Executive Function in the Everyday Context: The Evidence for Screening, Assessment, Intervention and Progress Monitoring

Gerard A. Gioia, PhD
Chief, Division of Pediatric Neuropsychology
Children's National Health System
Professor, Depts. of Pediatrics and Psychiatry & Behavioral Sciences
George Washington University
School of Medicine

Disclosure Statement

Psychological Assessment Resources, Inc.
- Test Author (royalties)
  - Behavior Rating Inventory of Executive Function (BRIEF)
  - Tasks of Executive Control (TEC)

Many other tests & measures (no royalties)

Acute Concussion Evaluation (ACE) – office, ED
ACE Care Plan; Home/School Instructions
Post-Concussion Symptom Inventory (PCSI) 5-7, 8-12, 13-18; Parent
BRIEF – Concussion Monitoring – Parent, Self-Report
Children's Exertional Effects Rating Scale (ChEERS)
Concussion Learning Assessment & School Survey (CLASS) – Parent, Self-Report
Progressive Activities of Controlled Exertion (PACE)-Self Efficacy (Child, Parent)
Multimodal Assessment of Cognition & Symptoms (MACS)
Concussion Recognition & Response (CRR) –Parent/Coach app
Concussion Assessment & Response (CARE)- Medical app

Children's National

Objectives

The learner will:

(1) explain the nature of the executive functions and the associated pros and cons of performance-based and rating scale measures;

(2) discuss an screening and assessment approach to identifying executive dysfunction in various clinical scenarios;

(3) describe the process of targeted executive function intervention planning, and monitoring progress.

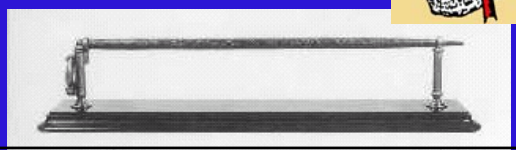
(4) Articulate the challenges that students with concussions face in their return to school, including the executive functions.

Overview

- Introduction to Executive Function
- Assessment of Executive Function
- A Brief History of the BRIEF
- What's new in the BRIEF2
- Evidence-Based Interpretation
- Intervening in executive function problems
- Monitoring the executive functions

Phineas Gage: Cavendish, VT 1848

- 3' tamping iron shot through left cheek and exited left frontally
- Destroyed much of left frontal lobe



Phineas Gage: A changed man

"He is fitful, irreverent, indulging at times in the grossest profanity, impatient of restraint or advice when it conflicts with his desires; at times pertinaciously obstinate yet capricious and vascillating. His friends and acquaintances said he was no longer Gage"

Harlow, 1868

Inhibit Shift Emotional Control

Behavior is in the Brain

Why Are Executive Functions Important?

Questionnaire Use Among Nordic Neuropsychologists: Shift From Assessing Personality to Checking Ecological Validity of Neuropsychological Assessments?

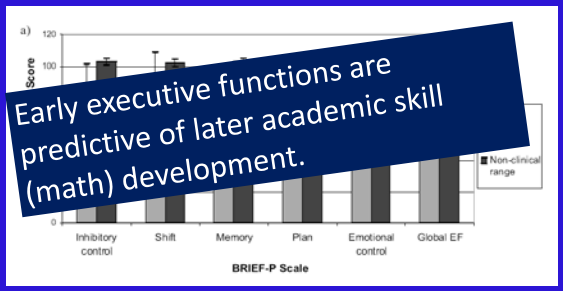
Rank of Total Questionnaire Use, Number of Users, and Use Frequency

Instrument name[a]	Nature of measure	Rank-order number of users	% Users	Rank-order use frequency among users	Mean use score among users[b]	Total use sc in whole sample
BDI-II: Beck Depression Inventory–II	(ES)	1	62.8	5	2.10	1.31
BAI: Beck Anxiety Inventory	(ES)	2	47.2	12	1.97	.93
MADRS: Montgomery Åsberg Depression Rating Scale	(ES)	3	35.5	23	1.84	.64
BRIEF-A: Behavior Rating Inventory of Executive Function–Adults	(C)	4	34.9	2	2.25	.79
ADI-r: Autism Diagnostic Interview–revised	(C)	5	32.7	16	1.92	.63
BRIEF: 5–18 years	(C)	6	32.4	1	2.34	.76
BROWN ADD: Scales for children and adolescents	(C)	7	31.5	7	2.10	.63
SCL-90 R: Symptoms Checklist 90-R	(ES)	8	26.6	18	1.87	.77
GAF: Global Assessment of Functioning	(B)	8	26.6	17	1.92	.51
AUDIT: Alcohol use disorder identification test	(B)	10	26.0	13	1.96	.51
MMPI-2: Minnesota Multiphasic Personality Invent.-2	(P)	11	24.8	33	1.53	.38
HADS: Hospital Anxiety and Depression Scale	(ES)	12	24.6	15	1.92	.47
MINI: Mini international Neuropsychiatric Interview	(D)	13	24.0	19	1.87	.45
WURS: Wender-Utah Rating Scale	(C)	14	23.4	4	2.14	.49
BRIEF 2–5: BRIEF preschool version	(C)	15	20.3	3	2.15	.44

Egeland et al., 2017

Professional Psychology: Research and Practice
2017, Vol. 48, No. 4, 227–235

Associations between teacher ratings on the BRIEF-P at 4 years and performance on WJ3 Math Fluency at 6 years



Early executive functions are predictive of later academic skill (math) development.

Clark, CA, Pritchard, VE & Woodward, LJ. (2010). Preschool executive functioning abilities predict early mathematics achievement. Developmental Psychology, 46, 1176-91.

What Specific Facets of Executive Function are Associated with Academic Functioning in Youth with Attention-Deficit/ Hyperactivity Disorder?

Joshua M. Langberg · Melissa R. Dvorsky · Steven W. Evans

The EF Planning and Organization subscale as rated by both parents and teachers predicted school grades above and beyond symptoms of ADHD and relevant covariates (achievement, IQ). Parent ratings of youth's ability to transition effectively between tasks/situations (Shift) also predicted school grades.

J Abnorm Child Psychol (2013) 41:1145–1159

Executive Functioning and Non-Verbal Intelligence as Predictors of Bullying in Early Elementary School

Marina Verlinden · René Veenstra · Akhgar Ghassabian · Pauline W. Jansen · Albert Hofman · Vincent W. V. Jaddoe · Frank C. Verhulst · Henning Tiemeier

In conclusion, our study showed that peer interactions may be to some extent influenced by children's executive function and non-verbal intelligence.

J Abnorm Child Psychol (2014) 42:953–966
DOI 10.1007/s10802-013-9832-y

Maternal self-regulation, relationship adjustment, and home chaos: Contributions to infant negative emotionality

David J. Bridgett*, Nicole M. Burt, Lauren M. Laake, Kate B. Oddi

Better maternal self-regulation was associated with lower infant negative emotionality (NE) broadly, as well as lower infant sadness and distress…and better falling reactivity (i.e., emotion regulation), specifically. Maternal self-regulation also predicted less chaotic home environments and better maternal inter-parental relationship adjustments.

Infant Behavior & Development 36 (2013) 534–547

Parenting stress and neurocognitive late effects in childhood cancer survivors

Sunita K. Patel[1]*, Andrew L. Wong[1,2], Michelle Cuevas[1,3] and Hillary Van Horn[1]

Parent stress was significantly associated with both performance-based and parent measures of child executive functioning. Child executive functioning significantly predicted stress even after controlling for socio-demographic and clinical factors, and the final model accounted for 42% in parent stress levels.

Psycho-Oncology **22**: 1774–1782 (2013)

Association of Parent Ratings of Executive Function With Global- and Setting-Specific Behavioral Impairment After Adolescent Traumatic Brain Injury

Brad G. Kurowski, MD, MS[a], Shari L. Wade, PhD[a], Michael W. Kirkwood, PhD[b], Tanya M. Brown, PhD[c], Terry Stancin, PhD[d], Amy Cassedy, PhD[e], and H. Gerry Taylor, PhD[f]

Conclusions—Caregiver ratings of deficits in EF were associated with impaired behavioral functioning after adolescent TBI and were independent of performance on tests of memory and processing speed. Understanding the relation of EF with clinical impairments as manifested in different settings will help hone assessment batteries and focus treatments where they are needed most.

Arch Phys Med Rehabil. 2013 March ; 94(3): 543–550. doi:10.1016/j.apmr.2012.10.029.

Self-Regulation and Other Executive Functions Relationship to Pediatric OCD Severity and Treatment Outcome

Joseph P. H. McNamara · Adam M. Reid · Amanda M. Balkhi · Regina Bussing · Eric A. Storch · Tanya K. Murphy · Paulo A. Graziano · Andrew G. Guzick · Gary R. Geffken

Multi-level modeling results found that deficits in shifting, inhibition, emotional control, planning/organizing, monitoring and initiating all predicted higher average obsessive compulsive severity across treatment. Interestingly, out of the eight domains of EF investigated, only emotional control moderated treatment outcome….

J Psychopathol Behav Assess (2014) 36:432–442

Parent, peer, and executive function relationships to early adolescent e-cigarette use: A substance use pathway?

Mary Ann Pentz *, HeeSung Shin, Nathaniel Riggs, Jennifer B. Unger, Katherine L. Collison, Chih-Ping Chou

Institute for Health Promotion and Disease Prevention Research, Department of Preventive Medicine, Keck School of Medicine, University of Southern California, 2001 N. Soto St., Soto Building, Los Angeles, CA 90089-9239, USA

HIGHLIGHTS

- Lifetime e-cigarette use was almost twice the use of cigarettes in early adolescents.
- Executive function (EF) deficits related to e-cigarette, cigarette, and alcohol use.
- EF deficits were more important than demographic, peer, or parent influences on use.
- Suggests adolescent drug use prevention programs should include EF skills training.

Behavior regulation and mood predict social functioning among healthy young adults

Erica L. Dawson[1], Paula K. Shear[2,3], and Stephen M. Strakowski[2,3]

Better self-reported executive functioning and mood were significant independent predictors of higher social functioning, even in a sample of healthy adults.

JOURNAL OF CLINICAL AND EXPERIMENTAL NEUROPSYCHOLOGY 2012, 34 (3), 297–305

Cogn Ther Res (2014) 38:612–620
DOI 10.1007/s10608-014-9629-5

BRIEF REPORT

Executive Function Deficits in Daily Life Prospectively Predict Increases in Depressive Symptoms

Allison M. Letkiewicz · Gregory A. Miller · Laura D. Crocker · Stacie L. Warren · Zachary P. Infantolino · Katherine J. Mimnaugh · Wendy Heller

Behavioural ratings of self-regulatory mechanisms and driving behaviour after an acquired brain injury

Per-Ola Rike[1], Pål Ulleberg[2], Maria T. Schultheis[3], Anna Lundqvist[4], & Anne-Kristine Schanke[1,2]

Abstract

Objective: To explore whether measurements of self-regulatory mechanisms and cognition predict driving behaviour after an acquired brain injury (ABI).
Design: Consecutive follow-up study.
Participants: [illegible] with a [illegible] ent [illegible] ory [illegible] nd [illegible] and accident rates). [illegible] driving characteristics were collected by mailed questionnaires from the participants who succeeded the MDA.
Methods: A MDA, which included a medical examination, neuropsychological testing and an on-road driving test, was considered in the decision for or against granting a driver's license. Self-regulatory mechanisms and driving behaviour were examined for research purposes only.
Results: At baseline, self-regulatory mechanisms were significantly associated to aberrant driving behaviour, but not with neuropsychological data or with the outcome of the on-road driving test. Aspects of self-regulation were associated to driving behaviour at follow-up.
Conclusion: It is recommended that self-regulatory measurements should regularly be considered in the driving assessments after ABI.

Behavioral Self-regulation can be associated with driving behavior. May be important factor to consider in driving assessment.

Use of the Behavior Rating Inventory of Executive Function and Child Behavior Checklist in Ugandan Children With HIV or a History of Severe Malaria

Itziar Familiar, PhD, MD,* Horacio Ruisenor-Escudero, PhD, MD,* Bruno Giordani, PhD,† Paul Bangirana, PhD,‡ Nocline Nakasujja, PhD,‡ Robert Opoka, MMED,§ Michael Boivin, PhD*

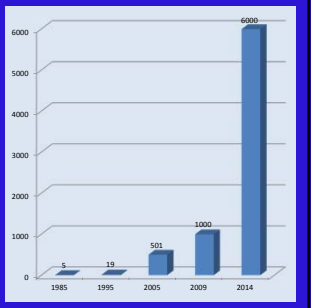
ABSTRACT: *Objective:* To assess the structural overlap between the Behavior Rating Inventory of Executive Function (BRIEF) and Achenbach Child Behavior Checklist (CBCL) among children in Uganda. *Methods:* Caregiver ratings for the BRIEF and CBCL were obtained for 2 independent samples of school-aged children: 106 children (5–12 years old, 50% males) with a history of severe malaria and on 144 HIV-infected children (5–12 years old, 58% males) in Uganda. Exploratory factor analysis was used to evaluate the factor structure of the 8 subscales for the BRIEF and the 8 scales of the CBCL to determine correlation. *Results:* Overall, children in the severe malaria group had higher (increased symptom) BRIEF and CBCL scores than those in the HIV-infected group. Three factors that provided a reasonable fit to the data and could be characterized as 3 specific domains were identified: (1) Metacognition, which consisted of the scales in the BRIEF Metacognition domain, (2) Behavioral Adjustment, which comprised of the scales in the BRIEF Behavioral Regulation domain and the Externalizing Symptoms scales in the CBCL, and (3) Emotional Adjustment, which mainly consisted of the Internalizing Symptoms scales in the CBCL. The BRIEF Behavior Regulation and CBCL Externalizing Symptoms scales, however, did overlap in terms of assessing similar behavior symptoms. These findings were consistent across the severe malaria and HIV-infected samples of children. *Conclusion:* The BRIEF and CBCL instruments offer distinct, yet complementary, assessments of behavior in clinical pediatric populations in the Ugandan context, supporting the use of these measures for similar research settings.

J Dev Behav Pediatr 0:1–8, 2015) **Index terms:** BRIEF, CBCL, psychological assessment, behavior, children, sub-Saharan Africa.

Interest in Executive Function in Children

- 5 articles in 1985
- 14 articles in 1995
- 501 articles by 2005
- >1000 articles by 2010
- >6000 articles by 2014

- *Bernstein & Waber In Meltzer (2007) Executive Function in Education*



What is executive function?

What are executive functions?

The unity and diversity of executive functions

Teuber, 1972

Approaches to defining Executive Functions

- Evolutionary purpose- allow organism to engage in goal oriented problem-solving
- Neuroanatomy- frontal lobe function
- Neurocognitive processes- what tests test
- Complex skills- what we observe (inhibit, shift, working memory, plan, organize, monitor)

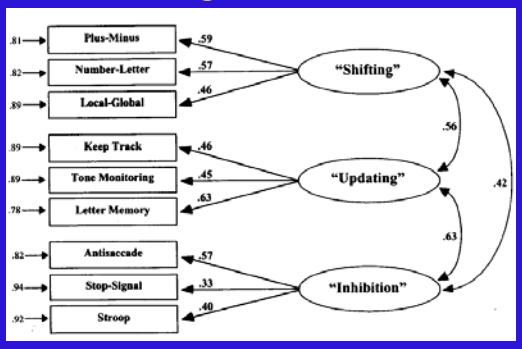
Suchy, Y. 2009

Neuroanatomical Model: Executive Functions & the Frontal Lobes

"There is no unitary executive function. Rather, distinct processes related to the frontal lobes can be differentiated which converge on a general concept of control functions."

