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Exposure to Violence as a Mediator of the CU–Aggression Relationship: on the Importance of Establishing the Causal Direction of Variables in a Path Analysis

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Abstract
The current study sought to determine which of three variables—callous-unemotional (CU) traits, exposure to violence (ETV), and aggressive offending—did the best job of mediating the other two variables. This question was addressed in a sample of 1170 male delinquents from the Pathways to Desistance study using three waves of data and the comparison pathways approach to mediation. Consistent with predictions, ETV successfully mediated the CU–aggression relationship, whereas the two control pathways (ETV → CU → aggression and CU → aggression → ETV) were non-significant. These results suggest that certain variables are better suited to serving as mediators than other variables. Hence, while personality-based constructs like CU traits perform well as independent variables and behavioral measures like aggressive offending make for effective dependent variables, mediation is perhaps best served by social cognitive, affective-motivational, perceptual, and experiential variables, the latter of which is the category into which exposure to violence falls. From a theoretical standpoint, these findings suggest that exposure to violence may trigger or prime aggressive offending in individuals possessing strong CU traits. Exposure to violence may therefore serve as one mechanism with the capacity to link CU traits to later aggressive offending, with implications for both prevention and intervention.

Keywords Callous-unemotional traits · Exposure to violence · Aggressive offending · Mediation

Callous-unemotional (CU) traits are included as specifiers of conduct disorder in the most recent version of the Diagnostic and Statistical Manual (DSM-5: APA 2013) based on research showing that they portend a more serious pattern of future antisocial behavior (McMahon et al. 2010) and a more limited response to treatment (Hawes et al. 2014). There is also a growing body of research to suggest that CU traits are correlated with and predictive of interpersonal violence and aggressive conduct (Frick et al. 2014). These findings dovetail with a tradition in which CU traits are viewed as a direct cause of violence and aggressive behavior (Frick and White 2008). This view is inconsistent, however, with the fact that not all children with strong CU traits go on to become violent or aggressive in later life (Fanti et al. 2017; Fontaine et al. 2011). One possible explanation for this discrepancy is that one or more "third" variables moderate or mediate the CU–aggression relationship. Walters (in press), for instance, determined that moral disengagement mediated the nexus between CU traits and peer influence (peer deviance → participant delinquency). The purpose of the current investigation was to determine whether another variable with suspected ties to CU traits and aggression—i.e., exposure to violence—also mediates the CU–aggression relationship.

There is little question that exposure to community violence correlates with CU traits and violence (Frick and Dantagnan 2005; Kimonis et al. 2008). What is more at issue is the direction of the putative causal effect. Analyzing prospective data, Davis et al. (2015) discovered that exposure to community violence was associated with higher levels of CU traits one year later. Baseline levels of CU traits were not controlled, however, making it impossible to determine whether exposure to community violence was the cause or effect of CU traits. The results of other studies suggest that exposure to violence may promote subsequent criminal and violent activity (Eitle and Turner 2002; Nofziger and Kurtz 2005). The problem with these

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studies is that they relied on retrospective accounts of violence exposure rather than on prospective data. In studies probing the connections between all three variables, it has been shown that witnessing violence but not experiencing violence mediates the CU–offending relationship (Howard et al. 2012; Oberth et al. 2017). Unfortunately, these results are limited by several methodological deficiencies. First, the authors disregard state-of-the-art mediation procedures and advice, like nonparametric bootstrapping and sensitivity testing. Second, there were no controls in either study for prior levels of the outcome measures, thereby impeding efforts to establish the causal direction of the results (Cole and Maxwell 2003). Third, both studies failed to control for routine peer activities, a construct that may bridge the gap between a lifestyle of victimization and a lifestyle of crime (Hindelang et al. 1978).

Analyzing data from the Pathways to Desistance study, Baskin-Sommers and Baskin (2016) studied the relationship between violence exposure, aggressive offending, and psychopathy as measured by the Youth Psychopathic Traits Inventory (YPI: Andershed et al. 2002). Based on their findings, Baskin-Sommers and Baskin concluded that the association between violence exposure and violent offending was reciprocal or bidirectional and that psychopathy mediated both relationships. Despite the fact the authors employed nonparametric bootstrapped confidence intervals to evaluate the significance of their findings and clearly established the causal order of their variables by using longitudinal data, they failed to rule out model misspecification of the causal direction type by neglecting to control for previous levels of violence exposure, psychopathy, and aggressive offending. A reverse causal effect is therefore a viable alternative explanation for these results. This is because psychopathy, being a reasonably stable personality trait, may have been in place long before exposure to violence even though it was measured subsequent to the individual's exposure to violence. For the purpose of establishing a presumptive causal link between violence exposure and psychopathy, prior levels of psychopathy should have been controlled. Moreover, the relative stability of psychopathy suggests that it may be better suited to the role of independent variable than to that of mediator.

