



## GET THE FACTS:

# Understanding Alzheimer's Genes What is Alzheimer's Disease?

Alzheimer's disease is an illness of the brain where connections among brain cells break down, causing these cells to die. Over time, these dying cells affect how well a person can remember, think, and make judgements about a situation. Alzheimer's disease typically begins slowly and symptoms may not appear for years. And it gradually gets worse over time.

Does Alzheimer's disease run in your family? It depends. Your risk of having the disease may be higher if you have certain inherited genes or certain gene mutations. But that doesn't always mean that you'll develop the disease.



## 10 Fast Facts About Alzheimer's Disease<sup>1</sup>

1. An estimated 6.5 million Americans aged 65 and older are living with Alzheimer's in 2022—and 73 percent are older than 75.
2. Almost two-thirds of Americans with Alzheimer's disease are women.
3. Barring a medical breakthrough, the number of people aged 65 and older with Alzheimer's disease may grow to 12.7 million by 2050.
4. 1 in 3 seniors dies with Alzheimer's disease or another dementia—more than breast cancer and prostate cancer combined.
5. Deaths from Alzheimer's disease have more than doubled between 2000 and 2019, while those from heart disease have decreased.
6. At age 70, those with Alzheimer's disease are twice as likely to die before age 80 than those who do not have the disease.
7. People aged 65 and older survive an average of four to eight years following diagnosis, though some live as long as 20 years with Alzheimer's disease.
8. About one-third of people with mild cognitive impairment (MCI) due to Alzheimer's disease develop dementia within 5 years of diagnosis.
9. The U.S. will have to nearly triple the number of geriatricians to effectively care for the number of people projected to have Alzheimer's disease in 2050.
10. Elderly people living with Alzheimer's disease or other dementias make up a large proportion of all older people who receive adult day services and nursing home care—and have more skilled nursing facility stays and home health care visits per year than other older people.



<sup>1</sup> Alzheimer's Association, [alz.org](https://www.alz.org), retrieved 10/01/2022



## *Agnes' Story*

I've always prided myself on being organized and paying our bills on time. So when I found myself constantly searching for the right word and losing my keys, I began to worry. But then I missed 2 mortgage payments and my husband started to worry. Because some of my family members have had Alzheimer's disease—my dad started having memory loss in his 60s and I'm 64 now—we decided to make an appointment with my doctor. The doctor asked about my health and my family history, and I told him about my dad. He said that many things, like depression or a side effect of some medications, can also cause memory problems. He ordered some tests to help rule out Alzheimer's disease.

## Getting into the Genes

Genes are passed down from your biological parents and are found in every cell in your body, except red blood cells. Not only do they help keep cells healthy, but genes also carry the codes that define physical traits, such as hair color, eye color, and height. Gene mutations or variations—even small changes—can cause diseases, such as Alzheimer’s disease and other dementias.

### Genes linked to Alzheimer’s disease

A human being has 23 chromosomal pairs which contain all of the 30,000 genes that code his or her biological blueprint.

Those with the rare early-onset Alzheimer’s disease often have familial Alzheimer’s disease (FAD) which is caused by an inherited change in one or more genes—namely amyloid precursor protein (APP), presenilin-1 (PS-1), and/or presenilin-2 (PS-2). But some with early-onset Alzheimer’s disease do not have FAD and it’s unclear why they get the disease.

On the other hand, the risk for the more common late-onset Alzheimer’s disease increases with age and the presence of the apolipoprotein E-e4 (APOE 4) gene, though this gene is not always found in late-onset Alzheimer’s disease. The cause likely involves a mix of genetic, lifestyle, and environmental factors.

