# *EARLY WARNING SIGNS OF IMPAIRED FINANCIAL SKILLS IN OLDER ADULTS*

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**FINAL REPORT**
**STUDY PERIOD--SEPTEMBER 2013 to AUGUST 2015**
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## I.  Study Goals and Outcomes:

Dr. Marson and his UAB team proposed to analyze two unique financial capacity datasets, the COINS1 and COINS2 datasets previously developed by Dr. Marson through funding from the NIA, in order to identify very early financial declines in cognitively normal older adults.  The primary objective has been to translate these findings into a set of "early warning signs" of financial decline in the elderly.  We have also recently sought to identify cognitive changes potentially associated with these early declines.   A secondary objective has been to seek to identify older adults who show resiliency to financial decline over time, and factors that help to explain this financial resiliency.

The study findings were anticipated to have important public policy implications for older adult consumers, their families, and professional, agency, and governmental stakeholders.   Specific study outcomes were as follows:

1.  Study Deliverables:
    a.  Checklist of early warning signs of financial decline in the elderly
    b.  Pamphlet on early warning signs of financial decline in the elderly
    c.  Video of early warning signs of financial decline in the elderly

2.  Dissemination of study findings though media reports, conference presentations, and scientific papers.

## II. Summary of Findings:

### Phase 1 Findings (September 2013 to March 2014):

Over the first five months of the study, our UAB team conducted multiple statistical analyses of performance on the Financial Capacity Instrument (FCI) in the normal older control sample (n=103) of our NIA funded Cognitive Observations in Seniors (COINS1) longitudinal dataset.

These analyses identified very early financial declines in a subset of normal older adults (n=16) who were cognitively normal at baseline but who, in a subsequent study visit, showed cognitive decline and underwent a consistent study diagnostic change to mild cognitive impairment (MCI) and/or dementia, and who remained cognitively impaired through their final COINS1 follow-up visit.   We referred to this group as *control-decliners* (CD) (n=16).

We distinguished the CD group from normal controls who were normal at baseline and who remained cognitively normal up through their final COINS1 follow-up visit (*control-normals*) (CN) (n=77).

A smaller third group (*control-mixed*) (CM) (n=10) were baseline normal controls who on a later visit showed cognitive impairment and diagnostic change, but who then returned to normal cognition prior to their last COINS1 visit. The CM group was interesting but diagnostically unstable and was not included in subsequent study analyses.

In order to identify initial early financial declines, we evaluated in Phase 1 the CD group's FCI performance <u>at baseline to the baseline performance</u> of the CN group.   From a methodological standpoint, we believed that baseline differences--when both CN and CD groups were still diagnosed as cognitively normal—would be the most relevant indicators of the early financial declines we were seeking to identify in older adults.

Phase 1 findings are summarized below. We identified several relevant FCI variables (shown in parentheses).

*Phase 1 FCI Performance Score Differences at Baseline*
The CD group showed:
- mildly diminished overall financial skills (FCI Global Scores)
- mildly diminished checkbook management skills, in particular emerging difficulty accurately completing checks and check registers (Domain 4, and Task 4b)
- mildly diminished awareness and understanding of telephone fraud  risk (Task 6b)
- emerging difficulties with everyday cash transactions, including mildly diminished abilities to tip and to make specific kinds of change (eg., for a vending machine) (Domain 3, and Tasks 3c and 3d)
- emerging difficulty understanding and prioritizing bills for payment (Task 7b)

*Phase FCI Task Completion Time Differences at Baseline*
The CD group showed:
- slower time preparing bills for mailing (Task 7c  Time)
- slower time completing a check and check register in a simulated transaction (Task 4b Time)
- slower processing speed overall in completing designated financial tasks (FCI Composite Time)

*Summary of Phase 1 Cross-Sectional Findings (COINS1 Dataset Analyses)*
At baseline the CD group:
- showed diminished performance on overall financial skills
- showed diminished performance on specific skills of checkbook management, telephone fraud risk detection, tipping, making change, and prioritizing bills.
- was slower preparing bills for mails
- was slower completing a check and check register
- was slower in overall financial task completion time.

**Phase 2 Methods and Findings: February-September 2014:**
During Phase 2 we merged the COINS1 database with a newer and completely separate COINS2 database in order to power a more detailed investigation of baseline FCI differences between CN and CD groups.

Our initial task was to identify normal control participants from our second and separate COINS2 dataset that met criteria to serve as additional control normal (CN) and control decliner (CD) participants.  In order to qualify as a CN, we again required that each COINS2 participant have both a baseline and at least one follow-up

evaluation where they were deemed cognitively normal by the diagnostic consensus committee, and no instances in which they showed cognitive decline or diagnostic change.   To qualify as a CD, we required a baseline evaluation of normal cognition, followed at a later visit by cognitive decline and a shift in diagnostic status and continuous impairment going forward.  Using these criteria, we identified COINS2 control subgroups of CN (n=38) and CD (n=7).