Causal mediation analysis, the methodological approach adopted in the Baskin-Sommers and Baskin (2016) study, is subject to both procedural and conceptual considerations. One of the principal procedural considerations for researchers conducting causal mediation analysis is the selection of mediators. A mediator should be sufficiently stable to predict some variables, yet sufficiently malleable to be predicted by other variables (Bandura 1986; Wu and Zumbo 2008). Psychopathy and CU traits may be significantly less malleable than exposure to violence, thereby making the latter a more effective mediator than the former. Conceptually, it is important to understand that causal mediation analysis is a confirmatory approach (Baron and Kenny 1986) and that relationships should be predicted ahead of time and efforts directed at testing these relationships rather than looking for new ones (James and Brett 1984). Anderson and Bushman's (2002) general aggression model (GAM) is a theory with some seeming relevance to the CU–violence exposure relationship. Although the priming effect discussed in GAM is normally attributed to exposure to media-based violence, there is no reason why personally witnessing or experiencing violence cannot also serve as a prime or trigger for an aggressive response or pattern of behavior. In fact, findings from a recent study by Kokkinos and Voulgaridou (2018) revealed that CU traits, along with hostile attribution biases, correlated with both violence exposure and relational victimization in a group of elementary school children.

Whereas much of the focus of psychopathy research in children and adolescents has been on CU traits, it is important to understand that there are two other factors in the three-factor model of psychopathy—grandiose-manipulative and impulsive-irresponsible traits (Cooke and Michie 2001)—and that these factors may be of value in determining whether exposure to violence serves a priming function for future aggressive behavior (Salekin 2016, 2017). The YPI psychopathy measure used in the Baskin-Sommers and Baskin (2016) study actually assesses all three factors. From the standpoint of theory, then, it is imperative that researchers determine whether it is the full psychopathy construct or one of its dimensions (grandiose-manipulative, callous-unemotional, or impulsive-irresponsible) that is primarily responsible for placing an individual exposed to violence at risk for increased future aggressive behavior. Although exposure to violence may serve as a prime for future aggressive behavior in children with strong callous-unemotional traits, it could also stimulate egocentric based aggression in children with strong grandiose-manipulative traits, hostile attribution biases in children with strong impulsive-irresponsible traits, or the full psychopathy syndrome in children with elevated total YPI scores. The conceptual position adopted in the current investigation was that exposure to violence serves as a prime or trigger for those with high initial levels of CU traits and that this then leads to an increase in aggressive behavior on the part of the affected individual.

Current Investigation

The present study used the same sample and many of the same variables as Baskin-Sommers and Baskin (2016).

There were three principal differences, however, between the two studies: (1) the Callous-Unemotional, Grandiose-Manipulative, and Impulsive-Irresponsible dimensions of the YPI and the total YPI score served as independent variables in the current study, whereas the Baskin-Sommers and Baskin (2016) study used only the total YPI score; (2) precursor or prior measures of each predicted variable were included in the current study but not in Baskin-Sommers and Baskin (2016); (3) a control measure designed to eliminate the alternate explanation that unsupervised peer interactions leave one vulnerable to exposure to violence and the perpetration of violence was added to the design for the current study but was missing from the Baskin-Sommers and Baskin (2016) study. One objective in conducting this study was to demonstrate how some variables (violence exposure) make better mediators than other variables (CU traits, aggression), and a second objective was to determine whether the effect was specific to a single facet of psychopathy.

Of the three principal variables examined in this study (CU traits, violence exposure, aggression), violence exposure was considered the best fit for a mediating variable (Bandura 1986; Wu and Zumbo 2008). And of the three facets of psychopathy measured by the YPI, CU traits were considered the best candidate for the independent variable. The comparison pathways approach was used to test these hypotheses. The comparison pathways approach involves contrasting a target pathway (CU → violence exposure → aggression) with one or more control pathways (Walters 2018). Control pathway 1 was constructed by reversing the independent and mediator variables (violence exposure → CU → aggression) and control pathway 2 was constructed by switching the mediator and dependent variables (CU → aggression → violence exposure). It was predicted that the target pathway would achieve significance, the control pathways would fail to achieve significance, the target pathway would achieve significantly better result than the two control pathways, and that CU traits would be the only facet of psychopathy to serve as the independent variable in a significant target pathway.

Method

Participants

All 1170 male juvenile offenders from the Pathways to Desistance study (Mulvey 2012) participated in this study. There are also 184 female participants in the Pathways sample but they were excluded from the present investigation because they were significantly more likely to have current charges of simple drug possession than male participants. Each participant had been adjudicated delinquent or convicted of a felony in Maricopa County (Phoenix), Arizona or Philadelphia, Pennsylvania when they were 14 to 18 years of age and the average age of participants at the time of the baseline interview was 16.05 years (SD = 1.16, range = 14–19). Ethnically, 19.2% of the participants were Caucasian, 42.1% were African American, 34.0% were Hispanic, and 4.6% identified themselves as Asian, Native American, or being of mixed ethnicity.

Measures

Independent, Dependent, and Mediating Variables Three variables functioned as independent, dependent, and mediating variables in this study: callous-unemotional traits, exposure to violence, and aggressive offending. Callous-unemotional (CU) traits served as both an independent and mediator variable. The CU construct was assessed using the Callous-Unemotional dimensional score from the Youth Psychopathic Traits Inventory (YPI: Andershed et al. 2002). The Callous-Unemotional dimensional score is based on 15 self-report items (e.g., "I think that crying is a sign of weakness, even if no one sees you;" "I usually feel calm when other people are scared"), each scored on a four-point Likert-type scale (1 = *does not apply at all*, 4 = *applies very well*). The internal consistency of the YPI Callous-Unemotional dimensional score was adequate over the two waves of the Pathways study in which it served as an independent or mediating variable (α = .73–.76: Mulvey 2012). The total YPI score, along with the 20-item Grandiose-Manipulative (α = .91–.92) and 15-item Impulsive-Irresponsible (α = .82–.83) dimensional scores of the YPI, were also included in the target pathway as alternate independent variables.

