



# Social Determinants of Health: Wisconsin Longitudinal Study and Alzheimer's

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## Definition

- Social Determinants of Health:

Conditions in the environments in which people are born, live, work, play, worship, and age that impact a wide array of health, functioning, quality-of-life outcomes and risks\*





# CDC Health Impact Pyramid

## Factors that Affect Health



Check the Tarrant County Public Health Web site to learn more.  
<http://health.tarrantcounty.com>



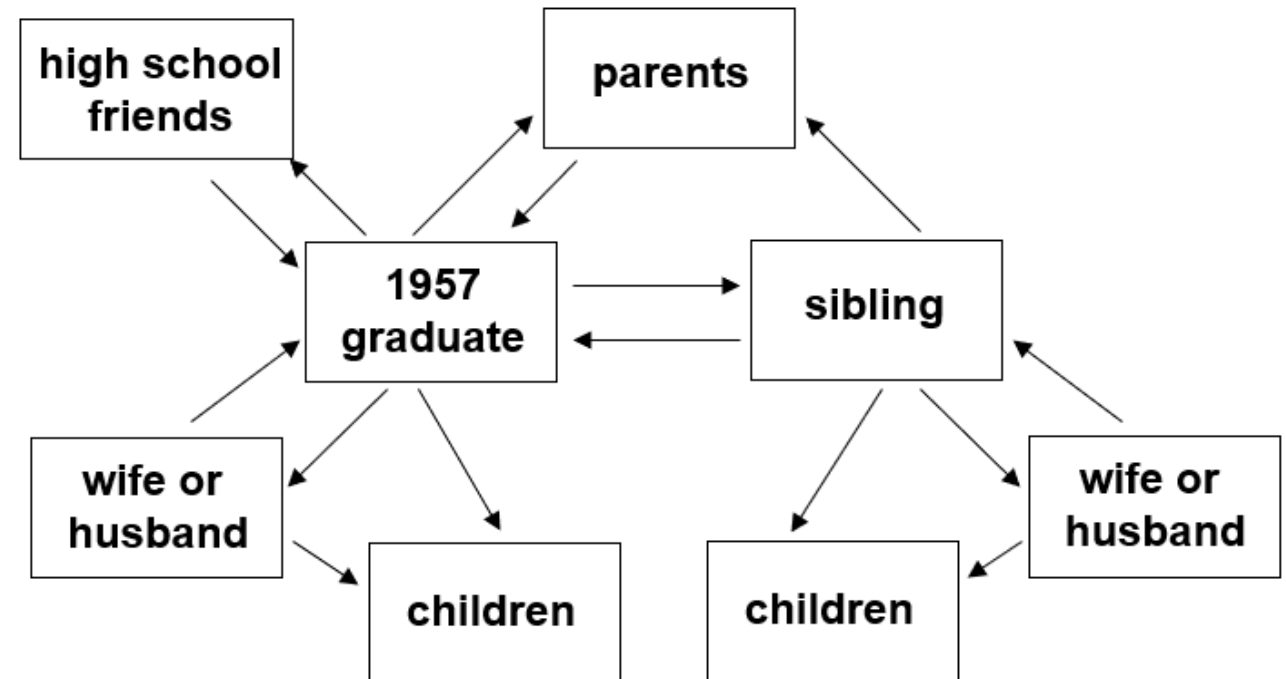
# 1957: The Wisconsin Longitudinal Study (WLS) is born

- NIH-funded since 1957
- 1/3 of all high school graduates
  - 10,317
- Social sciences-based study
- Data collection focused on:
  - Education, family life, aspirations, etc.
- Community-based sample
  - Rural and urban
  - All ranges of SES represented
    - 20% below poverty line at study enrollment
  - Largely a white, non-Hispanic sample
- Has become a world-class study
  - Nearly 500 different papers have come from this data



