Revista de Psicología Clínica con Niños y Adolescentes
Vol. 12 nº. 1- enero 2025 - pp 5-13
doi: 10.21134/rpcna.2025.12.1.2

www.revistapcna.com - ISSN 2340-8340

Revista de Psicología Clínica con Niños y Adolescentes

Psychopathic traits and behavioral problems in children at risk of psychopathology: The mediating role of executive functions

Víctor Barrau[1, 2], Laura López-Romero[3], Rosa Bosch[1, 4, 5], Rafael Torrubia[1], Albert Bonillo[1], Miquel Casas[1,4], & Beatriz Molinuevo[1]

[1]*Universitat Autònoma de Barcelona (Spain)*
[2]*CSMIJ Horta-Guinardo (Hospital Sant Rafael), Germanes Hospitalàries, Barcelona (Spain)*
[3]*Instituto de Psicoloxía. Universidade de Santiago de Compostela (Spain)*
[4]*Institut de Recerca Sant Joan de Déu, Barcelona (Spain)*
[5]*Instituto de Salud Carlos III, Madrid (Spain)*

Abstract

Psychopathic traits (PT) are present from early development and are associated with severe behavioral problems (BP). Poorer executive function (EF) is also associated with BP. This study aims to examine whether PT are associated with deficits in EF, whether these deficits are associated with BP, and the potential mediating role of EF in the relationship between PT and BP. Parents of 180 children at "risk for psychopathology", aged 5-12 years (M = 8.29; SD = 2.13; 41.1% girls) participated in the study. Results from path analyses supported the expected direct effects, and highlighted the mediation effect of EF in the association between PT and BP. The effects were noteworthy when considering behavioral regulation and emotional control, showing how the relationship between the affective dimension of PT (callous-unemotional traits) and BP was fully mediated by these EF. These findings provide insight to BP heterogeneity and may clarify pathways of BP development, prognosis, and treatment.

Keywords: Psychopathic traits; executive functions; behavioral problems; children.

Resumen

Rasgos psicopáticos y problemas de conducta en niños/as en riesgo de psicopatología: El papel mediador de las funciones ejecutivas. Los rasgos psicopáticos (RP) están presentes desde el desarrollo temprano y se asocian con problemas de conducta (PC) graves. Una función ejecutiva (FE) más deficiente también se asocia con PC. El objetivo de este estudio fue examinar si los RP están asociados con déficits en las FE, si estos déficits están asociados con los PC y el posible papel mediador de las FE en la relación entre RP y PC. Familias de 180 niños en "riesgo de psicopatología", de 5 a 12 años (M = 8,29; DT = 2,13; 41,1% niñas) participaron en el estudio. Los resultados de los análisis de mediación respaldaron los efectos directos esperados y resaltaron el efecto de mediación de las FE en la asociación entre los RP y los PC. Los efectos fueron notables al considerar la regulación conductual y el control emocional, mostrando cómo la relación entre la dimensión afectiva de los RP (rasgos de dureza e insensibilidad afectiva) y los PC estaba totalmente mediada por estas FE. Estos hallazgos proporcionan información sobre la heterogeneidad de los PC y pueden aclarar sus vías de desarrollo, pronóstico y tratamiento.

Palabras clave: Rasgos psicopáticos; funciones ejecutivas; problemas de conducta; infancia.

Children with behavioral problems (BP) are heterogeneous, with a wide variety of profiles, etiologies and trajectories (Fairchild et al., 2019; Rosa-Justicia et al., 2022). Understanding the factors that influence different BP courses is essential to develop appropriate prevention and treatment programs (Rizeq et al., 2020). In reference to their etiology, at least 50% of the variance of BP could be attributed to environmental influences (Latimer et al., 2012), although heritability is estimated to range from 5-74% (Wesseldijk et al., 2018). Parenting practices and styles (van Dijk et al., 2017), school context (Squillaci & Benoit, 2021), intelligence (McKenzie & Lee, 2015), psychopathic traits (Salekin, 2017), or executive functions (EF; Wall et al., 2016), have been proposed as factors that may contribute to the occurrence of BP.

Corresponding author: Laura López-Romero: laura.lopez.romero@usc.es

Cite as: Barrau, V., López-Romero, L., Bosch, R., Torrubia, R., Bonillo, A., Casas, M., & Molinuevo, B. (2025). Psychopathic traits and behavioral problems in children at risk of psychopathology: The mediating role of executive functions. *Revista de Psicología Clínica con Niños y Adolescentes, 12(1), 5-13. doi: 10.21134/rpcna.2025.12.1.2*

Received: November 27, 2023 - Accepted: May 16, /2024

BP are strongly associated with executive dysfunction, particularly in inhibitory control and cognitive flexibility (Frick & Viding, 2009; Yang et al., 2022). EF encompasses higher order cognitive processes, which regulate goal-oriented, efficient, and adaptative behavior (Diamond, 2013), and it is crucial in self-regulation of behavior and emotions, especially inhibitory control - one of the core EF (Carver et al., 2017). These functions can be divided into cold EF, which are purely cognitive tasks (e.g., working memory, inhibition, metacognition), and hot EF, which involve affective or motivational components (e.g., behavior regulation, emotion regulation; De Luca & Leventer, 2008). However, this is a fuzzy distinction, since both work together as part of a more general adaptive function, and there is considerable overlap between the underlying neural systems (Zelazo & Carlson, 2012).

Psychopathic traits have also been linked to EF. Meta-analyses examining psychopathic traits in older adolescents and adults indicated an association with executive dysfunction (Morgan & Lilienfeld, 2000). Nevertheless, some authors suggest that they refer more to antisocial behavior than to psychopathic traits per se, adding that some dimensions of psychopathy (i.e., behavioral/lifestyle dimensions) are more related to EF deficits (e.g., inhibitory control) than others (i.e., affective and interpersonal dimensions; Baskin-Sommers et al., 2015; Friedman et al., 2021). In children, the emerging literature, which focuses mainly on the affective dimension, (i.e., callous-unemotional [CU] traits), is scarce and contradictory. There are studies that have shown positive associations between CU traits and executive dysfunction in community and high-risk preschool children (Ezpeleta et al., 2013; Waller et al., 2017) and community adolescents (Platje et al., 2018), whilst others have found positive relationships between CU traits and better EF in community children (Thomson & Centifanti, 2018; Wall et al., 2016). In addition, results can differ according to informants, parents or teachers (Graziano et al., 2019). At the neurobiological level, both psychopathic traits and EF have been associated with impairments in the prefrontal cortex, suggesting overlapping brain areas. Yet not all children with psychopathic traits (CU) and EF deficits present BP, which suggests that they may interact at different levels (Rizeq et al., 2020).

