# Forensic Research

JUNE 19, 2017

DEPARTMENT OF JUSTICE
Elder Justice INITIATIVE

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# TECHNICAL OVERVIEW

- If you are experiencing any technical issues with the audio for this session, please let us know in the feedback box.
- If you have technical difficulties during the webinar, contact Jason Adams, who is providing technical support for this webinar. His email address is jadams@ovcttac.org.
- Today's session will be recorded and made available on the training website.
- If you have questions, type them in the feedback box, and we will address as many as possible toward the end of the webinar.

# TODAY'S WEBINAR

"Neural Correlates of Financial Decisionmaking in Old Age"

Dr. S. Duke Han

# ELDER JUSTICE INITIATIVE

- The **mission** is to support and coordinate the Department of Justice's enforcement and programmatic efforts to combat elder abuse, neglect, and financial fraud and scams that target older adults.

- The Initiative does so by—
  - Promoting justice for older adults.
  - Helping older victims and their families.
  - Enhancing state and local efforts through training and resources.
  - Supporting, organizing and presenting research to improve elder abuse policy and practice.

# ElderJustice.gov


DEPARTMENT OF JUSTICE
ElderJustice INITIATIVE

# INTRODUCING

S. Duke Han, PhD, ABPP-CN
Director of Neuropsychology
Department of Family Medicine
Assoc. Professor of Family Medicine, Neurology, Psychology, and Gerontology
Keck School of Medicine
University of Southern California
Visiting Associate Professor of Neurological and Behavioral Sciences
Rush Alzheimer's Disease Center

I figured out what was wrong with my brain; on the left there is nothing right, on the right there is nothing left.

someecards
user card

# Background

- Adults over the age of 65 hold $18.1 trillion of the $53.1 trillion (approximately 1/3) in U.S. household net worth (Laibson, 2011).

- Older adults lose more than $3 billion annually to financial scams or fraud (MetLife, Inc., 2011), and some estimate this to be as high as $36 billion (True Link Financial, 2015).

- The problem of financial and health care fraud targeted at elderly persons is so significant that the FBI maintains a website dedicated to the problem.

# SCAMS AND SAFETY



## Fraud Against Seniors

The FBI's Common Fraud Schemes webpage provides tips on how you can protect yourself and your family from fraud. Senior citizens especially should be aware of fraud schemes for the following reasons:

- Senior citizens are most likely to have a "nest egg," to own their home, and/or to have excellent credit—all of which make them attractive to con artists.
- People who grew up in the 1930s, 1940s, and 1950s were generally raised to be polite and trusting. Con artists exploit these traits, knowing that it is difficult or impossible for these individuals to say "no" or just hang up the telephone.
- Older Americans are less likely to report a fraud because they don't know who to report it to, are too ashamed at having been scammed, or don't know they have been scammed. Elderly victims may not report crimes, for example, because they are concerned that relatives may think the victims no longer have the mental capacity to take care of their own financial affairs.
- When an elderly victim does report the crime, they often make poor witnesses. Con artists know the effects of age on memory, and they are counting on elderly victims not being able to supply enough detailed information to investigators. In addition, the victims' realization that they have been swindled may take weeks—or more likely, months—after contact with the fraudster. This extended time frame makes it even more difficult to remember details from the events.
- Senior citizens are more interested in and susceptible to products promising increased cognitive function, virility, physical conditioning, anti-cancer properties, and so on. In a country where new cures and vaccinations for old diseases have given every American hope for a long and fruitful life, it is not so unbelievable that the con artists' products can do what they claim.

## Telemarketing Fraud for Seniors

If you are age 60 or older—and especially if you are an older woman living alone—you may be a special target of people who sell bogus products and services by telephone. Telemarketing scams often involve offers of free prizes, low-cost vitamins and health care products, and inexpensive vacations. For more information and tips to avoid these scams please visit the Telemarketing Fraud webpage.

**Additional Resources on Frauds Impacting Seniors:**

- Resources from the United States Senate Special Committee on Aging

THE VANISHING MIND

# Money Woes Can Be Early Clue to Alzheimer's

Ryan Collerd for The New York Times

As Arthur Packel's dementia grew worse, he forgot how to handle money, and his wife, Renee, could not find where it all went.

By GINA KOLATA
Published: October 30, 2010

Renee Packel used to have a typical suburban life. Her husband, Arthur, was a lawyer and also sold insurance. They lived in a town house just outside Philadelphia, and Mrs. Packel took care of their home and family.

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**The Vanishing Mind**

*Dollars and Dementia*

Articles in this series are examining the worldwide struggle to find answers about Alzheimer's disease.

Previous Articles in the Series »

**Related in Opinion**

Room for Debate: When Boomers Get Dementia (June 2, 2010)



One day, it all came crashing down. The homeowners' association called asking for their fees. To Mrs. Packel's surprise, her husband had simply stopped paying them. Then she learned he had stopped writing checks to his creditors, too.

It turned out that Mr. Packel was developing Alzheimer's disease and had forgotten how to handle money. When she tried to pay their bills, Mrs. Packel, who enlisted the help of a forensic accountant, could not find most of the couple's money.

"It just disappeared," she said.

What happened to the Packels is all too common, Alzheimer's experts say. New research shows that one of the first signs of impending dementia is an inability to understand money and credit, contracts and agreements.



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Renee Packel used to have a typical suburban life. Her husband, Arthur, was a lawyer and also sold insurance. They lived in a town house just outside Philadelphia, and Mrs. Packel took care of their home and family.

One day, it all came crashing down. The homeowners' association called asking for their fees. To Mrs. Packel's surprise, her husband had simply stopped paying them. Then she learned he had stopped writing checks to his creditors, too.

It turned out that Mr. Packel was developing Alzheimer's disease and had forgotten how to handle money. When she tried to pay their bills, Mrs. Packel, who enlisted the help of a forensic accountant, could not find most of the couple's money.

"It just disappeared," she said.

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OPEN ACCESS Freely available online

PLOS ONE

# Poor Decision Making Is a Consequence of Cognitive Decline among Older Persons without Alzheimer's Disease or Mild Cognitive Impairment

**Patricia A. Boyle[1,2]*, Lei Yu[1,3], Robert S. Wilson[1,3], Keith Gamble[1,4], Aron S. Buchman[1,3], David A. Bennett[1,3]**

**1** Rush Alzheimer's Disease Center, Rush University Medical Center, Chicago, Illinois, United States of America, **2** Department of Behavioral Sciences, Rush University Medical Center, Chicago, Illinois, United States of America, **3** Department of Neurological Sciences, Rush University Medical Center, Chicago, Illinois, United States of America, **4** Department of Finance, DePaul University, Chicago, Illinois, United States of America

**Table 2.** Decision making and scams as a function of cognitive decline*.

| | Persons without dementia N = 420 | | No cognitive impairment only N = 334 | |
|---|---|---|---|---|
| | EST (SE) | P | EST (SE) | P |
| Decision making | | | | |
| Age | −0.057 (0.017) | <.001 | −0.051 (0.018) | 0.005 |
| Female | 1.142 (0.276) | <.001 | 0.949 (0.308) | 0.002 |
| Education | 0.154 (0.042) | <.001 | 0.115 (0.047) | 0.015 |
| Starting level of cognition | 2.284 (0.286) | <.001 | 2.935 (0.364) | <.001 |
| Cognitive decline | 0.229 (0.041) | <.001 | 0.195 (0.051) | <.001 |
| Susceptibility to scams | | | | |
| Age | 0.019 (0.005) | <.001 | 0.026 (0.005) | <.001 |
| Female | 0.030 (0.080) | 0.703 | 0.062 (0.088) | 0.478 |
| Education | −0.019 (0.012) | 0.106 | −0.017 (0.013) | 0.194 |
| Starting level of cognition | −0.152 (0.082) | 0.065 | −0.195 (0.104) | 0.060 |
| Cognitive decline | −0.039 (0.012) | 0.001 | −0.031 (0.015) | 0.037 |

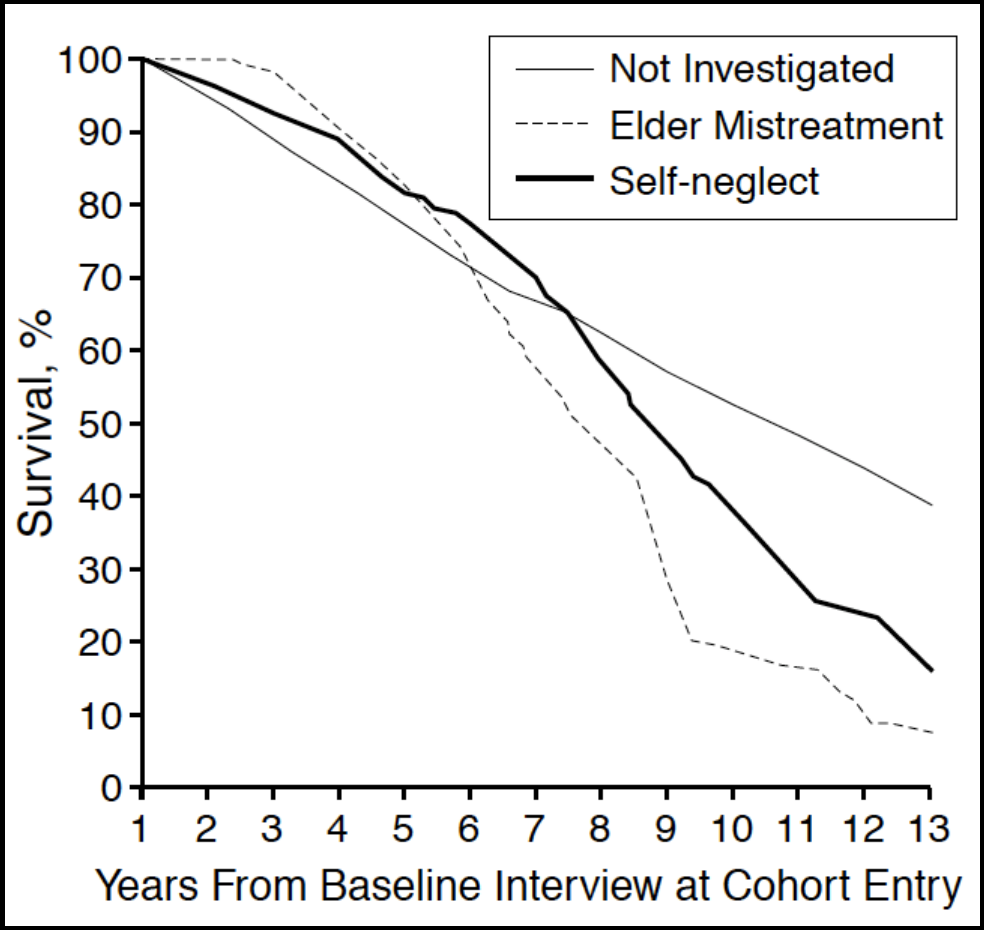
*Parameter estimates of cognitive decline per 0.01 unit increase in rate of change; estimated from regression models adjusted for age, sex, education, and starting level of cognition.

doi:10.1371/journal.pone.0043647.t002

# The Mortality of Elder Mistreatment

Mark S. Lachs, MD, MPH; Christianna S. Williams, MA; Shelley O'Brien, MS;
Karl A. Pillemer, PhD; Mary E. Charlson, MD





Original Paper

Neuro
epidemiology

Neuroepidemiology 2013;40:247–252
DOI: 10.1159/000342781

Received
Accepted
Published

# Poor Decision Making Is Associated with an Increased Risk of Mortality among Community-Dwelling Older Persons without Dementia

Patricia A. Boyle[a, b] Robert S. Wilson[a–c] Lei Yu[a, c] Aron S. Buchman[a, c]
David A. Bennett[a, c]

[a]Rush Alzheimer's Disease Center, [b]Department of Behavioral Sciences and [c]Department of Neurological S
Rush University Medical Center, Chicago, Ill., USA

