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The Bidirectional Effects of Antisocial Behavior, Anxiety, and Trauma Exposure: Implications for our Understanding of the Development of Callous–Unemotional Traits

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The association of anxiety and trauma with antisocial behavior in children and adolescents has long been the focus of research, and more recently this area of research has become critical to theories of the development of callous–unemotional (CU) traits. Research suggests those with elevated CU traits and anxiety (i.e., secondary CU variant) seem to show more severe externalizing behaviors and are more likely to show histories of trauma, compared to those with elevated CU and low anxiety (i.e., primary CU variant). These findings have typically been interpreted as being indicative of distinct etiological pathways to the development of CU traits. We test an alternative explanation that the higher rates of anxiety and trauma exposure in some youth with elevated CU traits are largely a consequence of their higher levels of antisocial behavior. The current study recruited a sample of 1,216 justice-involved adolescents ($M_{age} = 15.28$, SD = 1.28) from three distinct regions of the United States, who were assessed at 6, 12, 18, 24, 30, 36, 48, and 60 months following their first arrest. Using randomintercept cross-lagged models, both antisocial behavior and CU traits predicted changes in future anxiety and CU traits and aggressive behavior largely accounted for the predictive association between CU traits and anxiety and anxiety and CU traits and victimization. These results support a model in which anxiety and trauma histories may be a marker of the severity of antisocial behavior displayed by youth with elevated CU traits.

General Scientific Summary

Findings suggest that antisocial behavior predicts increases in anxiety and victimization over time, potentially as a result of the many social impairments and retaliation caused by such behavior. Further, our results suggest that callous–unemotional traits lead to increases in anxiety and victimization over time, largely as a consequence of antisocial behavior.

Keywords: callous–unemotional (CU) traits, primary and secondary variants, antisocial behavior, aggressive behavior, anxiety

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Data are available upon request and analytic codes are provided in the online supplemental materials.

Emily L. Robertson conducted the analyses along with other co-authors, wrote the original draft, and contributed equally to conceptualization, data curation, writing-review and editing. James V. Ray consulted on the analyses and made important contributions to the manuscript. Paul J. Frick secured grant funding for the study, designed the study, consulted on the analyses,

and contributed substantially to drafting and revising the manusript. Erin P. Vaughan coordinated data collection, collected data, and performed statistical analyses and contributed meaningfully to the manuscript. Laura C. Thornton coordinated data collection, collected data, and contributed meaningfully to manuscript. Tina D. Wall Myers coordinated data collection, collected data, and contributed meaningfully to manuscript. Laurence Steinberg secured grant funding for the project, designed the larger study, and contributed meaningfully to the writing of manuscript. Elizabeth Cauffman secured grant funding for the project, designed the larger study, and contributed meaningfully to the writing of manuscript.

Correspondence concerning this article should be addressed to Emily L. Robertson, Center for Children and Families, Florida International University, 11200 SW 8th Street, AHC1 140 Miami, FL 33199, United States. Email: emrobert@fiu.edu Anxiety disorders frequently co-occur with serious antisocial behavior in children and adolescents (i.e., behaviors that violate the rights of others or that violate important cultural norms; Cunningham & Ollendick, 2010). Even when assessed dimensionally, anxiety and antisocial behavior are positively correlated with estimates ranging from r = .23-.55 (Marsee et al., 2008). This association between antisocial behavior and anxiety has added importance because the presence of anxiety seems to be a marker of more severe behavior problems in children and adolescents with antisocial disorders, such as Conduct Disorder (Garai et al., 2009; Lansford et al., 2008).

Antisocial behavior has also been associated with trauma exposure (Copeland et al., 2018; Goodearl et al., 2014; Kubik et al., 2019). Theories to explain this association have focused on the disruption in emotion regulation and the processing of social information caused by the exposure to trauma (Busso et al., 2017; Gold et al., 2016; McLaughlin & Lambert, 2017). Faulty interpretations of social cues in the environment, coupled with significant difficulty modulating emotional responses, are theorized to put children at risk for angry, defensive, and aggressive behavior (McLaughlin & Lambert, 2017). In short, trauma exposure is theorized to lead to future antisocial behavior.

However, these causal theories on how trauma could lead to future antisocial behavior have not adequately considered the possibility of bidirectional effects. That is, antisocial children behave in defiant and aggressive ways toward others, and this disruptive behavior may elicit negative reactions, including aggression and violence from others or may lead themselves into dangerous situations (e.g., affiliating with delinquent peers), all of which may increase their level of victimization from others (Ford, 2002; Ford et al., 2000; McLaughlin et al., 2013). Thus, the trauma exposure could be a result of the antisocial behavior. Further, antisocial behavior is associated with a host of negative consequences (e.g., school suspensions; peer rejection, family conflict), all of which can also result in emotional distress, such as anxiety, in a child (Burke et al., 2005; Frick et al., 1999; van Lier et al., 2012). In support of this possibility, Fanti et al. (2019) studied over 2,000 children and reported that conduct problems at ages 5-7 years predicted anxiety at ages 8-10 years but anxiety did not predict future conduct problems. Taken together, there is evidence to suggest that antisocial behavior can lead to later traumatic victimization and anxiety among children and adolescents.

Developmental Pathways to Callous–Unemotional Traits

The possibility that antisocial behavior may increase the risk of trauma exposure and anxiety is important for theories of the development of callous–unemotional (CU) traits. CU traits are defined by a limited capacity for guilt, reduced empathic concern for others, reduced displays of appropriate emotion, and a lack of concern over performance in important activities (Frick et al., 2014). Such traits have been theorized to be an important causal factor for the development of antisocial behavior and, especially aggressive behavior (Frick et al., 2014). CU traits can also lead to poorer posttreatment outcomes in children with behavior problems (Wilkinson et al., 2016). As result, CU traits have been included in the most recent revisions of psychiatric classification systems for Conduct Disorder (DSM-5; American Psychiatric Association, 2013) and Oppositional Defiant and Conduct-dissocial Disorders (ICD-11; World Health Organization, 2019) under the specifier "with Limited Prosocial Emotions."

