Timecourse of cognitive and brain adaptations following cognitive training in older adults at-risk for dementia

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CCT – repetitive practice on domain-specific tasks.

More focus needed around understanding the underlying mechanisms and dose-response or timecourse of training.
Aims

1. To determine the minimum duration of Brain Training required to produce cognitive benefits;

2. To characterise the rate by which any positive functional effects may wane after the cessation of Brain Training;

3. To explore in a preliminary study the time course of different neurobiological adaptations as revealed by MRI
Study Design

Baseline: 0 weeks
FU1: +3 weeks
9 sessions

Cognitive Tests
+ MRI

36 sessions

FU2: +3 months
FU3: -3 weeks
No Sessions

Cognitive Tests
+ MRI

FU4: -3 months
Cognitive Tests

FU5: -12 months
Cognitive Tests

Training On

Training Off
Participants

- Recruited through newspaper ads
- Screened via medical history, MMSE and GDS.
- Cognitively intact individuals (> 65 years of age)
- N = 80 (n=15 for imaging sub-sample)
Participants
Participant Flow

180 assessed for eligibility (n = 180)

80 randomised

Cognitive Training

39 received allocated intervention

38 followed up after 9 sessions

31 followed up after 36 sessions

31 followed up 3 weeks post training

30 followed up 3 months post training

26 followed up 12 months post training

39 included in intention to treat analysis

Active Control

38 received allocated intervention

38 followed up after 9 sessions

34 followed up after 36 sessions

34 followed up 3 weeks post training

34 followed up 3 months post training

29 followed up 12 months post training

Analysis

38 included in intention to treat analysis
Intervention

› Group Setting, 3x1h sessions/week for 12 weeks.

› Brain Training (BT) group: “COGPACK” – multi-domain

› Active Control (AC) group: National Geographic videos and multiple-choice questions
Outcome Measures

› Primary Measures
- MindStreams: Memory; Information Processing Speed; Attention
- Stockings of Cambridge (SOC): Planning and Spatial Reasoning

› Secondary Measures
- COWAT, BNT, Matrices, RMT (recognition memory test) Faces, RMT Words
- BADL
- Grey Matter Volume, Cortical Thickness and Functional Connectivity
Cognitive Results

The graph shows the net effect size (d_{CCT} - d_{AC}) over time for different cognitive domains: Global Cognition, Memory, Processing Speed, and Executive Function. The x-axis represents time points: Baseline, 9 sessions (FU1), 36 sessions (FU2), -3 weeks (FU3), -3 months (FU4), and -12 months (FU5). The y-axis represents the net effect size range from 0.0 to 0.5.

The graph indicates that training results in an increase in cognitive function, with peaks at certain time points, and a decline when training is stopped.
Cognitive Results

- **Loading Phase**
- **Peak-finding Phase**
- **Decay Phase**

- **Therapeutic Effect (Cohen's net d)**
- **Sessions/Time**

- **Rapid gains**
- **Slow decay of residual gains**
- **Diminishing returns with further training**
- **Rapid decay of gains immediately after training cessation**
- **Some gains may be durable over the long term**

- **Training On**
- **Training Off**
Imaging Results
Summary

- Brain training → functional changes → structural changes → cognitive changes

Future Direction

- Trialling different schedules of booster sessions
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