We compared the COINS1 and COINS2 CN and CD subsamples on FCI and demographic variables in order to ensure that the two groups were sufficiently similar for purposes of subsequent dataset merger.   Comparisons on FCI variables revealed few demographic differences and remarkable score stability across the two datasets and we proceeded to merge them into a combined COINS1/COINS2 baseline dataset of normal older controls (n=138) with a CN subgroup (n=115) and CD subgroup (n=23).

All subsequent project analyses were conducted using this new merged dataset. These analyses are summarized in detail in the first year report of findings previously submitted to NEFE in September 2014.   We restate core FCI findings below, organized by findings using the Wilcoxon statistical test and findings using linear regression.

*Phase 2 Baseline Group Comparisons on FCI Variables Using Wilcoxon Test Without Age as a Covariate*
A range of significant performance and time to completion differences were obtained due to the increased power of the merged dataset.  Compared to the CN group, the CD group:
- showed lower performance on FCI **global score 1** (p=.0489), **global score 2** (p=.0195), and **global score 3** (p=.049).
- showed lower performance on the FCI **domains** of:
  - cash transactions (p=.0364)
  - checkbook management (p=.0348)
  - bank statement management (p=.0276)
  - investment decision-making (p=.0472)
- showed lower performance on the FCI **tasks** of:
  - making change for a vending machine (p=.0203) (Task 3c) (Cash Transactions domain)
  - understanding a checkbook/register (p=.0741) (Task 4a) (Checkbook Management domain)
  - using a checkbook/register (p=.0611) (Task 4b) (Checkbook Management domain)
  - identifying and prioritizing bills (p=.0531)  (Task  7b) (Bill Payment domain)
- showed slower time to completion on the FCI **variables** of:
  - completing a check and check register in a simulated transaction (p=.0166 (Task 4b) (Checkbook Management domain)
  - preparing bills for mailing (p=.0089) (Task 7c) (Bill Payment domain)
  - overall (composite) FCI task completion time (p=.0080)

*Phase 2 Baseline Group Comparisons on FCI Variables Using Linear Regression With Age as a Covariate*
A range of significant performance and time to completion differences were again obtained due to the increased power of the merged dataset, although a smaller number of significant findings and trends emerged due to the effects of age as a covariate.  Compared to the CN group, the CD group:
- showed lower performance on FCI **global score 1** (p=.0653), **global score 2** (p=.0640), and **global score 3** (p=.0239).
- showed lower performance on the FCI **domains** of:
  - cash transactions (p=.0264)

- bank statement management (p=.0430)
  - investment decision-making (p=.0653)
  - checkbook management (p=.0855)
- showed lower <u>performance</u> on the FCI **tasks** of:
  - making change for a vending machine (p=.0227) (Task 3c) (Cash Transactions domain)
  - identifying and prioritizing bills (p=.0764)  (Task  7b) (Bill Payment domain)
  - detection and understanding telephone fraud (p=.1045)  (Task  6b) (Financial Judgment domain)
  - understanding a checkbook and register (p=.1059)  (Task  4a) (Checkbook Mgmt domain)
  - tipping in a restaurant (p=.1078) (Task 3d) (Cash Transactions domain)
  - understanding a bank statement (p=.1376)  (Task  5a) (Bank Statement Mgmt domain)
- showed <u>slower time to completion</u> on the FCI timing **variables** of:
  - completing a check and check register in a simulated transaction (p=.0621) (Task 4b) (Checkbook Management domain)
  - preparing bills for mailing (p=.0284) (Task 7c) (Bill Payment domain)
  - overall (composite) FCI task completion time (p=.0384)

<u>Summary</u>:  The results indicated that, whether using the Wilcoxon test or linear regression, the CD group compared to the CN group at baseline showed slower performance on FCI timing variables and lower performance on a range of FCI task, domain, and global variables.

*Phase 2  Baseline Group Comparisons on Specific FCI  Test Items*
Although encouraged by these findings, we also wanted to penetrate beyond the FCI task and domain level and identify actual <u>test item performance differences between groups</u>.  We suspected that often it might be a specific test item that drove group effects at the task level, and that a small group of test items might ultimately drive differences at domain and global levels. We also believed that identification of specific test item differences would afford us the deepest glimpse into specific early financial declines in cognitively normal elderly, and allow us to understand these declines in ways unavailable at the more diffuse FCI task, domain, and global levels.

Accordingly, we used non-parametric statistics and logistic regression (controlling for both age and education) to identify specific FCI test items for which patients performed with significantly different degrees of ability between the two groups.   These test items are presented below, in order of p value:

| Description of Test Item | P value | Age covariate | Item# | Task/Domain |
|---|---|---|---|---|
| 1. write payee name in check register record | p=.006 | p = .116 | T4bq22 | 4b/Checkbook Mgmt |
| 2. which bill requires immediate attention? | p=.017 | p = .119 | T7bQ7 | 7b/Bill Payment |
| 3. meaning of bank statement interest rate | p=.019 | p = .187 | T5aq9 | 5a/Bank Statement |
| 4. detection of key risk in investment vignette | p=.019 | p = .134 | D9Q9 | Investment Decisions |
| 5. bank statement:  # gaps in check sequence? | p=.032 | p = .136 | T5q19 | 5b/Bank Statement |
| 6. select change =  $1 and $0.55 in vending machine | p=.042 | p = .057 | T3cq1 | 3c/Cash Transactions |
| 7. medical deductible calculation problem | p=.054 | p = .077 | T2b15 | 2b/Financial Concepts |
| 8. meaning of bank statement minimum balance | p=.054 | p = .70 | T5aq12 | 5a/Bank Statement |
| 9. explain numerical amount section of check | p=.075 | p = .05 | T4aq5 | 4a/Checkbook Mgmt |
| 10. calculation of $ return on investment choice | p=.084 | p = .08 | D9Q11 | Investment Decisions |

