Executive function, self-regulation, and self-efficacy effects on exercise adherence in older adults

Amanda N. Szabo, B.S., Sean P. Mullen, Ph.D, Siobhan M. White, B.S., Thomas R. Wójcicki, B.S. Arthur Kramer, Ph.D. & Edward McAuley, Ph.D.

Funded by the National Institute on Aging (AG-025667)
Introduction

• The difficulty of maintaining positive health behaviors

• Self-regulation- monitor and evaluate one’s own behavior

• Two main approaches to studying self-regulatory processes relative to behavior change:
  – Social/Psychological approach
    • *Self-reported goal-setting and intentions*
  – Neurocognitive approach
    • *Executive function*
Self-regulation and Physical Activity

- Association between self-reported intentions, physical activity, and executive function (Hall et al., 2008)

  - Executive function predicted physical independent of intentions

  - The intention X executive function interaction also predicted activity

  - Findings limited by short assessment period
Social Cognitive Theory and Behavior Change

- Social cognitive theory (SCT) - behavior change stems from changes in motivation and self-regulation

- Self-efficacy - the belief one has in one’s capabilities to successfully carry out a course of action
  - Consistent determinant of many health behaviors including physical activity
  - Related to adherence
The Current Study

Executive Function

Self-regulation

Self-efficacy

Adherence
Participants

- $N = 177$
- Older adults (M age = 66.44 yrs; 61 male; 116 female)
- Sedentary
- Community dwelling and surrounding area of Champaign County in Illinois
- Recruited to participate in a year long exercise intervention
Measures

• Baseline:
  – Demographics
  – Self-regulatory strategies
  – Neuropsychological battery

• 3-Weeks
  – Exercise Self-efficacy

• 12-Months
  – Adherence to exercise program
Self-Regulatory Strategies

- Twelve-item Physical Activity Self-Regulation scale (PASR-12; Umstattd et al., 2008; 2009)
- Composed of six strategy subscales
- Items are rated from 1 to 5
  - E.g. I mentally kept track of my physical activities.
- Subscales was used as a manifest indicator of the latent construct representing physical activity self-regulation
  - Internal consistency for subscales ranged from $\alpha = .79 - .94$. 
Neuropsychological Battery

• 5 assessments of executive function:
  – Dual Task
  – Stroop Color-Word Task
  – Flanker Task
  – Wisconsin Card Sorting Test
  – Task-Switching Paradigm
Dual Task Paradigm

- Dual Task (Erickson, 2005)
- Responses made on a key pad
- Each participant completed:
  - 48 dual trials
  - A or B
  - 2 or 3
  - % Error represented performance
Stroop Color-Word Task

- **Four types of trials:**
  - Congruent
  - Neutral
  - Incongruent-Eligible
  - Incongruent-Ineligible

- **Cost Interference** = \( \frac{\text{(mean eligible RT + mean ineligible RT)} - \text{mean congruent RT}}{\text{congruent RT}} \)

- **Higher scores represented less interference.**
Flanker Task

- Participants asked to identify orientation of a central arrow cue that was flanked by arrows

- Two types of trials
  - Congruent
  - Incongruent

- Proportional cost or inhibition = (Congruent RT - Incongruent RT)/Congruent RT

- Accounts for individual differences in perceptual speed
Wisconsin Card Sorting Test

- Working memory, inhibition, and task switching processes
- Computerized version
- Percentage of perseverative error
Task Switching

- Participants were asked to complete two tasks:
  - judging whether a number (1, 2, 3, 4, 6, 7, 8, or 9) was odd or even
  - judging whether a number was low or high (i.e., smaller or larger than 5)
- Switch trial = even/odd trial followed by high/low trial (or vice versa)
- Non-Switch trial = Two or more trials of the same type presented in a row
- Cost = non switch- switch trial
Self-Efficacy

- Assessed at the end of the third week of the exercise program
- Exercise Self-Efficacy scale (EXSE)
- Barriers Efficacy scale (BARSE)
- Life-style Efficacy Scale (LSE)
- Scores ranged from 0-100
- All measures had excellent internal consistencies ($\alpha \geq .93$)
Adherence

- Attendance data were recorded each day by staff at each session
- % Attendance = Total sessions attended / Total possible number of sessions
- Adherence reflects the percentage of attendance to exercise classes over the last 11 months program
Data Analysis

- Data were analyzed using *Mplus 6.0* with a robust maximum likelihood estimator
- Goodness of fit tests:
  - Chi-square statistic, \( p > .05 \)
  - Root Mean Square Error of the Approximation (RMSEA), < .06
  - Comparative Fit Index (CFI), > .95
  - Standardized Root Mean Square Residual (SRMR), < .08
Measurement Model

\[ \chi^2 = 34.61 \text{ (25)}, \ p = .10, \ CFI = .99, \ RMSEA = .05 \ (90\% \ CI = .00 \text{ to } .08), \ SRMR = .06 \]
$\chi^2 = 141.40$ (103), $p = .01$, CFI = .96, RMSEA = .05 (90% CI = .03 to .06), SRMR=.06
Discussion

• Direct and indirect effects of executive function, use of self-regulatory strategies, and self-efficacy in predicting adherence to an exercise intervention

• Higher levels of *some types* of executive function and greater use of self-regulatory strategies were associated with higher levels of exercise self-efficacy at three weeks into the trial

• Higher efficacy was associated with better adherence to weekly exercise classes for the subsequent 11 months
Discussion

• Use of self-regulatory strategies appears to enhance perceptions of capabilities relative to engaging in physical activity over time which leads to better program adherence

• Being able to effectively multi-task and inhibit habitual responses (i.e., better executive control) associated with higher efficacy and, in turn, adherence
Conclusion

• Relatively and one of several alternative models

• First study to examine the relationships between executive function and adherence to an exercise intervention

• Our findings may have implications for identifying “at-risk” participants – improve coping responses to balance life tasks and poor health habits
Thank you!