THE DEMENTIAS

Hope Through Research

LEARN ABOUT:

- Types of dementia
- Risk factors
- Diagnosis and treatment
- Current research

National Institutes of Health

National Institute of Neurological Disorders and Stroke
National Institute on Aging

The National Institute of Neurological Disorders and Stroke (NINDS) and the National Institute on Aging (NIA) are part of the National Institutes of Health, the nation's medical research agency—supporting scientific studies that turn discovery into health.

NINDS is the nation's leading funder of research on the brain and nervous system. The NINDS mission is to seek fundamental knowledge of the brain and nervous system and to use that knowledge to reduce the burden of neurological disease. For more information and resources, visit *www.ninds.nih.gov* or call 1-800-352-9424.

NIA leads the federal government effort to conduct and support research on aging and the health and well-being of older people. NIA's Alzheimer's and related Dementias Education and Referral (ADEAR) Center offers information and publications on dementia and caregiving for families, caregivers, and professionals. For more information, visit *www.nia.gov* or call 1-800-438-4380.

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Introduction

A diagnosis of dementia can be frightening for those receiving the diagnosis, their family members, and caretakers. Learning more about this medical condition can help. This booklet provides a general overview of various types of dementia, describes how the disorders are diagnosed and treated, and highlights research that is supported by the National Institute of Neurological Disorders and Stroke and the National Institute on Aging, which are part of the National Institutes of Health (NIH).

Alzheimer's disease and Alzheimer's disease-related dementias have a high impact on public health and are a priority for NIH-supported research. Within the past several decades, researchers have made great strides toward better understanding of what causes Alzheimer's disease and related dementias. Yet much is still unknown. Researchers are still trying to understand the underlying disease processes involved in dementia and the complex interplay of genetic, lifestyle, and environmental factors involved. Scientists have theories about mechanisms that may lead to different forms of dementia, but more research is needed to better understand if and how these mechanisms are involved.

The Basics of Dementia and Cognitive Impairment

Dementia is the severe loss of cognitive functioning (the ability to think, remember, or reason) that interferes with a person's daily life and activities. Signs and symptoms of dementia result when once-healthy neurons (nerve cells) in the brain stop working, lose connections with other brain cells, and die. While everyone loses some neurons as they age, people with dementia experience far greater loss.

Dementia ranges in severity from the mildest stage, when it is just beginning to affect a person's functioning, to the most severe stage, when the person must depend completely on others for basic activities of daily living.

Symptoms of dementia can include:

- problems with thinking, reasoning, memory, judgment, and planning
- difficulties learning new skills
- problems with self-management and performing everyday activities
- changes in behavior and mood
- changes in the ability to speak, understand, and express words
- problems with the ability to focus and pay attention
- impulsiveness, hallucinations, misbeliefs, and fears
- repeated questions and conversations
- personality changes

Age is the primary risk factor for developing dementia. For that reason, experts estimate the number of people living with dementia will increase substantially in the next 40 years, as the U.S. population age 65 and older increases from more than 54 million today to more than 94 million in 2060. For example, it is estimated that more than 6 million Americans age 65 and older are now living with Alzheimer's disease (AD), one of the several forms of dementia. The estimate increases to more than 13.8 million Americans who may be living with Alzheimer's in 2060 if no progress is made on treatments or prevention. Regardless of the form of dementia, the personal, economic, and societal demands can be devastating.

Dementia is not the same as forgetfulness or some slowing in thinking and information processing as we age. Occasional bouts of forgetfulness are normal in older adults. While dementia is more common with age (about one-third of all people age 85 or older may have some form of dementia), it is not an inevitable part of aging. Many people live into their 80s and beyond without any signs of dementia.

Dementia is also not the same as delirium, which is usually a short-term complication of a medical condition and most often can be treated successfully.

Mixed dementia is a term used when a person is affected by more than one type of dementia. It is common for people with dementia to have more than one cause of their symptoms. Many people with the condition have both AD and one or more closely related disorders that share features with AD.

Brain autopsy studies of people who had dementia suggest that many of them had dementia caused by a combination of AD-related processes, vascular disease-related processes (affecting the blood vessels), and/or another condition that involves the loss of nerve cell function or structure and nerve cell death (called neurodegeneration). In fact, some studies indicate that mixed dementia is the most common cause of dementia in older adults.

Mild cognitive impairment (MCI) is a stage between normal cognition and the more serious symptoms that indicate dementia. Symptoms of MCI can include problems with thinking, judgment, memory, and language, but the loss doesn't significantly interfere with the person's ability to handle everyday activities. Other symptoms of MCI include difficulty with planning or organization, trouble finding words, frequently losing or misplacing things, and forgetting names, conversations, and events. Someone who has MCI may be at greater risk of eventually developing AD or another type of dementia, particularly if the degree of memory impairment is significant, but MCI doesn't always progress to dementia. Symptoms may remain stable for several years or improve over time in some persons, and may even result from some reversible causes, such as certain medications, stress, or lack of sleep.

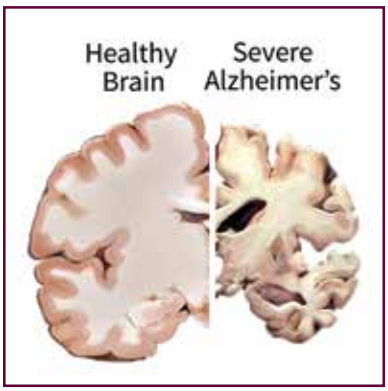
Dementias Associated with Aging and Neurodegeneration

Various disorders and factors contribute to dementia, resulting in a progressive and irreversible loss of neurons and brain functions. Currently there are no cures for these disorders.

