

# SYSTEMATIC REVIEW

OF EXECUTIVE FUNCTION ASSESSMENT TOOLS

IN CHILDREN AND ADOLESCENTS WITH AUTISM SPECTRUM DISORDER

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# AUTISM SPECTRUM DISORDER

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- Autism Spectrum Disorder is common, lifelong neurodevelopmental condition that involve substantial heterogeneity at numerous levels, including etiology, neurobiology, cognition, and especially behavior.
- Long-term follow-up studies show that the developmental outcomes of autistic individuals are highly variable, even for individuals at the more intellectually able end of the autism spectrum.

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- While some individuals go on to live independently and obtain qualifications, the majority fail to achieve independence, to attain full-time employment, or to enjoy friendships.
  - Explaining this variability is of critical import: to discover why developments take place in some areas and not in others, and especially in some individuals and not in others

# EXECUTIVE FUNCTION & ASD

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- EF has received extensive attention in the autism literature for many years largely due to the influential proposal that the inherent rigidity and invariance of autistic behaviors could be explained by a primary impairment in executive control.
- EF problems have been demonstrated consistently in school-age children, adolescents, and adults with autism, as well as relatives of individuals with autism albeit to a lesser degree

# EXECUTIVE FUNCTION & ASD

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## Why Focus on Autistic Children's Developing EF

- While there is general consensus that EF problems are unlikely play a primary causal role in autism, it remains possible that the degree of difficulties in EF could play a substantial role in autistic children's developmental outcomes—including their social competence
- their adaptive behavior (those skills necessary for individuals to live independently and to function well in real-life settings), and their success in school.
- Indeed, clinicians and those who care for individuals with autism often associate some individuals' inability to achieve independence with persistent difficulties in regulating behavior and adapting flexibly to change

# EXECUTIVE FUNCTION & ASD

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- Whether poor EF plays a fundamental role in the emergence of core autistic features or, instead, is a consequence of early atypical input from another cognitive system
- It is nevertheless likely to place the child with autism at risk for a poor developmental outcome either directly or indirectly

# DEFINITION OF EF

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- High level cognitive abilities that require for conduction of environment that constantly changing
- Frontal Lob, especially prefrontal cortex
- Neuroimaging studies: subcortical and thalamic pathways

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- Literature: impairment of EF in Autism

- Four main domains

Planning

Working Memory

Cognitive Flexibility

Response Inhibition



# PLANNING

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- A cognitive skill that include: decision making, judgment, and assessment of own and others behavior
- fMRI & PET studies: a consistent pattern of activation of brain in relevant tasks

# COGNITIVE FLEXIBILITY

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- Ability of thought or behavior shifting in response to environmental changes
- Neuroimaging studies: prefrontal, parietal and subcortical regions

# RESPONSE INHIBITION

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- Ability of suppression of impulses or information that are irrelevant or intrusive

# WORKING MEMORY

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- A system for temporarily storing and managing the information required to carry out complex cognitive tasks such as:
  - learning
  - reasoning
  - comprehension
  - .....
- Baddeley: three pathways:
  - orbito-spatial, phonological, central

# PERVIOUS REVIEWS

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- In 2018 a systematic review of correlation between dysfunction of EF and behavioral symptoms in children with high function autism:  
findings suggest that EF has an important role in development of ToM skills, relationship, social interaction and goal directed behaviors
- Another meta-analysis assess EF autism and clinical application of scales and effect of different variables (such as age, gender, diagnosis and scale characters) in neuropsychological scales of EF in in children with high function autism

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Report of Studies of Executive Function tools in  
Neuropsychologic Assessment of Children and  
Adolescents with ASD



# SEARCH STRATEGY

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- A comprehensive search of a scoping review of the topic area and consultation with an information specialist as well as experts in the fields of child mental health and education
- The search strategy will include both free-text searching and controlled vocabulary searching (e.g. MEDLINE Medical Subject Headings (MeSH) terms). Terms will be grouped according to these concepts:
  - autism, “pervasive developmental disorder”, PDD, ASD, autistic, Asperger
  - assessment, evaluation, test, measure, scale, inventory, checklist, instrument, reliability, validity
  - intervention, treatment, therapy, training, education, rehabilitation
  - Cognition (in general), emotion recognition/perception, face recognition/perception, theory of mind, executive function, attention, intelligence, memory, planning.

