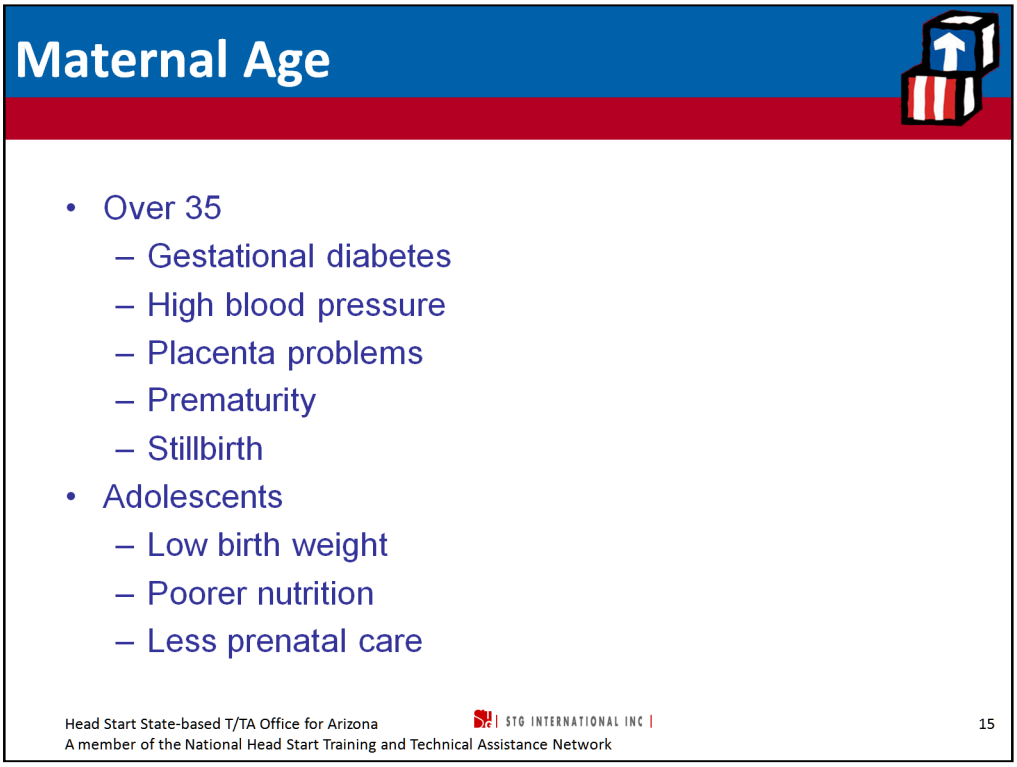
Slide #12: Next we will take a look at Prenatal Influences that can impact healthy development.



Slide #13: Nutrition is a very important factor in healthy prenatal development. A developing fetus depends completely on its mother for nutrition, which comes from the mother's blood. Among the important factors are the total number of calories and the appropriate levels of protein, vitamins and minerals. During pregnancy, a woman should expect to gain between 25 to 35 lbs. If a woman is underweight before pregnancy she should gain more weight and if overweight, should gain less. Women who begin pregnancy underweight, eat poorly during pregnancy, and consequently do not gain at least 1.5 kilograms per month in the second and third trimesters run a much higher risk than others of having a low-birthweight infant. Mothers are recommended to eat approximately 300 additional calories a day (above and beyond a normal non-pregnancy diet) to support the fetus's growth and development. A well-balanced diet rich in nutrients such as **folic acid** , calcium, iron, zinc, vitamin D, and the B **vitamins** is recommended for pregnant women. Certain vitamin and mineral deficiencies can interfere with normal prenatal development. For example, a deficiency in folic acid during the early stages of pregnancy may lead to neural tube defects such as **spina bifida** .



Slide #14: Maternal stress can impact a child's development. A fetus is somewhat protected by mother's stress as some stress hormones are not allowed to pass through placenta. The mother's stress, however, can be transmitted to the fetus. When a pregnant woman experiences intense fears, anxieties and other emotions, physiological changes occur in the fetus. These include changes in respiration and glandular secretions. For example, producing adrenaline in response to fear restricts blood flow to the uterine area and may deprive the fetus of adequate oxygen. On the other hand, providing support to a pregnant women, such as reassuring the mother of fetal well-being, has positive outcomes for the infants in the study.



