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Title:

The contributions of intelligence and executive function on behaviour problems in school-age children born very preterm

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Short Title:

IQ, executive function and behaviour problems

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ABSTRACT

Aim: To examine the contributions of specific neuro-cognitive skills to behaviour problems in children born very preterm.

Methods: We assessed children born <30 weeks' gestation or <1500g at age 7 years using subtests of the Wechsler Intelligence Scale for Children Fourth Edition, performance and questionnaire-based measures of executive function, and Child Behavior Checklist and Teacher Rating Form. We evaluated the contributions of IQ and executive function to behaviour problems and the moderating effect of sex using multiple regression.

Results: The 129 children (mean age = 7.2 years) had lower IQ, inferior executive function and increased internalising problems compared with normative samples. Verbal comprehension skills and working memory were associated with total, internalising and externalising problems at school. Performance-based and questionnaire-based executive function were associated with total and externalising behaviour problems both at home and school. Sex moderated the relationships between information processing and parent reported total problems, and between teacher rated executive function and total problems.

Conclusion: Both IQ and executive function are related to behaviour problems in children born very preterm, but the relationships are different in boys and girls. Executive function may be a useful target for intervention.

Key Notes

• Children born very preterm are at risk of low intelligence, low executive function and internalising problems

- Verbal comprehension skills and working memory are associated with behaviour problems at school, whereas overall performance-based and questionnaire-based executive function are associated with behaviour problems at home and school
- Girls with poorer information processing display more behaviour problems than boys; boys with greater executive difficulties according to teacher reports have more behaviour problems than girls

1. INTRODUCTION

Many studies have reported that infants born very preterm are at risk of long-term behavioural and emotional sequelae during childhood.[1,2] They show more symptoms of inattention and impulsivity[3] as well as display more internalising problems than term-born children.[4] Furthermore, there may be an effect of sex on problem behaviours. Delobel-Ayoub et al. found that boys born very preterm were more likely to exhibit behavioural difficulties at 5 years of age than girls.[5]

At the same time, children born very preterm and/or with very low birth weight (VLBW) are more likely to have lower intelligence (IQ) than their peers born at term.[6] Further, in one study, IQ predicted total problem scores and mediated the relationship between birth weight and behaviour problems in 9- to 16-year-old children born preterm.[7]

Children born very preterm also had lower executive function than term controls[4], which may be associated with behavioural problems. Inhibitory control and sequencing abilities (ability to plan a sequence of actions) of children aged 6 to 9 years predicted reduced behaviour problems over a two-year period.[8] Parent rated executive function mediated the effects of gestational age on behaviour problems in pre-school children.[9]

These findings suggest that children born very preterm are at increased risk of behaviour problems and demonstrate the links between IQ, executive function, and behaviour problems. However, much of the existing literature has focused on examining the contribution of overall IQ and executive function to behaviour problems and relied on single informants, mostly parents, in assessing the behaviour outcomes. Little is known about the relative contributions of specific domains of IQ and executive function contributing to behavioural problems in different contexts, and whether these differ in girls and boys.

We therefore investigated the relationships between IQ, executive function and behaviour problems in a cohort of children born very preterm. Specifically, we examined the independent contributions of IQ and executive function to behavioural problems, and whether sex moderated these relationships.

2. PATIENTS AND METHODS

2.1. Participants

The PIANO (Protein, Insulin And Neonatal Outcomes) study assessed neurodevelopmental, metabolic and physical outcomes at 7 years of age in a cohort of 129 children born < 1500g or < 30 weeks' gestation. Details have been published elsewhere.[10] Ethical approval was obtained from the Northern B Ethics Committee (NTY/12/05/035) and institutional approval from the Auckland

District Health Board (ADHB 5486). At 7 years' corrected age, children were invited to undergo a comprehensive assessment by assessors who were trained and supervised by a qualified psychologist.

Measures

Two major domains of intelligence (verbal comprehension skills and perceptual reasoning skills) were assessed by the subtests of Wechsler Intelligence Scale for Children - Fourth Edition, Australian (WISC-IV).[11] The scaled scores of Similarities, Vocabulary and Comprehension subtests were used to derive the Verbal Comprehension Index (VCI), which reflect children's verbal comprehension skills. The scaled scores of Block Design, Picture Concept and Matrix Reasoning subtests were used to derive the Perceptual Reasoning Index (PRI), which indicate children's perceptual reasoning skills. Both VCI and PRI have a mean score of 100 and an SD of 15. Low performance was defined as VCI or PRI < 85.

