Alzheimer's Disease

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Introduction History

Alzheimer's disease (AD) is a progressive brain disorder and the leading cause of dementia worldwide. It was first identified in 1906 by Dr. Alois Alzheimer, a German doctor, who found unusual clumps of proteins (amyloid plaques) and twisted fibers (tau tangles) in a patient's (Auguste Deter) brain after her death, marking AD as a unique condition rather than a normal part of aging.

History

Originally, AD was thought to be rare and mainly affected younger people (early-onset Alzheimer's). In the mid-20th century, scientists discovered the same brain changes in older people with dementia, leading to a broader understanding of AD that included both early and late-onset cases. This shift highlighted its significant public health impact. Research breakthroughs like the amyloid cascade theory in the 1980s suggested that the buildup of amyloid-beta proteins plays a key role in the disease, and advanced imaging techniques like positron emission tomography (PET) scans now allow doctors to observe these brain changes even before symptoms appear.

Today, Alzheimer's is understood as a disease caused by many factors, including genetics, lifestyle, and environment. Although there is still no cure, early diagnosis, and treatments can slow down the symptoms and improve the quality of life for patients and their families

Cause

There are many factors that would increase the risk of gaining Alzheimer's disease, such as genetic factors, head injuries, vascular diseases and most importantly, increase in age. Aging is the most significant risk factor due to reduced brain plasticity overtime, which refers to the brain's ability to adapt to environment and information. Combined with cumulative damage from lifestyle such as diet, physical activity, and mental stimulation, the likelihood of developing Alzheimer's disease, especially after the age of 65, will largely increase.

There are two major hypotheses behind the cause of Alzheimer's disease in terms of understanding the biological mechanisms, which are the cholinergic and amyloid hypotheses. For the cholinergic hypothesis, it suggests that Alzheimer's disease is caused by a lack of acetylcholine, a neurotransmitter in the brain's nerve cells that is important for memory and learning. As a result, lack of chemical emission will disrupt communication between nerve cells and lead to cognitive impairment. On the other hand, the amyloid hypothesis provides a theory that suggests that Alzheimer's disease is caused by accumulation of abnormal proteins, called amyloid-beta peptides (Aβ), in the brain's nerve cells. These proteins form plaques at the end of each nerve cell that disrupt communication between cells and trigger cell death, especially in areas involved in memory and learning. Over time, these causes will gradually lead to conditions such as memory loss, confusion and brain shrinkage.

Symptoms & Stages

As a progressive disease, Alzheimer's is a condition that can be classified into multiple stages. The preclinical phase of Alzheimer's disease is the period in which individuals do not

display visible symptoms, it is usually identified through clinical procedures like getting a brain scan.

Signs of Mild/Preclinical Alzheimer's disease:

- Memory loss that disrupts daily life (forgetting recent information or repeating questions)
- Lose track of dates and locations
- Take longer to complete familiar tasks, and experience challenges with planning or problem-solving
- Misplacing items in unusual places
- Wandering and getting lost
- Difficulty with daily activities like bathing

Signs of Moderate Alzheimer's disease:

In the moderate stage of Alzheimer's, the individual requires more assistance and depends on others for everyday life routines. In this stage, symptoms become more apparent to the patient and those around them. Patients can take medications to help alleviate some of their symptoms.

- Increased confusion and memory loss, such as forgetting events, personal history, and family & friends
- Withdrawal from social events
- Inability to learn new things
- Shortened attention span
- Problems coping with new situations

- Changes in sleeping patterns, such as sleeping more during the day and being restless at night
- Hallucinations, delusions, and paranoia
- Inappropriate emotional outbursts (anxiety, tearfulness, agitations), especially in the late afternoon or evening

Signs of severe Alzheimer’s disease

As Alzheimer's disease progresses into the late stage, the individual will lose almost all ability to carry out actions independently. Patients would have severe memory loss, they can not identify their surroundings and remain unaware of their whereabouts. They usually lose physical and cognitive abilities. Individuals lose the ability to respond to their environment appropriately, they require extensive care, and the individual becomes entirely dependent on their caregivers. Patients usually don’t live long after they enter the late stage of Alzheimer's as they will eventually lose control over basic functions of life

- Inability to communicate
- No awareness of recent activities and surroundings
- Weight loss with little interest in eating
- General physical decline, including dental, skin, and walking problems
- Difficulty of swallowing and grunting
- Increased sleeping

A common cause of death for people with Alzheimer’s is aspiration pneumonia, which means it develops when a person cannot swallow properly and takes food or liquids into lungs instead of air.

