This fact sheet describes a test carried out before pregnancy or in early pregnancy called reproductive carrier screening . The test can identify a couple's chance of having a child with a genetic condition. This is a screening test and is also known as pre-pregnancy or preconception carrier screening.

In summary

- **Reproductive carrier screening is a blood or saliva test that looks for faults (variants that cause disease) in a person's genes.**
- **Reproductive carrier screening is a test that provides information for couples about the chance of having a child with a genetic condition.**
- **Couples who are found to have a higher chance of having a child with a genetic condition will be given information about their reproductive choices.**
- **Reproductive carrier screening is an optional test.**
- **The number of conditions tested for varies according to the type of test being used.**
- **There are currently "out-of-pocket" costs associated with this test.**

Please note: Reproductive carrier screening is different to screening tests undertaken during pregnancy which assess the chances of a baby having Down syndrome or another chromosome condition.

WHAT IS REPRODUCTIVE CARRIER SCREENING ?

Reproductive carrier screening is a blood or saliva test that looks at a person's genes. Genes are made up of DNA. Genes contain the instructions for growth and development. We all have two copies of every gene, except for some genes which are found on the X-chromosome.

Females have two copies of the X chromosome and so have two copies of X chromosome genes (written as XX). Males only have one copy of the X chromosome (in combination with a Y chromosome, XY) and so have only one copy of genes from the X chromosome.

Sometimes variations in a gene can make it faulty so that the instruction is not read correctly or is not read at all by the cell. These variations in the DNA code that make genes faulty are referred to as variants and are also known as a mutation.

Reproductive carrier screening tests a person's DNA to check for variants which we know can cause certain genetic conditions. Reproductive carrier screening will determine if the mother (or both mother and father) are genetic carriers of one or more genetic conditions that can affect health and development in any children they may have together.

WHO MIGHT WANT TO HAVE REPRODUCTIVE CARRIER SCREENING?

Reproductive carrier screening might be useful for any couple who is considering a pregnancy and would like to be more informed about their chance of having a child with certain genetic conditions.

Reproductive carrier screening is available for all couples, however those with a known family history of a specific genetic condition may have a higher chance and should be referred to their local genetic service.

WHAT IS A GENETIC CARRIER?

A genetic carrier is a person who has a variant in one copy of a gene. The other copy of the gene does not have a variant and is said to be working. In most cases genetic carriers do not have any associated health problems.

When a genetic carrier has a child they will pass on one copy of the gene, either the copy with the variant or the working version. If a genetic condition only occurs when both copies of the gene have a variant, this is called a recessive condition. For recessive conditions both parents need to be genetic carriers of that condition to have an increased chance of having a child with the condition.

On rare occasions, a genetic condition occurs from a variant in only one gene on the X-chromosome. The X chromosome is one of the sex chromosomes; X and Y. When this happens then it is called X-linked inheritance. The presence of one working copy of the gene is usually sufficient to keep a genetic carrier healthy, but for X-linked conditions some women can show signs of the condition. A woman who is a genetic carrier for an X-linked condition has a higher chance of having a child with that condition.

WHAT DOES REPRODUCTIVE CARRIER SCREENING TEST FOR?

Reproductive carrier screening can test for a number of different genetic conditions at one time. The number of conditions tested for can vary depending on the test being used by your health care provider. Usually, the tests are carried out in one of the following ways:

- A **3-gene carrier screen** which tests for three common genetic conditions that have a serious impact on the health of an affected individual: cystic fibrosis, spinal muscular atrophy and fragile-X Syndrome. A recent study has shown that 1 in 20 people in the Australian population is a genetic carrier for one of these three conditions and the majority of couples "with an increased chance" do not have a family history of the condition (Archibald et al 2018).
- **Ethnic specific carrier screening** for individuals who know their ethnicity and where both the mother and father are from the same ethnic background, e.g. Ashkenazi Jewish people. This type of testing includes genetic conditions known to be more common in specific ethnic groups.
- **Expanded carrier screening** which can test for many different genetic conditions, sometimes tens or hundreds, most of which are rare. The expanded carrier screening test will identify if someone is a genetic carrier of the 3 common conditions cystic fibrosis, spinal muscular atrophy, fragile-X syndrome, as well as many others that are severe and can start early in life. They also include other genetic conditions that are not as common but are serious and can be life-limiting, sometimes in early infancy.

Couples who are considering reproductive carrier screening should be aware that not all tests look for the same genetic conditions and it is important to talk to your health care provider about the specific conditions that can be identified.