Four performance-based subtests were used to assess the selected domains of executive function as suggested by Anderson[12] and Miyake.[13] Working memory was assessed with the Digit Span Backward subtest of WISC-IV.[11] It requires children to repeat a series of digits, ranging in length from two to eight digits, in reverse order. Information processing was assessed with the Symbol Search subtest of the WISC-IV. This task asks children to look at a target symbol and decide whether it appears in an array of symbols or not. Attentional control was assessed with the Sky Search subtest of the Test of Everyday Attention for Children (TEA-Ch).[14] Children have to identify as many "target" spaceships as possible on a sheet filled with distractors. The number of correctly identified targets was recorded. Cognitive flexibility was assessed with Creature Counting of TEA-Ch, which required children to switch counting upwards and downward repeatedly in order to count the numbers of aliens in the burrow. Accuracy was scored in this subtest. All raw scores of these subtests were converted into scaled scores, which have a mean of 10 and an SD of 3. Higher scores indicate better performance. Low performance was defined as scaled scores < 7.

To assess the behaviour manifestations of executive function of children, parents and teachers were asked to complete the Behavior Rating Inventory of Executive Function (BRIEF).[15] The BRIEF is a standardised questionnaire consisting of 86 items within eight clinical scales to measure various aspects of executive function. The clinical scales can further yield an overall score, Global Executive Composite (GEC) score. The GEC is reported as T-score which has a mean of 50 and an SD of 10. Higher GEC scores indicate poorer executive functioning. Low

questionnaire-based executive function was defined as GEC ≥ 60.

Parents and teachers were also asked to complete the Child Behavior Checklist (CBCL) and Teacher Report Form (TRF)[16] to assess behavioural problems in home and school contexts. The CBCL and TRF each consist of 113 items, which can yield eight symptom scale scores. These can be combined into two groupings of behavioural problems; internalising and externalising. A Total Problems Score can be further derived. The scores of CBCL and TRF were reported as T-scores with a mean of 50 and an SD of 10. Higher scores indicate more behaviour problems. Problem behaviour was defined as T-scores in any of the problems scales (total, internalising and externalising) of CBCL and TRF ≥ 60.

Neonatal characteristics such as sex, birth weight, length, head circumference, gestational age, and antenatal steroid exposure of the cohort were obtained from the medical records. Maternal ethnicity was self-defined and prioritised with the Ministry of Health Guidelines.[17] The New Zealand Deprivation Index 2006, derived from maternal address, was used as a measure of socioeconomic status (SES).[18] This is a decile scale ranging from 1 to 10, with 1 representing least deprivation and 10 most.

2.2. Statistical analysis

We performed statistical analyses with SPSS Version 25 (IBM Corp, Armonk, NY, USA). An executive function composite score was created by averaging scaled scores from the four tests of executive function. To estimate this overall executive function construct, we conducted principal axis factor analysis with oblique rotation (direct oblimin). The factor analysis extracted one factor which had an eigenvalue of 1.9 and explained 46% of the variance, providing support for this latent construct. The reliability coefficient for the composite score was 0.61. Low performance was defined as executive function composite score <7.

Descriptive data are presented as median (interquartile range), mean (standard deviation) or number (%). Separate one sample t-tests or Chi-square tests were used to compare performance on IQ, executive function and behaviour problems of the cohort with the age-appropriate norms of each measure. Effect sizes (Cohen's d) and odds ratio were calculated.

We used multiple regression to ascertain the contributions of IQ and executive function on behaviour problems after controlling for sex and SES. Moderation analyses, using the PROCESS macro, were conducted to test whether sex moderated the relationships between IQ, executive function and behaviour problems after controlling for SES.

3. RESULTS

3.1. Neonatal and demographic characteristics

Of the 221 eligible children, 44 declined to participate, 23 were overseas or lost, 19 had died, and 6 were outside the age window for assessment, leaving a total of 129 children assessed at 7 years of age. Of these, 89 were born at 25 to <29 weeks' gestation (birth weight range 540 to 1560 g) and 89 were born <1000g (gestational age range 23 to 31 weeks) (Table 1). Half the mothers were of New Zealand European ethnicity, and around one fifth lived in the most deprived decile areas.

