

Screening for Executive Functioning in Preschoolers



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Students at the University of Waterloo created this product while being trained in the systematic review methods of Knowledge Impact Strategies. Authors are listed in alphabetical order.

Knowledge  Impact
strategies

Screening for Executive Functioning in Preschoolers

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Take Home Message

- BRIEF is best – the BRIEF and BRIEF-P appear to be the most widely used tool both internationally and in Canada for assessing executive functioning skills in preschoolers
- After the BRIEF, the WISC, WPPSI, CBCL and PPVT were the most frequently studied screening tools for executive functioning
- Subcomponents of executive functioning skills develop separately. Specific measures such as the BRIEF(-P) which isolate different subcomponents of executive functioning produce the most accurate results
- Certain subpopulations such as preschoolers from low-income families may require modified executive functioning tasks
- Measures which assess multiple subcomponents of executive functioning are the most in-depth, though less cost-effective, option

Overview

This project was completed during the Winter 2013 term by students in an upper-level Psychology course, *Community-Based Research*, at the University of Waterloo. The students were: Karam Khayata (Psychology), Jacklyn Koyama (Psychology), Melissa Subnath (Applied Health Studies), and Jang Tsai (Psychology). They were assisted by the course instructor Dr. Kathleen Bloom and teaching assistant Laura Snyder. The community partner organization for this project was Infant and Child Development Services (ICDS) Peel. Its partnership with the University was coordinated by Lorna Montgomery, Manager at ICDS Peel. Lorna Montgomery identified topics of interest and worked with the instructor to clarify and determine the feasibility of the review prior to the start of the course. Throughout the course, she answered questions online and also offered comments and insights during a classroom presentation of the final results.

Infant and Child Development Services (ICDS) Peel is an organization that provides services and resources for families of children diagnosed as developmentally delayed or at risk for developmental delays. Factors such as prenatal health, premature birth or lack of parental support may put a child at risk of being developmentally delayed, and have all been associated with deficits in executive functioning. Being able to screen for executive functioning abilities in preschool aged children allows ICDS Peel to provide interventions as early as possible in hopes of attaining the best possible results for these children's futures.

Executive function (EF) is a cognitive skill-set with elements related to anticipation and deployment of attention, impulse control and self-regulation, working memory and mental flexibility. These executive processes develop throughout childhood and have been linked to academic performance, as well as emotional, behavioural, and social functioning. There is a wide variability in child cognitive development; for those at risk for later problems at school, it is ideal that they are identified as early as possible.

What Was Studied?

Research on screening reported in peer-reviewed journals published from 2012-2013 was reviewed using systematic methods. The research question asked: “What does the recent research say are the most psychometrically sound assessments and screening tools for executive functioning in preschool children? Have any new tests for executive functioning been developed?”

How Was It Studied?

The review was conducted between January-April 2013. A search strategy was run through the Scopus database, limited to those articles published after 2009. Evidence was limited to peer-reviewed journal articles.

The search strategy was:

(TITLE-ABS-KEY(executive funct*) AND TITLE-ABS-KEY(preschoo*) AND TITLE-ABS-KEY(psychometric OR rating OR inventory OR scale OR assessment OR tool)) AND (LIMIT-TO(PUBYEAR > 2009)

- The search was conducted on January 22, 2013
- **226** total hits

Articles that met the following criteria were excluded from the review:

- Not published in English
- Not conducted with humans
- Referred only to research on language proficiency
- Did not include children 5 years old and under
- Did not refer to cognition

Because the remaining number of articles exceeded the number that could be read and coded within the remaining weeks of the 12-week undergraduate class, only articles published between 2012 and 2013 were included.

- **168** articles were excluded

- 58 articles remained

Some of the remaining 58 articles did not focus sufficiently on executive functioning. Therefore, a second filtering process was used that required articles to examine at least one subcomponent of executive functioning. The filtering process was applied to article titles, abstracts, and key words. A “Find” function (Ctrl-F) was conducted for the root of 7 EF terms, in order to account for all variations:

Executive Functioning Subcomponent	Search Term
Psychometrics/psychometry	psychomet
Flexibility/flexible	flexib
Inhibit/inhibition	inhib
Memory/memories	memor
Shift	shift
Plan	plan
Attention/attend	atten