### Differences Between Early-Onset and Late-Onset Alzheimer’s Disease

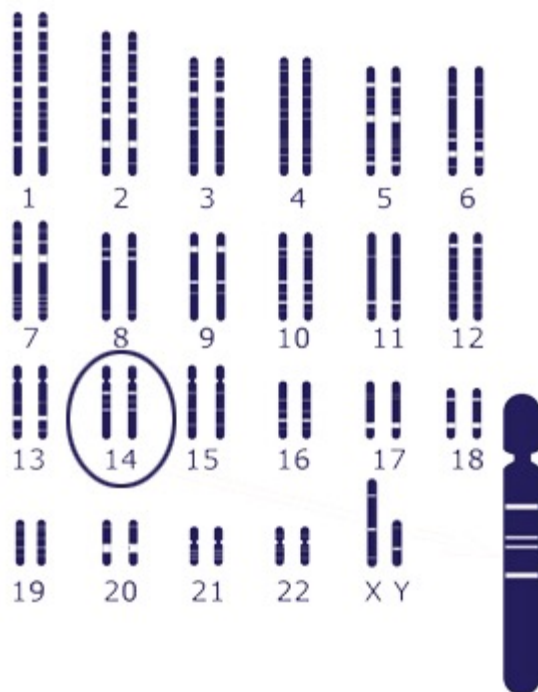
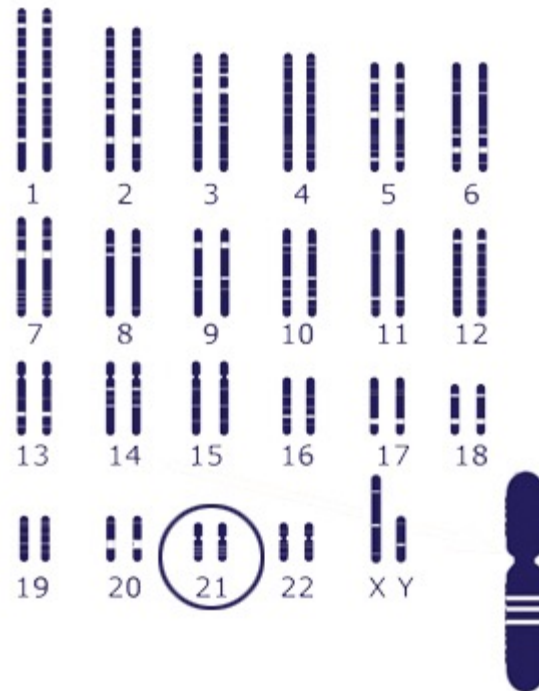
	Early Onset	Late Onset
<b>Inherited?</b>	Yes (generally)	No (generally)
<b>Genes involved</b>	May be related to three gene mutations (APP, PS-1, and PS-2)	May involve a gene called APOE 4
<b>When signs first appear</b>	Between 30-60 years old	In the mid-60s
<b>Prevalence</b>	>10%	60-65%
<b>Frequency</b>	Very rare	Most common

<sup>2</sup> “Cognitive Distortions and Stress,” VeryWellMind.com, 11/24/2020.

## Drilling Down into Alzheimer's Disease-Related Genes

- **Amyloid precursor protein (APP)** – Discovered in 1987 on chromosome 21, this was the first gene with mutations found to cause an inherited, early-onset form of Alzheimer's.

Source: Alzheimer's Association, alz.org.