3.2. Intelligence, executive function and behaviour problems

Overall, the cohort had lower IQ, lower executive function and greater risk of internalising behaviour problems than the normative values (Table 2). They had an increased risk of low perceptual reasoning skills (odds ratio (OR) = 2.85, 95% confidence interval (CI) 1.57-5.14, *p* = <0.001). There was no significant effect of sex on verbal comprehension and perceptual reasoning skills (*p* > .05).

The cohort had inferior performance on all subtests of executive function and executive function composite scores, compared with the normative values. They had increased risks of having low performance on cognitive flexibility (OR = 6.85, 95% CI 3.65-12.87, *p* = <0.001), EF composite score (OR = 2.07, 95% CI 1.13-3.78, *p* = 0.018), and parent-reported executive function (OR = 2.46, 95% CI 1.34-4.50, *p* = 0.003). There was no significant effect of sex on executive function measures (*p* > .05).

Children in this study had an increased risk of internalising problems compared to the normative values (OR = 1.95, 95% CI 1.05-3.62, *p* = 0.033 for CBCL; OR = 1.89, 95% CI 1. 01-3.51, *p* = 0.046 for TRF). Boys had higher total problem scores on the TRF than girls (*M* (SD) = 54 (10) for boys and 50 (9) for girls, *d* = 0.42, *p* = 0.030). Socioeconomic status was positively related to total problems in both the CBCL (*r* = 0.18, *p* = 0.048) and the TRF (*r* = 0.18, *p* = 0.042). Therefore, we included sex and SES as covariates in the regression models when testing the contributions of IQ and executive function on behaviour problems.

3.3. Association between IQ, executive function and behaviour problems

In general, higher IQ and better executive function were associated with reduced behaviour problems after controlling for sex and SES (Table 3). Verbal comprehension and perceptual reasoning skills explained 6-14% of the variance of behaviour problems. Specifically, better verbal comprehension skills were associated with reduced teacher reported behaviour problems. Performance-based executive function explained 6-15% of variance of behaviour problems. Better performance on executive function composite score was associated with reduced total and

externalising problems reported by both parents and teachers. Better working memory was associated with reduced total, internalising and externalising problems reported by teachers. Parent and teacher rated executive function had stronger associations with behaviour problems than IQ and performance-based measures of executive function, as they accounted for 15-72% of the variance in behaviour problems. Furthermore, parent reported executive function was associated with internalising problems assessed by both the CBCL and the TRF.

Moderating effect of sex

Moderation analysis suggested that sex moderated the relationship between information processing and total parent rated behaviour problems (CBCL) as well as teacher rated executive function and total teacher rated behaviour problems (TRF) (Table 4). Girls with poorer information processing had more total problems assessed by the CBCL than boys, whereas boys with greater teacher rated executive function difficulties had more behaviour problems than girls. However, there were no significant interactions between sex and IQ in relation to behaviour problems.

4. DISCUSSION

In this study, we found that children born very preterm have lower verbal comprehension and perceptual reasoning skills, lower performance-based and questionnaire-based executive function and an increased risk of internalising problems compared with normative samples. Verbal comprehension skills and working memory were associated with behaviour problems reported by teachers. Overall performance-based and questionnaire-based executive function were associated with total and externalising behaviour problems reported by parents and teachers. The relationships between specific executive functions and total behaviour problems were different in boys and girls.

We found a 5- and 11- point reduction in VCI and PRI respectively and decrements of 0.4 to 1.2 SD in performance-based measures of executive function. These findings are similar to those reported by Nyman et al.[19] and Aarnoudse-Moens et al.[4], although our cohort had worse verbal comprehension skills and cognitive flexibility. These deficits in neuro-cognitive functioning of children born very preterm may be related to brain white matter abnormalities. Children born very preterm with mild and moderate-to-severe white matter abnormalities were at greater risk of impaired IQ and executive function than children born at term or without white matter abnormalities.[20]

Similar to the children born very preterm or VLBW studied by Aarnoudse-Moens et al.[4], our study cohort had an increased risk of internalising problems. We also found that verbal comprehension skills, working memory and questionnaire-based executive function were specifically associated with internalising problems.

Lower intelligence may be associated with greater difficulties to cope with the demands of learning[21] and daily living, which in turn may increase behaviour problems. Consistent with this, we found that both verbal comprehension and perceptual reasoning skills were associated with behaviour problems, with verbal comprehension skills explaining more of the variance. Previous studies of preterm children suggested that overall IQ was not associated with internalising problems.[5,7] However, we found that verbal comprehension skills were not only related to internalising problems, but also to all three dimensions of teacher reported behaviour problems. These findings highlight the role verbal abilities may play in shaping children's behaviour at school.

