What is good research?
- How do I know this article is methodological sound?
- Are the findings clinically meaningful
  - Statistical versus clinical significance
- Design of research is a compromise
  - Use best possible methods
  - Avoid as many confound or other interpretations of your data
- Look for convergence among research methods

Research Methods
- What approaches do scientists use to measure behavior in aging research?
- What specific designs are unique to aging research?
- What are general designs for doing research?

Conducting Research Ethically
- Collaborative Research Training Initiative (CITI training)
- Institutional Review Board
- Informed Consent

Reliability & Validity of Measures
- Choice of outcome measures is important
- Reliability of a measure: extent to which it provides a consistent index of the behavior of interest (measurement error).
  - Repeatedly over items (internal consistency), over time (test-retest), over judges (inter-rater)
- Validity of a measure: extent to which it measures what researchers think it measures.
  - Content (representativeness of sample of items), construct (assessing what suppose to be measuring; convergent & discriminant validity), criterion-related (relationship with an outcome; concurrent & predictive validity)

Development of a questionnaire to capture difficulties with everyday activities
Internal Consistency Reliability

<table>
<thead>
<tr>
<th>Factor</th>
<th>Total Score</th>
<th>Variance</th>
<th>% Variance</th>
<th>chi-square</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.51</td>
<td>.00</td>
<td>8.8</td>
<td>98.56</td>
<td>4</td>
<td>.00</td>
</tr>
<tr>
<td>2</td>
<td>.56</td>
<td>.00</td>
<td>8.3</td>
<td>94.20</td>
<td>4</td>
<td>.00</td>
</tr>
<tr>
<td>3</td>
<td>.75</td>
<td>.00</td>
<td>1.0</td>
<td>68.74</td>
<td>4</td>
<td>.00</td>
</tr>
<tr>
<td>4</td>
<td>.91</td>
<td>.00</td>
<td>6.7</td>
<td>59.71</td>
<td>4</td>
<td>.00</td>
</tr>
</tbody>
</table>

- 27 item IADL-C, 4 factors accounted for 75.3% of variance
- Each of 4 scales also showed adequate fit to Rasch model supporting model unidimensionality

Test-Retest Reliability

- Healthy OA (N = 10) and MCI (N = 31)
- Interval avg 4.03 months (range 2-6)
- Spearman Correlation Coefficients
  - IADL-C total score ($r_s = .91$)
  - money and self-management subscale ($r_s = .91$)
  - home daily living ($r_s = .76$)
  - travel and event memory ($r_s = .70$)
  - social skills ($r_s = .70$)

Convergent & Discriminant Validity

Hypothesized:
0.5-0.8: Moderate to High (everyday functioning)
0.4-0.6: Moderate (global cognitive status)
0.0-0.3: Low (psychosocial & Demographics)

Ability to Distinguish between Diagnostic Groups

Representative Sampling

- Generalizability – across people, environment etc.
- Most aging research conducted on:
  - White
  - Middle-class
  - Well-educated
- Most research conducted in a laboratory environment
- Effects external validity

Aging Assistive Technologies Programs

- Video intervention to increase awareness & knowledge about ASTs, promote more positive attitudes and reduce stigma among users, caregivers and professionals.
- AST phone intervention to help promote AST use
- AST Lending Program
The Meaning of Age

- How old are you?
  - Calendar years?
  - How old you feel at this time?
  - How old you look?
  - Your cognitive competence?
  - Your social role?

Ernestine Shepherd, at age 74, said she’s up at 3 a.m. every morning: runs, lifts weights and works out with other senior citizens at a local church in Baltimore. “I feel better than I did at 40”

How Older Age Defined in Research

- When does late adulthood or older age begin?
  - Most developed countries use age 60/65+
  - Some gerontologist differentiate between
    - Young-old (60/65 – 74)
    - Old-old (75 - 84)
    - Oldest-old (age 85+)
    - Centurions (age 100+)

Research Design

- Nondevelopmental research
  - Examine relationships between factors that might apply regardless of age
- Developmental research

Developmental Research Design

- Age Effects
  - Differences due to underlying aging processes (biological, psychological or social)
  - Variable in cross-sectional & longitudinal designs
- Cohort Effects (generation)
  - Differences due to experiences and circumstances unique to the generation to which one belongs
  - Possible confound in cross-sectional designs
- Time-of-Measurement Effects
  - Differences stemming from social, environmental, historical, or other events at time data collected
  - Possible confound in longitudinal designs
Developmental Research

- **Cross-Sectional Research Design**
  - Involves comparing groups of people varying in age
  - Does not take long to complete
  - Cannot disentangle aging process from cohort effects
  - Allows us to make statements about Age Differences but not Age Changes

- **Longitudinal Research Designs**
  - Involves observations of the same person at two or more different points in time
  - Time consuming and expensive to complete
  - Shifts in personnel, subject attrition, practice effects
  - Allows us to record Age Changes
  - Cannot disentangle age changes from time of measurement effects

Research Methods

- Controlled experiments
- Quasi-experimental & Non-experimental designs
- Correlational studies
- Observational methods
- Psychobiological studies
- Survey and questionnaire measures
- Standardized test
- Qualitative methods: Interviews and focus groups
- Case studies
- Computer simulations and artificial intelligence
In an Experiment...
- Random sample of participants
- Manipulate the Independent Variable (IV)
  - Create experimental group
  - Create control group
  - Randomly assign participants
- Measure the Dependent Variable(s) (DV)
  - Same for all groups
- Control all other variables
  - Prevent confounds

Experimental design
- Amap task
  - Participants: older adults randomly assigned to condition
    - IV: planning condition (planning versus no planning)
    - DV: task accuracy & efficiency measures

Possible confounds?