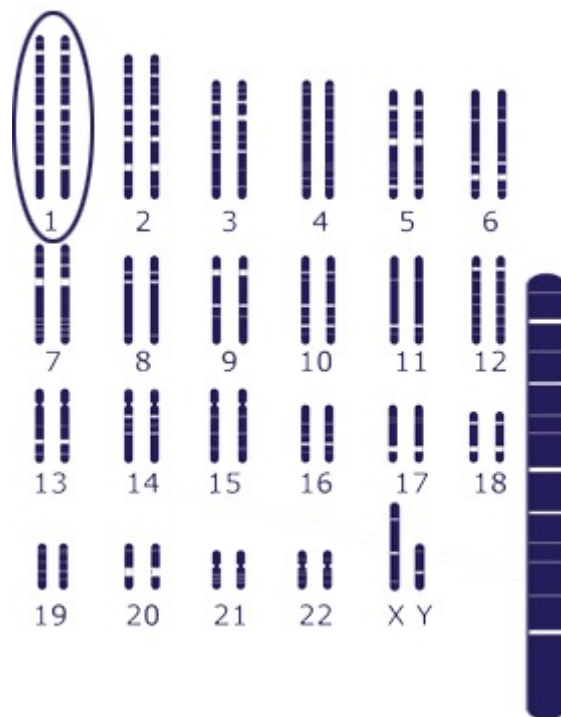


- **Presenilin-1 (PS-1)** – Discovered in 1992, PS-1 on chromosome 14 is the second gene with mutations found to not only cause inherited, early-onset Alzheimer's disease but it is also the most common cause.

Source: Alzheimer's Association, alz.org.



- **Presenilin-2 (PS-2)** – Discovered in 1993, PS-2 on chromosome 1 is the third gene with mutations found to cause inherited, early-onset Alzheimer's disease.



Source: Alzheimer's Association, alz.org.

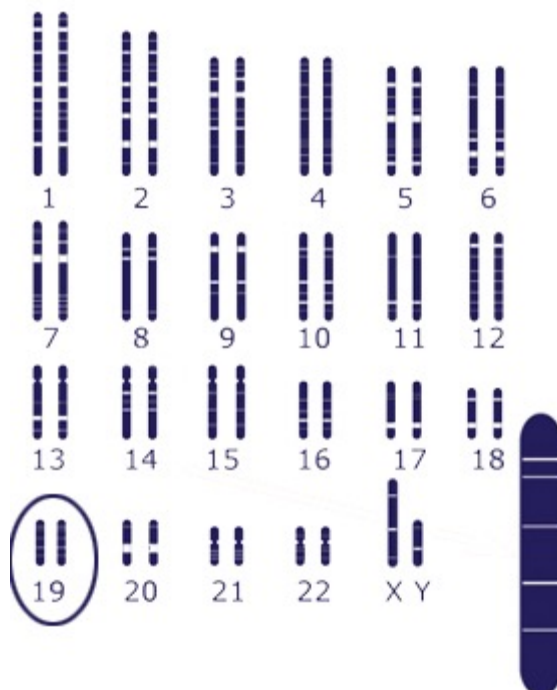




- **Apolipoprotein E-e4 (APOE 4)** – Researchers have not found a gene that directly causes late-onset Alzheimer’s disease but having a genetic variant of the APOE gene on chromosome 19 does increase the risk. Discovered in 1993, APOE 4 is the first risk gene identified and remains the gene with strongest impact on risk. Between 40-65% of people diagnosed with Alzheimer’s have the APOE 4 gene. But having this risk gene does not mean that you or your loved one will develop the disease.

The APOE gene has different forms called alleles. An allele will be passed down from each biological parent. APOE 2 is relatively rare and may provide some protection against Alzheimer’s disease, while the most common allele, APOE 3, neither increases nor decreases risk. However, APOE 4 increases risk for Alzheimer’s disease and is also associated with an earlier age of disease onset.

Even still, inheriting an APOE 4 allele does not mean that you will develop Alzheimer’s disease. There are those who develop Alzheimer’s disease who do not have any APOE 4 alleles.



Source: Alzheimer’s Association, alz.org.