Stuss, D.T., & Alexander, M.P. Psychological Research, 2000.

Neurocognitive Processes



Miyake, Friedman, Emerson, Witzki, Howerter & Wager, 2000

The Unity and Diversity of Executive Functions and Their Contributions to Complex "Frontal Lobe" Tasks: A Latent Variable Analysis

Akira Miyake, Naomi P. Friedman, Michael J. Emerson, Alexander H. Witzki, and Amy Howerter

Cognitive Psychology **41**, 49–100 (2000)

The main results from the CFA analyses indicate that executive functions may be characterized as separable but related functions that share some underlying commonality. Thus, as Teuber (1972) suggested in his review of frontal lobe functions more than a quarter of a century ago, the results point to both unity and diversity of executive functions and indicate that both of these aspects need to be taken into consideration in developing a theory of executive functions (see also Duncan et al., 1997).

Complex Skills: Executive function is a multidimensional construct

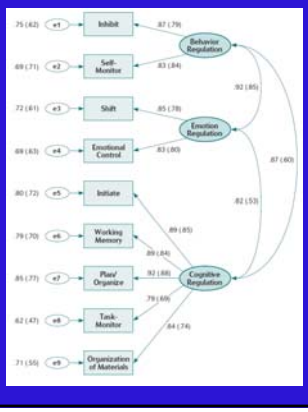
An umbrella term encompassing distinct, but interrelated, abilities that contribute to management of goal-directed behaviors including inhibiting, shifting, and regulating emotions; initiating; planning; organizing; and monitoring while holding goals in working memory.

Gioia, Isquith, Guy & Kenworthy, 2000

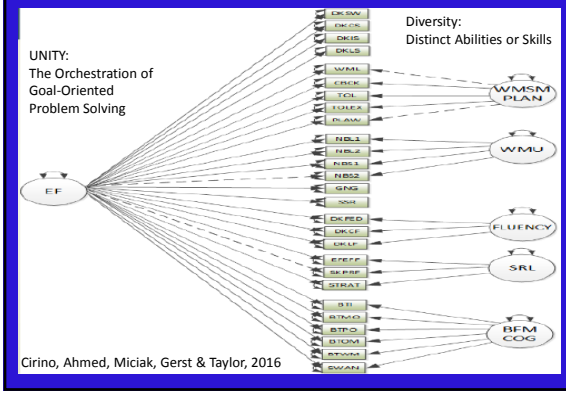
BRIEF2 Multidimensional Factor structure

Parent Form

Confirmatory Factor Analysis



Neurocognitive Processes + Complex Skills?



Cirino, Ahmed, Miciak, Gerst & Taylor, 2016

"There is no unitary executive function."
Stuss, D.T., & Alexander, M.P., 2000.

"EF is an umbrella term encompassing distinct, but interrelated, abilities that contribute to management of goal-directed behaviors."
Gioia, Isquith, Guy & Kenworthy, 2000

"Both the unity and diversity of executive functions need to be taken into account in developing a theory of executive functions."
Miyake et al., 2000

Two Levels of Executive Function Definitions

Unity: Evolutionary purpose- allow organism to engage in goal oriented problem-solving

Diversity:
- Neuroanatomy- frontal lobe function
- Neurocognitive processes- what tests test
- Complex skills- what we observe (inhibit, shift, working memory, plan, organize, monitor)

The Nature and Organization of Individual Differences in Executive Functions: Four General Conclusions

Akira Miyake[1] and **Naomi P. Friedman**[2]

Individual differences in executive functions:

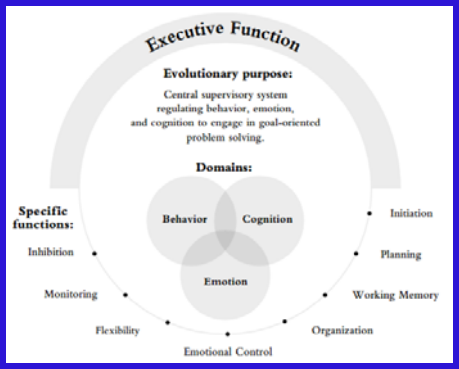
1. Show unity and diversity- are related yet separable
2. Reflect substantial genetic contributions
3. Are related to clinically & societally important phenomena
4. Show some developmental stability

Curr Dir Psychol Sci. 2012 February ; 21(1): 8–14. doi:10.1177/0963721411429458.

Executive control is "The orchestration of basic cognitive processes during goal oriented problem solving"

in *Cognitive Psychology*
Ulric Neisser, 1967

The Unity & Diversity Model of Executive Function

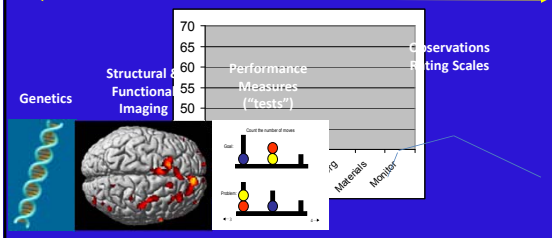


Isquith, Gioia, Guy & Kenworthy, 2017

Evaluating Executive Functions

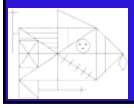
Methods of Assessing EF

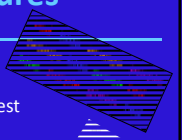
Micro — Molar — Macro

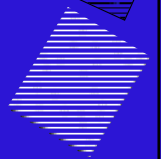


Performance Measures

- Verbal Fluency / Figural Fluency
- Stroop Color-Word Interference Test
- Rey-Osterrieth Complex Figure
- Tower of Hanoi / Tower of London
- Wisconsin Card Sorting Test
- Mazes
- Trail Making
- Continuous Performance Tests
- n back
- Go/No-go



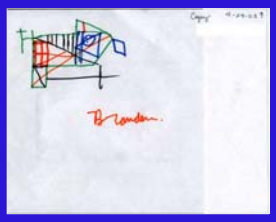




Color-Word (Stroop) Interference Test

The Rey-Osterrieth Complex Figure

10 year-old boy with ADHD-C



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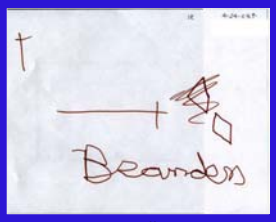
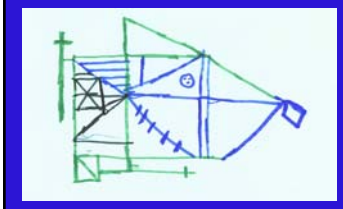


Recall

10 year old with ADHD-I



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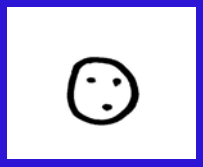
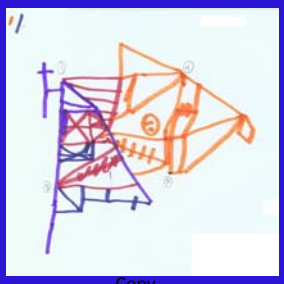


Recall

8 year-old boy with Asperger's



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Recall

Verbal Fluency

Tower of London 6 Move

Advantages of EF Performance Tests:

- Increased specificity of processes
- Increased task control and internal validity
- Decades of research on test behavior

Limitations to Performance Tests:

Performance tests tap individual components of executive function over a short time frame and not the integrated, multidimensional, relativistic, priority-based decision-making that is often demanded in real world situations

(Goldberg & Podell, 2000)

"Dogmatic adherence to the psychometric tradition of understanding and assessing EF at its most basic cognitive level is grossly inadequate. It provides only a superficial evaluation of even the conventional phenotypic view of EF. It fails to capture entirely the multilevel, concentrically arranged, affectively/motivationally charged, socially important and culturally facilitated nature of the extended phenotype of EF/SR in everyday human activities."

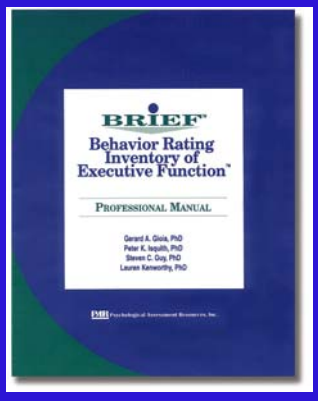
Barkley, 2012, pg 190

1994- Recognized need for:

- external validation, ecological validity for test data
- Standardized information about everyday executive function
- Efficient collection of parent / teacher/ self observations
- assess multiple aspects of executive functions
- Time & cost efficiency

What's in a name

- Children's Behavior Questionnaire (*CBQ*)
- Executive Function Questionnaire (*EFQ*)
- Developmental Executive Function Test (*DEFT*)
- Behavioral Evaluation of Executive Function (*BEEF*)
- Behavioral Assessment of Regulatory Function (*BARF*)
- Planning and Organization Rating Questionnaire (*PORQ*)
- Behavioral Evaluation of Executive Regulation (*BEER*)
- Behavior Rating Inventory of Executive Function (*BRIEF*)



A BRIEF History

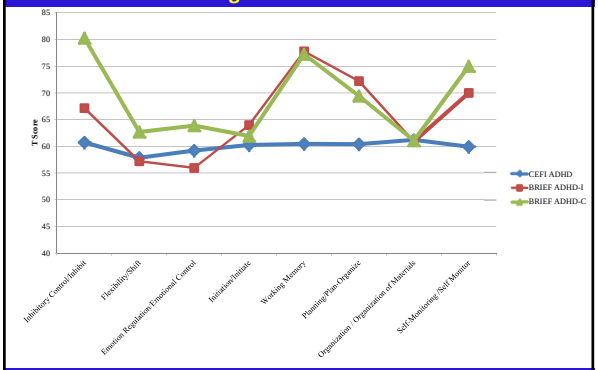
2003 2000 2004 2005

Since publication:

- Expanded to cover ages 2-90 years
- More than 800 peer-reviewed publications
- More than 40 clinical trials and outcome studies
- Translated into more than 60 languages
- Used on 6 continents

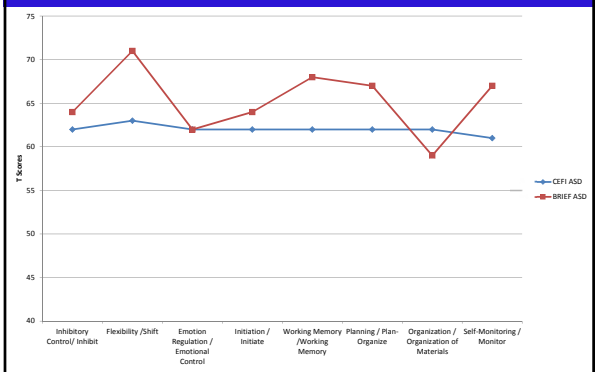
	BRIEF 2000	BDEFS 2011	DREF 2012	CEFI 2012
Ages	2-90	5-81	5-18	5-18
Forms	PTS	P	PT	PTS
Scales	9	5	3	1
Languages	>60	1	1	2
Peer-Reviewed	926	21	1	4
Empirical Studies	838	17	0	1
Clinical Trials	56	0	0	0
INS Papers 2016-17	62	1	0	0

Parent Ratings on BRIEF Scales in ADHD



Note: CEFI re-scored as T scores with M=50+/-10 to match BRIEF scores
*From CEFI Manual; **From Gioia et al., 2002 Profiles of Everyday Executive Function

Parent Ratings on BRIEF in ASD



*From CEFI Manual; **From Gioia et al., 2002 Profiles of Everyday Executive Function

At a Glance

Ages: 5-18 years

Administration time:
- 5 minutes Screening
- 10 minutes full

Parent, Teacher, Self-Report Forms:
- Paper & pencil
- iConnect

Enhancements in the BRIEF2

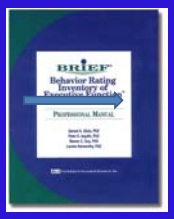
Standardization

- 1400 Parents 1400 Teachers 800 Students
- Even across age groups
- Stratified by gender, ethnicity, parent education, geographic region
- No meaningful effects of ethnicity, parent education, or geographic region

All 50 states represented

Equivalence with the BRIEF

No new items on clinical scales, allowing for consistency of data collection between the BRIEF and BRIEF2

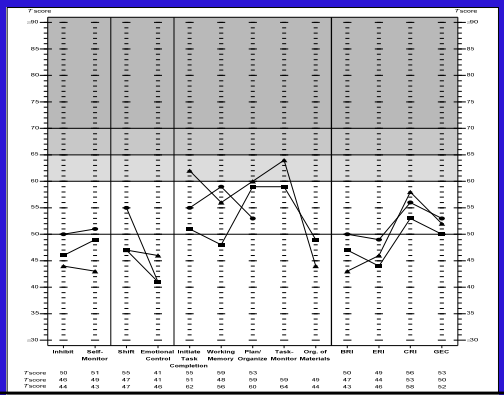


More concise scales

	BRIEF			BRIEF-2		
Scale	Parent	Teacher	Self-Report	Parent	Teacher	Self-Report
Inhibit	10	10	13	8	8	8
Self-Monitor	--	--	--	4	5	5
Shift	8	10	10	8	8	8
Emotional Control	10	9	10	8	8	6
Initiate	8	9	10	8	8	7
Task Completion	--	--	10	--	--	7
Working Memory	10	10	12	8	8	8
Plan/Organize	12	10	13	8	8	10
Task-Monitor	--	--	--	5	6	--
Organization of Materials	6	7	7	6	5	--
Monitor	8	10	5	--	--	--
Additional Clinical Items	14	13	--	--	--	--
Infrequency	--	--	--	3	3	3
Total	**86**	**86**	**80**	**63**	**63**	**55**

Shorter by a Quarter

Multiple Raters on Protocol Summary

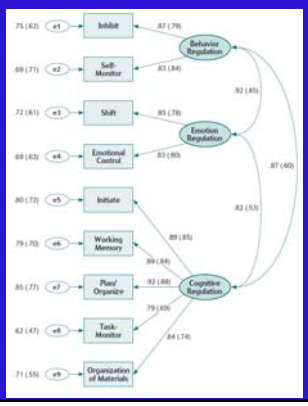


Parallelism in item content

Scale/Item		Self-Report	Parent Report	Teacher Report
Inhibit				
1 (P/T)	Is fidgety		--	Never
1 (SR)	I have trouble sitting still	Sometimes		
10 (P/T)	Does not think before doing (is impulsive)		Sometimes	Never
10 (SR)	I am impulsive (I don't think before doing)	Sometimes		
16 (P/T)	Gets out of control more than friends		Never	Never
16 (SR)	I get out of control more than my friends	Sometimes		
24 (P/T)	Talks at the wrong time		Never	Never
24 (SR)	I talk at the wrong time	Never		
30 (P/T)	Gets out of seat at the wrong times		Never	Never
30 (SR)	I have problems waiting my turn	Never		
39 (P/T)	Acts too wild or "out of control"		Never	Never
39 (SR)	I interrupt others	Never		

BRIEF Multidimensional Factor structure

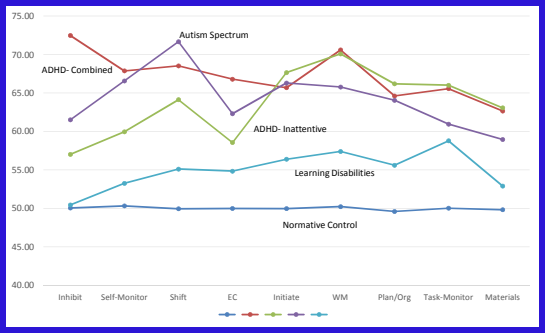
Parent Form Confirmatory Factor Analysis



Increased sensitivity

- Items were selected for maximum performance in more than 6,000 clinical cases
- Increased sensitivity to executive function problems in clinical groups, such as attention-deficit/hyperactivity disorder (ADHD) and autism spectrum disorders (ASD)

Parent Form Profile Analysis



Initial Examination of the BRIEF2 in Clinically Referred Children With and Without ADHD Symptoms

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1–10
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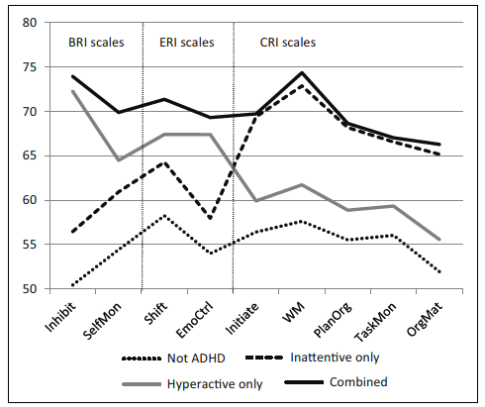
Lisa A. Jacobson[1,2], Alison E. Pritchard[1,2], Taylor A. Koriakin[3], Kelly E. Jones[1,2], and E. Mark Mahone[1,2]

Table 4. Classification Accuracy Measures for Discriminating Between Groups With Selected Scales at *T* = 70.

