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Regular Article

Synergy between callous–unemotional traits and aggression in preschool children: Cross-informant and cross-cultural replication in the UK Wirral Child Health and Development Study, and the Colombian La Sabana Parent–Child Study

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Abstract

Incremental prediction of aggression from callous–unemotional (CU) traits is well established, but cross-cultural replication and studies of young children are needed. Little is understood about the contribution of CU traits in children who are already aggressive. We addressed these issues in prospective studies in the United Kingdom and Colombia. In a UK epidemiological cohort, CU traits and aggression were assessed at age 3.5 years, and aggression at 5.0 years by mothers ($N = 687$) and partners ($N = 397$). In a Colombian general population sample, CU traits were assessed at age 3.5 years and aggression at 3.5 and 5.0 years by mother report ($N = 220$). Analyses consistently showed prediction of age-5.0 aggression by age-3.5 CU traits controlling for age-3.5 aggression. Associations between age-3.5 CU traits and age-5.0 aggression were moderated by aggression at 3.5 years, with UK interaction terms, same informant, $\beta = .07$ $p = .014$ cross-informant, $\beta = .14$ $p = .002$, and in Colombia, $\beta = .09$ $p = .128$. The interactions arose from stronger associations between CU traits and later aggression in those already aggressive. Our findings with preschoolers replicated across culturally diverse settings imply a major role for CU traits in the maintenance and amplification of already established aggression, and cast doubt on their contribution to its origins.

Keywords: aggression, callous–unemotional traits, cross-cultural, cross-informant, preschool

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Children with aggressive and disruptive behavior "conduct" problems who also show lack of remorse, absence of empathy with others, uncaring attitudes, and lack of concern about the consequences of one's own performance, "callous–unemotional" (CU) traits, differ in many respects from other children with conduct problems (CP) (Frick, Ray, Thornton, & Kahn, 2014; Frick & White, 2008). For example, the genetic contribution to their disorder is stronger (Henry, Pingault, Boivin, Rijsdijk, & Viding, 2016; Viding, Blair, Moffitt, & Plomin, 2005), and they are less sensitive to punitive parenting (Dadds & Salmon, 2003). Most studies of CU traits have been of children and adolescents. Furthermore, with few exceptions, studies of CU traits have been conducted in countries characterized by the World Bank as high-income countries (HICs), and it is yet to be established whether the findings generalize across cultures and socioeconomic conditions. Hypotheses regarding the mechanisms whereby CU traits create vulnerability for aggression envisage both that they may have a role in the emergence of aggression, or in perpetuating it in children who are already aggressive. In this study we examined in preschool children the incremental validity of two measures of CU traits widely used in older children and across contrasting cultures. We also tested the hypothesis that CU traits are associated with increasing child aggression specifically among children who are already aggressive using cross-cultural and cross-informant tests of robustness.

Given that "life course persistent" CP, which are associated with a wide range of adverse outcomes in adolescence and adulthood, typically start during the preschool period (Odgers et al., 2008), it is important to understand the role of CU traits in early-onset CP. This requires valid measurement of CU traits in young children. Several studies have provided support for validity in 3-year-olds based on incremental prediction of CP over time after accounting for baseline CP (Waller, Hyde, Grabell, Alves, & Olson, 2015; Waller et al., 2016; but see Willoughby, Mills-Koonce, Gottfredson, & Wagner, 2014). However, evidence regarding measures widely used in older children, is limited. Furthermore most studies of childhood CP come from HIC such as the United States of America, the Netherlands, Australia, Cyprus, United Kingdom, and Canada. Replication

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across HIC and low- and middle-income countries (LMIC) would add to the generalizability of findings. A search conducted for this paper using the term "callous–unemotional traits" yielded 720 publications of which 15 were from LMIC (11 from China), 2% of the total. We were not been able to identify any previous publications that compared effect sizes for the same analyses across HIC and LMIC. In this study, we sought to establish incremental prediction as a test of validity of two measures widely used in older children, the Antisocial Process Screening Device (APSD) and the Inventory of Callous Unemotional Traits (ICU) in a HIC and in a LMIC.

Commonly in studies of young children, where teacher reports are not available, measurement relies on parent report, leading to the possibility of associations inflated by common method variance where the same parent reports on the key variables. Therefore, in a further test of robustness of our findings we examined in the UK study, incremental prediction by maternal report of CU traits to paternal report of child aggression.