Some specific causes of dementia disorders are explained below.

Alzheimer's disease (AD) is the most common cause of dementia in older adults. More than 6 million Americans age 65 and older may have AD. Like other forms of dementia, the risk increases with age, but it can also occur in midlife, between a person's 30s and mid-60s. Early-onset AD represents less than 10 percent of all people with the disease.

In neurodegenerative diseases, certain proteins abnormally clump together and are thought to damage healthy neurons and their connections, causing them to stop functioning and die. In AD, fragments of a protein called amyloid form abnormal clusters called plaques between brain cells and a protein called tau forms harmful tangles inside nerve cells. Researchers don't know exactly why these clumps form.



Symptoms of AD include changes in thinking, behavior and personality, and reasoning. Damage to the brain may start a decade or more before memory and other cognitive problems appear. The damage often initially appears to take place in the hippocampus, the part of the brain essential in forming memories. Ultimately, the abnormal plaques and tangles spread throughout the brain, and brain tissue significantly shrinks.

People experience greater memory loss and other cognitive difficulties as AD progresses. In early-stage AD, problems can include wandering and getting lost, trouble handling money and paying bills**,** repeating questions, taking longer to complete normal daily tasks, and personality and behavior changes. People are often diagnosed in this stage.

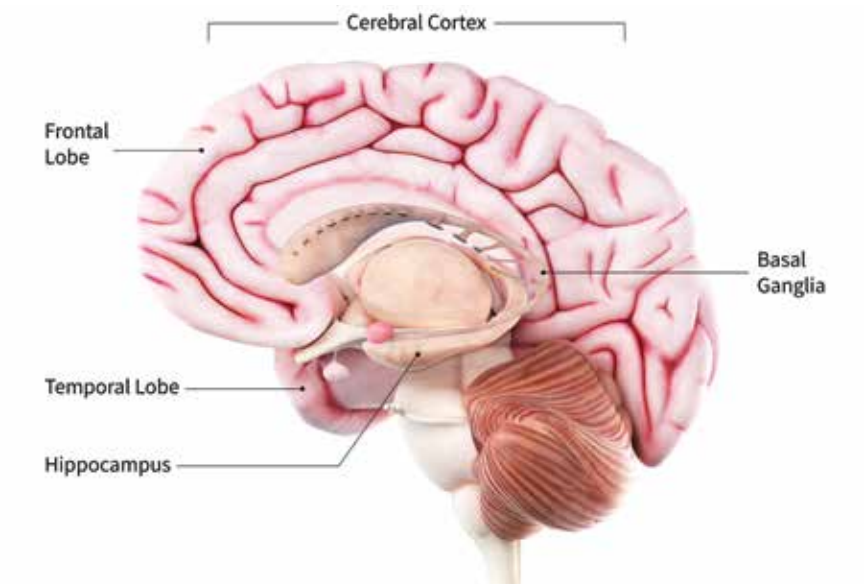
In middle-stage AD, memory loss and confusion worsen, and people begin to have problems recognizing family and friends. They may be unable to learn new things, carry out multi-step tasks such as getting dressed, or cope with new situations. In addition, people at this stage may have hallucinations, delusions, and paranoia and may behave impulsively.

People with severe AD cannot communicate and are completely dependent on others for their care. Near the end, the person may be in bed most or all of the time as the body's functions shut down.

There are no treatments that can stop the progression of AD, but certain drugs can temporarily slow worsening of some symptoms. For more information on Alzheimer's disease, visit the Alzheimer's and related Dementias Education and Referral (ADEAR) Center at ***www.alzheimers.gov***.

In some cases of early-onset AD, genetic mutations have been associated with the disease. But in most cases, researchers have not found a single gene solely responsible for AD; rather, multiple genes are likely involved. One genetic risk factor—having the ε4 form of the apolipoprotein E *(APOE)* gene on chromosome 19—increases a person's risk for developing AD. Having this genetic variant is linked to an earlier onset of memory loss and other symptoms and leads to an increased number of amyloid plaques in the brain. However, not everyone who inherits *APOE ε4* will develop AD.

Frontotemporal disorders (FTD, sometimes called frontotemporal dementia) are forms of dementia caused by a family of neurodegenerative brain diseases that primarily affect the frontal and temporal lobes of the brain. In FTD, changes to nerve cells in the brain's frontal lobes affect the ability to reason and make decisions, prioritize and multitask, act appropriately, and control movement. Changes to the temporal lobes affect memory, how people understand words, recognize objects, and recognize and respond to emotions. This "frontotemporal lobar degeneration" is different than the widespread shrinking and wasting away (atrophy) of brain tissue seen in AD.



Early in the disease, frontotemporal disorders do not affect other areas of the brain. Different symptoms appear later in the disease as more parts of the brain become affected. Some people decline rapidly over 2 to 3 years, while others show only minimal changes for many years. People can live with FTD for up to 10 years, sometimes longer, but it is difficult to predict because the timing can vary from person to person.

Types of FTD include:

- ***Behavioral variant frontotemporal dementia*** (bvFTD) involves changes in behavior, judgment, and personality. People with this disorder may have problems with cognition, but their memory may stay relatively intact. They may do impulsive things that are out of character or may engage in repetitive, unusual behavior. People with bvFTD also may say or do inappropriate things or become disinterested in family or activities that they used to care about. Over time, language and/or movement problems may occur.