	Any ADHD symptoms vs. non-ADHD						IA only vs. HI only					
T = 70	Sens	Spec	CA	PPV	NPV	AUC	Sens	Spec	CA	PPV	NPV	AUC
Inhibit	38.12	96.13	63.07	92.88	53.97	.806	61.04	88.35	83.90	50.54	92.08	.874
WM	66.45	87.88	75.67	87.90	66.41	.872	69.37	87.01	72.25	96.48	35.64	.844
Org	38.75	95.79	63.29	92.42	54.14	.834	41.01	94.81	49.79	97.59	23.86	.784
GEC	61.88	93.27	75.38	92.41	64.87	.888	46.84	58.44	48.73	85.25	17.65	.535

n = 1969 clinically referred 5-18 year-olds



NASP Data-Based Decision Making and Accountability

Releva

- Know … ssment and … eeds
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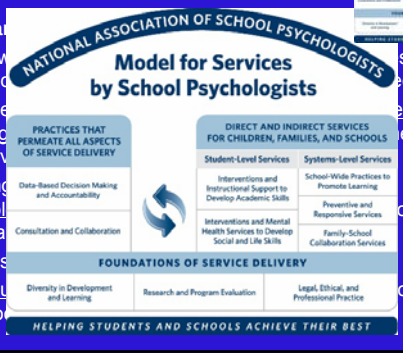
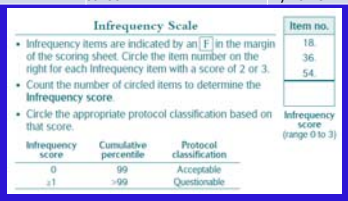


New to the BRIEF2

Infrequency scale

Infrequency scale helps identify unusual responding

Parent Form	Teacher Form	Self-Report Form
Forgets his/her name	Forgets his/her name	I forget my name
Has trouble counting to three	Has trouble counting to three	I have trouble counting to three
Cannot find the front door of home	Cannot find the front door of school	I cannot find the front door of my home



Screening Forms

12-item Screening Parent, Teacher and Self-Report Forms quickly indicate whether further assessment is needed

Correlate with GEC ≥.93

New statistics that support interpretation

- Base-rate tables
- Reliable change indexes
- Interrater agreement metrics
- Contingency statistics for Screening Forms and select diagnostic groups:
  - Sensitivity/specificity
  - Predictive power
  - Likelihood ratios

Base rates – standardization sample

BRIEF2 Parent Form Base Rates of Elevated *T* Scores for the Standardization Sample

	T-score elevation		
Scale/index/composite	≥70	≥65	≥60
Inhibit	5	9	16
Self-Monitor	4	8	16
Behavior Regulation Index	5	10	17
Shift	5	10	18
Emotional Control	6	10	19
Emotion Regulation Index	6	10	17
Initiate	5	9	15
Working Memory	5	10	16
Plan/Organize	4	8	16
Task-Monitor	4	8	15
Organization of Materials	5	7	14
Cognitive Regulation Index	5	9	17
Global Executive Composite	6	11	17

N = 1,400.

Base rates – clinical samples

Clinical Groups		
ADHD-Combined	ADHD/Learning Disability	Tumor
ADHD-Inattentive	ASD	Epilepsy
ADHD-Sluggish Cognitive Tempo	Neurofibromatosis type 1	Diabetes
TBI	Acute lymphoblastic leukemia	Anxiety
Learning Disability		

BRIEF2 Parent Form Base Rates of Elevated *T* Scores for ADHD-C and TD Groups

	T-score elevation					
	≥70		≥65		≥60	
Scale/index/composite	ADHD-C[a]	TD[b]	ADHD-C[a]	TD[b]	ADHD-C[a]	TD[b]
Inhibit	61	2	78	7	89	13
Self-Monitor	48	2	64	7	78	14
Behavior Regulation Index	66	3	78	7	89	14
Shift	45	1	63	8	75	14
Emotional Control	48	4	58	9	70	16
Emotion Regulation Index	49	3	65	8	76	14
Initiate	44	2	59	8	72	13
Working Memory	61	2	76	6	86	15
Plan/Organize	36	1	57	5	75	13
Task-Monitor	35	2	63	5	74	12
Organization of Materials	32	3	41	5	64	15
Cognitive Regulation Index	50	2	71	6	82	14
Global Executive Composite	66	1	80	6	91	14

Note. ADHD-C = attention-deficit/hyperactivity disorder, combined type; TD = typically developing.
[a]*n* = 218. [b]*n* = 218.

Reliable change

BRIEF2 Parent Form Reliable Change Scores by Significance Level

	Significance level				
Scale/index/composite	*ns*	.20	.10	.05	.01
Inhibit	0-5	6-7	8	9-11	12+
Self-Monitor	0-7	8-9	10-11	12-14	15+
Behavior Regulation Index	0-5	6-7	8	9-11	12+
Shift	0-6	7	8-9	10-12	13+
Emotional Control	0-5	6-7	8-9	10-12	13+
Emotion Regulation Index	0-5	6-7	8	9-11	12+
Initiate	0-5	6-7	8-9	10-12	13+
Working Memory	0-3	4	5	6-7	8+
Plan/Organize	0-5	6-7	8-9	10-12	13+
Task-Monitor	0-7	8-9	10-11	12-15	16+
Organization of Materials	0-5	6-7	8	9-11	12+
Cognitive Regulation Index	0-4	5	6-7	8-9	10+
Global Executive Composite	0-4	5-6	7	8-10	11+

Note. ns = not significant.

Inter-rater agreement metrics

Percentages of the Combined Clinical Sample That Obtained Various *T*-Score Differences Between BRIEF2 Parent and Teacher Forms for Index and GEC Scores

	BRIEF2 index/composite			
T-score difference	BRI	ERI	CRI	GEC
Parent more than 20 *T*-score points > Teacher	7.5	12.5	9.3	9.1
Parent 10-20 *T*-score points > Teacher	17.7	18.4	17.9	19.3
Parent and Teacher within ±10 *T*-score points	54.6	53.0	58.9	57.3
Parent 10-20 *T*-score points < Teacher	12.1	10.8	10.2	9.6
Parent more than 20 *T*-score points < Teacher	8.1	5.2	3.7	4.6

Note. n = 1,426. GEC = Global Executive Composite; BRI = Behavior Regulation Index; ERI = Emotion Regulation Index; CRI = Cognitive Regulation Index.

Contingency statistics

BRIEF2 Parent Form Classification Measures for the Working Memory and Inhibit Scales in ADHD Research and Clinical Samples

	TD vs. ADHD		ADHD-C vs. ADHD-I			
	ADHD research sample[a]	ADHD clinical sample[b]	ADHD research sample[c]		ADHD clinical sample[d]	
Classification measure	Working Memory *T* ≥ 65	Working Memory *T* ≥ 65	Inhibit *T* ≥ 65	Inhibit *T* ≥ 70	Inhibit *T* ≥ 65	Inhibit *T* ≥ 70
True positive	101	282	80	66	170	133
False positive	13	20	17	10	40	18
False negative	32	95	18	32	48	85
True negative	120	357	18	25	119	141
Sensitivity	.76	.75	.82	.67	.78	.61
Specificity	.90	.95	.51	.71	.75	.89
Positive predictive value	.89	.93	.82	.87	.81	.88
Negative predictive value	.79	.79	.50	.44	.71	.62
Positive likelihood ratio	7.77	14.10	1.68	2.36	3.10	5.39
Negative likelihood ratio	0.27	0.27	0.36	0.46	0.29	0.44
Classification accuracy (%)	83.08	84.75	73.68	68.42	76.66	72.68

Note. ADHD = attention-deficit/hyperactivity disorder; TD = typically developing; ADHD-C = attention-deficit/hyperactivity disorder, combined type; ADHD-I = attention-deficit/hyperactivity disorder, inattentive type.
[a]*n* = 266. [b]*n* = 754. [c]*n* = 133. [d]*n* = 377.

Evidence-Based Interpretation

Using statistics/psychometrics to benefit your clinical decision-making

Following a systematic method

BRIEF2 interpretation

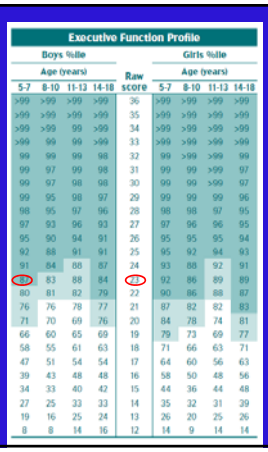
Procedure	Example statements
Review validity scales	Ratings on the BRIEF2 were valid
Review *T* scores and percentiles	Parent ratings noted difficulties on the Inhibit, Working Memory, and Plan/Organize scales but typical function on the Emotional Control, Self-Monitor, Initiate, and Task-Monitor scales.
Compare to base rates	Elevations of this magnitude on the Inhibit and Working Memory scales occur in less than 10% of students his age.

BRIEF2 interpretation (continued)

Procedure	Example statements
Review profile relative to diagnostic groups	The pattern is like that seen in students diagnosed with attention disorders.
Examine inter-rater differences	Teacher and parent ratings were in good agreement. Teacher ratings revealed a similar pattern of concerns with inhibitory control and working memory but also suggested problems with self-monitoring in the social setting.
Calculate *T* score differences; examine significance of difference.	Ratings over time showed a significant decrease in behavior regulation concerns, but while there was some decrease in emotion and cognitive regulation scores, the change was not beyond that expected within an 80% confidence interval.

Jeremy: 7 year-old boy with ADHD-C

- Impulsivity, hyperactivity, inattention identified by kindergarten with impact on academic functioning but not skills
- Pediatrician administered BRIEF2 Screening
- Parent (23) and teacher (20) scores indicated high risk for EF problems


Executive Function Profile

Boys %ile Age (years) 5-7	8-10	11-13	14-18	Raw score	Girls %ile Age (years) 5-7	8-10	11-13	14-18
>99	>99	>99	>99	36	>99	>99	>99	>99
>99	>99	>99	>99	35	>99	>99	>99	>99
>99	>99	99	>99	34	>99	>99	>99	>99
>99	99	99	>99	33	>99	>99	>99	>99
99	99	99	98	32	99	>99	>99	99
99	97	99	98	31	99	99	>99	97
99	97	98	98	30	99	99	>99	97
99	95	98	97	29	99	99	99	96
98	95	97	96	28	98	98	97	95
97	93	96	93	27	97	96	96	95
95	90	94	91	26	95	95	95	94
92	88	91	91	25	95	92	94	93
91	84	88	87	24	93	88	92	91
87	83	88	84	23	92	86	89	89
80	81	82	79	22	90	86	88	87
76	76	78	77	21	87	82	82	83
71	70	69	76	20	84	78	74	81
66	60	65	69	19	79	73	69	77
58	55	61	63	18	71	66	63	71
47	51	54	54	17	64	60	56	63
39	43	48	48	16	58	50	48	56
34	33	40	42	15	44	36	44	48
27	25	33	33	14	35	32	31	39
19	16	25	24	13	26	20	25	26
8	8	14	16	12	14	9	14	14

Parent Screening Form

Raw score of 23 is 87th percentile

Clinically elevated

Recommendation is to refer

Table I.1
BRIEF2 Screening Parent Form Classification Measures for the Executive Function Screening Raw Score: **Boys 5-7 Years**

Raw score cutoff	Sensitivity	Specificity	Positive likelihood ratio[a]	Negative likelihood ratio[b]	Classification accuracy (%)
12/13	1.00	.00	1.00	–	49.35
13/14	.98	.03	1.01	0.68	49.78
14/15	.97	.09	1.06	0.31	52.38
15/16	.96	.17	1.15	0.26	55.84
16/17	.95	.23	1.23	0.23	58.44
17/18	.95	.34	1.44	0.15	64.07
18/19	.94	.50	1.86	0.12	71.43
19/20	.91	.58	2.18	0.15	74.46
20/21	.89	.66	2.59	0.17	77.06
21/22	.85	.74	3.32	0.20	79.65
22/23	.82	.79	4.02	0.22	80.95
23/24	.75	.87	5.82	0.29	80.95
24/25	.70	.92	9.12	0.32	81.39
25/26	.63	.93	9.24	0.40	78.35
26/27	.56	.97	16.42	0.45	76.62
27/28	.48	.97	18.82	0.53	73.16
28/29	.41	.97	16.08	0.60	69.70
29/30	.35	.99	41.05	0.65	67.53

Table J.1
BRIEF2 Screening Parent Form Base Rates of Potentially Clinically Elevated and Clinically Elevated Executive Function Screening Raw Scores for Boys

Sample	*n*	Raw score elevation: Potentially clinically elevated	Raw score elevation: Clinically elevated
Standardization	687	28	19
Combined clinical	1,980	79	64
ADHD-C	163	93	87
Typically developing	163	22	10
ADHD-I	94	88	71
Typically developing	94	25	15
SCT	17	88	71
Typically developing	17	18	0
ADHD research sample			
ADHD-C	77	95	91
ADHD-I	19	100	90
Typically developing	96	37	25
ASD	214	91	80
Typically developing	214	29	19

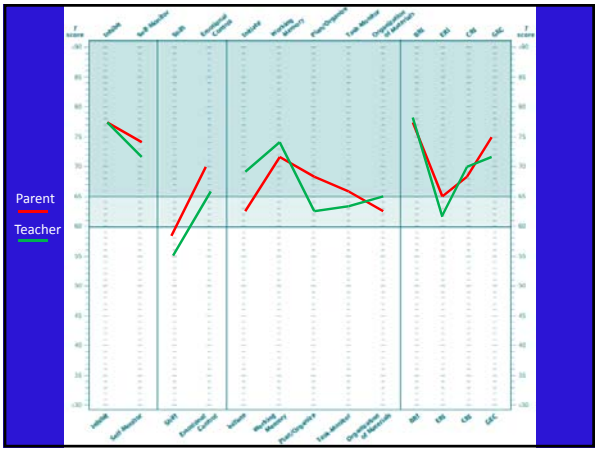
- Jeremy is a 7-year-old boy with a history of impulsivity, hyperactivity, and inattention first identified in kindergarten with impact on academic functioning despite good skills.
- Parent ratings on the BRIEF2 Screening Form were at the 87th percentile. Students with scores at this level are four times more likely to have actual executive function problems than to be mistakenly identified.