Research has shown that, while CU traits are less consistently related to anxiety than antisocial behavior (Frick et al., 1999), some youth with elevated CU traits do show elevated anxiety (Cecil et al., 2018; Craig et al., 2021; Ezpeleta et al., 2017; Fanti & Kimonis, 2017; Kahn et al., 2013; Kimonis et al., 2011, 2012, 2013; Meehan et al., 2017; Sethi et al., 2018; Tatar et al., 2012; Vaughn et al., 2009). Youths with elevated CU traits, but without high levels of anxiety, are often referred to as the "primary" CU variant (Craig et al., 2021) and are characterized by emotional hyporeactivity to certain stimuli, such as deficits in their ability to orient quickly to emotional stimuli (i.e., images of distress in others; Kimonis et al., 2012). In contrast, youth with elevated CU traits and elevated anxiety are often referred to as the "secondary" CU variant (Craig et al., 2021) and have been shown to have elevated rates of traumatic victimization (Docherty et al., 2016, 2018; Kahn et al., 2013; Kimonis et al., 2013) and greater levels of psychopathology (Bennett & Kerig, 2014: Craig & Moretti, 2019: Gill & Stickle, 2016: Salihovic et al., 2014; Sharf et al., 2014). One of the most consistent findings from research on CU variants is that the secondary CU variant (i.e., those with elevated levels of anxiety) shows greater levels of antisocial behavior, including aggression, compared to the primary variant (Docherty et al., 2016; Fanti et al., 2013; Kahn et al., 2013; Kimonis et al., 2011, 2013; Salihovic et al., 2014; Vaughn et al., 2009). As a result of this research, it has been hypothesized that CU traits in the secondary variant are *caused by* traumatic victimization, which can lead to the child becoming hypervigilant to some emotional cues (e.g., threat and anger) at the expense of others (e.g., distress in others; Bennett & Kerig, 2014; Kerig & Becker, 2010; Kerig et al., 2012; Kimonis et al., 2012; Mozley et al., 2018). In contrast, the primary variant has been hypothesized as being the result of temperamental deficits in a child's emotional reactivity to the distress of others, which can negatively influence the development of empathy, guilt, and other prosocial emotions (Kimonis et al., 2011, 2012).

An Alternative Model to CU Variants

While there is some support for a model of different variants of CU traits resulting from unique causal processes using cross-sectional data (Craig et al., 2021), the findings that antisocial behavior can lead to both anxiety and traumatic victimization leads to the possibility of an alternative explanation, which requires longitudinal data to assess the direction of effects. That is, the serious and persistent antisocial behavior in some children with elevated CU traits could increase their risk for being victimized by others. Further, the persistent antisocial behavior could lead to increases in various psychosocial impairments (e.g., discipline, confrontations, conflict with others), which can also lead to anxiety. Thus, it is possible that the high rate of trauma exposure and anxiety in some youths with elevated CU traits may be the result of their severe antisocial behavior (i.e., a marker of severity) and not indicative of a unique causal pathway to the development of CU traits. However, longitudinal tests of these theoretical predictions have not been conducted to date.

Current Study

Thus, the goal of the current study was to test these predictions for why some youths with elevated CU traits show high rates of anxiety and traumatic victimization. Using a longitudinal design in an ethnically and racially-diverse sample of adolescents, recruited to have relatively high rates of CU traits and antisocial behavior (i.e., adolescents who have been arrested at least once for an offense of moderate severity), we tested the following hypotheses. First, we tested the prediction that antisocial behavior would predict increases in future victimization and anxiety across repeated assessments over a 60-month follow-up period but that anxiety and victimization would not predict future antisocial behavior. We recognize that antisocial behavior is a broad construct that includes aggression as well as other behaviors that violate the rights of others (e.g., stealing, vandalism) and that there are some potentially important differences in the causal processes leading to aggressive and nonaggressive antisocial behavior (Burt, 2012). For the purposes of the model tested in our study, both aggressive and nonaggressive antisocial behavior are correlated with CU traits and both can result in subsequent trauma and anxiety. However, we wanted to include separate measures of both, given that the broad category of antisocial behavior may lead to greater psychosocial impairments and subsequent anxiety, whereas aggression may be more likely to specifically evoke aggression from others, increasing trauma exposure. Second, we tested the hypotheses that CU traits would predict increases in future victimization and anxiety across repeated assessments over a 60-month follow-up period but that anxiety and victimization would not predict future CU traits. For both of these hypotheses, our repeated measurement allows us to parse out the overall between individual associations among the various variables of interest (i.e., trait level associations) in order to better test predictive associations within individuals over time (Hamaker et al., 2015). That is, typical longitudinal tests do not separate variance due to associations between individuals, or trait level associations across individuals (e.g., people higher on CU traits are more likely to be victimized by others across development), from changes within the individual (e.g., changes in an individual's level of CU traits at an earlier time point predict changes in victimization at a later time point; Berry & Willoughby, 2017). Third, we predicted that CU traits prediction of future anxiety and victimization would be mediated by the adolescents' level of antisocial behavior and aggression. Importantly, we used strong longitudinal methods to test mediation, with CU traits assessed at an earlier time point than the proposed mediators (i.e., antisocial behavior and aggression) and the mediators assessed at a time point earlier than the outcomes [i.e., anxiety and victimization (Preacher & Kelley, 2011)].

Method

Participants

The sample was 1,215 male first-time juvenile offenders ($M_{age} = 15.29$, SD = 1.29) from three distinct regions of the United States. Participants were eligible if they were English speakers, were arrested for an eligible offense of low to moderate severity, and were between the ages of 13 and 17 at the time of their first arrest. We used first time offenders with offenses of low to moderate severity to ensure significant variability in levels of antisocial behavior and CU traits. Participants were primarily Hispanic (45.9%) and African American (36.9%) with a smaller proportion identifying as Caucasian (14.8%) and Other (2.5%). A more detailed description of the sample is published elsewhere (Ray et al., 2016).

Procedures

Parental informed consent and youth assent were obtained for all participants at the time of each assessment period, until the participant turned 18 at which point, he provided informed consent. Participants and their parents were informed that participation was entirely voluntary, would not influence the youth's treatment by the juvenile justice system, and that they were able to withdraw from the study at any time without penalty. The youth and parents were also informed that the research project had obtained a Privacy Certificate from the Department of Justice, which protected their data from being subpoenaed and used in legal proceedings.

