PATIENT EDUCATION

The American College of Obstetricians and Gynecologists
WOMEN'S HEALTH CARE PHYSICIANS

Prenatal Genetic Screening Tests

*Prenatal genetic testing gives parents-to-be information about whether their fetus has certain **genetic disorders** before birth. Many prenatal genetic tests are available. Prenatal **screening tests** can tell you the chances that your fetus will have a type of genetic disorder called **aneuploidy** and a few other disorders. Prenatal **diagnostic tests** can tell you whether your fetus actually has certain disorders. Both screening and diagnostic testing are offered to all pregnant women.*

This pamphlet focuses on prenatal screening tests and explains

- *types of genetic disorders*
- *prenatal testing options*
- *types of genetic screening tests*
- *screening test results and what they mean*
- *what to consider when deciding whether to have prenatal testing*

Overview of Genetic Disorders

Genetic disorders are caused by changes in a person's ***genes*** or ***chromosomes*** (see box "Genes and Chromosomes"). Aneuploidy is a condition in which there are missing or extra chromosomes (see box "What Is Aneuploidy?"). ***Inherited disorders*** are caused by changes in genes called ***mutations***. Inherited disorders include ***sickle cell disease***, ***cystic fibrosis (CF)***, ***Tay–Sachs disease***, and many others. In most cases, both parents must carry the same gene to have an affected child.

Prenatal Testing Options

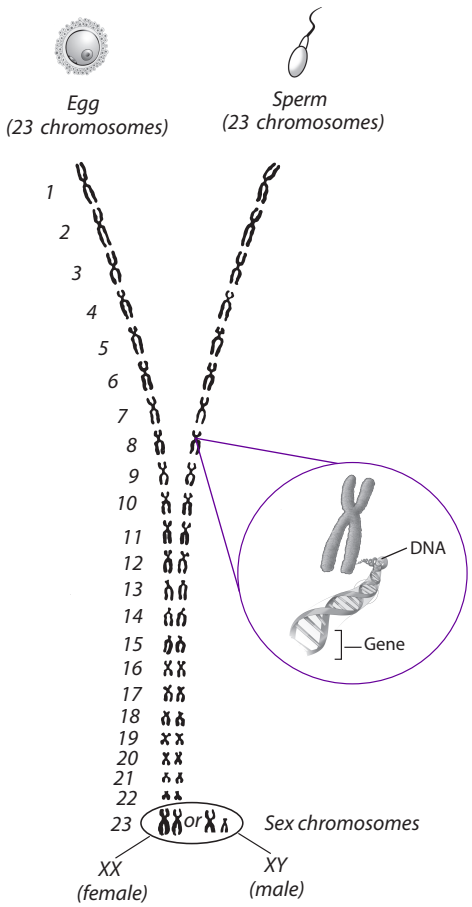
There are two types of prenatal tests for genetic disorders: 1) screening tests and 2) diagnostic tests. Screening tests can tell you your risk of having a baby with certain disorders. They include ***carrier screening*** and prenatal genetic screening tests:

- Carrier screening is done on parents (or those just thinking about becoming parents) using a blood or tissue sample swabbed from inside the cheek. Also called "gene testing," these tests are used to find out whether a person carries a gene for certain inherited disorders. Carrier screening can be done before or during pregnancy.
- Prenatal genetic screening tests of the pregnant woman's blood and findings from ***ultrasound exams*** can screen the fetus for aneuploidy; defects of the brain and spine called ***neural tube defects (NTDs)***; and some defects of the abdomen, heart, and facial features. This pamphlet focuses on these tests.

Genes and Chromosomes

A gene is a small piece of hereditary material called ***DNA***. Genes come in pairs and are located on chromosomes. Chromosomes also come in pairs. Most ***cells*** have 23 pairs of chromosomes for a total of 46 chromosomes. Sperm and egg cells each have 23 chromosomes. During fertilization, when the egg and sperm join, the two sets of chromosomes come together.

