Jewish Genetic Diseases

In every ethnic, demographic, or racial group, there are certain inherited disorders that occur more frequently than in the general population. Such is the case for Ashkenazi Jewish individuals whose ancestors lived in Central or Eastern Europe. If you or your spouse is of Ashkenazi Jewish descent, you have the opportunity to be screened to determine if you carry a gene change for these inherited diseases that are more prevalent among Ashkenazi Jews.

What Is Genetic Screening?

Genes are the basic units of heredity passed from parent to child. They occur in pairs, and we inherit one member of each pair from our mother and the other from our father. A change in a gene, known as a mutation, can cause that gene not to work properly. This can lead to disease. Certain diseases are caused when both genes of a pair have mutations. These are recessive diseases. In order to have a child with a recessive disease, each parent has a gene that works properly and a gene that does not. The parents are known as carriers and do not have any health problems related to that disease. Genetic screening can identify carriers by a simple blood test to determine if a couple is at risk to have a child affected with a specific disease.

What If We Are Both Carriers?

If both partners of a couple are identified as carriers for the same disease, they have a 25% risk with each pregnancy to have a child affected with that disease. They also have a 50% chance that their child will be a carrier with no symptoms of that disorder, and a 25% chance that the child will not inherit a gene mutation from either parent. If a couple is at risk to have a child with any of the diseases for which we screen, prenatal diagnosis is available to determine whether or not the fetus is affected. This is possible through either chorionic villus sampling (CVS) at 10-12 weeks of pregnancy or amniocentesis in the second trimester of pregnancy. In addition, there are technologies involving in vitro fertilization (IVF) that provide other reproductive options. When a carrier couple is identified, our genetic counselors can provide information and support which may be helpful in making important family planning decisions.

The Mount Sinai Center for Jewish Genetic Diseases is the oldest center in the country dedicated to the care of patients with genetic disorders that are prevalent in the Jewish community and to conducting research to improve diagnosis and treatment. The Center conducts a Jewish genetic disease screening program which provides expert screening and genetic counseling to individuals at risk for being carriers of these diseases. All services are provided by board-certified genetic counselors and clinical and molecular geneticists.
Diseases Included In The Ashkenazi Jewish Screening Panel

Ideally, both members of a couple should be screened prior to starting a family, or as soon as you learn of your pregnancy, to allow all optional options to be considered. You may decide to be screened for each of the diseases described below or for selected diseases.

Bloom syndrome is a condition in which children grow poorly, have frequent infections and may have learning disabilities and early developmental milestones, and severe mental retardation. Bloom syndrome is a progressive disease of the central nervous system for which there is no treatment. Risk of leukemia is increased. The carrier frequency in the Ashkenazi Jewish population is approximately 1 in 31. Testing for one common mutation allows for a carrier detection rate that is approximately 99%.

Canavan disease is a progressive disease of the central nervous system for which there is no treatment. Risk of blindness is increased. The carrier frequency in the Ashkenazi Jewish population is approximately 1 in 25. Testing for one common mutation allows for a carrier detection rate of at least 95%. Canavan disease is a severe disease that results in the inability to stop insulin production even in the presence of very low blood sugar. For individuals with this disorder, low blood sugar in the newborn period or during childhood results in seizures, poor muscle tone, poor feeding and breathing difficulty. Although the onset and presentation of the disease is variable, it is fatal when untreated. The treatments include glucose infusions and drugs that reduce the metabolic stress in the brain, surgical procedures to remove most of the pancreas. The carrier frequency of familial hyperinsulinism in the Ashkenazi Jewish population is approximately 1 in 68. Screening for two mutations will detect about 90% of non-Jewish, Northern European CF carriers.

Cystic fibrosis (CF) is a progressive, lifelong condition in which the glands that produce mucus, sweat, and intestinal secretions do not function properly. This results in thick mucus accumulation in the lungs, leading to breathing difficulty and infection. CF also causes poor digestion, and makes with this disease are usually intolerable. There is no cure for CF. Supportive treatments are available to improve quality of life, and average life expectancy has increased over the years. While some babies with CF die in infancy, many patients with CF live into their 20s or 30s.

Familial Dysautonomia (FD) is a severe disease of the autonomic nervous system. Autonomic nervous control functions such as swallowing, sweating, the ability to cry with tears and to sense pain, and the control of gastrointestinal and pulmonary complications such as pneumonia. The carrier frequency in the Ashkenazi Jewish population is approximately 1 in 31. Testing for the common mutations provides a carrier detection rate of 99.5%.

Fanconi Anemia (Type C) is a disorder in which the central nervous system progressively degenerates. This causes loss of coordination, seizures, difficulty swallowing, and poor pulmonary function. Symptoms usually appear at about 5 months of age. Eventually, children with Tay-Sachs disease cannot see, speak, sit, crawl, walk, and are unaware of their surroundings. There is no treatment, and average life expectancy is 3–5 years. Approximately 1 in 27 Ashkenazi Jewish individuals are carriers for Tay-Sachs disease.