Slide #15: Maternal age can indicate certain pregnancy risks as well. In terms of the **mother's age**, two time periods are of special interest: adolescence and the thirties and beyond.

Some complications that are more common in women over 35 include:

Gestational diabetes: This form of diabetes develops for the first time during pregnancy. Studies suggest that women over age 35 are about twice as likely as younger women to develop gestational diabetes. Women with gestational diabetes are more likely to have a very large baby who is at risk of injuries during delivery and of newborn health problems (such as breathing problems).

High blood pressure: As with diabetes, high blood pressure can develop for the first time during pregnancy. This is called pregnancy-induced high blood pressure or pregnancy-induced hypertension. In its more severe form, it is called preeclampsia. Some studies have found that pregnancy-induced high blood pressure is more common in women over age 35.

Placental problems: The most common placental problem is placenta previa, in which the placenta covers part or all of the uterine opening (cervix). One study found that women in their late 30s were almost twice as likely, and women in their 40s nearly three times as likely, as younger women to have this complication. Placenta previa can cause severe bleeding during delivery, which can endanger mother and baby. A cesarean birth or c-section often can prevent serious complications.

Premature birth: Women ages 40 and older are more likely than women in their 20s and 30s to deliver prematurely (before 37 completed weeks of pregnancy). From 2003 to 2005, 16.6 percent of women ages 40 and older delivered prematurely, compared to 12.5 percent of women ages 30 to 39, and 11.9 percent of women ages 20 to 29. Premature babies are at increased risk of health problems in the newborn period and of lasting disabilities. Some studies also suggest that women in their 40s may be at increased risk of having a low-birthweight baby (less than 5½ pounds). Low birthweight can result from premature birth, poor growth before birth or both.

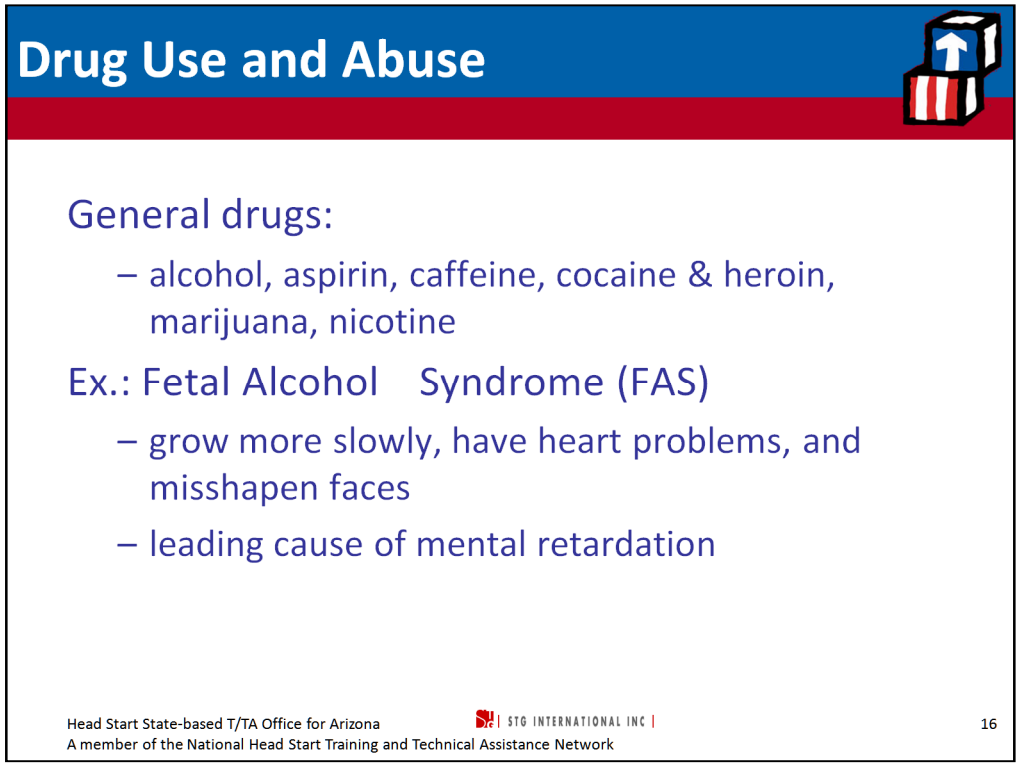
Stillbirth: Stillbirth is the death of the fetus after 20 weeks of pregnancy. A number of studies have found that women over age 40 are about two to three times as likely as women in their 20s to have a stillborn baby. The causes of stillbirth in the over-40 age group are not known.