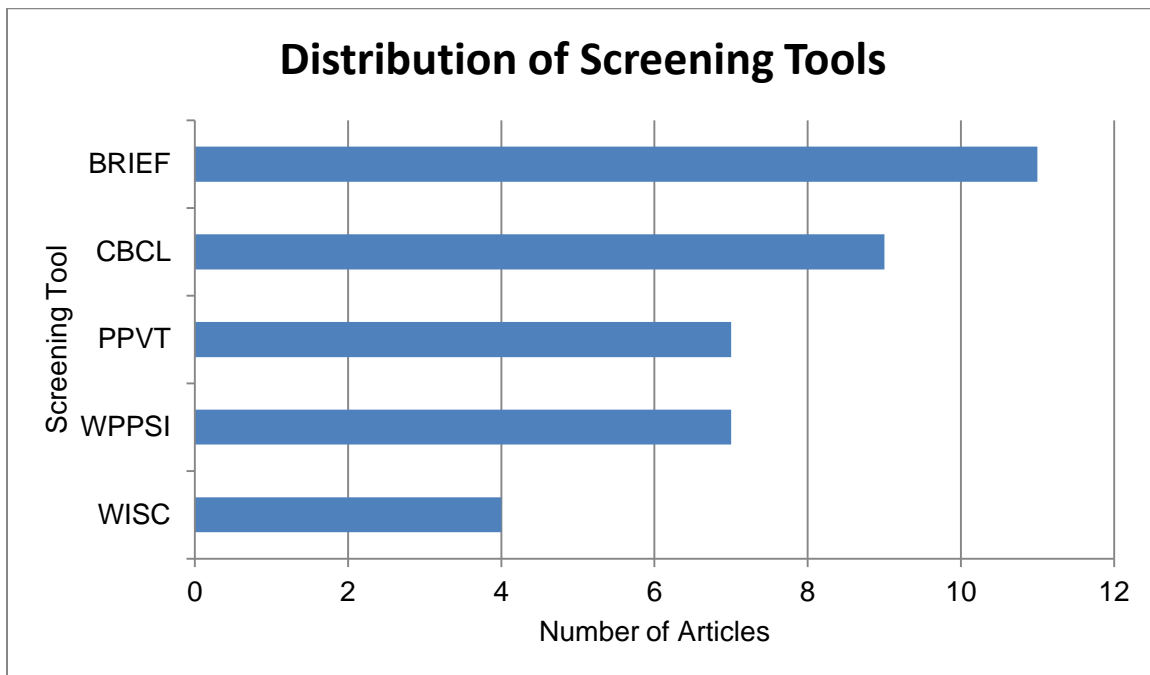
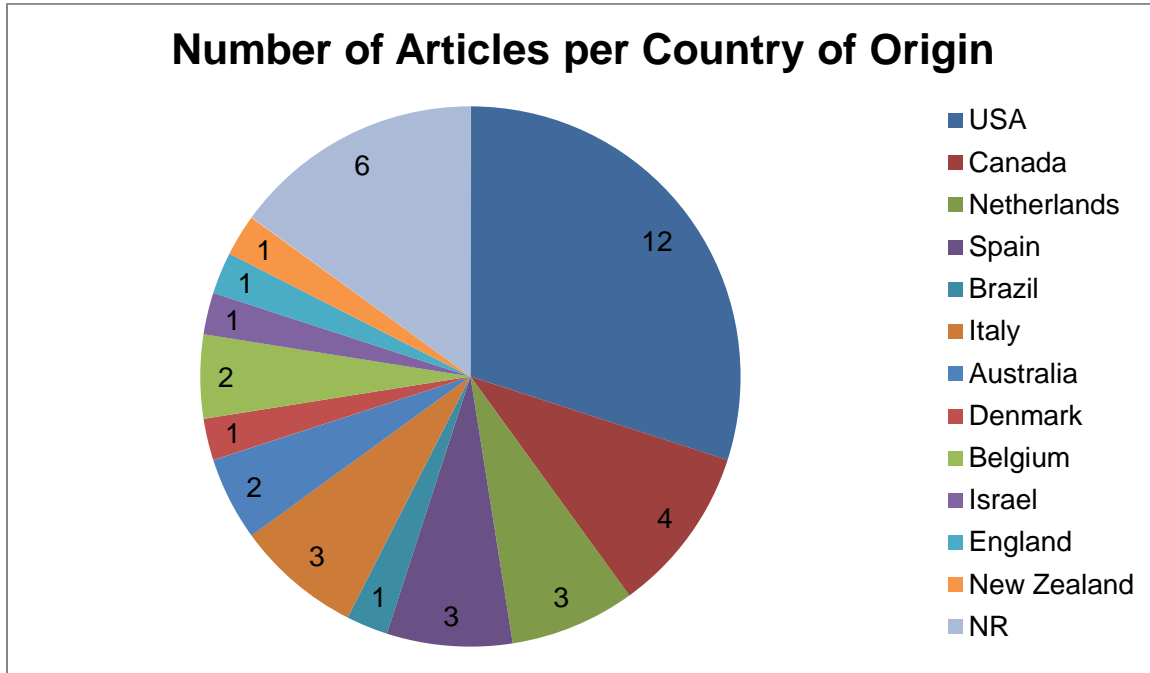
The filtering process resulted in 41 relevant articles. One article could not be obtained for review. The final review included 40 articles.

To assess reliability and quality control of data extraction, 12 articles were independently coded by two students each. No discrepancies were found between the students’ understanding and application of the coding categories.