Participants completed the baseline assessment and were re-assessed every 6 months for 36 months and then again at 48 and 60 months (9 time points across 5 years). Interviews lasted on average approximately 2–3 hr and were administered using a secure computerbased program on a laptop in their preferred location (e.g., home, public library). If participants were incarcerated, interviews were conducted in their secure facility, or if participants moved outside the study area, phone interviews were completed. Participants were paid \$50 for the baseline interview and the payment increased by \$15 for each subsequent interview up to \$140 at the 30-, 36-, 48-, and 60-month follow-ups. Retention rates were 95.7% at 6 months, 93.8% at 12 months, 93.6% at 18 months, 92.9% at 24 months, 92.1% at 30 months, 90.6% at 36 months, 86.6% at 48 months, and 84.4% at 60 months.

Measures

Antisocial Behavior was measured at all time points using the Self-Report of Offending (SRO; Huizinga et al., 1991), a 22-item scale that assesses drug, property, and violent crimes. Scores on this scale have been shown to correlate with official records of offending across diverse samples (Farrington et al., 1996; Thornberry & Krohn, 2000). Each item asked participants (yes = 1 or no = 0) if, in the last 6 months, they engaged in each crime, and if yes, how many times. At baseline, each item asked participants if they had ever in their life engaged in each crime. The SRO variety score was used to determine the number of different antisocial behaviors (i.e., offense types) endorsed over each assessment period. The stability of the scores on the SRO baseline to 60 months was significant (r = .27; p < .001).

Physical aggression was measured at all time points using the Peer Conflict Scale (PCS; Marsee et al., 2011), a 40-item scale designed to provide extensive coverage of aggression expressed physically and relationally. Only the 20 physical aggression items are used in the current study, with 10 items assessing reactive physical aggression. Items are rated on a four-point Likert scale (i.e., 0 "Not at all true" to 3 "Definitely true") and scores on the PCS have been associated with self-reported delinquency in adolescents (Marsee et al., 2014), as well as laboratory measures of aggressive responding in detained adolescents (Munoz et al., 2008). Cronbach's alpha ranged from 0.88 to 0.93 across time points.

CU traits were assessed at all time points using the self-report version of the Inventory of Callous–Unemotional traits (ICU; Kimonis et al., 2008). The ICU is a 24-item instrument that utilizes a fourpoint Likert scale (i.e., 0 "Not at all true" to 3 "Definitely true") to indicate how accurately each statement describes them. Total ICU scores have been positively associated with antisocial behavior and negatively associated with empathy and prosocial behavior across a range of adolescent samples (Cardinale & Marsh, 2020). While the ICU items have been found to factor into three

subdomains, the items consistently load on an overarching factor that is captured well by unit weighing of items, the subscales are largely the result of method variance (i.e., positive vs. negatively worded items), they show variance that is largely due to the overarching factor, and they do not show consistent and theoretically meaningfully differential associations with important external criteria (Ray et al., 2016; Ray & Frick, 2020). Thus, only the total ICU score was used in analyses. Cronbach's alpha ranged from 0.76 to 0.80 across time points.

Anxiety was measured at all time points using the six items from the generalized anxiety disorder subscale of the Revised Children Anxiety and Depression Scale (Chorpita et al., 2000). The items are rated on a 4-point Likert scale (i.e., 0 "Never" to 3 "Always"), and total scores are created by summing all items within each time point. This subscale has shown convergent validity with other measures of trait anxiety in both community and clinical samples of adolescents (Chorpita et al., 2000, 2005). Cronbach's alpha ranged from 0.80 to 0.92 across time points.

Victimization was measured at all time points using the Exposure to Violence scale, a 13-item, self-report measure which asks whether participants were victimized by different types of violence or witnessed someone else victimized since the last interview. Scores on this scale have been associated with increased self-report offending in other adolescent samples (Selner-O'Hagan et al., 1998). Only the five items assessing the number of times that the participants had been a victim of violence since the previous interview was used in analyses. The stability of victimization from baseline to 60 months was significant (r = .17; p < .001).

Baseline Covariates

Participants self-reported their *age* and *race/ethnicity*. Race/ethnicity was dichotomized such that endorsement of the ethnicity/race was coded as a 1 and no endorsement was coded as 0 (i.e., 1—African American, 0—Not African American, 1—Hispanic, 0—Not Hispanic). *Intelligence* was measured at baseline (M = 88.43, SD = 11.59) using the matrix reasoning and vocabulary subtests of the Wechsler Abbreviated Scale of Intelligence (Wechsler, 1999).

Analytic Plan

Missing data ranged from 0.1% (n = 1) to 15.6% (n = 190) on individual measures, resulting in 6.4% of all values missing. Missing data were imputed using expectation-maximization within SPSS 26 using all variables in the analyses. To test hypotheses one and two, a series of random-intercept cross-lagged panel models (RI-CLPM; Hamaker et al., 2015) were constructed in MPlus 8 to examine the longitudinal associations among our main study variables using only yearly assessments (baseline, 12, 24, 36, 48, and 60 months). Like traditional cross-lagged panel models, RI-CLPM tests the relationship between variables across time, such that changes in variables across occasions are accounted for by regressing each repeatedly assessed variable on its immediate prior value. Additionally, the models simultaneously use crosslagged, across-time, paths such that variable X at time 1 predicts variable Y at time 2, while controlling for variable Y at time 1. Further, within time-correlated errors between the variables are also modeled. The RI-CLPM improves upon these traditional cross-lagged panel models by also estimating trait-like between individual differences using random intercepts. When between individual differences are removed, cross-lagged paths, autoregressive paths, and within-time correlations are estimated using within-individual latent variables.

