

# Executive functioning in adult ADHD

From basic mechanisms to functional outcome

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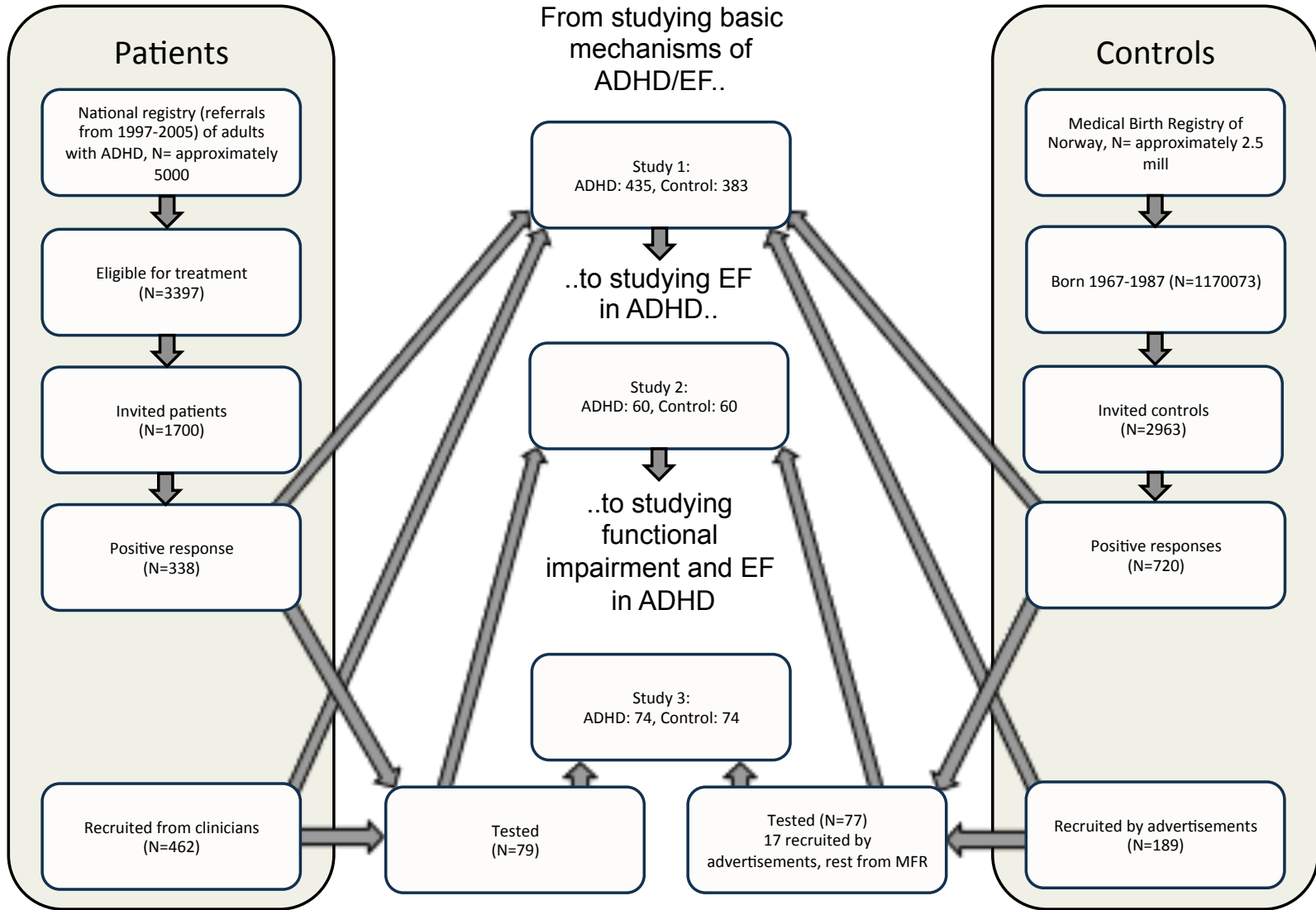
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## Set-Shifting in Adults with ADHD

