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ARMADA: Advancing **R**eliable **M**easurement in **A**lzheimer's **D**isease and Cognitive **A**ging (NIA: U2C AG057441-01)

Devin Peipert, PhD

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DEPARTMENT OF
MEDICAL SOCIAL SCIENCES

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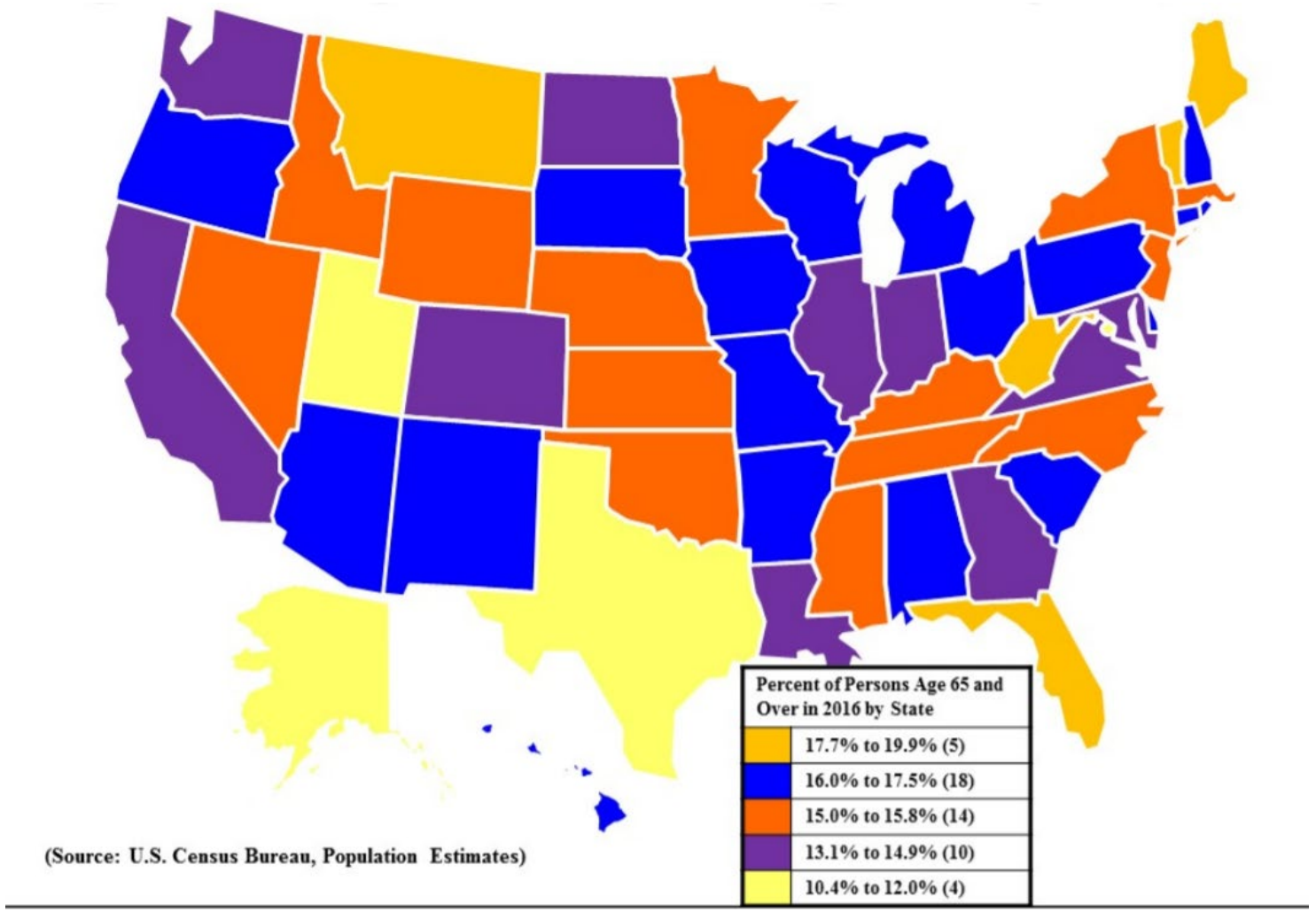
AGING AMERICA



