

**Center for Reproductive Health
University of California, San Francisco
Obstetrics, Gynecology & Reproductive Sciences
2356 Sutter Street, Floor 7**

Patient Information: Genetic Screening

What is genetic screening?

Genetic screening can provide important information about potential risks for a future pregnancy. Genetic screening tests tell us if you carry or are at risk of carrying a certain genetic trait that could put you at higher risk for having a baby with a genetic disease or syndrome. People who carry genes for these disorders usually do not have symptoms. Most can only be inherited if both parents are carriers, whereas others can be passed on if only one parent carries the gene. We will explain the different inheritance patterns for the diseases for which we routinely offer genetic screening below.

Which genetic tests can be done?

There are several genetic tests we routinely offer to all patients. Some others may only be desired if you belong to an ethnic group in which the disease is more common, or if you have a family history suggestive of disease. **Please review the following information and tell your doctor or nurse if you would like to arrange carrier screening for any conditions listed or if you have further questions.**

Cystic Fibrosis (CF):

CF is a condition with various degrees of severity, in which the body produces abnormally thick mucus, leading to life threatening lung conditions, digestion problems, diarrhea, poor growth and male infertility. Individuals with CF may not survive past their teens or early childhood.

CF can only be inherited if a child receives an abnormal copy of the Cystic Fibrosis gene from each parent (autosomal recessive inheritance). About 1 in 25 Caucasian people and 1 in 46 Hispanic people carries one abnormal copy of the Cystic Fibrosis gene. Cystic Fibrosis mutations are found less frequently in other ethnic backgrounds. A carrier is otherwise healthy, but carries a risk of passing CF on to a child if she has a child with another CF carrier. Genetic testing for carrier status will detect 85-95% of the gene changes known to cause CF in the Caucasian population, and 95% of carriers in the Ashkenazi Jewish population, but fewer carriers in other ethnic groups. A negative carrier test does not eliminate the chance that you may carry a CF mutation, but can lower that chance.

Fragile X syndrome:

Fragile X syndrome has a range of symptoms, with varying degrees of intellectual involvement and behavioral problems, from learning disabilities to mental retardation and possibly autism.

Fragile X syndrome can be inherited if a woman carries an abnormal copy of her Fragile X gene. It is considered to be inherited in an X-linked semi dominant manner. This means that a carrier woman has about a 50% risk with each pregnancy of having an affected child. Boys are more often and severely affected than girls. Fragile X syndrome can be passed on to children by individuals who have no signs of the syndrome. It is not specific to a certain ethnic background. Current studies indicate that the risk for being a female carrier is in the range of 1/113 to 1/250.

Hemoglobinopathy screening:

Hemoglobinopathy is a word that refers to all abnormalities of the hemoglobin molecule, the central component of red blood cells. Sickle cell anemia is one example discussed below. Others include the thalassemias, which are basically a decrease in production of a central component of the hemoglobin. This can lead to very severe, life-threatening anemia.

Hemoglobinopathies are usually inherited in an autosomal recessive manner. A child is affected if he or she receives an abnormal copy of the gene from each parent. A carrier is otherwise healthy, but may have mild anemia. Carriers of thalassemias can be found all over the world. We screen everybody by checking to see if they have mild anemia. We might also offer another, more specific blood test for patients of South East Asian descent or people who are mildly anemic, as they have a higher chance of being carriers (about 1/7).

Sickle Cell screening:

Sickle cell anemia is another severe blood condition, in which the red blood cells tend to become abnormal in shape. When these red cells go through the small blood vessels, they tend to get stuck and block further blood flow, causing pain, damage and a low blood count. It can lead to death in early childhood, although longer survival is becoming more common and some treatments are available.

Sickle cell anemia can only be inherited if a child receives an abnormal copy of the gene from each parent (autosomal recessive inheritance). A carrier is otherwise healthy, but carries a risk of passing sickle cell anemia on to a child if she has a child with another sickle cell carrier. Carriers of sickle cell anemia can be found all over the world. We offer testing for sickle cell when a patient has ancestors from Africa, the Middle East, certain European countries, Brazil, Central America or the Caribbean. The carrier frequency for certain high-risk groups can be as high as 10-30%, depending on ethnic background.

Tay Sachs disease:

Tay Sachs disease results from a build-up of certain substances in the brain, and is fatal in early childhood. There is presently no treatment for the condition.

Tay Sachs disease can only be inherited if a child receives an abnormal copy of the gene from each parent (autosomal recessive inheritance). A carrier is otherwise healthy, but carries a risk of passing Tay Sachs on to a child if she has a child with another Tay Sachs carrier. We offer testing for Tay Sachs when a person is of Ashkenazi Jewish, Cajun or French Canadian ancestry, as they have the greatest chance of being carriers (a frequency of 1/30 versus 1/250 in the general population).

Canavan disease:

Canavan disease is a central nervous system disease that is usually fatal in childhood, with a few people surviving to adulthood. This disease is the result of a substance which destroys the central nervous system over time. There is presently no effective treatment for the condition.

