Atrius Health

Genetic Carrier Screening Information

Overview:
Genetics is the study of how traits are inherited. We all have chromosomes that carry genes that determine our physical makeup, such as hair color and eye color. Like these traits, genetic conditions can sometimes be passed to your baby through genes and chromosomes. The risk of your baby having a genetic condition depends on your family history, your ethnic or racial background, and/or your age during pregnancy. For example, as women age, the chance of having a baby with a chromosome condition, such as Down syndrome, increases. It is important to understand that everyone has about a 3-4% (background) risk for birth defects in their offspring regardless of age, ethnic/racial background, or family history.

There are genetic tests available prior to conception and during pregnancy that can help assess the risk of a chromosome condition, genetic disorder, or birth defect in your offspring. Sometimes it is possible to definitively determine the presence of a chromosome condition, genetic condition, or birth defect with prenatal testing (diagnostic testing). Sometimes genetic testing results tell us about the possibility for the baby to have a particular condition (screening tests). Genetic tests may be a blood test or a more complex procedure, like amniocentesis (where a sample of amniotic fluid is obtained with a needle in the abdomen). Whether or not to have a genetic test is a personal decision. If you decide to have a genetic test, Massachusetts law requires that you complete and sign a consent form.

Please talk with your clinician about genetic screening. S/he can explain tests that can be done before or during pregnancy to help find out if your baby could have certain birth defects or genetic conditions

Insurance Coverage:
Some health insurances will cover the cost of genetic screening tests and others will not. If you elect to have any genetic testing, you should check with your insurance company to determine what coverage they provide.

Family History:
If you or your family member has any of the following conditions, you may have increased chance of having a child with the same condition:

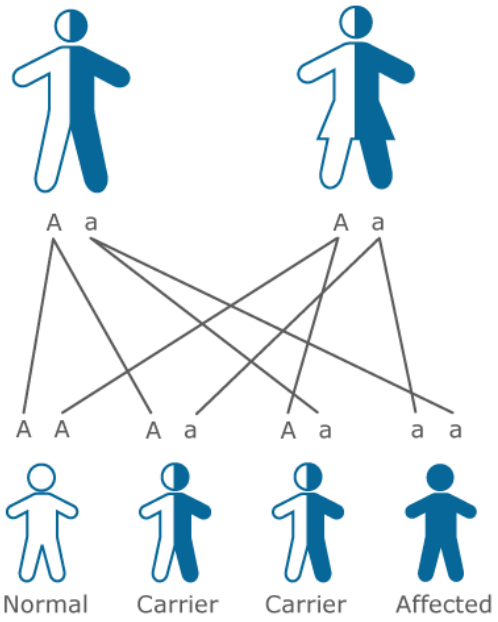
- Birth defects such as heart, spine, or kidney problems
- Intellectual disabilities such as Fragile X syndrome or Down syndrome (if you have a family history of intellectual disabilities and the cause is unknown- review the circumstances with your clinician)
- Genetic conditions such as muscular dystrophy, hemophilia, Huntington's disease, and cystic fibrosis

If your history of these disorders is uncertain or you have questions, be sure to review them with your clinician.

Carrier screening:
Most genes come in pairs. We inherit one copy from our mother and one copy from our father. Sometimes healthy people can carry a non-working or abnormally working gene. Individuals with one different gene are healthy because the other copy of the gene is working. These people are referred to as "carriers". If a carrier has a child with someone who carries the same abnormal gene, there is an increased risk for a particular genetic condition in their offspring.

If both parents are carriers, each of their children has a 1 in 4 (25%) chance to get both non-working genes and the resulting genetic condition. Each of their children also has a 1 in 2 (50%) chance to be a carrier (like the parents), and a 1 in 4 (25%) chance to have two working genes. This is called autosomal recessive inheritance (see picture below).