2017 Profile of Older Americans

PREVALENCE OF ALZHEIMER'S

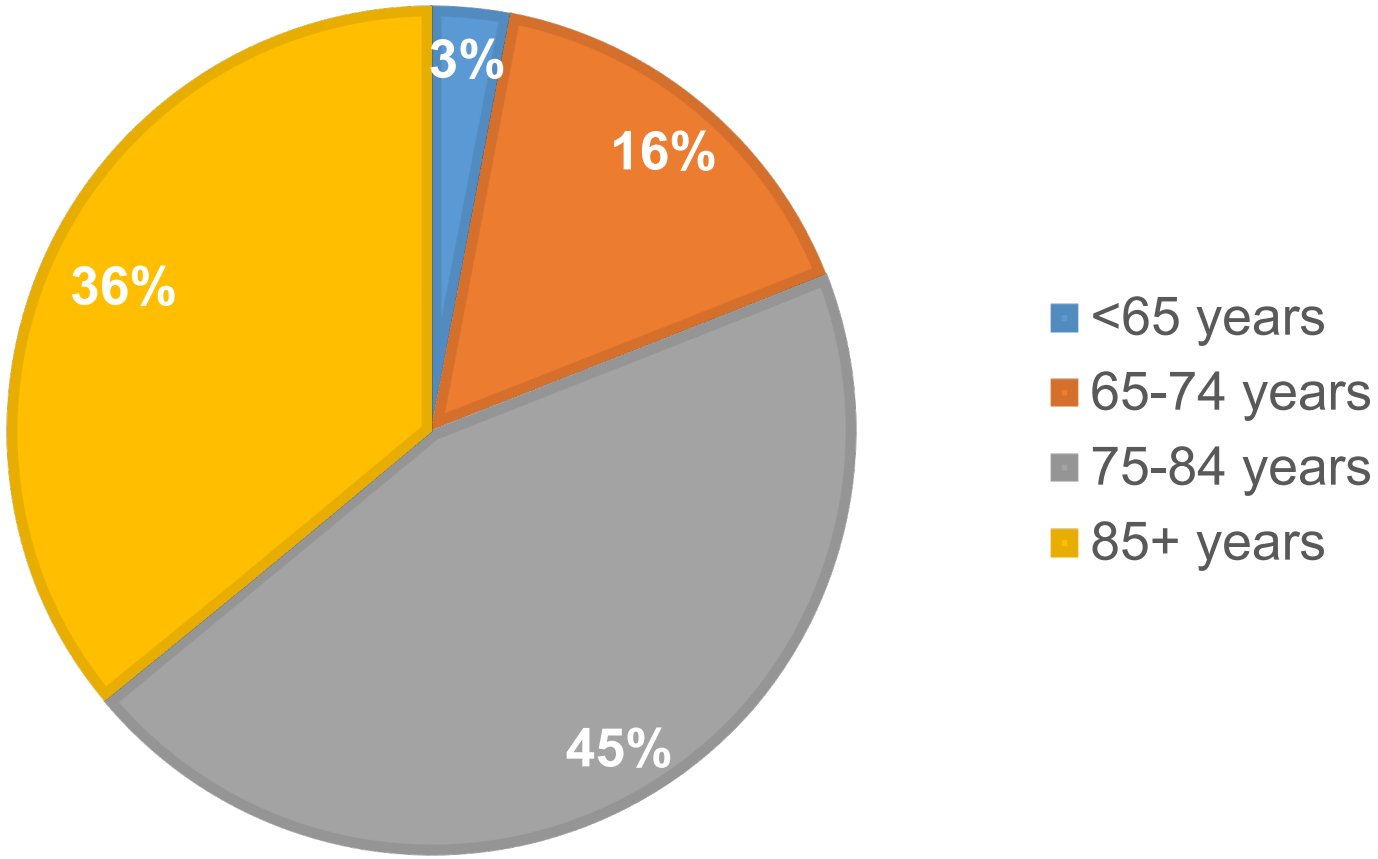
1 in 10

Americans aged **65 years** or older has **Alzheimer's Dementia**

5.8 million people

2017 Profile of Older Americans

RISK OF ALZHEIMER'S INCREASES WITH AGE



2019 Alzheimer's Disease Facts and Figures

COGNITIVE AGING & DECLINE

- Both mild & severe aging-associated cognitive decline impacts:
  - Independence
  - Well-being
  - Physical and mental function