To assess the first hypothesis that antisocial behavior and aggression would predict increases in future anxiety and victimization, four RI-CLPMs were estimated (i.e., antisocial behavior and anxiety, antisocial behavior and victimization, aggression and anxiety, aggression and victimization). To assess the second hypothesis that CU traits would predict increases in future anxiety and victimization, two additional RI-CLPMs were estimated (i.e., CU traits and anxiety, CU traits and victimization). For each of these RI-CLPMs, four models were compared. Model 1 constrained autoregressive and cross-lagged paths to be equal across time. Model 2 constrained autoregressive paths to be equal across time, but cross-lagged paths were estimated freely for each wave. Model 3 allowed the autoregressive paths to freely vary, and the cross-lagged paths were constrained to be equal. Finally, a fourth model was run which allowed both autoregressive and cross-lagged paths to freely vary. Significant improvements in model fit were tested using chi-square difference tests, root-mean-square error of approximation (RMSEA), standardized root-mean-square residual (SRMR), comparative fit index (CFI), the Tucker-Lewis index (TLI), Akaike information criterion (AIC), and Bayesian information criterion (BIC; Hu & Bentler, 1999). Significant chi-square difference tests indicate that reducing constraints across time resulted in significant improvement in model fit but these tests are highly susceptible to sample size. Using Chen's (2007) recommendations for significant differences in model fit indices, reductions of >0.015 for RMSEA, increases of >0.01 for CFI, and reductions of >0.03 for SRMR indicate significant improvement in model fit. Reductions in AIC and BIC also indicate improvement in model fit. Covariates were not included in the RI-CLPMs due to the between individual parameters controlling for all time-invariant influences.

Finally, to test the third hypothesis that the relationship between CU traits and future anxiety and victimization would be accounted for (i.e., mediated) by the adolescents' level of antisocial behavior and aggression, a series of longitudinal parallel mediation models were estimated using SPSS PROCESS. All models included CU traits as the predictor variable, both aggression and antisocial behavior as parallel mediators, and either anxiety or victimization as the outcome variable. We used the same panels as the cross-lagged analyses, but for these analyses, we used data from the intermediate points to assess the mediators (e.g., baseline CU traits predicting anxiety at year 1 being mediated by aggression and antisocial behavior at 6 months). Given that follow-up assessments went to a yearly basis after year 3, we tested whether year 3 CU traits' relationship with year 5 anxiety/victimization was mediated by year 4 aggression and antisocial behavior. Indirect effects were only calculated for models in which there was a significant total effect. Standard errors and bias-corrected bootstrapped confidence intervals for indirect effects were based on 5,000 bootstrap resamples. In order to calculate the proportion of variance that is explained by both mediators (i.e., aggression, antisocial behavior), we divided the direct and indirect effects by the total effect. This method has been shown to produce relatively nonbiased estimates of effect sizes in large samples (e.g., over n = 500; Miočevic et al., 2018). To minimize the Type 1 error rate, Bonferroni correction was used to adjust for family-wise error leading to a significance level of p < .013 across all models. All mediational models controlled for age, race/ethnicity, and IQ.

Results of these tests of mediation were followed by the use of RI-CLPM to estimate whether the any mediation effects were largely due to between- or within-individual level effects. Thus, RI-CLPMs with all four variables (i.e., CU traits, aggression, antisocial behavior, and either anxiety or victimization) were constructed. Only the hypothesized direction of cross-lagged effects between within-individual variables was included, such that CU traits predicted the two mediators (i.e., aggression and antisocial behavior), which then predicted anxiety or victimization. In order to keep consistent 6-month intervals, only baseline through year 3 time points were included in these analyses. Using the MODEL INDIRECT command, indirect effects from CU traits to anxiety/ victimization through aggression and antisocial behavior were estimated using between-individual random-intercept variables and within-individual variables. Data are available upon request and analytic codes are provided in the online supplemental materials.

Table 1

Random-Intercept Cross-Lagged Panel Model Fit Statistics

Results

Descriptive statistics and zero-order correlations for all study variables are reported in Table S1 in the online supplemental materials.

Does Antisocial Behavior and Aggression Predict Future Anxiety and Victimization?

Table 1 provides the model fit information for the six RI-CLPMs. As shown in Table 1, results from the analyses testing the relationship between antisocial behavior and anxiety suggest that constraining cross-lagged paths to be equal while allowing autoregressive paths to freely vary was the best fitting model. The results of this best fitting model are summarized in Figure 1. This figure provides standardized parameter estimates; although the unstandardized parameters for cross-lagged paths were constrained to be equal across time, standardized parameters are not equivalent due to unequal standard errors. First, there was a significant between-person correlation between antisocial behavior and anxiety (b = 1.02, SE = 0.12; $\beta = 0.38$, p < .001). Second, when the cross-lagged paths were constrained to

Model	RMSEA	SRMR	CFI	TLI	AIC	BIC	$\Delta \chi^2 (\Delta df) \text{ (Model 1)}$	$\Delta \chi^2 (\Delta df) (Model 2)$	$\Delta \chi^2 (\Delta df)$ (Model 3)
					Antiso	cial behavior	and anxiety		
Model 1	0.034	0.037	.985	.982	65,916.9	66,105.7			
Model 2	0.036	0.036	.986	.979	65,922.8	66,152.4	10.09 (8)		
Model 3	0.032	0.034	.989	.984	65,906.0	66,135.6	26.83 (8)*		
Model 4	0.034	0.032	.989	.981	65,911.7	66,182.1	37.19 (16)*	27.10 (8)*	10.36 (8)
					Antisocia	l behavior and	1 victimization		
Model 1	0.040	0.039	.979	.974	40,728.8	40,917.6			
Model 2	0.039	0.036	.983	.975	40,714.9	40,944.5	29.87 (8)*		
Model 3	0.039	0.041	.983	.975	40,717.8	40,947.4	27.01 (8)*		
Model 4	0.039	0.035	.986	.975	40,709.4	40,979.9	51.37 (16)*	21.50 (8)*	24.37 (8)*
					Ag	gression and	anxiety		
Model 1	0.047	0.047	.977	.971	80,931.7	81,120.4			
Model 2	0.049	0.047	.978	.968	80,930.6	81,160.2	17.02 (8)*		
Model 3	0.043	0.039	.984	.976	80,899.0	81,128.6	48.69 (8)*		
Model 4	0.043	0.037	.986	.976	80,889.8	81,160.2	73.86 (16)*	56.83 (8)*	25.17 (8)*
					Aggr	ession and vic	timization		
Model 1	0.045	0.042	.971	.964	57,218.9	57,407.7			
Model 2	0.048	0.043	.972	.959	57,222.9	57,452.5	11.98 (8)		
Model 3	0.040	0.031	.981	.972	57,184.5	57,414.1	50.38 (8)*		
Model 4	0.044	0.032	.981	.966	57,191.8	57,462.2	59.09 (16)*	47.11 (8)*	8.71 (8)
					C	U traits and a	nxiety		
Model 1	0.034	0.047	.988	.985	85,444.0	85,632.8			
Model 2	0.037	0.045	.988	.982	85,451.5	85,681.1	8.50 (8)		
Model 3	0.035	0.040	.989	.984	85,442.4	85,672.0	17.58 (8)*		
Model 4	0.038	0.038	.989	.981	85,449.0	85,719.4	27.03 (16)*	18.53 (8)*	9.45 (8)
					CU	traits and vict	imization		
Model 1	0.033	0.044	.984	.981	61,766.7	61,955.5			
Model 2	0.036	0.044	.984	.976	61,778.2	62,007.9	4.44 (8)		
Model 3	0.034	0.040	.985	.979	61,770.7	62,000.3	11.99 (8)		
Model 4	0.039	0.039	.984	.972	61,782.8	62,053.3	15.86 (16)		