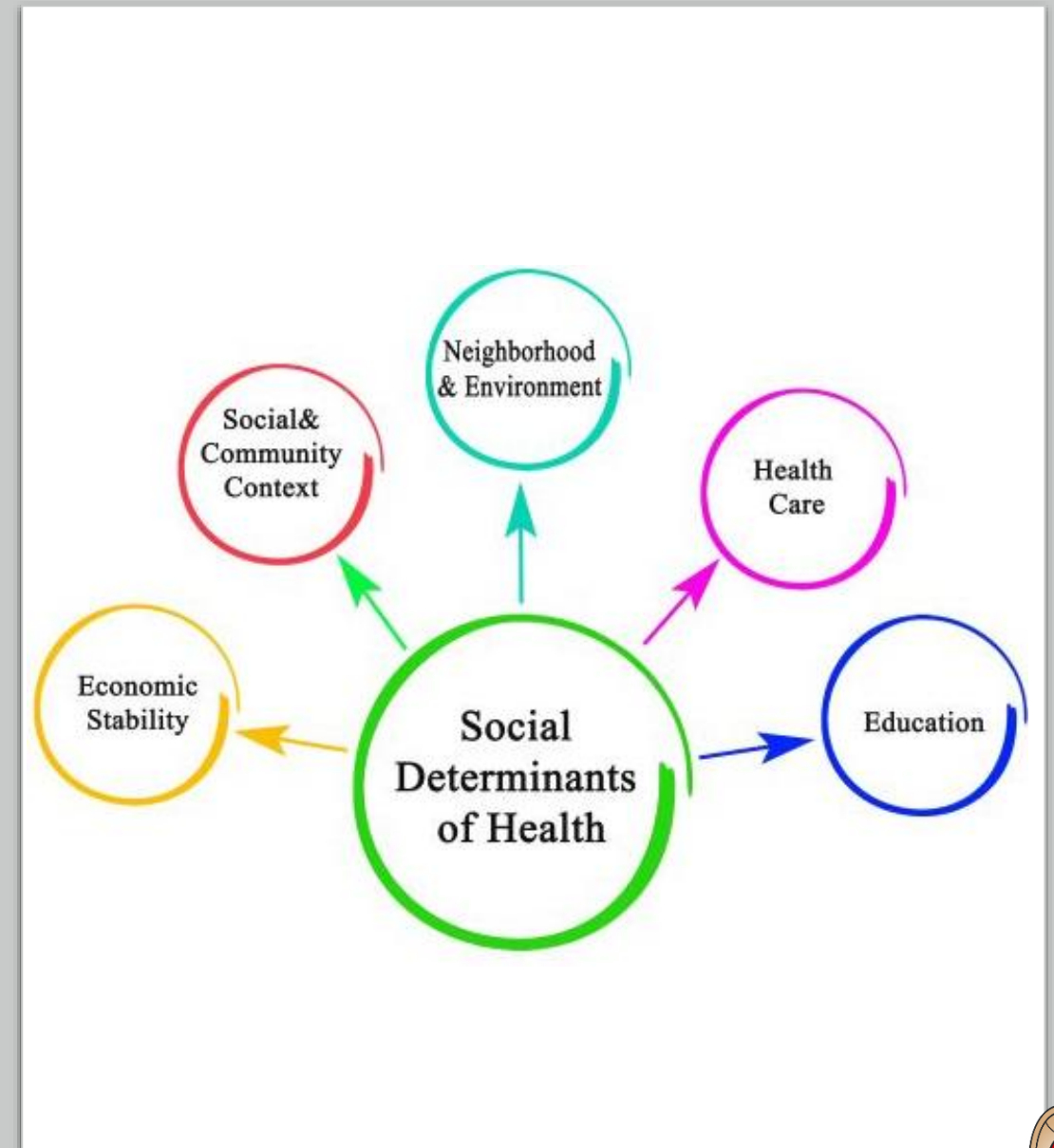
# 60+ years of data collection!

- Since 1957, WLS has had multiple waves of data collection:
  - 1964
  - 1975 – siblings added
  - 1993
  - 2003
  - 2011
  - NOW!