The above list reveals 10 FCI items which, following logistic regression controlling for age, showed actual CN-CD differences or trends warranting attention and interpretation. Inspection of the list reveals a set of subtle financial skill impairments implicated in a baseline group of cognitively normal older controls destined over time to show cognitive decline and diagnostic change (CD group).

**Using the above FCI test item findings, we derived the following initial NEFE project "warning signs checklist" of very early financial declines in cognitively normal older adults.**

**III.   Checklist of Early Warning Signs of Financial Skill Decline in Cognitively Normal Older Adults**

The following five "early warning signs" of financial decline in normal older adults have  been distilled from the test item, task, domain and global FCI results described above.    These represent the core findings of the NEFE study, and the basis for the three study deliverables.

**Warning Sign 1:   Is the person taking longer to complete everyday financial tasks?**
a.   Examples:
    i.   Slower preparing bills for mailing
    ii.   Slower completing check and check register (taxes)
    iii.   Slower on composite of financial tasks
b.   Hypothesized cognitive ability: processing speed

**Warning Sign 2:   Is the person showing reduced visual attention to key details/facts in financial documents?**
a.   Examples:
    i.   Cannot identify a bill that is overdue, that needs prompt attention
    ii.   Trouble identifying transactions in complex documents like a bank statement -- gaps in check number sequence
    iii.   Difficulty completing payee section of check register
b.   Hypothesized cognitive abilities: visual attention and search abilities for financial detail in documents

**Warning Sign 3:  Is the person showing declines in everyday arithmetic skills related to his/her finances?**
a.   Examples:
    i.   Difficulty calculating a medical deductible
    ii.   Calculating  a return on a specific investment option
    iii.   Difficulty making correct change for a vending machine purchase when a dual task is involved (making change for $1, and ensuring receipt of coins sufficient for $0.55 soft drink purchase).
b.   Hypothesized cognitive ability: basic oral and written arithmetic skills

**Warning Sign 4:   Is the person showing decreased understanding of financial concepts?**

a.    Examples:
    i.   Difficulty understanding a medical deductible problem
    ii.   Difficulty understanding terms in a bank statement like a specific interest rate, minimum balance, and concept of gaps in check sequence.
    iii.   Difficulty understanding key investment risk
    iv.   Difficulty explaining the 'quantity' section of a check
b.   Hypothesized cognitive abilities: conceptual ability, verbal expressive ability

**Warning Sign 5:  Is the person having new difficulty identifying risks in an investment opportunity?**
a. Example:   Trouble identifying key risk in an investment scenario
b. Hypothesized cognitive abilities: conceptualization and judgment

**IV. New Study Analyses**

**A. Cognitive Models of Discriminative FCI Test Items:**
We have subsequently used the neuropsychological test data from the COINS1 and COINS2 datasets to develop preliminary neurocognitive models for each of the ten FCI test items that discriminated the CN and CD groups, and also the FCI time to completion indices. We wanted better to understand what cognitive skills are associated with declining performance on the FCI test items and timing indices..

Initial results are presented in **Appendices A and B**. We used the full sample (stable controls and decliners) (n=138) and also covariates of age, education, and written arithmetic skill in all models.

*Models of Discriminative FCI Performance Variables:*
With respect to key FCI performance items, statistically significant models emerged for 8 of the 10 key FCI test items tested (see **Appendix A**). Cognitive predictor models varied by FCI test item and the financial knowledge and behavior being sampled. Key cognitive skills (and related test measures) that emerged in the performance item models were:

- delayed verbal recall of financial task instructions (WMS-III LMII, CVLT-2 short and long delay free recall)
- semantic knowledge of financial concepts (Boston Naming Test, semantic fluency, CLOX1 clock drawing-command)
- visual attention to coins/currency and other financial stimuli (DRS Attention, DRS Construction, CLOX2 clock copy)
- processing speed on speeded financial tasks (WAIS-III Digit Symbol)
- multi-tasking on financial tasks (Trails C)
- written arithmetic skills (WRAT-3 Arithmetic)

*Models of Discriminative Time to Completion Variables:*
With respect to FCI time to completion items, highly statistically significant models ($p < .0001$) emerged for all four of the FCI timing variables tested (see **Appendix B**). Age was a crucial demographic variable which was predominant in three of the four time to completion models. Interesting, years of education was not a key predictor of completion time. Written arithmetic skill was a key covariate appearing in three of the four models. Key cognitive predictors included measures of delayed verbal memory (LMII and CVLT LDFR) and semantic knowledge (DRS IP and Boston Naming).

