

Regular Article

Primary and secondary callous–unemotional traits in adolescence are associated with distinct maladaptive and adaptive outcomes in adulthood

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Abstract

While phenotypically indistinguishable with respect to callousness, individuals with primary and secondary callous–unemotional (CU) traits may show different developmental outcomes. This research predominantly comprised cross-sectional studies of male participants with a focus on maladaptive correlates. Thus, the present study examined whether youth with primary and secondary CU traits identified in Grade 7 reported distinct maladaptive outcomes (internalizing, externalizing, and substance use problems; criminal offenses; and sexual and partner experiences) and adaptive outcomes (health and wellbeing, education, and employment) in adulthood at age 25. We also examined sex differences. Participants included the high-risk control and normative samples from the Fast Track project ($N = 754$, male = 58%, Black = 46%). Youth with secondary CU traits reported higher levels of adult internalizing and externalizing psychopathology, a greater number of sexual partners and risky sexual behavior, and a greater number of violent offenses, compared with individuals with primary CU traits and those with low CU and anxiety symptoms. Conversely, youth with primary CU traits and low symptoms had higher wellbeing and happiness scores than those with secondary CU traits. Finally, there was differentiation on outcomes between female primary and secondary CU variants and male primary and secondary CU variants.

Keywords: callous-unemotional traits, callous-unemotional variants, adolescence, adulthood

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Interest in identifying heterogeneous groups among antisocial individuals has increased considerably in recent years, and the construct of callous–unemotional (CU) traits has been one focus of this interest. CU traits are considered to be the affective dysfunction component of psychopathy and reflect characteristics such as deficient affect, empathy, and affiliative capacity (Frick, Ray, Thornton, & Kahn, 2014). With the same sample as the present study, CU traits in early adolescence predicted antisocial and criminal behavior in early adulthood (i.e., 2 years after high school), over and above prior and concurrent conduct problems (McMahon, Witkiewitz, Kotler, & Conduct Problems Prevention Research Group, 2010). Once considered homogeneous, there is now growing recognition of multiple developmental pathways to CU traits – known as *primary* and *secondary variants* – illustrating the developmental equifinality principle that states that a common outcome can develop over time from different starting points (Cicchetti & Rogosch, 1996). Derived from the theoretical work of Karpman (1941), primary CU traits are

thought to be underpinned by genetically based temperamental deficits in fear and emotional responsivity. In contrast, secondary CU traits are theorized to develop from experiences of environmental and social adversity, particularly parental trauma or maltreatment. Specifically, exposure to this trauma places children at risk for emotion dysregulation and hyperarousal (Cicchetti, 2016), which disrupts children's capacity to process negative emotions and derails conscience development (Kimonis, Frick, Munoz, & Aucoin, 2008; Kochanska, Aksan, Knaack, & Rhines, 2004). This inhibition of empathy is then reinforced because it reduces emotional distress, thus serving as a protective mechanism against further adversity (Bennett & Kerig, 2014; Lansford et al., 2006).

The dominant approach for identifying these variant groups has been clustering methods. The indicators tend to include CU traits (or the broader psychopathy construct in adult samples; i.e., interpersonal, affective, and impulsive-lifestyle dimensions) in combination with anxiety symptoms (Craig, Goulter, & Moretti, 2020). Variant groups are then validated against theoretically and empirically relevant variables (e.g., depression, post-traumatic stress symptoms) (Craig & Moretti, 2019; Goulter, Kimonis, Denson, & Begg, 2019; Kimonis, Goulter, Hawes, Wilbur, & Groer, 2016b). Several studies have suggested that primary and secondary CU variants are phenotypically indistinguishable with regard to observable characteristics of uncaring and callousness (e.g., Kimonis, Fanti, Goulter, & Hall 2016a; Kimonis, Frick, Cauffman, Goldweber, & Skeem, 2012a), although

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these variant groups may be distinguishable on a number of important maladaptive constructs (Fanti, Demetriou, & Kimonis, 2013; Kahn et al., 2013). However, the research examining outcomes of primary and secondary CU variants is limited by its focus on stress-related psychopathology and specific antisocial behaviors (e.g., substance use), and there are several additional maladaptive and adaptive outcomes that have yet to be examined.

