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ORIGINAL CONTRIBUTION

Peer relationships and prosocial behaviour differences across disruptive behaviours

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Abstract

It is unclear if impairments in social functioning and peer relationships significantly differ across common developmental conditions such as attention-deficit/hyperactivity disorder (ADHD), oppositional defiant disorder (ODD), conduct disorder (CD), and associated callous–unemotional traits (CU traits). The current study explored sex differences and symptoms of parent- and teacher-reported psychopathology on peer relationships and prosocial behaviour in a sample of 147 referred children and adolescents (aged 5–17 years; 120 m). The results showed that increases in parent-reported ADHD Inattentive symptoms and teacher-reported ADHD Hyperactive–Impulsive symptoms, CD, ODD, and CU traits were significantly associated with peer relationship problems across sex. At the same time, teacher-reported symptoms of ODD and both parent- and teacher-reported CU traits were related to difficulties with prosocial behaviour, for both boys and girls, with sex explaining additional variance. Overall, our findings show a differential association of the most common disruptive behaviours to deficits in peer relationships and prosocial behaviour. Moreover, they highlight that different perspectives of behaviour from parents and teachers should be taken into account when assessing social outcomes in disruptive behaviours. Given the questionable separation of conduct problem-related constructs, our findings not only point out the different contribution of those aspects in explaining peer relationships and prosocial behaviour, but furthermore the variance from different informants about those aspects of conduct problems.

Keywords Attention-deficit/hyperactivity disorder · Oppositional defiant disorder · Conduct disorder · Callous–unemotional traits · Sex · Peer relationship problems · Prosocial behaviour

A large body of research has found that children and adolescents diagnosed with externalising disorders, including attention-deficit/hyperactivity disorder (ADHD), conduct disorder (CD), oppositional defiant disorder (ODD), and callous–unemotional traits (CU), a specifier for CD in DSM-5 [1], are at increased risk of experiencing relationship difficulties with peers [2, 3]. Further, research has shown that impairments in social functioning affect both males and females [4] and predict negative outcomes later in their lives, such as the development of CD [5] and interpersonal relationship problems, including those with members of the opposite sex [6]. As peer interactions present a promising area for interventions due to a potentially easier way of approaching youth with their peers in their everyday environments [7], we need to first get a better understanding of the relationship between peer interactions (prosocial behaviour vs. peer relationship problems) and different forms of externalising behaviours (ADHD, ODD, CD, and CU traits), and whether these differ for males versus females.

Peer difficulties and ADHD/ODD

All the three core symptoms of ADHD (i.e. inattention, hyperactivity, and impulsivity) can impact the development of social relationships [8]. Additionally, children with ADHD are more

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likely to display negative, aversive, and disruptive behaviour and, as such, can be viewed by peers as being argumentative and inappropriate in their interactions [9, 10], so peer rejection can occur very quickly after entering a new peer group [11]. As for ODD, which is often comorbid with ADHD, further studies have found that children diagnosed with this disorder have more pervasive problems with social functioning compared with children who are diagnosed with other psychiatric diagnoses, including ADHD and CD [2, 12, 13]. Early behaviours linked to ODD have been associated with parenting behaviour. Burke et al. [12], for example, found a reciprocal relationship between timid parental discipline and worsening ODD symptoms, with ODD also predicting poorer communication, and decreased parental involvement. The same study also showed that CD was predicted by poor parental supervision, while ADHD was not associated with parenting behaviour [12]. Difficulties with social functioning in ODD is pervasive across all relationships and contexts (i.e. with peers, parents, siblings, and at home or in school), and this impairment remains significant even after controlling for comorbid conditions, including CD [14]. Further evidence indicates that females with ODD experience more difficulties with peers than males. For example, Carlson, Tamm, and Gaub [15] found that females, on average, received higher peer dislike scores than males, and were rated as displaying more social problems.

Peer difficulties and CD/CU

Children and adolescents diagnosed with CD and those who report elevated CU traits also experience peer relationship problems [16, 17], where difficulties are evident for both sexes and are most acute for those individuals with CD [18]. Interestingly, CU traits, which describe specific characteristics of low affective responsivity and high sensation seeking, make a significant contribution to this association. Adolescent offenders reporting relationships of high quality showed lower psychopathic traits (callous–unemotional and grandiose aspects), while those high on psychopathic traits reported more antisocial behaviour and antisocial influence in relationships [19]. Additionally, youths from the community with high stable psychopathic traits report more peer conflict, while their peers do not share that perception [20]. Thus, not only CD but the additional CU traits seem to contribute to more difficulties with peers.

