I AM | IMAGING | AGING | MEMORY

INSIDE:

I AM STUDY

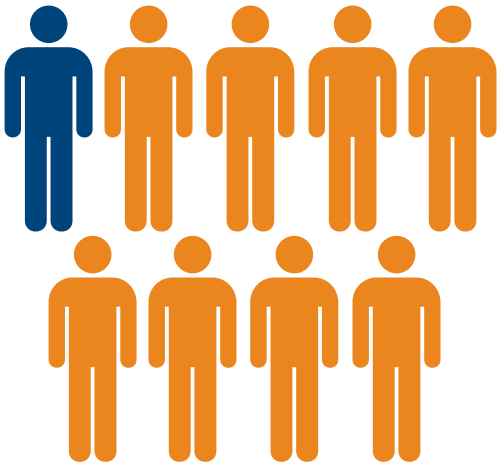
We are so grateful for your participation in the IAM Study! We are nearing the end of the study and have collected follow-up data on most participants and we plan to finish this summer. Analyzing this follow-up visit data and comparing it to baseline data will happen after that. But we wanted to take the time to update you and thank you for helping us!

Andreana Benitez, PhD
Principal Investigator

MUSC
Medical University of South Carolina

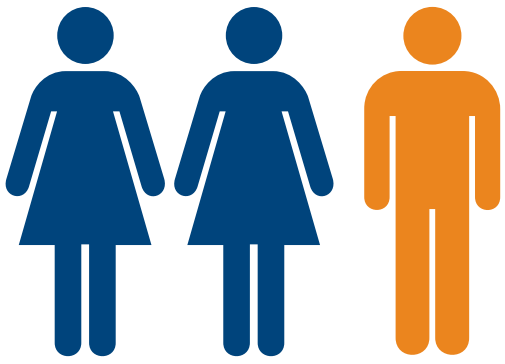
I AM | FAST FACTS

ONE IN NINE PEOPLE AGE 65 AND OLDER (11.3%) HAS ALZHEIMER'S DEMENTIA.



BETWEEN 2000 AND 2019, DEATHS FROM HEART DISEASE HAVE DECREASED 7.3% WHILE DEATHS FROM ALZHEIMER'S HAVE INCREASED 145%.

IN THE UNITED STATES, ALZHEIMER'S AND DEMENTIA DEATHS HAVE INCREASED 16% DURING THE COVID-19 PANDEMIC



ALMOST TWO-THIRDS OF AMERICANS WITH ALZHEIMER'S ARE WOMEN.

FACTS TAKEN FROM THE ALZHEIMER'S ASSOCIATION

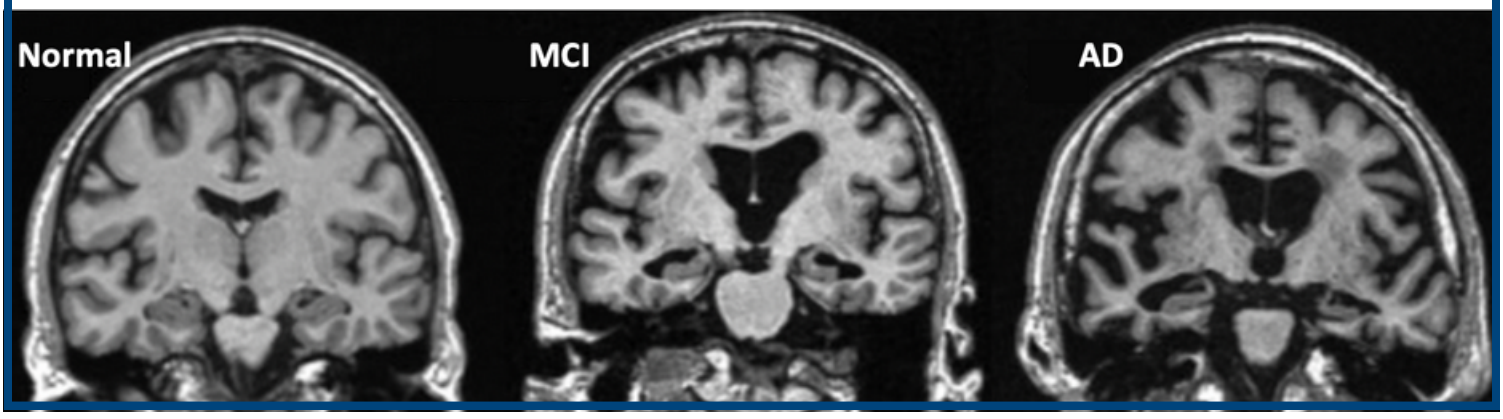
I AM | ALZHEIMER'S AT A GLANCE

Alzheimer's disease (AD) is thought to begin many years before symptoms arise.

