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Estimating and Predicting the Course of Callous-Unemotional Traits in First-Time Adolescent Offenders

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The stability of callous-unemotional (CU) traits and both individual and contextual factors that influence this stability have been studied in community adolescent samples but not to great extent in adolescents who have been arrested. We estimated the developmental changes in CU traits measured over the course of 36 months (6-month intervals) following the first arrest of male adolescents (N = 1,216). Using latent growth curve modeling and the multiple cohort multiple group method to account for the accelerated cohort study design, we were able to estimate the degree of change in these traits from ages 13 to 20 years. Overall in the sample, CU traits showed a moderate level of stability, similar to what has been reported in community samples, as well as an overall decline at older ages. Whether the adolescent was formally processed after first arrest (positively) and intelligence (negatively) was related to high levels of CU traits at arrest but unrelated to changes over time. Impulse control and maternal warmth showed consistent negative associations whereas self-reported offending, neighborhood disorganization, and association with delinquent peers showed consistent positive associations with CU traits over time. These findings support the importance of these variables for understanding the level and course of CU traits in justice-involved adolescents and provide potential targets for interventions implemented to reduce these traits in justice-involved adolescents.

Keywords: callous-unemotional traits, delinquency, juvenile justice, latent growth curve modeling

Callous-unemotional (CU) traits include a lack of empathy and guilt, lack of concern over performance in important activities, and shallow or superficial emotions (Frick & Ray, 2015). Elevated levels of these traits designate a particularly severe subgroup of antisocial youth (Frick, Ray, Thornton, & Kahn, 2014b; McMahon et al., 2010) leading to their inclusion of the most recent editions of the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 2013) and the International Classification of Diseases (ICD-11; World Health Organization, 2018) as a specifier for the diagnosis of Conduct Disorder, through the use of a specifier "With Limited Prosocial Emotions". A critical issue for developmental research has been the stability of these traits in children and adolescents. Frick, Ray, Thornton, and Kahn (2014a) reviewed 12 studies testing the stability of these traits in childhood and adolescence and concluded that they showed modest levels of stability prior to adulthood. For example, in a sample of older adolescents, Forsman, Lichtenstein, Andershed, and Larsson (2008) reported that the stability of CU traits from ages 16 to 19 years (n = 1,467) was r = .43 and r = .54 (both $p < .05$) for boys and girls, respectively.

Although these estimates are comparable to the stability estimates reported in adolescence for other personality dimensions (Roberts & DelVecchio, 2000), they do suggest that these personality traits are less stable in adolescence than in adulthood (Cauffman, Skeem, Dmitrieva, & Cavanaugh, 2016). Further, studies assessing potentially different developmental trajectories of CU traits in longitudinal studies using latent growth curve modeling

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(LGCM) and group-based trajectory modeling (GBTM) have consistently found several distinct trajectories of CU traits across childhood and adolescence. Specifically, these studies tend to identify a relatively large group that shows low and stable levels of CU traits and smaller groups with (a) high stable levels of CU traits, (b) increasing levels, and (c) decreasing levels of CU traits across development (Byrd, Hawes, Loeber, & Pardini, 2018; Fanti, Colins, Andershed, & Sikki, 2017; Fontaine, McCrory, Boivin, Moffitt, & Viding, 2011; Fontaine, Rijsdijk, McCrory, & Viding, 2010; Klingzell et al., 2016; Salihovic, Özdemir, & Kerr, 2014).

Thus, research suggests important levels of both stability and change in CU traits across development. Importantly, the majority of studies to date have focused on community samples of adolescents. Only one study has examined the developmental trajectories of CU traits among a sample of youth involved in the juvenile justice system for serious offenses (Baskin-Sommers, Waller, Fish, & Hyde, 2015). Using GBTM, Baskin-Sommers et al. (2015) identified three stable groups of CU traits trajectories over a 5 year period: high stable, moderate stable, and low stable. Thus, these findings suggest that CU traits may be more stable in justice-involved samples because neither an increasing nor a decreasing group was identified. However, their findings were based on a sample of youth who were adjudicated delinquent for serious offenses and these patterns have yet to be examined among less serious juvenile justice-involved youth. Such additional research could be important for juvenile justice policy because CU traits can be considered in various legal proceedings (e.g., risk assessment, placement decisions, jury decisions), and perceptions of their stability could lead to harsher punishments (Edens, Mowle, Clark, & Magyar, 2017).

In addition to documenting the developmental trajectories of CU traits, it is also important to determine variables that might influence these trajectories in both positive and negative ways. Variables associated with change could provide important targets for intervention among youth with elevated CU traits, a group that has often not responded as well to traditional interventions when compared with other antisocial youth (Frick et al., 2014b; Hawes, Price, & Dadds, 2014; Wilkinson, Waller, & Viding, 2016). In past studies, both individual and contextual factors have predicted stability or instability in CU traits. In terms of individual factors, intelligence, impulse control, and level of conduct problems have all been associated with more stable patterns of CU traits in past studies using community samples (Fanti et al., 2017; Fontaine et al., 2011; Frick, Stickle, Dandreaux, Farrell, & Kimonis, 2005; Klingzell et al., 2016). However, a notable omission from these studies is the failure to consider the youth's race and ethnicity as a predictor of stability, especially given concerns raised about potential differences in the predictive validity of CU traits for adolescents of color (Edens & Cahill, 2007).