Additional limitations of the extant research base on CU variants are that it has tended to be cross-sectional in design and although mixed-sex samples have been used, few researchers have examined sex differences. Given theory suggesting that secondary CU traits represent an adaptive developmental process involving emotional numbing in order to cope with experiences of adversity (Karpman, 1941; Porter, 1996), conclusions from cross-sectional CU variant research are developmentally constrained. Of the limited longitudinal research, Fanti and Kimonis (2017) identified CU variants among boys and girls at age 3 years, and at age 15 years primary and secondary CU groups were undifferentiated on externalizing problems but secondary CU variants scored higher than primary CU variants and a low problems group on internalizing symptoms. The authors also found several differences in cognitive and biological indices, but they did not examine sex differences. Other research found that, when controlling for sex, oxytocin methylation at birth and low childhood adversity scores were associated with greater CU traits at age 13 years among primary CU variants, whereas secondary CU variants were exposed to greater stressors during the prenatal period (Cecil et al., 2014). Another study identified stable primary and secondary CU variants from age 7 years through to 15 years among high-risk girls (Goulter, Kimonis, Hawes, Stepp, & Hipwell, 2017). Compared with primary CU variants and a low problems group, secondary CU variants had greater depression and lower self-control at age 7 years and poorer mental health outcomes at age 16 years. These studies, however, are limited to childhood and adolescence, and it is currently unknown whether CU variants identified in adolescence show distinct developmental outcomes in adulthood related to the divergent primary versus secondary processes.

While mixed-sex samples have been examined (e.g., Bennett & Kerig, 2014; Kahn et al., 2013), few studies have investigated sex differences or whether sex moderated the findings. It is important to examine sex differences among CU variants given studies showing that female participants scoring high on psychopathy often fail to show core emotional deficits (e.g., attenuated emotion startle reflex) frequently found in male populations (Justus & Finn, 2007; Vitale, Maccoon, & Newman, 2011). This may be because of the putative contextual origin of psychopathy or CU traits in female versus male samples. Some researchers have suggested that environmental factors may play a greater role in the development of CU traits in females relative to males (Verona & Vitale, 2018). To illustrate, in a large longitudinal sample of twins, Fontaine, Rijdsdijk, McCrory, and Viding (2010) found that shared environmental influences (which may have included an adverse home environment and negative parenting behaviors) predicted stable high trajectories of CU traits among girls compared with boys, for whom they found that higher genetic heritability predicted high trajectories of CU traits. In the CU variant literature, two cross-sectional studies with youth samples did not find sex differences on negative affect between primary and secondary CU variants (Craig & Moretti, 2019; Gill & Stickle, 2016). These studies suggest that differences on affect between primary and secondary CU variants could persist beyond the

effect of sex; however, these studies were cross-sectional in design and may not capture the developmental process of secondary CU traits, which could be particularly important in females relative to males. A greater understanding of the adult phenotypic presentations of primary versus secondary CU traits may inform developmental theory on CU variants, especially when differentiated by sex.

Maladaptive outcomes

Central to theory on the development of secondary CU traits is the experience of early life adversities (e.g., childhood trauma or maltreatment; Craig, Goulter, & McMahan, 2021; Karpman, 1941; Porter, 1996). In the stress literature, adverse experiences have been linked to the development of internalizing and externalizing problems (Obradović, Shaffer, & Masten, 2012), suggesting that secondary CU variants may show higher levels of internalizing symptoms. Quite consistently across studies, male and female youth with secondary CU traits report greater levels of internalizing symptoms (e.g., anxiety, depression, posttraumatic stress) compared with those with primary CU traits (Fanti et al., 2013; Tatar, Cauffman, Kimonis, & Skeem, 2012). The findings on externalizing problems are less consistent, however. To illustrate, justice-involved individuals with secondary CU traits showed higher levels of delinquency and reactive aggression but were indistinguishable from those with primary CU traits on proactive aggression (Kimonis, Skeem, Cauffman, & Dmitrieva, 2011; Vaughn, Edens, Howard, & Smith, 2009). Other researchers have found that high-risk youth with secondary CU traits reported greater symptoms of attention-deficit/hyperactivity disorder (ADHD) than youth with primary CU traits and a low problems group (Craig & Moretti, 2019). Similarly, other research found no significant differences between clinic-referred CU variants on aggression and externalizing behavior, but greater psychopathology associated with dysregulation (e.g., ADHD symptoms) among those with secondary CU traits compared to primary CU traits (Kahn et al., 2013). Thus, although secondary CU variants are characterized by internalizing problems, both CU variants also may be associated with externalizing problems, with secondary CU variants showing greater reactive externalizing problems due to their underlying dysregulation.