Indeed, beyond identifying the key factors involved in the onset of BP in childhood, the underlying processes that lead to trajectory variability should be explored. In this regard, there is a growing interest in explaining under what circumstances the effects occur. For instance, the moderating effect of EF has been investigated with mixed results. Some studies found that EF moderated the association between CU traits and BP, but in different ways; better EF in the presence of elevated CU would lead to milder BP (Waller et al., 2017), or better developed EF would facilitate more complex BP (Baskin-Sommers, Waller, et al., 2015; Thomson & Centifanti, 2018). Other studies detected a slight tendency of a moderating effect (Kim & Chang, 2019), or even no effect (Rizeq et al., 2020). The moderating effect of CU traits on the relationship between BP and EF has also been tested, and the scant literature suggests that BP at high levels of CU traits show worst EF (Dotterer et al., 2021; Waschbusch et al., 2022). From an alternative perspective, in a mixed preschool sample (Georgiou et al., 2019), findings showed a mediating role of cognitive empathy - which can be defined as a hot EF (Nemeth & Chustz, 2020) - in the relationship between CU traits and BP, but these findings were not replicated for overt and relational aggressive behavior. Lastly, in a study of a young adult twin community sample (Friedman et al., 2021), a mediating role of the behavioral dimension of psychopathy in the relationship between EF and antisocial behavior was found.

In the current study, we sought to expand the literature on associations among children's psychopathic traits, EF, and BP. Due to the shortage of studies examining the potential mediation effect of EF on the association between psychopathic traits and BP, this study intends to explore how these effects are established in an at-risk sample of children aged 5 to 12 years. This approach will allow to analyze whether other types of effects occur in the relationships examined (i.e., indirect or mediated effects), with practical implications of interest for prevention (Friedman et al., 2021; Georgiou et al., 2019). First, we examined direct effects of psychopathy dimensions (interpersonal, affective, behavioral/lifestyle, and the whole construct) on EF, and of EF on BP. Based on previous research, we hypothesized that psychopathic traits explain -invertedly- EF, and that poorer EF are related to BP. Second, we examined the potential mediating role of EF in the relationship between psychopathic traits and BP. We hypothesized that EF mediate the relationship between the psychopathic traits and BP.

Method

Participants

The present study is part of a larger research project called INSchool (Bosch et al., 2021; Español-Martín et al., 2021). Eligible subjects (N= 319) were those participants who were susceptible to being at-risk for psychopathology - for a detailed description of the sample see (Barrau et al., 2022) -, after they and their parents were separately interviewed by trained psychiatrists to confirm or discard a clinical diagnosis using the *Present and Lifetime version of the Kiddie Schedule for Affective Disorders and Schizophrenia* (*K-SADS/PL*; Kaufman et al., 1997). To avoid possible biases, we removed 18 subjects, eight with diagnoses of autism spectrum disorder, eight with borderline intellectual functioning and two affected by parental relationship distress. Of the remaining 301 participants, only those with reports of EF (n = 197; retention rate = 65.4%) were considered. There were statistically significant differences between participants with (n = 197) and without (n = 104) EF reports, in delinquent behavior (t [297] = 2.23, p = .03, d = .27, r = .13). No differences were found for aggressive behavior, conduct problems, or psychopathic traits. However, 17 of these participants were removed to avoid potential biases, as they were assessed with a new version of the BRIEF. The final sample was composed of 180 children (41.1% girls) aged 5–12 years (M = 8.29; SD = 2.13), from eight schools (7 state and 1 private state-subsidized) of two different rural and urban areas of Catalonia (NE Spain). Schools in these two different areas did not differ in terms of families' SES (χ_2 [3] = 6.06, p = .109).

Instruments

Sociodemographic characteristics were assessed with items developed ad hoc for the project INSchool. To this end, parents provided information on variables such as the child's age, gender, and health (general anamnesis and medical record), and the family's socioeconomic level.

The Child Problematic Traits Inventory-Parent reported (CPTI; Colins et al., 2014; López-Romero et al., 2019) is a 28-item questionnaire aimed at assessing psychopathic personality traits in children. It consists of 28 items rated by parents on a response scale ranging from 1 (*Does not apply at all*) to 4 (*Applies very well*). It is composed of three scales: Grandiose-Deceitful (GD; Cronbach's alpha [α] =.88); Callous- Unemotional (CU; α =.81); Impulsive-Need for stimulation (INS; α=.88), and a composite total score ($CPTI_{total\ score}$; α =.91).

Table 1. Correlation between Main Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
GD	-																
CU	.45***	-															
INS	.51***	.37***	-														
CPTI_total score	.79***	.71***	.86***	-													
AB	.49***	.44***	.62***	.67***	-												
DB	.58***	.50***	.47***	.62***	.64***	-											
CP	.63***	.45***	.56***	.69***	.79***	.61***	-										
EC	.39***	.44***	.38***	.54***	.61***	.43***	.61***	-									
S	.38***	.44***	.35***	.48***	.46***	.36***	.52***	.67***	-								
INH	.44***	.37***	.57***	.64***	.67***	.44***	.57***	.65***	.50***	-							
M	.36***	.32***	.46***	.54***	.44***	.38***	.41***	.50***	.49***	.72***	-						
PO	.28***	.26**	.40***	.44***	.34***	.30***	.36***	.43***	.56***	.59***	.80***	-					
OM	.30***	.18***	.37***	.37***	.31***	.26***	.31***	.36***	.43***	.51***	.52***	.54***	-				
WM	.26**	.21**	.36***	.40***	.26**	.20**	.29***	.42***	.52***	.58***	.71***	.83***	.53***	-			
I	.35***	.34***	.41***	.48***	.42***	.35***	.43***	.53***	.66***	.53***	.66***	.73***	.51***	.71***	-		
BRI	.47***	.48***	.51***	.64***	.68***	.48***	.66***	.91***	.81***	.85***	.67***	.61***	.50***	.58***	.65***	-	
MI	.35***	.30***	.46***	.51***	.39***	.34***	.41***	.52***	.62***	.68***	.86***	.92***	.70***	.91***	.84***	.70***	-

Note. GD = Grandiose-deceitful; CU = Callous-unemotional; INS = Impulsive-Need of stimulation; CPTI total score = The Child Problematic Traits Inventory total score; AB = Aggressive behavior; DB = Delinquent Behavior; CP = Conduct Problems; EC = Emotional Control; S = Shift; INH = Inhibit; M = Monitor; PO = Plan Organize; OM = Org. of materials; WM = Working Memory; I = Initiate; BRI = Behavioral regulatory index; MI = Metacognition index.
**p < .05 **p < .01 ***p < .001.*

The Strengths and Difficulties Questionnaire (Goodman, 1997) is a 25-item screening instrument intended to measure psychosocial functioning of children and adolescents. Items were rated by parents in a response scale ranging from 0 (*Not true*) to 2 (*Certainly true*), and divided into five scales: Emotional symptoms; Conduct problems (CP); Hyperactivity/inattention; Peer relationship problems; and Prosocial behavior. In the present study, only the CP scale (α =.62) was considered.