# WLS has collected a wealth of data!

- Data collected from prior waves:
  - Participant and family wealth and income
  - Employment history
  - Educational history
  - Mental and physical health history
  - Social activities
  - Religious affiliation
  - Childhood IQ
  - Cognitive testing
  - Genetics



# ILIAD Aims

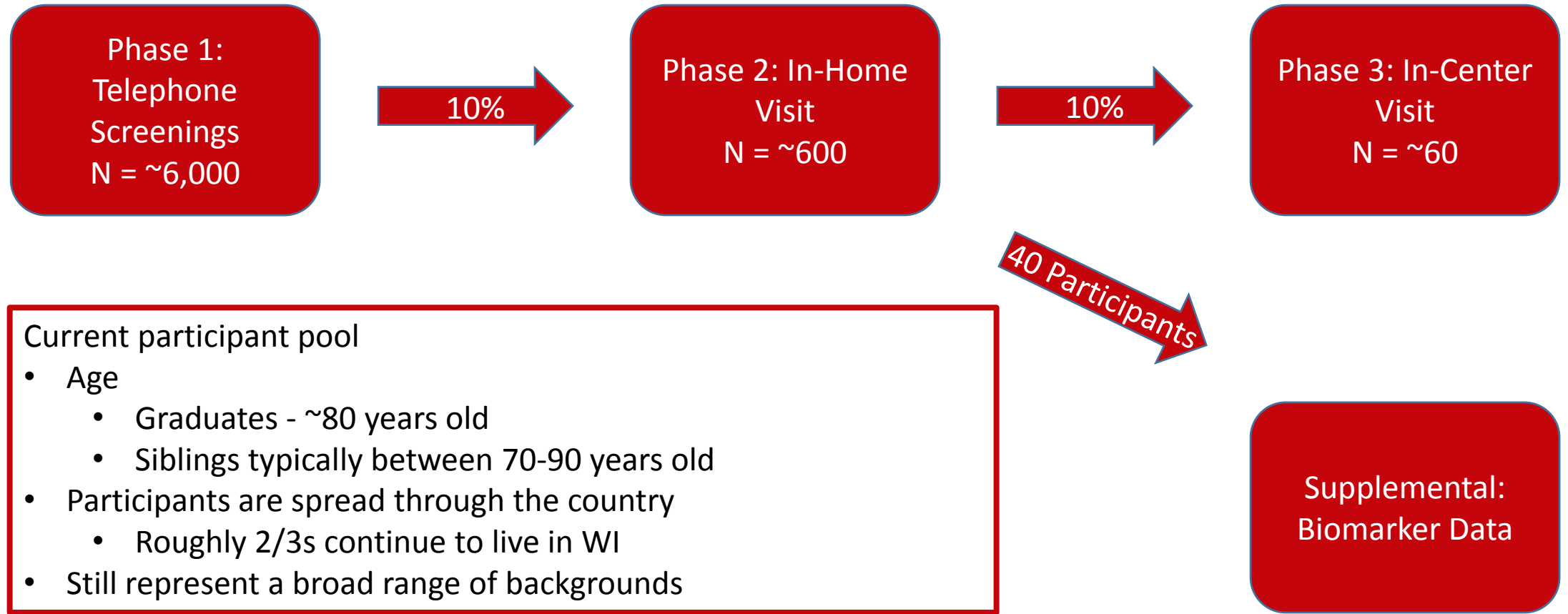
|        |   |
|--------|---|
| Track  | Track the progression of dementia across cognitive phenotypes (normal, AD dementia, non-AD dementia), including the use of rigorous AD diagnostic protocols, in the full population-based WLS cohort. |
| Test   | Test the role of early life disadvantage/ advantage on the risk for AD/ADRD in later life.  |
| Test   | Test whether early life disadvantage may be offset by adult behavioral protective factors.  |
| Test   | Test whether adolescent IQ and educational attainment moderate genetic risk for AD/ADRD.  |
| Create | Create a public good: a data resource that can facilitate cutting edge dementia research.   |