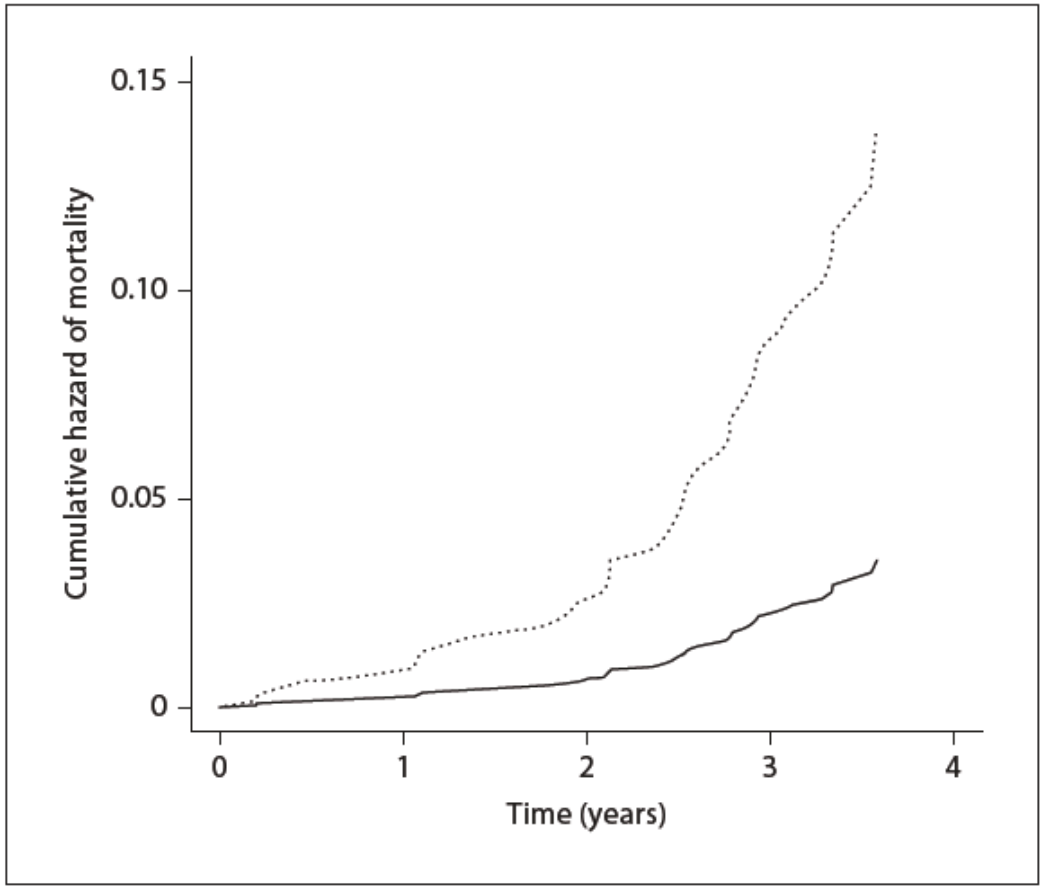



**Fig. 1.** Cumulative hazard of mortality for participants with poor (dotted line) versus good (solid line) decision making derived from a model adjusted for age, sex and education.

# Rationale

If an older adult shows impaired financial decisionmaking or becomes a victim of a scam, the burden is not only experienced by the older adult, but is often displaced upon family members, care givers, or society.

There is some suggestion that impairment in decisionmaking may be an early sign of Alzheimer's disease.

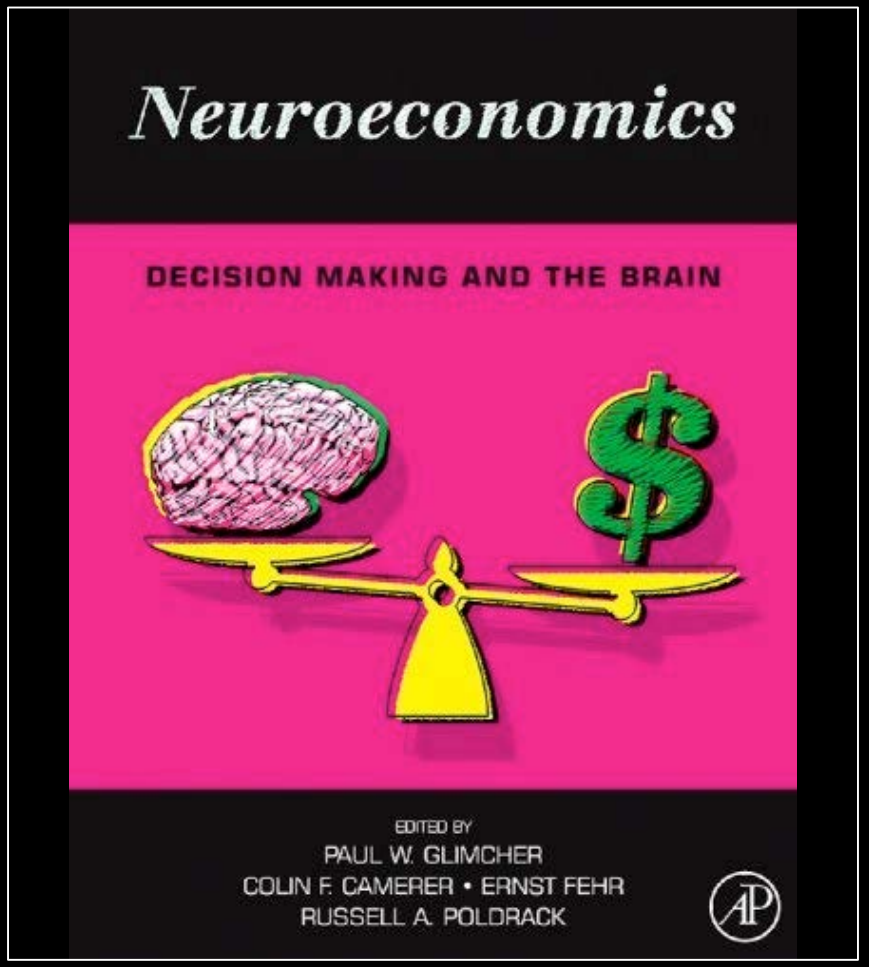
Poor decisionmaking is associated with an increased risk of mortality.

*Therefore, understanding the susceptibility of older persons to impaired decisionmaking or fraud is a significant public health concern, as this understanding may inform prevention and intervention strategies.*

- *How can we understand this?*

# Neuroeconomics

- Integration of the fields of economics and neuroscience
- Neuroscience methods are used to elucidate the biology of economic principles
- Methods include brain imaging and computational neuroscience




Schiller, 2011; Camerer et al., 2005

# Paul B. Beeson Career Development Award in Aging Research

## Neural Correlates of Impaired Financial and Healthcare Decision Making in Old Age (NIH K23AG040625; PI: Han)


Funding Sources:

- National Institute of Aging
- National Institute of Mental Health
- American Federation for Aging Research (AFAR)
- John A. Hartford Foundation
- Atlantic Philanthropies
- The Starr Foundation


Mentoring Team:

- Rush University: David A. Bennett, MD, Konstantinos Arfanakis, PhD, Lisa Barnes, PhD, Debra Fleischman, PhD, Patricia A. Boyle, PhD, Bryan D. James, PhD, XinQi Dong, MD, MPH, Sue Leurgans, PhD
- University of Michigan: Bob Willis, PhD & Ken Langa, MD, PhD
- Harvard University: Randy Buckner, PhD
- Weill Cornell Medical College: Mark Lachs, MD
- USC Keck School of Medicine: Laura Mosqueda, MD

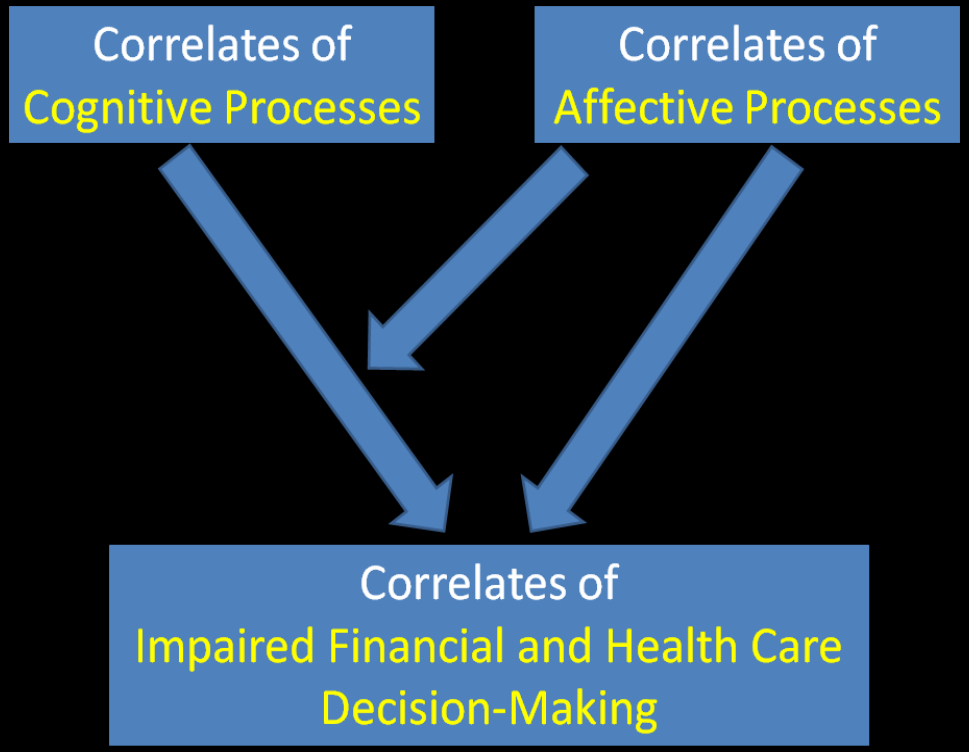
# RADC Studies Supported by NIA

- Rush Memory and Aging Project (MAP; R01AG017917 PI: David Bennett)
  - Longitudinal clinicopathologic study of aging and AD
  - Participants come from more than 50 residential facilities, retirement communities, retirement homes, local churches, etc.
  - Through Sept 2015, > 1,800 persons have agreed to participate in MAP (26.6% men, 93.1% non-Hispanic white; mean age of 88.8 [SD=9.4] and mean education of 14.7 [SD=4.8]).

- Decision Making Study (R01AG033678 PI: Patricia Boyle)
  - Longitudinal study of factors and outcomes associated with decisionmaking
  - Decisionmaking, cognitive, affective, and contextual data collected on more than 800 MAP participants

# Decisionmaking

- Decisionmaking
  - Cognitive processes
    - Attention
    - Working memory
    - Executive functions
  - Affective processes
    - Risk aversion
    - Impulsivity
    - Personality styles



# Methods

- Decisionmaking
  - Cognitive processing
  - Affective processing
  - Personality styles
  - Behavioral economics