  In the past, bvFTD was called Pick's disease, named after the scientist who first described it in 1892. The term "Pick's bodies" is now sometimes used to describe abnormal collections of the protein tau that accumulate inside nerve cells in the brain. Some people living with bvFTD and primary progressive aphasia have Pick's bodies in the brain, and some do not.
- ***Primary progressive aphasia*** (PPA) involves progressive changes in the ability to speak, write, read, and understand and express thoughts and/or words. Many people with PPA develop symptoms of dementia. Problems with memory, reasoning, and judgment can develop and progress over time. Sometimes a person with PPA cannot recognize the faces of familiar people and common objects. Other individuals have increasing trouble producing speech and may eventually be unable to speak at all. PPA is a language disorder that is different from the problems with speech and the ability to read and write that can result from a stroke.

Movement disorders in FTD that affect muscle or motor (movement) function are:

- Corticobasal degeneration (CBD) is a progressive disorder characterized by abnormal buildup of the protein tau, nerve cell loss, and atrophy in multiple areas of the brain. CBD can affect memory, behavior, thinking, language, and movement. The disease is named after parts of the brain that are affected—the cerebral cortex (the outer part of the brain) and the basal ganglia (structures deep in the brain involved with movement). Not everyone who has CBD has problems with memory, cognition, language, or behavior. It tends to progress gradually, with early symptoms beginning around age 60. Some of the movement symptoms of CBD are similar to those seen in Parkinson's disease.
- **FTD with Motor Neuron Disease** (also called FTD-ALS) is a combination of bvFTD and the progressive neuromuscular weakness typically seen in amyotrophic lateral sclerosis (ALS). ALS is a neurodegenerative disease that attacks nerve cells responsible for controlling voluntary muscle movement (those muscles we choose to move). Symptoms of either disease may appear first, with other symptoms developing over time.
- **Progressive supranuclear palsy** (PSP) can cause problems with thinking, memory, mood and behavior, problem solving, and changes in judgment. It also affects walking and balance, the control of eye movements, speech, swallowing, vision, concentration, and language. Because certain parts of the brain that control movement are damaged, PSP shares some of the problems with movement seen in people with CBD and Parkinson's disease.

Lewy body dementia (LBD) is one of the most common causes of dementia, after AD and vascular disease. It typically begins after age 50 or older but can occur earlier.

In the early stages of LBD, symptoms can be mild, and people can function fairly normally. Initial symptoms may vary, but over time, people with LBD develop similar cognitive, behavioral, physical, and sleep-related symptoms. People with LBD live an average of five to eight years, but sometimes as long as 20 years, following diagnosis.

LBD involves abnormal buildup of the protein alpha-synuclein into Lewy bodies, which are balloon-like structures that form inside of nerve cells.

LBD includes two related conditions—*dementia with Lewy bodies* and *Parkinson's disease dementia*. Both types cause similar changes in the brain, but those changes start in different areas of the brain. The distinguishing difference between them lies largely in the timing of symptoms. In both conditions, people experience movement symptoms called parkinsonism, which include tremor, difficulty with walking and posture, and rigid muscles. In dementia with Lewy bodies, cognitive symptoms begin within a year of parkinsonism. In Parkinson's disease dementia, the cognitive problems develop more than a year after the movement problems begin.

- ***Dementia with Lewy bodies*** (DLB) is a progressive dementia in which dopamine-producing neurons in the substantia nigra (a part of the brain that has an important role in movement) die or become impaired. Symptoms such as difficulty sleeping, loss of smell, and visual hallucinations often precede movement and other problems by as many as 10 years. Later in the course of DLB, some signs and symptoms are similar to AD and may include memory loss, poor judgment, and confusion. Other signs and symptoms of DLB are similar to those of Parkinson's disease, including difficulty with movement and posture, a shuffling walk, and changes in alertness and attention. There is no cure for DLB, but there are medications that control some symptoms.

- ***Parkinson's disease dementia*** (PDD) can occur in people with Parkinson's disease, but not all people with Parkinson's disease will develop dementia. PDD may affect memory, social judgment, language, or reasoning. Autopsy studies show that people with PDD often have Lewy bodies in the cortex and other brain areas, and many have amyloid plaques and tangles of the protein tau similar to those found in people with AD. The time from the onset of movement symptoms to the onset of dementia symptoms varies greatly from person to person. Risk factors for developing PDD include the onset of Parkinson's-related movement symptoms followed by mild cognitive impairment and REM sleep behavior disorder, which involves having frequent nightmares and hallucinations.

Vascular contributions to cognitive impairment and dementia (VCID) is an umbrella term that refers to conditions, including stroke or injury to the heart or blood vessels, that affect blood flow to and within the brain. VCID can cause significant changes to memory, thinking, and behavior. Cognition and brain function can be significantly affected by the size, location, and number of changes. Conditions resulting from VCID can begin suddenly and progress or subside during a person's lifetime.

VCID arises as a result of risk factors that similarly increase the risk for cerebrovascular disease (stroke), including atrial fibrillation, hypertension, diabetes, and high cholesterol. VCID can occur along with AD. People who have VCID almost always have abnormalities in the brain that can be seen on magnetic resonance imaging (MRI) scans. These abnormalities can include evidence of prior strokes, which are often small and don't show symptoms as they happen, as well as diffuse changes in the brain's "white matter"—the connecting "wires" of the brain that are critical for relaying messages between brain regions. A thickening of blood vessel walls (called arteriosclerosis) and thinning or loss of components of the white matter can occur.

