

Appendix A: Search Strategy

Date limits for the search; from inception to April 28th 2020

APA PsycNET (PsycINFO, PsycARTICLES, PsycBOOKS, PsycTESTS)

Query	Records retrieved
<p>Index Terms: {Cognitive Ability} OR {Cognitive Development} OR {Cognitive Impairment} OR {Cognition} OR {Dysexecutive Syndrome} OR {Intellectual Development Disorder} OR {Memory Disorders} OR {Cognitive Processing Speed} OR {Intelligence} OR {Intellectual Development} OR {Intelligence Quotient} OR {Neuropsychology} OR {Neurocognition} OR {Language} OR {Language Development} OR {Language Disorders} OR {Nonverbal Ability} OR {Verbal Communication} OR {Communication Skills} OR {Verbal Comprehension} OR {Memory} OR {Spatial Ability} OR {Visual Perception} OR {Learning} OR {Perception} OR {Learning Ability} OR {Retention} OR {Memory Disorders} OR {Executive Function} OR {Attention} OR {Attention Deficit Disorder} OR {Neuropsychological Assessment} OR {Goal Setting} AND Index Terms: {Child Abuse} OR {Emotional Abuse} OR {Physical Abuse} OR {Sexual Abuse} OR {Verbal Abuse} OR {Child Neglect} OR Any Field: complex trauma OR Any Field: adverse childhood experience AND Age Group: Childhood (birth-12 yrs) OR Neonatal (birth-1 mo) OR Infancy (2-23 mo) OR Preschool Age (2-5 yrs) OR School Age (6-12 yrs) OR Adolescence (13-17 yrs) AND Methodology: Followup Study OR Longitudinal Study OR Prospective Study</p>	405

Pubmed Central

Query	Records retrieved
<p>((((((((("Cognitive Dysfunction"[Mesh] OR "Neurobehavioral Manifestations"[Mesh]) OR "Mental Processes"[Mesh]) OR "Attention"[Mesh]) OR "Psychomotor Performance"[Mesh]) OR "Neuropsychological Tests"[Mesh]) OR "Intelligence"[Mesh]) OR "Intelligence Tests"[Mesh]) OR "Neuropsychology"[Mesh]) OR "Communication"[Mesh]) OR "Language Development"[Mesh] AND (("Child Abuse"[Mesh] OR "Physical Abuse"[Mesh] OR Trauma'[All Fields] OR ("Childhood"[Journal] OR "childhood"[All Fields]) AND Experience'[All Fields])) AND longitudinal[All Fields] AND ("infant"[MeSH Terms] OR "child"[MeSH Terms] OR "adolescent"[MeSH Terms]))</p>	207

EBSCO (CINAHL)

Query	Records retrieved
<p>((MH "Child Abuse") OR (MH "Verbal Abuse") OR Adverse Childhood Experience OR Complex Trauma) AND ((MH "Mental Processes") OR (MH "Neurobehavioral Manifestations") OR (MH "Intelligence") OR (MH "Neuropsychological Tests") OR (MH "Language Tests") OR (MH "Aptitude Tests") OR (MH "Neuropsychology") OR (MH "Communication") OR (MH "Language Development") OR (MH "Attention Deficit Hyperactivity Disorder") OR (MH "Attention")) AND longitudinal AND (Childhood OR Neonatal OR Infancy OR Preschool Age OR School Age OR Adolescence OR infant OR toddler OR child OR adolescent)</p>	16

EBSCO (ERIC)

Query	Records retrieved
DE ("Intellectual Disability" OR "Cognitive Tests" OR "Cognitive Measurement" OR "Cognitive Development" OR "Intelligence" OR "Intellectual Disability" OR "Language Impairments" OR "Neuropsychology" OR "Perceptual Impairments" OR "Attention" OR "Neurological Impairments" OR "Cognitive Processes" OR "Attention Deficit Disorders" OR "Cognitive Ability" OR "Communication Disorders" OR "Learning" OR "Attention Control" OR "Attention Span" OR "Spatial Ability" OR "Memory" OR "Language" OR "Language Impairments" OR "Verbal Tests" OR "Verbal Communication" OR "Communication Skills" OR "Verbal Ability" OR "Goal Orientation") AND DE ("Child Abuse" OR "Sexual Abuse" OR "Sexual Harassment" OR "Child Neglect") OR adverse childhood experience OR complex trauma AND longitudinal AND (Childhood OR Neonatal OR Infancy OR Preschool Age OR School Age OR Adolescence OR infant OR toddler OR child OR adolescent)	692