Note. RMSEA = root-mean-square error of approximation; acceptable values < 0.08. CFI = comparative fit index; acceptable values > 0.90. TLI = Tucker–Lewis Index; acceptable values > 0.90. SRMR = standardized root-mean-square residual; acceptable values < 0.10. AIC = Akaike information criterion. BIC = Bayesian information criterion. Model 1 = autoregressive and cross-lagged paths constrained across time. Model 2 = autoregressive paths constrained across time, cross-lagged paths estimated freely. Model 3 = autoregressive paths estimated freely, cross-lagged paths constrained across time. Model 4 = all paths estimated freely. The best-fitting model that was retained for interpretation is depicted in bold. *p < .05. be equal across time, the latent within-subjects path from antisocial behavior to anxiety was significant (b = 0.10, SE = 0.02; $\beta = 0.04$ -0.11, p < .001) but the path from anxiety to antisocial behavior was not $(b = -0.01, SE = 0.01; \beta = -0.02 - .03, p = n.s.)$.

As shown in Table 1, the analyses testing the relationship between antisocial behavior and victimization found that allowing all paths to vary freely was the best fitting model. These results are displayed in Figure 2. As illustrated by this model, there was a strong betweensubject association between antisocial behavior and victimization $(b = 0.24, SE = 0.02; \beta = 0.76, p < .001)$. However, once this between-subject association was controlled for, only one of the within-subject cross-lagged paths was significant, which was between antisocial behavior at year 1 predicting victimization at year 2 (b = 0.04, SE = 0.01; $\beta = 0.13$, p < .001).

In the next set of analyses testing the longitudinal relationship between aggression and anxiety, the best fitting model was one that allowed all paths to freely vary (see Table 1). As illustrated in Figure 3, there were again a strong between-subjects association between aggression and anxiety (b = 3.68, SE = 0.39; $\beta = 0.38$, p < .001). When this association was controlled for, only three cross-lagged paths remained significant: the path from baseline aggression to year 1 anxiety (b = 0.06, SE = 0.02; $\beta = 0.13$, p < .001), the path from baseline anxiety to year 1 aggression $(b = -0.14, SE = 0.05; \beta = -0.08, p = 0.012)$, and the path from year 2 anxiety to year 3 aggression (b = 0.17, SE = 0.06; $\beta =$ 0.10, p = .005).

Finally, in the analyses testing the predictive relationships between aggression and victimization, allowing autoregressive paths to freely vary while constraining cross-lagged paths was the best fitting model (see Table 1). Again, a significant betweensubjects association was found (b = 0.48, SE = 0.05; $\beta = 0.41$, p < .001), but once this was controlled for, neither set of crosslagged paths were significant (aggression to victimization: b =0.00, SE = 0.00; $\beta = 0.02 - 0.03$, p = n.s.; victimization to aggression: b = 0.10, SE = 0.09; $\beta = 0.01-0.02$, p = n.s.; see Figure 4).

Do CU Traits Predict Future Anxiety and Victimization?

In the analyses testing the longitudinal association between CU traits and anxiety, the model allowing autoregressive

Antisocial

Year 4

W-Anti

V4

W-Anx

Y4

Anx

Year 4

.21***

. 02

04*

.35***

0.22***

.03

.05***

Antisocial

Year 5

W-Anti

Y5

W-Anx

Y5

Anx

Year 5

.11***

Random-Intercept Cross-Lagged Panel Models of Antisocial Behavior and Anxiety



Anx

Note. Standardized coefficients are reported. Anti = Antisocial Behavior; Anx = Anxiety. These coefficients are based on the model in which all autoregressive paths were estimated freely, but the cross-lagged paths were constrained to be equal across time. However, while the unstandardized beta was constrained to be equal for the cross-lagged paths, the SE differed leading to differences in the standardized estimates. *p < .013, **p < .01, ***p < .001 (Bonferroni corrected).

Antisocial

Year 2

W-Anti

Y2

W-Anx

Y2

Anx

Year 2

.18***

.02

.07**

0.28***

0.18***

Antisocial

Year 3

W-Anti

Y3

W-<u>Anx</u>

Y3

Anx

Year 3

.09***

02

05**

20**

0.18***





Note. Standardized coefficients are reported. Anti = Antisocial Behavior; Vict = Victimization. These coefficients are based on the model in which all autoregressive and cross-lagged paths were estimated freely across time. *p < .013, **p < .01, **p < .01 (Bonferroni corrected).

paths to freely vary while constraining cross-lagged paths was the best fitting model (Table 1). The results of this best fitting model are provided in Figure 5. As with all models, there was a significant between-subjects association between CU traits and anxiety (b = 3.03, SE = 0.55; $\beta = 0.22$, p < .001). When controlling for this association, the latent within-subjects path from CU traits to anxiety was significant (b = 0.03, SE = 0.01; $\beta = 0.05-0.07$, p < .001) but the path from anxiety to CU traits was not (b = 0.04, SE = 0.03; $\beta =$ 0.02, p = n.s.).

In the analyses testing the longitudinal association between CU traits and victimization, the model constraining all paths to be equal was the best fitting model, as indicated by all model fit indices with the exception of SRMR (Table 1). Again, the estimate of between-subjects effects was significant (b = 0.27, SE = 0.08; $\beta = 0.16$, p < .001). When controlling for this association, the within-subjects paths from CU traits to victimization was significant (b = 0.01, SE = 0.001; $\beta = 0.04-0.05$, p < .001) but the path from victimization to CU traits was not (b = 0.24, SE = 0.13; $\beta = 0.02-0.04$, p = n.s.; see Figure 6).