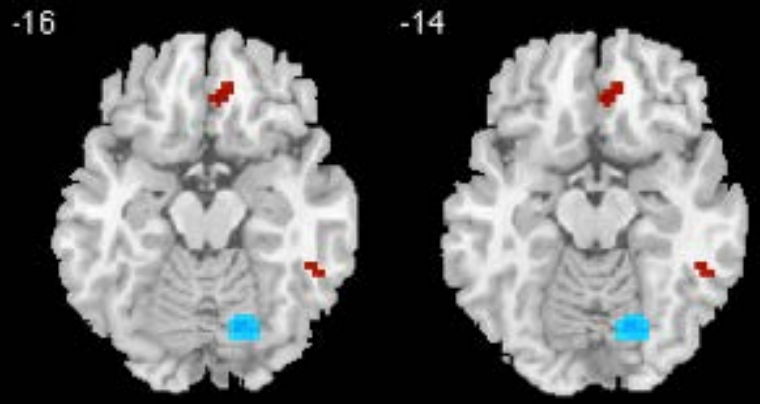
$$GP_{ij} = \frac{0.5 \times \text{Gain}_j^{1-\gamma i}}{1-\gamma_i} \qquad SP_{ij} = \frac{\text{Safe}_j^{1-\gamma_i}}{1-\gamma_i}$$

$$\text{logit}(P(Y_{ij}=1)) = GP_{ij} - SP_{ij}$$

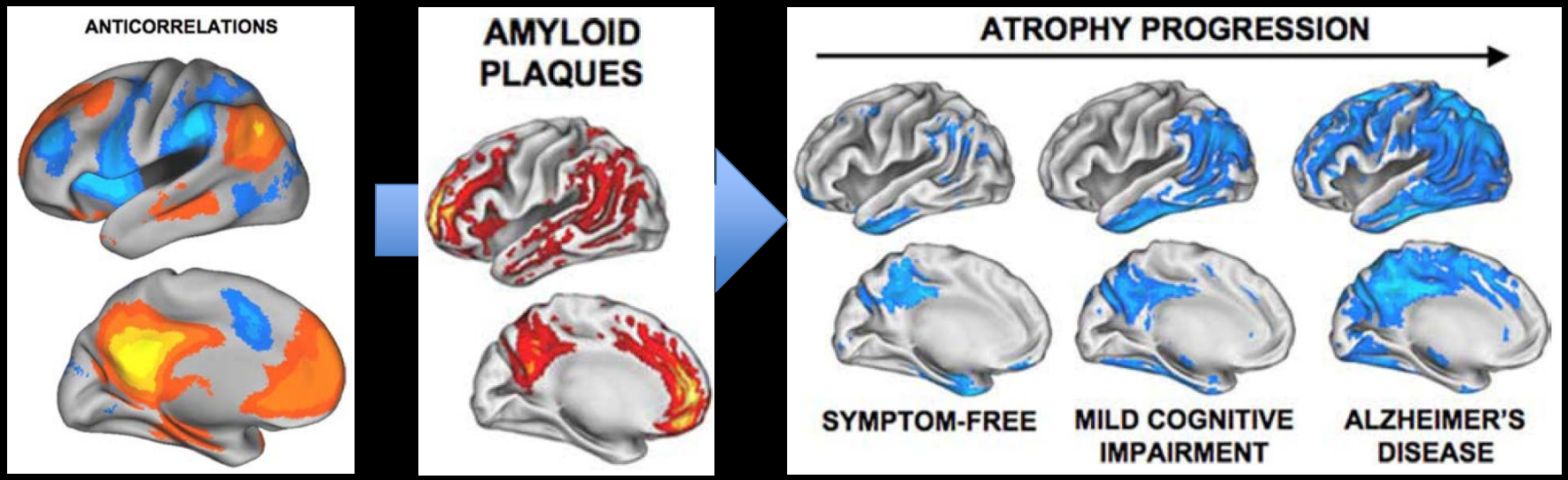
$$\text{logit}(P(Y_{ij}=1)) = \frac{0.5 \times \text{Gain}^{1-\gamma_i} - \text{Safe}^{1-\gamma_i}}{1-\gamma_i}$$

R01AG033678; PI: Patricia Boyle

- Neuroimaging
  - Volumetry
  - Diffusion Tensor Imaging
  - Functional connectivity

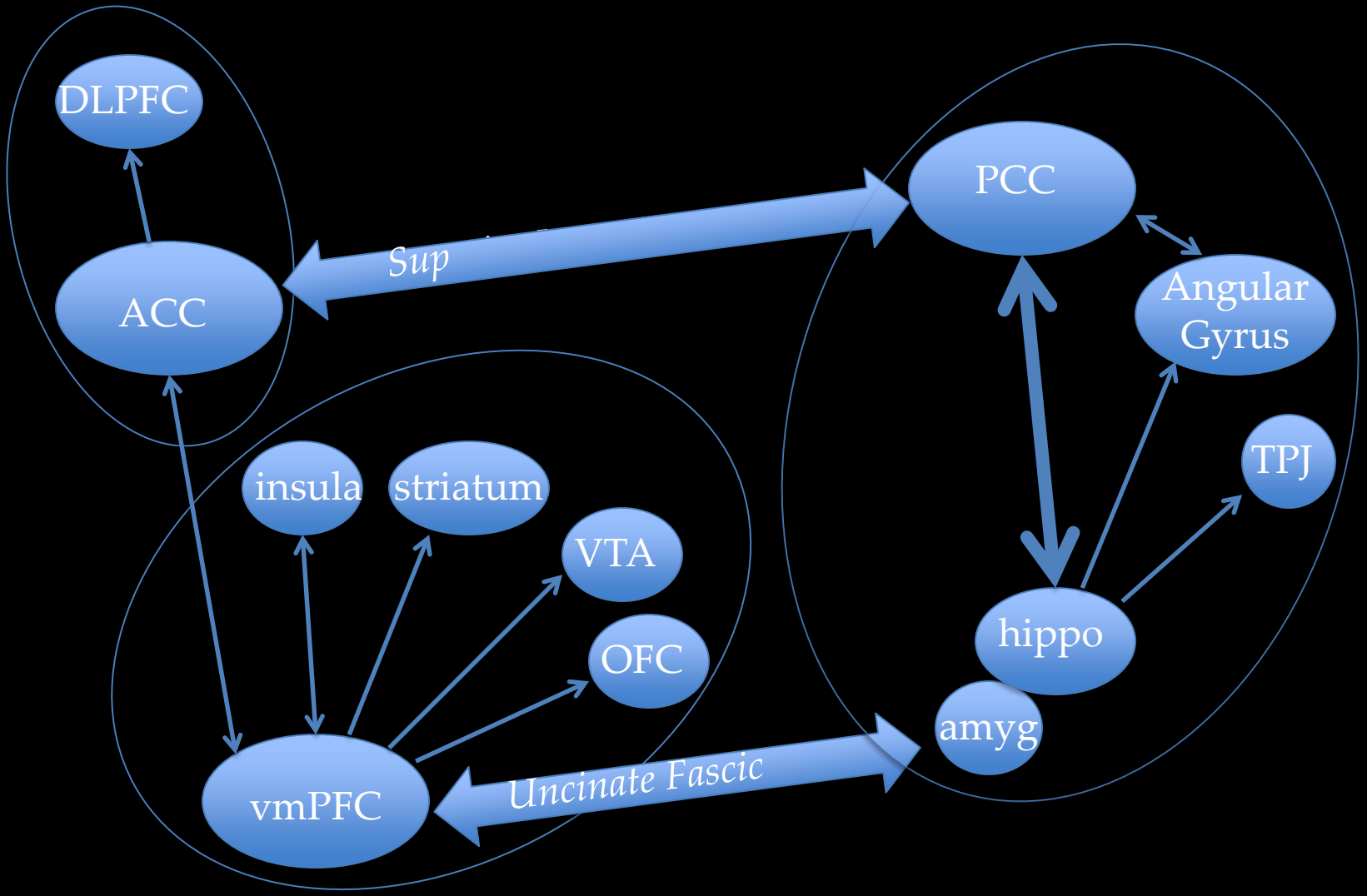


# Age-Associated Neuropathology




Buckner et al., 2008; Buckner et al., 2005; Lustig et al., 2003

# Theoretical Neuroeconomic Model of Impaired Decisionmaking in Old Age



# Risk Aversion

Behavioural Brain Research 227 (2012) 233–240

Contents lists available at SciVerse ScienceDirect

Behavioural Brain Research

journal homepage: www.elsevier.com/locate/bbr

Research report

## Neural intrinsic connectivity networks associated with risk aversion in old age

S. Duke Han[a,*], Patricia A. Boyle[a,c], Konstantinos Arfanakis[b,c,e], Debra A. Fleischman[a,c], Lei Yu[c,d], Emily C. Edmonds[a], David A. Bennett[c,d]

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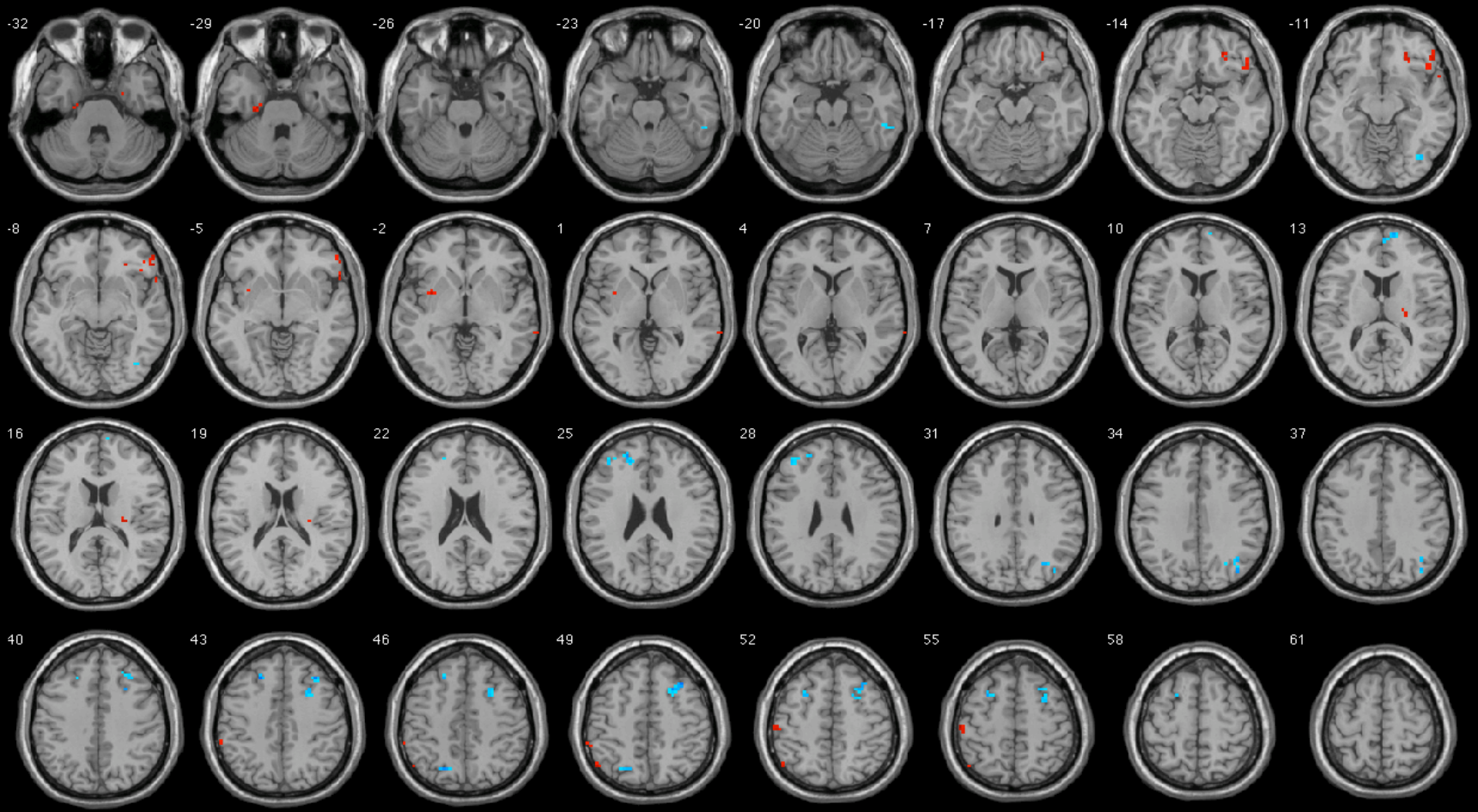
[b] Department of Biomedical Engineering, Illinois Institute of Technology, Chicago, IL 60616, USA
[c] Rush Alzheimer's Disease Center, Rush University Medical Center, Chicago, IL 60612, USA
[d] Department of Neurological Sciences, Rush University Medical Center, Chicago, IL 60612, USA
[e] Department of Radiology, Rush University Medical Center, Chicago, IL 60612, USA