Assess to rule-out other problems and observe / evaluate EF

- Average verbal/nonverbal functioning but below average PS and WM
- Academic skills average or better
- Fine motor mild weakness
- Deficits in sustained attention, vigilance, speed on continuous performance test

BRIEF2

Scale/index/composite	Baseline assessment: Parent Form Raw score	Parent Form T score	Teacher Form Raw score	Teacher Form T score
Inhibit	23	**77**	24	**78**
Self-Monitor	11	**74**	14	**72**
BRI	34	**77**	38	**78**
Shift	14	**58**	13	**55**
Emotional Control	19	**69**	15	**66**
ERI	33	**65**	28	**62**
Initiate	11	**63**	11	**69**
Working Memory	21	**72**	22	**74**
Plan/Organize	20	**68**	17	**62**
Task-Monitor	13	**66**	15	**63**
Organization of Materials	14	**63**	11	**65**
CRI	79	**68**	76	**70**
GEC	146	**75**	142	**72**



BRIEF2 interpretation

Procedure	Example statements
Review validity	Ratings on the BRIEF2 were valid
Review *T* scores and percentiles	Parent ratings noted difficulties on the Inhibit, Working Memory, and Plan/Organize scales but typical function on the Emotional Control, Self-Monitor, Initiate, and Task-Monitor scales.
Compare to base rates	Elevations of this magnitude on the Inhibit and Working Memory scales occur in less than 10% of students his age.

- Parent and teacher ratings on the BRIEF2 were valid.
- Significant elevations were seen on scales reflecting difficulties with inhibiting impulses, monitoring social interactions, and sustaining working memory.
- Jeremy was also described as having difficulty regulating emotions, and initiating, planning and organizing his work.
- Scores at this level occur in approximately 5% of typically developing students

BRIEF2 interpretation (continued)

Procedure	Example statements
Review profile	The pattern is like that seen in students diagnosed with attention disorders.
Examine inter-rater agreement	Teacher and parent ratings were in good agreement. Teacher ratings revealed a similar pattern of concerns with inhibitory control and working memory but also suggested problems with self-monitoring in the social setting.
Examine Reliable Change Scores	Ratings over time showed a significant decrease in behavior regulation concerns, but while there was some decrease in emotion and cognitive regulation scores, the change was not beyond that expected within an 80% confidence interval.

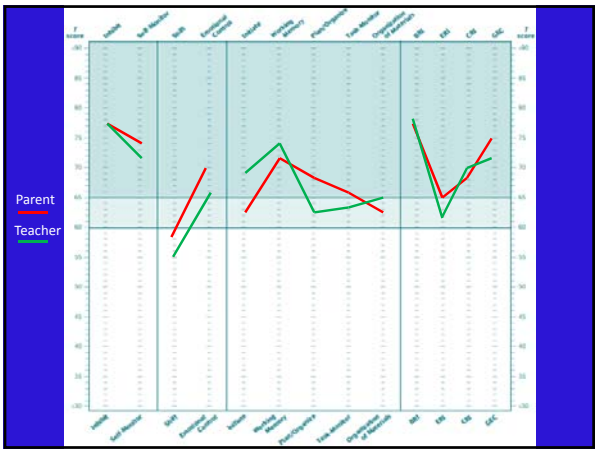


Table F.1
BRIEF2 Parent Form Classification Measures for the Working Memory and Inhibit Scales in ADHD Research and Clinical Samples

	TD vs. ADHD		ADHD-C vs. ADHD-I			
	ADHD research sample[a]	ADHD clinical sample[b]	ADHD research sample[c]		ADHD clinical sample[d]	
Classification measure	Working Memory $T \geq 65$	Working Memory $T \geq 65$	Inhibit $T \geq 65$	Inhibit $T \geq 70$	Inhibit $T \geq 65$	Inhibit $T \geq 70$
True positive	101	282	80	66	170	133
False positive	13	20	17	10	40	18
False negative	32	95	18	32	48	85
True negative	120	357	18	25	119	141
Sensitivity	.76	.75	.82	.67	.78	.61
Specificity	.90	.95	.51	.71	.75	.89
Positive predictive value	.89	.93	.82	.87	.81	.88
Negative predictive value	.79	.79	.50	.44	.71	.62
Positive likelihood ratio	7.77	14.10	1.68	2.36	3.10	5.39
Negative likelihood ratio	0.27	0.27	0.36	0.46	0.29	0.44
Classification accuracy (%)	83.08	84.75	73.68	68.42	76.66	72.68

Note. ADHD = attention-deficit/hyperactivity disorder; TD = typically developing; ADHD-C = attention-deficit/hyperactivity disorder, combined type; ADHD-I = attention-deficit/hyperactivity disorder, inattentive type.
[a] n = 266. [b] n = 754. [c] n = 133. [d] n = 377.

- Students with Working Memory scores ≥ 65 are over 7 times more likely to be correctly identified as a child with ADHD than incorrectly identified.
- Students in this group with Inhibit scores ≥ 70 are 2-5 times more likely to be accurately identified as having ADHD-C than to be over-identified.

OR

- The pattern is like that seen in students diagnosed with ADHD-C.

BRIEF2 interpretation (continued)

Procedure	Example statements
Review profile	The pattern is like that seen in students diagnosed with attention disorders.
Examine inter-rater agreement	Teacher and parent ratings were in good agreement. Teacher ratings revealed a similar pattern of concerns with inhibitory control and working memory but also suggested problems with self-monitoring in the social setting.
Examine Reliable Change Scores	Ratings over time showed a significant decrease in behavior regulation concerns, but while there was some decrease in emotion and cognitive regulation scores, the change was not beyond that expected within an 80% confidence interval.

	Baseline assessment				
	Parent Form		Teacher Form		
Scale/index/composite	Raw score	*T* score	Raw score	*T* score	Differences
Inhibit	23	77	24	78	
Self-Monitor	11	74	14	72	
BRI	34	77	38	78	1
Shift	14	58	13	55	
Emotional Control	19	69	15	66	
ERI	33	65	28	62	3
Initiate	11	63	11	69	
Working Memory	21	72	22	74	
Plan/Organize	20	68	17	62	
Task-Monitor	13	66	15	63	
Organization of Materials	14	63	11	65	
CRI	79	68	76	70	2
GEC	146	75	142	72	3

Teacher and parent ratings were in good agreement.

Percentages of the Combined Clinical Sample That Obtained Various *T*-Score Differences Between BRIEF2 Parent and Teacher Forms for Index and GEC Scores

	BRIEF2 index/composite			
T-score difference	BRI	ERI	CRI	GEC
Parent more than 20 *T*-score points > Teacher	7.5	12.5	9.3	9.1
Parent 10-20 *T*-score points > Teacher	17.7	18.4	17.9	19.3
Parent and Teacher within ±10 *T*-score points	54.6	53.0	58.9	57.3
Parent 10-20 *T*-score points < Teacher	12.1	10.8	10.2	9.6
Parent more than 20 *T*-score points < Teacher	8.1	5.2	3.7	4.6

Note. n = 1,426. GEC = Global Executive Composite; BRI = Behavior Regulation Index; ERI = Emotion Regulation Index; CRI = Cognitive Regulation Index.

BRIEF2 interpretation (continued)

Procedure	Example statements
Review profile	The pattern is like that seen in students diagnosed with attention disorders.
Examine inter-rater agreement	Teacher and parent ratings were in good agreement. Teacher ratings revealed a similar pattern of concerns with inhibitory control and working memory but also suggested problems with self-monitoring in the social setting.
Examine Reliable Change Scores	Ratings over time showed a significant decrease in behavior regulation concerns, but while there was some decrease in emotion and cognitive regulation scores, the change was not beyond that expected within an 80% confidence interval.

Repeat ratings after a 3 week medication trial (Progress Monitoring)

	Baseline assessment				1-month follow-up			
	Parent Form		Teacher Form		Parent Form		Teacher Form	
Scale/index/composite	Raw score	*T* score	Raw score	*T* score	Raw score	*T* score	Raw score	*T* score
Inhibit	23	77	24	78	18	63	17	61
Self-Monitor	11	74	14	72	8	58	10	58
BRI	34	77	38	78	26	62	27	60
Shift	14	58	13	55	12	52	13	55
Emotional Control	19	69	15	66	17	64	13	59
ERI	33	65	28	62	29	59	26	58
Initiate	11	63	11	69	10	59	9	60
Working Memory	21	72	22	74	17	63	18	64
Plan/Organize	20	68	17	62	19	66	16	58
Task-Monitor	13	66	15	63	11	58	14	60
Organization of Materials	14	63	11	65	13	60	10	60
CRI	79	68	76	70	70	62	67	63
GEC	146	75	142	72	125	65	120	63

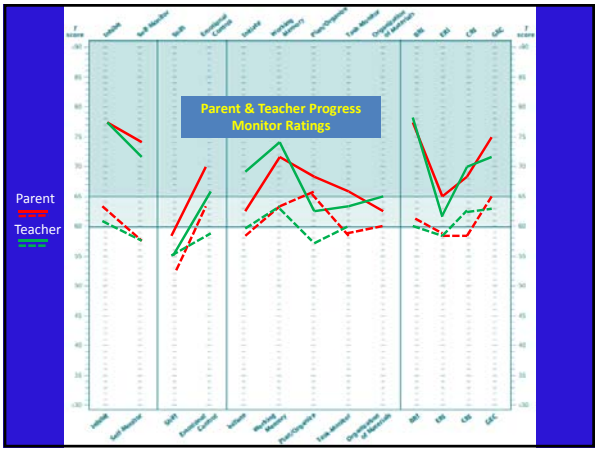


Table G.1
BRIEF2 Parent Form Reliable Change Scores by Significance Level

	Significance level				
Scale/index/composite	*ns*	.20	.10	.05	.01
Inhibit	0-5	6-7	8	9-11	12+
Self-Monitor	0-7	8-9	10-11	12-14	15+
Behavior Regulation Index	0-5	6-7	8	9-11	12+
Shift	0-6	7	8-9	10-12	13+
Emotional Control	0-5	6-7	8-9	10-12	13+
Emotion Regulation Index	0-5	6-7	8	9-11	12+
Initiate	0-5	6-7	8-9	10-12	13+
Working Memory	0-3	4	5	6-7	8+
Plan/Organize	0-5	6-7	8-9	10-12	13+
Task-Monitor	0-7	8-9	10-11	12-15	16+
Organization of Materials	0-5	6-7	8	9-11	12+
Cognitive Regulation Index	0-4	5	6-7	8-9	10+
Global Executive Composite	0-4	5-6	7	8-10	11+

Note. ns = not significant.

- Repeat assessment with the BRIEF2 after a 3 week trial of intervention resulted in marked improvements in behavior regulation and working memory, with significant decreases on Parent and Teacher BRI and Working Memory scales, both beyond the 99th percentile ($p<.01$) for reliable change.

Clinical Profiles: ADHD

Validity of the EF Theory of ADHD

- 83 Studies
- 3734 ADHD vs 2969 Controls
- Effects .43 - .69
- No subtype differences
- BUT < ⅓ in ADHD showed impairment on any EF tasks

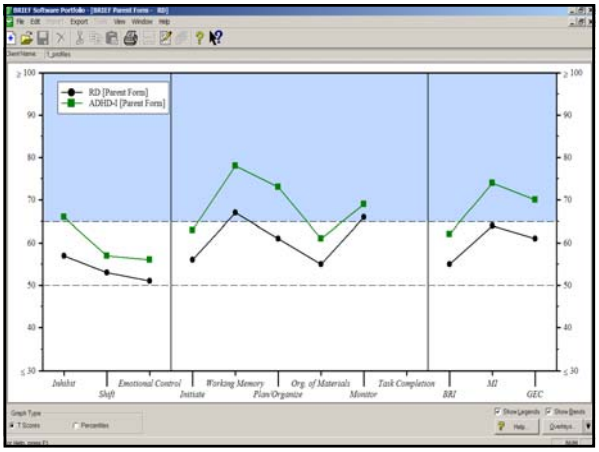
Tasks:	% Impaired
Stop signal RT	82
CPT Commissions	
CPT Omissions	77
WCST Perseveration	
Trails B time	
TOH/TOL	59
Porteus Mazes	
ROCF	
Sentence Span	
Digits Backward	

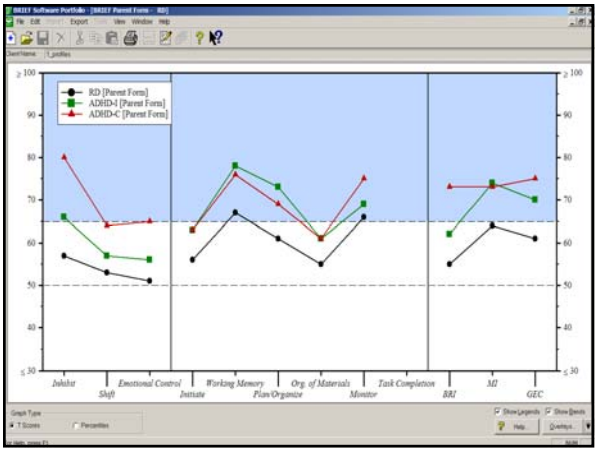
Willcutt, Doyle, Nigg, Faraone & Pennington, 2005

Profiles of Everyday Executive Function in Acquired and Developmental Disorders

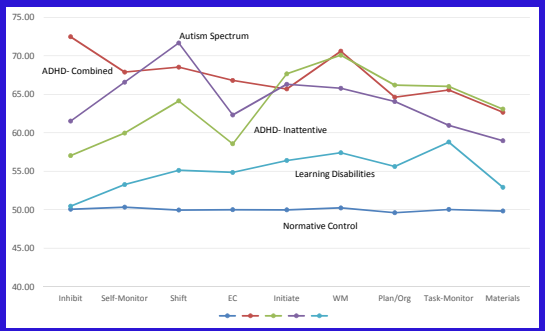
Gerard A. Gioia[1], Peter K. Isquith[2], Lauren Kenworthy[1], and Richard M. Barton[3]
[1]Children's National Medical Center, Washington, DC, USA, [2]Dartmouth Medical School, Hanover, NH, USA, and [3]Dartmouth College, Hanover, NH, USA

- 34 Reading Disorder
- 27 ADHD-I
- 26 ADHD-C
- 54 ASD
- 33 Moderate TBI
- 34 Severe TBI
- 208 Controls





Parent Form Profile Analysis



BRIEF-2 WM & Inhibit Predict ADHD

Classification Measure	TD vs. ADHD		ADHD-C vs. ADHD-I		
	Working Memory T≥65	Function 1[a]	Inhibit T≥65	Inhibit T≥70	Function 2[b]
Sensitivity	0.76	0.88	0.82	0.67	0.97
Specificity	0.9	0.87	0.51	0.71	0.51
PPV	0.89	0.87	0.82	0.87	0.85
NPV	0.79	0.88	0.5	0.44	0.86
Likelihood Ratio +	7.77	6.88	1.68	2.36	2
Likelihood Ratio -	0.27	0.14	0.36	0.46	0.06
Correct Hit Rate %	83.08%	87.59%	73.68%	68.42%	84.96%

[a] Function 1 = Inhibit, WM, EC
[b] Function 2 = Inhibit, Shift, Initiate

Isquith, Keneally, Roth & Gioia, 2015,
Diagnostic Accuracy of the BRIEF-2 for Children with ADHD

EXECUTIVE FUNCTIONS: PERFORMANCE-BASED MEASURES AND THE BEHAVIOR RATING INVENTORY OF EXECUTIVE FUNCTION (BRIEF) IN ADOLESCENTS WITH ATTENTION DEFICIT/ HYPERACTIVITY DISORDER (ADHD)

Maggie E. Toplak,[1] Stefania M. Bucciarelli,[2] Umesh Jain,[3] and Rosemary Tannock[4]

Table 2 Mean (*SD*) Performance in ADHD and Comparison Control Groups on Executive Function Performance-Based Tasks.