Forms of VCID include:

- **Vascular dementia** refers to progressive loss of memory and other cognitive functions caused by vascular injury or disease within the brain. Symptoms of vascular dementia may sometimes be difficult to distinguish from AD. Problems with organization, attention, slowed thinking, and problem solving are all more prominent in VCID, and memory loss is more prominent in AD.
- **Vascular cognitive impairment** involves changes with language, attention, and the ability to think, reason, and remember that are noticeable but are not significant enough to greatly impact daily life. These changes, caused by vascular injury or disease within the brain, progress slowly over time.
- **Post-stroke dementia** can develop months after a major stroke. Not everyone who has had a major stroke will develop vascular dementia, but the risk for dementia is significantly higher in someone who has had a stroke.
- **Multi-infarct dementia** is caused by numerous small strokes (infarcts) and mini-strokes. Language or other functions may be impaired, depending on the region of the brain that is affected. Dementia is more likely when strokes affect both sides of the brain. Even strokes that don't show any noticeable symptoms can increase the risk of dementia.
- **Cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy** (CADASIL) is an extremely rare inherited disorder caused by a thickening of the walls of small- and medium-sized blood vessels, which reduces the flow of blood to the brain. CADASIL is associated with multi-infarct dementia, stroke, and other disorders. The first symptoms can appear in people between ages 20 and 40.

- **Subcortical vascular dementia**, previously called Binswanger's disease, involves extensive microscopic damage to the small blood vessels and nerve fibers that make up white matter. Some scientists think it may be an aggressive form of multi-infarct dementia. It can include changes to short-term memory, organization, attention, decision-making, and behavior. Symptoms tend to begin after age 60 and progress in a stepwise manner. People with subcortical vascular disease often have high blood pressure, a history of stroke, or evidence of disease of the large blood vessels in the neck or heart valves.
- **Cerebral amyloid angiopathy** is a buildup of amyloid plaques in the walls of blood vessels in the brain. It is generally diagnosed when multiple tiny areas of bleeding in the brain are discovered using MRI.

Proteins Involved with Neurodegenerative Disorders

Changes in various proteins may cause the different forms of age-related dementia and many age-related neurodegenerative diseases. Diseases involving abnormal buildup of specific proteins in the brain are called **proteinopathies**. Mutations in genes that provide instructions for making these proteins have been found to cause dementia in some families. However, in the vast majority of people with dementia, dementia is not inherited, and the cause is unknown. Alzheimer's disease (AD), frontotemporal disorders (FTD), and Lewy body dementia (LBD) are proteinopathies.

In some dementias, changes in a protein called tau cause it to form clumps inside nerve cells in the brain, which is believed to make the cells stop functioning properly and die. Disorders that are associated with the abnormal buildup of tau are called **tauopathies**.

In AD, the tau protein accumulates abnormally and becomes twisted and tangled, forming fibers—called neurofibrillary or tau tangles—inside neurons. Abnormal clumps (plaques) of another protein, called beta-amyloid, are prominent in spaces between brain cells. Both plaques and tangles are thought to contribute to reduced function and nerve cell death in AD and are the hallmarks of the disease.

Beta-amyloid plaques are also seen in the brains of people with cerebral amyloid angiopathy and in some people with LBD and Parkinson's disease dementia. These plaques are also commonly seen in older adults who do not have dementia, although it is not clear whether they might have developed dementia later. Researchers are still trying to answer this important question.

Some, but not all, forms of FTD are tauopathies. Other forms of FTD are associated with the buildup of the protein TDP-43. A mutation in a gene called *progranulin*, and another in a gene called *C9orf72*, can cause FTD with accumulation of TDP-43 in nerve cells.

TDP-43 is also associated with a newly recognized brain disorder called LATE, which stands for "Limbic-predominant Age-related TDP-43 Encephalopathy." The symptoms of LATE can mimic those of AD. Recent research has shown that misfolded TDP-43 protein is common in older adults. Roughly 25 percent of individuals over age 85 have enough misfolded TDP-43 protein to affect their memory and/or thinking abilities. Neuropathologists and other researchers are conducting further studies on LATE to better understand the underlying causes and to help clinicians distinguish it from AD.

In other dementias and some brain disorders, the protein synuclein becomes misshapen and forms harmful clumps inside neurons in different brain regions. Disorders in which synuclein builds up inside neurons are called **synucleinopathies.** Changes in synuclein and/or its function are the basis of the Lewy body disorders and other disorders such as multiple system atrophy (MSA). MSA is a progressive neurodegenerative disorder characterized by a combination of symptoms that affect both the autonomic nervous system—the part of the nervous system that controls involuntary action such as blood pressure or digestion—and movement, causing parkinsonism—a condition resembling that seen in Parkinson's disease.

Reversible Dementia-like Disorders and Conditions

Many conditions that cause dementia-like symptoms can be halted or even reversed with the appropriate intervention.

- Normal pressure hydrocephalus is an abnormal buildup of cerebrospinal fluid in the brain. It can be treated or even reversed by implanting a shunt system to divert fluid from the brain.

- Nutritional deficiencies of vitamin B_1 (thiamine), caused by chronic alcoholism, and of vitamin B_{12} can be reversed with treatment. People who have abused substances such as alcohol and recreational drugs sometimes display signs of dementia even after the substance abuse has stopped.
- Side effects of certain medications (including some sleep, bladder, and allergy medicines) or drug combinations may cause cognitive impairment that looks like a degenerative or vascular dementia, but which could reverse upon stopping these medications.
- Vasculitis, an inflammation of brain blood vessels, can cause dementia after multiple strokes and may be treated with immunosuppressive medications.
- Subdural hematoma**,** or bleeding between the brain's surface and its outer covering (the dura), is common after a head injury, such as from a fall or accident. Subdural hematomas can cause dementia-like symptoms and changes in mental function. With treatment, some symptoms can be reversed.
- Some non-malignant brain tumors can cause symptoms resembling dementia that go away after the tumor is removed.
- Some chronic infections around the brain, so-called chronic meningitis, can cause dementia and may be treated with drugs that kill the infectious agent.
- Depression and early Alzheimer's disease share some symptoms, such as trouble with concentration, memory, and decision making, as well as loss of interest or pleasure in daily activities and social withdrawal. Treatment can help a depressed person regain some or all of his or her thinking and cognition.
- Delirium, like dementia, can cause confusion, disorientation, and changes in mood, sleep, and behavior. Treating the underlying causes of delirium (such as a medical condition) can resolve symptoms in most cases.