The model for **overall time to completion (composite time)** comprised four predictors: *age* ($p < 0.0001$), *delayed verbal recall* ($p = .006$), *semantic fluency* ($p = 0.025$), and *semantic knowledge* (p 0.029). *Written arithmetic knowledge* showed a trend (p= 0.07). The overall model was significant ($p < 0.0001$) and adjusted $R^2$ = .31. The results suggest, in a group of cognitively normal older adults (including a subgroup destined to decline cognitively over time), that <u>age is the most critical factor associated with completion time of financial tasks</u>, followed by verbal recall (of financial task instructions presumably), semantic understanding of the financial concepts involved, and efficiency of semantically generated responses to the task questions posed.

**Taken together, Appendices A and B represent a preliminary neurocognitive model of very early financial skill loss in cognitively normal older adults.**

**B.  Analysis of Financial Resiliency in Stable Cognitively Normal Older Adult Group (Non-Decliners) (N=115).**

As an ancillary study objective, Dr. Marson and his team recently sought to understand "resiliency" to financial decline in the cognitively normal elderly group <u>that did not decline cognitively over time</u> (n=115).  Specifically, we have sought to identify variables that appear associated with continuing intact financial capacity—"financial resiliency"—in this stable group.

In our approach, we summed all of the ten discriminative FCI test items to create a new FCI discrimination composite score variable (score range 0-20) for each stable control.   As this composite score was comprised of very sensitive test items likely to show decline over time in "decliners", we believed that it could also serve as a measurement reference for understanding resiliency to financial decline in the stable older adult group.   We then correlated demographic and clinical variables with this "discrimination composite score" to identify factors associated with resiliency in this group.

Initial results are presented in **Appendix C, Table 1**.    With respect to demographic variables, years of education was positively and significantly correlated with the FCI composite score (p= 0.006), indicating that <u>educational level is a key predictor of financial resiliency in cognitively normal elderly</u>.   <u>We believe that this finding underscores the importance of the NEFE educational mission regarding supporting financial literacy, particularly as it affects the elderly</u>.   Among non-declining cognitively normal elderly, the greater the educational level, the higher they scored on the composite of sensitive FCI performance items, and arguably the greater their "resiliency" to financial skill decline.

Age was negatively and weakly correlated with the FCI composite score (p= 0.22).   A negative correlation was expected, as increasing age was expected to be associated with slightly diminishing performance on the FCI composite in the stable normal group.  However, the relationship did not achieve significance, indicating that age by itself is not a decisive factor for resilience.

Similarly, five medical variables (systolic and diastolic blood pressure, and cardiovascular, neurological and metabolic risk variables, were largely negatively correlated with the composite scores (as expected), but none of them achieved significance.

In contrast, as reflected in Table 1, multiple cognitive variables were significantly and positively associated with performance on the composite and hence with "resiliency."   The key cognitive correlates, in order of importance, were:
- **written arithmetic skill (r=0.47, p < 0.0001)**
- high load verbal learning (r=0.38, p < 0.0001)
- delayed high load verbal recall (r=0.39, p < 0.0001)
- semantic knowledge of words (r=0.36, p < 0.0001)
- delayed verbal recall for narrative stories (r=0.34, p = 0.0002)
- immediate verbal recall for narrative stories (r=0.31, p = 0.0007)

These cognitive findings indicate that the stronger one's written arithmetic skills, short term verbal memory, and semantic knowledge abilities are, the more **resilience** one will likely have for maintaining financial skills in later life.   We believe that this finding also <u>underscores the importance of the NEFE educational mission regarding supporting arithmetic skills and financial literacy in all age groups</u>.

**Table 2** in **Appendix C** provides results of subgroup comparisons on the FCI discrimination composite within the non-declining group (n=115).    There were no gender or APOE E4 allele genotype differences in performance.  However, there was a significant difference by racial group, with white participants performing higher on the FCI discrimination composite than African-American participants.    This differential likely reflects educational disparities experienced  by African-American participants who for the most part were raised and educated in the Deep South during the early to middle decades of the 20th century.    <u>This finding also underscores the importance of NEFE's mission of providing financial literacy education and programmatic initiatives to minorities and other underserved populations of the United States.</u>

**V.  Study Deliverables**

*1. Checklist of Warning Signs*

A draft of the checklist of the five warning signs was delivered to NEFE on September 12, 2014.   The checklist was then transferred by NEFE to cardstock and was distributed by Dr. Marson and various conferences and presentations.

**2. *Brochure of Warning Signs***

A draft brochure presenting the five warning signs was delivered to NEFE on January 25, 2015.    NEFE subsequently drew upon both the draft checklist and the draft brochure to develop a graphically professional and attractive handout that combined key aspects of both of these two deliverables.   Dr. Marson continues to distributed this "warning sign" brochure/handout at national conferences.

**3. *Video of Warning Signs***

As this deliverable requires technical knowledge and resources that exceed the UAB group's capacity, NEFE agreed to take the lead in preparing this final study deliverable.  An initial video project plan has been developed by Paul Golden of NEFE and initial filming is likely to occur at the end of 2015 with public relations efforts ongoing in 2016.   Dr. Marson will continue to be available to assist with the video deliverable component following conclusion of the study proper.

