Prenatal Carrier Screening

**To the point:** Prenatal carrier screening involves a blood draw on mom and/or dad to determine if they carry genetic changes that could be passed on to the baby. Most carrier screening is done for recessive conditions. With recessive conditions a carrier does not have any symptoms, but if they are both carriers of the same genetic condition there is an increased chance of having a child with that genetic condition. Historically, the conditions screened for have been offered based on an individual or couple’s ethnic background, or family history which is still often the case. However, many providers now offer what is called expanded carrier screening, which may include testing for dozens to hundreds of conditions. Carrier screening may be performed prior to or during the pregnancy.

Results
How to Decide

The BASICS

So, why do they call it carrier screening in the first place? All of us are, “carriers” for certain genetic conditions (in fact, we all are probably carriers of 5-10 or more recessive genetic conditions and most of the time we will never even know we are carriers). As you may recall or can go back and review in genetics 101, we have 2 copies of each gene, one from our mom and one from our dad. When we are a “carrier” of a genetic condition, this simply means that one of the copies out of the 2 genes has a change or mutation and is not working as usual. But, the other copy of the gene that is working compensates or makes up for the one that isn’t working. So we don’t have the genetic disorder or any symptoms; we are a “carrier” of the disease. Again, there are typically no health problems associated with being a carrier of a mutation for a recessive disease. However, as a carrier, there is a chance that your children could inherit that genetic disorder if your partner is also a carrier and you both pass the non-working gene on to your baby. If you AND your partner are carriers of the condition, there is a 25% chance or ¼ chance for each of your children to inherit the condition.

Other carrier screening looks for genetic disorders that are inherited in an X-linked manner. This means that the gene involved is on the X chromosome. Since women have 2 X chromosomes and men have only 1 X chromosome, this type of condition affects men and women differently. Women who carry the condition may have very mild or no symptoms, whereas, men typically have the full-blown condition. So, if a woman is a carrier of an X-
linked condition, she will have a 50% chance of passing it on to her children, but boys will have the genetic condition and girls may not (or symptoms may be very mild).

**Screening for COMMON DISORDERS**

Offered to EVERYONE, regardless of ethnic background.

Some genetic disorders are relatively common and carrier screening may be offered to you regardless of your ethnic background. One example of this is **Cystic Fibrosis**.

Screening for another condition, **Fragile X-Associated Disorders** may be offered, however, the American College of Medical Genetics and other professional societies do not recommend offering this to all patients unless there is a family history or some other indication for doing so.

**Screening for ASHKENAZI JEWISH DISORDERS**

Offered to couples where at least 1 of the partners has some Ashkenazi Jewish ancestry.

There are a number of genetic disorders that are more common in people of Ashkenzi Jewish descent/ancestry; however, they may occur in people of other ethnic backgrounds as well. Many of these disorders can have a serious effect on the patient’s quality of life, some of which may result in shortened life expectancy. Some, like Gaucher, may have a milder effect. The following disorders are recommended (by the American College of Medical Genetics & Genomics) to be offered to couples who are planning a pregnancy or currently pregnant:

- Familial dysautonomia
- Tay-Sachs disease*
- Canavan disease
- Fanconi anemia group C
- Niemann-Pick type A
- Bloom syndrome
- Mucolipidosis IV
- Gaucher disease Type I

There are many other conditions that are increased in risk in the Ashkenazi Jewish population for which you may be offered screening.
*Tay-Sachs disease is also increased in risk among individuals of French-Canadian, Cajun & Irish ancestry and should be offered to individuals with this ethnic background.

**Screening for HEMOGLOBINOPATHIES**

Offered to couples where at least 1 of the partners has one of the following ethnicities:

- African American
- Mediterranean
- SE Asian

Hemoglobin diseases, called [hemoglobinopathies](#), are a group of disorders characterized by abnormal or decreased production of hemoglobin, the molecule that carries oxygen throughout the body. The severity of these diseases ranges from mild to severe, depending on the type of hemoglobin defect. The most common hemoglobinopathies are the following:

- alpha-thalassemia
- beta-thalassemia
- sickle cell disease

**Expanded Carrier Screening**

Expanded carrier screening is offered by some providers but if not it may be available upon your request. Expanded carrier screening looks for hundreds or thousands of mutations that are related to multiple genetic conditions with the goal of identifying “carriers”.

Some of the conditions screened for in expanded carrier screening are more severe, some mild, some have treatment available and some don’t. There is a very small chance that you could be found to have a genetic condition through this test as well (depending on what laboratory your doctor uses and what conditions are screened for). In general, this test often screens for most of the conditions commonly offered based on ethnic background (CF, common Ashkenazi Jewish diseases, and hemoglobinopathies). However, the labs offering expanded carrier screening may or may not be as comprehensive in their analysis as labs that focus on screening for individual conditions. For example, if you have a family history of a specific condition, expanded carrier screening may not be a good test for you.

As you can imagine, there are many viewpoints on the use of this test and many ethical
issues involved. This test begs the question, “is bigger better?” Some would argue yes, some would argue no. We would say that like most things, there are pros and cons to this testing.