Other Neurodegenerative Diseases and Conditions that Include Dementia or Dementia-like Symptoms

Doctors have identified many other conditions that can cause dementia or dementia-like symptoms. The diseases have different symptoms that involve body and brain functions and affect mental health and cognition. Some of these conditions are:

- **Creutzfeldt-Jakob disease** (CJD) is a rare brain disorder that is characterized by rapidly progressing dementia. Infectious proteins called prions become misfolded and clump together, causing brain damage. Initial symptoms include impaired memory, judgment, and thinking, along with loss of muscle coordination and impaired vision. Some symptoms of CJD can be similar to symptoms of other progressive neurological disorders, such as Alzheimer's disease.
- **Chronic traumatic encephalopathy** (CTE) is caused by repeated traumatic brain injury (TBI) in some people who suffered multiple concussions. People with CTE may develop dementia, poor coordination, slurred speech, and other symptoms similar to those seen in Parkinson's disease 20 years or more after the injury. Late-stage CTE is also characterized by brain atrophy and widespread deposits of tau in nerve cells. In some people, behavior and mood changes may occur just 5 to 10 years after the TBI.
- **Huntington's disease** is an inherited, progressive brain disease that affects a person's judgment, memory, ability to plan and organize, and other cognitive functions. Symptoms typically begin around age 30 or 40 and include abnormal and uncontrollable movements called chorea, as well as problems with walking and lack of coordination. Cognitive problems worsen as the disease progresses, and problems controlling movement lead to complete loss of ability for self-care.

- **HIV-associated dementia** (HAD) can occur in people who have human immunodeficiency virus, the virus that causes AIDS. HAD damages the brain's white matter and leads to a type of dementia associated with memory problems, social withdrawal, and trouble concentrating. People with HAD may develop movement problems as well.

Risk Factors for Dementia and Cognitive Impairment

The following risk factors can increase a person's chance of developing one or more kinds of dementia. Some of these factors can be modified, while others cannot.

- **Age.** Advancing age is the strongest risk factor for developing dementia.
- **Hypertension.** High blood pressure has been linked to cognitive decline, stroke, and types of dementia that damage the white matter regions of the brain. Over time, high blood pressure can damage arteries and brain blood vessel walls, resulting in thickening and hardening of the walls—a condition called arteriosclerosis.
- **Stroke.** A single major stroke or a series of smaller strokes increases a person's risk of developing vascular dementia. A person who has had a stroke is at an increased risk of having additional strokes, which further increases the risk of developing dementia.
- **Alcohol use.** Most studies suggest that regularly drinking large amounts of alcohol increases the risk of dementia.
- **Atherosclerosis.** This condition, a form of arteriosclerosis, refers to the accumulation of fats and cholesterol in the lining of arteries, coupled with an inflammatory process that leads to a thickening of the vessel walls. It can lead to stroke, which raises the risk for vascular dementia.

- **Diabetes.** People with diabetes appear to have a higher risk for dementia. Poorly controlled diabetes is a risk factor for stroke and cardiovascular disease, which in turn increase the risk for vascular dementia.
- **Down syndrome.** Many people with Down syndrome develop symptoms of Alzheimer's disease by the time they reach middle age.
- **Genetics.** A very small proportion of dementia is dominantly inherited (meaning that a mutation in a gene that causes the disorder is inherited from a parent) but the chance of developing a genetically linked form of dementia increases when more than one family member has the disorder.
- **Head injury.** An impact to the head can cause a traumatic brain injury, or TBI. Certain types of TBI, or repeated TBIs, can cause dementia and other severe cognitive problems.
- **Obesity.** Being overweight increases the risk for related health problems such as diabetes and heart disease that increase the risk for dementia.
- **Parkinson's disease.** The degeneration and death of nerve cells in the brain in people with Parkinson's disease can cause dementia and significant memory loss.
- **Smoking.** Smoking increases the risk of developing cardiovascular diseases that slow or stop blood from getting to the brain.

Diagnosis

To diagnose dementia, a doctor may complete a series of tests and assessments. In many cases, the specific type of dementia may not be confirmed until after the person has died and the brain is examined. Some forms of dementia have similar symptoms and some people may have more than one form of dementia.

Diagnosing a dementia disorder in a living person may include:

- recording the person's current symptoms, vital signs, and current medications
- compiling the person's medical and family history of illness or disease
- a physical exam and laboratory tests of the person's blood, other fluids, and various chemical and hormone levels, to help identify or rule out conditions that may contribute to dementia
- neurological evaluations to assess balance, sensory response, reflexes and other functions, and recordings of electrical activity in the brain
- brain scans to look for structural abnormalities, amyloid plaques and tau tangles, and patterns of altered brain activity that are common in dementia
- cognitive and neuropsychological tests to assess memory, language skills, math skills, problem-solving, and other abilities related to mental functioning
- genetic testing to identify risk for a dementia from gene mutations associated with dementia
- a psychiatric evaluation to help determine if depression or another mental health condition is causing or contributing to a person's symptoms

Treatment and Management

There are currently no treatments to stop dementia in neurodegenerative diseases. Some diseases that can occur at the same time as dementia (such as diabetes and depression) can be treated. Other symptoms that may occur in dementia-like conditions can also be treated, although some symptoms may only respond to treatment for a period of time. A team of specialists familiar with these disorders can help guide patient care. Specialists can include doctors, nurses, and therapists, such as speech and physical therapists.