Deficits in recognition of, and responsiveness to, fear and sadness, possibly related to lack of eye contact in social interactions, are thought to underpin indifference to others' distress in CU traits (Blair, Colledge, Murray, & Mitchell, 2001; Dadds, Jambrak, Pasalich, Hawes, & Brennan, 2011). This deficient response to distress has been proposed to lead to persistent aggressive behavior because the normal inhibitory effect of another persons' distress when harming them is reduced or absent (Blair et al., 2001; Blair, 2013). However, when we study CU traits in general population samples, in contrast to clinical samples where all the children have CP, there are some indications that elevated CU traits may occur in the absence of CP (Fanti, 2013; Fontaine, McCrory, Boivin, Moffitt, & Viding, 2011; Rowe et al., 2010; Wall, Frick, Fanti, Kimonis, & Lordos, 2016).

Our understanding of the processes that lead some children with high CU traits to develop aggressive and antisocial behavior, while others do not, is limited. One possibility is that the risk for aggression arises from the combination of unresponsiveness to others' distress seen in CU traits and a second source of vulnerability such as under-arousal reflected in low cortisol reactivity (Wright, Hill, Pickles, & Sharp, 2019), low observed behavioral inhibition (Waller, Hyde, Baskin-Sommers, & Olson, 2017), parent-reported need for stimulation and grandiose traits (Colins et al., 2014) or low mentalization (Taubner, White, Zimmermann, Fonagy, & Nolte, 2013). These direct tests of synergy conducted using moderator analyses, are consistent with findings from studies using latent-profile analyses which have shown that children with elevated CU traits in the absence of CP have lower levels of possible sources of additional individual and environmental vulnerabilities than those with both elevated CU and CP (Fanti, 2013; Wall et al., 2016). A further, and as yet relatively unexplored, possibility is that CU traits create vulnerability for CP or aggression specifically among children who are already aggressive, for example by reducing their response to, or concern for, the harm they cause to others, which in turn decreases their likelihood of desisting their aggressive behavior. If that were the case, we would expect the association between CU traits and future aggression to be greatest in the presence of current aggression. If CU traits only contribute to aggression among children who are already aggressive, then we expect no association between CU traits and future aggression among non-aggressive children.

There has been limited attention paid to these possible mechanisms in preschool children, a key period for early intervention and the starting point of life-course persistent antisocial behavior. In a one-year prospective study of one group of children recruited at ages 4–6 years, and another at ages 7–9 years, synergistic effects of baseline CU traits and CP were seen in boys in the younger group, and in girls in the older group (Dadds, Fraser, Frost, & Hawes, 2005). These findings indicate that there may be age-related differences in these processes, highlighting the need for studies that examine the mechanisms at specific ages, and test for replicability of findings. In the studies reported here of preschool children we were able to ask whether there is a synergistic effect of CU traits and aggression, that is seen in preschool children, in two contrasting cultural and socio-economic settings, and in same and cross-informant analyses.

Method

Overview of method

Sampling, measures, and data analyses in Study 1 from the UK Wirral Child Health and Development Study are described first, followed by sampling, measures and analyses in Study 2 from the Colombian La Sabana Parent and Child Study. We then compare the effects from each study in Table 3 and Figure 1, showing associations between age-3.5 CU traits and age-5 aggression at three levels of initial aggression, and use a combined dataset to test whether the effects in the UK and Colombian studies are different.

Study 1

Participants and procedure

The Wirral Child Health and Development Study (WCHADS) is a prospective epidemiological study starting in pregnancy designed to identify the earliest origins of childhood CP. (Further information about the data and conditions for access are available at the University of Liverpool Research Data Catalogue: doi.org/10.17638/datacat.liverpool.ac.uk/564.) Ethical approval was granted by the Cheshire North and West Research Ethics committee and all women gave written informed consent at the point of recruitment in the antenatal clinic.

The cohort comprised 1,233 first-time expectant mothers recruited in pregnancy with a live, singleton baby for long-term follow-up post-birth (see Sharp et al., 2012 for a detailed account of sampling). The participants were identified from consecutive first-time mothers who booked for antenatal care at 12 weeks' gestation between 12/02/2007 and 29/10/2008. The booking clinic was administered by the Wirral University Teaching Hospital, which was the sole provider of universal prenatal care on the Wirral Peninsula. Socioeconomic conditions on the Wirral range between the deprived inner city and affluent suburbs, but with low numbers from ethnic minorities. The mean age at recruitment was 26.8 years ($SD = 5.8$, range 18–51), 41.8% of the sample were in the most deprived quintile of UK neighborhoods (Noble et al., 2004) and 96.1% were White British. The analysis that follows focuses on 687 children (326 boys) who provided questionnaire data by maternal report at both the age 3.5 years (mean age = 41.70 months, $SD = 2.33$) and 5.0 years (mean age = 58.18 months, $SD = 2.83$) waves, and on the 397 on whom partner reports were available at 5.0 years. The maternal report sample did not differ from the whole cohort ($N = 1,233$) on maternal depression scores at 20 weeks ($t(1,208) = 1.157$, $p = .247$) but was less deprived (χ^2 (1, 1,233) = 19.502, $p < .001$)