Embase Classic + Embase

Query	Records retrieved
(cognitive defect/ or "disorders of higher cerebral function"/ or cognitive development/ or neuropsychological test/ or cognitive neuroscience/ or cognition/ or intellectual impairment/ or mental deficiency/ or intelligence/ or intelligence test/ or cognitive function test/ or neuropsychology/ or language/ or verbal communication/ or language ability/ or language delay/ or developmental language disorder/ or language disability/ or verbal communication/ or learning/ or memory/ or attention/ or perceptive discrimination/ or visual perception test/ or perception test/ or memory disorder/ or attention deficit disorder/) AND (child abuse/ or emotional abuse/ or physical abuse/ or (complex trauma or adverse childhood experience).af.) AND (prospective study/ or longitudinal study/ or follow up/) AND ((conference abstracts or embase) and (infant <to one year> or child <unspecified age> or preschool child <1 to 6 years> or school child <7 to 12 years> or adolescent <13 to 17 years>))	99

Appendix B: Study Characteristics

	Articles	Study	Country	Recruitment and identification of trauma group(s)	Recruitment and identification of control group(s)
#1	Beckett et al., 2006; O'Connor, 2000; Sonuga-Barke et al., 2017	English and Romanian Adoptees Study	United Kingdom (UK)	Children adopted from Romanian Institutions into UK families.	Children adopted from English Institutions into UK families.
#2	Cheatham et al., 2010	No specific name	United States (US)	Recruited from the DHS. Maltreatment status confirmed by CPS records. Children were further classified into neglecting or abusing groups based on maternal interview.	Low-SES children recruited from the DHS. Nonmaltreatment status was confirmed by an absence of CPS records and by maternal interview.
#3	Enlow et al., 2012	Minnesota Longitudinal Study of Parents and Children: a prospective examination of adaptation in low-income families	US	Participants of the longitudinal study were classified as maltreated based on home and laboratory observations, maternal interviews, and reviews of medical and CPS records. Children were further classified as maltreated between 0-24 months; between 24-64 months; or between 0-24 and 24-64 months.	Participants from the longitudinal study were classified as nonmaltreated based on the same assessments.
#4	Fitch et al., 1976	Child Study Program	US	Children hospitalized for non-accidental trauma (NAT) and/or non-organic failure-to-thrive (FTT) in hospitals providing services for the low-income population.	Children referred by clinics operated by the same hospitals.
#5	Font & Berger, 2015	Fragile Families and Child Wellbeing Study (FFSW): a population- based sample of disadvantaged families	US	FFSW participants with behaviorally approximated maltreatment based on parent interview and, to a lesser-extent, in-home observations.	FFSW participants with no behaviorally approximated maltreatment.
#6	Harpur et al., 2015	Longitudinal Studies of Child Abuse and Neglect (LONGSCAN): longitudinal studies with participants selected based on risk of/exposure to maltreatment.	US	LONGSCAN participants with history of maltreatment confirmed by CPS records.	LONGSCAN participants with no known history of maltreatment (CPS records).

#7	Jaffee et al., 2007	Environmental Risk (E-Risk) Longitudinal Twin Study: birth cohorts of twins using a high-risk sampling strategy	UK	E-Risk Study participants who experienced physical maltreatment based on mother's report.	E-Risk Study participants who did not experience physical maltreatment based on mother's report.
#8	Manly et al., 2013	No specific name	US	Children who had been identified through the DHS as having documented histories of physical neglect.	Nonmaltreating families selected randomly from the county recipients of Temporary Assistance for Needy Families.
#9	Mills et al., 2010	Mater University Study of Pregnancy	Australia	Participants of the longitudinal study with confirmed CPS records.	Participants of the longitudinal study with no CPS records.
#10	Noll et al., 2010	No specific name	US	Referred by CPS agencies.	Recruited in the same neighborhoods in which the abused participants lived.
#11	Rieder & Cicchetti, 1989; Rogosch et al., 1995	Harvard Child Maltreatment Project	US	Recruited through CPS social workers.	Low-income families from the community with no documented history of child maltreatment (parent-reported and/or confirmed by CPS records).
#12	Tibu et al., 2016	Bucharest Early Intervention Project (BEIP)	Romania	Recruited from institutions in Romania.	Never institutionalized children raised by their families in Romania.
#13	Weller et al., 2015	No specific name	US	Referred by child welfare staff. Girls were randomly assigned to foster care services-as-usual (SAU) or the Middle School Success intervention (MSS).	At-risk girls from the community with no prior involvement in child welfare (parent-reported).

Note. Child Protection Services (CPS); Department of Human Services (DHS).