The Child Behavior Checklist (CBCL; Achenbach, 1991; Rubio-Stipec et al., 1990) is a 113-item checklist reported by parents and scored from 0 (*not true*) to 2 (*very true or often true*). The CBCL encompasses eight syndrome scales: Withdrawn; Somatic complaints; Anxious/depressed; Social problems; Thought problems; Attention problems; Delinquent behavior (DB); and Aggressive behavior (AB). In the present study, only the DB (α =.62) and AB scales (α =.89) were considered. Prior to the main statistical analyses, 10 items were eliminated because of their low frequency when referring to primary school children.

The Behavioral Rating Inventory of Executive Function (BRIEF; Belmonte, 2016; Gioia et al., 2000) is reported by parents and used to assess impairment of EF. It consists of 103 items scored on a 3-point scale: *never*, *sometimes*, and *often*. The BRIEF has eight clinical scales, of which inhibitory control (Inhibit; INH), cognitive and behavioral flexibility (Shift; S) and emotional regulation (Emotional Control; EC) make up the composite Behavioral Regulation Index (BRI), encompassing hot EF. The composite Metacognition Index (MI), reflecting cold EF, comprises of Beginning a task or generate ideas (Initiate; I), Working Memory (WM), Plan/Organize (PO), planning and organization of cognition and problem solving (Organization of Materials; OM), and self-monitoring in the social context as well as monitoring problem solving and task performance (Monitor; M). High scores on any of the BRIEF scales indicate the presence of problems in the area represented.

Procedure

The project was approved by the Clinical Research Ethics Committee of the Vall d'Hebron Hospital in Barcelona. Informed consent was obtained from all individual participants included in the study. Data for the current study were collected during the 2016-2017 academic year.

Data Analysis

All analyses between psychopathic traits, EF, and BP were examined through path analyses in Mplus 7.4 (Muthén & Muthén, 2019), which makes it possible to examine complex models including the direct and indirect (mediated) effects with observed variables. A total of 18 models were tested to assess the three scales of behavioral problems described above. Of these, nine considered the three dimensions of psychopathy, and nine the global construct of psychopathy. Analyses of the BRIEF indices and scales were performed separately, the latter being grouped according to the index to which they were related. A combination of maximum likelihood (ML) and bootstrapping (b = 5,000) was used in order to maximize accurate estimations under a non-normal distribution and estimate bias-corrected 95% confidence intervals for indirect effects (Hancock & Liu, 2012). Goodness of fit was assessed with chi-square distribution (χ2/DF), comparative fit index (CFI), root-mean-square error of approximation (RMSEA), and standardized root-mean-square residual (SRMR). The criteria considered for an optimum fit were χ2/DF < 2–3, CFI > .95, RMSEA and SRMR< .05; and for an acceptable fit χ2/DF < 4, CFI > .90, and RMSEA and SRMR < .08 (Byrne, 2013; Hu & Bentler, 1999).

Table 2. Effects of Psychopathic Traits on Aggressive Behavior Mediated by the Behavioral Rating Inventory of Executive Function Indices

CPTI	EF mediator	Direct effects						Indirect effects	
		(1) PT on AB		(2) PT on EF		(3) EF on AB			
		β	CI [95%]	β	CI [95%]	β	CI [95%]	β	CI [95%]
GD	BRI	.173*	.037, .314	.234*	.049, .416			.099*	.017, .196
CU		.001	-.117, .128	.260**	.073, .437	.422***	.296, .536	.110**	.031, .191
INS		.303***	.204, .406	.312***	.178, .435			.131***	.071, .192
CPTI total score		.405***	.290, .518	.655***	.553, .744	.419***	.297, .530	.274***	.189, .365
GD	MI	.266**	.110, .408	.116	-.070, .315			.006	-.020, .037
CU		.105	-.012, .240	.115	-.088, .310	.053	-.103, .196	.006	-0.20, .0.38
INS		.414***	.278, .540	.384***	.227, .530			.020	-.036, .084
CPTI total score		.643***	.536, .745	.526***	.409, .642	.069	-.092, .216	.036	-.053, .115

Note. EF = Executive function; PT = Psychopathic traits; AB = Aggressive behavior; CI = Confidence interval; GD = Grandiose-deceitful; CU = Callous-unemotional; INS = Impulsive-Need of stimulation; CPTI total score = The Child Problematic Traits Inventory total score; BRI = Behavioral regulatory index; MI = Metacognition index.
In terms of model fit, all models were identified (χ_2 = .00; RMSEA = .00; CFI = 1.00; TLI = 1.00)
**p < .05 **p < .01 ***p < .001.*

Table 3 . Effects of Psychopathic Traits on Delinquent Behaviora Mediated by the Behavioral Rating Inventory of Executive Function Indices

CPTI	EF mediator	Direct effects						Indirect effects	
		(1) PT on DB		(2) PT on EF		(3) EF on DB			
		β	CI [95%]	β	CI [95%]	β	CI [95%]	β	CI [95%]
GD	BRI	.427***	.317, .540	.193	-.014, .389			.029	-.004, .078
CU		.124	-.004, .249	.288**	.109, .475	.152	-.001, .282	.044	-.001, .100
INS		.097	.002, .215	.326***	.192, .451			.050	-.005, .100
CPTI total score		.527***	.381, .648	.662***	.562, .751	.146	-.002, .288	.097	-.002, .195
GD	MI	.449***	.334, .559	.113	-.077, .320			.008	-.010, .036
CU		.161**	.045, .267	.113	-.102, .309	.068	-.060, .186	.008	-.014, .038
INS		.121*	.010, .237	.388***	.232, .533			.026	-.022, .077
CPTI total score		.603***	.494, 695	.528***	.408, .643	.040	-.087, .175	.021	-.044, .095

Note. EF = Executive function; PT = Psychopathic traits; DB= Delinquent Behavior; CI = Confidence interval; GD = Grandiose-deceitful; CU = Callous-unemotional; INS = Impulsive-Need of stimulation; CPTI total score= The Child Problematic Traits Inventory total score; BRI = Behavioral regulatory index; MI = Metacognition index
Model fit: BRI-CPTI Dimensions (χ_2 = .88 [1]; RMSEA = .00 [.00 - .15]; CFI = 1.00; TLI = 1.00); BRI-CPTI total score (χ_2 = .95 [1]; RMSEA = .00; CFI = 1.00; TLI = 1.00)
a Due to significant gender differences in Delinquent Behavior, all models were controlled by gender
**p < .05 **p < .01 ***p < .001.*

Table 4. Effects of Psychopathic Traits on Conduct Problems Mediated by the Behavioral Rating Inventory of Executive Function Indices