Autosomal Recessive Inheritance



Although recessive conditions are inherited, frequently there is no other known affected family member when a child is born with a recessive condition. If, however, there is a family history of any recessive condition, the chance of having an affected child is significantly increased.

Sometimes there are tests that can screen parents for non-working genes. Then if both parents are found to carry a non-working gene, their offspring can be screened. Carrier screening usually involves a blood test. These tests usually take anywhere from a few days to a few weeks to report results. **Some health insurance plans may not cover genetic testing or they may be applied to a deductible. Be sure to check your health insurance policy to see what restrictions might apply**. These tests are expensive.

Some non-working genes are more common in certain racial and ethnic groups. The following table shows the genetic conditions that occur more frequently among certain ethnic backgrounds. Carrier screening is available for these conditions for interested parents who are of the ancestry specified. The American College of Obstetricians and Gynecologists (ACOG), recommends offering screening to all women who are considering pregnancy or who are currently pregnant, for Cystic Fibrosis (CF) and Spinal Muscular Atrophy (SMA), regardless of ethnicity.

Ethnic Background	***Disease***	***Carrier Frequency***	***Detection Rate***
African	Alpha-thalassemia Beta-thalassemia Sickle cell anemia CF SMA	1:3 <1:8 (African American) 1:10 (African American) 1:61(African American) 1:66	 >99% 64% 71%
Asian	Alpha-thalassemia Beta-thalassemia CF SMA	1:20 (SE Asian) 1:20 1:94 1:53	 >99% 49% 93%
Caribbean	Sickle cell anemia CF SMA		>99%
Eastern & Central European Jewish	Familial dysautonomia Canavan disease Tay Sachs disease CF SMA	 1:31 1:100 1:30 1:24 1:41	 99% 99% 92% for DNA 98% for enzyme 94% 90%
French Canadian or Cajun	Tay Sachs disease CF SMA	1:30	>98%
Mediterranean	Alpha-thalassemia Beta-thalassemia CF SMA	1:30 1:7	 >99%
Middle Eastern	Alpha-thalassemia Beta-thalassemia CF SMA	1:20	 >99%
Northern European (Caucasian)	CF SMA	1:25 1:35	88% 95%
Hispanic	CF (Hispanic White) SMA	1:58 1:117	72% 91%

An overview of the symptoms and severity of diseases in the table above is included on Page 5.

Who should consider carrier screening?
You may be interested in carrier screening if you are planning a pregnancy or are already pregnant, and you belong to an at-risk ethnic background or you have a family history of any of the conditions listed. Although these conditions are more common among these ethnicities, they also can occur in other ethnic groups. Therefore, even if you are only partially in an at-risk group, or if your partner is not in an at-risk group, you may still wish to consider carrier screening.

What do the results mean?
If a carrier screen is positive indicating that someone is a carrier; the results are usually very accurate. If you are a carrier, then testing would be recommended for your partner to determine if your child would be at-risk for having that particular genetic condition. Also, your relatives, particularly your siblings, may be at increased risk for being a carrier for the same condition, and may want to pursue carrier screening.

The accuracy of a negative carrier screen depends on the ethnic background of the individual being tested and detection rate of the particular test (See right hand column of above table). **Usually a negative carrier screen means that there is still a small chance of being a carrier.**

What happens if we are both carriers?
If you and your partner are both found to be carriers for the same condition, there would be a 1 in 4 (25%) chance that you could have an affected child.

If you are not already pregnant your options include prenatal diagnosis for the disease in a future pregnancy, artificial insemination with a donor who has tested negative, adoption, or testing of the child after birth. Pre-implantation genetic diagnosis (PGD) is a technique that screens embryos made via in vitro fertilization for the presence of a particular genetic condition; only embryos without the condition are subsequently implanted into the uterus.