*4.   Presentation of NEFE Study Findings at National Conferences*

The following conference presentations have either featured or included discussion of the NEFE warning signs and study findings:

Marson, D. (August 9, 2014).  Diminished financial capacity in older adults.  Presentation part of ABA Annual Meeting CLE Showcase Program entitled The Epidemic of Elder Financial Exploitation: Ethical Traps for Lawyers and Skills Every Lawyer Needs, 2014 American Bar Association Annual Meeting, Boston, Massachusetts.

Marson, D. (October 2, 2014).  Impact of Alzheimer's disease on financial capacity of older adults.  Presentation part of conference entitled Financial Planning in the Shadow of Dementia, MIT AgeLab and Transamerica Financial Services, Massachusetts Institute of Technology, Boston, Massachusetts.

Marson, D. (October 9, 2014).  Very early financial decline in cognitively normal older adults.  Oral presentation as part of Aging Session at the 2nd Annual Meeting of the Society of American Business Editors and Writers (SABEU) and National Endowment for Financial Education (NEFE), New York, New York.  .

Marson, D. (October 16, 2014). Very early financial decline in cognitively normal older adults. Oral presentation in the Financial Literacy II session of the 28th Annual Meeting of the Academy of Financial Services, Nashville, Tennessee.

Marson, D. (November 6, 2014). Diminished financial capacity in older adults. Oral presentation part of Policies Series Program entitled Elder Financial Exploitation: New Federal and State Initiatives for Prevention, Detection, and Response, 2014 Annual Scientific Meeting of the Gerontological Society of America, Washington, D.C. Course 550: Program Book, p. 83.

Marson, D. (March 11, 2015). Very early financial declines in cognitively normal older adults. Presentation at the initial meeting of the North American Securities Administrators Association (NASAA) Seniors and Diminished Capacity Committee & Advisory Council, Washington, D.C.

Marson, D. (May 4, 2015). Diminished financial capacity in older adults. Presentation at the NASAA Investor Education 2015 conference, North American Securities Administrators Association (NASAA), Newport Beach, California.

**\*Upcoming:**
Marson, D. (October 1, 2015). Diminished financial capacity in older adults: Recent research findings. Presenter and member of panel "Boomers and Gen X", 2015 IFIC Annual Leadership Conference, The Investment Funds Institute of Canada, The Carlu, Toronto, Canada.

Marson, D. (October 2, 2015). Diminished financial capacity in older adults: Recent research findings. Part of joint keynote presentation (with Dr. Jason Karlawish), 6th Annual Summit on Elder Financial Exploitation, part of the 26th Annual Conference of the National Adult Protective Services Agency (NAPSA), Rosen Plaza Hotel, Orlando, Florida.

## 5. *Media Reports of NEFE Study Findings*

*As Cognition Slips, Financial Skills Are Often the First To Go*
New York Times
April 24, 2015 (internet); April 25, 2015 (paper edition)
Business section: Your Money / Retiring
Reporter: Ms. Tara Siegel-Bernard
http://www.nytimes.com/2015/04/25/your-money/as-cognitivity-slips-financial-skills-are-often-the-first-to-go.html?_r=0

## 6. *Scientific Paper*
We are finalizing a manuscript that sets forth the early warning signs and their public policy implications. Once the final draft is complete, we will circulate it among the NEFE team to receive input and suggestions prior to submission for publication.

**VI. Summary and Next Steps**

From a scientific standpoint, the present study has achieved its original aims:

1. it has empirically identified early warning signs of financial skill loss in cognitively normal older adults;
2. it has developed preliminary cognitive models of these early financial skill declines; and
3. it has also identified demographic and cognitive factors associated with financial skill "resiliency" in cognitively normal elderly who remain cognitively stable over time.

Dissemination of study findings to date have occurred primarily through national conference presentations and through national media (eg., New York Times).

Ongoing goals relate to continuing dissemination of the study results. The UAB team looks forward to publishing scientific papers regarding the above NEFE study findings, continuing to distribute the study brochure/checklist at scientific and other meetings, and assisting NEFE with it's creation and development of the final video deliverable of the project.

The UAB team has enjoyed very much the opportunity to work with NEFE and its staff on this project. If NEFE believes that the UAB study findings may warrant further follow-up and development, the UAB team would be pleased to discuss possible further research collaborations. In particular, the initial study findings discussed above on pages 8-9 regarding "financial resiliency" in the stable cognitively normal older adult group appear consistent with the NEFE mission and might warrant additional exploration.

Finally, the UAB team also wishes to acknowledge the support of the NIA/NIH as part of this NEFE funded project, without which this study would not have been possible.