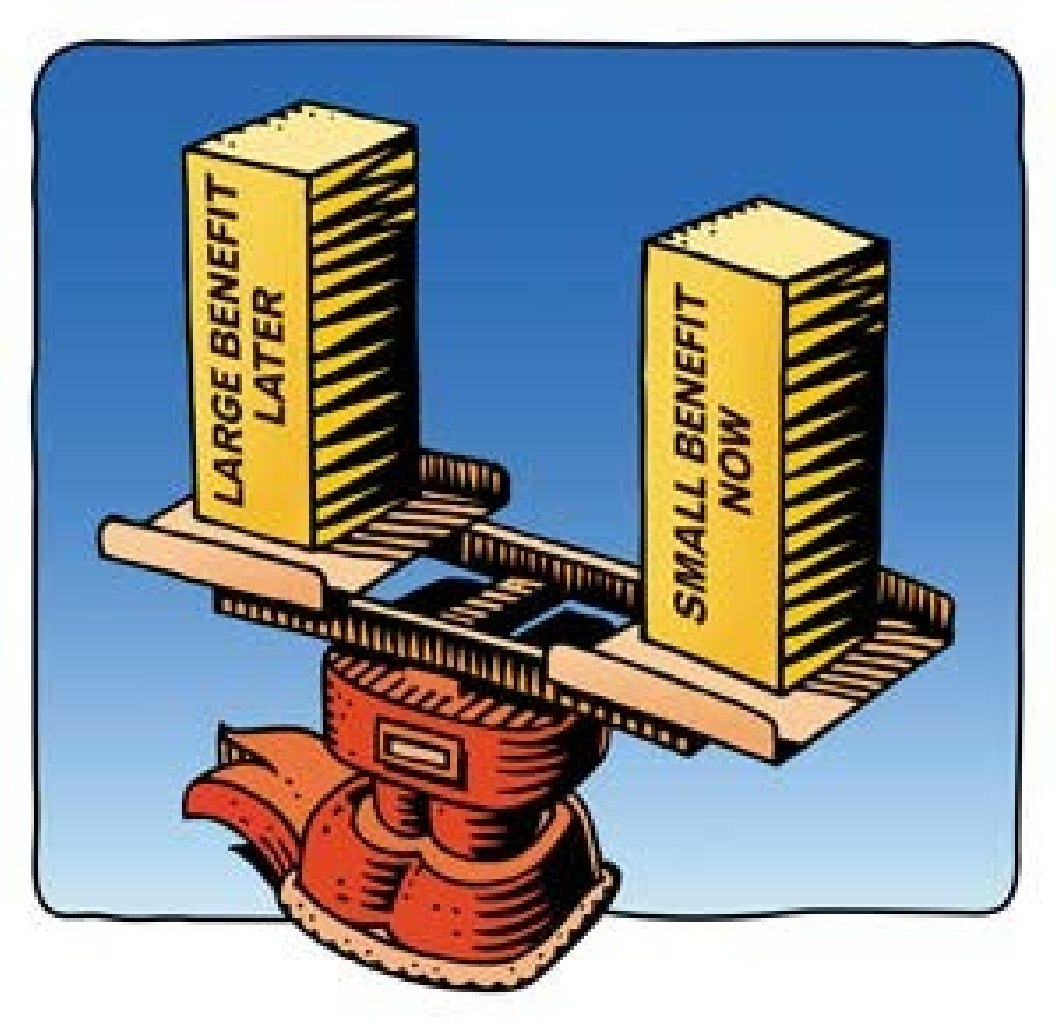
- Using a seed region of interest (ROI) in the anterior cingulate cortex (ACC); we investigated whether there were rs-fMRI differences between older adults high and low in risk aversion.
- "Would you prefer $15 for sure, OR a coin toss in which you will get $[an amount greater than $15] if you flip heads or nothing if you flip tails?"
- N=54 (27 high and 27 low) nondemented older adults
- High risk averse mean age=83.9, s.d.=6.9; mean number of years of education=14.8, s.d=2.5; 74% female; low risk averse mean age=80.0, s.d.=6.5; mean number of years of education=15.3, s.d=2.8, 70.3% female; age and total gray matter used as a covariate

# Risk Aversion

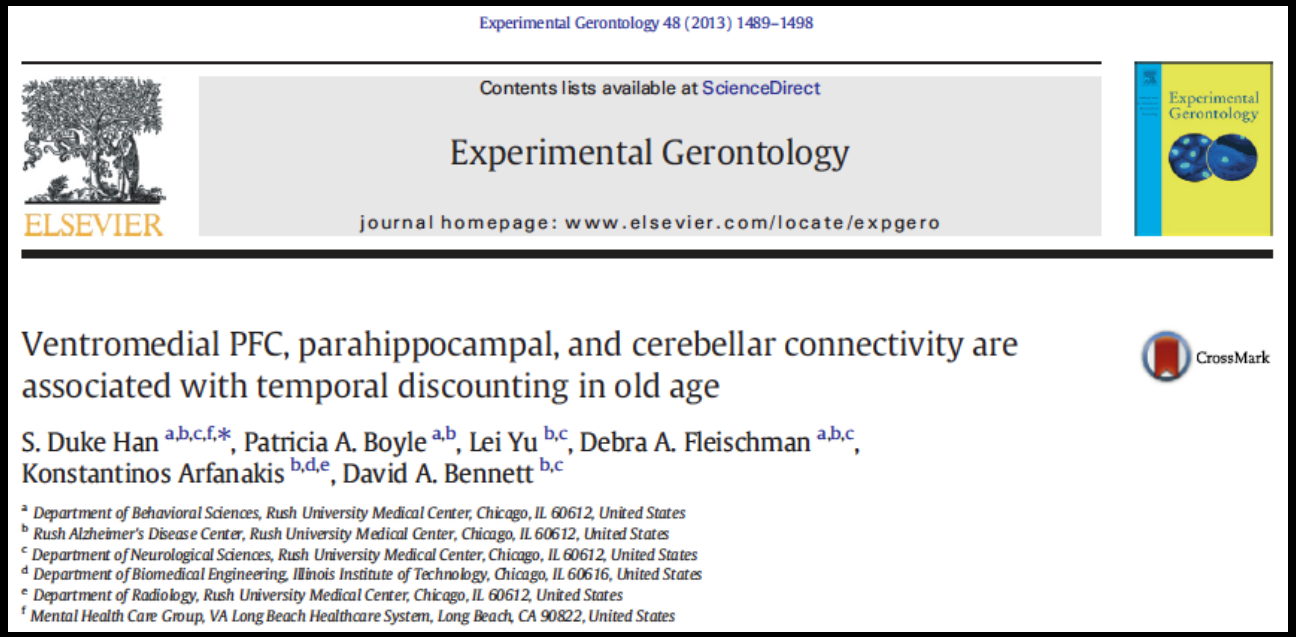



HIGH/LOW Risk Aversion Contrast
N=54 (27/27)

# Temporal Discounting



# Temporal Discounting



Experimental Gerontology 48 (2013) 1489–1498

Contents lists available at ScienceDirect

Experimental Gerontology

journal homepage: www.elsevier.com/locate/expgero

## Ventromedial PFC, parahippocampal, and cerebellar connectivity are associated with temporal discounting in old age

S. Duke Han [a,b,c,f,*], Patricia A. Boyle [a,b], Lei Yu [b,c], Debra A. Fleischman [a,b,c], Konstantinos Arfanakis [b,d,e], David A. Bennett [b,c]

[a] Department of Behavioral Sciences, Rush University Medical Center, Chicago, IL 60612, United States
[b] Rush Alzheimer's Disease Center, Rush University Medical Center, Chicago, IL 60612, United States
[c] Department of Neurological Sciences, Rush University Medical Center, Chicago, IL 60612, United States
[d] Department of Biomedical Engineering, Illinois Institute of Technology, Chicago, IL 60616, United States
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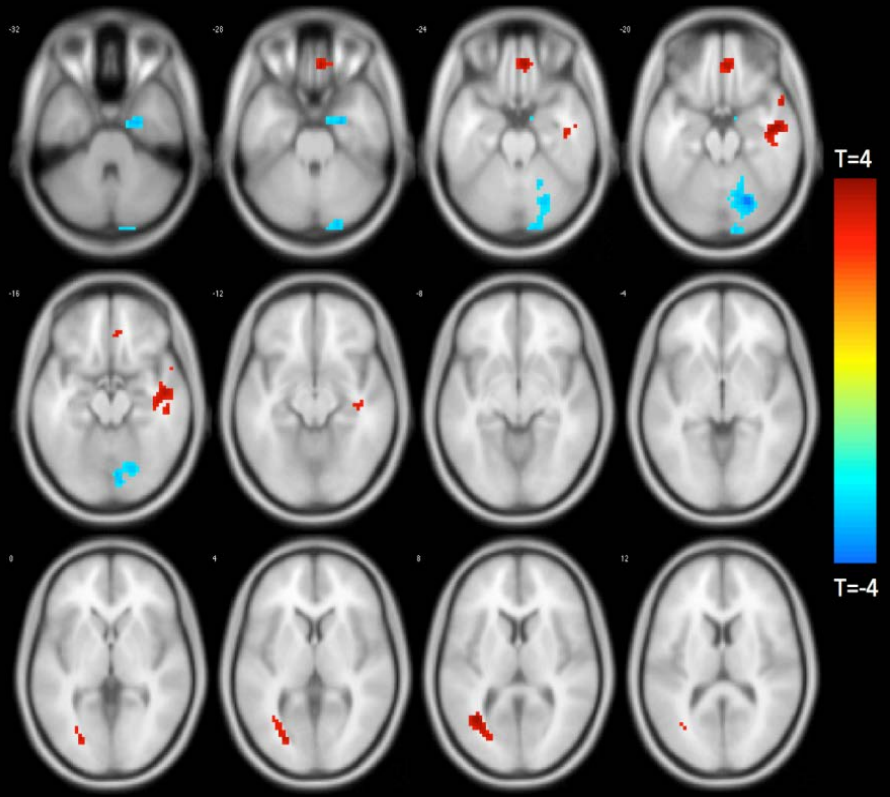
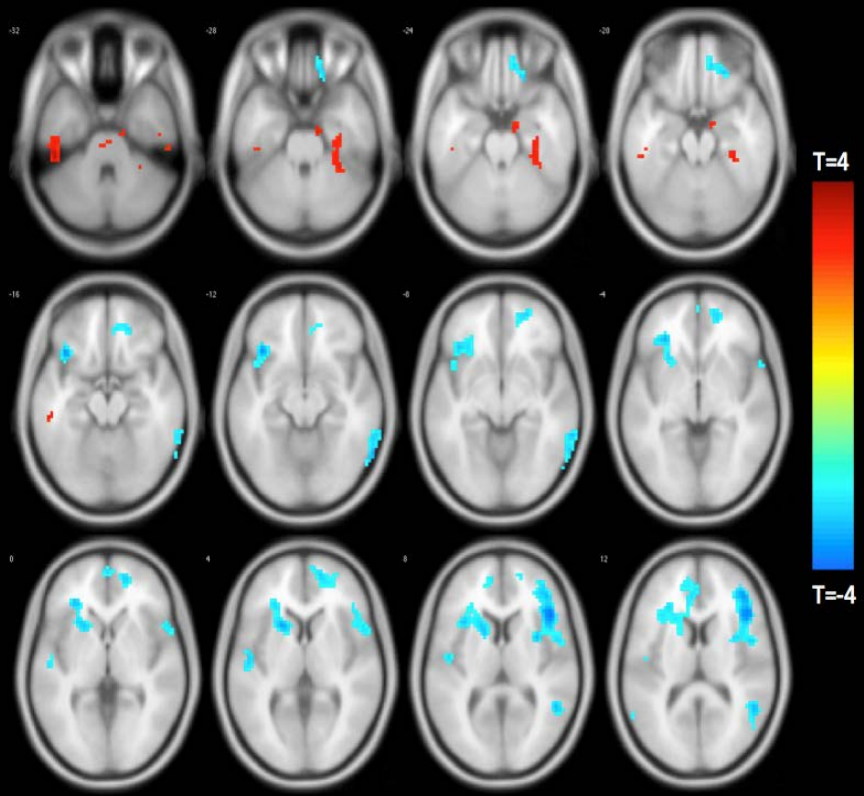
[f] Mental Health Care Group, VA Long Beach Healthcare System, Long Beach, CA 90822, United States

- Temporal discounting refers to the discounting of greater delayed rewards for smaller immediate rewards and is associated with a number of real-world outcomes.
- Using a seed region of interest (ROI) in the left and right fronto-insular cortex (FI); we investigated whether there were rs-fMRI correlations with temporal discounting, accounting for age, education, gender, and global cognition.
- N=123 nondemented older adults
- Mean age=82.95, s.d.=6.64; mean number of years of education=15.67, s.d=3.20; 82.1