Prosocial behaviour and ADHD/ODD

One element of peer relationships is prosocial behaviour, defined as behaviour undertaken voluntarily and intended to help or benefit another person or a group of individuals [21]. There is some evidence, which indicates that prosocial behaviour is adversely affected (i.e. less apparent) in children diagnosed with ADHD [22, 23] or ODD [24]. Paap et al. [24] found that children displaying clinical levels of ADHD or ODD, and without evident peer relationship difficulties, showed very little prosocial behaviour (even when given an opportunity to practice social skills with peers). The study also found that parents (and not teachers) reported that males with ODD symptoms showed less prosocial behaviours than females with a similar number of ODD symptoms. Similarly, Hay et al. [25] found that gender was a significant predictor of prosocial behaviour in children diagnosed with ADHD, with females receiving significantly higher teacher (and not parent)-reported prosocial scores.

Prosocial behaviour and CD/CU

Both CD and CU traits are associated with fewer prosocial behaviours [26] and this relationship tends to be stronger for individuals with both CD and elevated CU traits (e.g. [17, 18]). CU traits (specifically when measured with the uncaring and callous subscales of the ICU) are also related to low prosocial beliefs in terms of a disapproval of antisocial behaviour [27]. For example, in a cross-sectional study in a general population investigating the relationship between peer relationship problems and prosocial behaviour with conduct problems and callous–unemotional traits, Eisenbarth et al. [18] found that the relationship with prosocial behaviour was most evident for CU traits compared to CD symptoms. Furthermore, the study showed that the negative association between CU traits and prosocial behaviour was mediated by increased negative emotional symptoms and lower cognitive ability. This study also found that females reported more prosocial behaviour, compared with males. Another community-based investigation, however, found prosocial behaviour to be predicted by narcissism, impulsivity, and CU, but not by gender [28].

Thus, considering the impact of externalising difficulties (ADHD, CD, ODD) and CU traits on social relationships, one study found only ADHD and ODD as significant predictors of peer relationship difficulties [29]. However, this study only considered boys and collapsed informant assessment across teachers and parents.

Variation based on informants

Assessment of ADHD, ODD, CD, and CU symptoms is based on at least one informant, usually parent or teacher. Ideally, the different reports show high inter-rater reliability and the assessment of those traits is based on this assumption. However, in reality there is some variance between the sources and this can contribute to variance in findings. For example, a recent study investigated the consistency

of different informants as well as their stability over time, focussing on the assessment of CU, and found weak consistency between parents and teachers [30]. Similarly, teacher and parent rating discrepancies have been reported for ADHD [31], and for conduct problems more generally [32]. Thus, it seems sensible to investigate the relationships between externalising symptoms and peer interaction variables using both parent and teacher reports.

The current study

While previous research indicates associations between psychopathology in childhood and adolescence with indices of social functioning, it remains unclear how externalising disorders (ADHD, CD, and ODD) and CU traits are differentially associated with impairments in parent- and teacher-reported peer interactions and prosocial behaviour, and whether sex moderates this association. The present study investigated the extent to which dimensional scores of externalising symptoms and CU traits reported from different sources are associated with peer relationship difficulties and prosocial behaviour, and whether these associations are consistent between males and females. We also included separation anxiety/fear and emotional distress as control variables as externalising symptoms, as well as CU traits, have been linked to low anxiety and emotional distress [33, 34].

Method

Participants

The sample was drawn from the SHARE project, a database that was initiated in 2010 with the aim of establishing a standardised recruitment and assessment protocol and clinical and genetic database for children and adolescents with ADHD, anxiety, or behavioural difficulties living in Hampshire (UK) and that included information about children and adolescents (and their relatives) who were seeking assessment for symptoms of ADHD, or anxiety, or conduct disorder (CD). At the time of data extraction, the sample included 521 children/adolescents aged 3–18 years ($M = 9.34$, SD = 3.20; $n = 492$ males). Selected participants, with complete data for the variables of interest for both parent and teacher reports, consisted of 147 children and adolescents aged 5–17 years ($M = 9.78$, SD = 2.71, $n = 120$ males). For descriptive variables, see Table 1. An independent samples t test revealed that those included and those excluded from analyses did not significantly differ according to their ages at the time of assessment, $t(491) = -1.78$, $p = 0.075$. A Chi square test of goodness of fit showed that between those excluded and those included in analyses, sex did not significantly differ, $\chi^2(1, N = 507) = 1.72$, $p = 0.189$. Independent samples t tests also revealed that those included and those excluded from analyses did not significantly differ on any of the externalising measures: parent-reported

Table 1 Descriptive statistics for parent and teacher reports for each of the variables of interest