**Appendix A: Neurocognitive Models of Most Discriminative FCI <u>Performance Items</u> in All Participants (n=138)**

| FCI Domain | FCI Item# | FCI Item Description | Model Predictors/Covariates | Variable P-Value | Point Estimate | L95 Odds Ratio | U95 Odds Ratio | Model P-Value |
|---|---|---|---|---|---|---|---|---|
| D2 Financial Concepts | 2B-Q15 | More recently, you had minor foot surgery and the hospital bill comes to $350. How much of the $350 bill you your insurance company pay? | Age (in years) | 0.7394 | 1.0100 | 0.9530 | 1.0700 | |
| | | | Education (in years) | 0.7878 | 0.9700 | 0.7780 | 1.2090 | |
| | | | Boston Naming 30 Item | 0.2332 | 0.8610 | 0.6730 | 1.1010 | |
| | | | Logical Memory II (delayed) | 0.0079 | 0.8890 | 0.8160 | 0.9700 | |
| | | | WRAT-3 Arithmetic | 0.1186 | 0.9110 | 0.8100 | 1.0240 | 0.0159 |
| | | | | | | | | |
| D3 Financial Transactions | 3C-Q1 | How would you like change for your dollar? [select correct coins for 2 tasks] | Age (in years) | 0.6986 | 0.9870 | 0.9230 | 1.0550 | |
| | | | Education (in years) | 0.2204 | 1.1720 | 0.9090 | 1.5090 | |
| | | | Boston Naming 30 Item | 0.0180 | 0.7300 | 0.5630 | 0.9470 | |
| | | | WRAT-3 Arithmetic | 0.7836 | 0.9820 | 0.8600 | 1.1210 | 0.1095 |
| | | | | | | | | |
| D4 Checkbook Management | 4A-Q5 | Meaning of section of check where numerical $ amount is written. | Age (in years) | 0.1001 | 0.936 | 0.865 | 1.013 | |
| | | | Education (in years) | 0.7863 | 0.966 | 0.752 | 1.241 | |
| | | | Logical Memory II (delayed) | 0.0136 | 0.885 | 0.802 | 0.975 | |
| | | | Trails C (seconds) | 0.1440 | 1.015 | 0.955 | 1.035 | |
| | | | CLOX 1 Clock Drawing-Command | 0.0644 | 1.361 | 0.982 | 1.887 | |
| | | | WRAT-3 Arithmetic | 0.1696 | 0.914 | 0.805 | 1.039 | 0.0166 |
| | | | | | | | | |

| FCI Domain | FCI Item | Item Description | Model Covariates | Variable P-Value | Point Estimate | L95 Odds Ratio | U95 Odds Ratio | Model P-Value |
|---|---|---|---|---|---|---|---|---|
| D4 Checkbook Management | 4A-Q22 | Meaning of "payee" section of check | Age (in years) | 0.2437 | 1.0490 | 0.9680 | 1.1380 | |
| | | | Education (in years) | 0.6758 | 0.9400 | 0.7030 | 1.2570 | |
| | | | Semantic fluency test | 0.0587 | 0.9350 | 0.8730 | 1.0020 | |
| | | | WRAT-3 Arithmetic | 0.1618 | 0.9040 | 0.7840 | 1.0420 | 0.0483 |
| | | | | | | | | |
| D5 Bank Statemt Management | 5A-Q9 | Meaning of "interest rate of 1.49%" | Age (in years) | 0.0262 | 1.0510 | 1.0060 | 1.0980 | |
| | | | Education (in years) | 0.8826 | 0.9880 | 0.8410 | 1.1610 | |
| | | | Logical Memory II (delayed) Raw | 0.0028 | 0.9130 | 0.8600 | 0.9690 | |
| | | | WRAT-3 Arithmetic | 0.0666 | 0.9240 | 0.8480 | 1.0050 | 0.0014 |
| | | | | | | | | |
| D5 Bank Statemt Management | 5A-Q12 | Meaning of "minimum balance" | Age (in years) | 0.4149 | 0.9770 | 0.9250 | 1.0330 | |
| | | | Education (in years) | 0.0029 | 0.7350 | 0.6010 | 0.9010 | |
| | | | DRS Attention | 0.0420 | 0.7210 | 0.5260 | 0.9880 | |
| | | | Boston Naming 30 Item | 0.0316 | 0.7840 | 0.6280 | 0.9790 | |
| | | | CVLT-2 Long Delay Free Recall | 0.0792 | 0.8710 | 0.7460 | 1.0160 | |
| | | | WRAT-3 Arithmetic | 0.8561 | 0.9900 | 0.8930 | 1.0980 | 0.0013 |
| | | | | | | | | |