# Temporal Discounting




HIGH->LOW Temporal Discounting




FC of R Parahippocampal Seed ROI

# Peters and Buchel, 2011

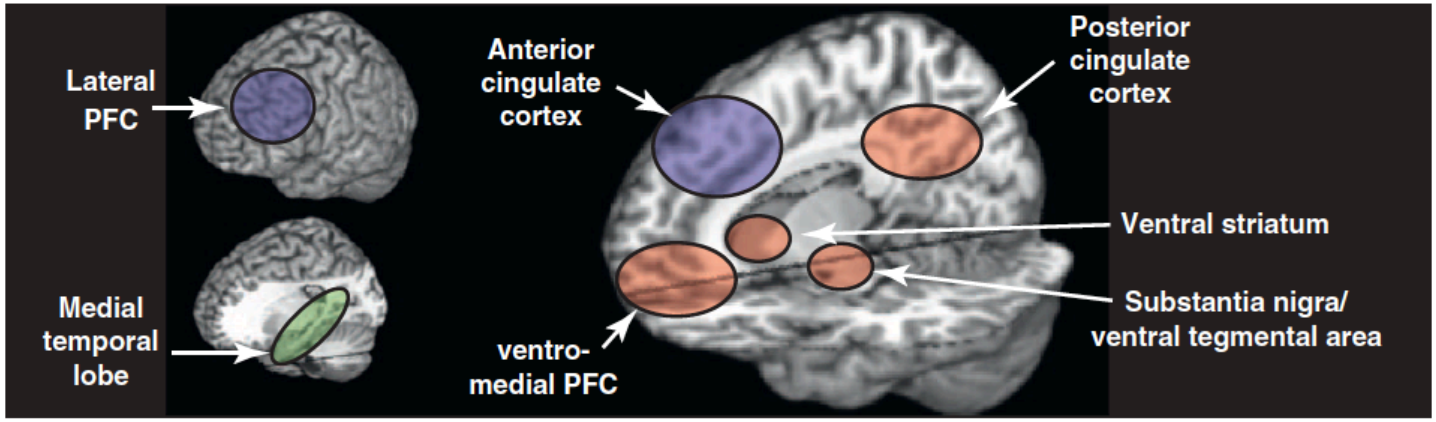
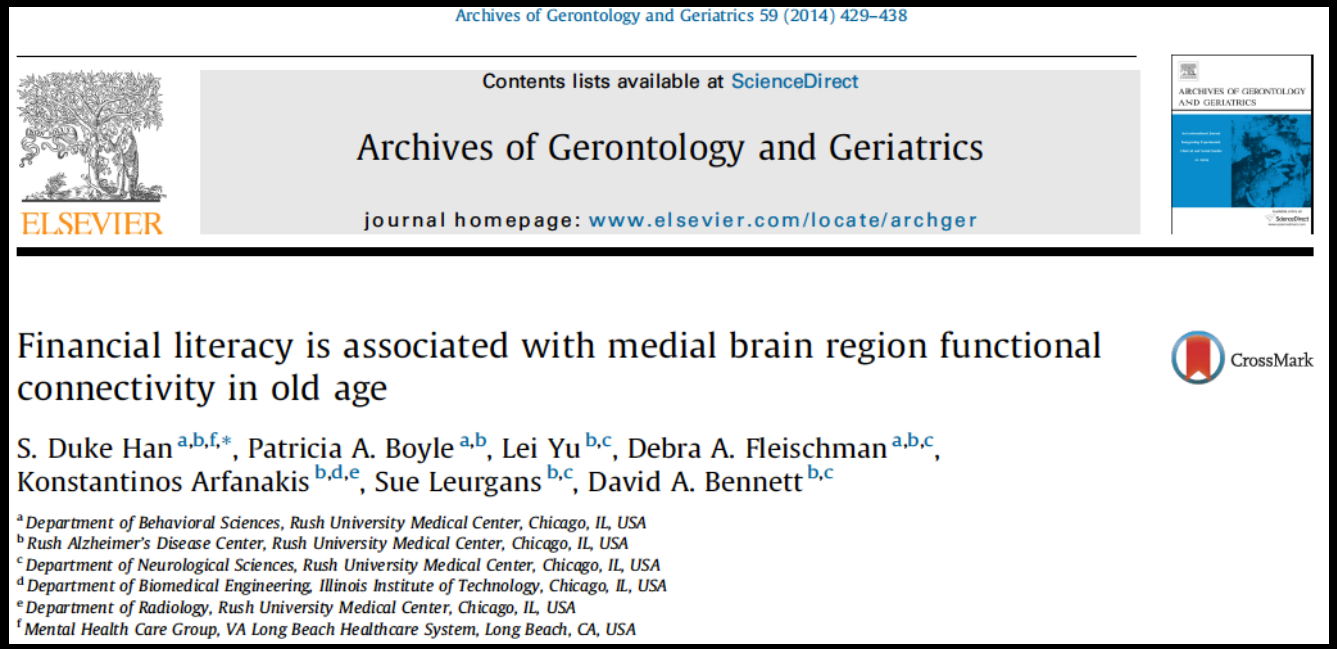



**Figure 2.** Networks implicated in different component processes of temporal discounting: cognitive control (blue), reward valuation (red) and imagery or prospection (green). Ventromedial PFC and posterior cingulate cortex are involved in both prospection and valuation.

# Financial Literacy



Archives of Gerontology and Geriatrics 59 (2014) 429–438

Contents lists available at ScienceDirect

Archives of Gerontology and Geriatrics

journal homepage: www.elsevier.com/locate/archger

Financial literacy is associated with medial brain region functional connectivity in old age

S. Duke Han [a,b,f,*], Patricia A. Boyle [a,b], Lei Yu [b,c], Debra A. Fleischman [a,b,c], Konstantinos Arfanakis [b,d,e], Sue Leurgans [b,c], David A. Bennett [b,c]

[a] Department of Behavioral Sciences, Rush University Medical Center, Chicago, IL, USA
[b] Rush Alzheimer's Disease Center, Rush University Medical Center, Chicago, IL, USA
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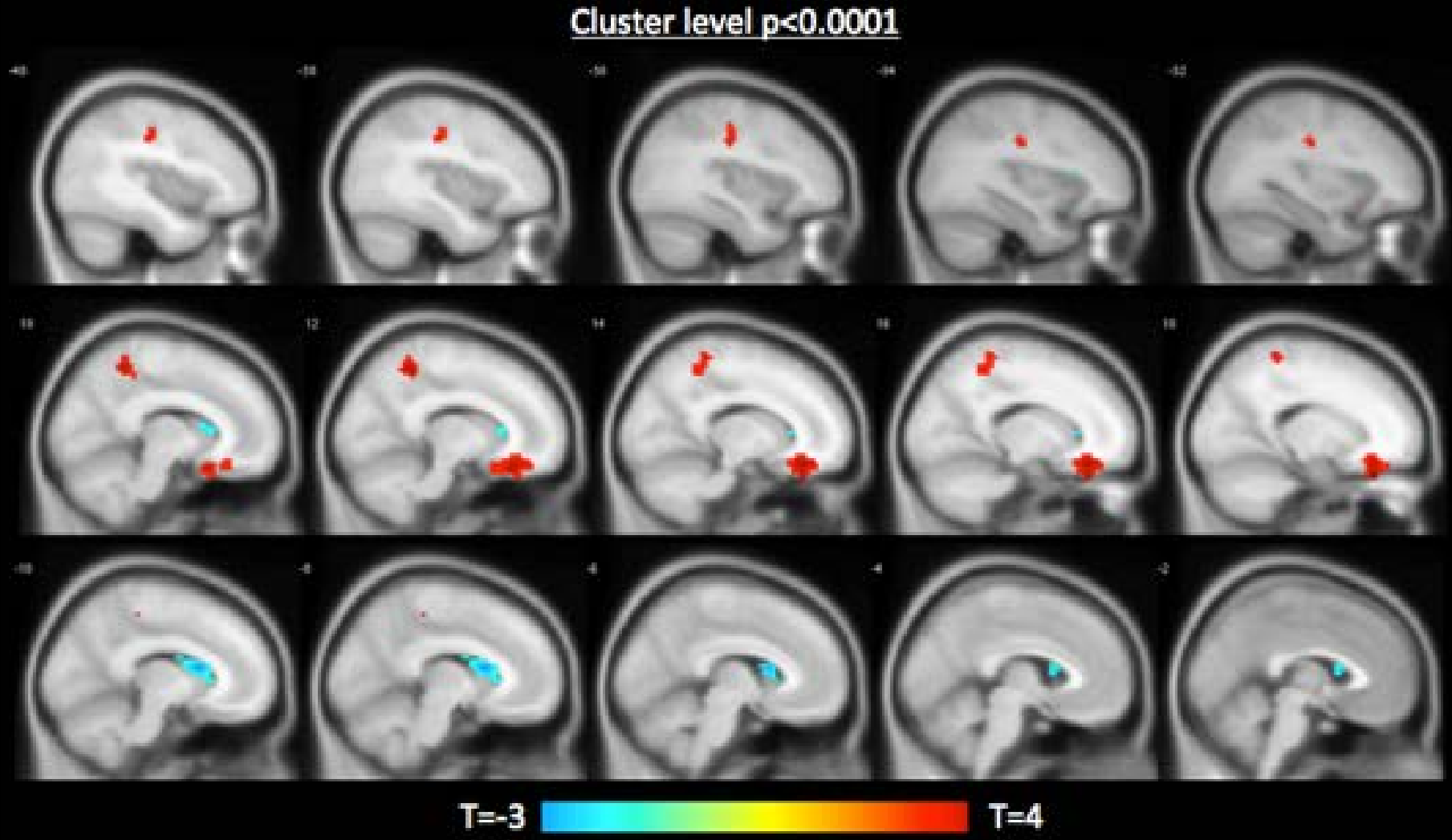
[d] Department of Biomedical Engineering, Illinois Institute of Technology, Chicago, IL, USA
[e] Department of Radiology, Rush University Medical Center, Chicago, IL, USA
[f] Mental Health Care Group, VA Long Beach Healthcare System, Long Beach, CA, USA

- Using a seed region of interest (ROI) in the posterior cingulate cortex (PCC); we investigated whether there were rs-fMRI correlations with financial literacy was associated with greater functional connectivity to ventromedial prefrontal cortex, accounting for age, education, gender, and global cognition.

- N=139 nondemented older adults

- Mean age=82.08, s.d.=7.17; mean number of years of education=15.70, s.d=3.29; 80.6% female

# Financial Literacy



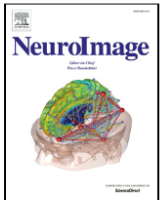
# Financial Literacy

NeuroImage 130 (2016) 223–229

Contents lists available at ScienceDirect

NeuroImage

journal homepage: www.elsevier.com/locate/ynimg




## Financial literacy is associated with white matter integrity in old age

S. Duke Han [a,b,c,*], Patricia A. Boyle [d,e], Konstantinos Arfanakis [d,h,i], Debra Fleischman [d,e,f], Lei Yu [d,f], Bryan D. James [d,g], David A. Bennett [d,f]

