E-bikes and their benefit for older adults
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Age and cognitive function

- Age, also in the absence of pathological conditions, is associated with **cognitive decline** (e.g., Sandberg, 2014; Park, 2000; Salthouse, Atkinson, & Berish, 2003; Salthouse, 2004)

- Executive functions start to decline from the age of 20 onwards
Fig. 1. Effect sizes for the different process-task types reflecting the four theoretical hypotheses concerning the process-based specificity of the benefits of fitness training. Parenthetical notations on the x-axis indicate the number of effect sizes contributing to the point estimates for each task type in the exercise (E) and nonexercise (C) groups. Error bars show standard errors.

Cycling, ageing, cognition and well-being

• Cycling accounts for only 1% of all journeys amongst people aged 65 and older in the UK
  • 23% in the Netherlands
  • 15% in Denmark
  • 9% in Germany

• Benefits of activity in outdoor environments on well-being of older adults (see e.g. Sugiyama & Thompson, 2007)

• Older adults who are physically active report higher levels of well-being and physical function (Spirduso & Cronin, 2001)

• Aerobic exercise has been shown in laboratory conditions to improve cognitive function in older adults, particularly executive function (e.g., Erickson, 2011, Colcombe & Kramer, 2003)

• Benefits of cycling for regeneration in the brain (Erickson et al., 2011; Thomas et al., 2015)
Wellbeing and cognition trial

- Investigate the impact of cycling for an **8-week** period on older adults’ cognition and well-being
- Participants, over 50, cycle for an 8 week period
  - At least **1 ½ hours/week**
    - 37 Pedal bike participants
    - 40 E-bike participants
      - Levels of assistance
- Complete a diary of rides
  - Duration and physical intensity of ride
  - Other physical activity undertaken
- Cognition and wellbeing are measured before the trial (pre-intervention) and after (post-intervention) – Change score
# Participant demographics

<table>
<thead>
<tr>
<th>Group</th>
<th>Age</th>
<th>Gender</th>
<th>MMSE</th>
<th>PWB</th>
<th>PANAS</th>
<th>PASE</th>
<th>SF36 Mental health</th>
<th>SF36 Physical health</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-bike</td>
<td>62 (7.6)</td>
<td>20 Females</td>
<td>26.88 (1.26)</td>
<td>4.71 (.52)</td>
<td>33.86 (5.01)</td>
<td>45.36 (31.46)</td>
<td>76.92 (15.5)</td>
<td>78.08 (17.73)</td>
</tr>
<tr>
<td>N=40</td>
<td>Range 50-83</td>
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<tr>
<td>Pedal</td>
<td>63 (7.6)</td>
<td>18 Females</td>
<td>26.86 (1.90)</td>
<td>4.81 (.48)</td>
<td>35.94 (5.13)</td>
<td>50.54 (33.66)</td>
<td>80.49 (12.1)</td>
<td>81.25 (12.74)</td>
</tr>
<tr>
<td>N=37</td>
<td>Range 51-83</td>
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</table>
Cycling during the intervention

Average weekly cycling duration

Average weekly cycling duration and intensity
E-bike participants: Assistance level

[Bar chart showing the mean proportion of time spent using each level of assistance (OFF, ECO, TOUR, SPORT, TURBO), with error bars indicating variability.]
Age and cycling duration

- Older participants cycled for longer on the e-bike than younger older adults.
- Even when removing outlier.
- Not correlated with level of assistance.
Cycling as a way to engage older adults in exercise

- Physical activity levels (measured by the PASE) correlate with age
  - The younger the participant, the more physical activities they conducted before taking part in the trial and during
- However, this measure did not correlate with duration
  - Suggesting that those more physically active do not necessarily cycle more during the trial
- Cycling appears to be a way to engage older adults in physical exercise
  - EVEN for those less physically activate prior to the trial
Cognitive tasks - Letter updating task

H HJ HJW JW B WBC

![Graph showing average letter updating change score for E-bike and Pedal.]
Cognitive function – Eriksen flanker task

Average change in Eriksen Flanker task for incongruent stimuli.
Verbal fluency – Letter and category
Wellbeing – Positive affect

![Bar chart showing change in positive affect after intervention for E-bike and Pedal groups.](chart.png)
Physical activity and cognitive change

• The level of physical activity before starting the trial did not correlate with any of the measures of change in cognition/well-being.

• This suggests that those with a higher level of physical fitness before starting the trial did not benefit more or less than those who were less physically active.

• Prior fitness unlikely to predict whether someone will benefit from cycling.
Conclusions

• Older adults re-engaging with cycling cycled for long periods each week during the trial
• Those less physically active before the trial did not cycle less than more physically active participants
• Cycling using an e-bike appears to have as much impact on cognitive function and well-being as regular cycling
  • Despite a lower level of physical exertion being required
• E-bikes have the potential to aid older adults re-engaging with cycling and cycling seems to be a clear way to get exercise into older adults lifestyles
  • even for those less physically active before the intervention
• Urban planning should support older adult cycling
Thanks!

Oxford Brookes

CycleBOOM team

Reading

Emma Street – Urban design guide

Bristol

Kiron Chatterjee – Interviews

Cardiff

Justin Spinney – Mobile rides

Tim Jones - PI

Nick Beale – Project Manager

Benedict Spencer – Mobile rides and interviews

Carien van Reekum – Cognition trials

Heather Jones – Interviews

Carl Mann – Mobile rides

http://www.cycleboom.org/