Measure	All ($N = 147$)	Male ($n = 120$)	Female ($n = 27$)	α
Parent reports				
CBRS ADHD Inattentive	81.59 (10.95)	80.95 (10.94)	84.41 (10.77)	0.88
CBRS ADHD Hyperactive–Impulsive	82.44 (11.13)	82.14 (11.59)	83.74 (8.83)	0.88
CBRS Conduct Disorder	73.43 (17.81)	73.10 (17.93)	74.89 (17.53)	0.84
CBRS Oppositional Defiant Disorder	81.57 (13.68)	81.47 (13.71)	82.04 (13.76)	0.89
CBRS Emotional Distress	78.43 (13.98)	77.95 (14.11)	80.52 (13.48)	
CBRS Separation Fear	62.14 (15.81)	61.85 (16.05)	63.41 (14.94)	
Callous–Unemotional Traits	36.15 (9.60)	35.97 (9.54)	36.93 (10.02)	0.76
SDQ Peer Relationship Problems	4.87 (2.39)	4.81 (2.42)	5.15 (2.82)	0.63
SDQ Prosocial Behaviour	5.36 (2.41)	5.21 (2.45)	6.04 (2.10)	0.75
Teacher reports				
CBRS ADHD Inattentive	66.73 (12.92)	65.07 (12.15)	74.11 (13.86)	0.67
CBRS ADHD Hyperactive–Impulsive	71.70 (16.48)	71.38 (16.13)	73.11 (18.21)	0.80
CBRS Conduct Disorder	66.83 (18.53)	66.29 (18.40)	69.22 (19.27)	0.70
CBRS Oppositional Defiant Disorder	73.51 (17.77)	73.70 (17.79)	72.67 (17.96)	0.62
CBRS Emotional Distress	67.65 (16.51)	66.79 (16.15)	71.62 (17.92)	
CBRS Separation Fear	58.76 (17.82)	57.05 (16.74)	66.33 (20.66)	
Callous–Unemotional Traits	31.56 (10.04)	31.61 (10.11)	31.37 (9.92)	0.84
SDQ Peer Relationship Problems	3.48 (2.46)	3.52 (2.53)	3.33 (2.17)	0.73
SDQ Prosocial Behaviour	4.67 (2.69)	4.47 (2.72)	5.59 (2.36)	0.84

symptoms of ADHD Inattentive, $t(457) = 1.25$, $p = 0.210$; parent-reported symptoms of ADHD Hyperactive–Impulsive, $t(459) = 1.66$, $p = 0.098$; parent-reported symptoms of CD, $t(455) = 1.61$, $p = 0.109$; parent-reported symptoms of ODD, $t(459) = 1.02$, $p = 0.307$; parent-reported CU traits, $t(470) = -0.67$, $p = 0.505$; teacher-reported symptoms of ADHD Inattentive, $t(318) = -1.16$, $p = 0.249$; teacher-reported symptoms of ADHD Hyperactive–Impulsive, $t(320) = 0.23$, $p = 0.821$; teacher-reported symptoms of CD, $t(306) = -0.02$, $p = 0.982$; teacher-reported symptoms of ODD, $t(320) = -0.13$, $p = 0.894$; teacher-reported symptoms of CU traits, $t(316) = -0.56$, $p = 0.577$. In the selected sample, 72.1, 77.6, 60.5, and 77.6% met the requirements for a diagnosis of ADHD predominantly inattentive, ADHD predominantly hyperactive–impulsive, CD, and ODD, respectively, with 8.2% meeting the requirements to be diagnosed with one of these disorders, 11.6% with two of these disorders, 27.9% with three of these disorders, and 43.5% with all of these disorders.

Measures

Symptoms of ADHD, ODD and CD Symptoms of ADHD, ODD, and CD were measured using the Conners Comprehensive Behaviour Rating Scales (CBRS) [35], including both parent and teacher reports (Conners CBRS-P and Conners CBRS-T, respectively). The CBRS is a questionnaire that asks parents and teachers to rate on a four-point scale how well a behaviour describes a child/adolescent and how frequently they have shown this behaviour over the past month. Responses are coded on a four-point Likert scale from 0 (not true at all/never, seldom) to 3 (very much true/very often, very frequently). CBRS subscales that were included in analyses were CBRS ADHD Inattentive, CBRS ADHD Hyperactive–Impulsive, CBRS ODD, and CBRS CD, with the CBRS Emotional Distress and Separation Fear subscales also included in analyses to assess their impact (see Table 1).

Callous–unemotional traits (*CU traits*) The Inventory of Callous–Unemotional Traits (ICU) [36] was used to measure the presence of CU traits. The ICU is a questionnaire consisting of 24 questions in which parents and teachers are asked to rate how well a statement describes the child 0 (not at all true) to 3 (definitely true), making a total score range from 0 to 72.

Peer relationship problems and prosocial behaviour These two outcomes were assessed using the Strengths and Difficulties Questionnaire (SDQ) [37]. The SDQ asks parents and teachers to rate how applicable a statement is to the child from 0 (not true) to 2 (certainly true). The 25 items of the SDQ comprises five scales and the current study focusses on items related to the "peer problems" (e.g. "Has at least one good friend"), and prosocial (e.g. "Helpful if someone is hurt") subscales, making a possible score range for each scale from 0 to 25. SDQ subscales that were included in analyses were SDQ peer relationship problems and SDQ prosocial behaviour (see Table 1).