In terms of contextual factors, the most consistent finding is that warm and involved parenting can lead to reductions in CU traits over time (Fanti et al., 2017; Fontaine et al., 2010; Pardini & Loeber, 2008). In addition, Pardini and Loeber (2008) reported that an adolescent's association with deviant peers were associated with particularly stable and high level of CU traits from ages 14 to 17 years. Unfortunately, several contextual factors outside the youth's family and peer group have not been studied extensively in relation to their impact on the developmental trajectories of CU traits over time but there are theoretical reasons to hypothesize their potential impact. Specifically, adolescents living in high risk neighborhoods who are exposed to high rates of violence could respond by becoming more emotionally detached to the effects of violence on others (Kerig, Bennett, Thompson, & Becker, 2012). In support of this possibility, youth with CU traits are more likely than other youth to be exposed to violence (Howard, Kimonis, Muñoz, & Frick, 2012). However, the role of living in high risk neighborhoods and being exposed to violence has not been specifically studied in relation to changes in CU traits over time.

The role of neighborhood and exposure to violence in the developmental trajectory of CU traits is especially important to study in justice-involved youth who are more likely to come from high risk neighborhoods and be exposed to violence (Wasserman & McReynolds, 2011). In addition, the youth's contact with the justice system itself could also have a detrimental effect on the youth's development (Steinberg, Chung, & Little, 2004). For example, incarceration could directly lead to or help to maintain an adolescent's CU traits by reducing empathy toward others, fostering distrust toward others, and leading to a pessimistic outlook toward to future, which could reduce concern over performance in important activities (Dmitrieva, Monahan, Cauffman, & Steinberg, 2012; Heynen, van der Helm, Cima, Stams, & Korebrits, 2016). Additionally, juvenile justice system involvement has been shown to increase a youth's exposure to other delinquent peers (Dishion, McCord, & Poulin, 1999), exposure to violence (Sampson & Lauritsen, 1994), and disrupt the parent–child relationship, leading to less parental warmth (Steinberg et al., 2004). Thus, justice involvement could influence the trajectory of CU traits directly or by increasing the youth's exposure to negative contextual influences that have been associated with more stable trajectories of CU traits in past research.

Current Study

In summary, previous research has suggested that, although CU traits are relatively stable in childhood and adolescence, there is also evidence to support some different developmental trajectories in these traits. However, this has been largely studied in community samples and not in juvenile justice samples, in which CU traits may demonstrate more stability. Testing the stability of CU traits in justice involved samples is important for developmental research, given their potential use to make important decisions on how the youth may be treated in the juvenile justice system. Further, research has documented both individual differences (e.g., intelligence, impulse control, conduct problems) and contextual influences (e.g., level of parental warmth, association with deviant peers) associated with changes in these traits across time but has not considered other potentially important factors, such as race/ethnicity and certain contextual factors that may be particularly relevant to youth in the juvenile justice system (e.g., neighborhood disorganization, exposure to violence). In addition, we provide one of the first tests for whether the youth's level of juvenile justice system involvement itself influences the stability of CU traits, a question that could have important policy implications for how youth are processed after their first arrest. Identifying factors that influence CU traits over time in justice-involved youth not only has important implications for advancing knowledge on the developmental outcomes of this group of youth but also for potentially designing more effective treatment for these youth. Therefore, in

the current study, we investigated the developmental trajectory of CU traits in a large and ethnically/racially diverse sample of adolescent boys, who were assessed every 6 months for 36 months following their first arrest, using an accelerated longitudinal design that allowed us to examine the developmental trajectory of CU traits from ages 13 to 20 years. We tested the stability and course of CU traits over this developmental period to determine if it was similar to the general decreasing pattern of CU traits over time found in community samples. Further, we tested if several factors within the child and his social context accounted for change in CU traits across this developmental period.

Method

Participants

The sample consisted of adolescent male first-time offenders from the Crossroads Study, which draws from the juvenile justice systems of Jefferson Parish, LA; Orange County, CA; and Philadelphia, PA. To be eligible for the Crossroads Study, juveniles had to be first-time male offenders, English speakers between the ages of 13 to 17 at the time of arrest, and charged with a midrange offense. Limiting the sample to those with midrange offenses was important for studying the role of justice system involvement on the trajectory of CU traits by resulting in significant variability in how the adolescent was processed by the justice system (i.e., either diverted from the system or formally charged) while still maintaining comparable levels of offense severity. Across all sites, 72.32% of individuals eligible to participate enrolled in the study leading to 1,216 adolescents assessed at the first assessment. The participants were first assessed within 6 weeks of their arrest (baseline) and then reassessed at 6-month (n = 1,161; 95.48% retention), 12-month (n = 1,141; 93.83% retention), 18-month (n = 1,132; 93.09% retention), 24-month (n = 1,130; 92.93% retention), 30-month (n = 1,120; 92.0%), and 36-month (n = 1,102; 90.6%) follow-ups, which were all conducted within 6 weeks of the anniversary of their baseline assessment. There were no significant differences in terms of ethnicity, IQ, or age between those that remained in the study at the 36-month follow-up and those that did not. The current study used participants who had valid scores on CU traits at least three time points (n = 1,170; 96.21% retention). Participants' age at the first assessment ranged from 13 to 18 (M = 15.28 years, SD = 1.29), and the ethnic composition of the sample was White Latino (n = 546, 46.7%), Black (n = 442, 37.8%), and White non-Latino (n = 182, 15.6%).