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### Abstract

Difficulties related to inhibition and set-shifting have been suggested as possible endophenotypes of Attention Deficit Hyperactivity Disorder (ADHD). However, such difficulties have not been consistently found in studies using standard neuropsychological tests. This has been partly explained by the complexity of these tests and the need to include contrast measures which control for more basic functions. The purpose of the present study was to examine whether difficulties related to inhibition and set-shifting in adult ADHD patients could be revealed by the Color Word Interference Test (CWIT) from the Delis Kaplan Executive Function System (D-KEFS). A clinically recruited group of adults with ADHD ( $n = 60$ ) obtained significantly lower scores than population derived controls ( $n = 60$ ) on both primary summary ( $p < .001$ ) and contrast measures ( $p = .004$ ) of set-shifting. The differences between the groups remained statistically significant after controlling for intellectual function and working memory ( $p = .003$ ). However, no significant differences between the groups were observed on any measure of inhibition. The study indicates that adults with ADHD have specific difficulties with set-shifting as measured by the CWIT, difficulties that probably also reflect problems related to executive function in their daily life. (*JINS*, 2012, *18*, 728–737)

**Keywords:** Executive functioning, D-KEFS, Contrast scores, Attention deficit hyperactivity disorder, Pure measures, Stroop test

# How to obtain "pure" measures?

- Delis-Kaplan Executive Function System (D-KEFS)
  - Delis, Kaplan & Kramer, 2000

# Set shifting in ADHD

“The ability to move back and forth between multiple tasks, operations and mental sets”

(Monsell,1996)

# Color Word Interference Test (Color naming)



# Color Word Interference Test (color reading)

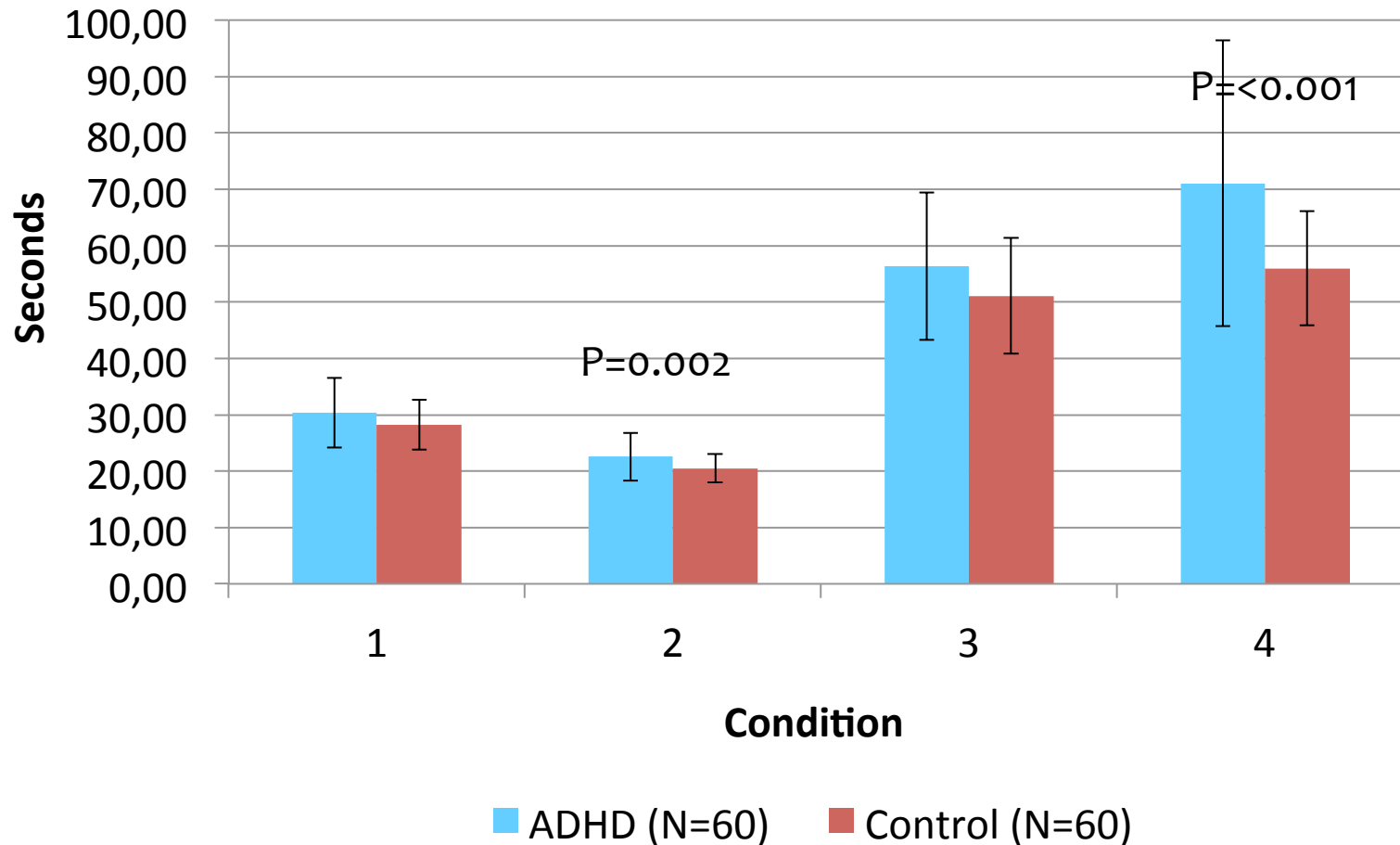
# Color Word Interference Test (Inhibition)