Prevention

While Alzheimer's disease cannot be completely prevented, healthy lifestyle choices may lower the risk or slow its progression. A good starting point is focusing on overall health, including a balanced Mediterranean diet. This diet features fruits, vegetables, whole grains, legumes, fish, and olive oil, which support brain and heart health while reducing the risk of high blood pressure and diabetes—conditions linked to dementia.

Avoiding smoking and limiting alcohol is important, as both can increase cognitive decline risks. Regular physical activity, like brisk walking or cycling for 150 minutes a week, improves blood flow to the brain, lowers blood pressure, and promotes well-being. Exercise also reduces the chances of stroke and depression, which are tied to cognitive decline.

Keeping mentally and socially active is another effective strategy. Activities like reading, learning new skills, or volunteering help maintain brain function, while puzzles or new hobbies challenge the mind. Building strong social connections provides emotional support and protects against cognitive decline.

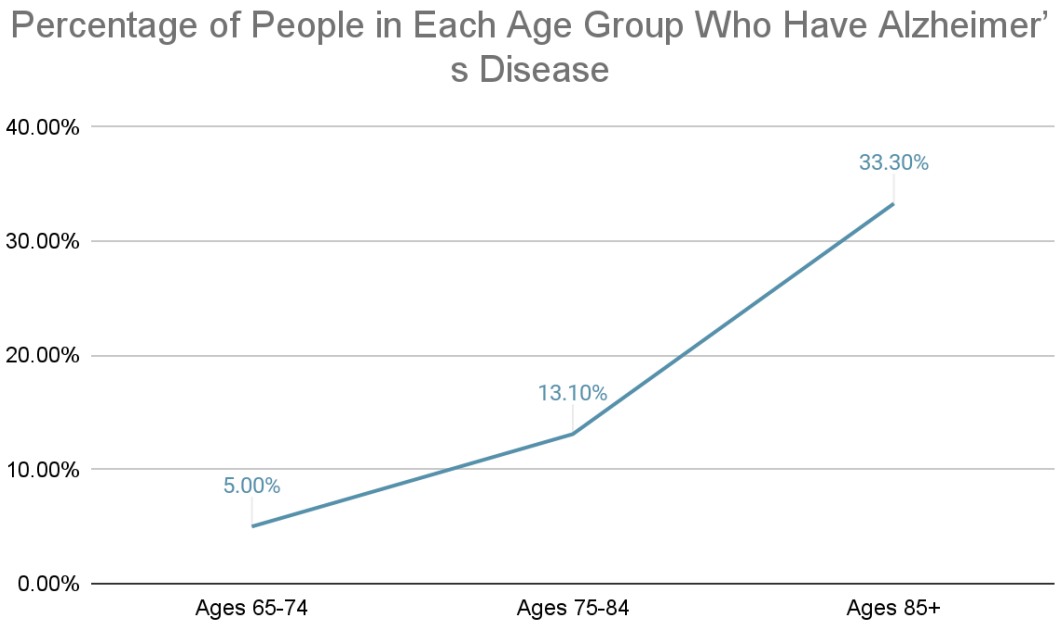
Sleep is equally critical. You should aim for 7-8 hours a night to help clear harmful brain plaques linked to Alzheimer's. Lastly, regular health checkups to manage conditions like high blood pressure and diabetes can further reduce dementia risks.