CPTI	EF mediator	Direct effects						Indirect effects	
		(1) PT on CP		(2) PT on EF		(3) EF on CP			
		β	CI [95%]	β	CI [95%]	β	CI [95%]	β	CI [95%]
GD	BRI	.305***	.156, .438	.163	.049, .416			.067	-.012, .163
CU		-.007	-.154, .142	.284**	.073, .437	.412***	.277, .541	.117**	.045, .203
INS		.183**	.046, .310	.345***	.211, .466			.142***	.078, .210
CPTI total score		.412***	.285, .539	649***	.547, .738	.397***	.242, .526	.258***	.157, .359
GD	MI	.363***	.214, .502	.102	-.093, .308			.010	-.019, .045
CU		.099	-.036, .260	.116	-.085, .310	.095	-.064, .259	.011	-.012, .052
INS		.288***	.121, .440	.393***	.235, .538			.037	-.022, .113
CPTI total score		626***	.514, .727	.524***	.403, .638	.083	-.065, .226	.044	-.034, .127

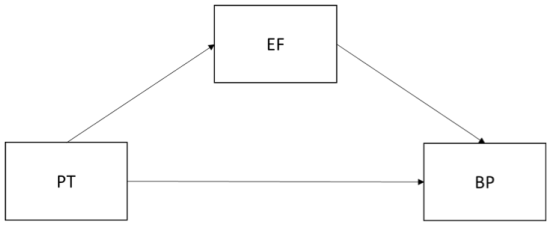
Note. EF = Executive function; PT = Psychopathic traits; CP = Conduct problems; CI = Confidence interval; GD = Grandiose-deceitful; CU = Callous-unemotional; INS = Impulsive-Need of stimulation; CPTI total score = The Child Problematic Traits Inventory total score; BRI = Behavioral regulatory index; MI = Metacognition index
In terms of model fit, all models were identified (χ_2 = .00; RMSEA = .00; CFI = 1.00; TLI = 1.00)
**p < .05 **p < .01 ***p < .001.*

Results

All study variables were significantly correlated (see Table 1). Preliminary analyses revealed statistically significant differences in delinquent behavior in terms of gender (t [178] = 2.52, p = .01, d = .38, r = .19), with higher rates in boys, and in the EF Initiative in terms of age (F [7, 172] = 2.17, p < .05), with younger children (i.e., 6-year-olds) showing significantly lower levels of initiative than their oldest counterparts (i.e., 12-year-olds). No differences were found for aggressive behavior, conduct problems, psychopathic traits and the remaining EF. Therefore, both gender and age were controlled for in subsequent analyses when the affected variables were examined.

A visual representation of the tested mediation model can be seen in Figure 1. All models ranged from acceptable to fully saturated model (further details available in the table notes).

Figure 1. Theoretical Mediation Model of the Relationship between Psychopathic traits and Behavioral Problems via Executive Functioning



Note. PT = Psychopathic traits; EF = Executive functions; BP = Behavioral Problems

The Effect of Psychopathy Dimensions on Executive Functions

Only the results obtained with the BRIEF indices are shown below; the results of each BRIEF subscale are attached as supplementary material. Findings show that psychopathic traits in children had a direct effect on EF. These effects were noticeable in the subscale Aggressive behavior of the CBCL (see Table 2), where all dimensions had effects on the Behavioral Regulation Index. A direct effect of INS, and $CPTI_{total\ score}$ was found on the Metacognition Index. When subscale Delinquent behavior of the CBCL is considered (see Table 3), we can observe direct effects of CU, INS, and $CPTI_{total\ score}$ on the Behavioral Regulation Index, whilst only INS, and $CPTI_{total\ score}$ scales had a direct effect on the Metacognition Index. Similar results are observed for subscale Conduct problems of the SDQ (see Table 4).

The Effects of Executive Function on Behavioral Problems

Tables 2 and 4 show that EF have an impact on BP. Thus, we can observe how the Behavioral Regulation Index has a direct effect on subscale Aggressive behavior of the CBCL, and subscale Conduct problems of the SDQ, but not on subscale Delinquent behavior of the CBCL (see Table 3).

Focusing on the BRIEF scales that account for the Behavioral Regulation Index (i.e., "hot" EF; see Tables S1-S3 for a more detailed information), we observed that the Emotional Control subscale has an impact on subscale Aggressive behavior (see Table S1) of the CBCL (β = .368, p < .001 for CPTI dimensions; β = .351, p < .001 for $CPTI_{total}$), on subscale Delinquent behavior (see Table S2) of the CBCL (β = .133, p < .05 for $CPTI_{total\ score}$), and on subscale Conduct problems (see Table S3) of the SDQ (β = .382, p < .001 for CPTI dimensions; β= .365, p < .001 for $CPTI_{total\ score}$). The Shift subscale has an impact on subscale Aggressive behavior (see Table S1) of the CBCL (β = 193, p < .01 for CPTI dimensions; β = .174, p < .01 for $CPTI_{total\ score}$), and on subscale Conduct problems (see Table S3) of the SDQ (β = .284, p < .001 for CPTI dimensions; β = .263, p < .001 for $CPTI_{total\ score}$). The Inhibit subscale has an impact on subscale Aggressive behavior (see Table S1) of the CBCL (β = .383, p < .001 for CPTI dimensions; β = .395, p < .001 for $CPTI_{total\ score}$), on subscale Delinquent behavior (see Table S2) of the CBCL (β = .165, p < .05 for CPTI dimensions), and on subscale Conduct problems (see Table S3) of the SDQ (β = .252, p < .01 for CPTI dimensions; β = .231, p < .01 for $CPTI_{total\ score}$). Regarding the BRIEF scales accounting for the Metacognition index (i.e., "cold" EF; see Tables S4-S6 for a more detailed information), the Monitor subscale has an impact on subscale Delinquent behavior (see Table S5) of the CBCL (β = .119, p < .05 for CPTI dimensions), whilst the Initiate subscale has an impact on subscale Aggressive behavior (see Table S4) of the CBCL (β = .140, p < .05 for CPTI dimensions; β = .152, p < .05 for $CPTI_{total\ score}$), and on subscale Conduct problems (see Table S6) of the SDQ (β = .196, p < .01 for CPTI dimensions; β= .178, p < .05 for $CPTI_{total\ score}$)

Mediation Effects of Executive Functions on the Relationship between Psychopathic Traits and Behavioral Problems.

There is a mediating role of some EF in the relationship between psychopathic traits and BP. Thereby, indirect effects of GD, CU, INS and $CPTI_{total\ score}$ on subscale Aggressive behavior of the CBCL are observed through the Behavioral Regulation Index (see Table 2), as well as the Emotional Control subscale, the Shift subscale and the Inhibit subscale (see Table S1). Indirect effects of CU, INS and $CPTI_{total\ score}$ on subscale Conduct problems of the SDQ are observed through the Behavioral Regulation Index (see Table 4), and the Emotional Control subscale, the Shift subscale, and the Inhibit subscale (see Table S3). Furthermore, an indirect effect of $CPTI_{total\ score}$ is shown through subscale Initiate on subscale Aggressive behavior of the CBCL (see Table S4), and an indirect effect of INS and $CPTI_{total\ score}$ on subscale Conduct problems of the SDQ. No EF mediation is observed between psychopathy and subscale Delinquent behavior of the CBCL.