A baby's sex depends on the ***sex chromosomes*** it gets. Egg cells contain only an ***X chromosome***. Sperm cells can carry an X chromosome or a ***Y chromosome***. A combination of XX results in a girl and XY results in a boy.



Prenatal diagnostic tests can tell you, with as much certainty as possible, whether the fetus has an aneuploidy or a specific inherited disorder for which you request testing. These tests are done on ***cells*** from the fetus or ***placenta*** obtained through ***amniocentesis*** or ***chorionic villus sampling (CVS)***. The cells can be analyzed in different ways. Diagnostic tests carry a very small risk of pregnancy loss.

Types of Genetic Screening Tests

The screening tests offered to you depend on which tests are available in your area, how far along you are in your pregnancy, and your health care professional's assessment of which tests best fit your needs (see Table 1). Any woman of any age, regardless of risk factors, can choose to have diagnostic testing instead of or in addition to screening tests.

Timing needs to be considered when having prenatal screening tests. With first-***trimester*** testing,you have more options and more time to think about what an abnormal screening test result may mean for you and your family. With second-trimester testing, there is less time and fewer options.

Not all types of tests are covered by health insurance plans. It is a good idea to check with your insurance company before you have any of these tests. If your company does not cover a test, you will have to pay for it yourself.

First-Trimester Screening

First-trimester screening includes a test of the pregnant woman's blood and an ultrasound exam. Both tests usually are performed together and are done between 10 weeks and 13 weeks of pregnancy:

- The blood test measures the level of two substances.
- The ultrasound exam, called a ***nuchal translucency screening***, measures the thickness of a space at the back of the fetus's neck. An abnormal nuchal translucency measurement means there is an increased risk that the fetus has Down syndrome or other type of aneuploidy. It also is linked to physical defects of the heart, abdominal wall, and skeleton.

What Is Aneuploidy?

Aneuploidy is a condition in which there are missing or extra chromosomes. In a ***trisomy***, there is an extra chromosome. In a ***monosomy***, a chromosome is missing. Examples include the following:

- ***Down syndrome (trisomy 21)***—Most cases caused by an extra chromosome 21
- ***Patau syndrome (trisomy 13)***—Caused by an extra chromosome 13
- ***Edwards syndrome (trisomy 18)***—Caused by an extra chromosome 18
- ***Turner syndrome***—Caused by a missing or altered X chromosome

Although any woman at any age can have a child with an aneuploidy, the risk increases as a woman ages.

Table 1. Prenatal Screening Tests

Screening Test	Description	What Does It Screen for?	When Is It Done During Pregnancy?	Down Syndrome Detection Rate
		First-Trimester Screening		
Blood test	Blood test for PAPP-A and hCG	Down syndrome (trisomy 21) Patau syndrome (trisomy 13) Edwards syndrome (trisomy 18)	10–13 weeks	When combined with the nuchal translucency ultrasound exam, 82–87%
Nuchal translucency (NT) test	Measurement of a space at the back of the fetal neck during an ultrasound exam	Down syndrome Patau syndrome Edwards syndrome	10–13 weeks	64–70%
		Second-Trimester Screening		
Blood test	Quad screen: Blood test for MSAFP, hCG, estriol, and inhibin-A	Down syndrome Edwards syndrome Neural tube defects (NTDs)	15–22 weeks	81%
Ultrasound exam	Ultrasound exam that checks the fetus's anatomy	Major physical defects	18–20 weeks	Varies with type of finding
		Combined First- and Second-Trimester Screening		
Integrated screening	Blood test for PAPP-A and an NT ultrasound exam in the first trimester, followed by quad screen in the second trimester	Down syndrome Edwards syndrome NTDs	10–13 weeks; then 15–22 weeks	96%
Contingent sequential	First-trimester combined screening	Down syndrome Edwards syndrome NTDs	10–13 weeks; then 15–22 weeks	88–94%
Stepwise sequential	First-trimester combined screening result: —Positive: cfDNA screening or diagnostic test offered —Negative: second-trimester screening test offered	Down syndrome Edwards syndrome NTDs	10–13 weeks; then 15–22 weeks	95%
		Screening After 10 Weeks of Pregnancy		
Cell-free DNA (cfDNA) test	Blood test that analyzes DNA from the placenta circulating in the mother's blood	Down syndrome Edwards syndrome Patau syndrome (some labs); does not screen for NTDs	10 weeks and later	99% in women at high risk

Abbreviations: cfDNA, cell-free DNA; hCG, human chorionic gonadotropin; MSAFP, maternal serum alpha fetoprotein; NT, nuchal translucency; PAPP-A, pregnancy-associated plasma protein A.