Exposure to violence served all three variable functions (independent, dependent, and mediator) and was assessed with a modified version of the Exposure to Violence Inventory (ETV: Selner-Ohagan et al. 1998). The ETV consists of 6 items addressing experienced violence (e.g., "Have you been chased where you thought you might be seriously hurt in the past 6 months?") and 7 items addressing observed or witnessed violence (e.g., "Have you seen someone else being raped, an attempt made to rape someone or any other type of sexual attack in the past 6 months?"). The number of experiences or observations reported over the course of the recall period was then summed to produce a total score that could range from 0 to 13. The 13-item ETV total score displayed adequate internal consistency in the three waves where it served as an independent, dependent, or mediating variable (α = .74–.75: Mulvey 2012). The ETV victim and witness subscales were included in several supplemental analyses.

The aggressive offending variety score from the Self-Reported Offending scale (SRO: Huizinga et al. 1991) served as a dependent and mediator variable in this study. Variety scores were used instead of frequency scores in the main analysis because research indicates that they possess better psychometric properties than frequency scores (Sweeten 2012). The aggressive offending variety score is the proportion of SRO aggressive crime categories (out of 11) the respondent acknowledged engaging in over the past six months: destroyed/damaged property, set fire, forced someone to have sex, killed someone, shot someone, shot at someone, took by force with a weapon, took by force without a weapon, beat up someone with serious injury, in a fight, and beat someone as part of a gang. Test-retest reliability for the aggressive offending variety score was moderately high over a one-year period starting at Wave 2 and ending at Wave 4 ($r = .38–.48$). A frequency measure of all aggressive offenses was also calculated and included in a supplemental analysis.

Control Variables The current investigation included three control variables. Two of the control variables were basic demographic measures: age in years and race (White = 1, Nonwhite = 2). The third control variable was designed to assess unsupervised routine activities with peers. Items for this measure came from the "Monitoring the Future" questionnaire (Osgood et al. 1996) and asked respondents to rate the frequency (1 = *never*, 5 = *almost every day*) with which they participated in activities with friends where there was no adult supervision: 1. Get together with friends informally, 2. Riding around in a car for fun, 3. Going to parties, 4. Spending evenings out for fun and recreation. A total score was derived from the mean item rating across the four items. The internal consistency of the unsupervised routine activities measure was modest ($\alpha = .62$: Mulvey 2012). All three control variables were measured at baseline (Wave 0).

Cole and Maxwell (2003) recommend that precursor measures of predicted variables in a mediation analysis be controlled in order to avoid model misspecification of the causal direction type. One or more precursor measures of a predicted variable were therefore included in each regression equation. Hence, Wave 2 exposure to violence was included as a predictor in the regression equation predicting Wave 3 exposure to violence, Wave 2 CU traits was included as a predictor in the regression equation predicting Wave 3 CU traits, Wave 2 aggressive offending was included as a predictor in the regression equation predicting Wave 3 aggressive offending, Waves 2 and 3 exposure to violence were included as predictors in the regression equation predicting Wave 4 exposure to violence, and Waves 2 and 3 aggressive offending were included as predictors in the regression equation predicting Wave 4 aggressive offending.

Research Design

A fixed-sample multiple mediator panel design was employed in this study spanning Waves 2 through 4 of the Pathways study. There was no overlap between waves, thereby qualifying the design as prospective in nature. The rationale for commencing with Wave 2 instead of Wave 1 (when the YPI was first administered) was that missing data exceeded 20% for the YPI at Wave 1 but was under 10% for the YPI during Waves 2–4. The research design called for two independent variables (CU-2, ETV-2), three mediator variables (CU-3, ETV-3, Aggression-3), and two dependent variables (ETV-4, Aggression-4), which were then arranged into a target pathway and two control pathways.

Data Analysis

The two independent and two dependent variables were converted to a common scale (z-scores) in order to allow for direct comparisons between pathways. Because the recall periods for Waves 3 (range = 3–8 months, $M = 5.87$, $SD = 1.00$) and 4 (range = 2–8, $M = 5.93$, $SD = 1.00$) varied, length of recall or time at risk served as a control variable in this study. A five-equation path analysis was performed with *MPlus 5.2* (Muthén and Muthén 1998–2007). Bias-corrected bootstrapped 95% confidence intervals (b = 5000) were constructed and then used to assess the significance of individual pathways. Differences between pathways were evaluated using the Preacher and Hayes (2008) contrast test. A significance pathway or difference was indicated by a confidence interval that did not include zero. It should be noted that bootstrapping is superior to normal theory z-tests in modeling the non-normal distribution of indirect effects and accounting for non-normality in the dependent variable (Hayes 2013; MacKinnon et al. 2013; Pituch and Stapleton 2008; Rucker et al. 2011).