There are also complications that are more likely to occur in adolescents who are pregnant.

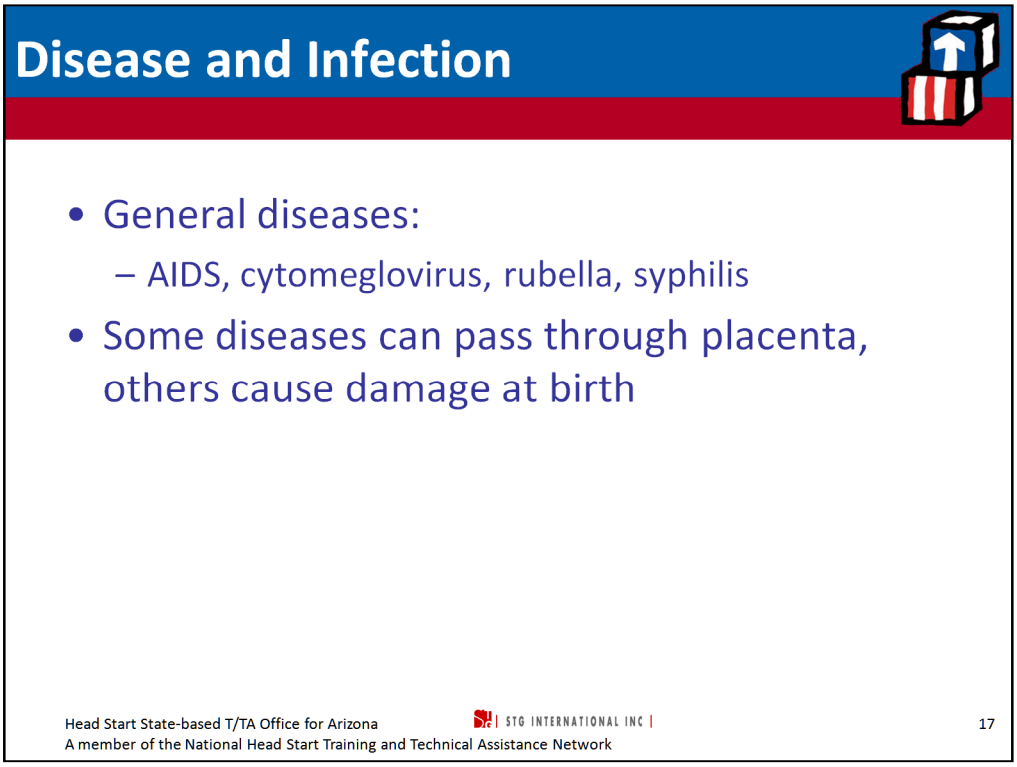
Teenage mothers are less likely to gain adequate weight during their pregnancy, leading to low birthweight. Low birthweight is associated with several infant and childhood disorders and a higher rate of infant mortality. Low-birthweight babies are more likely to have organs that are not fully developed, which can result in complications, such as bleeding in the brain, respiratory distress syndrome, and intestinal problems.

Teenage mothers have a higher rate of poor eating habits than older women and are less likely to take recommended daily prenatal multivitamins to maintain adequate nutrition during pregnancy. Teens also are more likely to smoke cigarettes, drink alcohol, or take drugs during pregnancy, which can cause health problems for the baby.