Appendix C: Group Characteristics

Study	Groups and subgroups	Trauma type	Age at the time of trauma (dev. period)	n	
#1	Trauma	<6 months in Romanian institutions 6-24 months in institutions 24-43 months in institutions	All subgroups: Severe deprivation in institution	0-6 months (EC)	42
				0-24 months (EC)	47
				0-43 months (EC)	42
	Control			50	
#2	Trauma	Abused group	Physical abuse	Both subgroups: before 12 months (EC)	59
		Neglected group	Neglect and/or emotional maltreatment		46
	Control			46	
#3	Trauma	Maltreatment in infancy only	All subgroups: Child maltreatment (physical abuse, psychological maltreatment, neglect and/or sexual abuse) and witnessing partner violence	Between 0-24 months (EC)	30
		Maltreatment in preschool only		Between 24-64 months (EC)	27
		Maltreatment in infancy + preschool		Between 0-24 months and 24-64 months (EC)	39
	Control			110	
#4	Trauma	Hospitalization 2-30 months	Both subgroups: NAT (physical abuse, sexual abuse and/or neglect) and/or non-organic FTT	Between 2 and 30 months (EC)	49
		Hospitalization 28 months-6 years		Between 28.5 months and 6 years (EC)	9
	Control	2-30 months		14	
		28 months-6 years		5	
#5	Trauma		Physical neglect (43.3%), supervisory neglect (43.3%), emotional abuse (30.7%) and/or physical abuse (7.6%)	Between 2-9 years (not included in M-A)	1132
	Control				3766
#6	Trauma	Maltreatment 0-4 years	All subgroups: Any type of maltreatment	Between 0-4 years (EC)	858
		Maltreatment 6-8 years		Between 6-8 years (CA)	267
		Maltreatment 10-12 years		Between 10-12 years (CA)	217
	Control	No maltreatment 0-4 years		496	
		No maltreatment 6-8 years		1087	
		No maltreatment 10-12 years		1137	

#7	Trauma		Physical maltreatment	Before age 5 (not included in M-A)	286
	Control				1895
#8	Trauma		Physical neglect, although 62% of children had combinations of other subtypes (physical neglect + physical abuse and/or emotional maltreatment).	Before age 4 (not included in M-A)	111
	Control				59
#9	Trauma		Abuse (84%) and/or neglect (63.4%)	30% of participants' cases were reported to CPS for the first time before 5 years of age, and 82% were reported by 14 years of age (CA).	789
	Control				6425
#10	Trauma		Sexual abuse	Median age: 7.8 years (CA)	84
	Control				102
#11	Trauma		Physical abuse (54%), neglect (80%), emotional maltreatment (85%) and/or sexual abuse (54%); 83% suffered from more than one form of maltreatment.	Before age 6 (EC)	46
	Control				43
#12	Trauma		Severe deprivation in institutions	Children were recruited between 6 and 31 months (EC)	136
	Control				72
#13	Trauma	MSS (Middle School Success intervention) SAU (Foster care services-as-usual)	Both subgroups: physical abuse (56%), sexual abuse (67%) and/or neglect (78%); 40% both physical and sexual abuse; 32% all types.	Both subgroups: the girls were first placed in foster care at age 7.63 years (CA).	46
	Control				46
	Control				80

Note. Childhood and adolescence (CA); Early childhood (EC); Meta-analyses (MA).

Appendix D: Assessment of Cognitive Outcomes

Study	# of cog. assess.	Age (dev. period)	T1		Age (dev. period)	T2		Age (dev. period)	T3	
			Outcome type	Test		Outcome type	Test		Outcome type	Test
#1	3	4 (EC)	Intelligence	McCarthy	6	Intelligence	McCarthy	11	Intelligence	WISC
#2	2	12 mo. (EC)	Intelligence	Bayley	18-24 mo.	Intelligence	Bayley			
#3	3	24 mo. (EC)	Intelligence	Bayley	64 mo.	Intelligence	WPPSI	96 mo.	Intelligence	WISC
#4	2	Shortly after recruitment at 2-30 mo. (EC)	Intelligence	Bayley	6 mo. after T1	Intelligence	Bayley			
		Shortly after recruitment at 28 mo.-6 years (EC)	Intelligence, Overall Memory, Perceptual/Visuospatial, Language	McCarthy	6 mo. after T1	Intelligence, Overall Memory, Perceptual/Visuospatial, Language	McCarthy			
#5 ^a	3	3	Language	PPVT	5	Language	PPVT	9	Language	PPVT
#6	1	6 (CA)	Perceptual/Visuospatial, Language	WPPSI						
#7 ^a	1	5	Intelligence	WPPSI						
#8 ^a	1	4	Intelligence	WPPSI						
			Language	PPVT, EVT						
#9	1	14 (CA)	Intelligence	RSPM						
#10	3	6-10 (CA)	Language	PPVT	11-14	Language	PPVT	15-18	Language	PPVT
#11	1	6 (CA)	Language	PPVT						
#12	1	8 (CA)	Visual Memory	CANTAB						
			Goal setting	CANTAB						
			EF	CANTAB						