The associations between executive function and behaviour problems have been documented previously in children born very preterm.[9] In our cohort, specific domains of executive function were associated with behaviour problems in specific contexts. Working memory was associated with teacher reported behaviour problems, whereas executive function composite score was more associated with parent reported behaviour problems than other performance-based measures. Working memory plays an important role in promoting success at school. School-age children with low working memory had poorer academic performance and higher ratings of maladaptive classroom behaviours.[22] Compared to the home environment, school provides more opportunities to use and develop working memory skills. Besides, consistent with previous findings, overall executive function was associated with behaviour problems reported by parents.[2] Addressing the differential contributions of executive functions to behaviour problems in different social contexts is important as it may help parents and teachers to adjust their expectations and to identify targets for intervention in specific contexts.

Sex appears to play a moderating role in the relationships between executive functions and problem behaviours. We found that the association between teacher reported executive function and total problem behaviour was stronger in boys than in girls. As both were assessed through questionnaires, this may reflect the perceptions of teachers of a child's behaviours manifested in the school context. Compared with girls, boys tend to display more overt and observable behaviours and difficulties.[23] Teachers may be more able to spot the difficulties in executive

function and behaviours in boys than in girls, which strengthens the observed relationships between them.

One strength of this study is using multiple methods and involving multiple informants to assess executive function and behaviour problems. Using both performance-based and questionnaire measures of executive function could provide information on the cognitive and behavioural facets of executive function. Our study also captured a comprehensive view on behaviour problems of children as it incorporated both parents' and teachers' perceptions.

Limitations of this study are the use of single cognitive-based measures to assess performance in each of the domains of executive function, which may affect consistency. Future work with more measures for each domain may improve the reliability of the assessment. We also studied a relatively small subset of the original cohort, which may affect the generalization of the test results to the overall cohort but should not affect the relationships between the variables of interest within the subset. Further, as one fifth of our sample were living in the most deprived areas, the generalisability of the findings to other samples with a different SES may be limited.

The findings of our study have several implications for practice. There is a need to address the emotional needs of children born very preterm. Early internalising problems may persist to adolescence and adulthood. Providing support and intervention for children showing internalising problems may ameliorate the risk of later psychopathology. In addition, the contributions of verbal comprehension skills and executive function to behaviour problems has been highlighted. Executive function may serve as a potential target of intervention.

5. CONCLUSION

Specific domains of IQ and executive function in children born very preterm are associated with behaviour problems in specific contexts, and these relationships differ in girls and boys. Delineating the underlying contributions of neuro-cognitive factors to behaviour problems may assist in targeting appropriate interventions, and in turn, improve their social-emotional outcomes.

Declaration of Interest

None

Abbreviations

BRIEF, Behavior Rating Inventory of Executive Function; CBCL, Child Behavior Checklist; GEC, Global Executive Composite; IQ, intelligence; PRI, Perceptual Reasoning Index; TEA-Ch, Test of Everyday Attention for Children; TRF, Teacher Rating Form; VCI, Verbal Comprehension Index; VLBW, very low birth weight; WISC-IV, Wechsler Intelligence Scale for Children, Fourth Edition

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TABLE 1 Neonatal and demographic characteristics of the cohort (n=129)

	Mean (SD)
Age at test, years	7.2 (0.1)
Birth weight (g)	920 (225)
Birth weight (g) <28 weeks (n=90)	854 (160)
Birth weight (g) ≥28 weeks (n=39)	1072 (275)
Birth weight z-score	0.03 (0.93)
Birth length z-score (n=120)	-0.04 (1.10)
Birth head circumference z-score (n=124)	0.19 (1.07)
	Median (interquartile Range)
Gestational age (weeks)	26 (25 to <29)
	Number (%)
Boys/ girls	69 (54)/ 60 (46)
Singletons	94 (73)
SGA	18 (14)
5-Minute Apgar score <7	24 (19)
Maternal ethnicity	
Māori	32 (25)
Pacific Island	16 (12)
Asian	19 (15)
European/ Other	62 (48)
Socioeconomic status (n=128)	
Most deprived decile	24 (19)
Least deprived decile	11 (9)