Discussion

The aim of this study was to investigate how psychopathic traits, EF and BP are related, and expand the literature from a multidimensional and ecological perspective. Consistent with our hypotheses, we demonstrated unique, main effects of psychopathic traits and EF on the relationship with BP, and furthermore, that EF mediate the relationship between the psychopathy dimensions and their global construct and the BP, in a sample of at-risk children aged 5 to 12 years.

The Effect of Psychopathy Dimensions on Executive Functions

Consistent with our first hypothesis, both the three dimensions of psychopathy and their general construct explain the presence of poorer EF, in line with previous research in children-adolescents (Ezpeleta et al., 2013; Platje et al., 2018; Waller et al., 2017), and adults (Morgan & Lilienfeld, 2000). However, not all dimensions of psychopathy have the same relationship with EF, and there is little support for a generalized impairment of EF in relation to the dimensions of psychopathy (Maes & Brazil, 2013). Hence, it can be observed that only the INS dimension or the global construct of psychopathy inversely explain most of the evaluated EF. The INS dimension has been clearly associated with poorer EF in adulthood over the other two dimen-

sions (Friedman et al., 2021). The CU dimension was related to poorer emotional and behavioral regulation (i.e., Emotional Control and Behavioral Regulation Index) according to recent findings in preschoolers (Graziano et al., 2019; Waller et al., 2017), and adolescents (Platje et al., 2018). Similarly, poorer flexibility in children with high CU traits was also observed (see Supplementary material). In particular, the presence of cognitive inflexibility could partly explain the persistence of behavioral perseverative conducts, despite punishment (Séguin & Zelazo, 2005), which in turn is clearly associated with the presence of CU traits (Frick et al., 2014; Squillaci & Benoit, 2021). Our findings do not show dysfunction in the Metacognition Index, in line with other studies (Graziano et al., 2019; Rydell & Brocki, 2019) but contrary to the results obtained by Platje and colleagues (Platje et al., 2018), and could be aligned with those who have reported that more CU traits implied markedly higher cold EF (Thomson & Centifanti, 2018; Wall et al., 2016). Regarding the GD dimension, the findings are similar to those obtained for the CU dimension, although they are only observed in the model that considers the Aggressive behavior scale. This might be attributable to the possibility that there is less damage to brain functioning in GD traits than in the other two dimensions (Salekin, 2017). Finally, the fact that the Metacognition Index is shown to be intact despite the presence of GD and CU traits may lead us to hypothesize about the concept of successful psychopaths, a subgroup which would be considered to have intact or superior executive functions in adulthood, especially for the GD and CU dimensions (Wallace et al., 2022).

The Effects of Executive Function on Behavioral Problems

Overall, our findings show that greater executive dysfunction leads to worse behavioral problems. The worse results in Behavioral Regulation Index and its related scales imply more Aggressive behavior or Conduct problems. Again, the findings suggest the importance of hot EF, but also of inhibition and cognitive flexibility. Behavioral and emotional regulation problems have a direct effect on BP (Lonigan et al., 2017), and both inhibition and cognitive flexibility could be postulated as being core executive functions (Rizeq et al., 2020). Therefore, lower EF may increase the risk of engaging in BP through a reduced ability to control emotions, reduced behavioral inhibition, and poorer behavioral regulation when faced with adverse situations (Sprague et al., 2011).

A surprising finding of our study was that in our sample, executive dysfunction had a clearer impact on the Aggressive behavior and Conduct problems scales than on the Delinquent behavior scale. One possible explanation lies in the fact that the delinquent behavior subscale seems to be more closely related to proactive aggression (Raine et al., 2006), which would be in line with previous studies (Baskin-Sommers, Waller et al., 2015; Thomson & Centifanti, 2018). Thus, while reactive aggressiveness is associated with poor behavioral control and emotional hyper-reactivity (Reidy et al., 2011), proactive aggressiveness would require more complex cognition (Dodge et al., 2015). Much more research is needed, however, to discard any potential methodological biases and further clarify this unexpected result.

Mediation Effects of Executive Functions on the Relationship between Psychopathic Traits and Behavioral Problems.

According to our results, the third hypothesis of the present study is no more than partially supported, because only some of the executive functions assessed have a mediating effect on the relationship between psychopathic traits and behavioral problems. As expected, there are direct effects of the different dimensions of psychopathy on the different scales of BP. Similarly, indirect effects of the dimensions of psychopathy on the Aggressive behavior and Conduct problems scales are also observed through the Behavioral Regulation Index and its related scales (i.e., mediation effects). Most of them are partial mediation effects, suggesting that at least part of the effect of psychopathic traits on BP is explained by executive dysfunction. However, our results show a couple of unexpected findings; there is no direct effect between CU and BP, showing as a total mediation effect through Behavioral Regulation Indexfor the Aggressive behavior and Conduct problems scales, while there is a direct effect between CU and the Delinquent behavior scale (only if the Metacognition Index is taken into account) with no mediation effect by EF. Taken together, these findings suggest that the relationship between CU and BP traits has something to do with the involvement of EF in behavioral regulation. Thus, EF would be relevant variables in the study of psychopathy, especially in CU traits, possibly due to the different cognitive correlates of each of the dimensions of psychopathy and the relationship that both CU traits and hot EF have with the amygdala (Noordermeer et al., 2016; Salekin, 2017). Another point to consider would be the absence of indirect effects with the Metacognition Index, for which we do not have a fully satisfactory explanation. As previously mentioned, our findings could be aligned with those who have reported that more CU traits implied markedly higher cold EF (Thomson & Centifanti, 2018; Wall et al., 2016), and may lead us to hypothesize about the concept of successful psychopaths (Wallace et al., 2022). Nevertheless, children with CU traits have deficits in reward responsivity and punishment insensitivity (Platje et al., 2018), and this is where poorer behavioral and emotional regulation (Behavioral Regulation Index and its related scales) would play a mediating role in the BP. However, these assertions are all very preliminary and further research to clarify associations is needed.

Strengths and Limitations

The strengths of this study include the availability of a considerable sample of children at-risk for psychopathology, the use of well-validated and commonly used questionnaires to measure external correlates, and the inclusion of the dimensions that make up the psychopathy construct. However, certain limitations should be considered. First, this is a cross-sectional study, so causality cannot be established. Indeed, making causal inferences has not been the objective of our study, but we aimed to explore and hypothesize the effects established between the variables of interest and preliminary explain how a certain relationship is produced. Yet, the possible directions of the effects should be explored and replicated in future longitudinal research. Second, because this study was conducted in a sample of children at risk of psychopathology, different pathological profiles (i.e., externalizing versus internalizing) could have influenced the results. This hypothesis should be explored in future research conducted from person-oriented perspectives, allowing to examine the intended effects across different profiles within clinical or at-risk samples. This approach will be enriched by also including a control or comparison group which allows for comparison between at-risk and community-based participants. Third, as information was provided by parents, our results may be conditioned by shared variance; nevertheless, it could be also considered a strength since it provides ecological validity (Gioia & Isquith, 2004; Rizeq et al., 2020). Future research should include the use of standardized performance tasks for EF, since they do not necessarily measure the same as the EF assess-

ment scales (Toplak et al., 2013). Finally, even though the potential effect of gender was controlled for, future research, involving larger samples, should include a gender perspective and differentially examine the observed chain of effects in boys and girls.