Does Antisocial Behavior and Aggression Mediate the Relationship Between CU Traits and Anxiety and Victimization?

Given that we found support for the hypothesis that CU traits would predict later anxiety and victimization, we then proceeded to test whether these relationships were mediated by antisocial behavior and aggression. In the first model assessing the mediating effects of antisocial behavior and aggression on the CU traits and anxiety association, indirect effects were only tested when significant total effects were found, which occurred in three of the four panels tested (baseline to year 1, year 1 to year 2, year 2 to year 3) of this first model. As depicted in Table 2, the total effect of CU traits accounted for between 37% and 46% of the variance in anxiety in these three panels. As can be seen in Figure 7 and Table 2, aggression and antisocial behavior fully or partially mediated the relationship between CU traits and future anxiety in these three panels, accounting for between 54% and 100% of these total effects across time points.



Figure 3 Random-Intercept Cross-Lag Path Models of Aggression and Anxiety

Note. Standardized coefficients are reported. Agg = Aggression; Anx = Anxiety. These coefficients are based on the model in which all autoregressive and cross-lagged paths were estimated freely across time.

p < .013, p < .01, p < .01, p < .01 (Bonferroni corrected).

In the second model, assessing the mediating effects of antisocial behavior and aggression on the relationship between CU Traits and future victimization, again only indirect effects were tested when significant direct effects were found, which occurred in two of the four panels (year 1 to year 2 and year 2 to year 3). As depicted in Table 3, the total effect of CU traits accounted for 20% of the variance in victimization in these two panels. As can be seen in Figure 8 and Table 2, aggression in one panel and antisocial behavior in two panels fully mediated the relationship between CU traits and future victimization, accounting for 80% of these total effects across time points.

When probing these mediation results by separating between- and within-individual effects using RI-CPLM, between-individual total indirect effects were significant for both anxiety (b = 0.11, SE = 0.01; $\beta = 0.26$, p < .001) and victimization (b = 0.02, SE = 0.002; $\beta = 0.36$, p < .001). However, within-individual total indirect effects were not significant for any waves for either anxiety or victimization (see Table S2 in the online supplemental materials), suggesting that the reported mediation effects may largely be the result of between-individual effects.

Discussion

The current study sought to disentangle the bidirectional relationships among CU traits, antisocial behavior, anxiety, and traumatic victimization by testing predictions from a novel theory proposing that anxiety and victimization are largely the consequence of an adolescent's antisocial and aggressive behavior and that these behavior problems explain why some adolescents who are elevated on CU traits also show high rates of anxiety and traumatic victimization. This theoretical model offers an alternative to theories that propose that anxiety and victimization increase children and adolescents' risk for antisocial behavior and CU traits over time (i.e., the development of a secondary CU variant).

Using a longitudinal design with repeated assessments over 5 years and using random-intercept cross-lagged panel models, we found that statistical models in which antisocial behavior and CU traits predicted later anxiety and victimization (Figures 1, 2, 5, and 6) fit the data better than models in which anxiety and victimization predicted antisocial behavior or CU traits. These findings are consistent with previous work suggesting that adolescents who show

Figure 4 Random-Intercept Cross-Lag Path Models of Aggression and Victimization



Note. Standardized coefficients are reported. Agg = Aggression; Vict = Victimization. These coefficients are based on the model in which all autoregressive paths were estimated freely, but the cross-lagged paths were constrained to be equal across time. However, while the unstandardized beta were constrained to be equal for the cross-lagged paths, the SE differed leading to differences in the standardized estimates. *p < .013, **p < .01, ***p < .001 (Bonferroni corrected).

antisocial behavior elicit negative consequences, such as peer or parental rejection, poor academic performance, or legal trouble that may increase their level of distress (Frick et al., 1999; van Lier et al., 2012). Further, these results are also consistent with research suggesting that antisocial adolescents may put themselves into situations that may increase their rate of being victimized (e.g., by victimizing others; Ford, 2002; Ford et al., 2000; McLaughlin et al., 2013). However, we expanded on this past work by showing that this predictive association is found for CU traits as well. That is, we also found that a model in which CU traits predicted increases in future anxiety and victimization fit the data better than one with bidirectional effects.

While these findings provide support for our theoretical model, we also tested the key prediction for *why* CU traits may result in future anxiety and victimization. Specifically, we tested whether antisocial behavior and aggression could explain (i.e., mediate) these effects. Using longitudinal parallel mediation analyses, we found that the indirect effects through antisocial behavior and aggression accounted for a significant portion (i.e., 54%–100%) of

the total effects of CU traits on anxiety and a significant portion (i.e., 80%) of the total effects of CU traits on victimization. These results suggest that adolescents with high levels of CU traits show increases in anxiety and victimization over time as a *consequence* of their aggressive and antisocial behavior. This finding is critical for interpreting a large amount of past research that has found that those high on CU traits, high anxiety, and high trauma histories show more severe behavior problems in cross-sectional studies (Craig et al., 2021; Docherty et al., 2016; Fanti et al., 2013; Kahn et al., 2013; Kimonis et al., 2011, 2013; Salihovic et al., 2014; Vaughn et al., 2009). That is, rather than being indicative of a distinct variant of CU traits with unique causal processes, the presence of anxiety and victimization may be a marker of the severity of antiso-cial behavior.

Our results are also consistent with the frequent finding of suppressor effects when studying the associations among CU traits, anxiety, and externalizing behavior. That is, CU traits are often either uncorrelated or positively correlated with anxiety until antisocial behavior is controlled for, at which point the correlation becomes



Figure 5

Random-Intercept Cross-Lag Path Models of CU Traits and Anxiety

Note. Standardized coefficients are reported. CU = Callous-Unemotional; Anx = Anxiety. These coefficients are based on the model in which all autoregressive paths were estimated freely, but the cross-lagged paths were constrained to be equal across time. However, while the unstandardized beta were constrained to be equal for the cross-lagged paths, the SE differed leading to differences in the standardized estimates.*<math>p < .013, **p < .01, ***p < .001 (Bonferroni corrected).

negative (see Frick, 2012 for a review). Further, while the association between anxiety and externalizing behavior is consistently positive (Marsee et al., 2008), this association becomes stronger when controlling for conduct problems (see Frick, 2012 for a review). Our theoretical model and results using a longitudinal design provide an explanation for these findings. That is, our results suggest that antisocial behavior can lead to increased anxiety. Given that the majority of youths with elevated CU traits show significant antisocial behavior, CU traits can be positively associated with anxiety. However, the suppressor effects suggest that given the same level of antisocial behavior, those high on CU traits may be less distressed or anxious compared to those low on CU traits, which leads to CU traits being negatively associated with anxiety when antisocial behavior is covaried (Frick et al., 1999). Further, this also means that the association between antisocial behavior is "suppressed" when not controlling for CU traits.