| FCI Domain | FCI Item | Item Description | Model Covariates | Variable P-Value | Point Estimate | L95 Odds Ratio | U95 Odds Ratio | Model P-Value |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| D5 Bank Statemt Management | 5B-Q15 | How many gaps were there in the sequence of cleared checks? | Age (in years) | 0.2650 | 1.064 | 0.954 | 1.187 | |
| | | | Education (in years) | 0.5705 | 1.155 | 0.748 | 1.693 | |
| | | | CLOX 2 (clock copy) | 0.0446 | 0.417 | 0.177 | 0.979 | |
| | | | DRS Construction | 0.0729 | 1.588 | 0.958 | 2.633 | |
| | | | WRAT-3 Arithmetic | 0.0425 | 0.784 | 0.619 | 0.992 | 0.0361 |
| | | | | | | | | |
| D5 Bank Statemt Management | 5B-Q22 | Show me where on bank statement you would look to see if your account was overdrawn/Was the account overdrawn? | Age (in years) | 0.0017 | 0.8980 | 0.8400 | 0.9600 | |
| | | | Education (in years) | 0.7437 | 1.0320 | 0.8530 | 1.2500 | |
| | | | DRS Attention | 0.0499 | 0.7030 | 0.4950 | 1.0000 | |
| | | | Trails C (seconds) | 0.0007 | 1.0310 | 1.0130 | 1.0500 | |
| | | | WAIS-R Digit Symbol | 0.0345 | 0.9600 | 0.9240 | 0.9970 | |
| | | | WRAT-3 Arithmetic | 0.1281 | 0.9230 | 0.8320 | 1.0230 | 0.0002 |
| | | | | | | | | |
| D7 Bill Payment | 7B-Q7 | Which of these bills (if any) requires immediate attention? | Age (in years) | 0.5629 | 1.0130 | 0.9690 | 1.0600 | |
| | | | Education (in years) | 0.7130 | 0.9690 | 0.8200 | 1.1460 | |
| | | | Boston Naming 30 Item | 0.0042 | 0.7580 | 0.6270 | 0.9160 | |
| | | | WRAT-3 Arithmetic | 0.8984 | 0.9940 | 0.9130 | 1.0840 | 0.0372 |
| | | | | | | | | |

| FCI Domain | FCI Item | Item Description | Model Covariates | Variable P-Value | Point Estimate | L95 Odds Ratio | U95 Odds Ratio | Model P-Value |
|---|---|---|---|---|---|---|---|---|
| D9 Investment Decisions | D9-Q9 | In the story, what is the main disadvantage of the We Are Computers stock investment? | No predictors.  Age & Education covariates also insignificant | | | | | 0.6801 |
| | | | | | | | | |
| D9 Investment Decisions | D9-Q11 | If you were to invest $20,000 in the computer stock, how much money would your investment earn in a year at the highest rate of return? | Age (in years) | 0.5100 | 0.9810 | 0.9270 | 1.0380 | |
| | | | Education (in years) | 0.7568 | 0.9690 | 0.7960 | 1.1800 | |
| | | | Logical Memory II (delayed) | 0.1472 | 0.9460 | 0.8770 | 1.0200 | |
| | | | CVLT-2 Short Delay Free Recall | 0.0068 | 0.7860 | 0.6600 | 0.9360 | |
| | | | CLOX 1 Clock Drawing-Command | 0.1437 | 0.7370 | 0.4900 | 1.1090 | |
| | | | WAIS-R Digit Symbol | 0.0695 | 0.9660 | 0.9300 | 1.0030 | |
| | | | WRAT-3 Arithmetic | 0.2485 | 0.9410 | 0.8480 | 1.0440 | 0.0015 |
| | | | | | | | | |

**Appendix B:   Neurocognitive Models of FCI <u>Time to Completion Variables</u> in All Participants (n=138)**

| FCI Domain | FCI Item | Item Description | Model Covariates | Variable P-Value | Point Estimate | L95 Odds Ratio | U95 Odds Ratio | Model P-Value |
|---|---|---|---|---|---|---|---|---|
| D2 Financial Concepts | 2B-Q15 **Time to Complete** | More recently, you had minor foot surgery and the hospital bill comes to $350. How much of the $350 bill you your insurance company pay? | Age (in years) | 0.3056 | 0.2609 | -0.2409 | 0.7627 | |
| | | | Education (in years) | 0.8153 | 0.2257 | -1.6822 | 2.1337 | |
| | | | WRAT-3 Arithmetic | 0.0023 | -1.4925 | -2.4405 | -0.5446 | |
| | | | DRS Initiation Perseveration | 0.0022 | -5.2335 | -8.5441 | -1.9228 | <0.0001 |
| | | | | | | | | Adj R$^2$ = 0.1368 |
| | | | | | | | | |
| D4 Checkbook Management | 4B-Q15-24 **Time to Complete** | Complete check and check register in simulated one item purchase | Age (in years) | <0.0001 | 1.5984 | 0.9437 | 2.2532 | |
| | | | Education (in years) | 0.6409 | 0.5730 | -1.8518 | 2.9977 | |
| | | | WRAT-3 Arithmetic | 0.0082 | -1.7056 | -2.9616 | -0.4495 | |
| | | | Boston Naming 30 Item | 0.0291 | -3.1659 | -6.0053 | -0.3265 | |
| | | | CVLT-2 Long Delay Free Recall | 0.0559 | -1.8898 | -3.8278 | 0.0483 | <0.0001 |
| | | | | | | | | Adj R$^2$ =0.2591 |
| | | | | | | | | |