# Color Word Interference Test (Inhibition/set shifting)

# Measures

- Summary measures (seconds used on each subtest)
- Contrast measures (basic functions subtracted from executive functions, standard scores)
- Residuals (obtained by hierarchical and standard regression analyses based on raw scores)
- Covariates: Age, IQ (WASI), reading/writing difficulties and working memory (PASAT)

# Results



Set shifting also significant after control for age, reading and writing difficulties, IQ and working memory, with use of contrast scores and with use of residuals

# Summary

- The ADHD-group may have problems with set shifting that can not be explained by basic functioning, working memory, reading/writing difficulties or IQ

## Occupational Status Is Compromised in Adults With ADHD and Psychometrically Defined Executive Function Deficits.

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### ⊕ Author information

#### Abstract

**OBJECTIVE:** Problems related to executive function (EF) are frequently reported in adults with ADHD. However, only a subgroup of patients show deficits on common neuropsychological tests designed to measure EF. We investigated whether this subgroup also had higher levels of functional impairments, including unemployment, than the ADHD group without such deficits.

**METHOD:** We defined executive function deficit (EFD) from selected tests from the Delis-Kaplan Executive Function System (D-KEFS) and assessed ADHD symptoms and psychiatric comorbidity with the use of questionnaires in 79 ADHD patients and 77 controls (IQ above 80 in both groups).

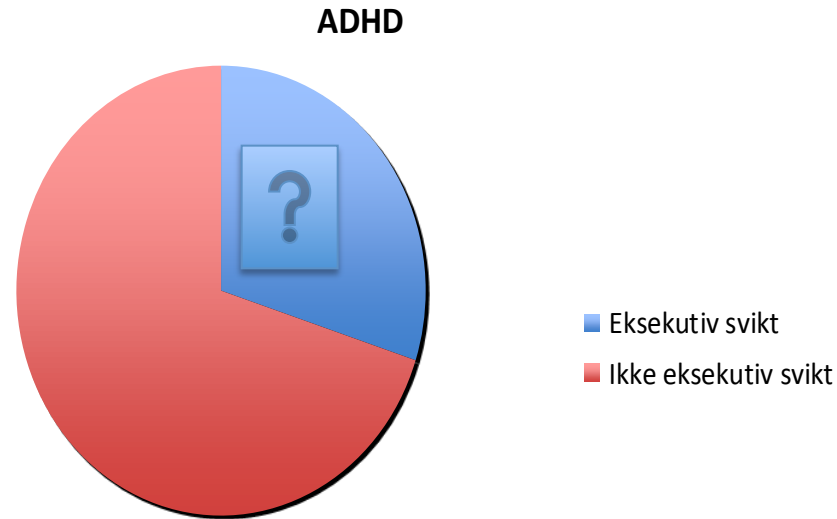
**RESULTS:** In the ADHD group, 24.3% had EFD. This subgroup showed significantly higher frequency of unemployment, more reading and writing problems, lower IQ scores, and more self-reported ADHD symptoms in childhood than the ADHD subgroup without EFD.

**CONCLUSION:** These findings indicate that it may be possible to identify individuals at risk of functional impairments, and emphasizes the importance of effective treatment programs targeting EF.

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**KEYWORDS:** ADHD; D-KEFS; executive function; executive function deficit; occupational status

# How to measure executive functioning in ADHD?



- How to define executive function deficit (EFD)?
  - Doyle et al. (2000), Biederman et al. (2004, 2006)