Medications are available to treat certain behavioral symptoms, as well as delusions, depression, and muscle stiffness. Always consult with a doctor, as some medications may make symptoms worse. Some risk factors for dementia and cognitive impairment such as high blood pressure, can also be treated through a combination of medications and lifestyle changes.

Alzheimer's disease (AD). Most drugs for dementia are used to treat symptoms in AD. One class of drugs, called cholinesterase inhibitors, can temporarily improve or stabilize memory and thinking skills in some people by increasing the activity of the cholinergic brain network—a subsystem in the brain that is highly involved with memory and learning. These drugs include donepezil, rivastigmine, and galantamine. A medication known as memantine, an N-methyl D-aspartate (NMDA) antagonist, is prescribed to treat moderate to severe AD. This drug's main effect is to decrease symptoms, which could enable some people to maintain certain daily functions a little longer than they would without the medication. Memantine may be combined with a cholinesterase inhibitor for added benefits. These drugs are sometimes used to treat other dementias in which AD is believed to co-occur.

The U.S. Food and Drug Administration (FDA) has also approved aducanumab, a disease-modifying therapy, to treat AD. This medication is a human antibody, or immunotherapy, that helps to reduce amyloid plaques in the brain and may help slow the progression of AD, although it has not yet been shown to affect clinical outcomes, such as progression of cognitive decline or dementia.

Frontotemporal disorders (FTD). There are no medications approved to treat or prevent FTD and most other types of progressive dementia. Sedatives, antidepressants, and other drugs used to treat Parkinson's and AD symptoms may help manage certain symptoms and behavioral problems associated with the disorders.

Dementia with Lewy bodies (DLB). Medicines available for managing DLB are aimed at relieving symptoms such as gait and balance disturbances, stiffness, hallucinations, and delusions. Studies suggest that the cholinesterase inhibitor drugs used for AD offer some benefit to people with DLB.

Parkinson's disease dementia (PDD). Some studies suggest that the cholinesterase inhibitors used to treat people with AD might improve cognitive, behavioral, and psychotic symptoms in people with PDD. Unfortunately, many of the medications used to treat the motor symptoms of Parkinson's disease worsen the cognitive problems. The FDA has approved rivastigmine (an AD drug) to treat cognitive symptoms in PDD.

Vascular contributions to cognitive impairment and dementia. Dementia caused by vascular conditions is often managed with drugs to prevent strokes or reduce the risk of additional brain damage. Some studies suggest drugs used to treat AD might benefit some people with early vascular dementia. Treating the modifiable risk factors can help prevent additional stroke.

Physical and occupational therapists can help with maintaining physical movement, addressing speech and swallowing issues, and helping people learn new ways to handle loss of skills with everyday tasks such as feeding oneself.

It is important to educate family, friends, and caregivers about a loved one's medical issues. Also, in-person and online support groups available through many disease awareness and caregiver advocacy organizations can give families and other caregivers additional resources, as well as opportunities to share experiences and express concerns. (See the **Resources** section on page 32).

Caring for a Person with Dementia

Caring for someone with dementia can be very hard, both physically and emotionally. Caregivers may face challenges with managing the medical and day-to-day care of people with dementia, as well as changing family and social relationships, loss of work, poor health, stress, decisions about long-term care, and end-of-life concerns.

To stay healthy, caregivers can do the following:

- get regular health care
- ask family and friends for help with errands and other tasks
- arrange for respite care—short-term help to give the regular caregiver a break—or take the person to an adult day care center, a safe, supervised environment for adults with dementia or other disabilities

- spend time doing enjoyable activities, away from the demands of caregiving
- join a support group for caregivers of people with dementia, as these groups allow caregivers to learn coping strategies and share feelings with others in the same position
- see an attorney for issues involving work, employee benefits, family leave, and disability if needed for someone who may have lost their job due to dementia

The organizations listed in the **Resources** section can help with information about caregiver services and support.

For many caregivers, there comes a point when they can no longer take care of the person with dementia without help. Caregivers may want to plan in advance to get home health care services or look for a residential care facility, such as a group home, assisted living facility, or nursing home. The decision to move the person with dementia to a care facility can be difficult, but necessary, and can give caregivers peace of mind to know that the person is safe and getting good care. Contacting a home care agency can be helpful for all caregivers, especially those with ethnic or cultural concerns involving providing care.

End-of-Life Concerns

It is difficult, but important, to plan for the end of life. Legal documents, such as a will, living will, and durable powers of attorney for health care and finances, should be created or updated as soon as possible after a diagnosis of dementia. Early on, many people can understand and participate in legal decisions. But as their illness progresses, it becomes harder to make such decisions. An attorney who specializes in elder law, disabilities, or estate planning can provide legal advice, prepare documents, and make financial arrangements for the caregiving spouse or partner and dependent children. If necessary, the person's access to finances can be reduced or eliminated.

Research

The National Institute of Neurological Disorders and Stroke (NINDS) and the National Institute on Aging (NIA), both parts of the National Institutes of Health (NIH), are the leading federal funders of research on Alzheimer's disease (AD) and related dementias, including Lewy body dementia (LBD), frontotemporal disorders (FTD), and vascular contributions to cognitive impairment and dementia (VCID).

Jointly sponsored clinical trials, research, and research partnerships have improved our understanding of dementia in several areas.