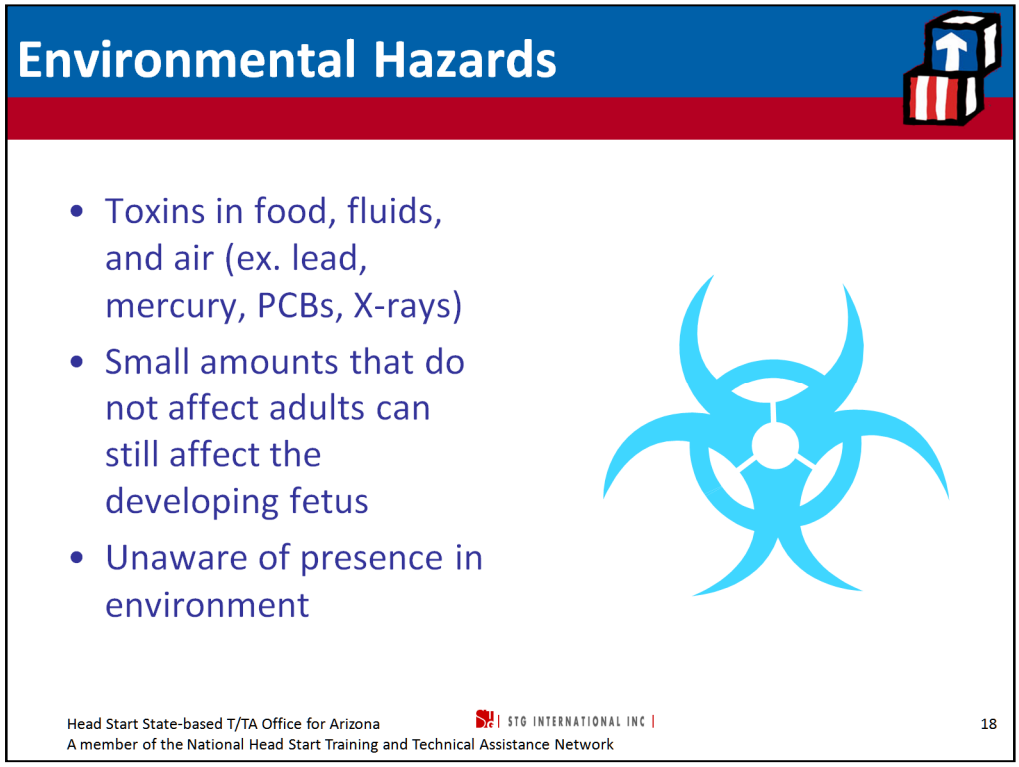
Teenage mothers receive regular prenatal care less often than older women. Prenatal care is essential for monitoring the growth of the fetus and the health of the mother. During prenatal care, medical professionals provide important information about good nutrition and about other ways to ensure a healthy pregnancy. According to the American Medical Association (AMA), babies born to women who do not have regular prenatal care are 4 times more likely to die before the age of 1 year.



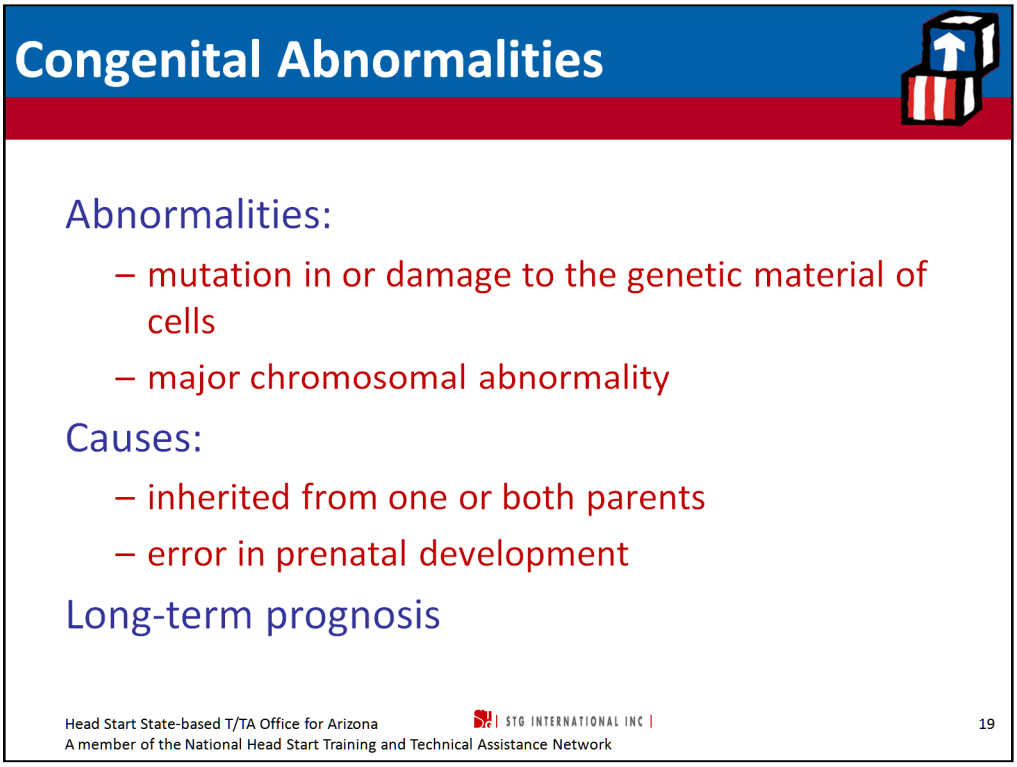
Slide #16: Drugs includes the use of tobacco, alcohol, prescription or illegal drugs. Heavy drinking by an expectant mother can also be devastating. Fetal alcohol syndrome is a cluster of abnormalities that appear in the offspring of mothers who drink alcohol heavily during pregnancy. The abnormalities include facial deformities and defective limbs, face and heart. Most of these children are below average in intelligence. In one study, however, even mothers who drank moderately during pregnancy had babies who were less attentive and alert, with the effects still present at 4 years of age. Cigarette smoking by pregnant women can also adversely influence pre-natal development, birth and postnatal development. Fetal and neonatal deaths are higher among smoking mothers. Also prevalent are a higher incidence of preterm births and lower birth weights. Respiratory problems and sudden infant death syndrome are also more common among the offspring of mothers who smoked during pregnancy. Tranquilizers taken during the first three months may cause cleft palate or other congenital malformations. Mothers who take large amounts of barbituates may have babies who are addicted or may exhibit tremors, restlessness and irritability