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[c] Department of Psychology, University of Southern California, Los Angeles, CA 90089, USA
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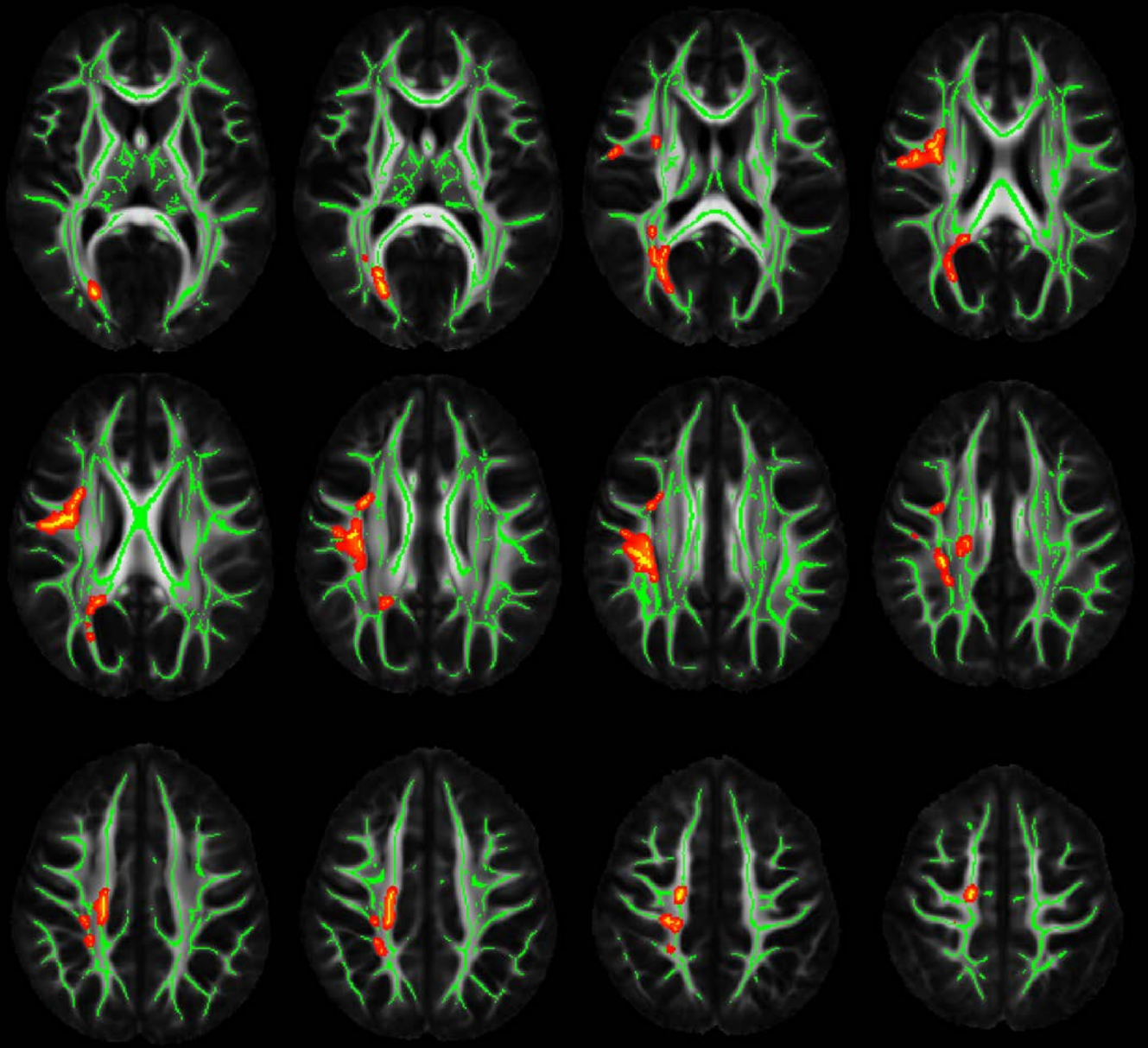
[e] Department of Behavioral Sciences, Rush University Medical Center, Chicago, IL 60612, USA
[f] Department of Neurological Sciences, Rush University Medical Center, Chicago, IL 60612, USA
[g] Department of Internal Medicine, Rush University Medical Center, Chicago, IL 60612, USA
[h] Department of Biomedical Engineering, Illinois Institute of Technology, Chicago, IL 60612, USA
[i] Department of Diagnostic Radiology and Nuclear Medicine, Rush University Medical Center, Chicago, IL 60612, USA

- Diffusion Tensor Imaging (DTI) to investigate white matter integrity
- N=346 nondemented older adults
- Mean age=81.36, s.d.=7.07; mean number of years of education=15.39, s.d=3.03; 77.17% female



GLM models adjusted for age, education, sex, and global cognition showing greater financial literacy is associated with greater white matter integrity in specific pathways (N=346)

# Susceptibility to Scams

Brain Imaging and Behavior
DOI 10.1007/s11682-015-9422-4

ORIGINAL RESEARCH

## Grey matter correlates of susceptibility to scams in community-dwelling older adults

S. Duke Han[1,2,3,4] · Patricia A. Boyle[1,2] · Lei Yu[1,3] · Konstantinos Arfanakis[6,7] · Bryan D. James[1,5] · Debra Fleischman[1,2,3] · David A. Bennett[1,3]

- Voxel-based morphometry (VBM) to assess grey matter density at the voxel level
- N=348 nondemented older adults
- Mean age=81.55, s.d.=7.25; mean number of years of education=15.30, s.d=2.91; 74.10% female

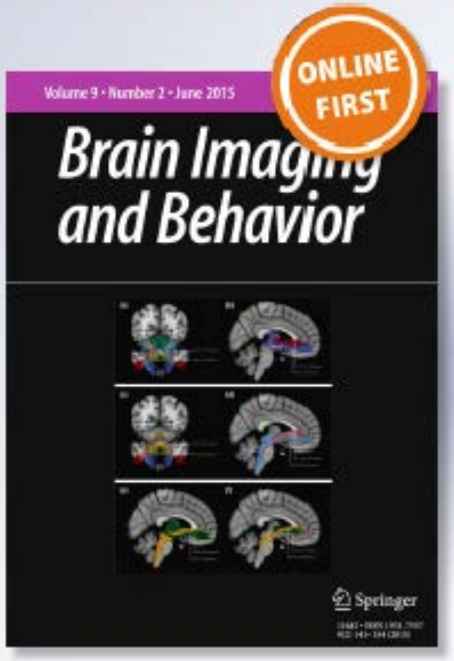
*Grey matter correlates of susceptibility to scams in community-dwelling older adults*

**S. Duke Han, Patricia A. Boyle, Lei Yu, Konstantinos Arfanakis, Bryan D. James, Debra A. Fleischman & David A. Bennett**

**Brain Imaging and Behavior**

ISSN 1931-7557

Brain Imaging and Behavior
DOI 10.1007/s11682-015-9422-4




Springer

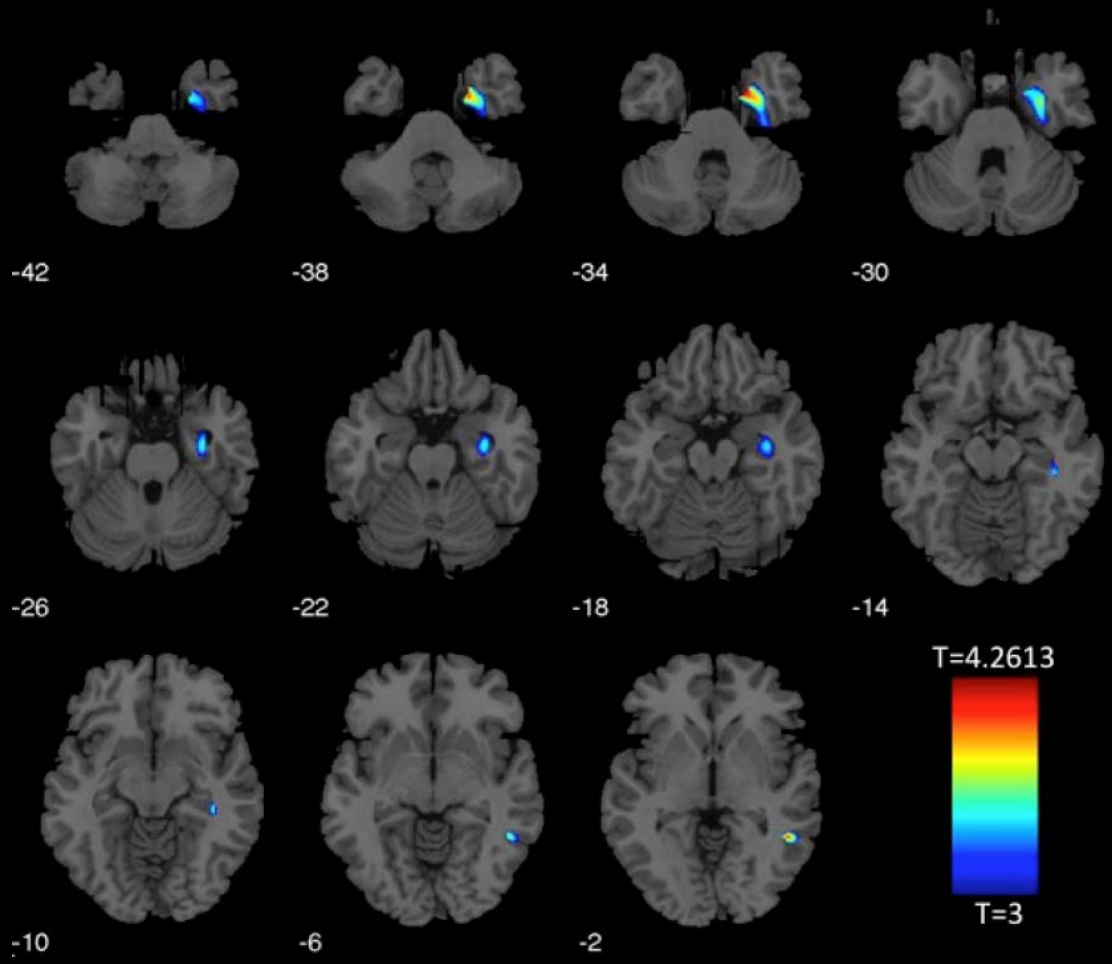
**Assessment of susceptibility to scams**

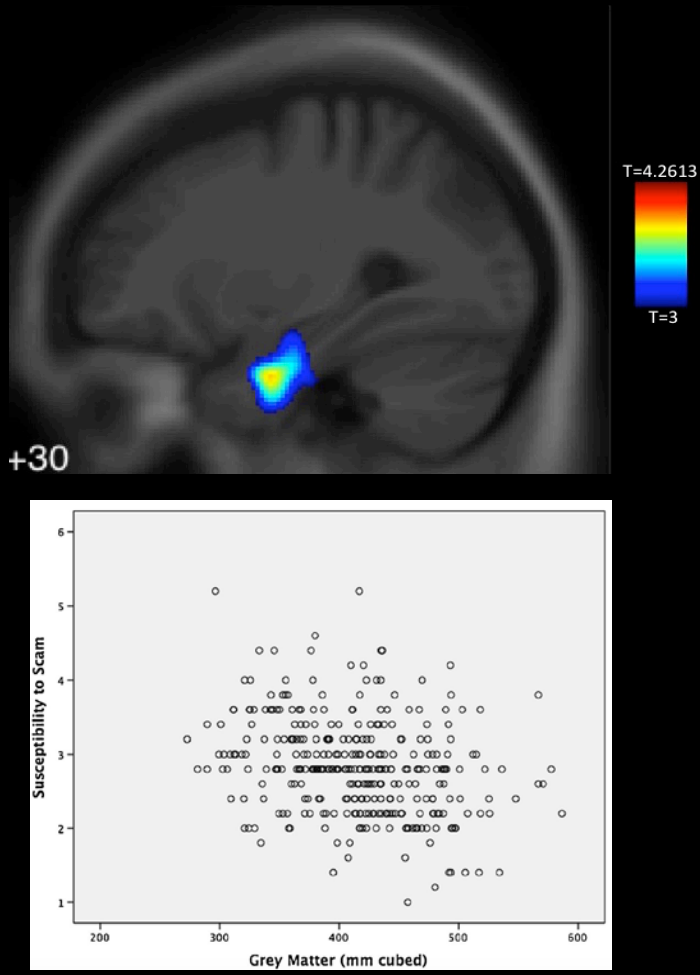
The susceptibility to scams scale is a five-item self-report measure in which participants rated their agreement to a statement according to a 7-point Likert scale (strongly agree to strongly disagree). The five statements included in the measure have been previously reported (James et al. 2014) and address topics such as telemarketing behaviors, older adults being targeted by con-artists, and suspiciousness of claims that seem too good to be true. The statements are:

1. I answer the phone whenever it rings, even if I do not know who is calling.
2. I have difficulty ending a phone call, even if the caller is a telemarketer, someone I do not know, or someone I did not wish to call me.
3. If something sounds too good to be true, it usually is.
4. Persons over the age of 65 are often targeted by con-artists.
5. If a telemarketer calls me, I usually listen to what they have to say.

