GROUP PIANO TRAINING ON EXECUTIVE FUNCTIONS AND PSYCHOSOCIAL OUTCOMES IN OLDER ADULTS

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OUTLINE

- Successful Aging and EF
- Music Training and EF
- Fine Motor Control
- RCT Methodology
- Results
SUCCESSFUL AGING

• A multidimensional term inclusive of preservation of physical and cognitive function and continued participation in social activities (Rowe & Kahn, 1997; Jeste, Depp, & Vahia, 2010).

• Cognitive impairment is projected to increase from 35 million to 115 million (AD International, 2010).
EXECUTIVE FUNCTIONS

Regulatory processes responsible for cognitive control (inhibition), updating, reasoning, working memory, verbal fluency, verbal memory, decision-making, planning, and processing speed.

Deficits in VF impair life functioning and serve as a first symptom of cognitive decline (i.e., MCI and AD) (Nutter-Upham et al., 2008)
Music training is associated with enhanced EF in older adults (Mansens, Deeg, & Comijs, 2017; Hannah-Pladdy & McKay, 2011).

Instrumental music engagement could be a protective factor for cognitive impairment in aging adults (Balbag, Pederson, & Gatz, 2014).
MUSIC TRAINING IN OA

*The Creativity and Aging Study*: The Impact of Professionally Conducted Cultural Programs on Older Adults (Cohen, 2006).

Drumming program strengthens immune system and increases exercise levels (Bittman et al., 2001).

Individualized piano instruction enhances EF and WM performance in adults (60-85) (Bugos et al., 2007; Bugos, 2010).

Individual piano training can enhance cognitive control (Seinfeld et al., 2013).
COGNITIVE TRAINING INTERVENTION

- Novelty (Chan et al., 2014)
- Bimanual Coordination (Bernard & Seidler, 2014)
- Progressive Difficulty (Lovden et al., 2010)
- Practice Components (Park et al., 2007)
- Social Components
- Leisure Activity (Ecological Validity)
PURPOSE

The purpose of this research is to experimentally evaluate the impact of piano training on executive functions and psychosocial factors in older adults (60-80).
METHODS

Clustered Randomized Control Trial (RCT) stratified by age, gender, and estimate of IQ to three groups: PT, CBT, or waitlist control.
METHODS

Criteria for Research Participation

- Adults (60-80)
- Screened for cognitive impairment (TICS, Brandt & Folstein, 1988)
- No manual motor difficulties
- No history of neurological impairment
- Fluent English speakers
- No learning, speech or language difficulties
- Typical hearing as scaled by age (audiometer)
- Less than 3 years of formal music training
- Not currently reading or performing music
Allocation

Enrollment

Recruitment

Assessed for eligibility (n=334)

Randomized into three groups (n=159)

Piano Training (n=54)
Attrition (n=18)
Reasons: illness, childcare, transportation

Brain Training: (n=53)
Attrition (n=17)
Reasons: illness, passive refusal, transportation

Wait-list Control (n=52)
Attrition (n=15)
Reasons: passive refusal, illness, transportation, medical condition

Excluded (n=175)
Did not meet criteria (n=166)
Declined to participate (n=9)

109 Completed Pre/Post-Testing, Follow-up Testing in August 2017
DESCRIPTION OF MEASURES

**Preliminary Measures**

Advanced Measures of Music Audiation (AMMA; Gordon, 1989)

Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999)

**Cognitive Measures**

D-KEFS Verbal Fluency (Delis, Kaplan, & Kramer, 2001)

Trail Making Test (Reitan & Wolfson, 1992)

RAVLT (Rey, 1941)

PASAT (Gronwall, 1977)

Cued Color Word Stroop and N-Back (Perlstein et al., 2003)

**Psychosocial Measures**

GSE (Scherer et al., 1982)

MPSE (Zelenak, 2011)

Siga/salivary cortisol
DESCRIPTION OF TRAINING PROGRAMS

Piano Training
- Finger Dexterity & Technical Exercises
- Music Theory
- Standard Piano Repertoire

Computer Brain Training
- Six levels of auditory cognitive exercises (auditory processing to auditory memory).
- The stimuli (i.e., tones, speech sounds, words, sentences) become less discriminable as speed of presentation increases.
## RESULTS

<table>
<thead>
<tr>
<th></th>
<th>Piano Training (N=36)</th>
<th>Computer Brain Training (N=36)</th>
<th>Controls (N=37)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>67.38 (4.28)</td>
<td>69.47 (5.33)</td>
<td>68.03 (6.47)</td>
</tr>
<tr>
<td>Gender (M/F)</td>
<td>14/22</td>
<td>12/24</td>
<td>10/27</td>
</tr>
<tr>
<td>Education (in Years)</td>
<td>15.96 (3.05)</td>
<td>16.11 (3.00)</td>
<td>15.85 (2.46)</td>
</tr>
<tr>
<td>FSIQ (WASI)</td>
<td>113.84 (14.74)</td>
<td>111.50 (13.21)</td>
<td>114.57 (12.19)</td>
</tr>
<tr>
<td>MOCA</td>
<td>26.05 (2.59)</td>
<td>25.56 (3.12)</td>
<td>26.32 (2.25)</td>
</tr>
<tr>
<td>AMMA Tonal Aptitude</td>
<td>24.43 (4.02)</td>
<td>23.28 (4.09)</td>
<td>23.78 (4.32)</td>
</tr>
<tr>
<td>AMMA Rhythm Aptitude</td>
<td>26.46 (3.78)</td>
<td>26.28 (4.39)</td>
<td>25.89 (4.14)</td>
</tr>
</tbody>
</table>
Results of a RPM ANOVA show significant increases in music reading performance post-training for the piano group, $F(2, 107)=31.31$, $p=.001$, $d=1.59$. 
RESULTS: CATEGORY SWITCHING

Results of a Group X Time X Measure ANOVA show significant increases in performance post-training for the piano group compared to computer brain training or controls, $F(2, 107)=4.58, p=.01, d=.31$. 

Mean Score

- Piano Training
  - Pre-Training
  - Post-Training

- Computer Brain Training
  - Pre-Training
  - Post-Training

- No Treatment
  - Pre-Training
  - Post-Training
RESULTS: LETTER FLUENCY

Results show significant increases in performance post-training for the piano group compared to computer brain training or controls, $F(2, 107)=3.13$, $p=.04$, $d=.46$. 
RESULTS: CATEGORY FLUENCY

Results of a Group X Time X Measure ANOVA show no group by time interaction, $F(2, 107) = .49, p = .62$. 

Piano Training       | Computer Brain Training       | No Treatment
---                  | ---                           | ---
Pre-Training        | Pre-Training                  | Pre-Training
Post-Training       | Post-Training                 | Post-Training
RESULTS: MUSIC SELF-EFFICACY (MPSE)

Results show increased musical self-efficacy for the piano training group compared to CBT and controls, $F(2, 107)=48.33, p=.001, d=.49$. 
RESULTS: GENERAL SELF-EFFICACY

Results show no group by time interaction in general self-efficacy, $F(2, 106)=.29, p=.74$. 

![Box plot showing comparisons between Piano Training, Computer Brain Training, and No Treatment groups at pre- and post-testing.](image)
DISCUSSION

Piano instruction may contribute to cognitive performance in verbal fluency and task switching in older adults.

Results remain prominent even in the presence of a very active control such as computer brain training.
ACKNOWLEDGEMENTS

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