Current research identifies three stages of AD: 1) preclinical AD, 2) mild cognitive impairment (MCI) due to AD, and 3) dementia due to AD. In the first stage, no symptoms are present due to the brain compensating for the degeneration of nerve cells that are involved in memory and thinking. In the last two stages, symptoms are present, but to varying degrees. Individuals in the preclinical stage still have measurable changes in biomarkers in the brain, cerebrospinal fluid, and blood. Biomarkers are biological factors that can be measured to show the presence or absence, developmental risk, or progression of a disease. These preclinical changes in certain biomarkers indicate the early signs of AD.

I AM Explained

Our research group has expertise in improving the sensitivity of brain imaging. Our goal is to improve the imaging sensitivity of neurodegeneration. The term neurodegeneration is a combination of two words – "neuro," referring to nerve cells, and "degeneration," referring to progressive damage. Specifically, we are interested in imaging white matter degeneration. White matter is a part of the brain which enables communication between various parts of the brain. Changes in white matter naturally occur with age. These changes worsen early in the course of AD. We hope that by developing better imaging technology we will be able to pinpoint where, when, and how these white matter changes lead to AD.



I AM | OUR EARLY FINDINGS

In Alzheimer's disease (AD), proteins clump together to form plaques and tangles in the brain.

These plaques and tangles damage neurons and their connections, affecting memory and thinking skills. The presence of amyloid plaque in the brain is an important part of the diagnosis of AD. Amyloid can begin to build up long before any memory and thinking problems are detected. Other processes that can affect memory and thinking also occur in the brain at the same time as amyloid buildup. In our first round of analysis of IAM study data, we focused on the white matter degeneration that occurs while amyloid accumulates. We looked at amyloid levels and small-scale white matter changes in individuals ages 45-85 using diffusion MRI, PET, and neuropsychological (memory and thinking) testing. PET scans tell us about how much amyloid is present in the brain and where that amyloid is located. Neuropsychological tests give us a measure of cognitive speed and accuracy. Diffusion MRI scans tell us about how water moves in the brain.

The Role of Diffusion MRI

If we see less water movement in a certain part of the brain, then we know that part of the brain has more structures that are restricting the movement of water. Neurons restrict the movement of water; however, other structures exist in the brain that can also restrict water movement. These structures can be thought of as 'helper cells'. They perform upkeep and repair processes for neurons. Helper cells exist all over the brain. However, abnormally high amounts of helper cells clustered in certain areas could be indicative of damage or malfunction in those areas. When helper cells cluster, they restrict water movement in the area even more than normal. In this first round of IAM analysis, we attempted to differentiate between normal water restriction in white matter areas versus high water restriction caused by clusters of helper cells drawn to an area to repair white matter degeneration.

Observing the Micro Scale

One of the significant challenges of studying the brain is size. Neurons and other brain structures are incredibly tiny (about 1-20 micrometers – 1/10 the size of a human hair). As a result, it's difficult to differentiate between white matter neurons and helper cells. To look at this, we used a combination of two diffusion MRI analysis methods – Diffusional Kurtosis Imaging (DKI) and White Matter Tract Integrity (WMTI). DKI gives us a picture of water movement in an entire area we image – white matter neurons and helper cells included. WMTI gives us a more detailed picture of how water is moving both inside and outside of neurons.

I AM | OUR EARLY FINDINGS CONT.

What Does This Tell Us?

What we've found is that early on in AD, water restriction in white matter outside of the neurons increases. This means that helper cells are collecting around degenerating white matter to perform repair processes. As helper cells cluster together around degenerating white matter, they restrict the movement of water. This increase in water restriction in damaged areas is detectable via MRI. This may be a non-invasive way to track the progress of AD and understand the relationship between cognitive symptoms, amyloid deposition, and white matter degeneration progression in AD.

Moving Forward

We plan to complete follow up scans on all participants this summer. In the next steps of our research, we will use diffusion MRI to look at how white matter changes between baseline and two-year follow-up scans. Additionally, we plan to use all the other data we have collected – PET, neuropsychological, and functional MRI (fMRI) - to continue to examine AD and its many complex properties.

We are submitting a new grant proposal to the National Institutes of Health so that we can continue our work. We want to learn about the possible ways that white matter can signal the shift from normal to abnormal aging. We will achieve this by using additional imaging techniques with our participants. We hope to have more information by the end of the year so keep an eye out for more details from us.

MORE THAN 6 MILLION AMERICANS ARE LIVING WITH ALZHEIMER'S. BY 2050, THIS NUMBER IS PROJECTED TO RISE TO NEARLY 13 MILLION

OLDER HISPANICS ARE ABOUT ONE AND ONE-HALF TIMES AS LIKELY TO HAVE ALZHEIMER'S OR OTHER DEMENTIAS AS OLDER WHITES.