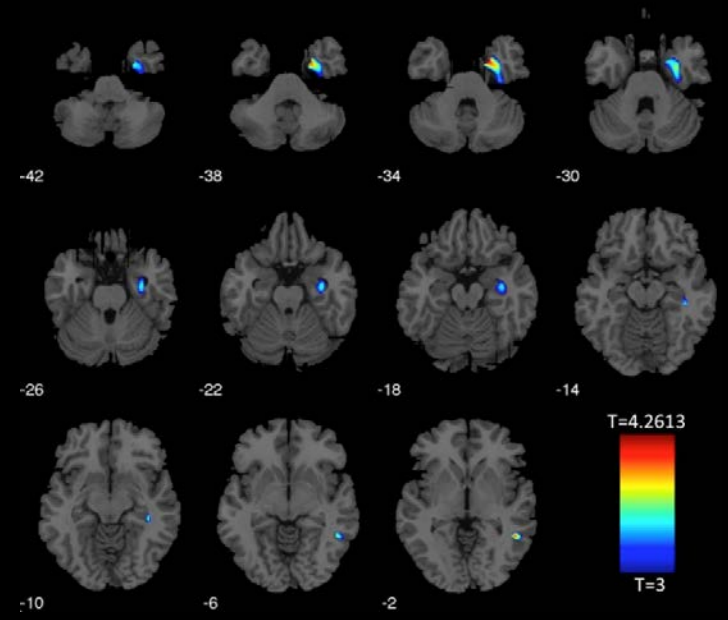
Each question corresponds to a Likert scale and has a total possible range of 1 to 7 (1 = strongly agree, 2 = agree, 3 = slightly agree, 4 = neither agree or disagree, 5 = slightly disagree, 6 = disagree, 7 = strongly disagree). The total score for susceptibility to scams was calculated by averaging the five items (with items 1, 2, and 5 reverse coded). The statements were based generally on findings from the AARP and the Financial Industry Regulatory Authority Risk Meter, a measure of poor and risky financial decision making that is widely used in finance studies (AARP 1999; Financial Industry Regulatory Authority 2013). The intraclass correla-

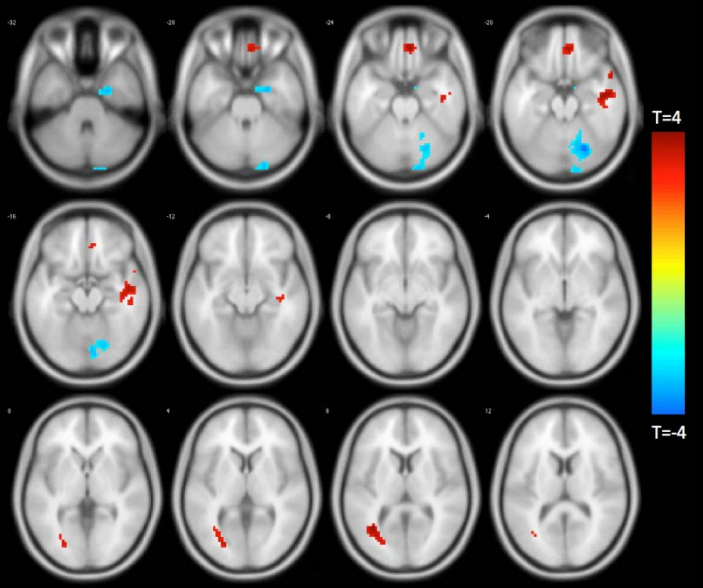
# Susceptibility to Scams

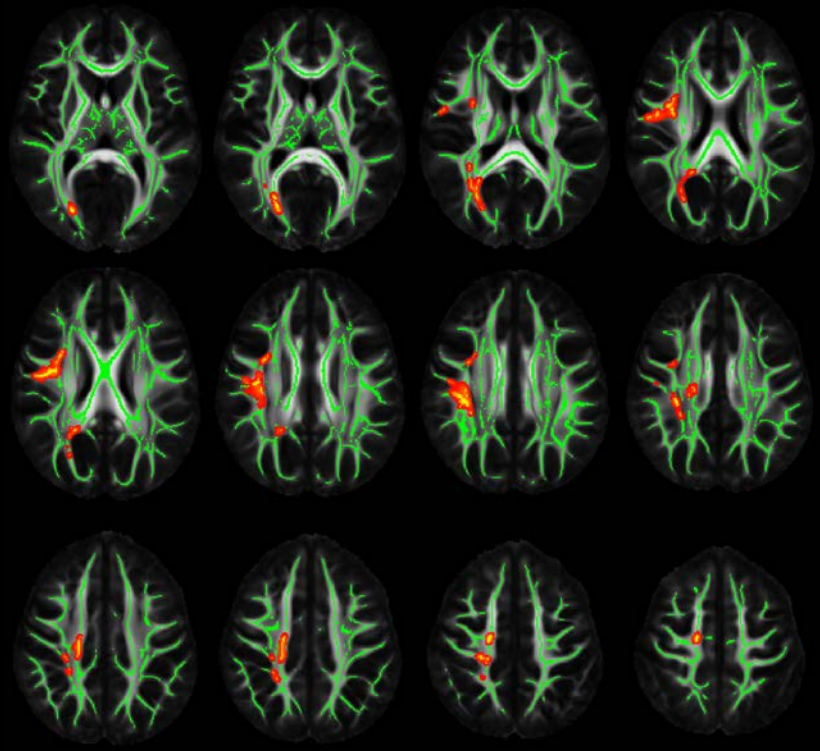


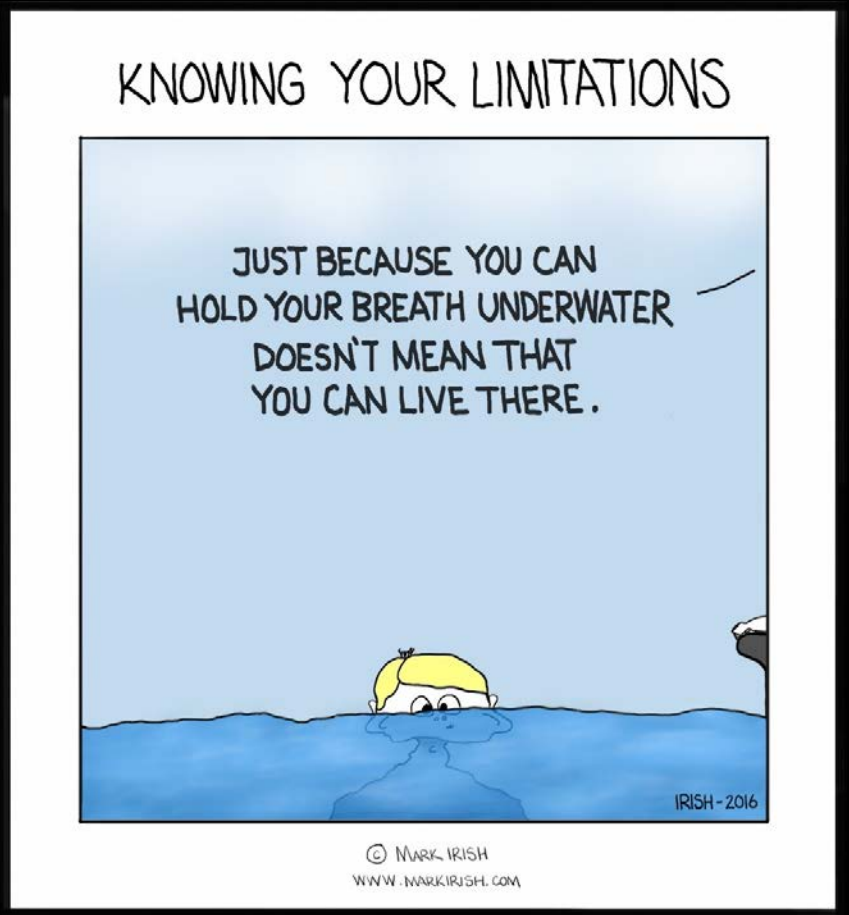



# Right Temporal?




KNOWING YOUR LIMITATIONS
JUST BECAUSE YOU CAN HOLD YOUR BREATH UNDERWATER DOESN'T MEAN THAT YOU CAN LIVE THERE.
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WELL, MY PRAYERS FOR A MIRACLE WERE ANSWERED. UNFORTUNATELY, NOW I CAN'T REPLICATE IT.

**“Of course we’ll make a decision ...
once we have considered the 5243 factors.”**

# Mild Cognitive Impairment Is Associated with Poorer Decision-Making in Community-Based Older Persons

*S. Duke Han, PhD,*[†‡§] *Patricia A. Boyle, PhD,*[*†] *Bryan D. James, PhD,*[*‖] *Lei Yu, PhD,*[*‡] *and David A. Bennett, MD*[*‡]

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0002-8614/15/$15.00

**Table 2. Relationship Between Mild Cognitive Impairment (MCI) and Decision-Making, Adjusted for Age, Education, and Sex**

| | Model 1 | Model 2 |
|---|---|---|
| Model Term | Estimate (Standard Error) *P*-Value | |
| Total decision-making | | |
| Age | –0.11 (0.01) <.001 | –0.10 (0.01) <.001 |
| Education | 0.28 (0.03) <.001 | 0.28 (0.03) <.001 |
| Male | 0.82 (0.22) <.001 | 0.89 (0.21) <.001 |
| MCI | | –1.35 (0.23) <.001 |
| Financial decision-making | | |
| Age | –0.06 (0.01) <.001 | –0.05 (0.01) <.001 |
| Education | 0.11 (0.02) <.001 | 0.12 (0.02) <.001 |
| Male | 0.52 (0.12) <.001 | 0.55 (0.11) <.001 |
| MCI | | –0.61 (0.12) <.001 |
| Healthcare decision-making | | |
| Age | –0.06 (0.01) <.001 | –0.05 (0.01) <.001 |
| Education | 0.16 (0.02) <.001 | 0.16 (0.02) <.001 |
| Male | 0.30 (0.13) .02 | 0.34 (0.13) .007 |
| MCI | | –0.74 (0.13) <.001 |

**Table 4. Relationship Between Individual Cognitive Function Measures and Decision-Making in Individuals with Mild Cognitive Impairment**

| Cognitive System | Estimate (Standard Error) | *P*-Value | $R^2$ Change |
|---|---|---|---|
| Total decision-making | | | |
| Global cognition | 3.20 (0.47) | <.001 | 0.16 |
| Episodic memory | 0.70 (0.32) | .03 | 0.02 |
| Semantic memory | 1.34 (0.33) | <.001 | 0.13 |
| Working memory | 0.65 (0.31) | .04 | 0.02 |
| Perceptual speed | 1.87 (0.22) | <.001 | 0.26 |
| Visuospatial ability | 0.60 (0.23) | .01 | 0.09 |
| Financial decision-making | | | |
| Global cognition | 1.61 (0.25) | <.001 | 0.14 |
| Episodic memory | 0.30 (0.17) | .08 | 0.01 |
| Semantic memory | 0.69 (0.18) | <.001 | 0.12 |
| Working memory | 0.49 (0.16) | .003 | 0.04 |
| Perceptual speed | 0.95 (0.12) | <.001 | 0.25 |
| Visuospatial ability | 0.24 (0.13) | .06 | 0.05 |
| Healthcare decision-making | | | |
| Global cognition | 1.59 (0.30) | .003 | 0.12 |
| Episodic memory | 0.39 (0.20) | .05 | 0.02 |
| Semantic memory | 0.65 (0.21) | .003 | 0.09 |
| Working memory | 0.16 (0.20) | .41 | 0.00 |
| Perceptual speed | 0.91 (0.15) | <.001 | 0.17 |
| Visuospatial ability | 0.36 (0.15) | .02 | 0.06 |

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# Mild Cognitive Impairment and Susceptibility to Scams in Old Age

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Handling Associate Editor: David Libon



Table 2
Relation of MCI to susceptibility to scams

| Variable | Model Term | Estimate (Standard Error, *p* Value) | |
|---|---|---|---|
| | | Model 1 | Model 2 |
| Susceptibility to scams | age | 0.027 (0.003,<0.001) | 0.026 (0.003,<0.001) |
| | education | –0.022 (0.008, 0.007) | –0.023 (0.008, 0.005) |
| | male | 0.067 (0.059, 0.249) | 0.061 (0.059, 0.300) |
| | MCI | | 0.125 (0.063, 0.047) |

Table 3
Relation of specific cognitive function measures to susceptibility to scams among individuals with MCI

| Factor | Cognitive System | Estimate | Standard Error | *p* Value | $R^2$ Change |
|---|---|---|---|---|---|
| Susceptibility to scams | Global cognition | –0.341 | 0.152 | 0.026 | 0.020 |
| | Episodic memory | –0.199 | 0.093 | 0.034 | 0.017 |
| | Semantic memory | –0.173 | 0.107 | 0.107 | – |
| | Working memory | 0.022 | 0.091 | 0.812 | – |
| | Perceptual speed | –0.163 | 0.081 | 0.047 | 0.013 |
| | Visuospatial ability | –0.002 | 0.077 | 0.985 | – |

Estimated from separate linear regression models adjusted for age, gender, and education.