# WLS Current Wave: ILIAD!

Initial Lifetime's Impact on Alzheimer's Disease and Related Dementias



# Phase 1: Telephone Screenings

Phase 1:  
Telephone  
Screenings  
N = ~6,000

- Utilizes the Telephone Interview for Cognitive Status – Modified (TICS-m)
  - Out of 50
  - 28 cutoff point
  - Adjustments for education level
- Collects updates on data from prior waves
- Roughly 10% of participants will move on to Phase 2
- Pros:
  - Gathering updated data on much of the cohort
- Cons:
  - Our participants are 80 and hearing is an issue

Phase 2: In-Home  
Visit  
N = ~600

Phase 3: In-Center  
Visit  
N = ~60

Supplemental:  
Biomarker Data



# Phase 2: “In-Home” Visits

## Pre-COVID:

- Visits completed by a field interviewer and a nurse practitioner
- Visit includes:
  - Fully-clothed physical exam
  - Neurological exam
  - Cognitive testing
  - Study partner interview
- Culminates with a consensus conference
  - Roughly 10% moving on for Phase 3 visit

Phase 2: In-Home  
Visit  
N = ~600

## Post-COVID:

- Restarted this month
- Phone “visit” includes:
  - Modified cognitive testing
  - Fewer tests
  - Study partner interview
  - Discussion of medical history
- Will be longer and more in-depth than the Phase 1 Phone Screener
- Culminates with a consensus conference
  - Could result in greater than 10% moving on for Phase 3



# Phase 3: In-Center Visits

- Restarting within the next couple months
  - Enhanced COVID safety protocols to be modeled off Dane County and CDC recommendations
  - In-person AD research has restarted on other studies
- Visit includes:
  - MRI
  - Blood draw
    - Basic Metabolic Panel
    - Lipid Panel
    - Hs-CRP
- Case returns to consensus after visit