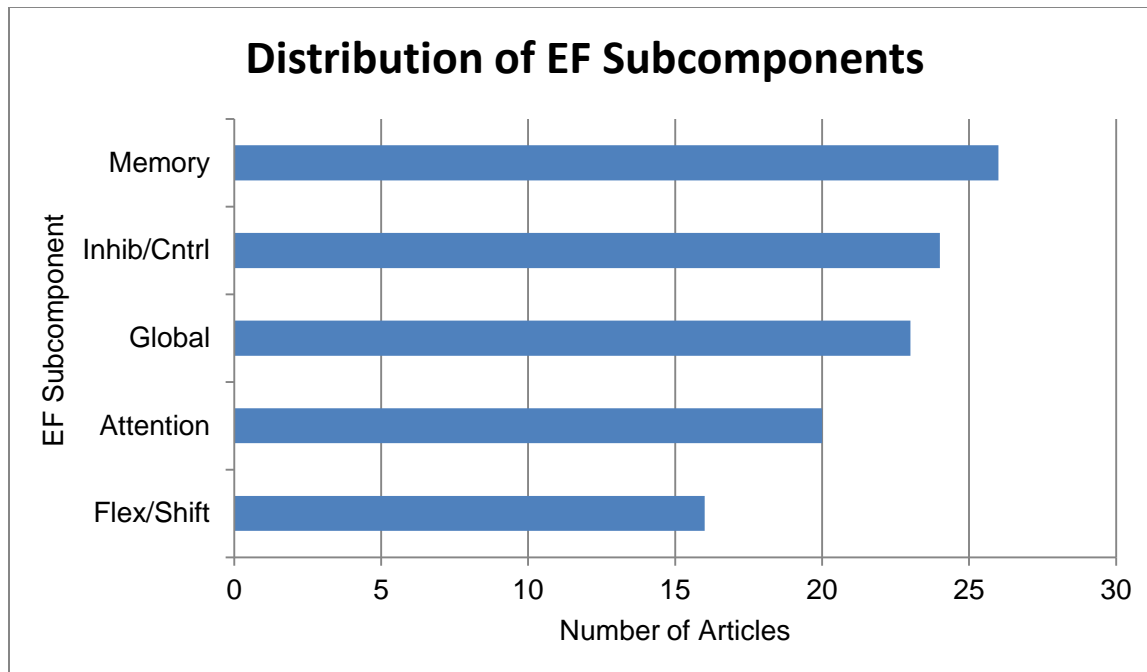
Highlights of Results

- 25 articles (62.5%) used one of the 5 most popular tools (BRIEF, WISC, WPPSI, CBCL, PPVT)
- No studies conducted with Canadian or Scandinavian populations reported norms
- Not all assessments of intelligence (IQ) measure executive function
- EF deficits do not always persist into childhood
- Children can show competency in some subcategories of EF but not others
- Teacher and parent reports of EF are not always concordant
- Child and parental behavior were shown to be correlated with the development of EF, in particular, inhibition, working memory, and cognitive flexibility

Landscapes of Articles



* Some articles use multiple screening tools



* Some articles focus on multiple subcomponents

Survey of Articles

Two main questions were asked of each of the 40 articles:

- What was studied?
- What was found?

Information on the following factors was extracted from each of the articles:

- Who was studied
 - Country of origin of study population
 - Gender
 - Age group
 - Subpopulation
- Screening tool(s) used
- Presence of detailed descriptions of reliability, validity and norms
- Subcomponents of EF studied
- Study design

In addition to the summary of each article, tables are provided for information on the most frequently studied assessment tools and the names of assessment scales.

Citation	Country	Scale	What Was Studied?	Who Was Studied?			Psychometrics			EF Focus					Method				What Was Found?	
				Age (yrs)	M/F	Sub-sample	Reliability	Validity	Norms	Global	Flex/Shift	Inhib/Cntrl	Memory	Attention	Descriptive	Comparison	Review	Intervention		
Aarnoudse-Moens, C.S. H., Duivenvoorden, H. J., Weisglas-Kuperus, N., Van Goudoever, J. B., Oosterlaan, J. (2012). The profile of executive function in very preterm children at 4 to 12 years. <i>Developmental Medicine and Child Neurology</i> , 54, 247-253	Netherlands	CANTAB; WISC-III; Other*	• EF of 4 to 12 year olds born preterm	4 - 12	M F	Very preterm (gestational age <30 weeks), without severe disabilities	X		X			X	X	X			X			<ul style="list-style-type: none"> • EF in preterm children is not a global deficit; there are consistently affected and non-affected areas • When testing EF in preterm children, select tasks that tap separate domains as 'purely' as possible; IQ scores may not act as a good indicator • Deficits persist over time except for response inhibition which catches up to peers
Atkinson, J., & Braddick, O. (2012). Visual attention in the first years: Typical development and developmental disorders. <i>Developmental Medicine and Child Neurology</i> , 54(7), 589-595.	NR	TEA-Ch; ECAB; WPPSI; Other	<ul style="list-style-type: none"> • Evidence for three subsystems of attention (selective attention, sustained attention, & EF) • Reliability and findings from new Early Childhood Attention Battery (ECAB) as a multidimensional 	0 - 6	M F	Children with developmental disorders, ADHD (in second stage of study only)	X	X	X			X	X			X		X	<ul style="list-style-type: none"> • Broad validity of ECAB confirmed; valid tool for creating individual attentional profiles • 3 - 4.5yr olds tested with ECAB show only two components with much overlap • Enables attentional profiling for developmental disorders beyond mental age measures 	
Bernier, A., Carlson, S. M., Deschênes, M., & Matte-Gagné, C. (2012). Social factors in the development of early executive functioning: A closer look at the caregiving environment. <i>Developmental Science</i> , 15(1), 12-24	Canada	PPVT-III; Other	• Links between quality of early caregiving environment and EF	1 - 3	M F		X	X			X	X	X	X		X	X		• Composite scores of parental behaviour and child attachment relate to performance on working memory and cognitive flexibility components of EF	
Bonillo, A., Araujo Jiménez, E. A., Jané Ballabriga, M. C., Capdevila, C., & Riera, R. (2012). Validation of Catalan version of BRIEF-P. <i>Child Neuropsychology</i> , 18(4), 347-355.	Spain	BRIEF-P	• Psychometric properties of BRIEF-P, Catalan version	3 - 6	M F		X	X			X	X	X	X	X	X			<ul style="list-style-type: none"> • The Catalan translation was reliable in relation to the English version • Call for deeper investigation of the first and second levels of the BRIEF-P 	

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Other: Any screening tool that did not assess any component of executive function, was author-created, or consisted of a subtest or subtests that had not been validated