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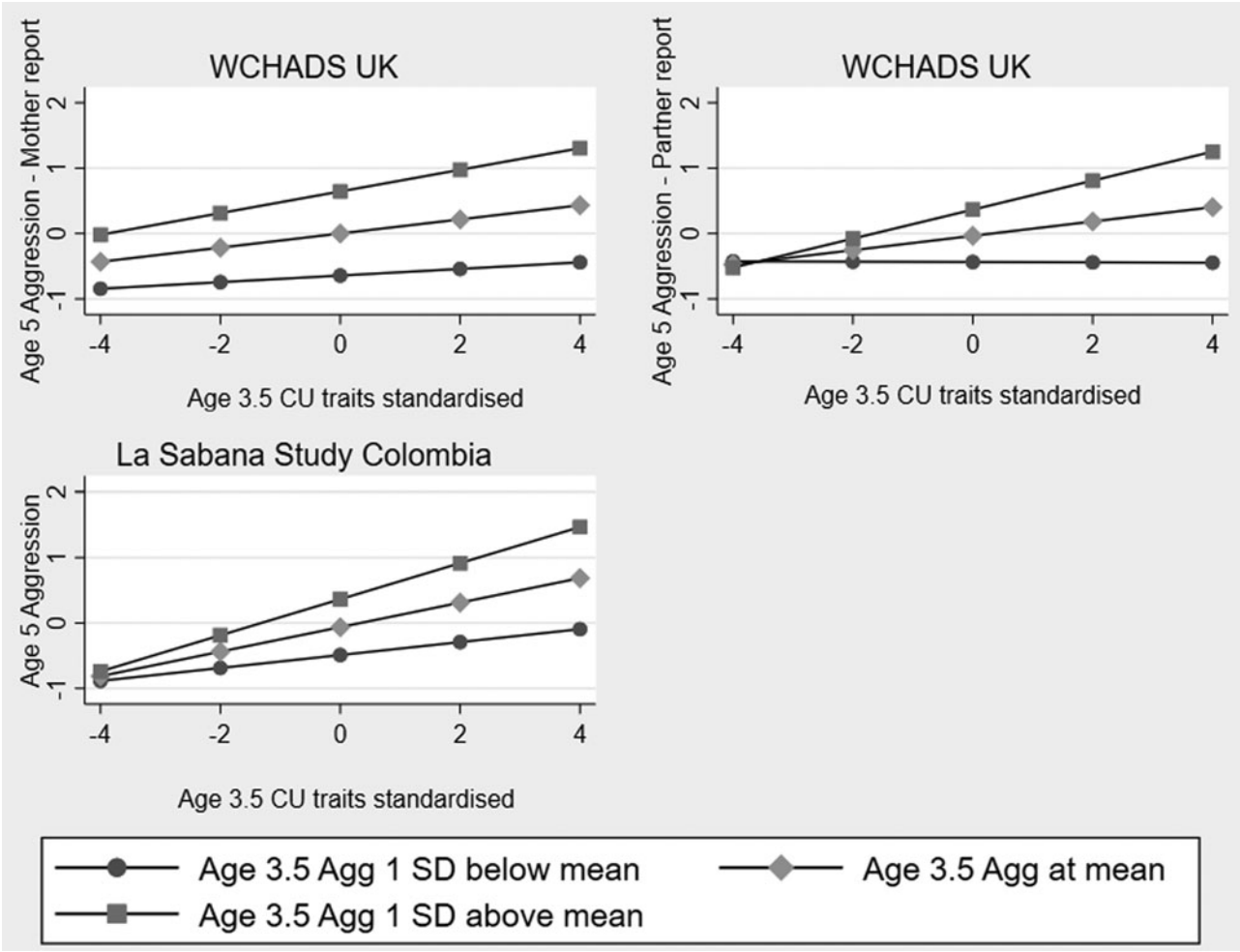

Figure 1. The prospective association between age-3.5 callous–unemotional (CU) traits and age-5.0 aggression at three levels of age 3.5 aggression (at mean and 1 *SD* above and below mean) in the mother and partner report Wirral Child Health and Development Study (WCHADS) sample and mother report La Sabana Parent–Child Study.

and had a lower maternal age at pregnancy ($t(1,230) = -1.834$, $p < .001$). The paternal report sample was less deprived (χ^2 (1, 1,233) = 9.690, $p < .001$), had a lower maternal age ($t(1,230) = -6.697$, $p < .001$) and lower depression scores ($t(1,208) = 2.217$, $p = .027$) in pregnancy compared to the whole sample. Of the 687, the majority (80%) were two parent families and 32% of mothers had university degrees.