SGA, small for gestational age, defined as a weight below 10th percentile for gestational age

TABLE 2 Performance on assessments of intelligence, executive function and behaviour problems at 7 years relative to the normal values (n=129)

	Cohort		Normative value		Cohen's d or	p
	Mean (SD)	Number (%)	Mean (SD)	(%)	OR (95% CI)	
Intelligence						
VCI	95 (14)		100 (15)		-0.34	<0.001
PRI	89 (15)		100 (15)		-0.73	<0.001
VCI <85		25 (19)		(16)	1.23 (0.65-2.34)	0.516
PRI <85		46 (36)		(16)	2.85 (1.57-5.14)	<0.001
Performance-based Executive Function						
Digit Span Backward	8.3 (3.4)		10 (3)		-0.53	<0.001
Symbol Search (n=126)	8.9 (2.7)		10 (3)		-0.39	<0.001
Sky Search (n=123)	8.7 (3.3)		10 (3)		-0.41	<0.001
Creature Counting (n=110)	6.2 (3.2)		10 (3)		-1.23	<0.001
EF composite	7.9 (2.3)		10 (3)		-0.79	<0.001
Digit Span Backward <7		25 (19)		(16)	1.24 (0.65-2.48)	0.521
Symbol Search <7		24 (19)		(16)	1.25 (0.65-2.40)	0.507
Sky Search <7		32 (26)		(16)	1.81 (0.97-3.39)	0.063
Creature Counting <7		63 (57)		(16)	6.85 (3.65-12.87)	<0.001
EF composite <7		37 (29)		(16)	2.07 (1.13-3.78)	0.018
Questionnaire-based Executive Function						
BRIEF-Parent report GEC (n=128)	54 (12)		50 (10)		0.36	0.001
BRIEF-Teacher report GEC (n=124)	53 (10)		50 (10)		0.30	<0.001
Parent report GEC ≥ 60		40 (31)		(16)	2.46 (1.34-4.50)	0.003
Teacher report GEC ≥ 60		29 (23)		(16)	1.59 (0.84-2.99)	0.156
Behaviour problems						
Total problems - CBCL (n=128)	51 (12)		50 (10)		0.09	0.158
Total problems - TRF (n=124)	52 (10)		50 (10)		0.20	0.012
Internalising - CBCL	52 (11)		50 (10)		0.19	0.044
Internalising - TRF	51 (10)		50 (10)		0.10	0.265
Externalising - CBCL	49 (11)		50 (10)		-0.10	0.432
Externalising - TRF	49 (8)		50 (10)		-0.11	0.442
Total problems - CBCL ≥ 60		31 (24)		(16)	1.73 (0.92-3.23)	0.088
Total problems - TRF ≥ 60		29 (23)		(16)	1.59 (0.84-2.99)	0.156
Internalising - CBCL ≥ 60		34 (27)		(16)	1.95 (1.05-3.62)	0.033
Internalising - TRF ≥ 60		33 (27)		(16)	1.89 (1.01-3.51)	0.046
Externalising - CBCL ≥ 60		26 (20)		(16)	1.38 (0.72-2.62)	0.335
Externalising - TRF ≥ 60		17 (14)		(16)	0.83 (0.41-1.67)	0.599

Data are mean (standard deviation) or number (%), Cohen's *d* or odds ratios (OR), 95% confidence intervals (CI). VCI, Verbal

Comprehension Index; PRI, Perceptual Reasoning Index, PRI; BRIEF, Behavior Rating Inventory of Executive Function; GEC, Global Executive Composite, EF composite; Executive function composite score; CBCL, Child Behavior Checklist; TRF, Teacher Report Form.

TABLE 3 IQ and executive function as predictors of behaviour problems after controlling for sex and socioeconomic status