Kenny's (2013) "failsafe ef" procedure—$(r_{my.x})$ x $(sd_{m.x})$ x $(sd_{y.x})$ / (sd_m) x (sd_y)—was used to test the sensitivity of significant indirect effects to missing variable bias. The coefficient produced when the "failsafe ef" is calculated indicates how strongly an unobserved covariate confounder would need to correlate with the mediating and dependent variables (controlling for the independent and mediating variables in the case of the dependent variable) to completely eliminate a significant coefficient along the *b* path of the indirect effect (note: the *a* path runs from the independent variable to the mediator variable and the *b* path runs from the mediator variable to the dependent variable).

One potential problem with precursor measures is their capacity to produce endogenous selection bias. By conditioning on the precursor to the outcome one runs the risk of creating a collider variable capable of artificially

inflating path coefficients (Elwert and Winship 2014). A collider effect is most likely to occur when the precursor lies on the path between the independent variable and outcome measure (Greenland 2003). Accordingly, two additional sensitivity tests were performed: one in which the Wave 3 precursors to Wave 4 outcomes (which lie on the path between the independent and dependent variables) were removed and one in which all precursors and control variables (except for time at risk) were removed.

Missing Data

Missing data was not considered a significant problem in this study because the majority of participants had complete data on all 11 study variables (83.8%). Of the participants with missing data, 4.0% were missing data on two variables, 5.4% were missing data on three variables, and 6.8% were missing data on 4 to 8 variables. All 11 variables had less than 10% missing data and all missing data were handled with full information maximum likelihood (FIML). The FIML procedure calculates model parameters and standard errors for all non-missing data and then applies these estimates to the entire sample. Research has consistently shown that FIML generates estimates that are significantly less biased than those produced by more traditional missing data procedures like simple imputation and listwise deletion (Allison 2012; Peyre et al. 2011).

FIML rests on two assumptions. The first assumption is that data are missing at random (MAR) and the second assumption is that the distribution is multivariate normal. The MAR assumption is untestable because the data required to test it are, by definition, missing (Allison 2012). Still, there was no reason to suspect a pattern to the missing data and the use of multiple administrations of key variables (CU traits, ETV, aggressive offending) provided increased confidence in the precision of FIML (Collins et al. 2001). The multivariate normality assumption was tested by comparing the standard errors achieved using an ML estimator with the standard errors achieved using a maximum likelihood with robust errors for parameters and standard errors (MLR) estimator. Differences between the two sets of standard errors (range = 0.0% to 34.2%, $M = 10.7\%$) indicated that the multivariate normality assumption was moderately satisfied. It should be noted that FIML has been found to be robust to moderate violations of its assumptions (Collins et al. 2001; Young and Johnson 2013).

Results

Main Analyses

Table 1 provides descriptive statistics for all 11 variables included in the present investigation. A review of this table indicates that nearly two-thirds of the 55 zero-order inter-correlations between variables in this study achieved Bonferroni-corrected significance. Collinearity diagnostics were performed and produced results that failed to show evidence of multicollinearity between predictor variables: Tolerance = .647–.992; Variance Inflation Factor = 1.008–1.533.

The results of the main path analysis are summarized in Table 2 (see Fig. 1 also) and denote the presence of significant coefficients on four of the six individual paths highlighted in this study: i.e., the *a* and *b* paths of the target pathway, the *b* path of control pathway 1, and the *a* path of control pathway 2. The bias-corrected bootstrapped confidence intervals used to assess each indirect effect (*ab*) are listed in Table 3. According to these results, only the target pathway was significant, although the effect did not differ significantly from the effects attained by the two control pathways.

Additional analyses were conducted to determine whether the psychopathy–aggression relationship was mediated by ETV when measures other than the CU traits subscale of the YPI served as the independent variable. Results indicated that ETV failed to mediate the psychopathy–aggression relationship when the YPI total score (Estimate = 0.046, Bias-Corrected 95% Confidence Interval = −0.023, 0.180; *a* path, β = .04, $p = .25$; *b* path, β = .12, $p = .01$), YPI Grandiosity-Manipulative dimensional score (Estimate = 0.029, Bias-Corrected 95% Confidence Interval = −0.037, 0.149; *a* path, β = .02, $p = .44$; *b* path, β = .12, $p = .01$), or YPI Impulsive-Irresponsibility dimensional score (Estimate = 0.015, Bias-Corrected 95% Confidence Interval = −0.068, 0.118; *a* path, β = .01, $p = .71$; *b* path, β = .12, $p = .01$) served as the independent variable.

Sensitivity Testing

Sensitivity testing using Kenny's (2013) "failsafe ef" procedure revealed that an unobserved covariate confounder would need to correlate .26 with both ETV-3 and Aggression-4, controlling for CU-2 and ETV-3 in the case of the latter, to completely eliminate the significant indirect effect of the target pathway. This suggests that the pathway running from CU traits to violence exposure to aggressive offending was moderately robust to missing variable bias and the effects of unaccounted for extraneous variables.