Slide #17: Maternal diseases and infections can produce defects by crossing the placental barrier. For example, the greatest damage to the fetus from the mother contracting German measles occurs during the 3rd and 4th weeks of pregnancy. Syphilis is more damaging later in pre-natal development - 4 months or more after conception. Rather than affecting organ development as Rubella does, syphilis damages organs after they have formed. The importance of the mother's health to the health of their offspring is nowhere better exemplified than when the mother is infected with HIV.



Slide #18: Exposure to certain substances called teratogens may interfere with prenatal development during pregnancy and may cause embryonic or fetal malformations. Examples of teratogens include alcohol, thalidomide, cocaine, certain seizure medications, and the anti-acne drug Accutane. Radiation, chemicals and other hazards in the **environment** can endanger the fetus. Chromosomal abnormalities are higher among the offspring of fathers exposed to high levels of radiation in their occupations. Environmental pollutants and toxic wastes are also sources of danger to unborn children. Among the dangerous pollutants and wastes are carbon monoxide, mercury and lead. Another environmental concern is toxoplasmosis, a mild infection that causes cold-like symptoms or no apparent illness in adults, but can cause eye defects, brain defects and premature birth. Cats are common carriers of toxoplasmosis, especially outdoor cats that eat raw meat. The expectant mother may pick up the virus through the cat litter box.



Slide #19: During prenatal development, some cases **of** abnormalities may arise that cause physical malformations or developmental delays or affect various parts of the body after the child is born. The cause may be a small mutation in or damage to the genetic material of cells, or a major chromosomal abnormality**.** Genetic problems can result from the failure of one or more genes to work properly or problems with the number or structure of chromosomes, such as extra or missing groups of genes. Sometimes the abnormality is inherited from one or both parents. In other cases, the defect occurs because of an error in prenatal development.

Some abnormalities are minor and do not affect the long-term prognosis once the child is born. At the other end of the spectrum, abnormalities may be so severe that fetal demise is inevitable. Approximately 10 to 15 percent of pregnancies end before the twentieth week, a process called miscarriage or spontaneous abortion. Congenital abnormalities account for a significant proportion of miscarriages. Genetic abnormalities account for approximately 5 percent of miscarriages.

Prenatal Care

- Folic Acid and Prenatal/Preconception Vitamins
- Proper Immunizations for the Mother
- Healthy Behaviors

Slide #20: Getting early and regular prenatal care is one of the best ways to promote a healthy pregnancy. Prenatal care is more than just health care; it often includes education and counseling about how to handle different aspects of pregnancy, such as nutrition and physical activity, what to expect from the birth itself, and basic skills for caring for your infant. Many parents have questions or concerns about the prenatal development of an existing or anticipated child and what steps they should take to ensure their child's health. During prenatal visits to an obstetrician, a pregnant mother should be educated in proper nutrition and prenatal care; often, prenatal vitamins are prescribed to avoid nutritional deficiencies. Prenatal testing is often recommended to parents-to-be as a means of assessing the fetus's health and the risk of developing certain conditions.