Statistical analyses

Separate hierarchical regressions were conducted using SPSS (Version 24.0; IBM Corp, 2016) for the parent and teacher reports with peer relationship problems and prosocial behaviour as the dependent variables, and with the dimensional psychopathology measures (ADHD, ODD, and CD; and ICU scores for CU traits) as regressors. Sex, age, separation fear, and emotional distress were included in regression analyses to control for their impact. Two-step hierarchical regressions were run, including all of the externalising psychopathology measures, sex, and age as regressors in the first step, and, subsequently, in the second step adding the separation fear and emotional distress measures as regressors. A probability level of $p < 0.05$ was used to indicate statistical significance.

Results

Correlations between parent and teacher reports

Pearson's correlations were used to explore the association between parent and teacher reports for all of the variables of interest (CBRS ADHD Inattentive, CBRS ADHD Hyperactive–Impulsive, CBRS ODD, CBRS CD, ICU- CU traits, SDQ peer relationship problems, and SDQ prosocial behaviour) and generally an agreement was found between the parent and teacher reports, as shown by the significant positive correlations between their respective reports (rs = 0.18–0.42; ps < 0.029). However, parent and teacher reports of externalising behaviour did not correlate regarding CU traits and prosocial behaviour (see Table 2). Correlations between all of the variables of interest are shown in Table 3, with Spearman's rho used to correlate sex with the other variables.

Hierarchical regressions

Parent reports explaining peer relationship problems

The two-step hierarchical regression based on parent reports revealed two significant models (model 1: $F(7,135) = 2.32$, $p = 0.029$, $R^2 = 0.11$; model 2: $F(9,133) = 2.96$, $p = 0.003$, $R^2 = 0.17$). ADHD Inattentive was a significant regressor over and above the other variables in all of the models: in model 1, with one standard unit increase in ADHD Inattentive, the predicted score on the SDQ peer relationship problems scale increased by 0.28 units when the other

Table 2 Correlations between the parent and teacher reports for each of the variables of interest

Measure	*r*	*p*
CBRS ADHD Inattentive	0.18	0.029
CBRS ADHD Hyperactive–Impulsive	0.32	< 0.001
CBRS Conduct Disorder	0.36	< 0.001
CBRS Oppositional Defiant Disorder	0.34	< 0.001
Callous–Unemotional Traits	0.16	0.059
SDQ Peer Relationship Problems	0.42	< 0.001
SDQ Prosocial Behaviour	0.15	0.075

$N = 147$, and r refers to the Pearson's correlation coefficient

regressors were held constant; and in model 2, with one standard unit increase in ADHD Inattentive, the predicted SDQ peer relationship problems scale increased by 0.23 units when the other regressors were held constant. All of the other regressors were non-significant for both of the models (see Table 4). Despite separation fear and emotional distress variables having no significant regressive role regarding peer relationship problem scores, their inclusion in the model produced a significant F change, $p = 0.01$, suggesting that they do help to account for variance within the model. Including the interaction between ADHD Inattentive and sex resulted in no significant interaction contribution ($b = -0.02$, $p = 0.58$).

Teacher reports explaining peer relationship problems

The two-step hierarchical regression based on teacher reports revealed two significant models (model 1: $F(7,138) = 5.47$, $p < 0.001$, $R^2 = 0.22$; model 2: $F(9,136) = 6.54$, $p < 0.001$, $R^2 = 0.30$). In model 1, ADHD Hyperactive–Impulsive was a significant regressor for peer relationship problems over and above the other variables; with one standard unit increase in ADHD Hyperactive–Impulsive, the predicted score on the SDQ peer relationship problems scale decreased by 0.24 units. ODD was also a significant regressor for peer relationship problems over and above the other variables; with one standard unit increase in ODD, the predicted score on the SDQ peer relationship problems increased by 0.35 units. CU traits was also a significant regressor for peer relationship problems over and above the other variables; with one standard unit increase in CU traits, the predicted score on the SDQ peer relationship problems increased by 0.24 units. All of the other regressors were non-significant (see Table 5). In model 2, CU traits was a significant predictor for peer relationship problems over and above the other variables; with one standard unit increase in CU traits, the predicted SDQ peer relationship problems score increased by 0.33 units. CBRS Emotional Distress was also a significant regressor for peer relationship problems over and above the other variables; with one standard unit increase in emotional distress, the predicted SDQ peer relationship problems score increased by 0.26 units when the other regressors were held constant. All of the other regressors were non-significant (see Table 5). The inclusion of the anxiety variables produced a significant F change, $p < 0.001$, suggesting that they do help to account for a significant amount of variance within the model: indeed, CBRS Emotional Distress had a statistically significant regressive role with regard to peer relationship problems. Including the interactions between ADHD Hyperactive–Impulsive and sex ($b = 0.01$, $p = 0.92$), between ODD and sex ($b = -0.004$, $p = 0.76$), and between CU and sex ($b = 0.01$, $p = 0.68$) did not yield significant contributions to the model.