Measures

Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2000*).* The parent report CBCL for children aged 1.5 to 5 years was used to assess aggressive behaviors at age 3.5 and 5.0 years. It has 99 items to assess internalizing and externalizing behaviors in the past 6 months, rated on a 3-point scale (0 = *not true*, 1 = *somewhat true/sometimes true*, and 2 = *very true/often true*). The sum of the 19 aggressive behavior items was used in the analyses. In addition to maternal reports at age 3.5 and 5.0 years, we collected reports from biological fathers or mothers' current partner who had regular contact with the child at age 5.0. These are referred to as partner reports.

Antisocial Processes Screening Device (APSD; Frick & Hare, 2001*).* The parent-report CU subscale was used to assess CU traits. This measure has been widely used in studies of CU traits in childhood, including a sample of children aged 3 years (Kimonis et al., 2006). The six items are rated on a 3-point scale (0 = *not at all true*, 1 = *sometimes true*, and 2 = *definitely true*). Internal consistency in this sample was α = .60, similar to that reported by Kimonis et al. (α = .54). In previous reports we have generated a factor score with more satisfactory psychometric properties by adding items from the CBCL aggression scale (Wright, Sharp, Pickles, & Hill, 2017; Wright, Hill, Sharp, & Pickles, 2018), but we did not use this here to avoid item overlap with our outcome measure across the UK and Colombian studies, CBCL aggression.

Confounders. Potential sources of mood-biased reporting at age 5 years were accounted for in mothers using the 20-item Centre for Epidemiological Studies – Depression (CES-D; Radloff, 1977) and in partners with the 12-item General Health Questionnaire (Goldberg & Williams, 1988). Two indices of family demographic status were included as covariates: (a) socio-economic status, which was derived from post code data using the English Index of Multiple Deprivation (IMD; Noble et al., 2004) and converted to quintile categories with a binary variable (1 = *most deprived*, 0 = *all four other quintiles*) used for analysis and (b) mother's age at pregnancy. Child sex (0 = *female*, 1 = *male*) was also included as a covariate.

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Table 1. Summary of linear regression models predicting maternal and partner report of aggression in the Wirral Child Health and Development Study (WCHADS)

		Maternal report age-5.0 aggression					Partner report age-5.0 aggression				
Variable		ΔR^2	*p*	β	β 95% CI	*P*	ΔR^2	*p*	β	95% CI	*p*
Child sex	Block 1	.501	<.001	.03	(−.04, .17)	.223	.270	<.001	−.06	(−.36, .08)	.198
Mother age				.03	(−.01, .02)	.285			.01	(−.02, .02)	.875
Deprivation				.09	(.07, .30)	.002			.17	(.21, .69)	<.001
Reporter mood age 5.0				.08	(.03, .13)	.004			.07	(−.03, .42)	.092
Aggression age 3.5				.67	(.62, .73)	<.001			.46	(.38, .55)	<.001
CU traits age 3.5	Block 2	.011	<.001	.12	(.06, .18)	<.001	.012	.010	.12	(.12, .87)	.010
Aggression × CU traits 3.5	Block 3	.004	.014	.07	(.01, .11)	.014	.018	.002	.14	(.15, .61)	.002

Note: Block 1 effects were generated from a model with only Block 1, Block 2 effect from a model with Block1 plus Block 2, and Block 3 effect from a model with all three blocks.

Data analyses

SPSS v.24 was used for the statistical analyses. Following square root transformations for skewed variables, bivariate associations between the study variables were examined using Pearson, point-biserial and tetrachoric correlations. In validity-checking and hypothesis-testing analyses, regression models predicting age-5.0 aggression were examined in three blocks. Block 1 included demographic covariates, age-3.5 child aggression, and parental mood at age 5 years, Block 2 included age-3.5 CU traits, and Block 3 included the age-3.5 aggression by CU traits interaction; testing was carried out at each stage to assess whether the addition of a block significantly increased the explained variance. The age-3.5 CU Traits × Aggression interactions were then explored in each sample, by using online computational tools to calculate regions of significance (Roisman et al., 2012), and testing the simple slopes and intercepts at three levels of age-3.5 aggression: 1 *SD* above the mean, mean, and 1 *SD* below the mean. In Supplementary Appendix 1 and Table A3 we report the results of exploring the interaction with CU traits as the moderator.

Results

Bivariate associations between the transformed study variables and descriptive statistics for untransformed variables are presented in Supplementary Table A1 (Appendix).