Some researchers have theorized that secondary CU variants may show greater involvement in substance use than primary CU variants, especially depressant substances (e.g., alcohol) to relax the central nervous system and emotional hyperactivity linked with these traits (Kimonis, Tatar, Joseph, & Cauffman, 2012b; Waller & Hicks, 2019). Furthermore, co-occurring substance use, particularly alcohol use pathology, has been found to be more prominent among youth with secondary CU traits, compared with those with primary CU traits (Kimonis et al., 2012b; Vaughn et al., 2009). However, other research has found no differences between groups differentiated on median splits of CU traits and anxiety (Cecil, McCrory, Barker, Guiney, & Viding, 2018). In the research outlined thus far, what is unclear is whether these differences in internalizing and externalizing problems are simply co-occurring psychopathologies, or whether youth with secondary CU traits are at a higher risk of developing these types of problems later in life compared to youth with primary CU traits.

CU traits characterize those youth at risk for more severe antisocial behavior (Frick et al., 2014; McMahan et al., 2010); however, whether the type of criminal behavior differs among youth with primary versus secondary CU traits is still unclear. The

majority of studies examining criminal offending between variants comprise adult samples and use the broader psychopathy construct in the clustering approach. Several have found that both community-based and justice-involved males with primary psychopathic traits had higher rates of violent offenses compared with males with secondary psychopathic traits and low problems groups (Drislane *et al.*, 2014; Swogger & Kosson, 2007). Among studies with youth participants, only one (to our knowledge) has examined criminal offending (Vaughn *et al.*, 2009). The authors found, in contrast to studies with adults, that youth with secondary traits scored higher than those with primary traits on violent and property offending. Some research has found that the affective dimension of psychopathy (i.e., CU traits) is associated with violent criminality, whereas other research has found that it is the impulsivity dimension – often more strongly linked with secondary CU traits – that predicts violent and nonviolent recidivism (Goulter, Kimonis, & Heller, 2018). Thus, discrepant findings in the research on adults and youth may be due to whether the complete psychopathy construct or just the affective dimension are used as indicators in the clustering method. Finally, to our knowledge, no research has examined whether primary and secondary CU variants are distinguished on risky sexual behavior and intimate partner violence – two outcomes strongly linked with experiences of early life adversity (Homma, Wang, Saewyc, & Kishor, 2012; Millett, Kohl, Jonson-Reid, Drake, & Petra, 2013). However, one study with groups differentiated on median splits of CU traits and anxiety found that youth with high CU traits and anxiety had more unsafe sex than youth with high CU traits only (Cecil *et al.*, 2018).

Adaptive outcomes

Early life adversity has been associated with dysregulation of biological systems and associated stress-related poor physical health outcomes in the long term (Felitti *et al.*, 1998; Norman *et al.*, 2012). Over time, the process of allostasis (i.e., the biological response to stressors to regain homeostasis) creates strain on organs and modifies metabolic hormones (e.g., insulin, glucose), known as allostatic load (McEwen, 1998). Thus, it would stand to reason that individuals with secondary CU traits would show poorer physical health in adulthood related to their histories of trauma and deprivation, compared to individuals with primary CU traits. One study found that, compared with undergraduates with secondary CU traits, undergraduates with primary CU traits scored higher on a measure of positive affect that assessed features such as being active, alert, attentive, enthusiastic, proud, and strong (Falkenbach, Stern, & Creevy, 2014). However, no research to date has examined health and wellbeing among primary and secondary CU variants longitudinally from adolescence to adulthood.