Parent reports explaining prosocial behaviour

The two-step hierarchical regression based on parent reports revealed two significant models (model 1: $F(7,135) = 8.60$, $p < 0.001$, $R^2 = 0.31$; model 2: $F(9,133) = 7.04$, $p < 0.001$, $R^2 = 0.32$). In model 1, CU traits was a significant regressor over and above the other variables; with one standard unit increase in CU traits, the predicted SDQ prosocial behaviour score decreased by 0.39 units. Sex was also a significant regressor for prosocial behaviour over and above the other variables; parents generally rated girls more positively with regard to displaying more prosocial behaviour than boys (see Table 1). All of the other variables were non-significant (see Table 6). In model 2, again CU traits was a significant regressor over and above the other variables; with one standard unit increase in CU traits, predicted SDQ prosocial behaviour scores decreased by 0.36 units when the other regressors were held constant. Sex was also a significant regressor again within this model. All of the other regressors were non-significant (see Table 6). The inclusion of the anxiety variables in model 3 did not lead to a significant F change, $p = 0.252$, suggesting that they do not account for a significant amount of variance within the model. Including the interaction between CU and sex ($b = 0.01$, $p = 0.83$) did not result in a significant contribution.

Teacher reports explaining prosocial behaviour

The two-step hierarchical regression based on teacher reports revealed two significant models (model 1: $F(7,135) = 8.60$, $p < 0.001$, $R^2 = 0.31$; model 2: $F(9,133) = 7.04$, $p < 0.001$, $R^2 = 0.32$). In model 1, ODD was a significant predictor for prosocial behaviour over and above the other variables; with one standard unit increase in ODD, predicted SDQ prosocial behaviour scores decreased by 0.28 units when the other regressors were held constant. CU traits was also a significant regressor over and above the other variables; with one standard unit increase in CU traits, the predicted SDQ

Table 3 Correlations between all variables of interest

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Sex	–																			
2. Age	0.05	–																		
3. CBRS Parent ADHD Inattentive	0.20*	−0.03	–																	
4. CBRS Parent ADHD Hyperactive–Impulsive	0.06	0.05	0.48**	–																
5. CBRS Parent Conduct Disorder	0.06	−0.12	0.39**	0.49**	–															
6. CBRS Parent Oppositional Defiant Disorder	0.03	−0.16*	0.34**	0.60**	0.72**	–														
7. CBRS Teacher ADHD Inattentive	0.26**	0.36**	0.18*	0.10	−0.02	−0.02	–													
8. CBRS Teacher ADHD Hyperactive–Impulsive	0.07	0.14	0.11	0.32**	0.17*	0.23**	0.58**	–												
9. CBRS Teacher Conduct Disorder	0.07	0.15	0.10	0.28**	0.36**	0.34**	0.38**	0.60**	–											
10. CBRS Teacher Oppositional Defiant Disorder	−0.01	0.18*	0.20*	0.32**	0.33**	0.34**	0.44**	0.67**	0.77**	–										

Table 3 (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
11. Parent Callous–Unemotional Traits	0.05	0.02	0.36**	0.41**	0.54**	0.46**	−0.004	0.06	0.06	0.15	–									
12. Teacher Callous–Unemotional Traits	−0.02	0.08	0.15	0.22**	0.24**	0.30**	0.47**	0.54**	0.60**	0.65**	0.16	–								
13. Parent SDQ Peer Relationship Problems	0.05	0.02	0.31**	0.15	0.18*	0.16*	0.001	−0.01	0.01	0.17*	0.20*	0.11	–							
14. Teacher SDQ Peer Relationship Problems	−0.02	0.19*	0.10	0.12	0.06	0.10	0.21*	0.17*	0.30**	0.39**	0.04	0.37**	0.42**	–						
15. Parent SDQ Prosocial Behaviour	0.12	0.07	−0.21*	−0.28**	−0.39**	−0.38**	0.10	0.03	−0.06	−0.16	−0.50**	−0.16	−0.17*	−0.05	–					
16. Teacher SDQ Prosocial Behaviour	0.17*	−0.06	−0.04	−0.18*	−0.13	−0.16	−0.29**	−0.42**	−0.40**	−0.53**	−0.06	−0.65**	−0.20*	−0.33**	0.15	–				
17. CBRS Parent Emotional Distress	0.07	0.04	0.37***	0.30***	0.31***	0.34***	0.07	−0.05	−0.003	0.05	0.26**	0.04	0.32***	0.08	−0.15	−0.01	–			
18. CBRS Teacher Emotional Distress	0.11	0.37***	0.04	−0.03	−0.04	0.01	0.41***	0.28***	0.34***	0.42***	−0.13	0.16	0.11	0.41***	0.09	−0.13	0.23**	–		