Procedure

Institutional review board (IRB) approval for *The Crossroads Study: Formal versus Informal Processing in the Juvenile Justice System* was obtained at the University of California, Irvine (IRB #2010–7867), Temple University (IRB #13566), and Louisiana State University (IRB #3650) site before data collection began. All youth who met inclusionary criteria were approached about study involvement and informed consent was obtained from the parent/guardian. Both the youth and parents were informed that their participation in the study was entirely voluntary and that their participation in the study would in no way influence their treatment by the juvenile justice system. Youth and parent/guardian were also informed that the research project had obtained a Privacy Certificate from the Department of Justice, which allowed the data to be protected from being subpoenaed for use in legal proceedings. Participants were interviewed at baseline and then at 6-month intervals for 36 months. Interviews were conducted using laptop computers to assist with administration as well as ease of data entry. The laptops were equipped with an interviewing program that included all of the items and measures for standardized administration. The interviews took place at a location convenient to the youth, such as their home or a local place in the community (e.g., library, coffee shop). The participants were compensated for their time. Participants received $50 for the first baseline interview. For each successive interview, participants received $15 more than the last (i.e., $65 for the 6-month follow-up, $80 for the 12-month follow up, $95 for the 18-month follow up, and $110 for the 24-month follow up, etc.).

Measures: Trajectory Outcome

CU traits were assessed at each time point using the 24-item Inventory of Callous Unemotional Traits (ICU; Kimonis et al., 2008). The use of the total score on the ICU, which sums all 24 items, has been supported in factor analyses conducted with both detained (Kimonis et al., 2008) and community (Essau, Sasagawa, & Frick, 2006) samples of adolescents. Further, total ICU scores have been associated with antisocial behavior (positively) and empathy (negatively) across a range of adolescent samples (Cardinale & Marsh, 2017). Within the current sample, the internal consistency for the ICU was adequate across all assessment periods (Cronbach's α ranged from .76–.79).

Measures: Justice Involvement

Processing decision. Youth who participated in the Crossroads Study were either processed formally (i.e., a petition was filed) or informally processed (i.e., diversion in which no petition was filed) and this was used as a time stable variable in the analyses. Thus, youth who were formally processed were expected to have more contact with the juvenile justice system given that a petition requires that the youth appear before a judge. Alternatively, youth who were informally processed were placed on some form of diversion program which required a contract with the juvenile court and formal processing was forgone upon successful completion of the conditions of that contract. In the current study, informal processing was coded as 0 (55% of the sample) and formal processing was coded as 1 (45% of the sample), based on the type of processing the youth received for the offense that made them eligible for study participation.

Secure placement in juvenile detention facility. Each interview asked participants where they were living over the last 6 months since their last interview. Participants reported on the various places they resided by month using a life calendar. On the basis of this information, we created a variable for each time point to determine the proportion of time a youth was residing in a secure facility over the last 6 months. Specifically, secure placement was defined and described as having spent at least 24 hr in a facility "where they slept and kept their belongings." Therefore, in the current study, a *secure placement* is defined as the proportion of time a youth reported being detained in a secure facility over the

last 6 months, and this was included as a time dependent variable in analyses.

Measures: Individual Differences

Impulse control. An eight-item subscale of the Weinberger Adjustment Inventory (Weinberger & Schwartz, 1990) was used to measure impulse control. A total score is calculated after reverse scoring seven of the items, with higher scores reflecting more impulse control. Scores on this measure of impulse control have been negatively associated with antisocial behavior in a sample of adolescents and young adults ages 14 to 22 years (Monahan, Steinberg, & Cauffman, 2009). The internal consistency of this scale across the seven waves was acceptable (Cronbach's α = .74–.79).

Delinquency. The self-report of offending scale (SRO; Huizinga, Esbensen, & Weiher, 1991) was used to assess offending behavior at each time point. The SRO comprises dichotomous items (0 = *no* and 1 = *yes*) asking participants if they have ever engaged in 24 different types of crime (e.g., property damage, theft, carrying a gun) at baseline and if they had engaged in these behaviors in the prior 6 months at each of the follow-ups. The scores for each of the items are summed to create an overall measure of variety of offending, where higher scores are indicative of more different types of offending. The SRO has demonstrated significant correlations with official reports of offending (Thornberry & Krohn, 2000). The SRO exhibited good internal reliability in the current sample at all waves (Cronbach's α ranged from .76–.81).

Ethnicity. Ethnicity was included as three dummy-coded variables including White Latino (0 = *no*, 1 = *yes*), White non-Latino (0 = *no*, 1 = *yes*), and Black (0 = *no*, 1 = *yes*) based on the adolescent's self-report at baseline.

Intelligence. Intelligence was assessed at baseline using the Wechsler Abbreviated Scale of Intelligence (Wechsler, 1999), using the proxy estimated full-scale IQ as indexed by the vocabulary and matrix reasoning subtests.

Measures: Nonjustice Contextual Factors

Maternal warmth. Maternal warmth was assessed using items from the Quality of Parental Relationships Inventory (Conger, Ge, Elder, Lorenz, & Simons, 1994), which was adapted for this study to assess the affective tone of each youth's relationship with his parents. The nine items (e.g., "How often does your mother let you know she really cares about you?") comprising the Maternal Warmth subscale were averaged to derive a maternal warmth score. The maternal warmth scale has been found to be negatively associated with depression and conduct problems in samples of adolescents (Ge, Best, Conger, & Simons, 1996 and showed excellent internal consistency across all waves in the current study (Cronbach's α ranged from .90–.92).