Our research design used an extended follow-up period (5 years) with repeated measurement, which allowed us to make a strong test of the potential mediational role of externalizing behaviors to account for why CU traits predict later anxiety and victimization. That is, we were able to test longitudinal parallel mediation models, in which the meditators were measured at intermediate time points between the predictor and outcome (Preacher & Kelley, 2011). This design also allowed us to make a strong test of potential bidirectional associations. It allowed us to use a data analytic method (i.e., RI-CLPM) that controlled for between-subject effects (i.e., stable or trait-like associations over time) when testing cross-lagged associations, which provides stronger indications that the predictive associations are due to individual-level changes over time (Berry & Willoughby, 2017). Further, it controls for any time-invariant variables that are not included in the model that might be influencing the association between variables (Hamaker et al., 2015).

This methodology is likely why our analyses did not demonstrate the predicted cross-lagged associations between aggression and victimization. That is, consistent with a large body of past research, antisocial behavior, aggression, and CU traits all had between-subject

Figure 6 Random-Intercept Cross-Lag Path Models of CU Traits and Victimization



Note. Standardized coefficients are reported. CU = Callous-Unemotional; Vict = Victimization. These coefficients are based on the model in which all autoregressive and cross-lagged paths were constrained across time. However, while the unstandardized beta were constrained to be equal for these paths, the SE differed leading to differences in the standardized estimates.*<math>p < .013, **p < .01, ***p < .001 (Bonferroni corrected).

associations with victimization (Copeland et al., 2018; Docherty et al., 2016, 2018; Goodearl et al., 2014; Kahn et al., 2013; Kimonis et al., 2013; Kubik et al., 2019). However, once the between-subjects association was accounted for, there were no predictive associations between aggression and victimization. Thus, contrary to our predictions, aggressive behavior did not lead to increases in victimization. Further, our sample and follow-up period focused on adolescence and any predictive relationship between aggression and victimization may be limited to earlier developmental periods. This possibility needs to be tested in future research.

The results need to be interpreted in light of some important limitations that could provide additional recommendations for future research. First, the current study was limited to boys and thus it is unclear if our findings will generalize to girls. This is an especially notable limitation, given that girls and boys show differences in their level of CU traits (Frick et al., 2000), antisocial behavior (Burt, 2012), type of victimization (de Waal et al., 2017), responses to

victimization (McLaughlin et al., 2013), and rate of anxiety disorders (Merikangas et al., 2010). Further, our sample consisted of adolescents who were arrested for the first time for a low to moderately severe crimes. While this likely increased the variability in the constructs of interest, future research needs to test whether these results would replicate in samples of adolescents who committed more serious offenses or in community adolescents. Finally, more complicated longitudinal models could be tested in future research that would enhance the theoretical models for the development of CU traits and its association with anxiety. That is, we tested the fundamental assumptions of a model in which CU traits predicted later anxiety and victimization, and this association was largely mediated by antisocial and aggressive behavior. However, we did not test any predictive associations between anxiety and victimization and it is possible that there may be serial mediation taking place, with CU traits leading to increases in victimization, which in turn leads to increases in anxiety.

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Table 2

	-	-		0	
b	SE	CI	t	р	Proportion of total effect
	CU traits	$(baseline) \rightarrow anxiety (year$	1)		
0.060	0.011	[0.038, 0.082]	5.392	.001	
0.028	0.012	[0.004, 0.051]	2.301	.022	0.46
0.033	0.007^{a}	$[0.020, 0.046]^{b}$			0.54
0.016	0.006^{a}	$[0.005, 0.028]^{b}$			0.27
0.016	0.005^{a}	$[0.006, 0.027]^{b}$			0.27
	CU traits	$(year 1) \rightarrow anxiety (year 2)$	2)		
0.026	0.011	[0.005, 0.047]	2.47	.014	
0.000	0.011	[-0.021, 0.021]	-0.003	.998	0
0.026	0.005^{a}	$[0.017, 0.037]^{b}$			1
0.017	$0.004^{\rm a}$	$[0.009, 0.026]^{b}$			0.65
0.01	0.004^{a}	$[0.003, 0.018]^{b}$			0.38
	CU traits	$(year 2) \rightarrow anxiety (year 2)$	3)		
0.035	0.012	[0.012, 0.058]	3.018	.003	
0.013	0.012	[-0.011, 0.036]	1.068	.286	0.37
0.022	0.005^{a}	$[0.013, 0.031]^{b}$			0.63
0.017	$0.004^{\rm a}$	$[0.008, 0.025]^{b}$			0.49
0.005	0.003^{a}	$[0.001, 0.010]^{b}$			0.14
	CU traits	$(year 3) \rightarrow anxiety (year 3)$	5)		
0.016	0.012	[-0.008, 0.039]	1.307	.191	
	<i>b</i> 0.060 0.028 0.033 0.016 0.016 0.026 0.000 0.026 0.017 0.01 0.035 0.013 0.022 0.017 0.005 0.016	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	b SE CI CU traits (baseline) → anxiety (year 0.060 0.011 [0.038, 0.082] 0.028 0.012 [0.004, 0.051] 0.033 0.007 ^a [0.020, 0.046] ^b 0.016 0.006 ^a [0.005, 0.028] ^b 0.016 0.005 ^a [0.006, 0.027] ^b CU traits (year 1) → anxiety (year 0.026 0.011 [-0.021, 0.021] 0.026 0.005 ^a [0.017, 0.037] ^b 0.017 0.004 ^a [0.009, 0.026] ^b 0.017 0.004 ^a [0.003, 0.018] ^b CU traits (year 2) → anxiety (year 0.035 0.012 [0.012, 0.058] 0.013 0.012 [-0.011, 0.036] 0.022 0.005 ^a [0.013, 0.031] ^b 0.017 0.004 ^a [0.008, 0.025] ^b 0.005 0.003 ^a [0.001, 0.010] ^b	b SE CI t CU traits (baseline) → anxiety (year 1) 0.060 0.011 [0.038, 0.082] 5.392 0.028 0.012 [0.004, 0.051] 2.301 0.033 0.007 ^a [0.020, 0.046] ^b 0.016 0.016 0.006 ^a [0.005, 0.023] ^b 0.016 0.016 0.005 ^a [0.006, 0.027] ^b 0.026 0.026 0.011 [0.005, 0.047] 2.47 0.000 0.011 [0.005, 0.021] -0.003 0.026 0.005 ^a [0.017, 0.021] -0.003 0.026 0.005 ^a [0.017, 0.037] ^b 0.003 0.017 0.004 ^a [0.003, 0.018] ^b 0.013 CU traits (year 2) → anxiety (year 3) 0.035 0.012 [-0.011, 0.036] 1.068 0.022 0.005 ^a [0.013, 0.031] ^b 0.017 0.017 0.004 ^a [0.008, 0.025] ^b 0.016 0.017 0.004 ^a [0.008, 0.025] ^b 0.005 0.005	b SE CI t p CU traits (baseline) → anxiety (year 1) 0.060 0.011 [0.038, 0.082] 5.392 .001 0.028 0.012 [0.004, 0.051] 2.301 .022 0.033 0.007 ^a [0.020, 0.046] ^b .016 .022 0.016 0.006 ^a [0.005, 0.028] ^b .016 .022 0.016 0.005 ^a [0.005, 0.027] ^b .014 0.000 0.011 [-0.021, 0.021] -0.003 .998 0.026 0.0011 [-0.021, 0.021] -0.003 .998 0.017 0.004 ^a [0.009, 0.026] ^b .014 0.001 0.004 ^a [0.003, 0.018] ^b .003 0.017 0.004 ^a [0.003, 0.018] ^b .003 0.013 0.012 [-0.011, 0.036] 1.068 .286 0.022 0.005 ^a [0.013, 0.031] ^b .286 .286 0.017 0.004 ^a [0.008, 0.025] ^b .286 .286 0.022