Kestler (2012) *Cancer Nurs*; Honea (2007) *Semin Oncol Nurs*; Miaskowski (2007) *Semin Oncol Nurs*

NIH TOOLBOX

- The NIH Toolbox (NIHTB) is a multidimensional, standard set of brief, royalty-free performance and patient-reported outcome measures that assesses multiple domains in people ages 3-85:
  - ❑ Cognition
  - ❑ Sensation
  - ❑ Motor
  - ❑ Emotion
- Available in English and Spanish
- Most measures are scored on T-score metric (mean = 50, SD = 10)
  - Referenced to the general US population
  - Performance measures demographically corrected

Cognition

- Flanker Inhibitory Control and Attention
- Picture Sequence Memory
- List Sorting Working Memory
- Picture Vocabulary
- Oral Reading Recognition
- Dimensional Change Card Sort
- Pattern Comparison Processing Speed

Emotion

- Anger
- Fear
- Sadness
- Positive Affect
- General Life Satisfaction
- Meaning & Purpose
- Perceived Stress
- Self-Efficacy
- Social Support
- Companionship
- Social Distress

Motor

- 9-hole Pegboard Dexterity
- Grip Strength
- Standing Balance
- 2-minute Walk Endurance
- 4-meter Walk Gait Speed

Sensation

- Audition (Words in Noise)
- Visual Acuity
- Odor Identification
- Regional Taste Intensity
- Pain Interference
- Pain Intensity

NIHTB +

Including 3 new tests to potentially add to the NIHTB

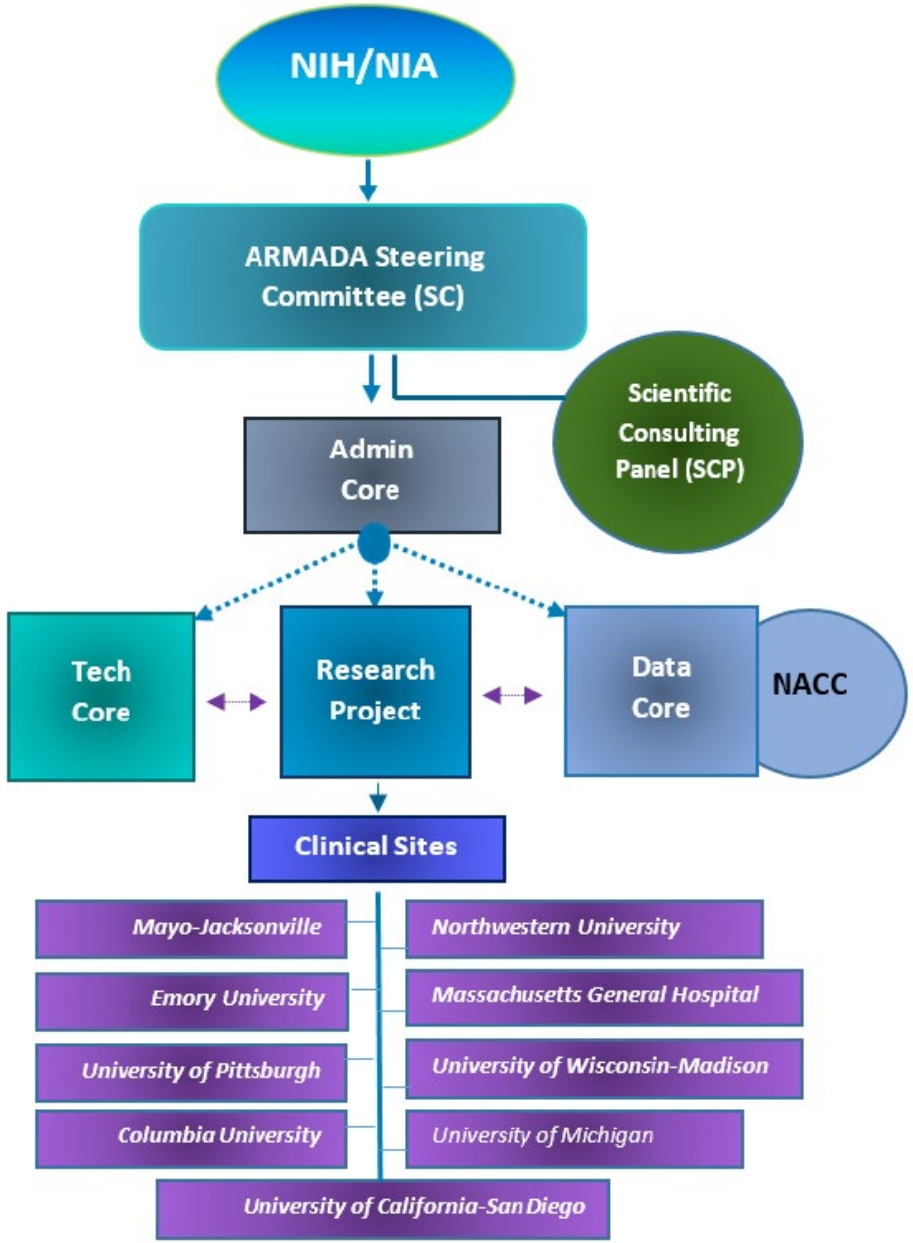
- ❑ Face Name Associative Memory (FNAME) (Cognition)
- ❑ Near Visual Acuity Test (Sensation)
- ❑ Hearing Threshold Test (Sensation)