It is important to know that reproductive carrier screening does not screen for every genetic condition.

HOW IS REPRODUCTIVE CARRIER SCREENING DONE?

There are two pathways for undertaking reproductive carrier screening:

- **Individual testing**: Starting with an individual (usually the woman), testing is carried out and if she is found to be a genetic carrier for a recessive condition, it is then necessary to test the partner to determine their chance as a couple. If the mother is tested first then the testing can also include X-linked conditions.
- **Couple testing**: Both the woman and man are tested at the same time to see if they are genetic carriers for the same genetic condition. The mother may also be tested for X-linked conditions.

HOW ACCURATE IS REPRODUCTIVE CARRIER SCREENING?

Carrier Screening is highly accurate for the genetic conditions that it screens for; however the accuracy is not 100%. If no variant is found there is still a small chance that you are a genetic carrier of a variant that was not detected or for another condition that was not tested.

It is important to discuss the different options for testing with your healthcare provider to identify which test is best for you and your partner.

DOES A NORMAL REPRODUCTIVE CARRIER SCREENING RESULT MEAN THAT THE BABY WILL BE HEALTHY?

No test can guarantee that a baby will be healthy at birth. Reproductive carrier screening can look for a number of genetic conditions but does not look at all genetic conditions.

The health professional providing information about reproductive carrier screening is the best person to ask about what will and won't be tested for.

WHEN CAN REPRODUCTIVE CARRIER SCREENING BE PERFORMED?

The ideal time for testing is before becoming pregnant. This gives couples time to consider the results and make informed choices about their reproductive options.

Reproductive carrier screening can also be performed in early pregnancy. There will be fewer options available to the couple, depending on the stage of the pregnancy.

Like other pregnancy-associated tests, reproductive carrier screening can raise questions of personal values and choice that may require time to consider. A couple should feel free to accept or decline the offer of this test. Some people will want this information and others will not want it.

WHAT IF REPRODUCTIVE CARRIER SCREENING SHOWS THAT YOU HAVE A HIGHER CHANCE OF HAVING A BABY WITH A GENETIC CONDITION?

If the reproductive carrier screening result shows that both parents are carriers of the same genetic condition or the woman is a carrier of an X-linked condition, information about the condition will be provided. Your health professional will refer you to a specialised Genetic Service to discuss your options.

Information will be provided about the chance of having a child with a genetic condition and the reproductive options available to you. Some of the options couples in this situation may consider include:

- Conceiving a pregnancy naturally, with prenatal diagnosis (testing during pregnancy to identify if the baby has inherited the genetic condition). Couples can then decide whether or not to continue a pregnancy which is affected with the genetic condition.
- Conceiving a pregnancy naturally without prenatal diagnosis.
- Preimplantation genetic diagnosis (PGD) using in-vitro fertilization (IVF) to test and then transfer embryos that do not have the genetic condition.
- The use of donor sperm or donor egg
- Adoption

If you are pregnant at the time of screening your health professional will discuss whether you wish to consider any prenatal testing for the genetic condition. You will be referred to your local genetic service to discuss this urgently.

CAN REPRODUCTIVE CARRIER SCREENING HARM ME?

The test usually requires a sample of blood or saliva from each individual.

Finding out that one or both parents are genetic carriers will usually be unexpected. It may lead to a range of emotional responses. Further information and support will be given to you by your healthcare provider or by referral to a specialist service.

WHO CAN I ASK TO ORDER THIS TEST?

This test is available through general practitioners, obstetricians, genetic counsellors and geneticists. These tests are currently not covered by Medicare which means there may be costs associated with the test.

DO I NEED TO HAVE REPRODUCTIVE CARRIER SCREENING EVERY TIME I HAVE A BABY?

No, you only need to have this test once in your lifetime. If you are not a genetic carrier, you remain at very low chance of having a child with the genetic conditions that were tested. If you are a genetic carrier and you have a new partner, your new partner may need to be tested.

IF THE TEST SHOWS THAT I AM A GENETIC CARRIER, DO I NEED TO TELL MY FAMILY?

If you are found to be a genetic carrier it is very likely that one of your parents is also a genetic carrier. This means that your siblings and extended relatives may also be genetic carriers and unaware of this. You may wish to share this information with adult family members. Family members can discuss their chance of being a genetic carrier with their healthcare provider or a local genetics service.

IF THE TEST SHOWS THAT I AM A GENETIC CARRIER, CAN I DEVELOP SYMPTOMS?

If you are a genetic carrier of a recessive inherited condition it is very unlikely you would develop symptoms. Some female carriers of X-linked conditions may develop some symptoms.