Table 3 (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
19. CBRS Parent Separation Fear	0.04	0.12	0.04	0.11	0.01	0.02	0.02	−0.08	0.02	−0.07	−0.08	−0.08	0.20*	0.10	0.13	−0.05	0.46***	0.24**	–	
20. CBRS Teacher Separation Fear	0.20*	0.11	0.07	−0.08	−0.01	−0.03	0.22**	0.03	0.19*	0.17*	−0.09	0.05	0.16	0.30***	0.03	0.03	0.19*	0.63***	0.25**	–

$N = 147$, $^{*}p \leq 0.05$, $^{**}p \leq 0.01$, $^{***}p \leq 0.001$

prosocial behaviour score decreased by 0.55 units. In addition, sex was a significant regressor for prosocial behaviour over and above the other variables; teachers generally rated girls more positively with regard to displaying more prosocial behaviour than boys (see Table 1). All of the other variables were non-significant (see Table 7). In model 2 again ODD was a significant predictor for prosocial behaviour over and above the other variables; with one standard unit increase in ODD, the predicted SDQ prosocial behaviour scores decreased by 0.28 units when the other regressors were held constant. CU traits was also a significant regressor over and above the other variables; with one standard unit increase in CU traits, the predicted SDQ prosocial behaviour scores decreased by 0.54 units when the other regressors were held constant. Sex was also a significant regressor again within this model. All of the other regressors were non-significant (see Table 7). The inclusion of the anxiety variables in model 3 did not lead to a significant F change, $p = 0.580$, suggesting that they do not account for a significant amount of variance within the model. Including the interactions between ODD and sex ($b = -0.02$, $p = 0.19$) and between CU and sex ($b = -0.01$, $p = 0.65$) yielded no significant contribution to the model.

Discussion

The present study is the first to explore the extent to which sex, teacher- and parent-reported symptoms of externalising psychopathology (ADHD, ODD, CD), and CU traits were related to peer relationship difficulties and prosocial behaviour, controlling for sex differences. The results showed that parent-reported ADHD Inattentive symptoms, as well as teacher-reported ODD symptoms, and CU traits were significantly related to increased peer relationship problems, whilst teacher-reported hyperactive–impulsive behaviour was significantly related to decreased peer relationship problems when controlling for other variables, indicating that this might be a protective factor. Whilst separation fear did not specifically relate to peer relationship, teacher-reported emotional distress did, and including those internalising aspects increased the variance explained for both parent- and teacher-reported models. Parent- and teacher-reported CU traits and teacher-reported ODD symptoms, as well as sex, were significantly related to reduced prosocial behaviour, while separation fear and emotional distress did not significantly contribute to differences in prosocial behaviour. The results extend existing findings to demonstrate that ADHD subtypes were significantly related to peer relationship difficulties and how this association was dependent on the source of information—teacher or parent. Moreover, they highlight that teacher reports of behaviour were more broadly associated with challenges around social functioning.

Table 4 Summary of hierarchical multiple regression results relating peer relationship problems with parent reports: investigating the influences of sex and anxiety

Regressors	*b*	SE *b*	*β*	sr^2	*R*	R^2	ΔR^2
Model 1					0.33	0.11	
Age	0.03	0.08	0.03	0.001			
Sex	0.13	0.50	0.02	< 0.001			
CBRS ADHD Inattentive	0.06	0.02	0.28**	0.05			
CBRS ADHD Hyperactive–Impulsive	− 0.01	0.02	− 0.06	0.002			
CBRS Conduct Disorder	0.002	0.02	0.02	< 0.001			
CBRS Oppositional Defiant Disorder	0.01	0.02	0.05	0.001			
Callous–Unemotional Traits	0.02	0.03	0.10	0.01			
Model 2					0.41	0.17	0.06**
Age	0.004	0.07	0.01	< 0.001			
Sex	0.09	0.49	0.01	< 0.001			
CBRS ADHD Inattentive	0.05	0.02	0.23*	0.04			
CBRS ADHD Hyperactive–Impulsive	− 0.02	0.02	− 0.08	0.004			
CBRS Conduct Disorder	0.00	0.02	0.002	< 0.001			
CBRS Oppositional Defiant Disorder	0.004	0.02	0.02	< 0.001			
Callous–Unemotional Traits	0.03	0.02	0.11	0.01			
CBRS Emotional Distress	0.03	0.02	0.16	0.02			
CBRS Separation Fear	0.02	0.01	0.14	0.01			

* $p < 0.05$, ** $p \leq 0.01$

Table 5 Summary of hierarchical multiple regression results relating peer relationship problems with teacher reports: investigating the influences of sex and anxiety