Delinquent peer association. The Peer Delinquency Scale (PDS; Thornberry, Lizotte, Krohn, Farnworth, & Jang, 1994) was used to assess peer antisocial behaviors. The items ask about 13 different delinquent acts (e.g., carried a knife, hit or threatened to hit someone), and participants responded with how many of their friends have done the specific behavior, ranging from 1 (*none of them*) to 5 (*all of them*). The scores are summed, with higher scores indicating a higher number of friends who are reported to engage in the range of behaviors. The PDS was correlated with both neighborhood disorder and self-reported offending in a sample of serious male juvenile offenders (Chung & Steinberg, 2006). The PDS demonstrated excellent internal reliability across all waves (Cronbach's α ranged from .90–.93).

Neighborhood disorder. Neighborhood disorder was assessed at each time point using the 21-item neighborhood conditions measure, which was adapted from Sampson and Raudenbush's (1999) measure of physical (e.g., cigarettes on the street or in the gutters, boarded up windows on buildings) and social (e.g., people drunk or passed out, adults fighting or arguing loudly) indicators neighborhood quality. The neighborhood disorganization scale and self-reported offending were significantly correlated in a sample of serious juvenile offenders (Chung & Steinberg, 2006). Within the current sample, the neighborhood disorder scale demonstrated excellent internal consistency across all waves (Cronbach's α = .94–.96).

Exposure to violence. Exposure to violence was assessed at each time point using the Exposure to Violence Inventory (ETV; Selner-O'Hagan, Kindlon, Buka, Raudenbush, & Earls, 1998). ETV is a self-report inventory with 18 items that assess the frequency of being a witness (e.g., "Have you ever seen someone else being raped, an attempt made to rape someone or any other type of sexual attack?") or being a victim (e.g., "Have you ever been chased where you thought you might be seriously hurt?") to different violent acts such as sexual attacks, attacks with weapons, shootings, and suicides. Scores on this scale have been associated with living in high crime neighborhoods, as well as higher levels of self-reported violent acts (Selner-O'Hagan et al., 1998). The ETV exhibited good internal reliability in the current sample at all waves (Cronbach's α ranged from .74–.80).

Analytic Approach

Developmental changes in CU traits were examined with LGCM using the multiple group multiple cohort (MGMC) approach in Mplus Version 8 (Muthén & Muthén, 2017). The MGMC approach was used to account for the accelerated longitudinal design. An accelerated longitudinal design examines individuals from different, yet overlapping, age cohorts. This technique enables the identification of developmental trajectories over longer periods of time than using a single cohort design (Duncan, Duncan, & Hops, 1996). This is done by linking the segments of data from each cohort so that a broader age range can be examined without requiring data from all individuals at each age. That is, each cohort contributes a unique segment of the time to the overall growth curve. This is done in Mplus using the MGMC approach by constraining the means and variances of the intercept and slope to be equal across each group. Model fit indices can then be used to test if this is an appropriate model by comparing this model to an unconstrained model (i.e., one in which each cohort can follow a unique trajectory—intercept and slope parameters are free to vary). The test, which follows a chi-square distribution, compares the log-likelihood values for the free and constrained models. Differences in the log-likelihood values between the free and constrained models were calculated and then adjusted by a correction factor (Asparouhov & Muthén, 2010). Model fit was also assessed based on several other indices (Hu & Bentler, 1999).

The current study uses five cohorts: 13-year-old adolescents (n = 136; age range = 13–16); 14-year-old adolescents (n = 210; age range = 14–17); 15-year-old adolescents (n = 300; age range = 15–18); 16-year-old adolescents (n = 310; age range = 16–19); and, 17-year-old adolescents (n = 259; age range = 17–20). Because only one individual was 18 at the study initiation, this case/cohort was removed from the analyses. Time was accounted for in the MGMC growth curve model by specifying growth parameters that were consistent with 6-month intervals (i.e., 0, .5, 1, 1.5, 2, 2.5 . . . 5.5, 6, 6.5, 7). Thus, using the MGMC approach, trajectories of CU traits were observed from ages 13 to 20 years. This was first done in an unconditional model with no covariates using maximum likelihood with robust standard errors (MLR). This was followed by a chi-square difference test using the Satorra-Bentler scaled chi-square for MLR (Muthén & Muthén, 2005) to compare a model where the variance, mean, and covariance of the intercept and slope were held to be invariant across cohorts (i.e., single trajectory model) to one where they were free to vary. However, because chi-square is sensitive to large sample sizes (Jöreskog & Sörbom, 1993), the comparative fit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) were also used to determine if a single trajectory could reasonably describe the cohorts' trajectories. We also tested if a linear or quadratic function of the slope parameter fit the data better.

Figure 1 depicts the MGMC latent growth curve model that was tested in this study using the ICU as the measure of CU traits. After the trajectories were observed, four conditional models were estimated with time-invariant covariates predicting the growth factors (i.e., the intercept and the slope) and time-varying covariates directly influencing the repeated ICU measures. Groups of variables were first entered separately to aid in interpretations. In Model 1, the juvenile justice variables (processing decision and secure placement) were entered alone. In Model 2 the individual variables were entered alone and in Model 3 the contextual variables were entered alone. As previously mentioned, ethnicity was dummy coded so that three separate variables were created (see the preceding description) and one of the dummy coded variables was not included in the model which then served as the comparison group (i.e., if all three dummy variables were included in the model they would be perfectly, negatively correlated with each other; Jaccard, 2001). We ran two models (one with Black as the comparison group and one with White non-Latino as the comparison group) in order to obtain all comparisons between ethnic groups. In Model 4, all predictors that were significant in the previous models were simultaneously included in the model. Missing data were handled in the LGCMs using full information maximum likelihood (FIML). FIML estimates a likelihood function in the analysis phase for each individual using information from variables for which the individual has valid, available data.