In the broader psychopathy literature, the concept of successful psychopathy has been proposed to explain why some individuals with core interpersonal and affective features avoid antisocial behavior and, instead, serve in “successful” professions and prove valuable to society (Benning, Venables, & Hall, 2018; Gao & Raine, 2010; Lykken, 1995). This concept has focused on adult samples and it is currently unclear which adult outcomes relate to youth CU traits. Further, the vast majority of research has examined the full psychopathy construct in the context of criminal or maladjusted samples; however, these findings may not translate to community or noncriminal populations and there may be adaptive outcomes associated with CU traits. For example, research has found that some psychopathic traits

(e.g., narcissism) are linked with greater education and employment opportunities (Smith & Lilienfeld, 2013). In addition, in the aforementioned longitudinal study, Fanti and Kimonis (2017) found that children with primary CU traits scored higher on cognitive and academic achievement compared with their secondary CU counterparts. However, most research on primary and secondary CU variants has focused on maladaptive outcomes and has failed to examine whether those with primary CU traits show greater adaptive functioning compared to individuals with secondary CU traits.

The Present Study

While appearing similar with reference to their callous disregard of others, primary and secondary CU variants may be associated with different outcomes related to their distinct etiologies. The present work is the second study in a series of two studies. Our first study examined the role of early (i.e., kindergarten to Grade 2) individual (i.e., emotion regulation and prosocial behavior) and environmental (i.e., harsh parenting and parental warmth) factors for predicting primary and secondary CU traits in adolescence (Craig *et al.*, 2021).¹ This study found that high levels of emotion regulation and prosocial behavior earlier in childhood predicted primary CU traits, while low levels of emotion regulation and low maternal warmth predicted secondary CU traits. Although harsh parenting was not associated with secondary CU traits, there is evidence that low parental warmth is critically involved in the development of CU traits (Pasalich, Dadds, Hawes, & Brennan, 2011). Parental warmth is important in conscience development (Kochanska, 1997), and it has been proposed that the affective quality of the parent–child relationship is related to the development of secondary CU traits (Larstone, Craig, & Moretti, 2018).

No research has examined CU variants identified in adolescence and outcomes in adulthood. Thus, in this second study we aimed to extend our previous study by determining whether primary and secondary CU traits in adolescence are associated with distinct maladaptive and adaptive outcomes in adulthood. Using the same clustering method as our first study, we identified primary and secondary CU variants with CU traits from the Antisocial Process Screening Device (APSD) (Frick & Hare, 2001) and anxiety from the Child Behavior Checklist (CBCL) (Achenbach, 1991) in Grade 7. This approach is in line with other studies in the field; in a recent systematic review (Craig *et al.*, 2020) examining CU variants in youth samples ($k = 41$), the majority of studies used mixture models or clustering methods ($k = 28$), and several cluster-based studies included two indicators (e.g., Docherty, Boxer, Huesmann, O’Brien, & Bushman, 2016; Euler *et al.*, 2015; Meehan, Maughan, Cecil, & Barker, 2017). We then validated identified primary and secondary CU variants against theoretically relevant variables, also in Grade 7, and hypothesized that secondary CU variants would score higher than primary CU variants on internalizing (withdrawn, somatic complaints) problems. Next, we examined whether primary and secondary CU variants were associated with distinct maladaptive and adaptive outcomes in adulthood (at age 25 years). We focused on seven domains indexing adult functioning previously

¹Slight discrepancies in grouping and validating findings between the present study and our other study examining predictors of primary and secondary CU variants (Craig *et al.*, 2021) are due to distinct analytic approaches (e.g., multiple imputation vs. full information maximum likelihood).

employed by Dodge et al. (2015). Specifically, we examined internalizing scores and symptoms in the clinical range (anxiety, depression, avoidant personality, somatic complaints) and externalizing scores and symptoms in the clinical range (antisocial personality disorder [ASPD], ADHD), substance use (alcohol, cannabis, other substances) problems, criminal offenses (substance, violent, property), sexual and partner experiences, health and wellbeing, and education and employment. Compared to those with primary CU traits and low CU and anxiety symptoms, it was hypothesized that youth with secondary CU traits would show greater adult maladaptive outcomes, including greater symptoms of internalizing and externalizing problems, higher rates of substance use, higher rates of nonviolent and violent criminality, and greater risky sexual behavior and intimate partner violence. It was hypothesized that youth with primary CU traits and the low symptoms group would show more positive adult adaptive outcomes, including higher health and wellbeing scores, and they would be more likely to be educated and/or employed, compared to those with secondary CU traits. Finally, we also examined sex differences. Given no research has examined sex differences among CU variants longitudinally, we had no a priori directional hypotheses for this aim.