Treatment

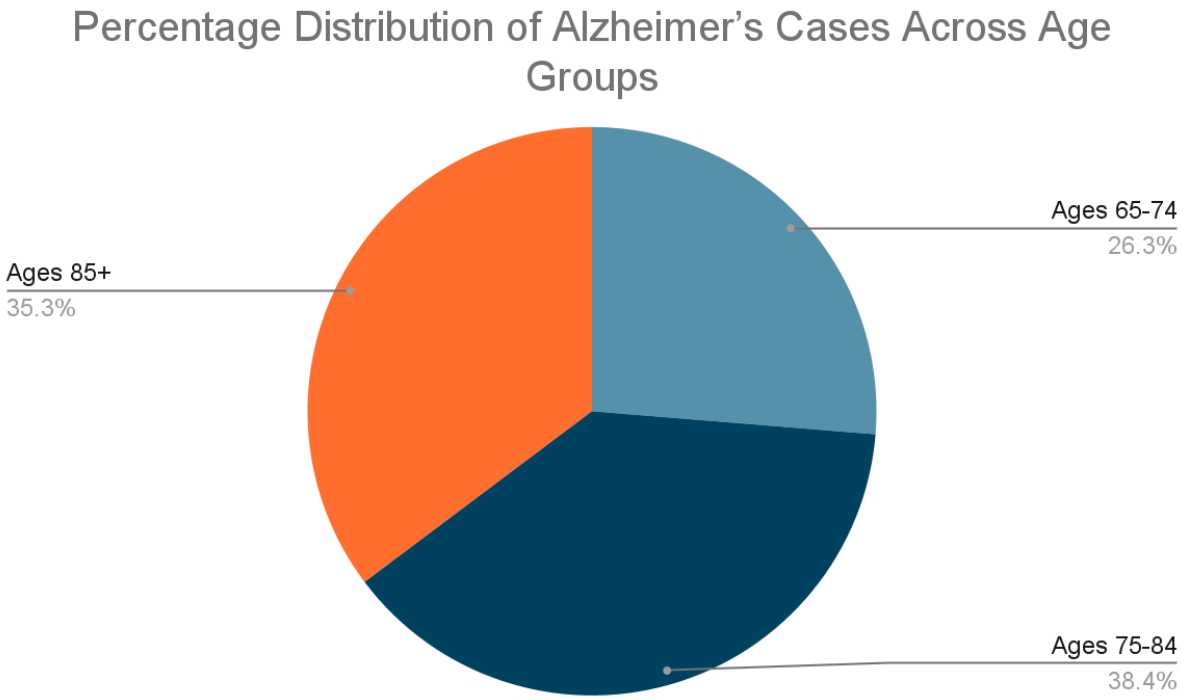
As of right now, the best way to control Alzheimer's disease is through medication. Some of the most effective and popular medications prescribed to Alzheimer patients are Galantamine, benzgalantamine, rivastigmine, and donepezil. These medications are cholinesterase inhibitors, a class of drugs that treat symptoms of memory, thinking, and language by preventing the

breakdown of acetylcholine, that are prescribed for mild to moderate Alzheimer's symptoms. They help reduce and or control cognitive and behavioral symptoms. These Cholinesterase inhibitors prevent the breakdown of acetylcholine, a chemical that is important for memory, which is crucial for Alzheimer's disease. Over time, Alzheimer's disease causes the brain to produce less acetylcholine, soon these medications will decrease in effectiveness. Therefore, Alzheimer's disease as time progresses will end up unable to be cured or treated. In early stages of Alzheimer's disease, Lecanemab and Donanemab are two FDA-approved immunotherapy drugs that can be used.

Statistics



Note: The data was obtained from Taxes Health Services *What is Alzheimer's Disease?FAQs*



Note: The data was obtained Statista *Alzheimer's Distribution by age group U.S. 2024*

The chance of getting Alzheimer's disease rises with age. This is due to natural brain aging and reduced brain repair mechanisms, which are unavoidable. As shown in the graph above, 5% of individuals aged 65 to 74 have the disease, increasing to 13.1% for those aged 75 to 84, and 33.3% for those 85 and older.

In terms of total cases, 38.6% of Alzheimer's patients are in the 75 to 84 age group, followed by 35.4% in the 85 and older group; although those above 85 have the highest risk, the largest number of cases is found in the 75 to 84 group due to their larger population size.

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