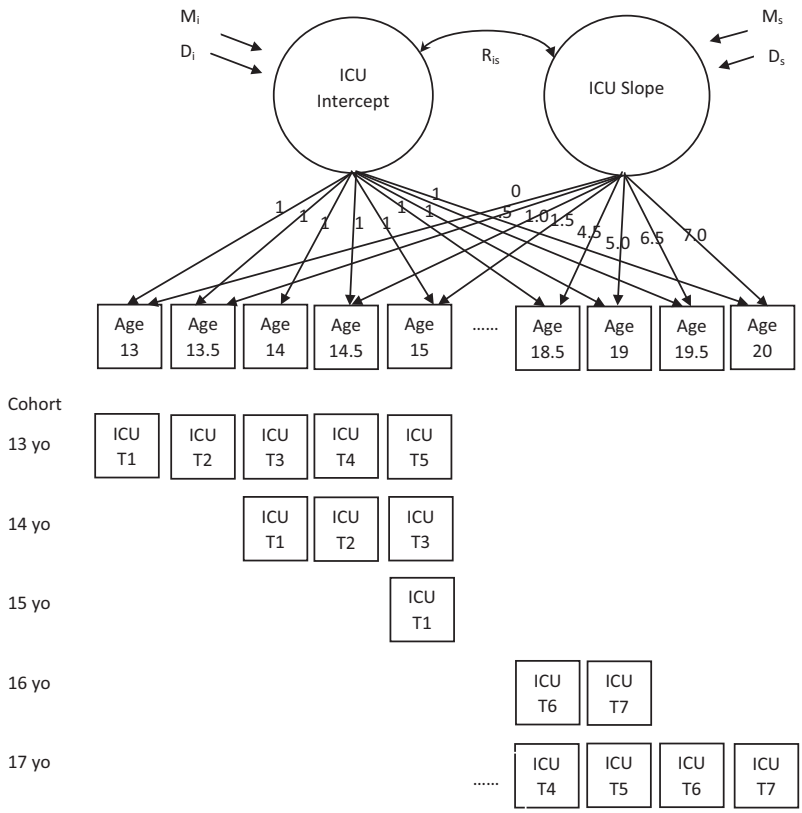

Figure 1. Representation of the cohort-sequential latent growth curve modeling for change in Inventory of Callous Unemotional Traits (ICU) from ages 13 to 20 years. T = time point (T1 = baseline, T2 = first follow-up, etc.).

FIML has shown to be a robust estimator of missing data (Enders & Bandalos, 2009).

Results

Descriptive Analyses

Table 1 displays the stability of ICU scores across the follow-up assessments and the zero-order correlation of the ICU with each of the covariates across time points. Of note, these analyses do not use the accelerated longitudinal design but simply assess the correlations at each time point for the full sample. The average stability of CU traits across 6 months was .67 and the correlation between baseline levels of CU traits and 36-month follow-up (the longest time interval) was .44 (all $p < .001$). Additionally, the juvenile justice variables were related to the ICU scores in the expected direction, with the initial decision to formally process and the time spent in secure facilities being associated with CU traits at most time points. Further, each of the individual and contextual predictors to be included in the longitudinal analyses also showed expected correlations with CU traits.

Unconditional Latent Growth Curve Models

In specifying the LGCM, a linear slope was modeled initially and showed acceptable fit: AIC = 52,154.01; BIC = 52,460.16; ABIC = 52,269.58; RMSEA = .05, SRMR = .07 CFI = .98, and TLI = .98. However, when a quadratic growth term was added, the model fit improved: AIC = 52,136.66; BIC = 52,361.17; ABIC = 52,221.40; RMSEA = .05, SRMR = .07 CFI = .98, and TLI = .98. The AIC, BIC, and ABIC were all smaller in the quadratic model suggesting better fit.

We then tested whether it was a reasonable assumption to fit a single trajectory to the multiple cohorts. This was done by estimating the constrained and unconstrained models and obtaining the degrees of freedom, the scaling factor, and the chi-square value for each model. The degrees of freedom for the test is the difference in the number of free parameters for the models (36), leading to a critical value of 73.40 in order to reject the null hypothesis which favored the constrained model ($p < .001$). The obtained chi-square value of 89.23 was larger than the critical value, suggesting rejection of the null hypothesis. However, because the chi-square tests a strict hypothesis regarding the match between covariance matrices among the models, negligible differences can suggest significant differences, particularly when the sample size is large (Kline, 2011). Thus, the CFI, TLI, RMSEA, and SRMR fit indices were also examined. All of these values suggested good fit for the constrained model based on conventional cutoffs (see the preceding text): CFI = .98, TLI = .98, RMSEA = .05, and SRMR = .07. Additionally, visual examination of the growth curves for the obtained and estimated sample means (see Figure 2) suggest that it is reasonable to pool the cohorts together using a single growth curve. Thus, despite the chi-square difference test favoring the unconstrained model, the pooled model was chosen based on alternative fit indices and in favor of parsimony.