Outcomes/	CBCL				TRF			
Predictors	R^2	*p*	B (SE)	*p*	R^2	*p*	B (SE)	*p*
Total problems								
VCI	0.08	0.022	-0.14(0.08)	0.057	0.14	0.001	-0.19(0.06)	0.002
PRI	0.08	0.018	-0.14(0.07)	0.046	0.14	<0.001	-0.19(0.06)	0.002
Working memory	0.08	0.020	-0.59(0.30)	0.050	0.15	<0.001	-0.82(0.25)	0.001
Attentional control	0.07	0.042	-0.52(0.32)	0.105	0.11	0.005	-0.60(0.27)	0.026
EF composite	0.09	0.008	-1.07(0.44)	0.015	0.15	<0.001	-1.24(0.37)	0.001
BRIEF-P	0.61	<0.001	0.74(0.06)	<0.001	0.19	<0.001	0.29(0.07)	<0.001
BRIEF-T	0.17	<0.001	0.40(0.10)	<0.001	0.72	<0.001	0.81(0.05)	<0.001
Internalising problems								
VCI	0.03	0.362	-0.11(0.07)	0.148	0.07	0.042	-0.16(0.07)	0.021
PRI	0.01	0.751	-0.02(0.07)	0.729	0.03	0.300	-0.06(0.07)	0.347
Working memory	0.02	0.490	-0.34(0.29)	0.250	0.07	0.041	-0.65(0.28)	0.020
Attentional control	0.02	0.455	-0.36(0.31)	0.256	0.04	0.171	-0.40(0.29)	0.180
EF composite	0.03	0.381	-0.61(0.43)	0.161	0.05	0.089	-0.82(0.42)	0.054
BRIEF-P	0.29	<0.001	0.50(0.07)	<0.001	0.06	0.066	0.17(0.08)	0.034
BRIEF-T	0.03	0.332	0.14(0.10)	0.171	0.21	<0.001	0.50(0.09)	<0.001
Externalising problems								
VCI	0.08	0.012	-0.18(0.07)	0.014	0.09	0.009	-0.17(0.06)	0.002
PRI	0.06	0.051	-0.12(0.07)	0.088	0.06	0.077	-0.12(0.06)	0.026
Working memory	0.07	0.041	-0.55(0.29)	0.066	0.08	0.021	-0.64(0.23)	0.005
Attentional control	0.06	0.079	-0.47(0.32)	0.142	0.02	0.478	-0.24(0.24)	0.325
EF composite	0.07	0.028	-0.90(0.43)	0.039	0.06	0.070	-0.79(0.34)	0.024
BRIEF-P	0.51	<0.001	0.66(0.06)	<0.001	0.15	<0.001	0.27(0.06)	<0.001
BRIEF-T	0.22	<0.001	0.49(0.10)	<0.001	0.57	<0.001	0.66(0.05)	<0.001

Data are R^2, B (unstandardised regression coefficient), SE B (standard error of B); VCI, Verbal Comprehension Index; PRI, Perceptual Reasoning Index; BRIEF, Behavior Rating Inventory of Executive Function; GEC, Global Executive Composite; EF composite, Executive function composite score; CBCL, Child Behavior Checklist; TRF, Teacher Report Form, Outcomes are T-scores for Total, Internalising, and Externalising problem scores.

TABLE 4 Interactions between questionnaire-based executive function and sex as predictors of behaviour problems after controlling for socioeconomic status

Outcomes/	CBCL		TRF	
Predictors	B (SE)	*p*	B (SE)	*P*
Total problems				
Overall model-				
Information processing	$R^2 = 0.10, p = 0.017$		$R^2 = 0.10, p = 0.014$	
Symbol Search	-1.61(0.62)	0.010	-1.09(0.53)	0.0423
Sex	-12.83(7.35)	0.084	-4.58(6.46)	0.480
Symbol Search × Sex	1.70(0.79)	0.033	0.85(0.69)	0.220
Overall model- Parent				
reported EF	$R^2 = 0.61, p = <0.001$		$R^2 = 0.19, p = 0.001$	
BRIEF-P	0.73(0.08)	<0.001	0.28(0.10)	0.004
Sex	2.94(5.95)	0.623	2.46(7.38)	0.740
BRIEF-P × Sex	0.01(0.11)	0.918	0.02(0.13)	0.885
Overall model-				
Teacher reported EF	$R^2 = 0.17, p = 0.002$		$R^2 = 0.73, p = <0.001$	
BRIEF-T	0.40(0.13)	0.003	0.70(0.06)	<0.001
Sex	3.74(10.70)	0.728	-9.27(5.12)	0.073
BRIEF-T × Sex	-0.01(0.20)	0.970	0.23(0.09)	0.015

Data are R2, B (unstandardised regression coefficient), SE B (standard error of B); EF, executive function, BRIEF,

Behavior Rating Inventory of Executive Function; CBCL, Child Behavior Checklist; TRF, Teacher Report Form,

Outcomes are T-scores for Total, Internalising, and Externalising problem scores.