Combined cognitive-physical interventions using exergames to prevent further cognitive decline in dementia

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CONFLICT OF INTEREST DISCLOSURE

I have no potential conflict of interest to report
Welcome to WhatsApp!

Platform mobile messaging with friends all over the world

Terms and conditions

1 Stern (2012), ² Ott (1995)
Dementia drug ‘disappointment’: Trial of Alzheimer’s drug STOPPED

Drug failure deals blow to dementia sufferers

There are 850,000 patients in Britain with dementia. Scientists believe that the search for a dementia cure will be far harder than had been thought.
Content of this presentation

1. Physical activity (PA) as a non-pharmacological intervention
2. Combining cognitive-physical training
3. Exergames
4. Our research design
5. Use of exergames for patients with dementia
Physical activity

- Positive effects on cognitive function in healthy elderly \(^3\)
- Brainstructure \(^4,5\)
  - hippocampal size
  - White matter integrity
- Neurogenesis, angiogenesis \(^6\)
- IGF-1, BDNF, VEGF \(^7\)

- Prevent cognitive decline in dementia?

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\(^3\) Angevaren et al. (2008), \(^4\) Colcombe et al. (2006), \(^5\) Erickson et al. (2011), \(^6\) Nokia et al. (2016), \(^7\) Lista et al. (2010)
Modifiable risk factors for dementia

<table>
<thead>
<tr>
<th>Modifiable Risk Factor</th>
<th>Relative risk for dementia (95% CI)</th>
<th>Prevalence</th>
<th>Communality</th>
<th>PAF</th>
<th>Weighted PAF*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early life (age &lt;18 years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less education (none or primary school only)</td>
<td>1.6 (1.26–2.01)</td>
<td>40.0%</td>
<td>64.6%</td>
<td>19.1%</td>
<td>7.5%</td>
</tr>
<tr>
<td>Midlife (age 45–65 years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>1.6 (1.16–2.24)</td>
<td>8.9%</td>
<td>57.3%</td>
<td>5.1%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Obesity</td>
<td>1.6 (1.34–1.92)</td>
<td>3.4%</td>
<td>60.4%</td>
<td>2.0%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Hearing loss</td>
<td>1.9 (1.38–2.73)</td>
<td>31.7%</td>
<td>46.1%</td>
<td>23.0%</td>
<td>9.1%</td>
</tr>
<tr>
<td>Later life (age &gt;65 years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td>1.6 (1.15–2.20)</td>
<td>27.4%</td>
<td>51.1%</td>
<td>13.9%</td>
<td>5.5%</td>
</tr>
<tr>
<td>Depression</td>
<td>1.9 (1.55–2.33)</td>
<td>13.2%</td>
<td>58.6%</td>
<td>10.1%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Physical inactivity</td>
<td>1.4 (1.16–1.67)</td>
<td>17.7%</td>
<td>26.6%</td>
<td>6.5%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Social isolation</td>
<td>1.6 (1.32–1.85)</td>
<td>11.0%</td>
<td>45.9%</td>
<td>5.9%</td>
<td>2.3%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1.5 (1.33–1.79)</td>
<td>6.4%</td>
<td>70.3%</td>
<td>3.2%</td>
<td>1.2%</td>
</tr>
</tbody>
</table>

Data are relative risk (95% CI) or %. Total weighted PAF adjusted for communality=35.0%. PAF=population attributable fraction. *Weighted PAF is the relative contribution of each risk factor to the overall PAF when adjusted for communality.

8 Livingston et al. (2017)
Recommendations\textsuperscript{9}

Physical inactivity (<3 MET)

Sedentary behaviour (<1.5 MET)

WHO (2010), Ekelund et al. (2016)
Combined cognitive-physical interventions

• Additive effects ¹¹

• Prime hippocampus ¹²

Cell proliferation

Cell survival ¹²

• Improves cognition in healthy older adults ¹³

¹¹ Shatil et al. (2013), ¹² Olson et al. (2006), ¹³ Zhu et al. (2016)
What is the overall effect of combined cognitive and physical exercise interventions on global cognitive function in older adults with MCI or dementia?