Folic Acid and Prenatal/Preconception Vitamins The U.S. Public Health Service recommends that women of childbearing age get at least 400 micrograms of **folic acid** each day, through food sources and/or supplements. For women who are thinking about getting pregnant, health care providers recommend supplementing the diet with folic acid for three months before pregnancy, and then for at least the first three months of pregnancy. Prenatal vitamins are a good way to get extra folic acid into the diet. Prenatal supplements often contain high amounts of folic acid and other compounds, such as **iron** and **vitamin A**. Findings from research supported by the National Institute of Child and Human Development (NICHD) and other agencies indicate that the right amount of folic acid can help prevent certain types of birth defects and other problems during pregnancy.Even though many foods available in the United States are fortified with folic acid, women who are thinking about pregnancy benefit from an extra boost of this important compound. It can be hard to get the full amount of folic acid from food sources alone, so preconception supplements are important.

Proper Immunizations for the Mother: Women who are thinking about getting pregnant should make sure that they have been properly vaccinated and are immune to certain diseases, such as **rubella** (also called German measles). If a woman gets rubella while she is pregnant, the fetus is at increased risk for a variety of problems, including deafness, heart problems, cataracts of the eyes, and intellectual and developmental disabilities, just to name a few. These problems, which together are called congenital rubella, are much more severe than the effects of getting rubella as a child. Health care providers often test a woman's blood for immunity to this infection, or they try to find proof of childhood immunizations from a woman's health history. In addition, if a woman gets **chickenpox** while she is pregnant, the fetus is at increased risk for a number of problems, which together are called congenital varicella. The name varicella comes from the name of the virus that causes chickenpox, called varicella zoster virus. Congenital varicella is much more serious than the effects of getting chickenpox as a child. It can result in scarring of the skin, weakening or withering of the arms and legs, called atrophy and eye abnormalities.

Healthy Behaviors

Vitamins and immunizations aren't the only things that can help promote a healthy pregnancy. Things like diet, physical activity, medications, smoking, alcohol or drug use, and environmental factors can all affect pregnancy.

A healthy diet, weight level, and regular physical activity level can help to reduce problems for both mother and fetus during pregnancy. For this reason, many health care providers suggest that women who are thinking about getting pregnant take steps to improve or maintain their own level of health before they get pregnant. A healthy diet helps to ensure that the fetus has all the nutrients it needs to grow and develop normally. Being active before and during pregnancy, if approved by a health care provider, can help women maintain their healthy weight and can improve the function of the circulatory, cardiovascular, and skeletal systems. Maintaining a healthy weight, both before and during pregnancy, can help to reduce stress on the mother's body and lower the risk of certain disorders of pregnancy.