| FCI Domain | FCI Item | Item Description | Model Covariates | Variable P-Value | Point Estimate | L95 Odds Ratio | U95 Odds Ratio | Model P-Value |
|---|---|---|---|---|---|---|---|---|
| D7 Bill Payment | 7C-Q9-17 **Time to Complete** | Preparing three bills for mailing | Age (in years) | 0.0009 | 1.4467 | 0.6084 | 2.2851 | |
| | | | Education (in years) | 0.2203 | -1.9839 | -5.1707 | 1.2029 | |
| | | | WRAT-3 Arithmetic | 0.4624 | 0.5952 | -1.0022 | 2.1926 | |
| | | | Logical Memory II (delayed) | 0.0060 | -1.5572 | -2.6948 | -0.4595 | |
| | | | DRS Initiation Perseveration | 0.0946 | -4.7521 | -10.3356 | 0.8314 | <0.0001 |
| | | | | | | | | Adj $R^2$ = 0.1403 |
| | | | | | | | | |
| **FCI Composite Time** | **All Tasks- Time to Complete** | Composite time for three timed tasks in Domains 2, 4, and 7 | Age (in years) | <0.0001 | 3.0529 | 1.7296 | 4.3762 | |
| | | | Education (in years) | 0.7174 | -0.9120 | -5.8857 | 4.0617 | |
| | | | WRAT-3 Arithmetic | 0.0710 | -2.3341 | -4.8705 | 0.2022 | |
| | | | CVLT-2 Long Delay Free Recall | 0.0055 | -5.6450 | -9.6005 | -1.6895 | |
| | | | DRS Initiation Perseveration | 0.0248 | -10.2075 | -19.0990 | -1.3160 | |
| | | | Boston Naming 30 Item | 0.0291 | -3.1659 | -6.0053 | -0.3265 | <0.0001 |
| | | | | | | | | Adj $R^2$ = 0.3089 |

**Appendix C:   Resiliency Analyses in Cognitively Stable Non-Declining Elderly (n=115)**

**Table 1:  Correlations Between Composite Variable Performance and Demographic and Clinical Variables**

| Domains | Variable | Pearson Correlation *Rho* $\rho$ | P-Value |
|---|---|---|---|
| **Demographic** | Age | - 0.11 | 0.22 |
| | Education | 0.34 | 0.0002 |
| | | | |
| **Mood** | Geriatric Depression Score | 0.06 | 0.52 |
| | | | |
| **Medical** | Systolic Blood Pressure | - 0.077 | 0.41 |
| | Diastolic Blood Pressure | - 0.076 | 0.42 |
| | Cardiovascular | 0.049 | 0.61 |
| | Neurological | - 0.03 | 0.76 |
| | Metabolic | - 0.06 | 0.50 |
| | | | |
| **Cognitive** | | | |
| Attention | DRS  Attention | 0.26 | 0.006 |
| Semantic Knowledge | Boston Naming 30 Item | 0.36 | <.0001 |
| | Semantic Fluency | 0.29 | 0.002 |
| Verbal Memory | DRS Memory | 0.18 | 0.061 |
| | WMS-III Logical Memory I (immediate) | 0.31 | 0.0007 |
| | WMS-III Logical Memory II (delayed) | 0.34 | 0.0002 |
| | CVLT-2 Five Trial Acquisition | 0.38 | <.0001 |
| | CVLT-2 Short Delay Free Recall | 0.37 | <.0001 |
| | CVLT-2 Long Delay Free Recall | 0.39 | <.0001 |
| Visuospatial Abilities | DRS Construction | 0.18 | 0.058 |
| | CLOX2 Clock Copy | 0.20 | 0.031 |
| Conceptualization | DRS Conceptualization | 0.15 | 0.10 |
| Executive Function | DRS Initiation Perseveration | 0.22 | 0.019 |
| | Trails B (seconds) | - 0.13 | 0.15 |
| | Trails C (seconds) | - 0.11 | 0.25 |
| | CLOX1 Clock drawing to command | 0.1533 | 0.10 |
| Processing Speed | Trails A (seconds) | - 0.13 | 0.16 |
| | WAIS-III Digit Symbol | 0.16 | 0.09 |
| Written Arithmetic | WRAT-3 Arithmetic | 0.47 | <.0001 |
| | | | |
| | **Group Differences on FCI Discrimination Composite FCI Variable** | | |
| | Race (white, black) | | 0.001 |
| | Gender (male, female) | | 0.94 |
| | APOE E4 Status (+/-) | | 0.97 |

**Table 2   Formulation of FCI Composite and Medical Variables Found in Table 1**

| Variable | Variable Formulation |
|---|---|
| **FCI Item Composite Measure** | T4BQ22+T7BQ7+T5AQ9+T5AQ12+D9Q9+T5BQ19+T3CQ1+T2BQ15+T4AQ5+D9Q11 |
| | |
| Cardiovascular | Angioplasty + Atrial Fibrillation + Cardiac Bypass + Endarterectomy + Hypercholesterolemia + Hypertension + Cardiac Arrest+ Pacemaker + Angina + Claudition + Vasculitis |
| | |
| Neurological | Traumatic brain Injury +Parkinsons + Seizures + Stroke + Ischemic Attack + ALS + Metastatic brain or CNS cancer + Meningitis + MS + COPD + Sleep Disorder |
| | |
| Metabolic | B12 Deficiency + Diabetes + Thyroid Disease |
| | |