There was also no evidence of endogenous selection bias when precursor and control variables were removed from the path analysis. When the Wave 3 precursors to the Wave 4 outcomes were removed from the analysis, only the target pathway achieved significance (Estimate = 0.0091, Bias-Corrected Bootstrapped 95% Confidence Interval = 0.0011, 0.0227; *a* path, $\beta = .07$, $p = .03$; *b* path, $\beta = .12$, $p = .001$). Similarly, when all control and

Table 1 Descriptive statistics and correlations for the 11 independent, dependent, mediator, and control variables used in the current study

Variable	*n*	*M*	*SD*	Range	2	3	4	5	6	7	8	9	10	11
1. Age	1170	16.05	1.16	14–19	.06	.09	.07	.00	.03	.07	.03	−.06	−.07	−.07
2. Race	1170	1.81	0.39	1–2		−.00	−.01	−.02	.04	.05	.02	−.02	−.05	−.02
3. Routine Activities	1166	3.85	0.82	1–5			.14*	.13*	.10*	.13*	.07	.11*	.12*	.08
4. CU Traits-2	1086	33.07	6.46	17–55				.55*	.21*	.16*	.18*	.29*	.24*	.20*
5. CU Traits-3	1057	32.72	6.71	13–59					.17*	.21*	.20*	.24*	.28*	.25*
6. ETV-2	1086	1.36	1.82	0–9						.40*	.31*	.56*	.34*	.30*
7. ETV-3	1057	1.26	1.78	0–9							.40*	.26*	.51*	.34*
8. ETV-4	1059	1.03	1.69	0–10								.25*	.26*	.52*
9. Aggressive Offending-2	1086	0.08	0.13	0–.82									.43*	.38*
10. Aggressive Offending-3	1057	0.07	0.11	0–.73										.48*
11. Aggressive Offending-4	1060	0.06	0.11	0–.82										

Variable = study variables; *n* = number of participants with non-missing data; *M* = mean, *SD* = standard deviation; Range = range of scores in the current sample; Age = chronological age in years measured at baseline (Wave 0); Race = 1 (White) or 2 (Nonwhite); Routine Activities = unsupervised routine activities with peers measured at baseline; CU Traits-2 = callous-unemotional traits measured at Wave 2; CU Traits-3 = callous-unemotional traits measured at Wave 3;ETV-2 = exposure to violence total score at Wave 2; ETV-3 = exposure to violence total score at Wave 3; ETV-4 = exposure to violence total score at Wave 4; Aggressive Offending-2 = aggressive offending variety score at Wave 2; Aggressive Offending-3 = aggressive offending variety score at Wave 3; Aggressive Offending-4 = aggressive offending variety score at Wave 4

*$p < .00091$ (Bonferroni-corrected alpha level; .05 / 55 correlations)

precursor variables were removed from the analysis, the target pathway was the lone significant effect (Estimate = 0.0111, Bias-Corrected Bootstrapped 95% Confidence Interval = 0.0016, 0.0287; *a* path, $\beta = .08$, $p = .04$; *b* path, $\beta = .13$, $p = .002$).

Witness and Victim Subscale Analyses

Replacing the total ETV score with the individual witness and victim subscale scores and analyzing each subscale separately, it was discovered that only the victim subscale achieved a significance indirect effect (Estimate = 0.0081, Bias-Corrected Bootstrapped 95% Confidence Interval = 0.0003, 0.0246; *a* path, $\beta = .09$, $p = .01$; *b* path, $\beta = .08$, $p = .07$). In a separate analysis, the indirect effect for the witness subscale was non-significant (Estimate = 0.0050, Bias-Corrected 95% Confidence Interval = −0.0006, 0.0176; *a* path, $\beta = .05$, $p = .13$; *b* path, $\beta = .10$, $p = .02$). Both control pathways were non-significant when the witness and victim subscales were analyzed separately.

Predicting the Frequency of Violent Offending

In a further analysis, the SRO violent variety score was replaced by a violent offending frequency score and analyzed with negative binomial regression analysis (overdispersion statistic = 8.11, $p < .001$, and 10.63, $p < .001$, for aggressive offending at Waves 3 and 4, respectively). Paralleling the variety score results, the *a* ($z = 2.42$, $p = .02$) and *b* ($z = 5.55$, $p < .001$) paths of the target pathway were significant. Because bootstrapping cannot be performed when Monte Carlo integration (a necessary condition for negative binomial regression) is used, the full pathways were evaluated using the Monte Carlo Method for Assessing Mediation (MCMAM). A series of MCMAM analyses were performed with 20,000 repetitions, the results of which indicated that while the target pathway was significant (95% CI = 0.00135, 0.0169), both control pathways failed to achieve significance (CU-mediated pathway: 95% CI = −0.00116, 0.03258; aggression-mediated pathway: 95% CI = −0.00040, 0.00053).

Discussion

Consistent with predictions, the target pathway in this study (CU → violence exposure → aggression) was significant and both control pathways were non-significant. Contrary to predictions, the target and control pathways failed to differ significantly from one another when evaluated with the Preacher and Hayes (2008) contrast test. Despite its small size, the indirect effect of the target pathway was both robust (sensitivity testing and significance across different versions of both the mediator and outcome) and specific (YPI CU traits dimension). Whereas effect size measures have been proposed for indirect effects, these measures are lacking in one or more respects: either because they are not independent of sample size, they cannot be compared across samples, they are lacking in monotonicity, or they are subject to external influences (Preacher and Kelley 2011; Walters 2018; Wen and Fan 2015). The comparison pathways approach