# INCLUDED ARTICLES

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108 studies included:

- Case-control studies: 97
- Longitudinal studies: 6
- Cross sectional studies: 4
- Case series studies: 1



# QUALITY ASSESSMENT

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Based on The Newcastle-Ottawa Scale (NOS) is an ongoing collaboration between the Universities of Newcastle, Australia and Ottawa, Canada

- Selection Bias
- Comparability bias
- Outcome bias

Results: 93 studies with acceptable quality

15 studies with low quality

# COGNITIVE FLEXIBILITY

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- 63 studies, 17 tools
  1. Wisconsin Card Sorting Test (WCST): 28 studies
  2. Intra-Dimensional/Extra-Dimensional (ID/ED): 8 studies
  3. Trail Making Test: 5 studies
  4. Dimensional Change Card Sort (DCCS): 4 studies
  5. Change task
  6. Switch Task
  7. Spatial Reversal Task

# COGNITIVE FLEXIBILITY

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8. Teddy-Bear Shifting Task

9. Woodcock-johnson Cognitive Battery II

10. Sorting Test

11. Battersea Multitask Paradigm

12. Multi-Step Multilocation Task

13. A Novel Task of Switching Paradigm

14. Flexible Item Selection Task

15. Brixton Spatial Anticipation Test

16. Zoo Map Test

17. Colour-Shape Task

# RESPONSE INHIBITION

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- 78 studies, 23 tools

1. Stroop Test: 16 studies

2. Go/No Go Test: 13 studies

3. Hayling Completion Test: 6 studies

4. Opposite Word Test: 5 studies

5. Luria Hand Game

6. Continuous Performance Test

7. Change Task

8. Walk, don't walk

9. Knock Tape

10. A-not-B

# RESPONSE INHIBITION

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11. Circle Drawing Task
12. Flanker Task
13. Pop Task
14. Cognitive Estimates Task
15. Mittenecker Pointing Task
16. Antisaccade Task
17. Less is More
18. Prepotent Response Inhibition Task
19. Card Task
20. Pseudo-Random Number Generating Task
21. Stop Signal Task
22. Color Word Interference Test
23. Proactive Interference Task

# PLANNING

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- 33 studies, 10 tools
  1. Tower of London: 11 studies
  2. Tower of Hanoi: 4 studies
  3. Stockings of Cambridge: 5 studies
  4. Mazes test
  5. Tower Test
  6. Monkey Tower
  7. Water Task
  8. Six Parts Test
  9. Key Search Test
  10. Virtual Errands Task

# WORKING MEMORY

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- 65 studies, 26 tools
  1. Spatial Working Memory Test: 11 studies
  2. Digit Span Test: 9 studies
  3. Self-ordered Pointing Task: 5 studies
  4. Corsi Block Taping Test: 4 studies

# WORKING MEMORY

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- Other tests:

5. Spatial Span

6. A-not-B

7. Spatial Reversal

8. Word Span

9. Counting Span

10. N-Back

11. Boxes Task

12. Block Span test

13. Letter-Number Sequencing Task

14. Same Different Computerized Task

15. Block Recall Task



# WORKING MEMORY

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16. Visual Pattern test

17. Odd-Man-Out

18. Odd-One-Out

19. Sums test

20. Spatial Recall Task

21. Computer Assist Seriation Training

22. Running Memory Task

23. Mr. X task

24. Word Recall

25. Oculomotor Delayed Response Task

26. SB5 Battery (WMM subtests)



# GLOBAL ASSESSMENT OF EF

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- BRIEF
- ✓ NEPSY-II
- ✓ Battersea Multitask Paradigm
- ✓ Delis-Kaplan Executive Functioning System (D-KEFS)
- ✓ Detail and Flexibility Questionnaire (DFLEX)
- ✓ Behavioral Assessment of the Dysexecutive Syndrome (BADS)

# PSYCHOMETRIC STUDIES

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- Only two studies:
  1. Stroop test for assessment of response inhibition
  2. WCST for assessment of cognitive flexibility

# CONCLUSION

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- 108 descriptive studies in assessment of EF in children and adolescents with ASD
- 93 studies had acceptable quality
- 78 studies in response inhibition, 65 studies in working memory, 63 studies in cognitive flexibility, 33 studies in planning
- 76 tools
- The most in working memory: 26 tools, 23 tools in response inhibition, 17 tools in cognitive flexibility, 10 tools in planning
- The most common tests were WCST & Stroop Test