Canavan disease can only be inherited if a child receives an abnormal copy of the gene from each parent (autosomal recessive inheritance). A carrier is otherwise healthy, but carries a risk of passing Canavan disease on to a child if she has a child with another Canavan carrier. We offer testing for Canavan disease when a person is of Ashkenazi Jewish ancestry, as they have the greatest chance of being carriers (with a carrier incidence of 1/40).

Familial dysautonomia:

Familial dysautonomia (FD) is a disease present from birth, which is caused by the incomplete development of neurons. People with FD may have altered sensitivity to pain and temperature, gastrointestinal abnormalities, abnormal body temperature regulation and altered developmental milestones or motor coordination. They usually live into adulthood, but have shortened life spans.

Familial dysautonomia can only be inherited if a child receives an abnormal copy of the gene from each parent (autosomal recessive inheritance). A carrier is otherwise healthy, but carries a risk of passing FD on to a child if she has a child with another FD carrier. We offer testing for FD when a person is of Ashkenazi Jewish ancestry, as they have the greatest chance of being carriers (with a carrier incidence of 1/27).

People of Ashkenazi Jewish descent also have the option of testing for several other conditions, though the incidence is often rarer than for those listed above. (We have chosen the conditions discussed above because these are the currently recommended screening tests through the American College of Obstetrics and Gynecology.) Other conditions for which genetic screening is available include Bloom's syndrome, Gaucher's disease, Niemann-Pick disease, Fanconi Anemia, Glycogen storage disease, Mucopolidosis and Maple syrup urine disease.

Making a Decision about Genetic Screening

What is genetic screening and how is it done?

Genetic screening (or carrier testing) involves checking to see if you carry a copy of an abnormal gene that can put you at risk for having a child with a specific disorder. This is usually done by a blood test. The number of conditions for which testing is possible is rapidly increasing, although it is not possible to test for all genetic conditions. Also, the implications of having a genetic disorder can vary. Some disorders cause severe problems, whereas others may be quite mild. The decision to have carrier testing is a personal one made after understanding and carefully considering the options. A genetic counselor is available to answer any questions you might have, and will discuss any abnormal results with you.

Who should consider testing?

1. *Family history:* If someone in your family has a genetic disorder, you may have an increased chance of being a carrier yourself. It is a good idea to speak with your relatives to determine if there are genetic disorders which are known to run in your family. This information can then be discussed with your physician or a genetic counselor to determine your chance of being a carrier. Genetic tests may exist to determine carrier status, although this will not always be possible.
2. *Ethnic background:* Some genetic disorders are particularly common in persons of a specific racial or ethnic background, because they share a common heritage. For example, sickle cell disease is found most often among persons of African ancestry, Tay Sachs disease most often in persons of Ashkenazi Jewish ancestry, and cystic fibrosis among persons of Caucasian ancestry.
3. *Population screening:* As technology improves, it becomes possible to test the general population for commonly encountered genes.

Deciding whether to have carrier testing:

If you are interested in carrier testing, there are several issues to consider:

1. *Detection rate of carrier testing:* Although some genetic tests can identify all carriers, others identify only some of the genes that cause a specific disease. When a person is identified as a carrier of a genetic disorder, the results are considered highly accurate. However, if a person has a “negative” result, there is sometimes still a chance that the individual could carry an abnormality in that gene change not detected by current testing. For some carrier tests, a negative result can lower the risk of being a carrier, but cannot make this risk zero.
2. *Accuracy of carrier testing may depend on ethnicity:* Carrier testing usually identifies the changes in a gene that are found most commonly in a specific ethnic group. For example, cystic fibrosis carrier testing can identify 85-95% of the genetic changes that cause disease in persons of Northern European ancestry, but only about 30% of changes in persons of Asian-American ancestry. Your ethnicity is an important determinant in the ability to detect carrier status.
3. *Health insurance coverage:* Your health insurance may cover genetic carrier testing. If it does not, however, you may have to pay for genetic testing yourself. Before testing, you may want to contact your insurance company.
4. *Information gained through carrier testing:* If you and your partner are found to be carriers of an autosomal recessive genetic disease, you have a 25% (1 in 4) chance of having an affected child. If you become pregnant, it is possible to test your baby for the genetic disease before he or she is born through prenatal diagnostic testing. There are also other options for you, including a special technique called preimplantation genetic diagnosis, where IVF is performed, and embryos are tested prior to transfer to the woman’s uterus. Other options include egg or sperm donor and adoption. If you and your partner are found not to be carriers of one of these inherited disorders, it greatly reduces your risk of having a child with that specific disease.
5. *The right time to have carrier testing:* Some types of genetic testing may be complicated and it may take several weeks to receive results. If you are interested in carrier testing, it is important to be tested as early as possible, so that you may be aware of the risk early and make decisions regarding your reproductive plans.

Conclusion:

Carrier testing may be helpful to some couples who are planning a pregnancy. Making a decision about this kind of testing requires careful thought and consideration of the information that may be obtained and its usefulness in your situation. You may speak with our program’s genetic counselor, Gina Davis (415-353-7397) about the possibility of having genetic carrier testing and whether it will be useful to you and your partner.