Table 2 Results of a five regression path analysis

Predictor	b(95% CI)	β	*z*	*p*
ETV-3 (Outcome)				
CU-2	1.268 (0.087, 2.455)	0.068	2.10	.036
Age	0.080(−0.006, 0.166)	0.052	1.84	.066
Race	0.117(−0.110, 0.346)	0.026	1.01	.315
Routine Activities	0.150 (0.037, 0.262)	0.069	2.63	.009
ETV-2	6.302 (4.741, 7.922)	0.355	7.78	<.001
Aggressive Offending-2	7.720(−5.392, 20.819)	0.055	1.18	.239
Time at Risk-3	0.126 (0.028, 0.229)	0.070	2.47	.013
CU-3 (Outcome)				
ETV-2	1.949(−2.500, 6.535)	0.029	0.84	.402
Age	−0.178(−0.480, 0.134)	−0.031	−1.13	.259
Race	−0.130(−0.909, 0.622)	−0.008	−0.33	.739
Routine Activities	0.318(−0.130, 0.764)	0.039	1.37	.171
CU-2	36.464 (32.270, 40.740)	0.525	17.16	<.001
Aggressive Offending-2	39.097(−3.047, 78.840)	0.074	1.91	.056
Time at Risk-3	−0.072(−0.403, 0.267)	−0.011	−0.42	.677
Aggressive Offending-3 (Outcome)				
CU-2	0.130 (0.060, 0.201)	0.117	3.62	<.001
Age	−0.005(−0.010, −0.001)	−0.058	−2.22	.027
Race	−0.012(−0.026, 0.002)	−0.043	−1.63	.102
Routine Activities	0.006(−0.001, 0.013)	0.049	1.85	.064
Aggressive Offending-2	2.713 (1.848, 3.553)	0.322	6.24	<.001
ETV-2	0.162 (0.082, 0.246)	0.153	3.91	<.001
Time at Risk-3	0.007 (0.001, 0.013)	0.065	2.37	.018
ETV-4 (Outcome)				
Aggressive Offending-3	0.128(−0.713, 0.994)	0.013	0.29	.769
Age	0.009(−0.042, 0.056)	0.010	0.36	.719
Race	0.017(−0.133, 0.153)	0.007	0.24	.811
Routine Activities	−0.003(−0.076, 0.062)	−0.002	−0.08	.932
ETV-3	0.169 (0.113, 0.225)	0.295	5.90	<.001
CU-3	0.010 (0.000, 0.021)	0.064	1.86	.063
Aggressive Offending-2	4.765(−2.148. 11.753)	0.059	1.34	.181
ETV-2	1.343 (0.423, 2.299)	0.132	2.78	.006
CU-2	0.494(−0.204, 1.188)	0.046	1.39	.166
Time at Risk-4	0.062 (0.001, 0.120)	0.060	2.02	.043
Aggressive Offending-4 (Outcome)				
ETV-3	0.067 (0.017, 0.121)	0.115	2.52	.012
Age	−0.049(−0.097, −0.007)	−0.055	−2.17	.030
Race	−0.024(−0.166, 0.098)	−0.009	−0.36	.720
Routine Activities	−0.004(−0.062, 0.053)	−0.003	−0.13	.897
CU-3	0.012 (0.002, 0.022)	0.078	2.34	.019
Aggressive Offending-3	2.998 (2.014, 4.009)	0.308	5.90	<.001
ETV-2	0.386(−0.485, 1.259)	0.037	0.86	.387
CU-2	0.184(−0.499, 0.915)	0.017	0.52	.602
Aggressive Offending-2	13.313 (5.650, 22.207)	0.162	3.18	.001
Time at Risk-4	0.060 (0.007, 0.113)	0.057	2.22	.027
ETV-3 with Aggression-3	0.065 (0.051, 0.084)	0.432	7.74	<.001
ETV-3 with CU-3	1.018 (0.495, 1.596)	0.114	3.65	<.001
Aggression-3 with CU-3	0.077 (0.046, 0.114)	0.149	4.43	<.001
ETV-4 with Aggression-4	0.335 (0.248, 0.458)	0.417	6.61	<.001

ETV-3 (Outcome) = regression equation with exposure to violence at Wave 3 as the outcome measure; CU-3 (Outcome) = regression equation with callous-unemotional traits at Wave 3 as the outcome measure; Aggressive Offending-3 (Outcome) = regression equation with aggressive offending variety score at Wave 3 as the outcome measure; ETV-4 (Outcome) = regression equation with exposure to violence at Wave 4 as the outcome measure; Aggressive Offending-4 (Outcome) = regression equation with aggressive offending variety score at Wave 4 as the outcome measure; Age = chronological age in years measured at baseline (Wave 0); Race = 1 (White) or 2 (Nonwhite); Routine Activities = unsupervised routine activities with peers measured at baseline; CU-2 = callous-unemotional traits measured at Wave 2; CU-3 = callous-unemotional traits measured at Wave 3; ETV-2 = exposure to violence total score at Wave 2; ETV-3 = exposure to violence total score at Wave 3; Aggressive Offending-2 = aggressive offending variety score at Wave 2; Aggressive Offending-3 = aggressive offending variety score at Wave 3; Time at Risk-3 = number of months covered by Wave 3; Time at Risk-4 = number of months covered by Wave 4; ETV-3 with Aggression-3 = covariance between exposure to violence at Wave 3 and aggressive offending variety score at Wave 3; ETV-3 with CU-3 = covariance between exposure to violence at Wave 3 and callous-unemotional traits at Wave 3; Aggression-3 with CU-3 = covariance between aggressive offending variety score at Wave 3 and callous-unemotional traits at Wave 3; ETV-4 with Aggression-4 = covariance between exposure to violence at Wave 4 and aggressive offending variety score at Wave 4; b(95% CI) = unstandardized coefficient and the lower and upper limits of the 95% confidence interval for the unstandardized coefficient (in parentheses); β = standardized coefficient; *z* = Wald Z-test statistic; *p* = significance level of the Wald Z-test statistic; *N* = 1170