The final growth curve had a mean intercept of 26.68 ($p < .001$), mean slope of .11 ($p = .62$), and a mean quadratic term of −.14 ($p < .001$). Figure 2 (bottom panel) depicts the growth curve which shows that there was an overall decline in CU traits across time, but this was greater at older ages, hence the significant quadratic term. There was also significant variance associated with both the intercept ($\sigma^2 = 44.88$, $p < .001$) and the linear slope ($\sigma^2 = 8.08$, $p = .002$), suggesting that there is reason to examine factors that might account for this variance. Thus, even though the slope was not significant, the latter finding suggested that a significant portion of the sample did not follow the general pattern. The variance associated with the quadratic slope, however, was not significant ($\sigma^2 = .09$, $p = .07$). Additionally, there was no significant association between the intercept and linear slope ($r = -.29$,

Table 1
Intercorrelations Among the ICU Measurements and Covariates

ICU	Baseline	6-month follow-up	12-month follow-up	18-month follow-up	24-month follow-up	30-month follow-up	36-month follow-up
6-month follow-up	.63***						
12-month follow-up	.56***	.66***					
18-month follow-up	.51***	.61***	.67***				
24-month follow-up	.49***	.57***	.62***	.67***			
30-month follow-up	.42***	.54***	.59***	.63***	.70***		
36-month follow-up	.44***	.54***	.54***	.60***	.65***	.68***	
Secure placement	.10***	.09**	.08**	.11***	.09**	.08**	.04
Processing decision	.06*	.07*	.05	.06*	.07*	.06	.07*
White non-Latino	−.05	−.05	−.05	−.06*	−.11***	−.10**	−.13***
Black	−.08**	−.03	−.01	.01	.03	.06*	.06
White Latino	.11***	.07*	.04	.03	.05	.01	.04
Intelligence	−.07*	−.09**	−.09**	−.10**	−.11***	−.12***	−.13***
Impulse control	−.34***	−.22***	−.22***	−.22***	−.20***	−.20***	−.14***
Self-reported offending	.35***	.22***	.22***	.18***	.16***	.11***	.09**
Neighborhood disorganization	.17***	.13***	.19***	.18***	.16***	.13***	.11**
Maternal warmth	−.31***	−.26***	−.18***	−.21***	−.15***	−.15***	−.11***
Deviant peers	.35***	.22***	.21***	.19***	.18***	.13***	.10**
Violence exposure	.22***	.17***	.15***	.13***	.12***	.08*	.08**

Note. ICU = Inventory of Callous Unemotional Traits.
* $p < .05$. ** $p < .01$. *** $p < .001$.

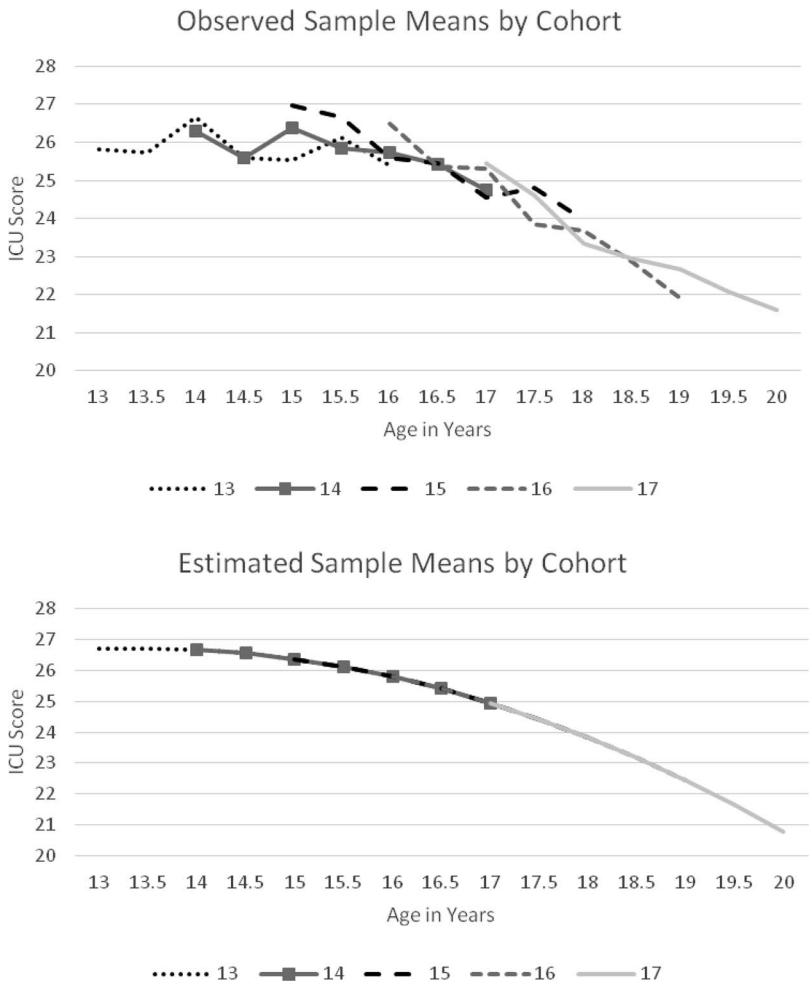

Figure 2. Plots of the observed (top panel) and estimated (bottom panel) sample means using multiple group multiple cohort design. ICU = Inventory of Callous Unemotional Traits.

$p = .07$) nor the intercept and quadratic slope ($r = -.36$, $p = .42$), suggesting that the change in CU traits was not dependent on the youth's initial level of these traits. However, the linear slope was significantly related to the quadratic slope ($r = -.78$, $p < .001$).

Conditional Latent Growth Curve Models

Table 2 presents the results from the conditional LGCM examining the influence of juvenile justice involvement, individual, and contextual variables on trajectories of CU traits.[1] Model 1, which included only the two justice involvement variables (i.e., secure placement and processing decision), fit the data well (AIC = 47,528; BIC = 48,462; ABIC = 47,881; RMSEA = .05, CFI = .95, TLI = .96, and SRMR = .08). Secure placement did not have a significant effect on CU traits across time when controlling for formal processing. Being formally processed compared with informal processing was related to higher baseline levels of CU traits but it did not predict change in the slope.