Conclusions

In sum, our findings show unique, main effects of psychopathic traits and EF on the relationship with BP. Furthermore, EF mediate the relationship of all three psychopathy dimensions and the total psychopathy score with BP, such that the higher the score on the psychopathy dimensions, the lower the EF score, which, in turn, would have a negative impact on BP. The results extend previous evidence about correlates of psychopathy associated with each dimension, and may have implications for both the prediction and prevention of BP. To advance on this knowledge, further studies should take into account the different profiles of psychopathic traits in childhood, to determine if the mediating role of both, hot and cold EF, varies for each of them. Furthermore, because in the current sample, the effects are mainly observed with hot EF, we suggest the possibility that the model may be influenced by other personality traits, an issue that should be further resolved in future research.

Supplementary Material

Supplementary Material can be found at https://osf.io/83w4a/

Acknowledgements

The authors thank the schools, the teachers, and the families for their participation.

Funding

This work was funded by la Caixa "Banking Foundation", Diputació de Barcelona, Diputació de Lleida, and Department of Health of Generalitat de Catalunya. It was also supported by the grant RYC2021-032890-I, funded by MCIN/AEI/10.13039/501100011033 and the European Union "NextGenerationEU"/PRTR.

Conflict of interests

The authors declare no conflicts of interest.

References

Achenbach, T. (1991). Child Behavior Checklist for Ages 4-18. In *Manual for the Child Behavior Checklist/4-18 and 1991 profile*. University of Vernon, Department of Psychiatry.

Barrau, V., López-Romero, L., Bosch, R., Torrubia, R., Casas, M., & Molinuevo, B. (2022). Further Validation of the Spanish Parent-Reported Child Problematic Traits Inventory: Discriminant Validity for Distinguishing Children Vulnerable to Externalizing and Other Psychopathology Conditions. *Journal of Psychopathology and Behavioral Assessment*, *44*(1), 245–260. https://doi.org/10.1007/s10862-021-09921-z

Baskin-Sommers, A. R., Brazil, I. A., Ryan, J., Kohlenberg, N. J., Neumann, C. S., & Newman, J. P. (2015). Mapping the association of global executive functioning onto diverse measures of psychopathic traits. *Personality Disorders*, *6*(4), 336–346. https://doi.org/10.1037/per0000125

Baskin-Sommers, A. R., Waller, R., Fish, A. M., & Hyde, L. W. (2015). Callous-Unemotional Traits Trajectories Interact with Earlier Conduct Problems and Executive Control to Predict Violence and Substance Use Among High Risk Male Adolescents. *Journal of Abnormal Child Psychology*, *43*(8), 1529–1541. https://doi.org/10.1007/s10802-015-0041-8

Belmonte, M. J. (2016). *Adaptación del BRIEF (Behavior Rating Inventory of Executive Function) a población española y su utilidad para el diagnóstico del trastorno por déficit de atención-hiperactividad: subtipos inatento y combinado.* [Universidad Complutense de Madrid]. https://eprints.ucm.es/id/eprint/37563/

Bosch, R., Pagerols, M., Rivas, C., Sixto, L., Bricollé, L., Espanõl-Martín, G., Prat, R., Ramos-Quiroga, J. A., & Casas, M. (2021). Neurodevelopmental disorders among Spanish school-age children: Prevalence and sociodemographic correlates. *Psychological Medicine,* 52(14), 3062–3072. https://doi.org/10.1017/S0033291720005115

Byrne, B. M. (2013). *Structural Equation Modeling with Mplus*. Routledge. https://doi.org/10.4324/9780203807644

Carver, C. S., Johnson, S. L., & Timpano, K. R. (2017). Toward a Functional View of the P Factor in Psychopathology. *Clinical Psychological Science : A Journal of the Association for Psychological Science*, *5*(5), 880–889. https://doi.org/10.1177/2167702617710037

Colins, O. F., Andershed, H., Frogner, L., Lopez-Romero, L., Veen, V., & Andershed, A.-K. (2014). A New Measure to Assess Psychopathic Personality in Children: The Child Problematic Traits Inventory. *Journal of Psychopathology and Behavioral Assessment*, *36*(1), 4–21. https://doi.org/10.1007/s10862-013-9385-y

De Luca, C. R., & Leventer, R. J. (2008). Developmental trajectories of executive functions across the lifespan. In *Executive functions and the frontal lobes: A lifespan perspective*. (pp. 23–56). Taylor & Francis.

Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, *64*, 135–168. https://doi.org/10.1146/annurev-psych-113011-143750

Dodge, K. A., Malone, P. S., Lansford, J. E., Sorbring, E., Skinner, A. T., Tapanya, S., Tirado, L. M. U., Zelli, A., Alampay, L. P., Al-Hassan, S. M., Bacchini, D., Bombi, A. S., Bornstein, M. H., Chang, L., Deater-Deckard, K., Di Giunta, L., Oburu, P., & Pastorelli, C. (2015). Hostile attributional bias and aggressive behavior in global context. *Proceedings of the National Academy of Sciences of the United States of America*, *112*(30), 9310–9315. https://doi.org/10.1073/pnas.1418572112

Dotterer, H. L., Tomlinson, R. C., Burt, S. A., Weigard, A. S., Klump, K. L., & Hyde, L. W. (2021). Neurocognitive abilities associated with antisocial behavior with and without callous-unemotional traits in a community sample. *Neuropsychology*, *35*(4), 374–387. https://doi.org/10.1037/neu0000733

Español-Martín, G., Pagerols, M., Prat, R., Rivas, C., Sixto, L., Valero, S., Artigas, M. S., Ribasés, M., Ramos-quiroga, J. A., Casas, M., & Bosch, R. (2021). Strengths and Difficulties Questionnaire : Psychometric Properties and Normative Data for Spanish 5- to 17-Year-Olds. *Assessment*, *28*(5), 1445–1458. https://doi.org/10.1177/1073191120918929

Ezpeleta, L., de la Osa, N., Granero, R., Penelo, E., & Domènech, J. M. (2013). Inventory of Callous-Unemotional Traits in a Community Sample of Preschoolers. *Journal of Clinical Child and Adolescent Psychology*, *42*(1), 91–105. https://doi.org/10.1080/15374416.2012.734221