Regressors	*b*	SE *b*	*β*	sr^2	*R*	R^2	ΔR^2
Model 1					0.47	0.22	
Age	0.12	0.08	0.13	0.01			
Sex	− 0.17	0.51	− 0.03	< 0.001			
CBRS ADHD Inattentive	0.01	0.02	0.04	< 0.001			
CBRS ADHD Hyperactive–Impulsive	− 0.04	0.02	− 0.24*	0.02			
CBRS Conduct Disorder	0.00	0.02	− 0.002	< 0.001			
CBRS Oppositional Defiant Disorder	0.05	0.02	0.35*	0.04			
Callous–Unemotional Traits	0.06	0.03	0.24*	0.03			
Model 2					0.55	0.30	0.09***
Age	0.07	0.08	0.08	0.004			
Sex	− 0.31	0.49	− 0.05	0.002			
CBRS ADHD Inattentive	− 0.01	0.02	− 0.07	0.003			
CBRS ADHD Hyperactive–Impulsive	− 0.03	0.02	− 0.17	0.01			
CBRS Conduct Disorder	− 0.01	0.02	− 0.06	0.001			
CBRS Oppositional Defiant Disorder	0.03	0.02	0.22	0.01			
Callous–Unemotional Traits	0.08	0.03	0.33**	0.05			
CBRS Emotional Distress	0.04	0.02	0.27*	0.03			
CBRS Separation Fear	0.02	0.01	0.11	0.01			

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Previous research has similarly found differences between the predictive validity of parent and teacher reports of psychopathology with respect to behavioural outcomes in children and adolescents. McLoughlin et al. [38], for example, found that although parents and teachers shared similar views of the behaviours of the two subtypes of ADHD—inattentive and hyperactive–impulsive, they also highlighted a diverse profile. The authors suggest that such results might be attributable to the different environments in which the respective raters observe children and young people (i.e. the classroom versus the home environment). While the positive associations data in the current study indicated that reports of symptoms of psychopathology were generally consistent (see also [39]),

Table 6 Summary of hierarchical multiple regression results relating prosocial behaviour with parent reports: investigating the influences of sex and anxiety

Regressors	*b*	SE *b*	*β*	sr^2	*R*	R^2	ΔR^2
Model 1					0.56	0.31	
Age	0.03	0.07	0.04	0.001			
Sex	0.98	0.45	0.16*	0.02			
CBRS ADHD Inattentive	−0.001	0.02	−0.01	< 0.001			
CBRS ADHD Hyperactive–Impulsive	0.00	0.02	0.002	< 0.001			
CBRS Conduct Disorder	−0.01	0.02	−0.10	0.004			
CBRS Oppositional Defiant Disorder	−0.02	0.02	−0.13	0.01			
Callous–Unemotional Traits	−0.10	0.02	−0.39**	0.10			
Model 2					0.57	0.32	0.01
Age	0.03	0.07	0.03	0.001			
Sex	0.97	0.44	0.16*	0.02			
CBRS ADHD Inattentive	0.001	0.02	0.01	< 0.001			
CBRS ADHD Hyperactive–Impulsive	−0.004	0.02	−0.02	< 0.001			
CBRS Conduct Disorder	−0.02	0.02	−0.11	0.01			
CBRS Oppositional Defiant Disorder	−0.02	0.02	−0.11	0.005			
Callous–Unemotional Traits	−0.09	0.02	−0.36**	0.08			
CBRS Emotional Distress	−0.01	0.02	−0.10	0.002			
CBRS Separation Fear	0.02	0.01	0.14	0.01			

*$p < 0.05$, **$p < 0.001$

Table 7 Summary of hierarchical multiple regression results relating prosocial behaviour with teacher reports: investigating the influences of sex and anxiety

Regressors	*b*	SE *b*	β	sr^2	*R*	R^2	ΔR^2
Model 1					0.69	0.48	
Age	0.02	0.07	0.02	< 0.001			
Sex	1.02	0.46	0.15*	0.02			
CBRS ADHD Inattentive	0.002	0.02	0.01	< 0.001			
CBRS ADHD Hyperactive–Impulsive	−0.10	0.02	−0.04	< 0.001			
CBRS Conduct Disorder	0.02	0.02	0.15	0.01			
CBRS Oppositional Defiant Disorder	−0.04	0.02	−0.28*	0.02			
Callous–Unemotional Traits	−0.15	0.02	−0.55**	0.15			
Model 2					0.69	0.48	0.004
Age	0.03	0.07	0.03	0.001			
Sex	0.95	0.46	0.14*	0.02			
CBRS ADHD Inattentive	0.00	0.02	0.00	0.00			
CBRS ADHD Hyperactive–Impulsive	−0.003	0.02	−0.02	< 0.001			
CBRS Conduct Disorder	0.02	0.02	0.14	0.01			
CBRS Oppositional Defiant Disorder	−0.04	0.02	−0.28*	0.02			
Callous–Unemotional Traits	−0.15	0.02	−0.54**	0.14			
CBRS Emotional Distress	−0.01	0.02	−0.05	0.001			
CBRS Separation Fear	0.01	0.01	0.09	0.004			