14 Karssemeijer et al. (2017)
Studies

- 10 RCT’s
  - 5 in dementia patients
  - 3 in MCI
  - 2 in patients with MCI or dementia

Outcome measures

- Global cognitive function (10 studies)
- Executive function and attention (3 studies)
- Memory (3 studies)
- Activities of Daily Living (ADL) (4 studies)
- Mood (4 studies)

1687 records screening

1597 excluded based on title/abstract

90 full text screening

80 excluded

10 studies included
Effect on global cognition

<table>
<thead>
<tr>
<th>Study name</th>
<th>Subgroup within study</th>
<th>Outcome</th>
<th>Stdev diff in means</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burgener</td>
<td>Dementia</td>
<td>MMSE</td>
<td>0.505</td>
<td>43</td>
</tr>
<tr>
<td>Fiatarone</td>
<td>MCI</td>
<td>ADAS-Cog</td>
<td>0.287</td>
<td>54</td>
</tr>
<tr>
<td>Graessl</td>
<td>Dementia</td>
<td>ADAS-Cog</td>
<td>0.514</td>
<td>96</td>
</tr>
<tr>
<td>Holhoff</td>
<td>AD</td>
<td>MMSE</td>
<td>0.340</td>
<td>30</td>
</tr>
<tr>
<td>Ji Won Han</td>
<td>MCI or dementia</td>
<td>Combined</td>
<td>0.126</td>
<td>120</td>
</tr>
<tr>
<td>Olazaran</td>
<td>MCI or AD</td>
<td>Combined</td>
<td>0.223</td>
<td>84</td>
</tr>
<tr>
<td>Santos</td>
<td>AD</td>
<td>MMSE</td>
<td>0.417</td>
<td>62</td>
</tr>
<tr>
<td>Suzuki</td>
<td>MCI</td>
<td>Combined</td>
<td>0.344</td>
<td>100</td>
</tr>
<tr>
<td>Consortium</td>
<td>MCI</td>
<td>ADAS-Cog</td>
<td>0.487</td>
<td>113</td>
</tr>
<tr>
<td>Venturelli</td>
<td>AD</td>
<td>MMSE</td>
<td>-0.171</td>
<td>40</td>
</tr>
</tbody>
</table>

**Effect on activities of daily living**

14 Karssemeijer et al. (2017)
Exergames

Opportunities for combining actions
Exergames

• Interactive video games

• Produce physical body movements

• To complete set tasks or actions

• Evidence that they can improve global cognition

• Effect in dementia?

15 Oh en Yang (2010), 16 Stanmore et al. (2017)
Our research question

What is the efficacy of **exergaming** on **cognitive function** in older adults with mild dementia compared to:

- **single-aerobic training**
- **active control group**

17 Karssemeijer et al. (2017)
Participants

- Mild dementia patients
- Age ≥ 60 years
- Being physical inactive

Measurements

- Cognitive function
  - executive function
  - episodic memory
  - working memory
  - psychomotor speed
- Physical function
- Activities of daily living (ADL)
- Mood
- Frailty
# Feasibility

<table>
<thead>
<tr>
<th></th>
<th>Exergaming (N=27)</th>
<th>Single (N=28)</th>
<th>Active control (N=28)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M Age (years) (SD)</strong></td>
<td>78.4 (7.0)</td>
<td>80.7 (6.4)</td>
<td>79.5 (4.3)</td>
</tr>
<tr>
<td><strong>M MMSE (SD)</strong></td>
<td>22.7 (3.5)</td>
<td>22.6 (3.4)</td>
<td>22.3 (2.9)</td>
</tr>
<tr>
<td><strong>N Drop-out (%)</strong></td>
<td>1 (4%)</td>
<td>4 (14%)</td>
<td>4 (14%)</td>
</tr>
<tr>
<td><strong>N Adherence-rate (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>low (&lt; 50%)</td>
<td>1 (3.7%)</td>
<td>3 (10.7%)</td>
<td>4 (14.3%)</td>
</tr>
<tr>
<td>moderate (50-70%)</td>
<td>2 (7.4%)</td>
<td>6 (21.4%)</td>
<td>1 (3.6%)</td>
</tr>
<tr>
<td>high (&gt; 70%)</td>
<td>24 (89%)</td>
<td>19 (68%)</td>
<td>23 (82.1%)</td>
</tr>
<tr>
<td><strong>M Rating (1-10) (SD)</strong></td>
<td>7.7 (1.0)</td>
<td>8.4 (0.9)</td>
<td>8.3 (0.8)</td>
</tr>
<tr>
<td><strong>M Duration (SD)</strong></td>
<td>31 (7.3)</td>
<td>31 (7.3)</td>
<td>30</td>
</tr>
</tbody>
</table>
"Exercise gives me a pleasant feeling."

"Sometimes I did not feel like exercising, but afterwards I was glad I did it."

"Next training I would like to cycle through my home town."

"Going to the training was a nice outing for my loved one, and gave me some time for myself."

"My loved one got more active and social."

"My loved one got more fit and cheerful due to training."
To Be Continued
Use of exergames for dementia

1. Personalized

2. Accompanied by a trained (family) caregiver

3. Use of exergames at home and in clinical settings
   a. feasibility studies are needed

\textsuperscript{18} Manera et al. (2017)
Thank you for your attention
QUESTIONS?

Health Help Desk