Fairchild, G., Hawes, D. J., Frick, P. J., Copeland, W. E., Odgers, C. L., Franke, B., Freitag, C. M., & De Brito, S. A. (2019). Conduct disorder. *Nature Reviews Disease Primers*, *5*(1), 1–25. https://doi.org/10.1038/s41572-019-0095-y

Frick, P. J., Ray, J. V, Thornton, L. C., & Kahn, R. E. (2014). Can callous-unemotional traits enhance the understanding, diagnosis, and treatment of serious conduct problems in children and adolescents? A comprehensive review. *Psychological Bulletin*, *140*(1), 1–57. https://doi.org/10.1037/a0033076

Frick, P. J., & Viding, E. (2009). Antisocial behavior from a developmental psychopathology perspective. *Development and Psychopathology*, *21*(4), 1111–1131. https://doi.org/10.1017/S0954579409990071

Friedman, N. P., Rhee, S. H., Ross, J. M., Corley, R. P., & Hewitt, J. K. (2021). Genetic and environmental relations of executive functions to antisocial personality disorder symptoms and psychopathy. *International Journal of Psychophysiology*, *163*, 67–78. https://doi.org/10.1016/j.ijpsycho.2018.12.007

Georgiou, G., Kimonis, E. R., & Fanti, K. A. (2019). What do others feel? Cognitive empathy deficits explain the association between callous-unemotional traits and conduct problems among preschool children. *European Journal of Developmental Psychology*, *16*(6), 633–653. https://doi.org/10.1080/17405629.2018.1478810

Gioia, G. A., & Isquith, P. K. (2004). Ecological Assessment of Executive Function in Traumatic Brain Injury. *Developmental Neuropsychology*, *25*(1–2), 135–158. https://doi.org/10.1080/87565641.2004.9651925

Gioia, G. A., Isquith, P. K., Guy, S. C., & Kenworthy, L. (2000). *BRIEF. Evaluación Conductual de la Función Ejecutiva. Manual de aplicación, corrección y interpretación*. TEA Ediciones, S. A. U.

Gioia, G. A., Isquith, P. K., Guy, S. C., & Kenworthy, L. (2017). *BRIEF 2. Evaluación Conductual de la Función Ejecutiva. Manual de aplicación, corrección y interpretación*. TEA Ediciones, S. A. U.

Goodman, R. (1997). The strengths and difficulties questionnaire: A research note. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *38*(5), 581–586. https://doi.org/10.1111/j.1469-7610.1997.tb01545.x

Graziano, P. A., Landis, T., Maharaj, A., Ros-Demarize, R., Hart, K. C., & Garcia, A. (2019). Differentiating Preschool Children with Conduct Problems and Callous-Unemotional Behaviors through Emotion Regulation and Executive Functioning. *Journal of Clinical Child & Adolescent Psychology*, *176*(12), 1–13. https://doi.org/10.1080/15374416.2019.1666399

Hancock, G. R., & Liu, M. (2012). Bootstrapping standard errors and data-model fit statistics in structural equation modeling. In *Handbook of structural equation modeling.* (pp. 296–306). The Guilford Press.

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Kaufman, J., Birmaher, B., Brent, D., Rao, U., Flynn, C., Moreci, P., Williamson, D., & Ryan, N. (1997). Schedule for affective disorders and schizophrenia for school-age children-present and lifetime version (K-SADS-PL): Initial reliability and validity data. *Journal of the American Academy of Child and Adolescent Psychiatry*, *36*(7), 980–988. https://doi.org/10.1097/00004583-199707000-00021

Kim, H., & Chang, H. (2019). Longitudinal Association Between Children's Callous-Unemotional Traits and Social Competence: Child Executive Function and Maternal Warmth as Moderators. *Frontiers in Psychology*, *10*, Article 379. https://doi.org/10.3389/fpsyg.2019.00379

Latimer, K., Wilson, P., Kemp, J., Thompson, L., Sim, F., Gillberg, C., Puckering, C., & Minnis, H. (2012). Disruptive behaviour disorders: A systematic review of environmental antenatal and early years risk factors. *Child: Care, Health and Development*, *38*(5), 611–628. https://doi.org/10.1111/j.1365-2214.2012.01366.x

Lonigan, C. J., Spiegel, J. A., Goodrich, J. M., Morris, B. M., Osborne, C. M., Lerner, M. D., & Phillips, B. M. (2017). Does Preschool Self-Regulation Predict Later Behavior Problems in General or Specific Problem Behaviors? *Journal of Abnormal Child Psychology*, *45*(8), 1491–1502. https://doi.org/10.1007/s10802-016-0260-7

López-Romero, L., Molinuevo, B., Bonillo, A., Andershed, H., Colins, O. F., Torrubia, R., & Romero, E. (2019). Psychometric properties of the Spanish version of the Child Problematic Traits Inventory in 3- to 12-year-old Spanish children. *European Journal of Psychological Assessment*, *35*(6), 842–854. https://doi.org/10.1027/1015-5759/a000458

Maes, J. H. R., & Brazil, I. A. (2013). No clear evidence for a positive association between the interpersonal-affective aspects of psychopathy and executive functioning. *Psychiatry Research*, *210*(3), 1265–1274. https://doi.org/10.1016/j.psychres.2013.09.028

McKenzie, M. E., & Lee, S. S. (2015). Cognitive Ability and Psychopathic Traits: Independent and Interactive Associations with Youth Conduct Problems. *Journal of Abnormal Child Psychology*, *43*(4), 761–771. https://doi.org/10.1007/s10802-014-9932-3

Morgan, A. B., & Lilienfeld, S. O. (2000). A meta-analytic review of the relation between antisocial behavior and neuropsychological measures of executive function. *Clinical Psychology Review*, *20*(1), 113–136. https://doi.org/10.1016/S0272-7358(98)00096-8

Muthén, L. K. &, & Muthén, B. O. O. (2019). *Mplus User's Guide* (8th ed.; 7th ed.). Muthén & Muthén.