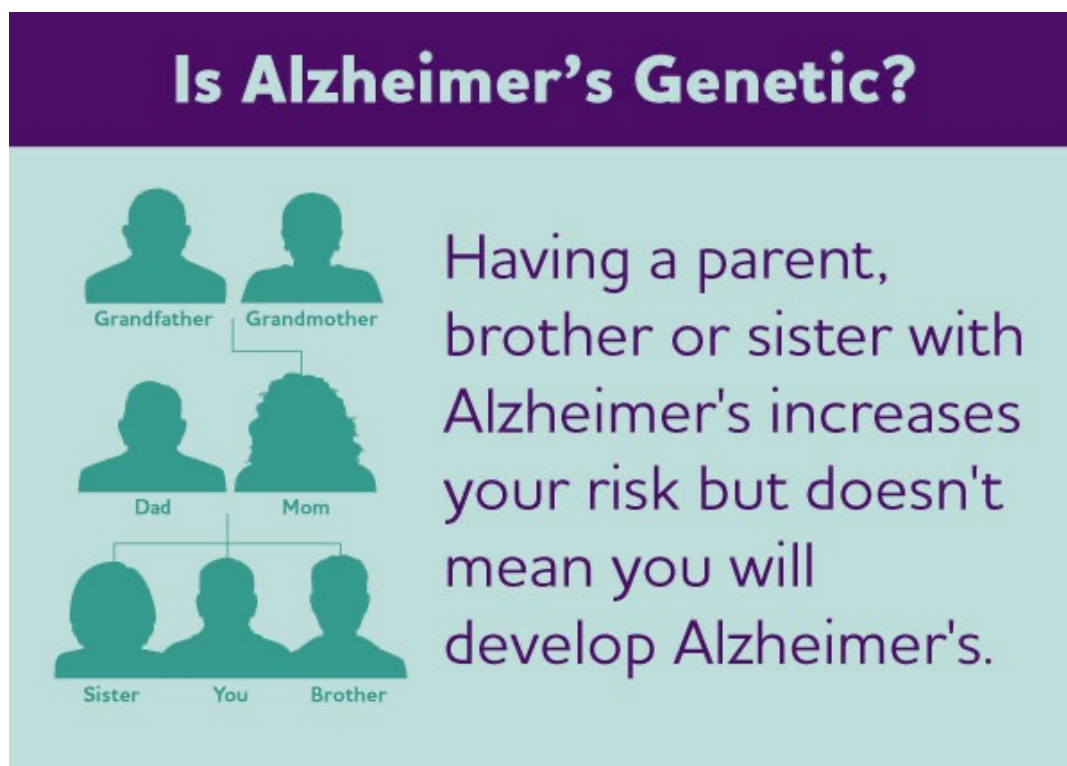
## *Quentin & Quincy's Story*

As identical twins, we found out in our early 70s that we had Alzheimer's disease. I was diagnosed at 71 and Quincy at 73. It wasn't exactly a surprise as it seems to run in our family. Fortunately, we've always lived together so if I forget something, Quincy usually remembers it and vice versa. The nice thing is that our two younger sisters call every day to check in on us and take us shopping once a week or so. They've also helped us make plans for where we can live later on when we need more care. It's nice to know that we can go through this together and still live together when we can no longer live at home. I don't know what I'd do without Quincy.



## Genes Do Not Equal Destiny

Your or your loved one's genes can affect how likely you or they are to develop Alzheimer's disease or other dementias. Or they won't have an impact at all.



Source: Alzheimer's Association, alz.org.



### The link between Down syndrome and Alzheimer's disease

People with Down syndrome are born with an extra copy of chromosome 21, known as trisomy 21, which carries a gene that increases the risk of Alzheimer's disease. This type of Alzheimer's is not hereditary but many people with Down syndrome—though not all—develop Alzheimer's disease as they get older.

In fact, about 30% of people with Down syndrome who are in their 50s have Alzheimer's dementia—but it jumps to about 50% for those in their 60s.

### Should I get an at-home DNA test?

Speak with a genetic counselor before deciding to take or give your loved one an at-home test for Alzheimer's disease and other dementias (or any other diseases). If you do decide to take a genetic test, be sure to speak with your genetic counselor who can help you interpret the results and think through any ramifications. You can find a genetic counselor through the National Society of Genetic Counselors (see Resources).

If you or your loved one is already experiencing symptoms of cognitive decline, skip the at-home DNA test and see a healthcare professional for a complete evaluation.