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Bücker, J., Kapczynski, F., Post, R., Ceresér, K. M., Szobot, C., Yatham, L. N., . . . Kauer-Sant'Anna, M. (2012). Cognitive impairment in school-aged children with early trauma. <i>Comprehensive Psychiatry</i> , 53(6), 758-764.	Brazil	K-SADS-E; GAF; WISC-III; WCST; CPT	• Effect of early childhood trauma on broad cognitive functions	5 - 12	M F	Early trauma victims				X			X	X		X			<ul style="list-style-type: none"> • High prevalence of attention impairments in victims with subsyndromal symptoms • Lower estimated IQ scores in those with subsyndromal symptoms
Chiappedi, M., Maffioletti, E., Piazza, F., D'Adda, N., Tamburini, M., & Balottin, U. (2012). Abilities of preschoolers: Comparing different tools. <i>Italian Journal of Pediatrics</i> , 38(1)	Italy	CBCL; CRS-R; RPM; Hollingshead's Four Factor Index; IPDA questionnaire; Modified Bell Cancellation Test; BVN 5-11	• Efficacy and efficiency (cost-effectiveness) of child behaviour and neuropsychology assessments	5 - 6	M F			X		X		X	X	X		X			<ul style="list-style-type: none"> • Raven Matrices are valuable and cost-effective • CBCL & Connors' well correlated with getting parents views and overlapped in terms of cost & utility • BVN5-II is expensive but the only test to give a broad profile needed to plan a treatment strategy • Psychometric properties poorly defined overall in most tests
Commodari, E. (2012). Attention skills and risk of developing learning difficulties. <i>Current Psychology</i> , 31(1), 17-34.	Italy	IPDA; Other	• Roles of attention measures for early detection of learning disorder risk signs	4 - 6	M F		X	X			X		X	X					<ul style="list-style-type: none"> • Different components of attention (e.g., visual selectivity, reaction times) are diversely involved in learning disorders and skills for school learning
Crotty, K. C., Ahronovich, M. D., Baron, I. S., Baker, R., Erickson, K., & Litman, F. R. (2012). Neuropsychological and behavioral effects of postnatal dexamethasone in extremely low birth weight preterm children at early school age. <i>Journal of Perinatology</i> , 32(2), 139-146.	USA	WISC-IV; CTOPP; TEA-Ch; Other	• Effect of postnatal dexamethasone treatment on cognitive, neuropsychological and behavioural functioning in preterm children	5 - 12	M F	Preterm children, dexamethasone treated				X						X	X		<ul style="list-style-type: none"> • Term infants outperformed preterm on all measures • For preterm infants, dexamethasone non-treated outperformed treated in visual memory, visual-motor integration, mathematical skill and motor dexterity • Stepwise regression indicated preterm differences were a result of medical and sociodemographic factors

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Cuevas, K., Hubble, M., & Bell, M. A. (2012). Early childhood predictors of post-kindergarten executive function: Behavior, parent report, and psychophysiology. <i>Early Education and Development</i> , 23(1), 59-73.	USA	CBQ; BRIEF-P	<ul style="list-style-type: none"> Ability of EF measured before kindergarten to predict variance in EF after kindergarten 	4 - 6	M F			X			X	X	X	X	X		X			<ul style="list-style-type: none"> Parent-reported and behavioural measures accounted for majority of variance in post-kindergarten EF Electroencephalogram (EEG) provided info on EF not provided by other measures Different types of measures provide overlapping but unique EF data EF data obtained prior to kindergarten predict post-kindergarten EF function
Denham, S. A., Bassett, H. H., Thayer, S. K., Mincic, M. S., Sirotkin, Y. S., & Zinsser, K. (2012). Observing preschoolers' social-emotional behavior: Structure, foundations, and prediction of early school success. <i>Journal of Genetic Psychology</i> , 173(3), 246-278.	NR	MPAC-R; PRSA	<ul style="list-style-type: none"> Social-emotional (S-E) behaviour of preschoolers using MPAC-R Extraction of a shortened version of MPAC-R Demographic correlates with different S-E behaviours Contribution of emotion knowledge and EF to S-E behaviours Contribution of S-E behaviours to early school adjustment and academic success 	3 - 4	M F		X	X					X	X	X		X			<ul style="list-style-type: none"> Shortened version is at least as good or better than longer version of MPAC-R
Fjell, A. M., Walhovd, K. B., Brown, T. T., Kuperman, J. M., Chung, Y., Hagler Jr., D. J., . . . Dale, A. M. (2012). Multimodal imaging of the self-regulating developing brain. <i>Proceedings of the National Academy of Sciences of the United States of America</i> , 109(48), 19620-19625.	NR	Flanker Task Performance	<ul style="list-style-type: none"> Differences between children under age 12 and over age 12 using multimodal imaging Areas related to cognitive control 	4 - 21	M F		X						X				X			<ul style="list-style-type: none"> Fractal anisotropy and cortical area both contribute to reaction time in Flanker Task Performance

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				Age (yrs)	M/F	Sub-sample	Reliability	Validity	Norms	Global	Flex/Shift	Inhib/Cntrl	Memory	Attention	Descriptive	Comparison	Review		Intervention
Ford, R. M., Driscoll, T., Shum, D., & Macaulay, C. E. (2012). Executive and theory-of-mind contributions to event-based prospective memory in children: Exploring the self-projection hypothesis. <i>Journal of Experimental Child Psychology, 111</i> (3), 468-489.	Australia	WPPSI-III Australian; Index of Empathy for Children and Adolescents; Other	• Causes of the development of prospective memory	4 - 6	M F		X			X		X	X		X		X		• Theory of mind proved to be a robust predictor of children's prospective memory, with slightly weaker but significant correlation with inhibition and working memory
Forns, J., Torrent, M., Garcia-Esteban, R., Grellier, J., Gascon, M., Julvez, J., . . . Sunyer, J. (2012). Prenatal exposure to polychlorinated biphenyls and child neuropsychological development in 4-year-olds: An analysis per congener and specific cognitive domain. <i>Science of the Total Environment, 432</i> , 338-343.	Spain	MSCA	• Effect of Polychlorinated biphenyls (PCBs) exposure on neuropsychological development in children	4	M F		X	X	X	X			X		X	X			• In utero exposure to low-levels of PCBs, particularly PCB153, associated with a decrease in general neuropsychological development at age four • Negative effects are contributed more so by in utero exposure, and less by postnatal exposure
Fulton, J. B., Yeates, K. O., Taylor, H. G., Walz, N. C., & Wade, S. L. (2012). Cognitive predictors of academic achievement in young children 1 year after traumatic brain injury. <i>Neuropsychology, 26</i> (3), 314-322.	USA	DAS; BBCS; Other	• Cognitive predictors of academic achievement in children with traumatic brain injury and orthopedic injury	3-6	M F	Traumatic brain injury (TBI), Orthopedic injury (OI)				X		X	X	X		X			• TBI had significantly lower scores than the OI • Lower SES predicts lower academic score post injury • Non-Caucasian children perform more poorly