Experimental Methods
- Age cannot be manipulated or randomly assigned
  - Quasi-experimental design
    - No random assignment
    - Manipulate the Independent Variable
  - Non-experimental design
    - No random assignment
    - No variable manipulated

Quasi-Experimental design
- Amap task
  - Participants: older & younger adults
    - IV: planning condition (planning versus no planning)
    - DV: task accuracy & efficiency measures

Non-Experimental design
- Amap task
  - Participants: older adults & individuals with mild cognitive impairment
    - IV: none: all perform Amap task with planning
    - DV: record task accuracy & efficiency measures

Correlational Studies
- Cannot infer causation
- Simply measure variables of interest
- Nature of relationship
  - Positive Correlation
  - Negative Correlation
- Strength of relationship
  - Determined by size of “r”
    - -1.0 to 1.0;
    - r of 0 = unrelated
What Factors Are Associated With the Reduction of Risk of Alzheimer’s Disease?

- Causation cannot yet be drawn about the association of any modifiable risk factor with AD (all data correlational)

<table>
<thead>
<tr>
<th>Linked to Decreased Risk of AD</th>
<th>Linked to Increased Risk of AD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate folic acid intake</td>
<td>Diabetes</td>
</tr>
<tr>
<td>Low saturated fat consumption</td>
<td>Elevated blood cholesterol (midlife)</td>
</tr>
<tr>
<td>High fruit &amp; veggie consumption</td>
<td>Depression</td>
</tr>
<tr>
<td>Use of statins</td>
<td>Current smoking</td>
</tr>
<tr>
<td>Light to moderate alcohol use</td>
<td>Never been married</td>
</tr>
<tr>
<td>Educational attainment</td>
<td>Low social support</td>
</tr>
<tr>
<td>Cognitive engagement</td>
<td>Participation in physical exercise</td>
</tr>
</tbody>
</table>

Observational Methods

- Naturalistic Observation: Observation of performance in everyday situations outside of the lab without any attempt to intervene; the situation is not initiated, manipulated or controlled by the investigator
  - Less experimental control
  - Presence of an observer could affect performance (reactivity)
  - High ecological validity

Community Activities: Compensatory Strategy Study

1. **Banking**: Please deposit the provided $20 check in your bank. Please save the receipt from the transaction and save it where you would put important documents.

2. **Shopping**: Please purchase items for a light lunch and a dessert you can serve guests at a party. Please purchase items as you normally would and as part of an already-planned shopping trip to avoid making a separate trip. You will be using the items during your next session. Please put purchased items away where you normally would put each item.

Because I want you to complete the shopping task in as natural of a way as possible I will not be accompanying you on this trip. Rather, if you agree, I would like you to wear a small, lightweight camera while you shop and put away your items. You can attach the camera to your shirt or the provided bag. We want the camera to record the tasks which provides you any discomfort. You do not need to wear the camera for the banking task. Furthermore, please remove and turn off the camera when you are waiting in line to respect the privacy of others. If someone were to approach in the store please let them read the backside of this page, let them know you are a part of a research study, and ask their verbal permission to continue recording. If they decline, please turn off the camera.

Psychobiological Studies

- Postmortem studies
  - Examining the cortex of persons with AD after death to see if count of plaques and tangles relates to degree of cognitive and functional deficits
  - Brain damaged individuals and their deficits
    - Study functional difficulties that individuals with MCI have as they progress to dementia
  - Monitor brain function of a participant doing a task (fMRI)
    - Measure brain activity while healthy older adults and individuals with MCI and AD are performing a working memory task

- Limited accessibility, expensive, small samples
- Networks of researchers working together to create large datasets: ADNI, TBI Model networks, CART

Survey and Questionnaire Methods

- Self-Report: Obtain participants’ report in progress or as recollected
  - Questionnaires
  - Diary
  - Ecological Momentary Assessment
  - Interviews
  - Think Aloud
  - Participants describe their conscious thoughts while working with a new prompting interface

- Informant Report: Obtain report about participants from someone who knows participant (e.g. spouse, clinician)

- Subject to reporter bias
- Cannot be assumed to be a mirror into objective status
- Context effects (wording, social)
Standardized Tests
- A test that is administered and scored in a standardized manner (e.g., neuropsychological test)

Continuous Data
- Wearable sensors
  - Sleep wake, activity levels etc.
- Smart home sensors
  - Activity recognition

Qualitative Methods
- Allow for exploration of a phenomenon of interest in an open-ended fashion
- Data typically organized on basis of themes
  - Interviews
  - Focus Groups
    - Discuss a topic with a group of respondents
  - Interviewer bias
  - Group dynamics

Focus Groups
Group TX Study - memory notebook
- Themes:
  - Support: Not feeling isolated/social support/other people are going through this too
  - Empowerment: Feeling empowered by a "game plan"/having tools to compensate for memory problems/psychoeducation to understand the process

Other Methods
- Case Study: Intensive studies of individuals
  - May examine archival records, interviews, direct observation, or participant-observations
  - Teaching an individual with memory deficits to use an electronic memory notebook paired with a smart home
  - Phineas Gage or HM
- Meta-analysis
  - A statistical technique for combining the findings from independent studies
Computers in Research

- **Computer Simulations**
  - Attempt to make computers simulate human performance on various tasks
- **Artificial Intelligence**
  - Attempt to make computers demonstrate intelligent cognitive performance, regardless of whether the process resembles human cognitive processing
  - Limitation imposed by hardware and the programs written by researchers

Model for solving volume conservation task