	ADHD ($n = 45$)	Controls ($n = 42$)	F	η^2
Inhibition Stop task–SSRT	2.29 (0.20)	2.19 (0.14)	8.22*	0.09
Working Memory Verbal and spatial working memory composite	19.11 (6.04)	23.71 (4.32)	16.50**	0.16
Set Shifting Trailmaking Part B time	75.40 (22.47)	59.67 (22.09)	10.82**	0.11
Planning Stockings of Cambridge standard score–Minimum number of moves for five-move problem	−1.31 (1.44)	−0.48 (1.09)	9.11*	0.10

**$p < .001$, *$p < .01$.

Table 3 Parent and Teacher BRIEF Ratings for ADHD and Comparison Controls.

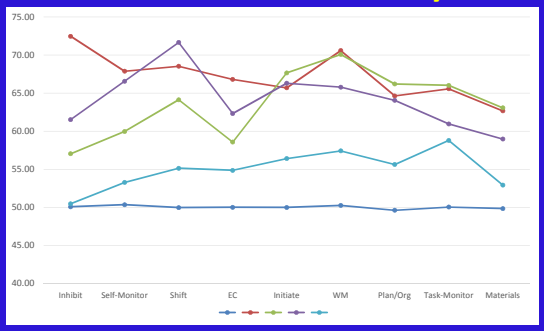
	ADHD	Controls	F	η^2
Parent BRIEF Scales (n = 46 for ADHD group, and n = 44 for Control group)				
Inhibit Index *T*-score	67.35 (13.55)	47.27 (7.74)	73.56**	0.46
Shift Index *T*-score	64.02 (12.44)	48.05 (7.72)	52.99**	0.38
Working Memory Index *T*-score	77.15 (11.48)	48.55 (8.42)	180.29**	0.67
Plan/Organize Index *T*-score	72.35 (7.85)	49.27 (9.36)	160.95**	0.65
Teacher BRIEF Scales (n = 37 for both groups)				
Inhibit Index *T*-score	69.68 (17.95)	48.84 (8.71)	40.38**	0.36
Shift Index *T*-score	72.35 (22.10)	47.68 (7.61)	41.24**	0.36
Working Memory Index *T*-score	79.05 (16.90)	50.35 (10.71)	76.18**	0.51
Plan/Organize Index *T*-score	78.68 (17.65)	50.14 (11.54)	67.81**	0.49

**$p < .001$. Standard deviation in parentheses.

Toplak et al., 2009

Clinical Profiles: ASD

Parent Form Profile Analysis



Classification Accuracy of BRIEF-2 in ASD

Classification Measure	Parent		Teacher	
	TD vs. ASD [a]		TD vs. ASD [b]	
	Shift T≥65	Shift T≥70	Shift T≥65	Shift T≥70
Sensitivity	0.73	0.53	0.61	0.4
Specificity	0.93	0.96	0.94	0.99
PPV	0.91	0.93	0.92	0.98
NPV	0.77	0.67	0.71	0.62
Likelihood Ratio +	10.61	13.9	10.83	42
Likelihood Ratio -	0.29	0.49	0.41	0.61
Correct Hit Rate %	83.02%	74.62%	77.83%	69.34%

[a] n = 524; [b] n = 212;

Updated BRIEF Profiles in Children with Autism Spectrum Disorders
Y. Granader, P. Isquith, R. Dudley, L. Kenworthy, 2015

Executive functioning in individuals with a history of ASDs who have achieved optimal outcomes

Eva Troyb[1], Michael Rosenthal[2], Inge-Marie Eigsti[1], Elizabeth Kelley[3], Katherine Tyson[1], Alyssa Orinstein[1], Marianne Barton[1], and Deborah Fein[1,4]

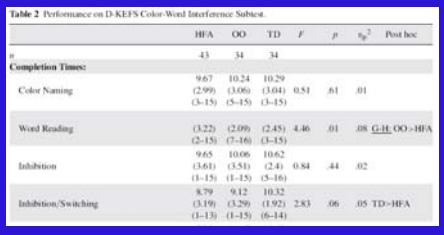


Table 2 Performance on D-KEFS Color-Word Interference Subtest.

	HFA	OO	TD	F	p	η_p^2	Post hoc
n	43	34	34				
Completion Times:							
Color Naming	9.67 (2.99) (3–15)	10.24 (3.06) (5–15)	10.29 (3.04) (3–15)	0.51	.61	.01	
Word Reading	(3.22) (2–15)	(2.09) (7–16)	(2.45) (3–15)	4.46	.01	.08	G-H: OO>HFA
Inhibition	9.65 (3.61) (1–15)	10.06 (3.51) (1–15)	10.62 (2.4) (5–16)	0.84	.44	.02	
Inhibition/Switching	8.79 (3.19) (1–13)	9.12 (3.29) (1–15)	10.32 (1.92) (6–14)	2.83	.06	.05	TD>HFA

Child Neuropsychology 2014

Table 3 Group Performance on the D-KEFS Verbal Fluency Subtest.

	HFA	OO	TD	*F*	*p*	η_p^2	Post hoc
n	43	34	34				
Primary Measures:							
Letter Fluency	10.23 (3.14) (5–17)	11.68 (3.53) (6–19)	11.00 (3.32) (6–19)	1.83	.17	.03	
Category Fluency	10.60 (3.79) (3–19)	12.44 (3.65) (5–19)	11.06 (2.95) (6–19)	2.72	.07	.05	OO > HFA ($p = .06$)
Category Switching – Total Correct Resp.	11.12 (3.16) (3–17)	10.94 (2.86) (6–17)	11.06 (3.35) (1–19)	0.03	.97	.01	
Category Switching – Accuracy	10.57 (3.12) (4–17)	10.74 (2.61) (5–16)	11.24 (3.07) (5–17)	0.50	.61	.01	
	10.05	9.24	9.91				

Troyb et al., 2014

Table 5 Group Performance on the BRIEF.

	HFA	OO	TD	*F*	*p*	η_p^2	Post Hoc
n	38	25	32				
Inhibit	62.13 (14.72) (42–94)	51.00 (10.10) (40–72)	45.63 (7.10) (37–72)	19.02	<.001	.32	G-H: HFA > TD, OO
Shift	69.24 (13.56) (41–95)	49.60 (9.45) (38–71)	42.94 (5.97) (36–61)	59.89	<.001	.59	G-H: HFA > OO > TD
Emotional Control	61.13 (11.53) (41–89)	48.56 (9.69) (37–76)	42.88 (8.31) (36–73)	30.23	<.001	.41	G-H: HFA > TD, OO
Initiate	60.68 (11.97) (39–86)	49.04 (9.74) (35–70)	45.59 (8.16) (35–63)	20.85	<.001	.31	HFA > TD, OO
Working Memory	62.50 (11.90) (40–90)	52.72 (12.30) (36–79)	45.19 (7.74) (36–63)	22.60	<.001	.36	G-H: HFA > OO > TD
Plan/Organize	60.78 (10.59) (41–80)	48.76 (11.22) (33–77)	45.97 (7.89) (33–63)	21.54	<.001	.33	HFA > TD, OO
Org. of Materials	57.03 (9.91) (36–72)	50.44 (8.53) (37–72)	47.78 (7.22) (37–63)	10.43	<.001	.19	HFA > TD, OO
Monitor	63.95 (8.83) (47–78)	49.32 (9.50) (27–66)	46.19 (9.68) (28–68)	36.23	<.001	.45	HFA > TD, OO

Troyb et al., 2014

Parent ratings more sensitive than performance tests

It is important to note that parent report of EF revealed considerably more differences in the performance of the HFA group as compared to the other two groups, than did direct testing of EF. This discrepancy may indicate that individuals with HFA are able to demonstrate age-appropriate EF tasks under optimal testing conditions, but show difficulty with these activities in everyday situations. This discrepancy may also reflect parental bias, in that parents of individuals with ASDs may over- or underreport current symptoms relative to their prior functioning. This study would have benefitted from the inclusion of a teacher's rating on the BRIEF in order to limit parental bias and to assess EF in school settings.

Troyb et al., 2014

Clinical Profiles: TBI

BRIEF Scale Profiles in Peds TBI

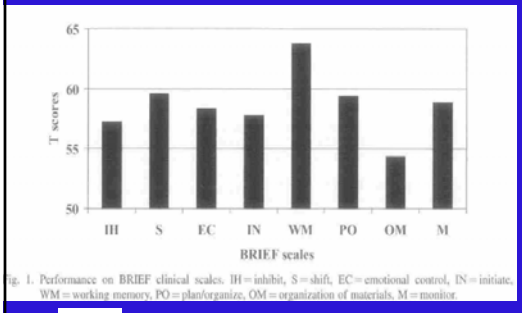


Fig. 1. Performance on BRIEF clinical scales. IH = inhibit, S = shift, EC = emotional control, IN = initiate, WM = working memory, PO = plan/organize, OM = organization of materials, M = monitor.

N = 48

Vriezen & Pigott, 2002, Child Neuropsychology

Neurobehavioral Measures in 10 Children with TBI at 12 Months post injury

TABLE 3. GROUP DIFFERENCES ON NEUROBEHAVIORAL MEASURES 12 MONTHS POST-INJURY

	TBI, mean (SD)	*OI, mean (SD)*	*p-Value*
DAS Verbal	96.0 (14.3)	98.7 (18.9)	NS
DAS Nonverbal	95.8 (15.9)	104.3 (19.0)	NS
DAS Spatial	93.4 (21.8)	101.3 (2.8)	NS
DAS General Cognitive Ability	94.5 (17.6)	101.1 (14.2)	NS
Bracken School Readiness Composite	100.9 (18.6)	108.2 (11.5)	NS
WJ Letter Word Identification	101.7 (15.8)	105.1 (13.5)	NS
WJ Applied Problems	100.2 (19.6)	104.7 (14.3)	NS
WJ Spelling	95.6 (18.3)	101.4 (10.1)	NS
CASL Pragmatics	102.7 (18.1)	104.9 (17.7)	NS
CBC Internalizing	52.1 (10.4)	45.5 (6.5)	NS
CBC Externalizing	**57.3 (9.0)**	**45.1 (7.6)**	**0.004**
BRIEF Global Executive Composite	**61.8 (10.1)**	**49.9 (11.1)**	**0.02**
Social Competence	**44.4 (12.4)**	**54.9 (6.9)**	**0.03**

Chertkoff Walz, Cecil, Wade, & Michaud, 2007, Journal of Neurotrauma

Neuroimaging Studies

Neuroimaging Correlates of BRIEF Working Memory Scale in Typically Developing Children (n = 35)

Table 3. Correlations between neuropsychological measures and volumetric MRI

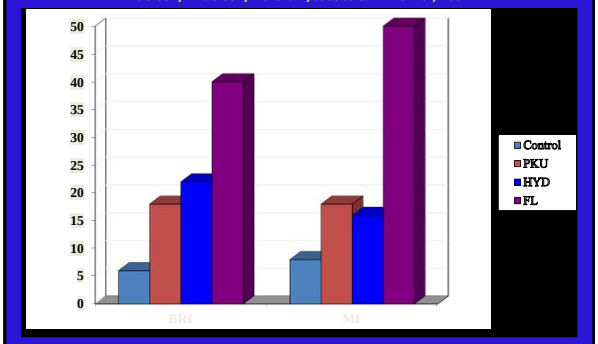
Variables	1	2	3	4
1. BRIEF Working Memory T-Score	—			
2. CBCL Anxious/Depressed T-Score	.207	—		
3. WJ-III Auditory Working Memory SS	−.279	.185	—	
4. WJ-III Spatial Working Memory SS	−.100	.043	.233	—
5. Frontal Gray	**−.463**	.035	.373	.143
6. Parietal Gray	−.216	−.132	.076	.019
7. Temporal Gray	.051	.197	.225	.087
8. Occipital Gray	.280	−.020	.041	.137
9. Frontal White	−.038	−.028	−.172	−.164
10. Parietal White	.051	−.170	−.336	−.209
11. Temporal White	.269	.026	−.297	.058
12. Occipital White	.385	.112	−.082	.085

Note. BRIEF = Behavior Rating Inventory of Executive Function; CBCL = Child Behavior Checklist; WJ-III, Woodcock Johnson III Auditory Working Memory Standard Score; SS = Standard Score. Lobar volumes are normalized to adjust for total cerebral volume. Rows 1–4 are zero-order correlations; rows 5–12 are partial correlations (correcting for age). The bolded value is $p < .01$ (two-tailed).

Mahone, Martin, Kates, Hay & Horska, 2009, JINS, 15, 31-41.