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Gatzke-Kopp, L. M., Greenberg, M. T., Fortunato, C. K., & Coccia, M. A. (2012). Aggression as an equifinal outcome of distinct neurocognitive and neuroaffective processes. <i>Development and Psychopathology</i> , 24(3), 985-1002.	USA	WJ-III; Other	• Connection between aggression and neurocognitive processes	NR	M F			X	X	X	X	X	X			X			• High aggression group scored lower on verbal ability test
Ghassabian, A., Herba, C. M., Roza, S. J., Govaert, P., Schenk, J. J., Jaddoe, V. W., . . . Tiemeier, H. (2012). Infant brain structures, executive function, and attention deficit/hyperactivity problems at preschool age. A prospective study. <i>Journal of Child Psychology and Psychiatry and Allied Disciplines</i>	Netherlands	BRIEF-P; CBCL/1½-5	• Characterization of the prospective association between brain structures measured during infancy and executive function and attention deficit/hyperactivity problems assessed at preschool age	3 - 5	M F	Dutch ethnicity, ADHD				X	X	X	X	X	X	X			• Smaller corpus callosum length in infancy and impaired executive function at age four • This association accounted for by higher scores of inhibition and emotional control
Goff, D. A., Luan, X., Gerdes, M., Bernbaum, J., D'Agostino, J. A., Rychik, J., . . . Gaynor, J. W. (2012). Younger gestational age is associated with worse neurodevelopmental outcomes after cardiac surgery in infancy. <i>Journal of Thoracic and Cardiovascular Surgery</i> , 143(3), 535-542.	USA	WPPSI-III; PLS-4 TLS; Other	• Impact of near-term delivery on neurodevelopment outcomes in children with congenital heart disease	4	M F	Surgery for congenital heart disease within the first 6 months of life					X			X		X			• Older gestational age predicted better performance for multiple neurodevelopment measure • Children born 39+ weeks into gestational period showed improved neurodevelopment
Guy, J., Rogers, M., & Cornish, K. (2012). Developmental changes in visual and auditory inhibition in early childhood. <i>Infant and Child Development</i>	Canada	PPVT-III; EVIP; BRIEF-P; BRIEF; Other	• Age-related differences in visual and auditory inhibition as well as lower scores on inhibition scales in general	3-6	M F	No hearing, visual or mental impairment, no ADHD or currently taking psychotropic medication	X				X		X			X			• Inhibition in both visual and auditory modalities improve as age increases

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Holt, R. F., et al. (2012). Developmental effects of family environment on outcomes in pediatric cochlear implant recipients. <i>Otology and Neurology</i> .	USA	PPVT-IV; FES; BRIEF; CELF-4; Other	• Effect of family environment on EF in children with cochlear implants	NR	M F	Partial hearing impair with cochlear implants					X		X				X	X	<ul style="list-style-type: none"> • Higher levels of support and lower levels of conflict resulted in fewer incidents with preschooler • School-age children had fewer problems with inhibition but more problems with shifting of attention when families reported lower levels of conflict
Holt, R. F., Beer, J., Kronenberger, W. G., Pisoni, D. B., & Lalonde, K. (2012). Contribution of family environment to pediatric cochlear implant users' speech and language outcomes: Some preliminary findings. <i>Journal of Speech, Language, and Hearing Research, 55</i> (3), 848-864.	USA	PPVT-4; PLS-4; CELF-4; BRIEF; Other	• Relationships between family environment and post implant language development and executive function in children with cochlear implants	5-7	M F	Children with cochlear implants					X	X	X	X			X		<ul style="list-style-type: none"> • Nothing remarkable about this particular study sample • Degree of control in family significantly influences language development • Cochlear implants children also shows lower inhibition level
Iadisernia, E., Battaglia, F. M., Vanadia, E., Trapolino, E., Vincent, A., & Biancheri, R. (2012). Anti-N-methyl-d-aspartate-receptor encephalitis: Cognitive profile in two children. <i>European Journal of Paediatric Neurology, 16</i> (1), 79-82.	NR	GMDS-R; Other	• Cognitive and neuropsychological profile in two children with anti-NMDAR (N-methyl D-aspartate receptor) encephalitis	4 - 5	M F	Have anti-NMDAR encephalitis										X			<ul style="list-style-type: none"> • Executive functioning is the core of the neuropsychological profile in these cases • Some cognitive abilities may be recovered if therapy is started soon after disease onset • Further studies needed for long-term outcome
Jackman, A. R., Biggs, S. N., Walter, L. M., Embuldeniya, U. S., Davey, M. J., Nixon, G. M., . . . Horne, R. S. C. (2012). Sleep-disordered breathing in preschool children is associated with behavioral, but not cognitive, impairments. <i>Sleep Medicine, 13</i> (6), 621-631.	Australia	BRIEF-P; CBCL; C-TRF; ABAS-II; Other	• Cognitive and behavioural functions of preschool children with sleep-disordered breathing	3 - 5	M F	Sleep-disordered breathing	X		X	X							X		<ul style="list-style-type: none"> • Sleep-disordered breathing was associated with poorer behaviour, but not cognitive performance • Possible window of opportunity for preventing cognitive impairment with early treatment