Research Areas

NIA and NINDS, along with other NIH Institutes, Centers, and Offices, support research spanning from basic biology to drug development to clinical studies to evaluating public health outcomes. Within the past several decades, researchers have made great strides toward better understanding of what causes AD and related dementias, and discovering approaches that may prevent, diagnose, and treat them. Research areas of focus include:

- **Biomarkers.** Several research projects are underway to identify dementia biomarkers—biological signs that could indicate disease risk or confirm diagnosis. The course of disease for people with AD or a related dementia varies greatly, and biomarkers may help predict and monitor its progression. These biomarkers could be detected through imaging or even blood tests. Biomarker measures may help researchers improve dementia diagnosis and identify specific changes in the brain.

- **Care and caregiver support.** To support people living with dementia, caregivers, and health providers, NIH has made large investments in research to improve the quality of care and care coordination. Already, research efforts have contributed to improvements in the quality of care—as well as in the resulting health, well-being, and quality of life—for those living with dementia. In addition, NIH support has enabled the development of resources designed to help ease burdens on care providers.
- **Drugs and compounds.** Several drugs and compounds that might slow the progression of AD and other dementias are in various stages of testing. Researchers are testing new drugs as well as exploring whether drugs approved for other conditions might be repurposed to treat dementias.
- **Lifestyle interventions.** Researchers are investigating interventions around exercise, healthy eating, cognitive training, preventive health care, and management of chronic conditions that—if made early in life—may be able to prevent or delay disease symptoms.
- **Genetics.** Scientists continue to look for new genes that may be responsible for the development of AD and other forms of dementia. Identifying more gene mutations and how they may be associated could lead to better strategies for detection, treatment, and prevention.
- **Imaging.** Clinical imaging may help researchers better understand changes in the brains of people with dementia, as well as help diagnose these disorders. NIH funds projects to develop neuroimaging as a core research tool to better understand and treat neurological disorders and conditions, including AD, Parkinson's disease, and stroke.
- **Population studies**. Studying groups of people over time helps scientists identify those at risk of developing dementia or cognitive impairment, better understand the progression of dementia both before and after symptom onset, identify potential genetic causes, and discover biomarkers to help detect and track diseases.

This information also could be used to establish a large network of clinical sites to support therapy development. For these kinds of studies, scientists aim to involve a large group of people who represent the diversity of the U.S. population.

- **Proteins.** NIH-funded research projects seek to better understand how certain proteins misfold and become harmful, as well as the toxic effects of protein buildup and how they are related to the development of dementia.
- **Stem cells.** Scientists can transform stem cells into different cell types and hopefully use them to discover nerve-cell mechanisms and biological changes that lead to the onset and progression of dementias.

Research Partnerships

The National Plan to Address Alzheimer's Disease was created in response to the 2011 National Alzheimer's Project Act (NAPA) and is designed to expand research in AD and related dementias and better meet the needs of families living with these diseases. For more information, see ***http://aspe.hhs.gov/national-alzheimers-project-act***.

In support of the National Plan, NIA and NINDS support many research partnerships on dementia, including:

- The **Longitudinal Early-onset Alzheimer's Disease Study (LEADS)** addresses several major gaps in AD and related dementias research. Its primary goal is to develop sensitive clinical and biomarker measures for future clinical and research use. This observational study will enroll and follow 500 cognitively impaired participants and 100 cognitively normal participants ages 40-64 years at approximately 15 sites in the United States. Clinical, cognitive, imaging, biomarker, and genetic characteristics will be assessed.
- The **Accelerating Medicines Partnership®** (AMP®) program is a public-private partnership between the NIH, FDA, multiple biopharmaceutical and life science companies, nonprofit and other organizations to transform the current model for developing new diagnostics and treatments. Current AMP projects include:
  - **AMP PD** (Accelerating Medicines Partnership Parkinson's Disease) will identify and validate the most promising biological targets for therapeutics for Parkinson's disease. For more information, see ***https://amp-pd.org***.
  - **AMP AD** (Accelerating Medicines Partnership Alzheimer's Disease) will transform the current model for developing new diagnostics and treatments for AD. For more information, see ***www.nia.nih.gov/research/amp-ad***.

Accelerating Medicines Partnership and AMP are registered service marks of the U.S. Department of Health and Human Services.

- **M^{2}OVE-AD** (Molecular Mechanisms of the Vascular Etiology of Alzheimer's Disease) allows scientists from diverse fields to work collaboratively to understand the complex molecular mechanisms by which vascular risk factors influence AD. For more information, see ***www.nih.gov/m2ove-ad***.
- The **Dementia with Lewy Bodies Consortium** expands the collection of clinical data and biological specimens in the NINDS **Parkinson's Disease Biomarkers Program** to include data from people with LBD. For more information, see ***https://pdbp.ninds.nih.gov/Dementia-with-Lewy-Bodies-Consortium***.
- The **Tau Center Without Walls** increases collaboration and data- and resource-sharing among researchers to better understand the protein tau and its involvement in such disorders as FTD. For more information, see ***http://tau-center-without-walls.org/east-cwow***.
- **DetectCID** (Consortium for Detecting Cognitive Impairment, Including Dementia) is establishing, testing, and validating tools for detecting cognitive impairment, including dementia, in primary care and other everyday clinical settings. For more information, see ***www.detectcid.org***.
- **MarkVCID** is a research consortium developing new and existing biomarkers for small vessel VCID. This could help improve the efficiency and outcomes of trials designed to test drug effectiveness and safety in humans and speed the development of therapies for the dementias. For more information, see ***https://markvcid.partners.org***.
- **DISCOVERY** (Determinants of Incident Stroke Cognitive Outcomes and Vascular Effects on RecoverY) is a study to unravel the mechanisms of post-stroke cognitive disability, early stroke recovery, and potential targets for personalized prevention, intervention, and rehabilitation. For more information, see ***www.resilientbrain.org/discovery.html***.