Phase 3: In-Center  
Visit  
N = ~60



Supplemental:  
Biomarker Data

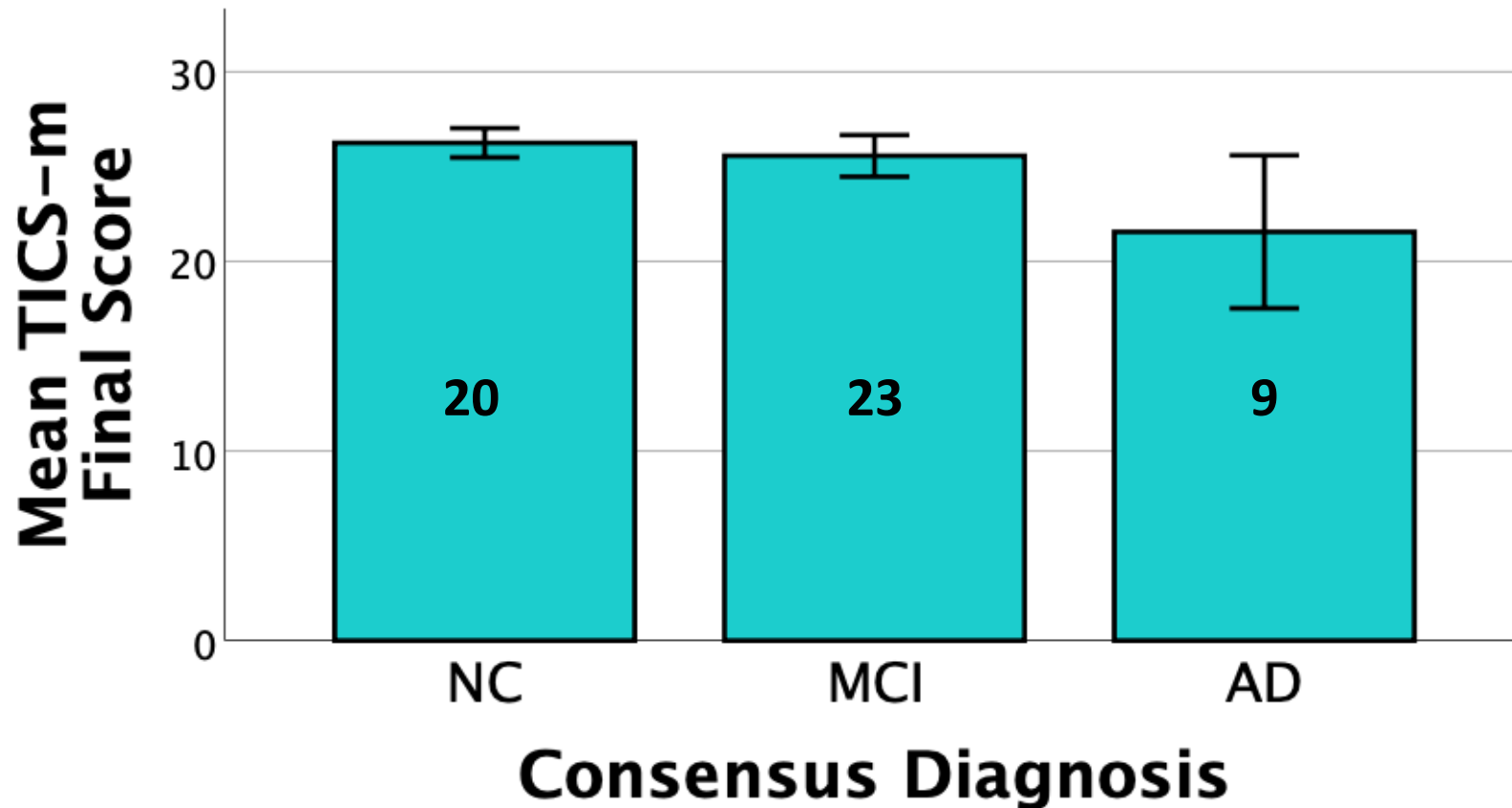


# Cognitive score sheet

|  | Raw Score | Standard | Percentile | Description |
|--|-----------|----------|------------|-------------|
| <b>GENERAL COGNITION</b>                 |           |          |            |             |
| CDR Global (1 SOB)                       | 0.5       |          |            | Normal      |
| MoCA                                     | 22 /30    | -0.79    | 21         | Low Average |
| <b>ATTENTION / PROCESSING SPEED</b>      |           |          |            |             |
| Trailmaking Part A (0 errors)            | 58 sec    | -0.97    | 17         | Low Average |
| Number Span Forward - Total              | 5 /14     | -1.38    | 8          | Borderline  |
| Number Span Forward - Span Length        | 5 /9      | -1.33    | 8          | Borderline  |
| Number Span Backwards - Total            | 3 /14     | -1.71    | 4          | Borderline  |
| Number Span Backwards - Span Length      | 3 /8      | -1.50    | 6          | Borderline  |
| WAIS-R Digit Symbol                      | 35        | 12       | 75         | Average     |
| <b>LANGUAGE</b>                          |           |          |            |             |
| MINT                                     | 28 /32    | -0.27    | 38         | Average     |
| Animal Fluency                           | 16        | -0.37    | 35         | Average     |
| Vegetable Fluency                        | 6         | -2.31    | 1          | Impaired    |
| F+L Words                                | 21        | -0.71    | 23         | Low Average |
| F+L+C Words                              | 33        | 10.00    | 50         | Average     |
| F Words                                  | 11        | -0.65    | 25         | Average     |