**HOW IT WORKS**

Carrier screening is done with a blood or saliva test. There are different methods utilized for carrier screening in terms of technology. But, for most of the carrier tests (some exceptions include testing for hemoglobinopathies and enzyme testing for tay-sachs disease), they are looking for changes or mutations in specific genes at the DNA level that cause the gene of interest to not work as usual. For some genes, take cystic fibrosis as an example, there are over 1,000 different mutations that have been reported. In this case, laboratories will vary on how many mutations they screen for; some labs may screen for 23 mutations, some may screen for more than 100 or read through the entire gene.

**What is a mutation anyway?**

**MUTATION**

the changing of the structure of a gene, resulting in a variant form that may be transmitted to subsequent generations, caused by the alteration of single base units in DNA, or the deletion, insertion, or rearrangement of larger sections of genes or chromosomes

In prenatal carrier screening, many of the mutations that are identified are changes in a single base unit of DNA. DNA is made up of 4 base units, namely, A, T, C, & G. The placement of these base units is critical and one alteration can change the function of the gene if altered in certain places. The carrier screen can identify changes in the DNA order or “sequence” of these base units and over time researchers have been able to figure out when a certain order change causes disease or genetic conditions to occur. Other carrier screening looks for deletion of parts of the DNA or insertions or rearrangements of the DNA.

**RESULTS**

Your result will indicate whether or not you are a carrier of a particular genetic condition and will give details regarding the specific change(s) identified in your DNA.
My results were normal/negative. What does that mean?

Normal/negative carrier screen results definitely reduces the chance of you being a carrier of the conditions screened, however, carrier screening does not typically detect 100% of carriers. Therefore, there is still what is called a “residual risk” of being a carrier. Residual risk is the chance that you are a carrier based on the fact that you have a normal/negative carrier screen. The residual risk will vary depending on which laboratory your doctor utilizes for the carrier screen and how many mutations they screen for each condition, etc. Your provider or genetic counselor should be able to provide you with your residual risk numbers.

My results indicate that I am a carrier of a genetic condition. Now what?

You are not alone...you are actually in very good company with the rest of the human race. All of us are carriers of something!

Next step- for most conditions (besides X-linked conditions like Fragile X) if you want to be able to find out more about the chance of the baby having the condition, the next step (if you haven’t already) is for your partner to consider being tested to see if he is a carrier of this same genetic condition. If your partner is not available or unwilling to be tested, your provider can help you determine the chances of the baby having the condition (which are still probably quite low). And, if you feel like you really want to know about the baby and your partner can’t be tested for some reason, you can talk to your provider about CVS or amniocentesis but just make sure you get the scoop on the limitations of testing without having the partner’s information in hand.

If both you AND your partner are carriers of the same condition, keep on reading...

Both my partner and I are carriers of the same autosomal recessive genetic condition; what does this mean for our baby/potential baby and what are our
options?

We understand that this news can cause a lot of worry. You maybe wondering how could this be...the chances of this occurring were so incredibly slim. But, just because you are both carriers does not mean that your baby will inherit the condition. In fact, with each pregnancy, there is a 75% chance that your baby will not inherit the condition.

As we stated above, most of the genetic conditions that are screened for are autosomal recessive in nature. Learn more about recessive inheritance here.

There is nothing you can do to cause or prevent this condition naturally.

So, what are your options or what do other people do in your situation who are concerned about having a child with the genetic condition at hand but still would like to have a family?

Some of this depends on what the condition is, how severe it is, what your thoughts are on having a child with the condition...just to name a few things. But, there are different options that couples consider when they find out that they are both carriers of a severe genetic condition.

- Move forward with your pregnancy (or future pregnancy) as planned and decline further genetic testing.
- Move forward with pregnancy (or future pregnancy) and undergo invasive testing such as CVS or amniocentesis to find out during the pregnancy if the baby has the condition and then make decisions regarding the pregnancy based on those results. If the results indicate that the pregnancy is affected with the condition, there are 3 options- continue the pregnancy, continue the pregnancy and consider placing the baby for adoption, or choose to end the pregnancy.
- Consider In-vitro fertilization with preimplantation genetic diagnosis (PGD). In a nutshell, this is basically testing the fertilized egg prior to implanting it in mom’s uterus to see if the embryo has the genetic condition. Only an embryo(s) without the condition is implanted.
- Consider using donor egg or donor sperm
- Consider adoption
These options are not all easy, some of them cost a lot of money, and some of them may not fit with your personal beliefs and values. In terms of emotional support, for some it may be helpful to connect with another couple who has gone through this process; your provider or genetic counselor may be able to help facilitate this. It is important to remember that you are not alone.

**HOW TO DECIDE**

**Should I pursue carrier screening?**

This is an important question that we hope more people start asking themselves about this test and prenatal testing in general. Similar to other prenatal testing, there are some questions that can help you decide whether carrier screening is right for you.

- Am I the type of person who likes to know as much information as possible so I can plan accordingly and be prepared?
- Does more information increase my anxiety, and therefore, would I rather not find out more information regarding the conditions screened for by carrier screening?
- Do I want to minimize the possibility of intervention in my pregnancy?
- If carrier screening did indicate my baby was at an increased risk for one of the conditions, would I want to pursue further testing (possibly invasive testing that poses some risk to the baby)?
- If I knew that my baby had one of these conditions, would it affect my decision to continue the pregnancy and raise the child, or would I consider other options, such as, ending the pregnancy or placing the baby for adoption?

*Ultimately, the decision to have carrier screening or any other prenatal screening is up to you.*