Glycogen storage disease Ia (GSD Ia) usually presents in infancy. Individuals with GSD Ia often have difficulty controlling their glucose metabolism. As a result, their glucose levels can drop dramatically after meals, or during fasting. This can also be effective on the development of diabetes. The carrier frequency in the Ashkenazi Jewish population is approximately 1 in 64. Testing for two mutations provides a carrier detection rate of at least 95%.

Joubert syndrome 2 (JUB2) is a neurological disorder associated with a specific brain malformation. Symptoms include developmental delay and, often, mental retardation, breathing difficulties, ataxia, failure to thrive, retinal degeneration and renal dysfunction. The carrier frequency in the Ashkenazi Jewish population is approximately 1 in 207. Screening for two common mutations provides a carrier detection rate of about 97%.

Lipoamide dehydrogenase deficiency (E3) is a highly variable disease in its age of onset and clinical presentation. Age of onset can vary from infancy to adulthood. The symptoms can vary from fatigue following mild exertion to, in some cases, episodes of decompensation followed by severe neurological decline and, occasionally, death. Individuals with severe disease are generally diagnosed with severe malnutrition and severe disability. The carrier frequency of this condition in the Ashkenazi Jewish population is approximately 1 in 100. Testing for two mutations provides a carrier detection rate of about 97%.

Maple Syrup Urine Disease (MSUD) manifests in the newborn period and can result in severe neurological complications and death. After ingesting dietary protein, affected infants show signs of neurological impairment including poor suck, irritability, lethargy, and, if untreated, with severe Maple Syrup Into coma. Maple Syrup disease can be effectively managed with dietary treatment that includes restriction of proteins. Early recognition of the disease has been made possible by detection via stool screening for increased levels of branched chain amino acids. Some individuals with intellectual development or neurological complications, particularly as a result of delayed diagnosis, infection, or stress. Although more than one gene has been found to result in MSUD, there is one gene region resulting in the most common form of MSUD. The carrier frequency of mutations in the E1B gene. The carrier frequency of mutations in the E1B gene in the Ashkenazi Jewish population is approximately 1 in 97. Screening for one mutation provides a carrier detection rate of greater than 95%.

Mucolipidosis Type IV (MLIV) is a severe neurodegenerative condition that is characterized by a variable degree of growth and psychomotor retardation. In addition, many patients develop abnormalities of bone, the cornea, and retina. Mutations in this gene do not involve learning disabilities. The carrier frequency in the Ashkenazi Jewish population is about 1 in 100. Testing for this mutation provides a carrier detection rate of approximately 95%.

Niemann-Pick Type A disease is a severe neurodegenerative condition of infancy which cannot be treated. Symptoms, including loss of brain function and enlargement of the liver and spleen, appear by about 6 months of age. Average life expectancy is about 2–3 years of age. The carrier frequency of Niemann-Pick disease in the Ashkenazi Jewish population is approximately 1 in 115. Testing for the common mutations allows a detection rate for carriers of about 97%.

Niemann-Pick disease is a neuromuscular disorder that most commonly has an infantile onset. This disease is characterized by neuronal involvement, particularly involving the tone of muscles in the face, neck, upper limbs, and respiratory tract. A severe disease of the brain, muscle and eyes. It is a severe disease of the brain in which the central nervous system progressively degenerates. This causes loss of coordination, seizures, difficulty swallowing, and poor pulmonary function. Symptoms usually appear at about 5 months of age. Eventually, children with Tay-Sachs disease cannot see, speak, sit, crawl, walk, and are unaware of their surroundings. There is no treatment, and average life expectancy is 3–5 years. Approximately 1 in 27 Ashkenazi Jewish individuals are carriers for Tay-Sachs disease.

Usher syndrome is a disease that is associated with deafness and progressive blindness. There are three different types of Usher syndrome which have been associated with mutations in different genes. In the Ashkenazi Jewish population, mutations for both Usher syndrome Type I and Type III have been identified. Usher syndrome Type I is associated with profound hearing loss and prepubertal onset of retinitis pigmentosa, a disease that impairs vision because of progressive degeneration of the retinal photoreceptors. The carrier frequency of Type I in the Ashkenazi Jewish population is approximately 1 in 147. Screening for one mutation will detect 75% of individuals with Usher syndrome.

Usher syndrome Type III is associated with postnatal onset of moderate to severe hearing loss and variable onset and severity of retinitis pigmentosa. The carrier frequency of Type III in the Ashkenazi Jewish population is 1 in 120. Screening for one mutation will detect 75% of individuals with Usher syndrome.

Walker-Warburg syndrome is a severe disease of the brain, muscle and eyes. It is characterized by muscle weakness, feeding difficulties, seizures, blindness, brain malformations and developmental delay with mental retardation. The carrier frequency of Type I in the Ashkenazi Jewish population is approximately 1 in 120. Testing for one mutation will detect 75% of individuals with Walker-Warburg syndrome.