## 6 Tips for Preventing and/or Slowing Alzheimer's Disease

Alzheimer's disease, the most common form of dementia, is characterized by the accumulation of two types of protein in the brain: tangles (tau) and plaques (amyloid-beta). Ultimately, they both kill brain cells and take people's lives.

While there are medications that can treat some of the symptoms of Alzheimer's disease—and a conditionally approved drug that can slow the progression of the disease—they are not a cure. Your best bet is to hone healthy habits which may help ward off or slow the progression of Alzheimer's disease. Consider the following tips:<sup>2</sup>

1. **Eat a healthy diet** – A healthy diet—that includes fresh fruits and vegetables, whole grains, olive oil and other healthy fats, nuts, legumes, fish, occasional red meat, and moderate amounts of poultry, eggs, dairy, and red wine—has been shown to delay or slow the progression of Alzheimer's disease. In fact, even partial adherence to specific diets—such as the Mediterranean, DASH, or MIND diet—is better than nothing!
2. **Exercise moderately** – There is evidence that physical exercise helps delay the onset or slow the progression of Alzheimer's disease in people who have symptoms. Experts recommend 30 minutes of moderately vigorous aerobic exercise, three to four days per week.
3. **Get enough sleep** – Growing evidence suggests that getting good sleep—7-8 hours per night—not only positively impacts your health, it's linked to greater amyloid clearance from the brain, which can help prevent Alzheimer's disease.
4. **Work your brain** – Cognitively stimulating activities, such as learning new things, may help prevent Alzheimer's disease. Note that this is often limited to improvement on a learned task, such as a thinking skills test, which does not generalize to overall improvement in cognition and activities of daily living.
5. **Make social connections** – While it's only been observed, greater social contact with others may help prevent Alzheimer's disease.
6. **Drink moderately** – There's conflicting evidence about the benefit of moderate alcohol intake—one drink per day for women, two for men—and a reduced risk of Alzheimer's disease. Red wine, in particular, may provide a benefit though it's not yet proven.

Our best advice is to make the most of your healthy lifestyle choices. If nothing else, it will help your overall health—for example, reduce high blood pressure and manage diabetes, which may be risk factors for Alzheimer's disease—and they may help you avoid Alzheimer's disease and other dementias.


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<sup>2</sup>"What Can You Do to Avoid Alzheimer's Disease?" Harvard Health Publishing, Harvard Medical School, 07/31/2019.



## *Lizzie's Story*

I like spending time with my grandmother who has Alzheimer's disease. Though she's changed from the person she used to be, I now have a better understanding of the disease and can be more patient with her. My mom, who usually takes care of my grandma, just learned that her sister—my Aunt Gretchen—is showing signs of memory and cognitive changes and is getting evaluated for Alzheimer's disease. This is scary...will my mom get it, too? Will I? I did a little research and asked my doctor about it at my last appointment. Though he can't tell me for sure if I'll get it, he gave me some pretty good advice about eating right, exercising, getting good sleep, and just staying healthy overall.



## Resources

### **Alzheimer's and Related Dementias Education and Referral (ADEAR) Center**

National Institutes of Health (NIH)  
[www.nia.nih.gov/health/alzheimers](http://www.nia.nih.gov/health/alzheimers)  
Email: [adear@nia.nih.gov](mailto:adear@nia.nih.gov)  
Phone: 1.800.438.4380

### **Alzheimer's Association**

[www.alz.org](http://www.alz.org)  
Phone: 1.800.272.3900 (24/7 helpline)

### **Alzheimer's Foundation of America**

[www.alzfdn.org](http://www.alzfdn.org)  
Phone: 1.866.232.8484

### **National Human Genome Research Institute**

[www.genome.gov](http://www.genome.gov)  
Phone: 301.402.0911

### **National Institute on Aging (NIA)**

[www.alzheimers.gov](http://www.alzheimers.gov)

### **National Society of Genetic Counselors**

[www.FindaGeneticCounselor.NSGC.org](http://www.FindaGeneticCounselor.NSGC.org)



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