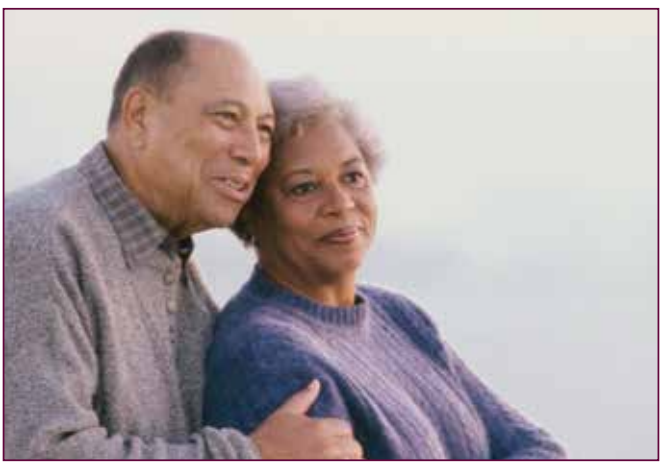
Additional NIH-funded research projects on dementia can be found using NIH RePORTER (*https://reporter.nih.gov*), a searchable database of current and past research projects supported by NIH and other federal agencies. RePORTER also includes links to publications and resources from these projects.

To learn more about research progress and scientific advances, visit *www.alzheimers.gov/taking-action/research-activities*.

What Can You Do?

Call Your Doctor

If you are concerned about memory problems or other symptoms of dementia, call your doctor. If you or someone you know has recently been diagnosed, contact the organizations in the **Resources** section to find out more about dementia care, support, and research. It is important to educate family, friends, and caregivers about a loved one's diagnosis. In-person and online support groups offered by nonprofit organizations can give families and caregivers additional resources and opportunities to share experiences and learn about strategies for care and support.



Participate in a Clinical Trial or Study

Clinical studies offer an opportunity to help researchers find better ways to safely detect, treat, or prevent dementia disorders. All types of volunteers are needed—people with dementia or memory problems, caregivers, at-risk individuals, and healthy volunteers—of all different ages, sexes, races, and ethnicities to ensure that study results apply to as many people as possible, and that treatments will be safe and effective for everyone who will use them. For information about how you can contribute to the goal of finding a treatment or cure for AD or a related dementia, visit the webpage "NIH Clinical Research Trials and You" at ***www.nih.gov/health/clinicaltrials***. To search for trials and studies, go to ***www.alzheimers.gov/clinical-trials*** or ***www.clinicaltrials.gov***.

Consider Brain Donation

Donating one's brain after death provides an opportunity to better understand dementia and can lead to improved treatments for future generations. To volunteer, people can register ahead of time through a brain donation program or research study. Learn more at ***www.nia.nih.gov/braindonation*** and the **NIH NeuroBioBank** at ***https://neurobiobank.nih.gov***.

Conclusion

Currently, there are no cures for the common dementias caused by progressive neurodegeneration, including Alzheimer's disease, frontotemporal disorders, and Lewy body dementia. Controlling vascular risk factors such as high blood pressure may reduce the risk of developing dementia decades later.

Learning more about dementia and dementia disorders and how they affect the brain will lead to new and better ways to treat them. Advance care planning and a healthy lifestyle for people living with dementia and their caregivers will allow them to live their lives more fully and meet daily challenges.

NIH and the federal government's AD and related dementias research strategy is training new generations of researchers and clinician-scientists and engaging in innovative partnerships with private industry, nonprofit groups, and more to increase collaboration and broaden access to research resources and data. Through research activities funded by NIA and NINDS, scientists hope that new knowledge about dementia will one day lead to improved diagnosis, new tools and resources, ways to slow disease progression, prevent disease, improve care and caregiver support, and enhance quality of life for people living with dementia.

Resources

Federal Government

National Institute of Neurological Disorders and Stroke

1-800-352-9424

www.ninds.nih.gov/contact-us

www.ninds.nih.gov

National Institute on Aging

Alzheimer's and related Dementias Education and Referral (ADEAR) Center

1-800-438-4380

adear@nia.nih.gov

www.alzheimers.gov

MedlinePlus

National Library of Medicine

www.medlineplus.gov

www.medlineplus.gov/spanish

Organizations

Alzheimer's Association

1-800-272-3900 (24-Hour Helpline)

1-312-335-8700

www.alz.org

Alzheimer's Drug Discovery Foundation

1-212-901-8000

info@alzdiscovery.org

www.alzdiscovery.org

Alzheimer's Foundation of America

1-866-232-8484

info@alzfdn.org

www.alzfdn.org

Association for Frontotemporal Degeneration (AFTD)

1-866-507-7222

1-267-514-7221

info@theaftd.org

www.theaftd.org

BrightFocus Foundation

1-800-437-2423

info@brightfocus.org

www.brightfocus.org/alzheimers

The Bluefield Project to Cure Frontotemporal Dementia

rodney.pearlman@bluefieldproject.org

www.bluefieldproject.org

Lewy Body Dementia Association

1-800-539-9767

www.lbda.org

Lewy Body Dementia Resource Center

1-833-533-5463

norma@lbdny.org

https://lewybodyresourcecenter.org

National Organization for Rare Disorders (NORD)

1-203-744-0100

Patient Services: 1-800-999- 6673

www.rarediseases.org

Caregiver Support

Family Caregiver Alliance

1-800-445-8106

www.caregiver.org

National Academy of Elder Law Attorneys

1-703-942-5711

naela@naela.org

www.naela.org

Well Spouse Association

1-732-577-8898

info@wellspouse.org

www.wellspouse.org

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