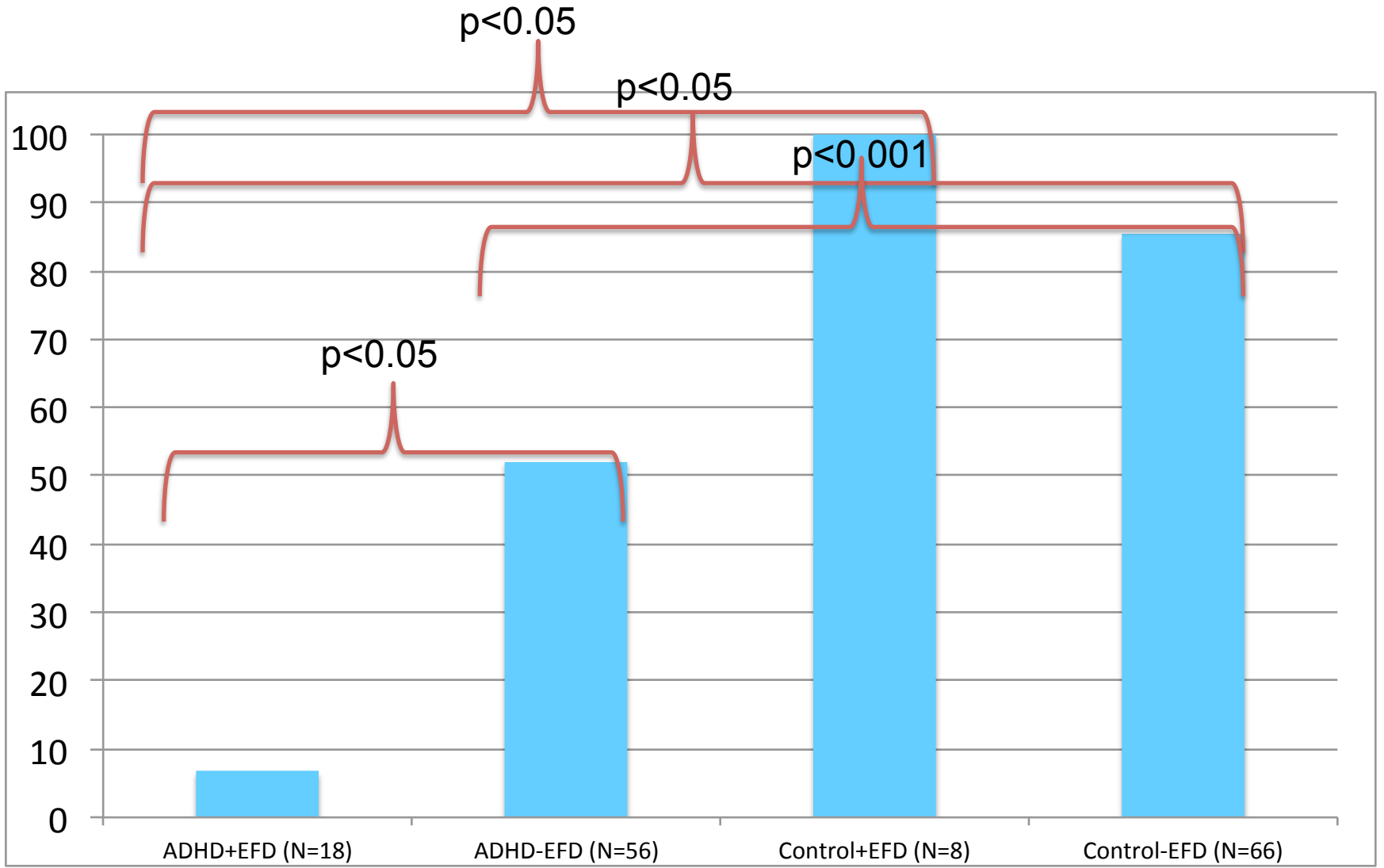
# What characterizes the ADHD group with EFD?

- IQ
- Education
- Reading and writing difficulties
- Work-status
- ADHD symptoms
- Psychiatric comorbidity

## Subtests from D-KEFS

- Trail Making Test, number-letter switching
- Word Fluency Test, letter fluency and switching
- Color-Word Interference Test, inhibition, inhibition/  
set-shifting
- Tower Test, total achievement score

# In work (%)



# Results

- ADHD with EFD
  - Fewer in work
  - Lower IQ
  - Higher scores on the WURS (symptoms in childhood)
  - None diagnosed in childhood
  - More reading and writing difficulties
  - No differences in ASRS-scores or psychiatric comorbidity

# Summary

- The group with ADHD and EFD combined may be a group at higher risk for functional difficulties than the group with ADHD alone

# Summary and recommendations for further studies

- ADHD comprises subgroups with different neuropsychological profiles
- Broad assessment of neuropsychological functioning
  - More targeted treatment
- Suggestions by Nigg:
  - Report results for individuals
  - Define neuropsychological subtypes

Individual focus

”Splitting” or ”lumping”?



# Personalized psychiatry

# Thank you for your attention!

And thanks to my supervisors: Astri Lundervold (main supervisor) and  
Jan Haavik (co-supervisor)