Table 1 shows separate models for maternal report of CBCL aggression regressed on to Block 1 variables, then Block 2 after accounting for Block 1, and similarly Block 3 accounting for Block 1 and 2 variables, so that all the reported coefficients are directly interpretable. It can be seen that CU traits at age 3.5 years explained significant additional variance after accounting for contemporary aggression and after controlling for possible biasing effects of maternal mood on child report at age 5.0 years. There was also an age-3.5 CU Traits × Aggression interaction, which arose as predicted by a progressively stronger association between age-3.5 CU traits and age-5.0 aggression, with increasing aggression at age 3.5 years, as shown in Table 3 and Figure 1.

Very similar effects were seen when father-reported CBCL aggression at age 5.0 years was regressed on to mother-reported age-3.5 CU traits and aggression (Tables 1 and 3, Figure 1). The regions of significance analysis indicated that the association between age-3.5 CU traits and age-5.0 aggression became significant at .67 *SD*s below the mean for mother-reported outcomes (equating to a score of 3 and above on age-3.5 aggression, $N = 524/687$ children) and .13 *SD*s below the mean for partner-reported outcome (equating to a score of 6 and above on age-3.5 aggression, $N = 384/687$). In analyses of the associations between age-3.5 and age-5.0 aggression at different levels of CU traits, shown in Supplementary Appendix 1 and Table A3, there were progressively stronger associations with increasing CU traits, which were nevertheless significant at all levels.

Study 2

Participants and procedure

The La Sabana Parent and Child Study participants were recruited through Facebook groups likely to be used by young mothers, such as "Latin Women League" and "More Moms Colombia". It is estimated that 91% of those between the ages of 14 and 65 in Colombia access Facebook (Ministerio de Tecnologías de la Información y las Comunicaciones, 2018). Parents who responded to the online study information ($n = 344$) were contacted to discuss participation. Of these, 40 were excluded as the children did not meet the age inclusion criteria of age 3–4 years. Of the remaining 304, 235 (77.3%) provided informed consent to take part in the study and full data. For the baseline assessment 235 families with children of 3.5 years (mean age = 3.31, $SD = .48$) participated, 48% girls, and the mothers' average age was 30.04 years ($SD = 6.29$). The study was approved by the Research and Ethical Committee of the Psychology Department at La Sabana University.

Participants were recruited from three Colombian regions, each with different cultural and demographic features. The Pacific ($N = 69$) and Caribbean ($N = 70$) regions are characterized by high levels of poverty and extensive numbers of Afro-Colombian and Indigenous inhabitants, while the Central region ($N = 96$) has the lowest levels of poverty in the country and it is predominantly *mestizo* (mix of European and Indigenous) (Ministerio de Ambiente y Desarrollo Sostenible, 2013). Overall, 15% of the participants lived in rural areas. The majority (77%) were two-parent families and 50% of mothers and 48% of fathers had university degrees; 45% of the sample belonged to the lowest two household income classifications, based on the Colombian government system that classifies households into six categories (1 the lowest) determined by housing conditions and basic public services, such as sewerage and water supply (Departamento

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Table 2. Summary of multiple linear regression models predicting mother report aggression in the La Sabana Parent–Child Study

	ΔR^2	*p*	Variable	β	95% CI	*p*
Block 1	.281	<.001	Child sex	.02	(−.20, .27)	.783
			Mother age	.03	(−.02, .03)	.673
			Household income	−.01	(−.26, .24)	.947
			Pacific region	−.10	(−.49, .07)	.143
			Caribbean region	−.06	(−.42, .15)	.339
			Maternal mood age 5.0	.21	(.08, .34)	.002
			Aggression age 3.5	.43	(.30, .56)	<.001
Block 2	.021	.014	CU traits age 3.5	.17	(.04, .30)	.014
Block 3	.008	.128	Aggression × CU traits 3.5	.09	(−.02, .19)	.128

Note: Block 1 effects were generated from a model with only Block 1, Block 2 effect from a model with Block1 plus Block 2, and Block 3 effect from a model with all three blocks.

Administrativo Nacional de Estadística - DANE, 2011). Classifications 1 and 2 receive subsidies from the Colombian government. Asked to identify their ethnicity, 38% mothers identified as mestizo, 9% Afro-Colombian, 5% Indigenous, 13% from "other" ethnic groups, and 35% did not identify themselves as belonging to a specific ethnic group.

At follow-up, 18 months later, 220 (93%) participants provided data for the analyses presented here (mean age = 4.86; *SD* = .42; 51% girls).