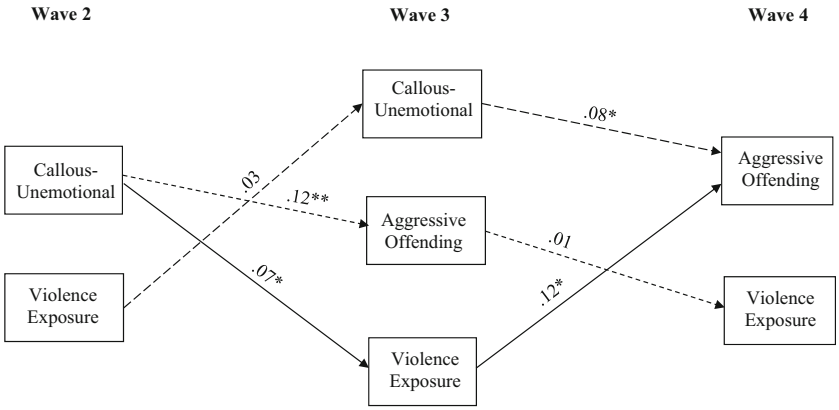

Fig. 1 Results of a maximum likelihood path analysis showing three pathways: a target pathway (Wave 2 callous-unemotional traits → Wave 3 violence exposure → Wave 4 aggressive offending), control pathway 1 (Wave 2 violence exposure → Wave 3 callous-unemotional traits → Wave 4 aggressive offending), and control pathway 2 (Wave 2 callous-unemotional traits → Wave 3 aggressive offending → Wave 4 violence exposure). Note. Standardized coefficients are reported; target pathway (solid lines); control pathway 1 (dashed lines); control pathway 2 (dotted lines); for direct effects, target pathway ($\beta = .02$, $p > .10$), control pathway 1 ($\beta = .04$, $p > .10$), control pathway 2 ($\beta = .04$, $p > .10$). $^{*}p < .05$, $^{**}p < .001$

provides an alternative to effect size estimation in mediation research. Given that the target pathway was significant, the control pathways non-significant, and the difference between the target and control pathways non-significant, the current results can be classified as moderate in magnitude and significance.

Implications

One conclusion that can be drawn from these results is that not all variables are created equal when it comes to mediation. Of the three variables included in the current investigation (CU traits, violence exposure, aggressive offending), violence exposure seemed best suited to the role of mediator based on the fact that it did a better job of balancing mutability and stability than either CU traits or aggressive offending. Violence exposure is known to predict offending behavior (Eitle and Turner 2002; Nofziger and Kurtz 2005) and has been found to be sufficiently pliant to the effects of CU traits (Howard et al. 2012; Oberth et al. 2017). Furthermore, it falls into a category of variables (social cognitive, affective, motivational, perceptual, experiential: Bandura 1986; Wu and Zumbo 2008) that ordinarily make for good mediators (i.e., in this case, experiential). CU traits, while good predictors, are much too stable to be reliably shaped by other variables. Aggressive behavior, on the other hand, may be a better outcome measure than mediator variable. In the current study, CU traits predicted aggressive behavior but were uninfluenced by violence exposure and aggressive behavior (see Fig. 1). It should also be pointed out that prior research has demonstrated that while social cognitive variables are capable of mediating behavioral variables, behavioral variables are generally incapable of mediating social cognitive variables when the roles are reversed (Walters 2016, 2017).

Table 3 Indirect effects for the target pathway and control pathways with the independent and mediator variables and mediator and dependent variables cross-lagged

	BCBCI		
Pathways	Estimate	Lower	Upper
Target Pathway (CU-2 → ETV-3 → Aggression-4)	0.0085	0.0007	0.0244
Control Pathway 1 (ETV-2 → CU-3 → Aggression-4)	0.0024	−0.0021	0.0115
Control Pathway 2 (CU-2 → Aggression-3 → ETV-4)	0.0017	−0.0101	0.0134
Preacher-Hayes Contrast Test			
Target Pathway vs. Control Pathway 1	0.0061	−0.0042	0.0224
Target Pathway vs. Control Pathway 2	0.0068	−0.0063	0.0283

CU-2 = callous-unemotional traits measured at Wave 2; ETV-2 = exposure to violence total score at Wave 2; CU-3 = callous-unemotional traits measured at Wave 3; ETV-3 = exposure to violence total score measured at Wave 3; Aggression-3 = aggressive offending variety score at Wave 3; ETV-4 = exposure to violence total score at Wave 4; Aggression-4 = aggressive offending variety score at Wave 4; Preacher-Hayes Contrast Test = Preacher and Hayes' (2008) test of the difference between two pathways; BCBCI = bias-corrected bootstrapped 95% confidence interval (b = 5000); Estimate = unstandardized point estimate; Lower = lower boundary of the 95% confidence interval; Upper = upper boundary of the 95% confidence interval; $N = 1170$