Model 2, in which the individual factors were included as predictors, also fit the data well (AIC = 100,800; BIC = 105,418; ABIC = 102,543; RMSEA = .04, CFI = .94, TLI = .94, and SRMR = .09). White Latino youth had higher baseline levels of CU traits but also showed larger declines (i.e., negative slope) compared with Black youth. To assess this effect more closely, we specified a recentered model so that the intercept for CU traits was now the final time point (−7, 6.5, −6, −5.5 . . . −2.5, −2, −1, 0; Bollen & Curran, 2006). The result of this model showed that being White Latino was negatively associated with the intercept ($b = -.14$, $p = .026$) suggesting that, after a decline from baseline, White Latino youth showed less CU traits compared with Black adolescents. The model with White non-Latino as the comparison group revealed no significant differences between White non-Latino and White Latino youth. Intelligence was related to

[1] Because site and ethnicity were confounded (see Table 1), site was examined as a covariate in a separate model that did not include ethnicity; however, there were no substantive differences between the models. Thus, only the models with ethnicity as covariates are presented. Further note that we compared models in which the effect of predictors was constrained to be equal across cohorts and across time with those in which they freely varied across cohort and across time. In all comparisons, the constrained models were a better fit.

Table 2
Time-Invariant and Time-Varying Predictors of Trajectories of CU Traits

Variable	Model 1 Justice variables *B* (*SE*)	Model 2 Justice with individual variables *B* (*SE*)	Model 3 Justice with contextual variables *B* (*SE*)	Model 4 all significant variables *B* (*SE*)
Justice involvement				
Secure placement	.46 (.43)			
Processing decision				
Intercept	2.33** (.87)			1.91* (.79)
Slope	–.82 (.44)			–.76 (.41)
Quadratic	.10 (.06)			.09 (.05)
Individual				
Race/Ethnicity				
Black (reference group)				
White non-Latino		.96 (1.36)		.85 (1.28)
Intercept		–.61 (.74)		–.64 (.69)
Slope		–.01 (.09)		–.01 (.09)
Quadratic				
White Latino				
Intercept		2.95** (.85)		2.48** (.83)
Slope		–1.13* (.44)		–1.12** (.43)
Quadratic		.08 (.06)		.09 (.06)
Intelligence				
Intercept		–8.63* (3.45)		–8.42* (3.32)
Slope		2.38 (1.86)		1.39 (1.80)
Quadratic		–.35 (.25)		–.23 (.23)
Impulse control		–1.75*** (.12)		–1.54*** (.12)
Self-reported offending		.40*** (.04)		.27*** (.04)
Nonjustice contextual				
Neighborhood disorganization			.51* (.21)	.58*** (.15)
Maternal warmth			–1.52*** (.19)	–2.12*** (.16)
Deviant peers			.74** (.22)	.71*** (.17)
Violence exposure			.10 (.06)	

Note. CU = callous-unintentional.
* $p < .05$. ** $p < .01$. *** $p < .001$.

initial levels of CU traits but not to changes over time. Finally, impulse control (negatively) and self-reported delinquency (positively) were both time-varying covariates that were significantly related to CU traits across time.

Model 3, in which nonjustice contextual factors were all included as time-varying covariates showed good fit (AIC = 113,968; BIC = 127.428; ABIC = 119,049; RMSEA = .04, CFI = .95, TLI = .92, and SRMR = .02). In this model, maternal warmth was associated with lower levels of CU traits at each wave. Delinquent peers and neighborhood disorganization were associated with higher levels of CU traits at each time point. The only variable that did not significantly predict CU traits over time was the measure of violence exposure.

Finally, Model 4 included all variables in the model that had a significant effect in prior models. This model also showed good fit (AIC = 69,181; BIC = 70,405; ABIC = 69,643; RMSEA = .04, CFI = .97, TLI = .97, and SRMR = .05). In this model, all variables maintained their significant associations with CU traits.

Discussion

In the current study, we tested the developmental trajectory of CU traits in a sample of justice-involved adolescents over the 3 years after their first arrest. Using an accelerated longitudinal design, we were able to model the growth of these traits from ages 13 to 20 and to test potential variables related to this growth. The first finding of note was the level of stability in CU traits and the pattern of change that we observed. These findings are similar to what has been reported in past research using community samples. First, the overall stability of CU traits over 3 years in the current sample ($r = .44$) was very similar to the 3-year stability reported in a sample of 91 boys (*M* age of 13.4 years at the initial assessment), in a high-risk community sample ($r = .48$; Muñoz & Frick, 2007), and a community sample of 1,467 adolescent boys followed from ages 16 to 19 ($r = .43$; Forsman et al., 2008). Thus, the stability of these traits does not seem to be different for justice-involved adolescents and do support the potential for change in these traits over time in youth involved in the juvenile justice system.

Another finding that was consistent with past research was the overall trend for these traits to decline over development (Fanti et al., 2017; Fontaine et al., 2010; Muratori et al., 2016; Pardini & Loeber, 2008). Importantly, the growth trajectory in our justice-involved sample showed a quadratic change in which this decrease in CU traits was largely evident at older ages, suggesting that the decline may be later in justice-involved youth. However, such findings are important to illustrate that, not only might the levels of CU traits change over adolescence, the most likely change is by showing decreases across development. As a result, youth with

elevated CU traits should not be considered destined to show elevated psychopathic traits as adults (Edens et al., 2017), even when displayed by justice-involved youth (Frick et al., 2014a). Alternatively, such youth should be targeted with more intensive treatment that targets their unique needs (Klahr & Burt, 2014). Such findings support the need for research to determine variables that can influence this trajectory in both positive and negative ways in order to inform interventions.