If you are already pregnant, prenatal diagnosis is performed by testing cells obtained through amniocentesis at about 16 weeks of pregnancy, or through chorionic villi sampling (CVS-a test where a sample of the placenta is examined) at about 10-12 weeks of pregnancy. These tests are associated with a small, but finite, risk for miscarriage. If the genetic condition were detected during a pregnancy, couples would have the option of continuing or terminating the pregnancy. In Massachusetts, the legal limit for pregnancy termination is prior to 24 weeks gestation.

What happens if only one of us is a carrier?
If only one parent is found to be a carrier, there still is a very small chance of having an affected child. This chance depends on the detection rate and ethnic background of the couple.

Who can I talk to if I have questions or want to arrange carrier screening?
Please talk to your clinician about what type of carrier screening might be most appropriate for you so the appropriate tests can be ordered.

Text the word CARRIER to 99150 to see a video explaining carrier screening in more detail.

For more information on birth defects and genetic disorders,

- Call the March of Dimes Resource Center at 1-888-MODIMES (1-888-663-4637) or email resourcecenter@modimes.org
- Visit the ACOG website: https://www.acog.org/Patients/FAQs/Genetic-Disorders

Carrier Screening - Overview of Genetic Diseases

Cystic Fibrosis (CF)

CF causes chronic lung and digestive system problems, the severity of which can vary and cannot be predicted. There is no cure for CF. Current medical treatment is aimed at reducing symptoms and prolonging life. Many children with CF are chronically ill and need frequent office visits and hospitalization. The average life expectancy for people with CF is age 37-40. It occurs equally in boys and girls.

Spinal Muscular Atrophy (SMA)

SMA Types I, II, and III belong to a group of hereditary diseases that cause weakness and wasting of the voluntary muscles in the arms and legs of infants and children. There is no cure for SMA. Treatment consists of managing the symptoms and preventing complications. The prognosis is poor for babies with SMA Type I. Most die within the first two years. For children with SMA Type II life expectancy is reduced but some individuals live into adolescence or young adulthood. Individuals with SMA type III may be prone to respiratory infections but with care may have a normal lifespan.

Hemoglobinopathies

Sickle cell disease and thalassemia are genetic disorders caused by errors in the genes for hemoglobin, a substance that is responsible for carrying oxygen within the red blood cell. These disorders can cause fatigue, anemia jaundice, and episodes of pain ranging from mild to very severe.

Canavan Disease

Classic Canavan disease is an inherited degenerative neurological disorder. Symptoms include developmental delays, followed by seizures and blindness. Onset is in early infancy and death usually occurs within the first decade of life. There is no cure for the disease.

Tay Sachs

Classic Tay-Sachs disease is an inherited degenerative neurological disorder, which is fatal in early childhood and for which there is no cure. Symptoms include developmental retardation, followed by paralysis, dementia & blindness. Onset is in early infancy and death in the second and third year of life.

Familial Dysautonomia

Familial dysautonomia (FD) is a rare genetic disease that affects the autonomic and sensory nervous systems of children from birth. The most striking symptoms of FD are reduced sensitivity to pain and temperature, and the inability to produce tears. It affects every major system of the body, causing severe respiratory, cardiovascular, orthopedic, digestive, renal and vision problems.

Additional Ashkenazi Jewish Testing

Some patients may opt for testing for conditions that are more commonly found in those of Eastern/Central European Jewish descent. These are screened for together and include testing for the following conditions*: CF, SMA, Fragile X, Tay Sachs DNA, Canavan, Familial dysautomia, Bloom Syndrome, Fanconi Anemia Group C, Gaucher disease, Maple Syrup Urine disease Type 1B, Neimann Pick disease, Glycogen Storage disease type 1a, ABCC8 Related Hyperinsulinism, Joubert Syndrome 2, Mucolipidosis IV, Usher Syndrome Type 1F, Type 3CF

For more detailed information on any of the conditions above, please see: https://medlineplus.gov/genetictesting.html

**the conditions tested may slightly vary depending on the processing lab that your insurance requires we use to analyze your specimen*

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