It is important to understand that causal mediation analysis is a confirmatory rather than exploratory approach. When using this methodology one should accordingly have a clear theoretical model in mind (James and Brett 1984). For reasons described in the previous paragraph, CU traits are not particularly good candidates for mediation. Even so, it is not unreasonable to assume that CU traits could mediate the relationship between violence exposure and aggressive offending. In fact, this particular model served as the first of two control pathways in the current study. This illustrates the importance of selecting control pathways that have at least some modicum of theoretical feasibility, against which to compare the target pathway. Subsequent analyses failed to support the presence of a pathway running from violence exposure to CU traits to aggressive offending but this does not diminish the pathway's conceptual viability, seeing as Baskin-Sommers and Baskin (2016) uncovered support for this pathway using the total YPI psychopathy score in the same sample of participants as was used in the current investigation. The conceptual model upon which the target pathway for the current study was constructed held that exposure to violence, a factor that correlates well with CU traits (Kokkinos and Voulgaridou 2018), may serve as a prime or stimulus for aggressive criminality on the part of someone with strong CU traits. What this then means is that it may be possible to reduce offending in delinquent adolescents by reducing time spent in criminogenic environments, a known risk factor for personal victimization (Hindelang et al. 1978).

A further practical implication of the current results is that while CU traits may lead to offending, they do so through other, more pliable, variables. Just as Walters (in press) determined that moral disengagement mediated the CU–peer influence relationship, so too did the current study show that violence victimization mediated the CU–violent offending association. Being a stable personality trait, CU is less than fully amenable to change (van Baardewijk et al. 2011), yet by targeting more malleable variables that have been found to mediate the CU–offending relationship, it may be possible to reduce the impact of CU traits on general and violent offending. The current results are consistent with prior research showing that violence exposure mediates the CU–violent offending relationship (Howard et al. 2012; Oberth et al. 2017) but they differ in the type of violence exposure they identify as most criminogenic. Whereas Howard et al. (2012) and Oberth et al. (2017) observed that witnessing but not experiencing violence mediated the relationship between CU traits and antisocial behavior, the current study found just the opposite, that experiencing but not witnessing violence mediated the CU–violent offending relationship. Thus, reducing the impact of CU traits on offending behavior not only means altering cognitive appraisals of prior violence the individual may have witnessed but also assisting the individual in coping with the trauma associated with his or her own victimization and finding ways of limiting the amount of time the individual spends in criminogenic environments.

Strengths and Weaknesses

The current study profited from a large sample size, reasonably reliable measures of key variables, one or more precursor measures of each outcome, controls for baseline levels of unsupervised routine peer activities, and state-of-the-art procedures for causal mediation analysis, such as nonparametric bootstrapping and sensitivity testing. These strengths need to be considered within the context of certain study limitations. One such limitation is the nature of the sample. Because participants were all serious delinquents it is difficult to discern how well these results generalize to a more normative sample of adolescents. In addition, participation was restricted to boys because the size and composition of the female subsample differed substantially from that of the male subsample. Consequently, the applicability of these findings to female offenders remains an open question. A second limitation of this study is that the effects were rather small and there were no differences between the target and control pathways, although only the target pathway was significant. Given the degree of control required to conduct a proper mediation analysis (e.g., precursor measures of all outcome measures) and fact that the size of the effect dissipates with the addition of each new mediator (Preacher 2015), it is no wonder that the effects were small (Kenny and Judd 2014). More so, the results of the comparison pathways procedure supported the existence of a medium sized effect and the sensitivity analyses revealed that the effect was moderately robust to missing variable bias and not likely the result of endogenous selection bias.

Final Comment

The results of this study indicate that when a rigorous mediation analysis is performed, violence exposure mediates the CU–violent offending relationship. There was no evidence, however, that violence exposure mediated the relationship between the total YPI score, the Grandiose-Manipulative dimension score, or the Impulsive-Irresponsible dimension score and violent offending. Thus, unlike CU traits, Grandiose-Manipulative and Impulsive-Irresponsible traits do not appear to put adolescents at risk for future violent victimization. This should serve as a reminder that CU traits are not synonymous with psychopathy and that all three dimensions need to be

evaluated when making a diagnosis of psychopathy in children and adults (Salekin 2017). It is unclear why CU traits were the only psychopathy facet to put participants at risk for future violent victimization, but it may be that high Grandiosity-Manipulative youth are better able to charm their way out of a potential victimizing situation and that high Impulsive-Irresponsibility youth avoid excessive victimization by being "on the go" all the time. In the current study a priming effect, whereby exposure to violence serves as a stimulus for future aggression in individuals sensitized to such stimuli by elevated CU traits, was used to explain why CU traits and not Grandiosity-Manipulative or Impulsive-Irresponsibility traits initiated an effect. None of the possibilities just mentioned, however, explains why Grandiose-Manipulative and Impulsive-Irresponsible traits are less sensitive to violent victimization than CU traits or whether children with strong Grandiose-Manipulative or Impulsive-Irresponsible traits require different forms of intervention than children with strong CU traits. Before these questions can be answered more research is required to test the priming hypothesis in youth exhibiting varying degrees of the three psychopathic dimensions.

Compliance with Ethical Standards

Conflict of Interest Glenn D. Walters declares that he has no conflict of interest concerning this study.

Experiment Participants This study constitutes a secondary analysis of publicly available data. Use of these data for research was granted by the Kutztown University Institutional Review Board (IRB). The current study received no funding.

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