Flanker task

#13 1 16 (CA) Language Shipley

Note. Bayley Mental Development Scale (Bayley); Childhood and adolescence (CA); Cambridge Automated Neuropsychological Test Battery (CANTAB); Early childhood (EC); Expressive Vocabulary Test (EVT); McCarthy Scales of Children's Abilities (McCarthy); Peabody Picture Vocabulary Test (PPVT); Raven's Standard Progressive Matrix (RSPM); Shipley Institute of Living Scale (Shipley); Wechsler Intelligence Scale for Children (WISC); Wechsler Preschool and Primary Scale of Intelligence (WPPSI).

^a Not included in meta-analyses

Appendix E: Studies and Results Not Included in Meta-Analyses

Conclusions of Studies not Included in Meta-Analyses

- Font & Berger, 2015
- Children who experienced behaviorally approximated maltreatment by age 9 exhibited lower average PPVT scores (mean of ages 3, 5 and 9) than children who did not experience maltreatment by age 9.
 - Behaviorally approximated maltreatment by age at was associated with lower PPVT scores at age 3 but was not associated with pattern of change between ages 3 and 9 in PPVT scores. Results for maltreatment subtypes indicated that physical neglect and physical abuse (but not supervisory neglect and emotional abuse) were associated with lower PPVT scores at age 3. Moreover, physical neglect was associated with poorer language trajectory between ages 3 and 9, whereas physical abuse, supervisory neglect and emotional abuse were not.
 - Authors estimated cross-lagged models using structural equation modeling to gain insight into whether associations of maltreatment with subsequent language outcomes are of equal, smaller, or larger magnitude than associations of earlier levels of language with subsequent maltreatment, and thereby the likely causal direction of these relations. Results suggested that although associations between maltreatment (all subtypes of maltreatment) and child language were likely bidirectional, larger effects appeared to run from maltreatment to later adverse language outcomes, rather than vice versa. The most consistent effects of maltreatment appeared to be early on and materialize fairly quickly.
- Jaffee et al., 2007
- 29% of maltreated children and 34% of non-maltreated children had above-average IQ (i.e., at least half a standard deviation above the mean on the IQ measure).
 - High IQ did not distinguish children who were resilient to maltreatment (children who engaged in normative levels of antisocial behavior despite having been maltreated) from those who were not maltreated.
- Manly et al., 2013
- IQ, PPVT and EVT scores were significantly negatively correlated ($r_s = -.16, -.19, -.21$, respectively) with presence of neglect at age 4. In addition, IQ and EVT scores were significantly negatively correlated ($r_s = -.17, -.20$, respectively) with severity of neglect.
 - IQ, PPVT and EVT scores were shown to form a valid and reliable latent cognitive performance construct at age 4. Using structural equation modeling, authors tested the link between severity of child neglect and child Kindergarten classroom behavior at age 5, followed by first-grade academic
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performance at age 6, via the latent cognitive performance construct. There was a significant negative direct path from severity of neglect to the cognitive performance construct, suggesting that more severe neglect was associated with decreased cognitive performance. Overall, findings supported that cognitive performance at age 4 mediated the relation between the severity of neglect and later classroom behavior and academic achievement.

Results of Perceptual/Visuospatial, Memory and EF Outcomes (not Included in Meta-Analyses)

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|---------------------|--|
| Fitch et al., 1976 | <ul style="list-style-type: none">• The trauma group scored significantly lower than the control group on both administrations (T1 and T2) of the Perceptual Performance and Memory scales of the McCarthy. There was no significant difference between T1 and T2 scores on these scales for either the trauma or the control group. |
| Harpur et al., 2015 | <ul style="list-style-type: none">• Children maltreated between 0-4 years old had significantly higher scores on the Block Design subtest of the WPPSI at age 6 than non-maltreated children. |
| Tibu et al., 2016 | <ul style="list-style-type: none">• Children in the trauma group performed significantly more poorly than controls on the memory, goal setting and EF tasks of the CANTAB as well as on the Flanker task assessing EF. |
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