Second-Trimester Screening

Second-trimester screening includes the following tests:

- The "quad" or "quadruple" blood test measures the levels of four different substances in your blood. The quad test screens for Down syndrome, Edwards syndrome, and NTDs. It is done between 15 weeks and 22 weeks of pregnancy.
- An ultrasound exam done between 18 weeks and 22 weeks of pregnancy checks for major physical defects in the brain and spine, facial features, abdomen, heart, and limbs.

Combined First- and Second-Trimester Screening

The results from first- and second-trimester tests can be combined in various ways. Combined test results are more accurate than a single test result. If you choose combined screening, keep in mind that final results often are not available until the second trimester.

Screening In Any Trimester: Cell-Free DNA Test

Cell-free DNA is the small amount of DNA that is released from the placenta into a pregnant woman's bloodstream. The cell-free DNA in a sample of a woman's blood can be screened for Down syndrome, Patau syndrome, Edwards syndrome, and problems with the number of sex chromosomes. This test can be done starting at 10 weeks of pregnancy. It takes about 1 week to get the results.

The cell-free DNA test is a screening test. If a cell-free DNA test result suggests that there is an increased risk of aneuploidy, diagnostic testing with CVS or amniocentesis and an ultrasound exam for physical defects may be recommended.

Screening Test Results

Results of blood screening tests for aneuploidy are reported as the level of risk that the disorder might be present:

- A positive screening test result for aneuploidy means that your fetus is at higher risk of having ethe disorder compared with the general popu-lation. It does not mean that your fetus definitely has the disorder.
- A negative result means that your fetus is at lower risk of having the disorder compared with the general population. It does not rule out the possibility that your fetus has the disorder.

Diagnostic testing with CVS or amniocentesis that gives a more definite result is an option for all pregnant women. Your ***obstetrician*** or other health care professional, such as a ***genetic counselor,*** will discuss what your screening test results mean and help you decide the next steps.

Accuracy of Prenatal Screening Tests

With any type of testing, there is a possibility of false-positive results and false-negative results. A screening test result that shows there is a problem when one does not exist is called a false-positive result. A screening test result that shows there is not a problem when one does exist is called a false-negative result. Your health care professional can give you information about the rates of false-positive and false-negative results for each test that is offered.

Deciding Whether to Have Prenatal Genetic Testing

Screening and diagnostic testing are voluntary. It is your choice whether to have prenatal testing. Your personal beliefs and values are important factors in the decision about prenatal testing.

It can be helpful to think about how you would use the results of prenatal screening tests in your pregnancy care. Remember that a positive screening test tells you only that you are at higher risk of having a baby with Down syndrome or another aneuploidy. A diagnostic test should be done if you want to know a more certain result.

Some parents want to know beforehand that their baby will be born with a genetic disorder. This knowledge gives parents time to learn about the disorder and plan for the medical care that the child may need. Some parents may decide to end the pregnancy in certain situations.

Other parents do not want to know this information before the child is born. In this case, you may decide not to have follow-up diagnostic testing if a screening test result is positive. Or you may decide not to have any testing at all. There is no right or wrong answer. Your health care professional or a genetic counselor can discuss all of the testing options with you.

Finally…

Screening tests can assess your risk of having a baby with aneuploidy and a few additional disorders. Screening tests are part of an overall strategy of prenatal testing for genetic disorders. Talk to your obstetrician or other health care professional about which tests are right for you.

Glossary

Amniocentesis: A procedure in which amniotic fluid and cells are taken from the uterus for testing. The procedure uses a needle to withdraw fluid and cells from the sac that holds the fetus.