* $p < 0.05$, **$p < 0.001$

they associated these symptoms with social behaviour differently. Interestingly, adding the internalising aspects (separation fear and emotional distress) to the model revealed a main relevance of CU traits and emotional distress for explaining peer relationship problems, but only in the teacher-based data. These informant discrepancies are also relevant in terms of decisions related to forensic questions [40], and therefore need more attention not only in research but also in practical contexts.

The results link to previous studies that have raised the possibility that inattention is likely to limit opportunities to acquire the necessary social skills through observational learning [41], and to attend to the social cues necessary for effective interactions with peers [42, 43]. However, the

results are inconsistent with the proposition that hyperactivity and impulsivity reflect unrestrained behaviour that is found aversive by peers [10, 44], with our results suggesting that, from the teacher reports, such symptoms may even act as a protective factor against difficulties with peer relationships, when controlling for oppositional and conduct problem behaviours, as well as for callous–unemotional traits. Thus, teacher-reported pure hyperactive symptoms can be seen as protective; however, when in combination with conduct problems, these symptoms have the expected positive association with peer relationship difficulties. In contrast, the results for ODD, as it is characterised by symptoms of oppositional, defiant, aggressive, and non-compliant behaviours [45], are consistent with past research, with such problem behaviours often resulting in peer rejection [46]. Additionally, regarding prosocial behaviour, children who score highly on CU traits would have a lack of empathy [47] and, therefore, would be expected to engage less in prosocial behaviour.

With respect to CU traits, whilst there was no significant relationship between parent and teacher reports of these traits, they were significantly associated with reduced prosocial behaviour in both parent and teacher reports, highlighting that increased CU traits across the sample were associated with fewer prosocial behaviours [17, 18]. Regarding the role of teacher-reported CU traits explaining peer relationship problems, this is in line with the results of Eisenbarth et al. [18], but from the results of this study an explaining role of CD would also have been expected and this finding was not replicated in this study. However, the research by Eisenbarth et al. did benefit from a larger sample of 337 and, therefore, had greater statistical power than the present study. Our current findings are in line with the results from Pardini and Fite [29], who utilised a far larger sample (1517 youth) and did not find a significant predictive power of CD traits. Yet, this study also failed to establish a relationship with CU traits on peer relationship problems. As Pardini and Fite [29] used an all-male sample, whereas Eisenbarth et al. [18] and the present study utilised mixed sex samples, the diverse findings could also be related to sex discrepancies. Thus, future research should incorporate the role of sex when investigating the relationship between CD, CU traits, and peer relationship difficulties.

Sex was found to be significantly related to prosocial behaviour in both parent and teacher reports, with females being rated as displaying higher prosocial behaviour, on average, than males. These findings are consistent with previous research highlighting that both parents and teachers reported that females display more prosocial behaviour across development compared with males [48]. Prosocial behaviour is typically reported to be more important to girls because of its link to peer acceptance [49]. More importantly, we found that sex was related to prosocial behaviour in addition to externalising traits for both parent-reported and teacher-reported prosocial behaviour. However, it is also possible that parents and teachers conformed with gender stereotypes in their report of prosocial behaviour and expectations that girls will engage with this more [50].

In conclusion, our study investigated the role of parent- and teacher-reported symptoms of ADHD (inattentive and hyperactive–impulsive subtypes), CD, ODD, and CU traits, as well as sex, in relation to peer relationships and prosocial behaviour. Our results are important in highlighting the differential explanatory validity of parent and teacher reports on social behaviour. While these results are important in understanding the developmental context of psychopathology and its impact, the use of a cross-sectional design precluded any inference of causal relationship. Furthermore, additional data such as ethnicity would be informative. However, the study sets the ground for further longitudinal research aimed at elucidating causality between externalising symptoms and associated constructs with key indices of developmental outcomes between males and females. Our study suggests that practitioners should systematically screen children referred for disruptive behaviours for difficulties with peer relationships and prosocial behaviour, and take both parents' and teachers' views into account, as well as sex differences. This has several implications: on one side, different informants seem to report differentially relevant information about such behaviour and therefore need to be considered not only at the initial stages of assessment and intervention, but also at later stages. Furthermore, interpersonal behaviour should be assessed and included in treatment planning, acknowledging potential sex differences.

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Compliance with ethical standards

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institution (ERGO ID: 23218) and national research committee (REC reference 14/WA/0149; IRAS ID: 138982) and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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