HOW ARE GENETIC CONDITIONS INHERITED?

Reproductive carrier screening can screen for both recessive and X-linked genetic conditions.

1. **Recessive conditions occur when both parents are genetic carriers of variants in the same gene.**

   For each pregnancy that this couple have together, there is a 1 in 4 (or 25%) chance that the baby will inherit both copies of the faulty gene and be affected by the genetic condition. This applies for both daughters or sons.

   Examples of conditions like this include:

   cystic fibrosis (affects the lungs and digestive system and is a life-limiting condition)

   spinal muscular atrophy Type 1 (Progressive muscular weakness leads to early childhood death without a cure)

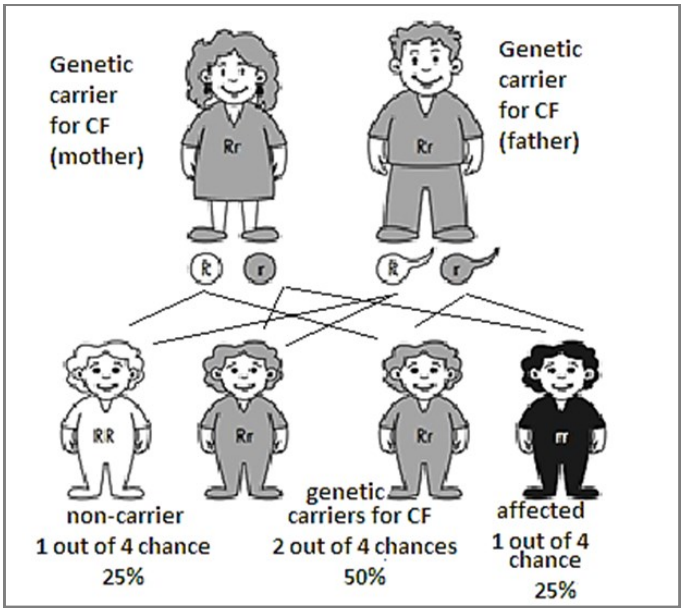

Figure 65.1: *Recessive inheritance where both parents are genetic carriers of a variant in the cystic fibrosis gene. The gene variant is represented by 'r' ; the working copy by 'R'.*

2. **X-Linked conditions occur in males when they inherit a variant from their mother who is a carrier of a variant on one of her X chromosomes.**

   Females have two X chromosomes, one inherited from their mother and one from their father. Males have one X chromosome (inherited from their mother) and a Y chromosome.

   For each pregnancy that this mother has, there is a 1 in 4 (or 25%) chance that the baby is a boy affected by the genetic condition.
   An example of a condition which is inherited in this way is **fragile-X syndrome** (the most common inherited cause of intellectual disability in boys; girls can also be mildly affected).

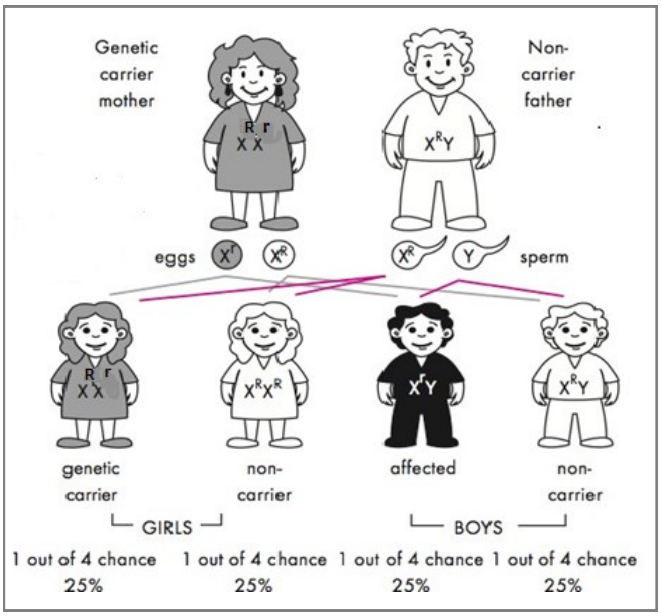

Figure 65.2: *X-linked inheritance where the mother is a genetic carrier of a variant in the fragile-X gene. The gene variant is represented by 'r' ; the working copy by 'R'.*

Archibald, A. *et al.,* Reproductive genetic carrier screening for cystic fibrosis, fragile X syndrome, and spinal muscular atrophy in Australia: outcomes of 12,000 tests. Genet Med. 2018 Apr; 20(5):513-523