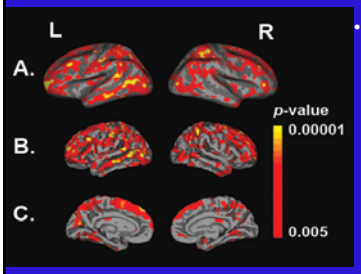
BRIEF Index Scores for Controls and Children with PKU, Hydrocephalus, and Frontal Lesions

Anderson, Anderson, Northam, Jacobs & Mikiewicz, 2002



Proportion of Children in Clinical Groups with T > 65

Diffuse Cortical Thinning Correlated with BRIEF Working Memory in Pediatric TBI



- WM correlated with:
  - Inferior temporal
  - Left fusiform
  - Superior parietal
  - Inferior Parietal

Merkley, Bigler, Wilde, McCauley, Hunter, & Levin, 2008, Journal of Neurotrauma

Behavior and corpus callosum morphology in 22q11.2 deletion syndrome

- Children with VCF had larger CC's than controls
- Children with VCF+ADHD had smaller splenium volumes than those with VCF only
- VCF+ADHD had higher BRIEF scores, $\eta^2 = .44$
- BRIEF scores correlated with splenium volume:
  - Composite r = -.70
  - Inhibit r = -.76

Antshel, Conchelos, Lanzetta, Fremont & Kates (2005). Psychiatry Research: Neuroimaging

Executive Function and DTI in Pediatric TBI

Wozniak, Krach, Ward, Mueller et al., 2007

- Examined Fractional Anisotropy (FA) in 14 children with mild-moderate TBI vs Controls
- Higher FA = better white matter organization
- Three regions: Inferior frontal, superior frontal, supracallosal
- FA was significantly lower in all three regions for children with TBI
- Compared FA with EF tests and ratings

Test	TBI	Control	*p*
WISC-IV FS IQ	109.93 (15.74)	113.29 (9.14)	.496
VCI	108.79 (20.02)	111.43 (15.36)	.698
PRI	113.00 (18.09)	112.50 (10.63)	.930
WMI	104.93 (15.33)	106.93 (13.47)	.717
PSI	100.36 (12.47)	109.00 (8.71)	.043*
WCST Errors (SS)	97.77 (18.40)	104.15 (16.54)	.361
FAS Total Score (z)	-0.701 (0.750)	-0.575 (0.755)	.662
Stroop interference (t)	51.50 (5.79)	55.79 (5.49)	.055
Trails-B (time)	61.69 (24.06)	50.94 (16.10)	.181
Tower of London—excess moves (*z-score)*	-0.120 (0.922)	0.740 (0.360)	.004*
Trails-A (time)	25.53 (8.14)	19.96 (3.89)	.030*

BRIEF Scale	TBI		Control		p
Emotional control	61.85	(10.07)	46.92	(8.03)	<0.001*
Inhibit	59.69	(8.57)	50.85	(9.93)	0.023*
Shift	58.69	(7.65)	49.77	(9.04)	0.012*
Initiate	60.77	(9.58)	49.23	(9.51)	0.005*
Monitor	63.46	(10.57)	47.31	(7.77)	<0.001*
Plan/organize	65.92	(11.51)	48.23	(10.18)	<0.001*
Organization of materials	56.38	(13.00)	52.31	(10.58)	0.389
Working memory	67.23	(8.96)	46.62	(7.90)	<0.001*

Executive Correlations with white matter integrity:

	Frontal	Supracallosal
• Tower of London	.40*	.52*
• Trials A time	-.58*	-.60*
• WISC-IV PSI	.24	.41*
• BRIEF Emotional Control	-.45*	-.53*

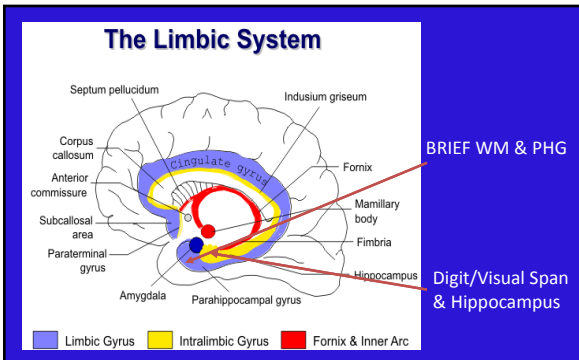
Neuroanatomical correlates of behavioral rating vs performance measures of working memory in typically developing children and adolescents

Faridi, Karama, Burgaleta, White, Evans, Fonov, Collins & Waber, NIH Brain Development Cooperative Group. (2014).

Method

- Longitudinial data from NIH MRI study
- N=347, 6-16 years, 54.3% girls
- Race, ethnicity, SES census matched
- Correlated lobar, amygdala, hippocampus, basal ganglia volumes with:
  - BRIEF WM EC INH scales
  - WISC-III Digit Span
  - CANTAB Spatial Working Memory

Faridi, Karama, Burgaleta, White, Evans, Fonov, Collins & Waber, NIH Brain Development Cooperative Group. (2014).



- Ratings and tests tap different substrate- be cautious with labels
- BRIEF WM reflects "momentary binding of items and context" in memory, thus may reflect episodic memory
- While not "working memory" per se, BRIEF WM captures important element of real world functioning not assessed on tests

Faridi, Karama, Burgaleta, White, Evans, Fonov, Collins & Waber, NIH Brain Development Cooperative Group. (2014).

Summary

- Executive function is a multimodal construct comprised of several executive functions
- Rating scales and performance tests are useful, but scales are more efficient/sensitive
- Rating scales can efficiently identify specific targets for intervention

Learning Executive Function 1965

Interventions: General Findings

REVIEW

Interventions Shown to Aid Executive Function Development in Children 4 to 12 Years Old

Adele Diamond[1]* and Kathleen Lee[1]

Diamond, A. & Lee, K. (2011) Science, 333

www.devcogneuro.com

Conclusions about interventions, programs, and approaches for improving executive functions that appear justified and those that, despite much hype, do not

Adele Diamond*, Daphne S. Ling

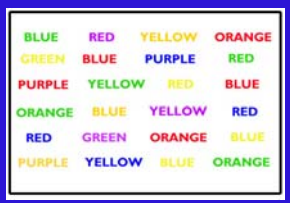
Developmental Cognitive Neuroscience 18 (2016) 34–48

Working Memory Training

- Most studied intervention
- Narrow Transfer: Gains do not generalize beyond WM
- Some evidence of gains in classroom
- Gains maintained at six months
- Gains more limited at 1 year

Inhibition Training

- More limited success
- No evidence of transfer beyond computer



Aerobics?

- People who are more physically active and fit have better executive functions
- Meta-analyses of aerobic exercise alone in older adults showed little to no EF benefits
- 2 of 3 studies in children found little to no EF change

Martial Arts Executive Training?

Martial arts training *with mindfulness* associated with improved attention, emotion regulation, and behavior regulation vs regular PE

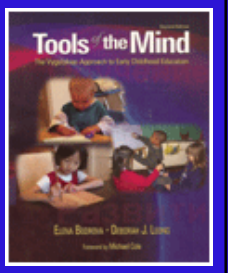
Yoga with *mindfulness* resulted in better EF

Physical /Cognitive Training

- Physical training alone did not improve EF
- Cognitive training with physical activity improved EF
  - Oswald et al., 2006; Moreau et al., 2015
- Few studies (no studies?) have examined EF benefits in sports with mindfulness

Tools of the Mind

- Preschool curriculum based on Vygotsky's notions of development
- Pretend play requires inhibition, flexibility, and working memory
- Children involved in Tools program showed better performance on range of EF tasks



- When "Tools" was used as an add-on, gains were limited and narrow
- When incorporated across the school day, gains were much larger and replicated
- BUT children with no EF risks showed minimal gains
- Children with low SES showed marked gains
  - Blair & Raver, 2014; Diamond et al., 2007

Take Aways:

- Direct EF training may improve an EF skill in isolation but transfer is narrow
- How an EF activity is presented is as important as the activity (i.e., coaching or mentoring)
- EF's need to be continually challenged
- Those with problems benefit more
- Training across the curriculum has greater benefit

Medication Intervention Studies using Rating Scale Measures

ADHD	Other
Biderman et al., 2011	Tourette's: Cummings et al., 2002
DuPaul et al., 2012	TBI: Beers et al., 2005
Findling et al., 2009	Depression: Roth et al., 2012; Madoo et al., 2014
Maziade et al., 2009	Hypertension (lande et al., 2010
Turgay et al., 2010	
Yange et al., 2011	

Journal of Attention Disorders
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Double-Blind, Placebo-Controlled, Crossover Study of the Efficacy and Safety of Lisdexamfetamine Dimesylate in College Students With ADHD

George J. DuPaul[1], Lisa L. Weyandt[2], Joseph S. Rossi[2], Brigid A. Vilardo[1], Sean M. O'Dell[1], Kristen M. Carson[1], Genevieve Verdi[2], and Anthony Swentosky[2]

Abstract

Objective: To evaluate stimulant medication on symptoms and functioning for college students with ADHD using double-blind, placebo-controlled, crossover design. **Method:** Participants included 24 college students with ADHD and 26 college students without psychopathology. Lisdexamfetamine dimesylate (LDX) was examined for ADHD participants over five weekly phases (no-drug baseline, placebo, 30-, 50-, and 70-mg LDX per day). Self-report rating scales of functioning and direct assessment of ADHD symptoms, verbal learning/memory, and adverse side effects were collected (baseline only for control students). **Results:** LDX was associated with large reductions in ADHD symptoms and improvement in executive functioning along with smaller effects for psychosocial functioning. Reduction in ADHD symptoms was found for 86.4% of participants; however, large differences in symptoms and executive functioning remained relative to controls. **Conclusion:** LDX is a safe, efficacious treatment for symptom relief in college students with ADHD. Research documenting medication effects on academic functioning and evaluating psychosocial/educational interventions is needed. *(J. of Att. Dis. 2012; 16(3) 202-220)*

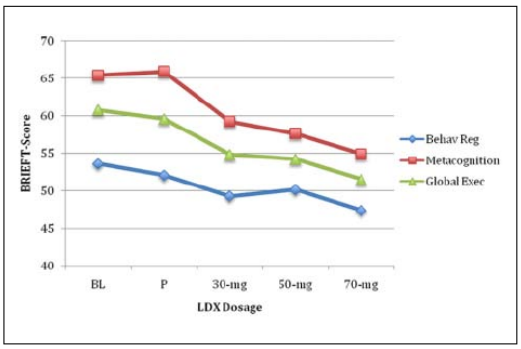


Figure 3. Self-report ratings of executive functioning across dosage conditions

DuPaul et al., 2012

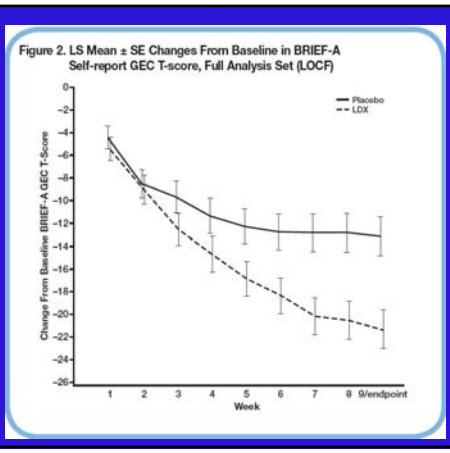
Effect of Lisdexamphetamine Dimesylate (Vyvanse) in Adults with Executive Dysfunction and Partial or Full remission of Major Depression

Table 1. Self-Report and Informant BRIEF-A GEC T-Scores and MADRS Total Scores Full Analysis Set (LOCF)

	LDX (n=71)	Placebo (n=72)
BRIEF-A Self-Report GEC T-score		
Baseline, mean ± SD	76.8±9.66	74.2±8.88
Endpoint, mean ± SD	55.2±16.15	61.4±14.61
LS mean (95% CI) reduction at endpoint	−21.2 (−24.5, −17.9)	−13.2 (−16.5, −9.9)
LS mean (95% CI) treatment difference	−8.0 (−12.7, −3.3) *P*=0.0009	
BRIEF-A Informant GEC T-Score		
Baseline, mean ± SD	63.9±10.81	63.1±11.01
Endpoint, mean ± SD*	54.8±11.85	59.6±10.71
LS mean (95% CI) reduction at endpoint	−9.3 (−11.6, −6.9)	−3.3 (−5.7, −1.0)
LS mean (95% CI) treatment difference	−5.9 (−9.3, −2.6) *P*=0.0006	
MADRS total score		
Baseline, mean ± SD	12.7±3.23	11.8±3.77
Endpoint, mean ± SD	7.6±6.28	8.9±5.67
LS mean (95% CI) reduction at endpoint	−5.0 (−6.3, −3.6)	−3.1 (−4.4, −1.8)
LS mean (95% CI) treatment difference	−1.9 (−3.7, 0.0) *P*=0.0465	

*Data are based on n=66 for LDX and n=67 for placebo.

Madhoo et al. (2014) *Neuropsychopharmacology*



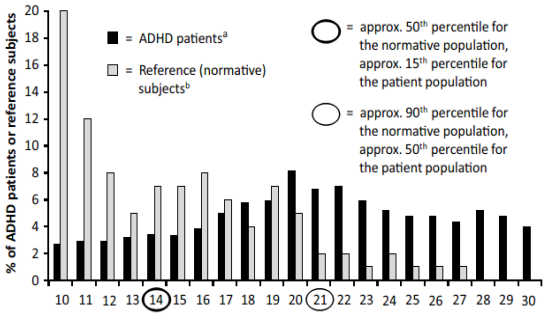
The effects of atomoxetine on emotional control in adults with ADHD: An integrated analysis of multicenter studies

P. Asherson [a,*], S. Stes [b,c], M. Nilsson Markhed [d], L. Berggren [e], P. Svanborg [f], A. Kutzelnigg [g], W. Deberdt [h]

- Emotional control recognized as a characteristic in ADHD for 100 years
- Thought to be associated with ADHD, but recent evidence suggests it may be a core symptom
- Treatment studies show emotional control responds to treatment for ADHD
- Integrated analysis of 2846 adults with ADHD treated with atomoxetine and 829 placebo controls in 10-12 week clinical studies

P. Asherson et al. / European Psychiatry 30 (2015) 511–520

BRIEF-A Emotional Control scores in ADHD vs Controls



Treatment effects in Atomoxetine vs Placebo

Table 4
Efficacy data: change from baseline to endpoint[a] in selected scales for the placebo-controlled population (LYDZ, LYEE studies), analyzed using ANCOVA.

	ATX	Placebo	*P*-value (ATX vs. placebo)
BRIEF-AS total: n	335	352	
Change from baseline, mean (95% CIs)	−21.63 (−24.20, −19.06)	−13.46 (−16.00, −10.92)	<0.0001
Effect size	0.34		
BRIEF-AS Emotional control: n	338	353	
Change from baseline, mean (95% CIs)	−2.37 (−2.81, −1.94)	−1.60 (−2.03, −1.18)	0.0128
Effect size	0.19		
BRIEF-AS Emotional control in patients with subscores > 20: n	142	141	
Change from baseline, mean (95% CIs)	−4.73 (−5.48, −3.97)	−3.31 (−4.07, −2.55)	0.0081
Effect size	0.32		

P. Asherson et al./European Psychiatry 30 (2015) 511–520

BRIEF-A EC Correlates with Change in ADHD Symptoms

Table 5
Correlations of changes from baseline to endpoint[a] between BRIEF-AS emotional control subscore and selected scales, for the overall population.