Measures

CBCL (Achenbach & Rescorla, 2000). The Spanish version of the CBCL for children aged 1.5 to 5 years was used to assess aggressive behaviors. For the present study this scale had an internal consistency of .85 for the baseline and .88 for the follow-up, values that are similar to those previously reported with Colombian children (α = .86; Hewitt, Vila, & Juárez, 2016).

ICU (Frick, 2004). CU traits were measured using the parent report version for preschool children. This inventory has 24 items scored using a 4-point scale (0 = *not at all true*, 1 = *somewhat true*, 3 = *very true*, and 4 = *definitely true*). Evidence for the reliability and validity of the ICU total score in preschool children has been provided from a cross-sectional study by Kimonis et al. (2016). The Spanish version of the inventory was shared by the authors, who also approved its use in the present study. The internal consistency of the total score was good in the current sample (α = .82). Previous studies with Latin-American (Rigatti et al., 2017) and Spanish children (Ezpeleta, Osa, Granero, Penelo, & Domènech, 2013) have used the ICU. We have previously supported the factor structure of the ICU in this sample (Obando, Wright, & Hill, 2021). Similar to other studies of childhood, a two-correlated factor structure showed the best fit, but in line with the recommendations of Ray, Frick, Thornton, Steinberg, and Cauffman (2016) we conduct the main analysis using the full 24-item ICU total score, but report the results using the 12-item total in the Supplementary Appendix.

Confounders. The Spanish version of the Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden, & Sagovsky, 1987) was used to assess maternal mood. The EPDS has 10 items scored on a 4-point scale. This measure is widely used during the prenatal and postnatal periods with parents of young children (Huntley, Wright, Pickles, Sharp, & Hill, 2017). Internal consistency of the EPDS was good in a previous study of Colombian women (α = .78; Campo-Arias, Ayola-Castillo, Peinado-Valencia, Amor-Parra, & Cogollo, 2007) and also in this study (α = .83). Child sex, maternal age at pregnancy, household income (operationalized as a binary variable, 1 = *lowest two DANE family income classifications*, 0 = *all other income classifications*), and dummy variables for Caribbean and Pacific regions were included as covariates in regression analyses.

Data analyses

Data analyses in Study 2 were the same as in Study 1 with the additional confounder of dummy variables for Caribbean and Pacific regions to the variables of Block 1.

Results

The bivariate associations between the study variables and descriptive statistics are presented in Supplementary Table A2 (Appendix). Mean levels of aggression were somewhat higher than in the UK sample (age-3.5 aggression mean = 11.83, *SD* = 6.35, compared to mean = 7.43, *SD* 5.83 in WCHADS). Overall associations were very similar to those in the WCHADS, although in contrast to the UK sample, in the La Sabana study the association between male sex and aggression at age 5.0 years was nonsignificant.

Table 2 shows that, as in WCHADS, CU traits at age 3.5 years explained significant additional variance after accounting for aggression at age 3.5 years. The age-3.5 CU Traits × Aggression interaction effect was slightly larger than in WCHADS, but in this smaller sample it was nonsignificant. It arose as in WCHADS from a progressively stronger association between age-3.5 CU traits and age-5 aggression, with increasing aggression at age 3.5 years (Table 3) (Figure 1). The results were very similar when using the 12-item ICU total (see Supplementary Appendix Table A4).

The regions of significance analysis indicated that the association between age-3.5 CU traits and age-5.0 aggression became significant at .37 *SD*s below the mean on age-3.5 aggression (equating to a score of 9 and above on age-3.5 aggression, *N* = 149/235 children). As in WCHADS, in analyses of the associations between age-3.5 and age-5.0 aggression at different levels of CU traits, shown in Supplementary Appendix 1 and Table A3, there were progressively stronger associations with increasing CU traits which were significant at all levels.

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Table 3. Simple intercepts and slopes for the association between age-3.5 callous–unemotional (CU) traits and age-5.0 aggression at three levels of age-3.5 aggression (at mean and 1 *SD* above and below mean) in the two samples

		UK – WCHADS mother report			UK – WCHADS partner report			Columbia – La Sabana Study		
Age 3.5 aggression		Est.	(*SE*)	*P*	Est.	(*SE*)	*p*	Est	(*SE*)	*p*
1 *SD* below mean	Intercept	1.08	(.36)	.002	1.35	(.38)	<.001	2.00	(.35)	.267
	Slope	.20	(.16)	.207	−.04	(.25)	.874	.08	(.08)	.207
At mean	Intercept	1.86	(.21)	<.001	1.87	(.38)	<.001	2.37	(.35)	.006
	Slope	.42	(.12)	<.001	.41	(.19)	<.001	.14	(.04)	.002
1 *SD* above mean	Intercept	2.63	(.36)	<.001	2.38	(.38)	<.001	2.74	(.35)	<.001
	Slope	.65	(.14)	<.002	.86	(.22)	<.001	.21	(.06)	.001

WCHADS: Wirral Child Health and Development Study

Comparison of main and interactive effects in the Wirral and La Sabana studies

Data analyses

The data from the two cohorts with maternal report of age-5 aggression were then standardized and pooled to test whether the main and interactive effects of CU traits differed between the United Kingdom and Colombia.

