Cogmed Research Summary Adults

COGMED
Working Memory Training

Title: Training of working memory in children with ADHD

PI: Torkel Klingberg, M.D., Ph.D.

Published: Journal of Clinical & Experimental Neuropsychology, November 2002

Summary: This was the first published research on working memory training and included separate small sample studies of children with ADHD and healthy adults. A randomized-controlled design was used. Results indicated improvements on non-trained tasks of working memory as well as on several other neuropsychological tests. The study is important in that it is the first indication that working memory capacity can be increased with training. Limitations include the small sample size, the lack of behavioral measures, and no longer-term follow-up.

Reference: Klingberg T, Forssberg H, Westerberg H (2002) Training of working memory in children with ADHD. J Clin Exp Neuropsych 24:781-791.

Title: Increased prefrontal and parietal brain activity after training of working memory

PI: Pernille Olesen, Ph.D.

Institution: Karolinska Institute

Published: Nature Neuroscience, January 2004

Summary: This was the first study to examine brain changes following working memory training. Separate small sample studies of 3 and 8 healthy adults were reported. Using FMRI scans, the researchers documented that behavioral changes following working memory training are associated with changes in brain activity in areas critical for working memory performance. Although the small samples highlight the need for replication, the findings are important in that they provide the first demonstration of changes in brain activity following working memory training.

Reference: Olesen P, Westerberg H, Klingberg T (2004) Increased prefrontal and parietal brain activity after training of working memory. Nature Neuroscience 7:75-79.

Title: Computerized working memory training after stroke – A pilot study

PI: Helena Westerberg, Ph.D.

Institution: Karolinska Institute

Published: Brain Injury, June 2007

Summary: This study examined the impact of working memory training in 18 adult stroke victims who were randomly assigned to working memory training or a no treatment control condition. Training was found to yield significant improvement on non-trained measures of working memory and on attention. Furthermore, participants reported significant improvement in their daily functioning. The study is important because it suggests a potential role of working memory training in the rehabilitation of stroke victims.

Reference: Westerberg H, Jacobaeus H, Hirvikoski T, Clevberger P, Östensson M L, Bartfai A, Klingberg T (2007) Computerized working memory training after stroke – A pilot study. Brain Injury, 2007; 21(1): 21–29.

Title: Changes in cortical activity after training of working memory – a single-subject analysis

PI: Helena Westerberg, Ph.D.

Institution: Karolinska Institute

Published: Physiology and Behavior, May 2007

Summary: This was a second study examining changes in brain activity after working memory training. Participants were 3 young healthy adults who completed the standard 5-week training program. Brain activity was measured using fMRI before and after training when subjects performed a working memory task and a comparison task that did not require working memory. Subjects showed increased working memory capacity following training - related brain activity was significantly increased in the middle and inferior frontal gyrus. Although this was a small sample study – not uncommon in fMRI research – it is important because it is the second demonstration of changes in brain activity following working memory training.

Reference: Westerberg H, Klingberg T (2007) Changes in cortical activity after training of working memory--a single-subject analysis. Physiology & Behavior, 10;92(1-2):186-92.

Title: Changes in cortical dopamine D1 receptor binding associated with cognitive training

PI: Fiona McNab, Ph.D.

Institution: Karolinska Institute

Published: Science, February 2009

Summary: This study examined brain changes at the receptor cell level following working memory training. Results indicated that training of working memory, which improves working memory capacity, is associated with changes in the density of cortical dopamine D1 receptors. This study is important as it builds on prior research showing brain changes following working memory training and is the first known demonstration that cognitive training alters fundamental aspects of brain biochemistry.

Reference: McNab F, Varrone A, Farde V, Jucaite A, Bystritsky P, Forssberg H, Klingberg T (2009) Changes in Cortical Dopamine D1 Receptor Binding Associated with Cognitive Training.Science, 323, 800.

Title: Computerized training of working memory in a group of patients suffering from acquired brain injury

PI: Anna Lundqvist, Ph.D.

Institution: Linköping University

Published: Brain Injury, September 2010

Summary: This study examined the efficacy of Cogmed training on 21 subjects (mean age 43.2 years) with a working memory deficit caused by an acquired brain injury or stroke. The study showed that there was significant improvement in working memory in both the trained working memory tasks and in nontrained neuropsychological assessments. Rating scales also showed better performance at work with noticeable improvement in pre-defined occupational problems. The researchers concluded that Cogmed training is an effective intervention to improve working memory capacity in people with an acquired brain injury or stroke - most likely leading to improved performance at work and other daily activities.

Reference: Lundqvist A, Grundström K, Samuelsson K, Rönnberg J (2010) Computerized training of working memory in a group of patients suffering from acquired brain injury. Brain Injury, September 2010.