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				Age (yrs)	M/F	Sub-sample	Reliability	Validity	Norms	Global	Flex/Shift	Inhib/Cntrl	Memory	Attention	Descriptive	Comparison	Review		Intervention	
Kesmodel, U. S., Bertrand, J., Støvring, H., Skarpnæs, B., Denny, C., & Mortensen, E. L. (2012). The effect of different alcohol drinking patterns in early to mid pregnancy on the child's intelligence, attention, and executive function. <i>BJOG: An International Journal of Obstetrics and Gynaecology</i> , 119(10), 1180-1190.	Denmark	WPPSI-R; TEA-Ch; BRIEF	• The effects of alcohol consumption and binge drinking during early to mid pregnancy on intelligence, attention, and executive functioning in 5-year-old children	5	M F	Children of mothers who consumed alcohol during early to mid pregnancy	X	X	X	X					X	X				<ul style="list-style-type: none"> • Small amounts of alcohol consumed occasionally during pregnancy may not present serious concern • No safe level of drinking during pregnancy has been established
Landau, Y. E., Bar-Yishay, O., Greenberg-Dotan, S., Goldbart, A. D., Tarasiuk, A., & Tal, A. (2012). Impaired behavioral and neurocognitive function in preschool children with obstructive sleep apnea. <i>Pediatric Pulmonology</i> , 47(2), 180-188.	Israel	CBCL; Other	• Effect of obstructive sleep apnea syndrome (OSAS)	2 - 5	M F	Spoke fluent Hebrew and had obstructive sleep apnea syndrome					X		X	X		X		X		<ul style="list-style-type: none"> • OSAS group has lower quality of life and cognitive deficit compared to control group • Treatment improved neurocognitive functions and outward behaviors comparable to control group
Lewis-Morrarty, E., Dozier, M., Bernard, K., Terracciano, S. M., & Moore, S. V. (2012). Cognitive flexibility and theory of mind outcomes among foster children: Preschool follow-up results of a randomized clinical trial. <i>Journal of Adolescent Health</i> , 51(2 SUPPL.), S17-S22	USA	PPVT-III; DCCS; Other	• Effect of the Attachment and Behavioural Catch-up Intervention (ABC) on self-regulatory capabilities of children with early life adversity	4 - 6	M F	Children placed in foster care before the age of 3					X							X		<ul style="list-style-type: none"> • Children who received the ABC intervention were not significantly different from comparison group children in terms of cognitive capabilities, suggesting that ABC enhances the development of foster children's self-regulatory capabilities
Mahone, E. M., & Schneider, H. E. (2012). Assessment of attention in preschoolers. <i>Neuropsychology Review</i> , 1-23	NR	CBCL/1½-5; C-TRF; BASC-2; Conners EC; ADHD-RS-IV; BRIC; ECI-4	• Assessment methods of attention in preschoolers	NR	NR									X			X			<ul style="list-style-type: none"> • More methods are available for assessing attention in preschoolers • Limited validity and utility research are available

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Mesotten, D., Gielen, M., Sterken, C., Claessens, K., Hermans, G., Vlasselaers, D., . . . Van Den Berghe, G. (2012). Neurocognitive development of children 4 years after critical illness and treatment with tight glucose control: A randomized controlled trial. <i>JAMA - Journal of the American Medical Association</i> , 308(16), 1641-1650	Belgium	WPPSI-R; CMS; CBCL	<ul style="list-style-type: none"> Effects of hyperglycemia and hypoglycemia on the developing brain and the benefits of Tight Glucose Control (TGC) 	1 - 16	M F							X	X	X	X				X	<ul style="list-style-type: none"> Tight Glucose Control improved motor coordination and cognitive flexibility
Miles, B. S., Anderson, P., Agostino, A., Golomb, M. R., Achonu, C., Blanchette, V., . . . Barnes, M. A. (2012). Effect of intracranial bleeds on the neurocognitive, academic, behavioural and adaptive functioning of boys with haemophilia. <i>Haemophilia</i> , 18(2), 229-234	Canada	CPRS-R; CBCL-Parent Version; VABS; BRIEF; BRIEF-P; SB-IV; WJ-III; TOWRE; PPVT; TLC-E; Beery-VMI; Purdue Pegboard Revised Edition; CVLT-C; WISC-III	<ul style="list-style-type: none"> Effect of intracranial hemorrhage (ICH) on cognitive and behavioural functioning in boys with haemophilia 	3 - 17	M	Have Haemophilia				X					X					<ul style="list-style-type: none"> ICH in boys with haemophilia affects cognitive and academic functioning Positive ICH status is a potential indicator for neuropsychological assessment and intervention
Müller, U., Kerns, K. A., & Konkin, K. (2012). Test-retest reliability and practice effects of executive function tasks in preschool children. <i>Clinical Neuropsychologist</i> , 26(2), 271-287	Canada	Other	<ul style="list-style-type: none"> Assessment of re-test reliability on measures of different aspects of EF in preschool children Practice effects in EF tasks 	3 - 6	M F	Low socioeconomic status (SES), Native English speakers	X					X	X	X						<ul style="list-style-type: none"> Measures of working memory and planning show good re-test reliability Measures of response inhibition and inhibition have moderate to poor retest reliability

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Other: Any screening tool that did not assess any component of executive function, was author-created, or consisted of a subtest or subtests that had not been validated

Citation	Country	Scale	What Was Studied?	Who Was Studied?			Psychometrics			EF Focus					Method			What Was Found?						
				Age (yrs)	M/F	Sub-sample	Reliability	Validity	Norms	Global	Flex/Shift	Inhib/Cntri	Memory	Attention	Descriptive	Comparison	Review		Intervention					
Olivieri, I., Bova, S. M., Urgesi, C., Ariaudo, G., Perotto, E., Fazzi, E., . . . Orcesi, S. (2012). Outcome of extremely low birth weight infants: What's new in the third millennium? neuropsychological profiles at four years. <i>Early Human Development</i> , 88(4), 241-250	Italy	NEPSY-II; LEITER-R; MSCA; CBCL	• Effect of extremely low birth weight (ELBW) on cognition and behaviour	4	M F	Extremely low birth weight infants											X	X	X	X				• Following up with ELBW children until school age allows early detection of at-risk children and planning of timely preventive interventions
Roskam, I., Meunier, J. -, Stievenart, M., & Noël, M. . (2013). When there seem to be no predetermining factors: Early child and proximal family risk predicting externalizing behavior in young children incurring no distal family risk. <i>Research in Developmental Disabilities</i> , 34(1), 627-639.	Belgium	PSA; Bipolar Rating Scales; Other	• Relationship between personality, inhibition, parenting and attachment and externalizing behaviour in children	3 - 6	M F		X	X												X	X			• Personality, inhibition, parenting and attachment correlated with externalizing behaviour in children
Rueda, M. R., Checa, P., & Cómbita, L. M. (2012). Enhanced efficiency of the executive attention network after training in preschool children: Immediate changes and effects after two months. <i>Developmental Cognitive Neuroscience</i> , 2 (SUPPL. 1), S192-S204.	Spain	K-BIT; Child ANT; Other	• Improvement of attention and other executive functions through training	5	M F	Caucasian/ European														X	X	X		• Trained children activate attention network faster than untrained children; results still observed two months after without further training