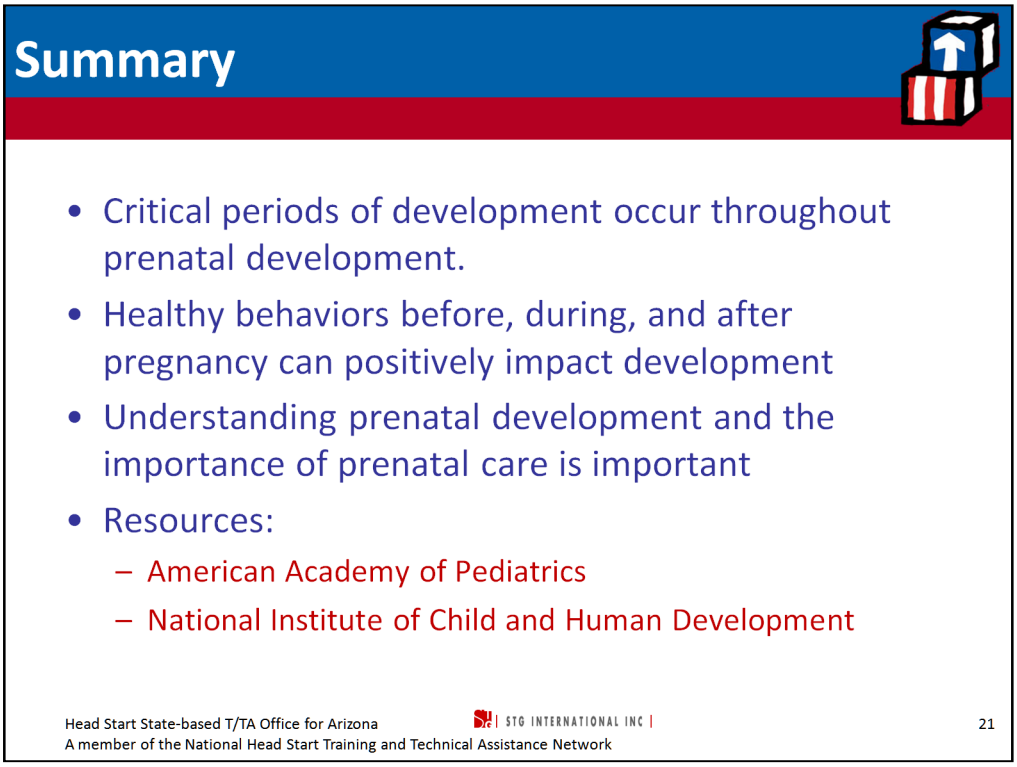
Gestational Diabetes Mellitus is a specific type of diabetes that only pregnant women get. To support the fetus as it grows, the mother's body makes hormones. In some women, these hormones work against their bodies, making them less able to make the insulin needed to get energy from body cells. Without this insulin, the level of sugar in the mother's blood starts to build up, which, if left untreated, can cause health problems for both mother and fetus.

Preeclampsia is an abnormal increase in a woman's blood pressure after the 20th week of pregnancy. Preeclampsia is often associated with swelling in the face and hands. This dangerous condition occurs in 3 percent to 4 percent of all pregnancies and is the leading cause of maternal and fetal death in the United States.

Eclampsia is a more severe form of preeclampsia that can lead to seizures and coma. Estimates place the number of women affected by eclampsia at one in 200 women who have preeclampsia. Eclampsia can be fatal if it's not treated quickly.

Just as important is keeping things that can be dangerous out of the mother's body. For instance, medications used to treat various diseases and conditions can affect the growth and development of the fetus. Certain herbal supplements and high amounts of vitamins can also make it harder for a woman to get pregnant, and can impact the fetus' health during pregnancy. Even being around certain materials, such as paint and pesticides can put the health of the fetus at risk. Women who are thinking about getting pregnant should discuss all of these factors with their health care providers. Some changes in medication or supplement use, or changes in environment may be recommended to prevent problems during pregnancy.

Research shows that smoking, drinking alcohol, or using drugs, even now and again or in small amounts during pregnancy can cause health problems for the fetus, some of them severe. Many of these problems can have life-long effects. Alcohol and drug use may also make it harder for some women to get pregnant. To reduce the risk of problems during pregnancy, health care providers recommend that women stop smoking, stop drinking alcohol, and stop using drugs, completely, and as early as possible before they start trying to get pregnant. They should maintain this tobacco-free, alcohol-free, and drug-free lifestyle throughout their pregnancies and after birth, as many of these substances can get into the baby's system through breast milk.



Slide #21: In summary, there are three main take-away points I hope you will remember.

Critical periods of development occur throughout prenatal development. As noted in the webinar, each week and month of prenatal development demonstrates significant growth. Therefore, encouraging healthy behaviors before, during, and after pregnancy can positively impact development. As a provider, either through Early Head Start or through other community programs that support pregnant women, it is your responsibility to understand prenatal development and the importance of prenatal care. This purpose of this webinar is to provide a brief overview of prenatal development. For more information, please visit the websites of the American Academy of Pediatrics, National Institute of Child and Human Development, or other local programs.

The Arizona Head Start Training and Technical Assistance Office and STG International thank you for joining our webinar today. Please contact me, Mary Kramer Reinwasser, at mary.reinwasser@stginternational.com for more information about our 2010 Summer Webinar Series occurring every Tuesday and Thursday during the months of June and July at 3:00 Pacific Daylight Time. Enjoy the rest of your day!