IN SOUTH CAROLINA, BLACK PEOPLE ARE 64% MORE LIKELY TO HAVE ALZHEIMER'S DISEASE AND RELATED DEMENTIAS COMPARED TO WHITE PEOPLE.

FACTS TAKEN FROM THE ALZHEIMER'S ASSOCIATION & AARP

I AM | PUBLICATIONS

Below are a few IAM study-related papers. A complete list along with summaries and full texts of all these papers are available on our website.

Greater Diffusion Restriction in White Matter in Preclinical Alzheimer's Disease.
Alzheimer's disease (AD) involves many co-occurring changes in the brain. Beta-amyloid builds up and, likely at the same time, white matter degeneration also occurs. This study examined white matter degeneration in the earliest stages of AD. It was shown that other factors may be influencing white matter degeneration in AD rather than just beta-amyloid buildup.

Modeling white matter tract integrity in aging with diffusional kurtosis imaging.
Certain physical changes occur in the brain as we age. This study attempted to see if a certain set of measures called White Matter Tract Integrity could be used to track these changes. According to the results, the measures examined were useful for seeing age-related changes in the brain.

Comparison of conventional and actuarial neuropsychological criteria for mild cognitive impairment in a clinical setting.
Cognitive testing is crucial to evidence-based practice in neuropsychology. This study centered on a new type of cognitive testing called ANP. This team found that ANP is more specific and yielded fewer false positives than the current conventional type of cognitive testing (CNP).

A Bayesian hierarchical change point model with parameter constraints.
A change point in Alzheimer's disease (AD) describes the point at which cognitive decline accelerates. A new model for characterizing the onset of AD based on change points was discussed in this study. The results showed that this new model was able to predict AD progression and the personalized risk of dementia from AD.

Psychometric Properties of the NIH Toolbox Cognition Battery in Healthy Older Adults: Reliability, Validity, and Agreement with Standard Neuropsychological Tests.
A type of cognitive testing called the NIHTB-CB is becoming more commonly used in neuropsychology. This study compared NIHTB-CB to older types of cognitive testing. The results showed that the NIHTB-CB test was both valid and reliable in older adults.

Modeling white matter microstructure with fiber ball imaging.
This study looked at a method of using diffusion MRI data to examine brain microstructures more closely. The method in question is called fiber ball imaging (FBI). The result of this study showed that this set of new FBI measures can be applied to future data.

10 WAYS TO **LOVE YOUR BRAIN**

START NOW. It's never too late or too early to incorporate healthy habits.

Growing evidence indicates that people can reduce their risk of cognitive decline by adopting key lifestyle habits. When possible, combine these habits to achieve maximum benefit for the brain and body.

HIT THE BOOKS

Formal education will help reduce risk of cognitive decline and dementia. Take a class at a local college, community center or online.

BUTT OUT

Smoking increases risk of cognitive decline. Quitting smoking can reduce risk to levels comparable to those who have not smoked.

BREAK A SWEAT

Engage in regular cardiovascular exercise that elevates heart rate and increases blood flow. Studies have found that physical activity reduces risk of cognitive decline.

FOLLOW YOUR HEART

Risk factors for cardiovascular disease and stroke – obesity, high blood pressure and diabetes – negatively impact your cognitive health.

STUMP YOURSELF

Challenge your mind. Build a piece of furniture. Play games of strategy, like bridge.

HEADS UP!

Brain injury can raise risk of cognitive decline and dementia. Wear a seat belt and use a helmet when playing contact sports or riding a bike.

BUDDY UP

Staying socially engaged may support brain health. Find ways to be part of your local community or share activities with friends and family.

FUEL UP RIGHT

Eat a balanced diet that is higher in vegetables and fruit to help reduce the risk of cognitive decline.

TAKE CARE OF YOUR MENTAL HEALTH

Some studies link depression with cognitive decline, so seek treatment if you have depression, anxiety or stress.

CATCH SOME ZZZ'S

Not getting enough sleep may result in problems with memory and thinking.

Visit alz.org/10ways to learn more.

alzheimer's association®

THE BRAINS BEHIND SAVING YOURS.

I AM | TEAM

Interested in Joining Another Study?

PUSH Study

This research study is focused on treating MCI, the stage between normal age-related changes and dementia. This is a six-week treatment study that uses transcranial magnetic stimulation (TMS). TMS is a non-invasive, non-drug procedure that uses magnetic fields to stimulate nerve cells. By pairing TMS with brain exercises, we aim to help patients PUSH against the onset of dementia.

Click here to learn more

PUMA Study

This research study explores the effects of marijuana use and stress on memory and thinking. We are looking for healthy adults aged 50-80 who regularly smoke/ingest marijuana.

Click here to learn more

If interested in either study, please contact:

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