Results

Table 4 presents the results from the combined dataset. There was a significant main effect of age-3.5 CU traits after accounting for age-3.5 aggression, and a significant CU Traits × Aggression interaction. Neither of these effects was moderated by country. There was a two-way aggression by country interaction reflecting a stronger continuity between age-3.5 and age-5.0 aggression in the WCHADS sample. The results were very similar when using the 12-item ICU total in the Colombian study (see Supplementary Appendix Table A5).

Discussion

In two longitudinal general population samples of preschool-aged children, we found support for the validity of two measures of CU traits, widely used in older children, at age 3.5 years. The robustness of this finding was supported by incremental prediction by CU traits at 3.5 years, accounting for concurrent aggression, of aggression at age 5.0 years across two cultures, in the United Kingdom and in Colombia, and by cross-informant prospective associations in the United Kingdom. This provided the basis for testing the hypothesis that CU traits are associated with increasing child aggression specifically among children who are already aggressive. Using the same cross-cultural and cross-informant tests of robustness, we found that the association between CU traits and later aggression was much greater in children who were already aggressive at age 3.5 years than among those with lower levels of aggression. In all cases the association between CU traits and later aggression was not significant at 1 *SD* below the mean on concurrently assessed aggression. This study represents the first cross-cultural comparison of effect sizes in testing both the validity of CU traits in relation to aggression and in exploring the synergistic relationship between CU traits and aggression predicting future aggression.

The findings add to the evidence that CU traits may act in synergy with other vulnerabilities, such as low arousal or behavioral inhibition (Waller, Shaw et al., 2017; Wright et al., 2019), sensation-seeking and grandiose traits (Colins et al., 2014), or low mentalizing ability (Taubner et al., 2013) to increase the risk for aggression in children. As we noted earlier, these direct tests of synergy are complemented by studies using latent-profile analyses to identify groups of children with common characteristics which have revealed differences between high CU traits low CP and high CU traits high CP groups indicative of further synergies. For example in a study of Cypriot children aged 7–11 years, those with both elevated CU traits and CP had poorer executive function and had experienced less positive parenting than those with elevated CU traits without CP, consistent with the idea that CU traits confer risk for aggression only in the presence of additional vulnerability (Wall et al., 2016). While studies such as these point to ways in which CU traits may contribute to CP or aggression in synergy with other factors, they do not examine for their dynamic interplay in the same way as the moderation analyses presented here, or as studies using latent transition analyses (Haltigan & Vaillancourt, 2018).

In relation to the synergy between CU traits and aggression, we can envisage mechanisms whereby CU traits either decrease the likelihood of reduction, or increase the likelihood of escalation. The aggressive child with low CU traits may be expected to be concerned about the distress they cause in other children, leading them to alter their behaviors, while the child with elevated CU traits lacks this mechanism for desisting. If other children respond with aggression as well as with distress, this may create conditions for escalation unrestrained by concern. We were not, however, able to demonstrate the counterfactual, that CU traits do not predict later aggression in low aggression children. While the effects were much smaller and nonsignificant in low-aggression children across all three models, absence of effect could not be demonstrated given the sample sizes. It remains to be established therefore, whether early CU traits, or their precursors, play a role in the emergence of aggressive behaviors in young children. Another possibility, which we did not examine, is that CU traits in the absence of aggression predict other adverse outcomes. Rowe et al. (2010) reported that children with high CU traits but without *Diagnostic and Statistical Manual of Mental Disorders* (DSM) conduct disorder had higher rates of peer difficulties and emotional problems than those with neither CU traits nor conduct disorder. It may also be the case that CU traits in the absence of overt aggressive behavior may be predictive of later more covert forms of antisocial behavior, such as relational aggression.