	Correlation coefficient (Spearman)	95% confidence intervals	*n*
CAARS-Self scores			
SV total	0.49	0.46, 0.52	2334
Hyperactive-impulsive	0.46	0.42, 0.49	2336
Inattentive	0.46	0.43, 0.49	2339
CAARS-Inv scores			
SV total	0.41	0.38, 0.45	2369
Hyperactive-impulsive	0.38	0.35, 0.42	2369
Inattentive	0.39	0.35, 0.42	2369
AAQoL total score	−0.54	−0.56,−0.51	2347

P. Asherson et al./European Psychiatry 30 (2015) 511–520

Non-medication interventions using Rating Scales as Outcome Measures

Liver transplant: Sorenson et al., 2011
Chemotherapy: Kesler et al., 2011; McDonald et al., 2013
Corticosteroids: Mrakostsky, 2012
Family Problem Solving; Wade et al., 2004, 2005
Cognitive Remediation: Beck et al., 2010; Hahn-Markowitz 2011, Toglia 2010
Flexibility in ASD: Kenworthy et al., 2014

A Cognitive-Behavior Therapy and Mentoring Program for College Students With ADHD

Arthur D. Anastopoulos and Kristen A. King, *University of North Carolina at Greensboro*

	1	2	3	4	5	6	7	8
ADHD Knowledge	Introduction to ACCESS What is ADHD?	What causes ADHD?	Assessment of ADHD	How does ADHD affect school? Does ADHD only affect school?	Depression, anxiety, and other things that may go with ADHD Sex, drugs, and ADHD	What medications are used to treat ADHD?	Is medication the only way to treat ADHD?	A look into the future
Behavioral Strategies	Accessing resources at UNCG	Choosing tools: using a planner and notebook	Getting organized	Getting the most from classes	Studying effectively	Taking exams Managing papers and long term projects	Healthy lifestyle Handling relationships	Setting long-term goals Maintaining your skills
Cognitive Therapy	What is cognitive therapy?	Recognizing maladaptive thinking	Replacing maladaptive thinking with adaptive thinking	How can adaptive thinking help me manage ADHD and improve my school work?	Dealing with emotions and resisting harmful temptations	Sticking with treatment	Improving relations with friends and family	An "adaptive thinking" look into the future Relapse Prevention

Figure 1. Session-by-Session Outline for Group Cognitive-Behavior Therapy Component of ACCESS.

Cognitive and Behavioral Practice 22 (2015) 141-151

Table 2
Results for Measures Assessing Functional Outcome

Measure	Pretreatment *M* (*SD*)	Posttreatment *M* (*SD*)	*t*	Cohen's *d*
CAARS-S:L				
Inattention	19.40 (4.52)	15.20 (4.71)	4.81*	0.76
Hyper–Imp	13.88 (6.23)	12.33 (5.74)	1.99**	0.31
Total	33.25 (8.73)	27.55 (8.77)	3.80*	0.60
BRIEF-A				
Metacognition	93.71 (9.25)	81.15 (14.36)	4.84*	0.86
Behavioral Regulation	62.26 (9.84)	54.59 (11.15)	4.29*	0.74
Global Executive	155.97 (15.14)	135.74 (22.37)	4.97*	0.88
BDI-II	17.24 (9.93)	14.74 (11.78)	1.54***	0.27
BAI	18.47 (11.95)	15.26 (9.77)	1.99**	0.35

Note. All *t* tests performed using raw scores; CAARS-S:L = Conners Adult ADHD Rating Scale, Self-Report, Long Version; Inattentive = DSM-IV inattentive symptoms; Hyper–Imp = DSM-IV hyperactive–impulsive symptoms; Total = DSM-IV ADHD symptom total; BRIEF-A = Behavior Rating Inventory of Executive Function–Adult Version; BDI-II = Beck Depression Inventory–II; BAI = Beck Anxiety Inventory.
* $p < .001$; ** $p < .06$; *** $p < .15$.

Cognitive and Behavioral Practice 22 (2015) 141-151

N=43

The effects of problem-solving skills training based on metacognitive principles for children with acquired brain injury attending mainstream schools: a controlled clinical trial D. Y. K. CHAN[1,2] & K. N. K. FONG[2]

- 16 children with mod-severe TBI
- 16 non-injured children
- Participated in problem solving skills training to teach metacognitive awareness and problem solving

Disability and Rehabilitation, 2011; 33(21–22): 2023–2032

Table I. Summary of problem-solving skills training programme.

Session	Theme	Heuristics	Examples of activity
1	Paying attention	1. Minimise environmental distraction 2. Maintain attention through different sensory inputs, e.g. auditory, visual	1. Warm-up games (introducing each other) 2. Vigilance exercises, e.g. cancellation exercises 3. Home exercises – writing down their problems in real-life 4. Self-evaluation
2	Remembering and organising	1. Association 2. Grouping 3. Categorisation	1. Review of previous session 2. What's wrong? (picture card games in daily life) 3. Classifying daily objects into groups 4. Association pictures, e.g. wood/furniture, tram/ferry, ruler/watch 5. Self-evaluation 6. Home exercises – categorising daily objects at home
3 and 4	Defining the problem, gathering information and goals setting	1. Problem documentation 2. Note taking	1. Review of previous sessions 2. Treasure hunts 3. Recording information exercises, e.g. shopping in the supermarket to facilitate grouping, association and categorisation 4. Role playing: 'I am a little teacher' (identifying problems for students) 5. Reading newspapers and picking up relevant information 6. Group and self-evaluation 7. Homes exercises – identifying the scenarios behind their real-life problems

Disability and Rehabilitation, 2011; 33(21–22): 2023–2032

5 and 6	Planning	1. Brainstorming 2. Think aloud 3. Means-end analysis	1. Review of previous sessions 2. Role playing: 'Being a salesman' (employing the brainstorming strategy) 3. Role playing: 'I am a detective' (employing the means-end analysis) 4. Group and self-evaluation 5. Home exercises – brainstorming solutions when they face different problems
7–10	Representing the problem	1. Visual imagery 2. Flow chart 3. Mind mapping 4. Time estimation	1. Review of previous sessions 2. 'Pictionary' game 3. Chocolate factory manufacturing line (employing the mind-mapping technique) 4. Time estimation – to make their bed and desktop 5. Planning a final group project 6. Group and self-evaluation 7. Home exercises – focussing on mind mapping and time estimation
11 and 12	Monitoring	1. Forward and backward chaining 2. Error prediction and goals checking 3. Repetition and error finding 4. Recognising limitation	1. Review of previous sessions 2. Debating (making arguments and conclusive statements) 3. Planning for a graduation ceremony (involving in organising an event and role playing) 4. Group and self-evaluation 5. Home exercises – revision of all metacomponents

Disability and Rehabilitation, 2011; 33(21–22): 2023–2032

Table III. Comparison of groups in post-test scores of dependent variables.

Dependent variable		Experimental group ($n = 16$) Mean (SD)	Comparison group ($n = 16$) Mean (SD)	p
TONI-3	Post-test	36.94 (3.73)	21.94 (6.02)	0.000*
	Change	11.69 (7.51)	0.94 (1.95)	
BRIEF	Post-test	51.94 (3.87)	69.69 (16.44)	0.000*
	Change	−15.62 (5.34)	0.75 (2.32)	
COPM – performance				
Child's perspective	Post-test	22.88 (3.26)	15.38 (4.43)	0.000*
	Change	7.62 (2.75)	0.25 (0.86)	
Parent's perspective	Post-test	21.13 (2.71)	11.75 (4.37)	0.000*
	Change	8.38 (6.60)	0.00 (0.00)	

Disability and Rehabilitation, 2011; 33(21–22): 2023–2032

Improving School Readiness in Preschoolers with Behavior Problems: Results from a Summer Treatment Program

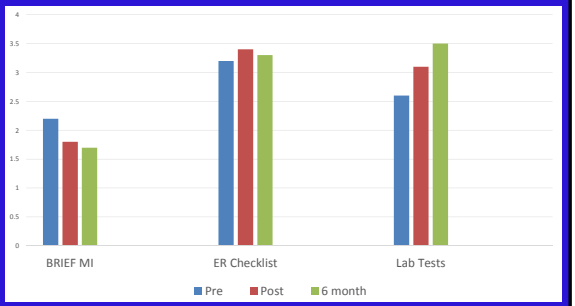
Paulo A. Graziano · Janine Slavec · Katie Hart · Alexis Garcia · William E. Pelham Jr.

J Psychopathol Behav Assess
DOI 10.1007/s10862-014-9418-1

Well designed feasibility study with:

- 30 preschooler aged 4-6 years
- At risk or significant behavior/emotional problems
- 8 week summer intensive program:
  - Parent behavior management training
  - Behavior modification
  - School readiness
  - Social-emotional and self-regulation training

Change in EF and ER with Intervention



Note: Decreased BRIEF scores and Increased Lab scores = improvement
Increased ER Checklist scores = improved functioning

A Collaborative Problem-Solving Model of Everyday Executive Function Intervention

- Knowledge Base
- Settings
- Delivery System
- Tool Kit

Inspired by Mark Ylvisaker & Tim Feeney

Knowledge Base

- Operational Definitions of EF
- Clinical Profiles
- Assess executive functions

Settings: Where to Intervene?

- Home
- School
- Community (Job, sports, theater, peers)

Delivery: Who Intervenes?

- Key Personnel: Mentor/ coach/ co-conductor
- "With" not "for"
- External to internal

Tool Kit

- Targeted Functional Domains
- Strategies
- Scripts/ Routines

EF Intervention
General Principles

- Teach goal-directed problem-solving process,
- within everyday meaningful routines,
- having real-world relevance and application,
- using key people as models & "coaches"

Based on the work of Mark Ylvisaker & Tim Feeney

Goal-Plan-Do-Review

COACHING

Intervention strategy in which a "coach" (adult or peer) works with a student to set goals (long-term, short-term, daily) designed to enhance executive skills and lead to improved self-regulation.

Dawson, P. Guare, R. (2012). Coaching Students with Executive Skills Deficits, Guilford Press

Key Components of Coaching

- Goal-setting (long, short-term)
- Correspondence training
- Coach in daily goal-oriented plans
- Teach students self-management

Goal-Setting

Evidence shows that individuals who set goals are more likely to achieve higher levels of performance.

Have student set goals

Correspondence Training

Correspondence training is based on evidence that individuals who make a verbal commitment are more likely to follow through.

Have students verbally state goals

Meet with students to make daily plans linked to their goals.

Basic Format: R.E.A.P.

Review: go over plans from previous session to determine if carried out

Evaluate: Did the student carry out plan? If not, why not?

Anticipate: Plan tasks to accomplish today--review upcoming tests, assignments.

Plan: Have the student identify when he plans to do each task and *how* he plans to do each task.

Change in grades with coaching

	A-B	C-D
Before coaching	19	81
During coaching	63	37

Chi Square = 39.41, p < .001

Family Problem-Solving Therapy for Adolescents with TBI

- Structured development of a realistic and optimistic approach to address problems
- Parents and teens collaborate in defining a problem and identifying solutions
- Provides a problem-solving heuristic to address executive dysfunction following TBI

Kurowski, Wade, Kirkwood, Brown, Stancin & Taylor. (2013). Online problem-solving therapy for executive dysfunction after child traumatic brain injury. Pediatrics, 132(1), doi:http://dx.doi.org/10.1542/peds.2012-4040

Online Counselor Assisted Problem Solving (CAPS)

- 7 sessions address common consequences of TBI using a problem solving framework.
- Training in problem-solving and communication skills to address family/ teen-identified goals.
- Initial session face-to-face in family's home.
- All sessions include online module and videoconference with psychologist.

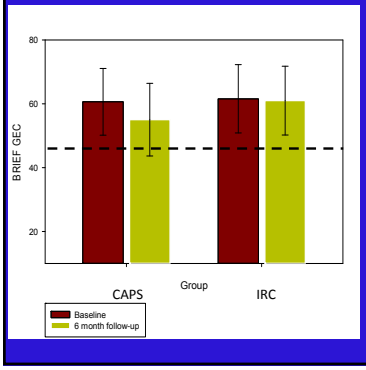
The CAPS Intervention

- 7 core sessions
  - Face-to-face introduction/overview
  - Staying Positive
  - Solving Problems
  - Dealing with Cognitive Challenges
  - Staying in Control
  - Handling Crises
  - Planning for the Future

Study Design

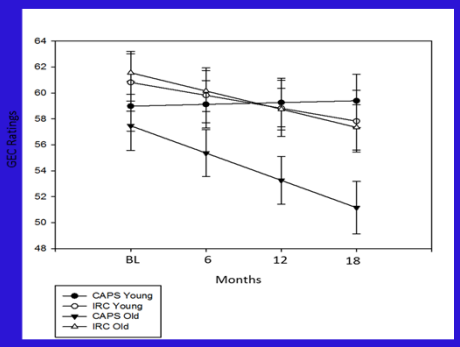
- Randomized Controlled Trial, single blind
- Multicenter cross-section study
- CAPS group (57) had web /videoconference intervention.
- Control group (63) had internet resources regarding TBI (Internet Resource Comparison; IRC)
- All received computers and high speed internet access
- Evaluators were naïve to group assignment (single blind)
- Average age at injury 14.5 years, 3.6 months post injury
- Mean GCS 10.05; 40% with severe TBI
- Outcome Measure: BRIEF

Post-Intervention in Older Adolescents



- GEC mean change **CAPS -4.78**, IRC -0.86 (F=6.74, p=0.01)
- Similar results for BRI and MI subscales in older adolescents (High school age)
- No significant differences in CAPS and IRC in the entire sample or younger teens

Longitudinal Results

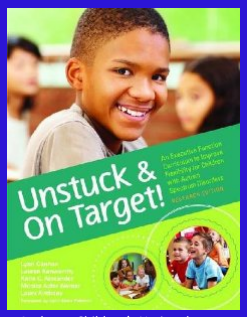


Kurowski et al., 2014 *JAMA Pediatrics*

Conclusion

- CAPS improved executive function immediately post-intervention
- benefits maintained up to 12 months in older adolescents
- Large, randomized controlled treatment trials for pediatric TBI demonstrating efficacy of an online problem solving intervention for management of executive dysfunction
- Utilization of the CAPS intervention clinically should be considered

Real-World Collaborative Problem-Solving Intervention for EF in ASD



Lauren Kenworthy & Laura Anthony, Children's National

Unstuck Philosophy: Principles of Remediation

1. Teach by Doing—Coaching Model: Support, Fade, Generalize
2. Talk Less—Self-regulatory scripts
3. Be consistent
4. Provide visual cues
5. Collaborate, use humor, have fun

Ylvisaker & Feeny, 1998; Feeny & Ylvisaker, 2008

Unstuck and On Target!

Introduction	• Guide to Using This Manual
Topic 1	• The Meaning of Flexibility
Topic 2	• Cognitive Flexibility Defined
Topic 3	• Coping Strategies
Topic 4	• Personal Heroes
Topic 5	• Why Be Flexible?
Topic 6	• Your Goals: Getting What You Want
Topic 7	• Scripts for How to Be Flexible
Topic 8	• Journey to Target Island
Topic 9	• Being Flexible Makes You a Good Friend
Topic 10	• Flexible Futures

Flexible	• Flexible is stronger • If I am flexible, more good things happen for me
Unstuck	• I'm getting stuck on ___, how can I get unstuck?
Compromise	• Let's compromise so we both get some of what we want
Whim/On Target	• Is this a whim, or are we on target? • What is our target goal?
Plan A/Plan B	• What is our plan? • What is our Plan B?
Big Deal/Little Deal	• Is this a big deal or a little deal? • How can we make this big deal into a little deal?
Choice/No Choice	• Do we have a choice about this? • Is this a no choice situation?

Flexible	• Flexible is stronger • If I am flexible, more good things happen for me
Unstuck	• I'm getting stuck on ___, how can I get unstuck?
Compromise	• Let's compromise so we both get some of what we want
Whim/On Target	• Is this a whim, or are we on target? • What is our target goal?
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Big Deal/Little Deal	• Is this a big deal or a little deal? • How can we make this big deal into a little deal?
Choice/No Choice	• Do we have a choice about this? • Is this a no choice situation?