Citation	Country	Scale	What Was Studied?	Who Was Studied?			Psychometrics			EF Focus					Method				What Was Found?
				Age (yrs)	M/F	Sub-sample	Reliability	Validity	Norms	Global	Flex/Shift	Inhib/Cntrl	Memory	Attention	Descriptive	Comparison	Review	Intervention	
Smithson, P. E., Kenworthy, L., Wills, M. C., Jarrett, M., Atmore, K., & Yerys, B. E. (2012). Real world executive control impairments in preschoolers with autism spectrum disorders. <i>Journal of Autism and Developmental Disorders</i> , 1-9.	NR	BRIEF-P; ADOS; DAS; DAS-II; WPPSI-R; WPPSI-III	• Executive control in preschoolers with and without autism spectrum disorders (ASD)	2.8 - 5.8	M F	Autism spectrum disorders				X	X	X	X			X			• Children with ASD rate significantly worse than control group on all BRIEF-P scores • Impairments do not correlate with ASD symptoms
Verkerk, G., Jeukens-Visser, M., Houtzager, B., Koldewijn, K., van Wassenae, A., Nollet, F., & Kok, J. (2012). The infant behavioral assessment and intervention program in very low birth weight infants; outcome on executive functioning, behaviour and cognition at preschool age. <i>Early Human Development</i> , 88(8), 699-705.	Netherlands	BRIEF-P; CBCL; PPVT-III; VAT; Other	• Effect of the Infant Behavioural Assessment and Intervention Program on executive functioning, behaviour and cognition in children born with very low birth weight	3	M F	Very low birth weight infants				X	X	X	X	X		X		X	• No significant differences between intervention group and controls

Citation	Country	Scale	What Was Studied?	Who Was Studied?			Psychometrics			EF Focus					Method			What Was Found?		
				Age (yrs)	M/F	Sub-sample	Reliability	Validity	Norms	Global	Flex/Shift	Inhib/Cntrl	Memory	Attention	Descriptive	Comparison	Review		Intervention	
Viner, R. M., Booy, R., Johnson, H., Edmunds, W. J., Hudson, L., Bedford, H., . . . Christie, D. (2012). Outcomes of invasive meningococcal serogroup B disease in children and adolescents (MOSAIC): A case-control study. <i>The Lancet Neurology</i> , 11(9), 774-783.	England	BRIEF; BRIEF-P; WPPSI; WASI; TEA-Ch	• Outcomes of invasive meningococcal serogroup B disease in children and adolescents	3 - 16	M F	Survivors with serogroup B meningococcal disease					X			X	X		X			• Children with meningococcal serogroup B disease were more likely to have deficits in executive functioning and certain aspects of memory compared to controls • No significant differences noted in attentional function
Vitiello, V. E., Greenfield, D. B., Munis, P., & George, J. (2011). Cognitive flexibility, approaches to learning, and academic school readiness in head start preschool children. <i>Early Education and Development</i> , 22(3), 388-410.	USA	PLBS; Other	• Approaches to learning mediating relations between cognitive flexibility and school readiness	NR	M F	Head Start Program (low-income)	X					X			X			X		• Attention/persistence significantly mediated the relation between cognitive flexibility and school readiness
Walker, R. F., & Murachver, T. (2012). Representation and theory of mind development. <i>Developmental Psychology</i> , 48(2), 509-520.	New Zealand	Scale Model Task; Theory of Mind Battery; Other	• Relationship between children's early use of symbols and their later understanding of representation and metarepresentation	2.5 - 4	M F							X	X	X		X				• Executive function related to performance on scale model and theory of mind tasks, but did not mediate the relation between these two tasks

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Citation	Country	Scale	What Was Studied?	Who Was Studied?			Psychometrics			EF Focus					Method			What Was Found?	
				Age (yrs)	M/F	Sub-sample	Reliability	Validity	Norms	Global	Flex/Shift	Inhib/Cntrl	Memory	Attention	Descriptive	Comparison	Review		Intervention
Wilbourn, M. P., Kurtz, L. E., & Kalia, V. (2012). The lexical stroop sort (LSS) picture-word task: A computerized task for assessing the relationship between language and executive functioning in school-aged children. <i>Behavior Research Methods, 44</i> (1), 270-286.	USA	LSS; Other	• Relationship between language and executive functioning	5 - 8	M F			X		X			X		X				• Children's vocabulary was associated with the two executive function tasks
Willoughby, M. T., Blair, C. B., Wirth, R. J., & Greenberg, M. (2012). The measurement of executive function at age 5: Psychometric properties and relationship to academic achievement. <i>Psychological Assessment, 24</i> (1), 226-239.	USA	Other	• Psychometric properties of newly developed executive function tasks	5	M F	African American; Low-income	X	X					X	X	X	X	X		• Tasks work equally well for children in 'low-income' and 'not low-income' homes • Task scores are most informative about ability level for children in low-income homes
Willoughby, M. T., Wirth, R. J., Blair, C. B., & Family Life Project Investigators. (2012). Executive function in early childhood: Longitudinal measurement invariance and developmental change. <i>Psychological Assessment, 24</i> (2), 418-431.	USA	Other	• Longitudinal measurement invariance and developmental changes of a newly developed battery of EF tasks	3 - 5	M F	African American; Low-income	X						X	X	X	X			• EF battery showed partial strong invariance over time • Important to establish scalable measures of EF in children before investigating factors that predict EF