This study builds on our previous findings where we supported the factor structure of the ICU in this Colombian sample found in HIC samples (Obando et al., 2021) by providing evidence for the

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Table 4. Summary of multiple linear regression model predicting age-5 maternal report aggression from in the combined Wirral Child Health and Development Study (WCHADS) and La Sabana dataset

	ΔR^2	*p*	Variable	β	95% CI	*p*
Block 1	.448	<.001	Country	.02	(−.07, .17)	.393
			Aggression age 3	.62	(.57, .67)	<.001
Block 2	.013	<.001	CU traits age 3	.13	(.07, .18)	<.001
Block 3	.015	<.001	Aggression × CU traits 3.5	.07	(.02, .11)	.004
			Aggression × Country	.20	(.10, .36)	.001
			CU traits × Country	−.04	(−.17, .08)	.448
Block 4	.000	.693	Aggression × CU traits × Country	−.02	(−.12, .08)	.693

Note: the variables main effects and two-way interactions were taken from their individual blocks. Confounds not shown.

validity of the ICU in relation to aggression in a LMIC setting. The associations between CU traits and aggression, both cross-sectionally and prospectively, the incremental validity of CU traits predicting future aggression, and the interaction between CU traits and aggression, were remarkedly similar across the Colombian and UK settings. When testing for differences in the effects, only the prospective association between aggression at age 3.5 and 5.0 years was significantly different across countries, with the UK sample showing high continuity. As far as we are aware, this is the first study to provide a formal test of whether there are cross-cultural differences in the associations between CU traits and aggression.

The strengths of the study were that we examined associations prospectively in general population samples, testing for replication, and for common method variance explanations using cross-informant measurement. This was particularly important given the relative paucity of evidence in young children, and in the light of concerns regarding the validity and measurement of CU traits in 3–4-year-olds. Developmental processes in the origins of child CP in general, and of the role of CU traits in particular, have not been studied extensively outside of HICs, so the inclusion of a demographically diverse cohort from Colombia was a distinctive strength. A limitation of the replication is that, although it was somewhat higher than the interaction in the UK sample, the age-3.5 CU Traits × Aggression interaction in the smaller La Sabana study was nonsignificant. Both studies aimed to recruit samples that were representative of general populations; however, in the UK study attrition over the period from pregnancy to age 5 was selective, with more deprived families and younger mothers more likely to be lost from the study. Also, in the Colombian study, despite a similar proportion of families belonging to the lowest government family income classifications as reported from previous studies in Colombia (Buitrago-Lopez et al., 2015), around half of the sample had university degrees, contrasted with 22% in the general population (Organisation for Economic Co-operation and Development – OECD, 2018).

The modest internal consistency of APSD in the UK sample was a concern, raising the possibility that it may not have provided a good index of CU traits. This was mitigated to some degree by replication of validity and hypothesis-testing findings in the Colombian sample where the ICU showed good internal consistency in 3.5-year-olds. The APSD has been repeatedly found to have a low Cronbach's alpha, especially in studies with younger children (e.g., Dadds et al., 2005; Kimonis et al., 2006) and likely influenced by the small number of items on the scale (Tavakol & Dennick, 2011). The APSD was the only measure of CU traits available at the time of the age 3.5 data collection wave in WCHADS as the ICU had not been adapted or validated for use with preschool children. We included parental mood at the time of reporting the outcome to attempt to address the risk of biasing by mood; unfortunately different measures were used in the two samples and for the mother and partner reporters. Finally, while we took steps to check the possible role of same-informant effects, the robustness of the findings would have been further enhanced through the use of observational measures, such as of child empathy, and additional informants for child behaviors.

The findings have implications for the study of the link between CU traits and child aggression. On the one hand they could point to as yet unidentified heterogeneity whereby CU traits associated with later aggression are underpinned by different processes from CU traits with little or no implications for later aggression. This may be an alternative explanation for the moderator effect we report. The presence of aggressive behaviors at baseline in our studies may be a marker for such heterogeneity, whereby for example the CU traits of those who are already aggressive may be a manifestation of an unmeasured additional vulnerability, such as low arousal, which accounts for the stronger association with later aggression. Studying the dynamic interplay between CU traits and aggression over time could help clarify this further. On the other hand, if there is synergy of the kind we have hypothesized, specific mechanisms could be examined; for example, experimental approaches that examine the moment-by-moment responses of high-aggression/high-CU-traits children to others' distress resulting from peer aggression. Furthermore the role of different kinds of interpersonal sensitivity needs to be understood. The finding in adolescents, of synergy between CU traits and low mentalization, suggests each may have distinct functions (Taubner et al., 2013), with further questions to be addressed regarding ways they may modify aggression. Regarding early intervention, the findings strongly suggest targeting high-aggression/high-CU-traits children, and also that interventions either to reduce CU traits or to reduce aggression in these children may be effective. Equally, interventions may need to address specifically whether aggressive children with high CU traits can be provided with alternative strategies for understanding the emotional impact of their behaviors.

Supplementary Material. The supplementary material for this article can be found at https://doi.org/10.1017/S0954579420002114

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Conflicts of Interest. None.

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