STUDY AIMS

Aim 1: Operate a Central Data Repository

Aim 2: Conduct psychometric and statistical analysis to build validity evidence for the NIHTB+ batteries

- Alzheimer's Dementia & Mild Cognitive Impairment
- Normal Aging Controls
- "Oldest-old", aged 85+
- African Americans
- Spanish-Speakers


NIH/NIA
ARMADA Steering Committee (SC)
Scientific Consulting Panel (SCP)
Admin Core
Tech Core
Research Project
Data Core
NACC
Clinical Sites
Mayo-Jacksonville
Northwestern University
Emory University
Massachusetts General Hospital
University of Pittsburgh
University of Wisconsin-Madison
Columbia University
University of Michigan
University of California-San Diego

Where are We Now?

146 Baseline Surveys Complete

Descriptive Analyses of Baseline Data To Date

- Separated participants into:
  - General population 65-85 Normal Aging Controls
  - General population Mild Cognitive Impairment (MCI)
  - General population Alzheimer's Dementia (AD)
- Due to sample size, excluded
  - Age 86+
  - African American
  - Spanish-speaking

Statistical Analyses

- Conducted analyses only on the general population subset of the ultimate ARMADA sample
- Described participant characteristics stratified by cohort
- Compared NIHTB test scores across cohorts
  - One-way ANOVA with least-squared means

Baseline Cohorts to Date

	All (N=146)	Normal Aging 65-85 (n=103)	MCI (n=31)	Alzheimer's Disease (n=12)
Age, mean (range)	73 (65-84)	73 (65-84)	74 (66-82)	74 (66-84)
Female, % (n)	57% (83)	65% (67)	32% (10)	50% (6)
Hispanic/Latino, % (n)	1% (2)	1% (1)	3% (1)	0% (0)
White Race, % (n)	97% (142)	97% (100)	100% (31)	92% (11)
Education Level, % (n)				
Some College or Less	15% (22)	14% (14)	16% (5)	25% (3)
Bachelor's Degree	29% (43)	28% (29)	29% (9)	42% (5)
Graduate or Professional	56% (81)	58% (60)	55% (17)	33% (4)
Right Handed, % (n)	91% (133)	91% (94)	90% (28)	92% (11)

Cognition Scores by Cohort

	65-85	MCI	AD	p-value	R^2
Cognition Crystallized Composite	58.2	53.7	43.7	<0.001	0.26
Cognition Fluid Composite	52.4	39.7	21.7	<0.001	0.43
Cognition Total Composite	56.2	46.6	33.8	<0.001	0.40
Dimensional Change Card Sort	56.9	47	35.3	<0.001	0.32
Flanker Inhibitory Control and Attention	45.7	40.9	27.5	<0.001	0.33
List Sorting Working Memory	53.9	43.7	33.8	<0.001	0.33
Oral Reading Recognition	55.3	53.1	43.5	<0.001	0.19
Pattern Comparison Processing Speed	48.8	41.7	23.8	<0.001	0.25
Picture Sequence Memory	52.9	41.7	33.4	<0.001	0.24
Picture Vocabulary	59.6	53.6	45.4	<0.001	0.24
All reported in fully-corrected T scores					