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Information on Most Frequently Studied Assessment Tools:

BRIEF(-P)	Behavior Rating Inventory of Executive Function (– Preschool Version)
	Target Population: BRIEF-P: 2-5 years, BRIEF: 5-18 years
	Assessment of inhibition, control, memory and shift
	Type of Measure: Parent and teacher report
CBCL	Child Behavior Checklist
	Target Population: CBCL/6-18: 6-18 years and CBCL/1.5-5: 1.5- 5 years
	Assessment of children’s behavioral and emotional problems and competencies
	Type of Measure: Parent, teacher, and caregiver report
PPVT	Peabody Picture Vocabulary Test
	Target Population: 2-90 years
	Assessment of verbal skills and global EF
	Type of Measure: Behavioral measure completed by child
WISC; WPPSI	Wechsler Intelligence Scale for Children; Wechsler Preschool and Primary Scale of Intelligence
	Target Population: WISC: 6-16 years; WPPSI: 2 years 6 months – 7 years 3 months
	Assessment of IQ and learning difficulties and proficiencies
	Type of Measure: Behavioral measure completed by child

Names of Assessment Scales:

Abbreviations /Acronyms	Complete Name of Test
ADHD-RS-IV	ADHD Rating Scale, Version IV
Child ANT	Attention Network Task, Child Version
ADOS	Autism Diagnostic Observation Schedule
BVN 5-11	“Batteria di valutazione neuropsicologica per l'età evolutiva” (battery of neuropsychological tests developed for children aged from 5 to 11 years old)
BASC-2	Behavior Assessment System for Children, Second Edition
BRIC	Behavior Rating Inventory for Children
BRIEF	Behavior Rating Inventory of Executive Function
BRIEF-P	Behavior Rating Inventory of Executive Function, Preschool Version
	Bipolar Rating Scales
BBCS	Bracken Basic Concept Scale
CVLT-C	California Verbal Learning Test, Children’s Version
CANTAB	Cambridge Neuropsychological Testing Automated Battery
C-TRF	Caregiver-Teacher Report Form for ages 1.5 to 5
CBCL	Child Behaviour Checklist
CBCL/1½–5	Child Behaviour Checklist for Children 1.5 to 5 years old
CBQ	Children’s Behaviour Questionnaire
CMS	Children’s Memory Scale
CELF-4	Clinical Evaluation of Language Fundamentals, Fourth Edition
CTOPP	Comprehensive Test of Phonological Processing

CPRS-R	Conner's Parent Rating Scales, Revised
Conners EC	Conners Early Childhood Scales
CRS-R	Conners' Rating Scales, Revised
CPT	Continuous Performance Test
DAS	Differential Ability Scales
DAS-II	Differential Ability Scales, Second Edition
DCCS	Dimensional Card Change Sort
ECI-4	Early Child Inventory, Fourth Edition
ECAB	Early Childhood Attention Battery
EVIP	"Échelle de Vocabulaire en Images Peabody" (French version of PPVT)
FES	Family Environment Scale
	Flanker Task Performance
GAF	Global Assessment of Functioning
GMDS-R	Griffiths Mental Development Scale, Extended Revised
	Hollingshead's Four Factor Index of Social Status
IPDA	"Identificazione Precoce delle Difficoltà di Apprendimento" (teacher compiled questionnaire for early identification of learning difficulties)
	Index of Empathy for Children and Adolescents
K-BIT	Kaufman Brief Intelligence Test
K-SADS-E	Kiddie Schedule for Affective Disorders and Schizophrenia Epidemiologic Version
LEITER-R	Leiter International Performance Scale, Revised
LSS	Lexical Stroop Sort Task
MSCA	McCarthy Scales of Children's Abilities
MPAC-R	Minnesota Preschool Affect Checklist, Revised
	Modified Bell Cancellation Test
NEPSY-II	NEPSY (A Developmental NEuroPSYchological Assessment) Second Edition
PPVT-III	Peabody Picture Vocabulary Test, Third Edition
PLS-4 TLS	Preschool Language Scale Total Language Score, Fourth Edition
PLBS	Preschool Learning Behaviors Scale
PSRA	Preschool Self-Regulation Assessment
PSA	"Profil Socio-Affectif" (test of social and emotional profile)
	Purdue Pegboard Revised Edition
RPM	Raven's Progressive Matrices
	Scale Model Task
SV-IV	Stanford-Binet Intelligence Scale, Fourth Edition
TEA-Ch	Test of Everyday Attention for Children
TLC-E	Test of Language Competence-Expanded Edition
TOWRE	Test of Word Reading Efficiency
ABAS-II	The Adaptive Behavior Assessment System, Second Edition
Beery-VMI	The Beery Developmental Test of Visual-Motor Integration, Fourth Edition Revised
	Theory of Mind Battery

VABS	Vineland Adaptive Behavior Scales
VAT	Visual Attention Task
WASI	Wechsler Abbreviated Scale of Intelligence
WISC-IV	Wechsler Intelligence Scale for Children, Fourth Edition
WISC-III	Wechsler Intelligence Scale for Children, Third Edition
WPPSI	Wechsler Preschool and Primary Scale of Intelligence
WPPSI-Australian	Wechsler Preschool and Primary Scale of Intelligence, Australian Standardized Edition
WPPSI-R	Wechsler Preschool and Primary Scale of Intelligence, Revised Version
WPPSI-III	Wechsler Preschool and Primary Scale of Intelligence, Third Edition
WCST	Wisconsin Card Sorting Test
WJ-III	Woodcock-Johnson III Tests of Achievement
*OTHER	Any screening tool that did not assess any component of executive function, was author-created, or consisted of a subtest or subtests that had not been validated

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