Nemeth, D. G., & Chustz, K. M. (2020). Understanding "hot and cold" executive functions in children and adolescents. In *Evaluation and treatment of neuropsychologically compromised children.* (pp. 121–130). Elsevier Academic Press. https://doi.org/10.1016/B978-0-12-819545-1.00007-2

Noordermeer, S. D. S., Luman, M., & Oosterlaan, J. (2016). A Systematic Review and Meta-analysis of Neuroimaging in Oppositional Defiant Disorder (ODD) and Conduct Disorder (CD) Taking Attention-Deficit Hyperactivity Disorder (ADHD) Into Account. *Neuropsychology Review*, *26*(1), 44–72. https://doi.org/10.1007/s11065-015-9315-8

Platje, E., Huijbregts, S. C. J. J., van Goozen, S. H. M. M., Popma, A., Cima, M., & Swaab, H. J. T. T. (2018). Executive Functioning, Reward/Punishment Sensitivity, and Conduct Problems in Boys With Callous-Unemotional Traits. *International Journal of Offender Therapy and Comparative Criminology*, *62*(13), 4008–4023. https://doi.org/10.1177/0306624X18758897

Raine, A., Dodge, K., Loeber, R., Gatzke-Kopp, L., Lynam, D., Reynolds, C., Stouthamer-Loeber, M., & Liu, J. (2006). The reactive-proactive aggression questionnaire: Differential correlates of reactive and proactive aggression in adolescent boys. *Aggressive Behavior*, *32*(2), 159–171. https://doi.org/10.1002/ab.20115

Reidy, D. E., Shelley-Tremblay, J. F., & Lilienfeld, S. O. (2011). Psychopathy, reactive aggression, and precarious proclamations: A review of behavioral, cognitive, and biological research. *Aggression and Violent Behavior*, *16*(6), 512–524. https://doi.org/10.1016/j.avb.2011.06.002

Rizeq, J., Toplak, M. E., Ledochowski, J., Basile, A., & Andrade, B. F. (2020). Callous-Unemotional Traits and Executive Functions are Unique Correlates of Disruptive Behavior in Children. *Developmental Neuropsychology*, *45*(3), 154–166. https://doi.org/10.1080/87565641.2020.1737698

Rosa-Justicia, M., Saam, M. C., Flamarique, I., Borràs, R., Naaijen, J., Dietrich, A., Hoekstra, P. J., Banaschewski, T., Aggensteiner, P., Craig, M. C., Sethi, A., Santosh, P., Sagar-Ouriaghli, I., Arango, C., Penzol, M. J., Brandeis, D., Werhahn, J. E., Glennon, J. C., Franke, B., … Castro-Fornieles, J. (2022). Subgrouping children and adolescents with disruptive behaviors: symptom profiles and the role of callous–unemotional traits. *European Child and Adolescent Psychiatry*, *31*(1), 51–66. https://doi.org/10.1007/s00787-020-01662-w

Rubio-Stipec, M., Bird, H., Canino, G., & Gould, M. (1990). The internal consistency and concurrent validity of a Spanish translation of the Child Behavior Checklist. *Journal of Abnormal Child Psychology*, *18*(4), 393–406. https://doi.org/10.1007/BF00917642

Rydell, A. M., & Brocki, K. C. (2019). Cognitive and Emotional Profiles of CU Traits and Disruptive Behavior in Adolescence: a Prospective Study. *Journal of Abnormal Child Psychology*, *47*(6), 1039–1051. https://doi.org/10.1007/s10802-018-0496-5

Salekin, R. (2017). Research Review: What do we know about psychopathic traits in children? *Journal of Child Psychology and Psychiatry*, *11*, 1180–1200. https://doi.org/10.1111/jcpp.12738

Séguin, J. R., & Zelazo, P. D. (2005). Executive Function in Early Physical Aggression. In *Developmental origins of aggression.* (pp. 307–329). The Guilford Press.

Sprague, J., Verona, E., Kalkhoff, W., & Kilmer, A. (2011). Moderators and Mediators of the Stress-Aggression Relationship: Executive Function and State Anger. *Emotion*, *11*(1), 61–73. https://doi.org/10.1037/a0021788

Squillaci, M., & Benoit, V. (2021). Role of callous and unemotional (Cu) traits on the development of youth with behavioral disorders: A systematic review. *International Journal of Environmental Research and Public Health*, 18(9), Article 4712. https://doi.org/10.3390/ijerph18094712

Thomson, N. D., & Centifanti, L. C. M. (2018). Proactive and Reactive Aggression Subgroups in Typically Developing Children: The Role of Executive Functioning, Psychophysiology, and Psychopathy. *Child Psychiatry and Human Development*, *49*(2), 197–208. https://doi.org/10.1007/s10578-017-0741-0

Toplak, M. E., West, R. F., & Stanovich, K. E. (2013). Practitioner Review: Do performance-based measures and ratings of executive function assess the same construct? *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *54*(2), 131–143. https://doi.org/10.1111/jcpp.12001

van Dijk, R., Deković, M., Bunte, T. L., Schoemaker, K., Zondervan-Zwijnenburg, M., Espy, K. A., & Matthys, W. (2017). Mother-Child Interactions and Externalizing Behavior Problems in Preschoolers over Time: Inhibitory Control as a Mediator. *Journal of Abnormal Child Psychology*, *45*(8), 1503–1517. https://doi.org/10.1007/s10802-016-0258-1

Wall, T. D., Frick, P. J., Fanti, K. A., Kimonis, E. R., & Lordos, A. (2016). Factors differentiating callous-unemotional children with and without conduct problems. *Journal of Child Psychology and Psychiatry*, *57*(8), 976–983. https://doi.org/10.1111/jcpp.12569

Wallace, L., Fido, D., Sumich, A. L., & Heym, N. (2022). A systematic review on the current conceptualisations of successful psychopathy. *Forensic Science International: Mind and Law*, *3*, Article 100076. https://doi.org/10.1016/j.fsiml.2022.100076

Waller, R., Hyde, L. W., Baskin-Sommers, A. R., & Olson, S. L. (2017). Interactions between Callous Unemotional Behaviors and Executive Function in Early Childhood Predict later Aggression and Lower Peer-liking in Late-childhood. *Journal of Abnormal Child Psychology*, *45*(3), 597–609. https://doi.org/10.1007/s10802-016-0184-2

Waschbusch, D. A., Babinski, D. E., Fosco, W. D., Haas, S. M., Waxmonsky, J. G., Garon, N., Nichols, S., King, S., Santor, D. A., & Andrade, B. F. (2022). Inhibitory Control, Conduct Problems, and Callous Unemotional Traits in Children with ADHD and Typically Developing Children. *Developmental Neuropsychology*, *47*(1), 42–59. https://doi.org/10.1080/87565641.2022.2032713

Wesseldijk, L. W., Bartels, M., Vink, J. M., van Beijsterveldt, C. E. M., Ligthart, L., Boomsma, D. I., & Middeldorp, C. M. (2018). Genetic and environmental influences on conduct and antisocial personality problems in childhood, adolescence, and adulthood. *European Child and Adolescent Psychiatry*, *27*(9), 1123–1132. https://doi.org/10.1007/s00787-017-1014-y

Yang, Y., Shields, G. S., Zhang, Y., Wu, H., Chen, H., & Romer, A. L. (2022). Child executive function and future externalizing and internalizing problems: A meta-analysis of prospective longitudinal studies. *Clinical Psychology Review*, 97, Article 102194. https://doi.org/10.1016/J.CPR.2022.102194

Zelazo, P. D., & Carlson, S. M. (2012). Hot and Cool Executive Function in Childhood and Adolescence: Development and Plasticity. *Child Development Perspectives*, *6*(4), 354–360. https://doi.org/10.1111/j.1750-8606.2012.00246.x