*Article*

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# Poorer Financial and Health Literacy Among Community-Dwelling Older Adults With Mild Cognitive Impairment

**S. Duke Han, PhD[1,2], Patricia A. Boyle, PhD[1], Bryan D. James, PhD[1], Lei Yu, PhD[1], and David A. Bennett, MD[1]**

**Table 2.** Relation of MCI to Literacy.

| | | Estimate (*SE*, *p*) | | |
|---|---|---|---|---|
| Variable | Model term | Model 1 | Model 2 | Model 3 |
| Total literacy | Age | −0.57 (0.06, <.01) | −0.49 (0.06, <.01) | −0.50 (0.06, <.01) |
| | Education | 1.51 (0.15, <.01) | 1.55 (0.15, <.01) | 1.37 (0.16, <.01) |
| | Male | 4.41 (1.10, <.01) | 4.87 (1.07, <.01) | 4.63 (1.21, <.01) |
| | MCI | | −8.44 (1.15, <.01) | −9.15 (1.38, <.01) |
| | MCI × Age | | | 0.06 (0.18, .72) |
| | MCI × Education | | | 0.98 (0.38, .01) |
| | MCI × Male | | | 0.86 (2.54, .73) |
| Financial literacy | Age | −0.49 (0.07, <.01) | −0.42 (0.06, <.01) | −0.39 (0.07, <.01) |
| | Education | 1.52 (0.17, <.01) | 1.55 (0.16, <.01) | 1.33 (0.18, <.01) |
| | Male | 1.53 (1.18, <.01) | 11.93 (1.15, <.01) | 11.46 (1.31, <.01) |
| | MCI | | −7.48 (1.24, <.01) | −8.04 (1.49, <.01) |
| | MCI × Age | | | −0.23 (0.19, .23) |
| | MCI × Education | | | 1.15 (0.41, <.01) |
| | MCI × Male | | | 2.00 (2.74, .47) |
| Health literacy | Age | −0.65 (0.08, <.01) | −0.57 (0.08, <.01) | −0.61 (0.09, <.01) |
| | Education | 1.51 (0.21, <.01) | 1.55 (0.20, <.01) | 1.41 (0.22, <.01) |
| | Male | −2.71 (1.48, .07) | −2.20 (1.44, .13) | −2.21 (1.64, .18) |
| | MCI | | −9.39 (1.55, <.01) | −10.26 (1.87, <.01) |
| | MCI × Age | | | 0.36 (0.24, .14) |
| | MCI × Education | | | 0.81 (0.52, .12) |
| | MCI × Male | | | −0.27 (3.44, .94) |

*Note.* MCI = mild cognitive impairment.

Aging Clin Exp Res
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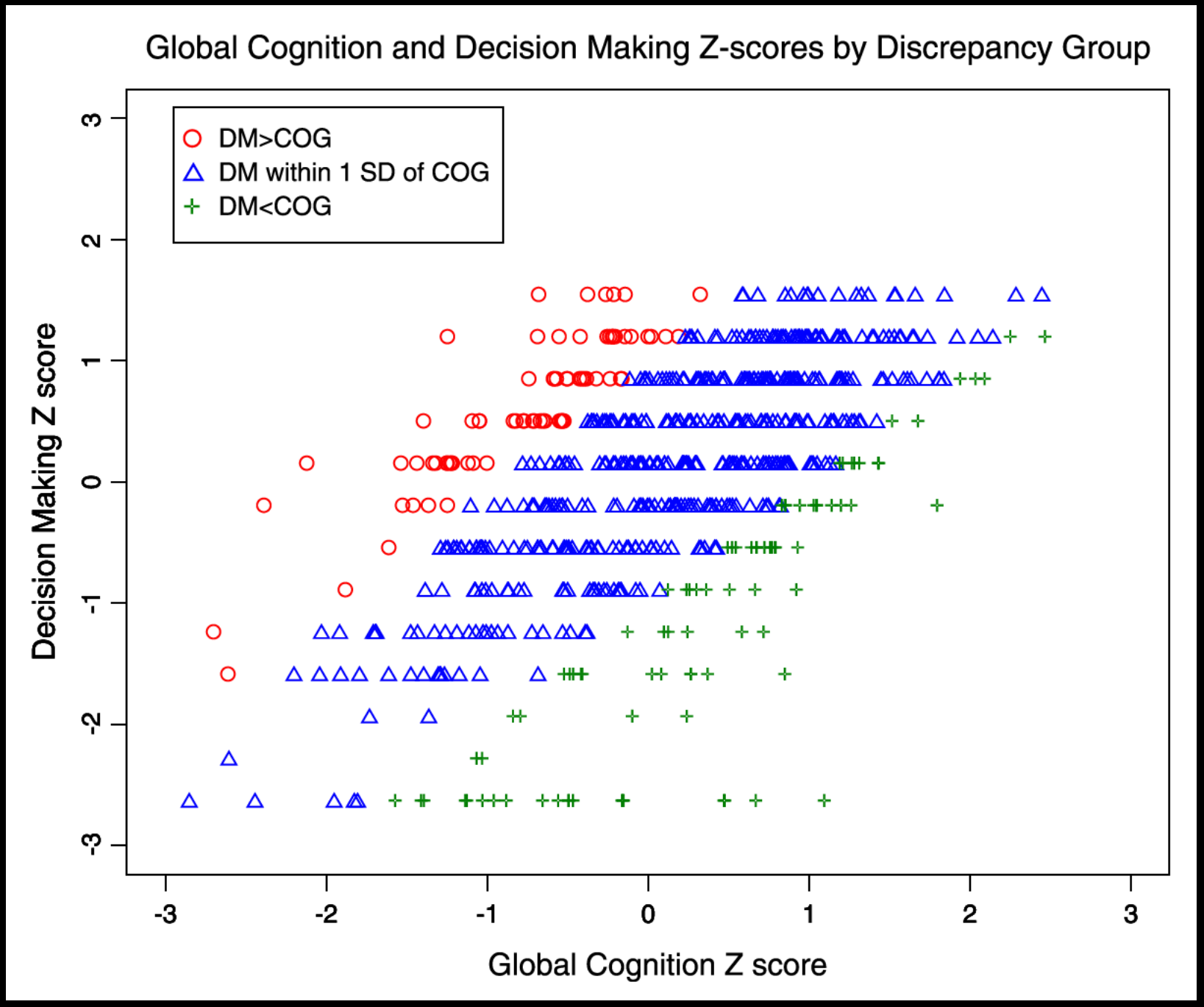
ORIGINAL ARTICLE

# Discrepancies between cognition and decision making in older adults

S. Duke Han[1,2,3,5] · Patricia A. Boyle[1,2] · Bryan D. James[2,3,4] · Lei Yu[2,3] · Lisa L. Barnes[1,2,3] · David A. Bennett[2,3]

- N=648 nondemented older adults
- Mean age=81.8, s.d.=7.6; mean number of years of education=15.2, s.d=3.1; 76.8% female


Global Cognition and Decision Making Z-scores by Discrepancy Group
DM>COG
DM within 1 SD of COG
DM<COG
Decision Making Z score
Global Cognition Z score
3
2
1
0
-1
-2
-3

Annals of Internal Medicine

IDEAS AND OPINIONS

# Age-Associated Financial Vulnerability: An Emerging Public Health Issue

**Mark S. Lachs, MD, MPH, and S. Duke Han, PhD**

Various processes common in the aging brain may affect an older adult's ability to manage personal finances, the most recognized of which are dementing illnesses (1). These conditions can affect cognitive abilities, which may jeopardize an older adult's financial well-being over their longitudinal course. However, recent studies suggest that even cognitively intact older adults can have "functional" changes that may render them financially vulnerable. Social isolation also increases dramatically with age, which places older persons at risk for exploitation from predators. Furthermore, capitalistic enterprises can threaten the financial security of this group, which is perceived to be a large untapped market and, in an era of information overload, is often presented with a dizzying array of products and services.

We propose the concept of age-associated financial vulnerability (AAFV) and discuss aspects of its epidemiology from the vantage of a neuropsychologist (S.D.H) and geriatrician–epidemiologist (M.S.L) who are both researchers and clinicians working in the field of elder abuse. We believe that considering AAFV a clinical syndrome may be advantageous to further critical research, promote public policy work, and encourage physicians to recognize it.

need not be associated with cognitive impairment differentiates research on this condition from previous work that has focused on cognitive impairment as the driving force for financial vulnerability (3).

Age-associated financial vulnerability and financial exploitation (4, 5) can be linked–AAFV may predispose an older adult to financial exploitation–however, we perceive them as conceptually different. Age-associated financial vulnerability focuses on a potential condition that may have multiple causes and ultimately may or may not lead to exploitation. We view financial exploitation as focusing on specific mechanisms that drive a particular outcome, often consisting of intentional or forceful methods of exploitation. In this sense, persons who do not show AAFV can be victims of financial exploitation. More is known about the effects of financial exploitation; less is known about AAFV because we believe that this concept is new.

## Epidemiology of AAFV: Prevalence and Risk Factors

Although a precise determination of the prevalence of AAFV would require assessment of a large population-based sample of older adults, community-

***Table.*** Possible Factors Contributing to Age-Associated Financial Vulnerability

| Domain Factor | Mechanism |
|---|---|
| **Cognitive/emotional** | |
| Executive dysfunction | Reduced ability to multitask, organize by time, and abstractly comprehend future ramifications of current financial actions |
| Acalculia | Inability to quickly calculate figures mentally to verify numbers or to perform numerical calculations |
| Frontal disinhibition | Reduced ability not to commit to financial courses of action with potentially negative consequences |
| Anxiety | May increase pressure to take bad financial risks or not pursue appropriate financial safeguards |
| Reduced ability to discern trustworthy persons | Results in having less information by which to discern good financial opportunities from bad financial risks |
| **Medical and functional** | |
| Serious progressive illness | Serious underlying medical illness unresponsive to traditional therapy may motivate patients to seek expensive and unproven treatments, creating susceptibility to fraud |
| Impaired mobility | Reduced ability to extricate themselves from an environment in which they are being pressured to make financial decisions |
| Vision and hearing loss | Decreased likelihood that complex financial transactions and/or documents are fully comprehended before execution |
| Polypharmacy | May contribute to delirium, directly influencing vulnerability; expense of medication may also lead to inadvisable risk-taking |
| **Psychosocial** | |
| Depression | Associated with executive dysfunction (7); shame and guilt may also preclude older persons from revealing their predicament to trusted friends and family who could extricate them from exploited role |
| Social isolation | No beneficent person within the older person's social network to recognize, mitigate, or report financial exploitation |
| Loneliness | Patients may engage potential exploiters as a mechanism of fostering social connectedness |
| **Environmental/societal** | |
| Wealth concentration | High concentration of wealth in older populations makes them targets of potential exploiters |
| Information overload | Complex offering of products and services may paradoxically reduce sound decision making in the aging brain |
| Sophisticated marketing | The aging brain may be more susceptible to increasing use of behavioral economics and cognitive neuroscience to sway consumers |

# Summary

- A complex network of brain regions involving the ventromedial prefrontal cortex, insula, medial temporal, and posterior parietal regions may be involved in poor decisionmaking in old age.
- Although poor cognition is associated with poor decisionmaking, poor decisionmaking may not be due to poor cognition.
- There are likely multiple factors that are involved in poor financial decisionmaking in old age.
- These results are preliminary and more studies are needed to replicate or confirm findings.

# Finance, Cognition, and Health in Elders Study

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# Questions & Suggestions

Suggestions can be emailed to
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