Aneuploidy: Having an abnormal number of chromosomes. Types include trisomy, in which there is an extra chromosome, or monosomy, in which a chromosome is missing. Aneuploidy can affect any chromosome, including the sex chromosomes. Down syndrome (trisomy 21) is a common aneuploidy. Others are Patau syndrome (trisomy 13) and Edwards syndrome (trisomy 18).

Carrier Screening: A test done on a person without signs or symptoms to find out whether he or she carries a gene for a genetic disorder.

Cell-Free DNA: DNA from the placenta that moves freely in a pregnant woman's blood. Analysis of this DNA can be done as a noninvasive prenatal screening test.

Cells: The smallest units of a structure in the body. Cells are the building blocks for all parts of the body.

Chorionic Villus Sampling (CVS): A procedure in which a small sample of cells is taken from the placenta and tested.

Chromosomes: Structures that are located inside each cell in the body. They contain the genes that determine a person's physical makeup.

Cystic Fibrosis (CF): An inherited disorder that causes problems with breathing and digestion.

Diagnostic Tests: Tests that look for a disease or cause of a disease.

DNA: The genetic material that is passed down from parent to child. DNA is packaged in structures called chromosomes.

Down Syndrome (Trisomy 21): A genetic disorder that causes abnormal features of the face and body, medical problems such as heart defects, and mental disability. Most cases of Down syndrome are caused by an extra chromosome 21 (trisomy 21).

Edwards Syndrome (Trisomy 18): A genetic condition that causes serious problems. It causes a small head, heart defects, and deafness.

Genes: Segments of DNA that contain instructions for the development of a person's physical traits and control of the processes in the body. The gene is the basic unit of heredity and can be passed from parent to child.

Genetic Counselor: A health care professional with special training in genetics who can provide expert advice about genetic disorders and prenatal testing.

Genetic Disorders: Disorders caused by a change in genes or chromosomes.

Inherited Disorders: Disorders caused by a change in a gene that can be passed from parents to children.

Monosomy: A condition in which there is a missing chromosome.

Mutations: Changes in genes that can be passed from parent to child.

Neural Tube Defects (NTDs): Birth defects that result from a problem in development of the brain, spinal cord, or their coverings.

Nuchal Translucency Screening: A test to screen for certain birth defects, such as Down syndrome, Edwards syndrome, or heart defects. The screening uses ultrasound to measure fluid at the back of the fetus's neck.

Obstetrician: A doctor who cares for women during pregnancy and their labor.

Patau Syndrome (Trisomy 13): A genetic condition that causes serious problems. It involves the heart and brain, cleft lip and palate, and extra fingers and toes.

Placenta: An organ that provides nutrients to and takes waste away from the fetus.

Screening Tests: Tests that look for possible signs of disease in people who do not have signs or symptoms.

Sex Chromosomes: The chromosomes that determine a person's sex. In humans, there are two sex chromosomes, X and Y. Females have two X chromosomes and males have an X and a Y chromosome.

Sickle Cell Disease: An inherited disorder in which red blood cells have a crescent shape, which causes chronic anemia and episodes of pain. The disease occurs most often in African Americans.

Tay–Sachs Disease: An inherited disorder that causes mental disability, blindness, seizures, and death, usually by age 5. It most commonly affects people of Eastern or Central European Jewish backgrounds, as well as people of French Canadian and Cajun backgrounds.

Trimester: A 3-month time in pregnancy. It can be first, second, or third.

Trisomy: A problem where there is an extra chromosome.

Turner Syndrome: A problem that affects women when there is a missing or damaged X chromosome. This syndrome causes a webbed neck, short height, and heart problems.

Ultrasound Exam: A test in which sound waves are used to examine inner parts of the body. During pregnancy, ultrasound can be used to check the fetus.

X Chromosome: One of two chromosomes that determine a person's sex. Egg cells carry only the X chromosome.

Y Chromosome: One of two chromosomes that determine a person's sex. Sperm cells can carry a Y chromosome or an X chromosome.

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