

## Genetic testing

People often want to know if a genetic test is useful in predicting their chances of developing Alzheimer's disease. The reality in most cases is that genetic testing for Alzheimer's offers limited information about one's chances of developing the disease.

### Genetic mutations that cause Alzheimer's disease

A small percentage of Alzheimer's cases — an estimated 1 percent or less — develop as a result of three genetic mutations that are known to cause the disease. A genetic mutation is an abnormal change in the sequence of chemical pairs that make up genes. These mutations involve the gene for the amyloid precursor protein and the genes for the presenilin 1 and presenilin 2 proteins. Inheriting any of these three genetic mutations guarantees that an individual will develop Alzheimer's disease. In such individuals, disease symptoms tend to develop before age 65, sometimes as early as age 30, while the vast majority of individuals with Alzheimer's have late-onset disease, occurring at age 65 or later.

### Apolipoprotein E (APOE)-ε4 gene

The APOE gene provides the blueprint for a protein that carries cholesterol in the blood. Everyone inherits one form of the APOE gene — ε2, ε3 or ε4 — from each parent. The ε3 form is the most common, with about 60 percent of the U.S. population inheriting ε3 from both parents. The ε2 and ε4 forms are much less common. An estimated 20 to 30 percent of individuals in the United States have one or two copies of the ε4 form; approximately 2 percent of the U.S. population has two copies of ε4. The remaining 10 to 20 percent have one or two copies of ε2.

Having the ε3 form is believed to neither increase nor decrease risk of Alzheimer's, while having the ε2 form may decrease risk. The ε4 form, however, increases the risk of developing Alzheimer's disease and of developing it at a younger age. Those who inherit two ε4 genes have an even higher risk. Researchers estimate that between 40 and 65 percent of people diagnosed with Alzheimer's have one or two copies of the APOE-ε4 gene.

Unlike inheriting one of the three known genetic mutations that cause Alzheimer's, inheriting the ε4 form of the APOE gene does not guarantee that an individual will develop Alzheimer's. This is also true for several genes that appear to increase risk of Alzheimer's but have a limited overall effect in the population because they are rare or only slightly increase risk.

### Genetic testing

Because no treatments are currently available to prevent, slow or stop Alzheimer's disease, the results of genetic testing have no practical impact on medical treatment decisions. However, for the rare families that have a known genetic mutation for Alzheimer's, a genetic test could be helpful because it will show whether an individual family member carries the gene mutation and will eventually develop the disease. For others, a genetic test can show whether an individual has inherited the APOE-ε4 gene variant that increases risk of Alzheimer's but does not guarantee that the disease will develop.

In both cases, individuals should seek the services of a genetic counselor before and after deciding whether to undergo testing. Genetic counselors will ask about your interest in testing, discuss the potential emotional impact of test results and inform you of possible

implications of the test, including how it may affect employment, health insurance, long-term care insurance and future plans. A genetic counselor can be located through the National Society of Genetic Counselors.

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