| L Words                                  | 10        | -0.65    | 25         | Average     |
| <b>VISUOSPATIAL</b>                      |           |          |            |             |
| Benson Figure Copy                       | 16 /16    | 0.44     | 67         | Average     |
| <b>MEMORY</b>                            |           |          |            |             |
| Benson Delay (0% retained; Recog = N)    | 0 /16     | -3.03    | 1          | Impaired    |
| Craft Immediate - Verbatim               | 5 /44     | -2.43    | 1          | Impaired    |
| Craft Immediate - Paraphrase             | 3 /25     | -3.05    | 1          | Impaired    |
| Craft Delay - Verbatim (80% retained)    | 4 /44     | -1.86    | 3          | Borderline  |
| Craft Delay - Paraphrase (100% retained) | 3 /25     | -2.31    | 1          | Impaired    |
| RAVLT Total Learning (4, 6, 7, 6, 6)     | 29 /75    | -1.08    | 13         | Low Average |
| RAVLT Distractor List                    | 3 /15     | -0.56    | 28         | Average     |
| RAVLT Short Delay                        | 0 /15     | -2.26    | 1          | Impaired    |
| RAVLT Long Delay (0% retained)           | 0 /15     | -2.92    | 1          | Impaired    |
| RAVLT Recognition (TP=12; TN=12)         | 80 %      | 7        | 16         | Low Average |
| <b>EXECUTIVE FUNCTIONING</b>             |           |          |            |             |
| Trailmaking Part B (2 errors)            | 163 sec   | -0.82    | 20         | Low Average |
| Clock Drawing Test                       | 2 /3      | ---      | ---        | Impaired    |
| <b>MOOD</b>                              |           |          |            |             |
| GDS-15 (Depression Symptoms)             | 0 /15     | ---      | ---        | Minimal     |