Motor Scores by Cohort

	65-85	MCI	AD	p-value	R^2
Standing Balance	51.5	52.1	48.0	0.50	0.01
Grip Strength (Dominant Hand)	53.1	50.1	43.5	0.006	0.07
Grip Strength (Non-Dominant Hand)	53.3	49.5	45.3	0.006	0.07
9-Hole Pegboard (Dominant Hand)	49.1	45.5	39.4	0.003	0.08
9-Hole Pegboard (Non-Dominant Hand)	49.8	45.8	38.5	<0.001	0.12
2-Minute Walk Endurance	51.3	47.0	37.9	<0.001	0.16
4-Meter Walk Gait Speed	1.2	1.2	1.2	0.01	0.68
All reported in Fully-corrected T scores except 4-Meter Gait Speed (m/s)					

Emotion Scores by Cohort (1)

	65-85	MCI	AD	p-value	R^2
Anger-Affect (CAT)	46.9	45.5	51.5	0.18	0.02
Anger-Hostility (Fixed Form)	42.2	43.4	52.4	<0.001	0.12
Anger-Physical Aggression (Fixed Form)	44.4	46.2	51.6	<0.001	0.10
Emotional Support (Fixed Form)	47.8	47.2	42.3	0.11	0.03
Fear-Affect (CAT)	49.5	49.4	50.4	0.94	0.008
Fear-Somatic Arousal (Fixed Form)	47.7	44.9	47.0	0.30	0.02
Friendship (Fixed Form)	50.7	51.0	43.3	0.06	0.04
General Life Satisfaction (CAT)	56.7	54.9	51.8	0.16	0.02
Instrumental Support (Fixed Form)	49.6	52.4	49.3	0.40	0.01
Loneliness (Fixed Form)	49.6	47.9	56.4	0.05	0.04
All reported in uncorrected T scores					

Emotion Scores by Cohort (2)

	65-85	MCI	AD	p-value	R^2
Meaning and Purpose (CAT)	50.1	50.0	47.2	0.56	0.01
Perceived Hostility (Fixed Form)	48.5	48.6	51.9	0.01	0.40
Positive Affect (CAT)	48.5	48.1	45.2	0.01	0.30
Perceived Rejection (Fixed Form)	47.3	46.5	53.4	0.03	0.07
Perceived Stress (Fixed Form)	45.1	45.6	49.4	0.02	0.32
Sadness (CAT)	47.7	47.5	51.3	0.01	0.50
Self-Efficacy (CAT)	52.0	51.2	44.1	0.06	0.02
All reported in uncorrected T scores					

Sensation Scores by Cohort

	65-85	MCI	AD	p-value	R^2
Pain Interference (CAT) [a]	49.7	48.9	46.8	0.84	0.01
Odor Identification [b]	51.6	42.3	37.5	<0.001	0.20
Visual Acuity [b]	52.1	51.0	55.9	0.31	0.02
Words-in-Noise Left Threshold [c]	12.2	14.7	13.8	0.07	0.04
Words-in-Noise Right Threshold [c]	11.0	13.2	13.8	0.04	0.08

[a] Reported in uncorrected T scores
[b] Reported in fully-corrected T scores
[c] Other corrected score: Words in Noise [decibels of signal-to-noise ratio (dB S/N)]

CONCLUSIONS & NEXT STEPS

- Results are **preliminary** and are subject to change as more participants are recruited.
- Trends on NIHTB tests to date are as expected.
- Finalize baseline and 12 month data collection to begin validation analyses
  - Participants with available AD biomarkers
    - Amyloid imaging
    - Cerebrospinal fluid markers of amyloid and tau
    - Carrier status for the AD risk factor gene, ApoE4
  - Will identify a behavioral phenotype of biomarker positivity

Thank you!

Questions?