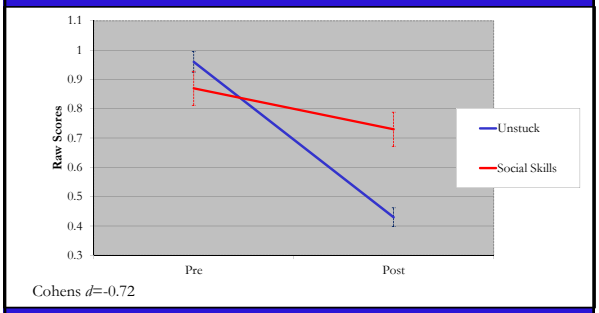
Goal What do we want to do? → **Plan** How will we do it? → **Do** Let's try our plan → **Check** How did it work?

"Real World," Well-Matched Methods

- 67 3rd-5th grade children in 14 schools randomized
- Children met full criteria for diagnosis and were already receiving services
- Existing school staff led interventions
- Interventions matched on number of sessions (28) and training:
  - Interventionists: Manual, 7 training sessions, 2 fidelity observations with feedback
  - Parents: Manual, 2 training sessions, visual supports
  - Mainstream Teachers: 1 training session, visual supports

Mean Challenge Task Flexibility

Higher score = Less flexible

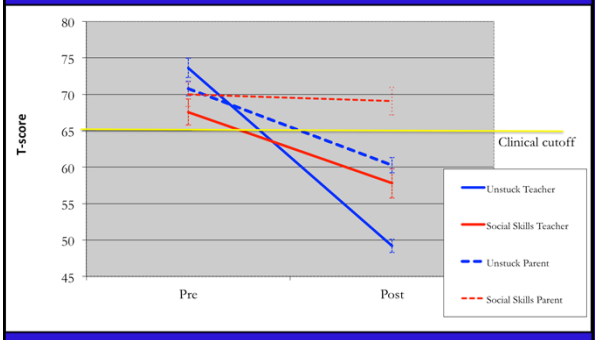


Cohens *d*=-0.72

Kenworthy & Anthony et al, 2014

Parent & Teacher BRIEF Shift

Higher score = Less flexible



Parent Cohen's *d*=-0.64; Teacher Cohen's *d*=-0.89

Progress Monitoring

Progress Monitoring

- Tracking and monitoring of student progress toward an academic, behavioral, or social-emotional goal
- Quantifying progress
- Allows adjustment of goals and interventions
- Assists the determination of goal attainment

Realistically, a progress monitoring tool should contain/ take:

- 5 items / less than 1 minute
- 10 items / 1-2 minutes
- 15 items / 2-3 minutes
- 20 items / 3-4 minutes
- 30 items / 5 minutes

Monitoring the Executive Functions

Development of the Concussion Monitor version

Need

- Impairment in the executive functions have been established in moderate-severe TBI
- Everyday manifestations of EF have been demonstrated (Gioia, Isquith & Kenworthy, 2010)
- Evidence exists that specific executive functions may also be impaired in mild TBI
- Need for a tool to monitor recovery progress, which changes relatively quickly

Development Process

- Five neuropsychologists with clinical experience with concussion symptomatology reviewed the 86-item BRIEF Parent form and 80-item Self-Report forms
- 1- SCALES: Selected the scales most likely to capture acute problems following concussion.
  - Working Memory
  - Planning/Organization
  - Task Completion (self-report)
  - Initiation (parent report)
  - Emotional Control
  - (Inhibition)

Development

- 2 - ITEMS: clinicians provided independent ratings of each item's likely association with concussion effects
- Ratings 0 (not likely), 1 (likely), 2 (highly likely)
- Individual items were retained based on expert consensus
- Item pool reduced to remove items with very similar content

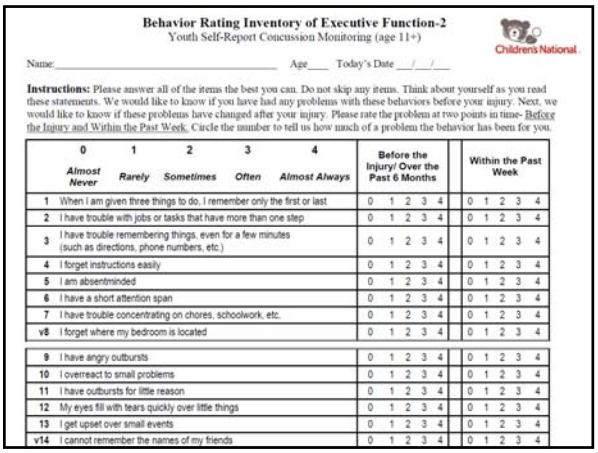
Development

RESULTS

- Parent concussion monitoring included
  - 31 items for children aged 5-18 years
  - BRIEF2: 23 items (8 trimmed out)
- Self-report concussion monitoring included
  - 28 items for adolescents aged 11-18 years
  - BRIEF2: 22 items (6 items trimmed out)

Development

- 3 - SCALING: Five-point dimensional scale (ranging from "almost never a problem" to "almost always a problem")
- 4 - SYMPTOM VALIDITY: Three symptom validity items of likely low endorsement (i.e., forgets where bedroom is located, cannot remember friends' names, has difficulty chewing food) were added to each form
- 5 - PRE-EVENT: The forms ask for retrospective pre-injury ratings alongside ratings of current (past week) post-injury functioning



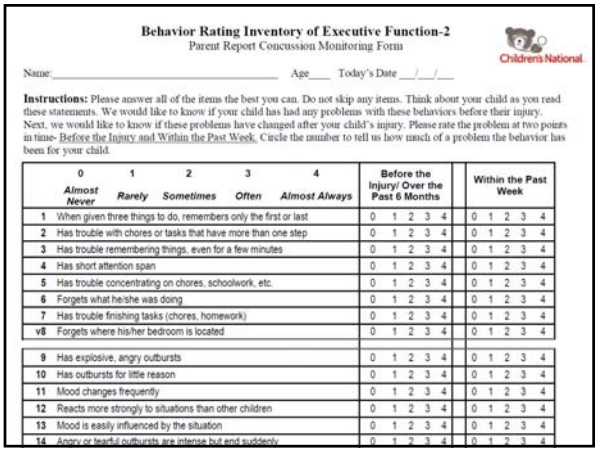
Behavior Rating Inventory of Executive Function-2
Youth Self-Report Concussion Monitoring (age 11+)

Children's National

Name:_____ Age____ Today's Date __/__/__

Instructions: Please answer all of the items the best you can. Do not skip any items. Think about yourself as you read these statements. We would like to know if you have had any problems with these behaviors before your injury. Next, we would like to know if these problems have changed after your injury. Please rate the problem at two points in time- Before the Injury and Within the Past Week. Circle the number to tell us how much of a problem the behavior has been for you.

	0 Almost Never	1 Rarely	2 Sometimes	3 Often	4 Almost Always	Before the Injury/ Over the Past 6 Months	Within the Past Week
1	When I am given three things to do, I remember only the first or last					0 1 2 3 4	0 1 2 3 4
2	I have trouble with jobs or tasks that have more than one step					0 1 2 3 4	0 1 2 3 4
3	I have trouble remembering things, even for a few minutes (such as directions, phone numbers, etc.)					0 1 2 3 4	0 1 2 3 4
4	I forget instructions easily					0 1 2 3 4	0 1 2 3 4
5	I am absentminded					0 1 2 3 4	0 1 2 3 4
6	I have a short attention span					0 1 2 3 4	0 1 2 3 4
7	I have trouble concentrating on chores, schoolwork, etc.					0 1 2 3 4	0 1 2 3 4
v8	I forget where my bedroom is located					0 1 2 3 4	0 1 2 3 4
9	I have angry outbursts					0 1 2 3 4	0 1 2 3 4
10	I overreact to small problems					0 1 2 3 4	0 1 2 3 4
11	I have outbursts for little reason					0 1 2 3 4	0 1 2 3 4
12	My eyes fill with tears quickly over little things					0 1 2 3 4	0 1 2 3 4
13	I get upset over small events					0 1 2 3 4	0 1 2 3 4
v14	I cannot remember the names of my friends					0 1 2 3 4	0 1 2 3 4



Behavior Rating Inventory of Executive Function-2
Parent Report Concussion Monitoring Form

Children's National

Name:_____ Age____ Today's Date __/__/__

Instructions: Please answer all of the items the best you can. Do not skip any items. Think about your child as you read these statements. We would like to know if your child has had any problems with these behaviors before their injury. Next, we would like to know if these problems have changed after your child's injury. Please rate the problem at two points in time- Before the Injury and Within the Past Week. Circle the number to tell us how much of a problem the behavior has been for your child.

	0 Almost Never	1 Rarely	2 Sometimes	3 Often	4 Almost Always	Before the Injury/ Over the Past 6 Months	Within the Past Week
1	When given three things to do, remembers only the first or last					0 1 2 3 4	0 1 2 3 4
2	Has trouble with chores or tasks that have more than one step					0 1 2 3 4	0 1 2 3 4
3	Has trouble remembering things, even for a few minutes					0 1 2 3 4	0 1 2 3 4
4	Has short attention span					0 1 2 3 4	0 1 2 3 4
5	Has trouble concentrating on chores, schoolwork, etc.					0 1 2 3 4	0 1 2 3 4
6	Forgets what he/she was doing					0 1 2 3 4	0 1 2 3 4
7	Has trouble finishing tasks (chores, homework)					0 1 2 3 4	0 1 2 3 4
v8	Forgets where his/her bedroom is located					0 1 2 3 4	0 1 2 3 4
9	Has explosive, angry outbursts					0 1 2 3 4	0 1 2 3 4
10	Has outbursts for little reason					0 1 2 3 4	0 1 2 3 4
11	Mood changes frequently					0 1 2 3 4	0 1 2 3 4
12	Reacts more strongly to situations than other children					0 1 2 3 4	0 1 2 3 4
13	Mood is easily influenced by the situation					0 1 2 3 4	0 1 2 3 4
14	Angry or tearful outbursts are intense but end suddenly					0 1 2 3 4	0 1 2 3 4

Scale Structure

3-factor model assessed

- Emotion (i.e., Emotional Control)
- Behavior (i.e., Inhibition) Regulation
- Cognitive Regulation: Working Memory, Planning/ Organization, Task Completion (or Initiation) items loaded
- The absolute fit of each model examined using the normed chi-square ($\chi 2/df$), comparative fit index (CFI), standardized root mean square residual (SRMR), and root mean square error of approximation (RMSEA).
- Indicators of adequate model fit included normed chi-square value less than 3, CFI greater than .90, and SRMR and upper end of the 90% RMSEA confidence interval less than .10 (Kline, 2004, 2010).

28-item self-report

- Post-injury ratings (n = 497)
- Suggested cutoffs were met on three metrics (CFI = .90; SRMR = .05, RMSEA 90% CI = .07 to .08), near desired range on the chi-square measure ($\chi 2/df = 3.9$)
- Similar results found for pre-injury symptoms (n = 519; $\chi 2/df = 3.9$, CFI = .88, SRMR = .06, RMSEA 90% CI = .07 to .08)

Self-Report

- All factor loadings were strong for items within each factor (see Table 1)
- Working Memory, Task Completion, and Planning/ Organization scales were significantly correlated (pre-injury r = .54 to .69; post-injury r = .63 to .75), each contributed highly to the higher-order Cognitive Regulation Factor.
- Moderate correlations were found between the Cognitive, Emotion, and Behavior Regulation Factors (pre-injury r = .38 to .56; post-injury r = .36 to .51).
- Overall model fit was determined to be acceptable and no additional changes were made.

31-item parent report

- Two items were dropped from the Initiation scale due to low standardized factor loadings (< .50).
- Subsequent analyses conducted with 29-items, resulting in improved model fit.
- Pre- (n = 613) and post-injury (n = 578) symptom reports yielded similar estimates of model fit.
- Normed chi-square values were greater than recommended ($\chi 2/df$ = 4.7 at pre-injury and 4.5 at post-injury)
- Model fit otherwise within desired ranges (CFI = .91, SRMR = .05, RMSEA 90% CI = .07 to .08 at pre- and post-injury).

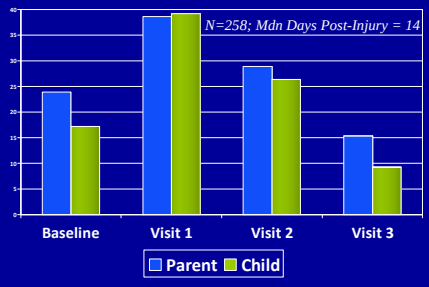
Parent Report

- Each item loaded strongly onto the corresponding factor
- Factor loadings were high for Cognitive Regulation Factor
- Strong correlations found between Cognitive Regulation subscales (i.e., Working Memory, Planning/Organization, Initiate; pre-injury r = .61 to .83; post-injury r = .59 to .63)
- Moderate correlations between the Cognitive, Emotion, and Behavior Regulation Factors (pre-injury r = .49 to .56; post-injury r = .43 to .53).

Reliability

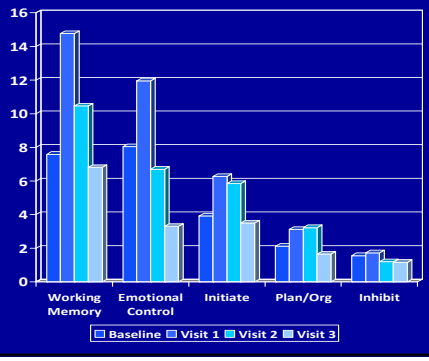
- Internal consistency estimates: high for both pre- and post-injury ratings.
- Cronbach's alpha for each factor
  - Self-report range = .78 to .95
  - Parent report range = .86 to .95
- Test-retest reliability (Pre-Injury ratings)
  - Pearson's r & ICC (two-way mixed, single measure, consistency)
  - Total and factor scores for pre-injury symptoms for total sample, demonstrating moderate to good reliability
    - Self-report (ICC = .58 to .75, *r* = .61 to .77)
    - Parent (ICC = .70 to .85, *r* = .70 to .83) forms
  - Split retrospective timing (<13 days, ≥13 days) – similar stability

BRIEF Concussion Monitoring
Mild TBI Total Scores at Serial Visits

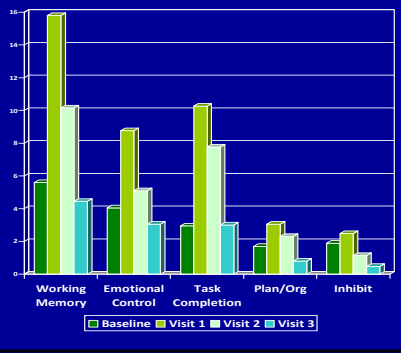


*All contrasts significantly different from the prior visit at p<.01

Parent Concussion Monitoring
Mild TBI Sub-Scales Across Visits



Child Concussion Monitoring
Mild TBI Sub-Scales Across Visits



Summary

- EF meets both unitary and diversity criteria as a construct
- Assessment: multiple modalities, evidenced based interpretation assists clinical decisions
- Clinical relevance of EFs demonstrated across many different human conditions
- Treatment/ intervention applications growing
- Monitoring of progress tied to interventions emerging to guide treatment process.