With this goal in mind, our study tested whether several individual and contextual predictors could influence levels of CU traits across time in a justice-involved sample. Although intelligence was related to initial levels of CU traits, it was not associated with changes over time. In contrast, several variables did appear to be important for predicting the level of CU traits over time. Specifically, impulse control and maternal warmth showed consistent negative associations with CU trait across development and self-reported delinquency, neighborhood disorganization, deviant peers showed consistent positive associations across development. Further, the effects of these variables were largely uninfluenced by the effects of the other risk factors and continued to influence levels of CU traits while accounting for the overall declining trajectory.

These findings are consistent with past findings suggesting that the combination of CU traits and antisocial behavior seems to designate a particularly severe and impairing pattern of behavior (Frick et al., 2014b) and support the recent inclusion of CU traits diagnostic classifications for antisocial individuals (American Psychiatric Association, 2013; World Health Organization, 2018). For example, Fontaine et al. (2011) reported that, in a large sample of twins ($N = 9,478$), followed from ages 7 to 12 years, children with chronic high levels of both CU traits and conduct problems showed the most negative outcomes across a wide range of variables studied. However, our findings also suggest that characteristics of the child and his or her social context are related to the level of CU traits across development and could be targeted in interventions that seek to treat a group of adolescents who heretofore have been less responsive to existing treatments for antisocial youth (Frick et al., 2014b; Hawes et al., 2014; Wilkinson et al., 2016). Of particular note is the association of CU traits with maternal warmth across time, supporting developmental research on the importance of warm and responsive parenting for conscience development (Frick et al., 2014a; Kochanska, Murray, & Harlan, 2000) and research supporting the importance of targeting the parent–child relationship as a critical part of interventions for youth with elevated CU traits (Wilkinson et al., 2016). It is important to point out that our analyses indicated that the influence of these factors were consistent across the developmental period observed (see Footnote 1). Thus, from a treatment standpoint, these factors appear to be important influences of CU traits across the developmental period (from ages 13 to 20 years).

A unique finding of our study is that youth who were formally processed for their offenses also showed higher initial levels of CU traits. It appears that youth with higher CU traits are more likely to be formally processed and this held even in this study that by design restricted the range in severity of offenses committed by the youth and even after controlling for the youths' level of self-reported delinquency (Model 4). Thus, it is possible that a reduced level of remorse shown by the youth is evident to juvenile justice decision-makers and this characteristic is considered in making processing decisions (Fine et al., 2017). However, our results did not suggest that either the initial decision or the child's placement in a secure facility was related to changes in CU traits after arrest. Notably, violence exposure was related to CU traits in zero-order correlations (see Table 1) but not significantly related to CU traits when included with other contextual variables. This finding suggests that the effects of violence exposure on CU traits may be explained by other factors in the child's social context (e.g., neighborhood disorganization and deviant peers) that influence the trajectory of CU traits and that may also result in the adolescent experiencing greater exposure to violence. Finally, relative to White non-Latino youth, neither Black nor White Latino show differences in their trajectory of CU traits, although Latino adolescents showed higher rates of CU traits at baseline relative to Black youth but showed a greater decline over time than Black youth.

These results need to be interpreted in light of several study limitations. With the exception of intelligence, all other variables were based on the youth's self-report. Therefore, some of the associations could have been inflated by shared method variance and the generalizability to other methods of report may be limited. Notably, the stability of CU traits may be greater when reported by parents compared to self-report (Muñoz & Frick, 2007; Obradović et al., 2007). Given research supporting the validity of parent-reports of CU traits specifically (Docherty, Boxer, Huesmann, O'Brien, & Bushman, 2017), future research that measures these constructs based multiple sources would be an important advance. Additionally, although the accelerated longitudinal design allows us to test developmental changes over a wider age range using the MGMC approach, it did lead to lower numbers of youth at the younger and older ages. Specifically, and, in contrast to a single-cohort longitudinal design, there have been concerns that the accelerated longitudinal design cannot accurately retrieve the true growth curve given that there is limited coverage in terms of overlap at certain age/time-points (Duncan et al., 1996). However, our findings suggest good fit for a single growth curve based on fit indices, as well as the observed individual growth curves across cohorts (see Figure 2, top panel). Also, our sample was confined to boys who were arrested for the first time for offenses of moderate severity. This design was chosen to study the trajectory of CU traits over the three years following the first arrest and to investigate the potential effects of juvenile justice involvement on the adolescent's level of CU traits following this first contact with the system. However, it means that the results may not generalize to girls in the juvenile justice system or to adolescents who have been arrested for more serious offenses.

Despite these limitations, our results support prior research showing that CU traits are moderately stable but show an overall decline across development. These results suggest that this developmental trajectory of CU traits is similar in justice-involved youth. In addition, our results highlight a number of both individual difference and contextual variables that could be important for predicting which justice-involved adolescents may be at most risk for a chronic trajectory of CU traits. Specifically, impulse control and maternal warmth showed consistent negative associations with CU trait across development and self-reported delinquency, neighborhood disorganization, and deviant peers showed consistent positive association with CU traits across development. Further, the effects of these variables were at least partially independent of each other. Thus, these characteristics of the child and his or her

social context could be targeted in interventions in the juvenile justice system that seek to treat a group of adolescents who heretofore have been less responsive to existing treatments for antisocial youth (Frick et al., 2014b; Hawes et al., 2014; Wilkinson et al., 2016).

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