Note. Unstandardized coefficients reported. ^a Bootstrapped standard errors using 5,000 samples. ^b Bootstrapped confidence intervals. All models control for age, race/ethnicity, and IQ.

Figure 7

The Mediating Role Aggression and Antisocial Behavior have on the Relationship Between CU Traits and Future Anxiety



Note. Standardized coefficients are reported, ns = nonsignificant. All models control for age, race/ethnicity, and IQ. *p < .013, **p < .01, ***p < .01 (Bonferroni corrected).

<i>v</i> 00		5	1		0	
Effect	b	SE	CI	t	р	Proportion of total effect
		CU traits (ba	seline) \rightarrow victimization (year	ar 1)		
Total effect	0.003	0.002	[-0.001, 0.008]	1.488	.137	
		CU traits (y	ear 1) \rightarrow victimization (year	r 2)		
Total effect	0.005	0.002	[0.002, 0.009]	2.792	.005	
Direct effect	0.001	0.002	[-0.002, 0.005]	0.653	.514	0.20
Total indirect effect	0.004	0.001 ^a	[0.002, 0.006] ^b			0.80
Aggression (18 months)	0.001	0.001 ^a	$[-0.001, 0.003]^{b}$			0.20
Antisocial behavior (18 months)	0.003	0.001 ^a	$[0.001, 0.005]^{b}$			0.80
		CU traits (y	ear 2) \rightarrow victimization (year	r 3)		
Total effect	0.005	0.002	[0.002, 0.008]	2.795	.005	
Direct effect	0.001	0.002	[-0.003, 0.004]	0.331	.741	0.20
Total indirect effect	0.004	0.001 ^a	$[0.002, 0.007]^{\rm b}$			0.80
Aggression (30 months)	0.002	0.001 ^a	$[0.000, 0.005]^{b}$			0.40
Antisocial behavior (30 months)	0.002	0.001 ^a	$[0.001, 0.004]^{b}$			0.40
		CU traits (y	ear 3) \rightarrow victimization (year	r 5)		
Total effect	0.001	0.002	[-0.003, 0.004]	0.245	.807	

Tests for Aggression and Antisocial Behavior as Mediators of the Relationship Between CU Traits Predicting Future Victimization

Note. Unstandardized coefficients reported. ^aBootstrapped standard errors using 5,000 samples. ^bBootstrapped confidence intervals. All models control for age, race/ethnicity, and IQ.

Within the context of these limitations, our findings do not support theoretical models suggesting that anxiety and victimization are markers for variants of CU traits with distinct etiologies. However, our results were consistent with another explanation for why anxiety and victimization may be elevated in some children and adolescents with CU traits. That is, a model in which anxiety and victimization were predicted by changes in CU traits fit our data better than a model in which anxiety and victimization predicted CU traits. Further, increases in antisocial behavior largely accounted for (i.e., mediated) the predictive association between CU traits and anxiety and CU traits and victimization. These findings support a theoretical model proposing that anxiety and victimization may be largely the consequence of an adolescent's antisocial behavior in those elevated on CU traits, rather than an indicator of a unique causal variant. While our results do not support the use of anxiety and victimization as an indicator for a unique causal pathway to CU traits, our results suggest that they are still clinically important as *a marker of the severity* of the conduct problems in youths with elevated CU traits. As a result, anxiety and trauma histories are still an important part of clinical assessments of adolescents with elevated CU traits. Further, our findings suggest that reducing adolescents' antisocial behavior may be an important focus of treatment for preventing or reducing the development of anxiety and trauma in adolescents with elevated CU traits.

Figure 8

Table 3

The Mediating Role Aggression and Antisocial Behavior Have on the Relationship Between CU Traits and Future Victimization



Note. Standardized coefficients are reported, ns =nonsignificant. All models control for age, race/ethnicity, and IQ. *p < .013, **p < .01, **p < .01, **p < .01 (Bonferroni corrected).

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