# TICS-m Score by Consensus Diagnosis

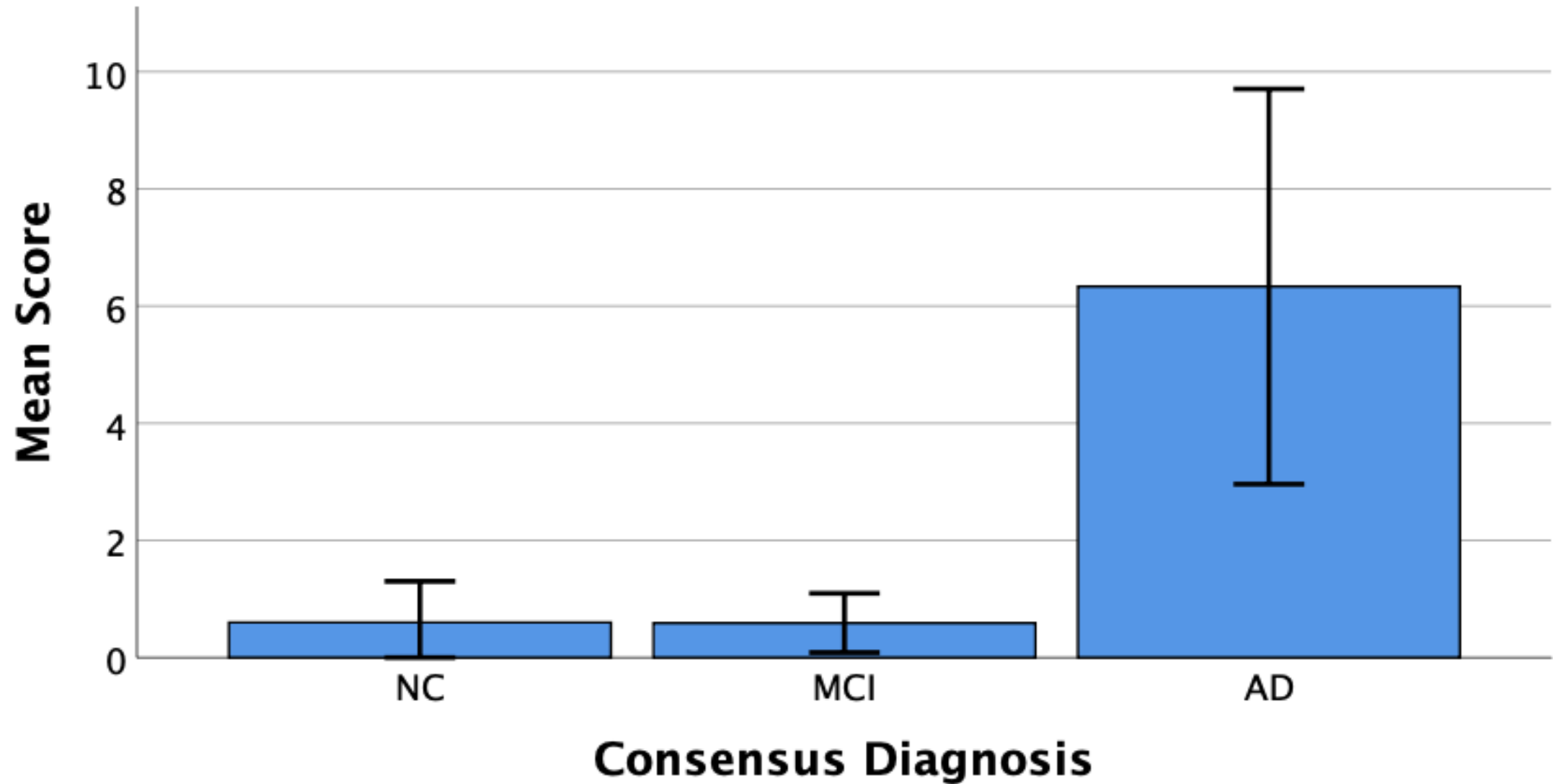


Error Bars: 95% CI

TICS-m score significantly predicted diagnosis overall ( $F(49)=8.55$ ,  $p=0.001$ ). There was a significant difference in TICS-m score between AD and both MCI ( $p=0.003$ ) and normal controls ( $p=0.001$ ), but not between NC and MCI ( $p=0.722$ ).



# NACC Functional Assessment Scale (FAS)



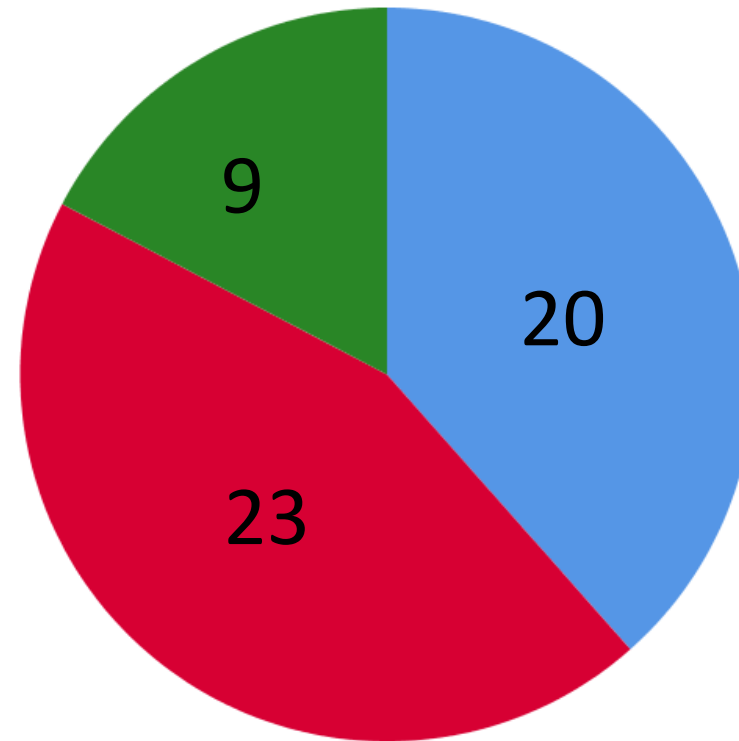
Error Bars: 95% CI



# Research Diagnosis

## Diagnosis

- Normal Cognition
- MCI
- Dementia



## Consensus Diagnosis





# The Future of WLS

- Supplemental Biomarker Data
  - Newly approved addition to WLS
  - Feasibility study (to start!)
    - Visit includes:
      - PET imaging
      - MRI
      - Blood draw
      - Lumbar puncture
      - Cognitive testing
      - Physical exam
  - Possibly visiting participant's children in the future??

Phase 2: In-Home Visit  
N = ~600

10%

Phase 3: In-Center Visit  
N = ~60

40 Participants

Supplemental:  
Biomarker Data



# Summary

- Several social factors likely affect the risk and progression of dementia
- The WLS is a landmark study evaluating the potential effects of life long exposure to various social factors and risk of dementia
- Findings from WLS will also assess if certain lifestyle and other factors can protect against dementia
- Plans are to seek additional funding from NIH and other sources to expand Alzheimer's biomarkers data on a larger number of WLS participants

Questions?



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