Method

Participants and procedure

The Fast Track project is a longitudinal, multisite (Durham, North Carolina; Nashville, Tennessee; Seattle, Washington; and rural Pennsylvania) investigation of the development and prevention of child conduct problems (Conduct Problems Prevention Research Group, 2019). In 1991–1993, 9,594 kindergarteners across three cohorts were screened for classroom conduct problems by teachers using the Teacher Observation of Classroom Adaptation-Revised Authority Acceptance Score (Werthamer-Larsson, Kellam, & Wheeler, 1991). A subset were screened for home behavior problems by parents using a 22-item instrument based on the CBCL (Achenbach, 1991). The teacher and parent screening scores were standardized within site and summed to yield a total severity-of-risk screen score. Children were selected for inclusion into the high-risk sample based on this screen score, moving from the highest score downward until desired sample sizes were reached within sites, cohorts, and groups. The outcome was that 891 children (control = 446, intervention = 445) participated. In addition to the high-risk sample of 891, a stratified normative sample of 387 children was identified to represent the population normative range of risk scores and this sample was followed over time. The present study used data from the high-risk control (65% male; 44% Black, 51% White, 5% other race) and normative (51% male; 42% Black, 51% White, 7% other race) samples; the intervention sample was not included in the present analyses. 79 of the participants recruited for the high-risk control group were included as part of the normative sample; thus, the total final sample included 754 participants. Legal guardians provided consent and the participants assented to procedures. Parents were compensated with \$75 for completing each of the summer interviews and teachers were compensated \$10/child each year for completing classroom measures. At the age 25 assessment, condition-blinded adults were trained to interview participants in person or via telephone. Participants were paid \$100 for the interview. Each participant was invited to nominate a peer (e.g., spouse or friend) for an independent interview

about the respondent. All procedures were approved by the institutional review boards of participating universities.

Measures

The present study included data collected from the following periods: covariates in kindergarten, clustering and validating variables in Grade 7, and adult outcomes at age 25 years.

Covariates (kindergarten)

Covariates measured in kindergarten included the initial risk screen scores summed from standardized teacher and parent screening scores ($M = 1.01$, $SD = 1.64$, range = -3 to 5), sex (male = 58%), socioeconomic status ($M = 25.66$, $SD = 12.90$; Hollingshead, 1975), and race/urban status (urban Black = 45.5%, urban White = 24.5%, rural White = 25.5%). The race/urban status variable was created to account for the multisite sampling of the Fast Track project that resulted in almost all Black participants living in urban areas.

Clustering variables (Grade 7)

CU traits. CU traits were measured with parent report on the APSD (Frick & Hare, 2001). The APSD is a 20-item measure that assesses CU traits, narcissism, and impulse control/conduct problems on a 3-point scale (0 = *not at all true*, 1 = *sometimes true*, 2 = *definitely true*). The six-item CU traits subscale (e.g., “is concerned about the feelings of others,” reverse scored) was also used in the present study and demonstrated acceptable internal consistency ($\alpha = .66$).

Anxiety symptoms. Anxiety symptoms were assessed with raw scores from the anxious/depressed problems narrow-band scale from the CBCL (Achenbach, 1991). The CBCL comprises 112 items that differentiate clinically-referred from non-referred children. Items are scored on a 3-point scale (0 = *not true*, 1 = *somewhat or sometimes true*, 2 = *very or often true*). Internal consistency was good for this scale ($\alpha = .85$).

Validating variables (Grade 7)

Psychopathology. Raw scores from the narrow-band scales of the CBCL (Achenbach, 1991) were included as validating variables, including withdrawn problems and somatic complaints (internalizing), and delinquent and aggressive behavior (externalizing). Internal consistency was acceptable to good for these subscales ($\alpha = .76-.91$).

Parent-child conflict. Parent-child conflict, including physical and verbal aggression, as assessed with the Conflict Tactics Scale (Straus, 1979) were also included as validating variables. This parent-report measure assesses how the parent reacts in conflict with the child, such as yelling at or insulting the child, and hitting or trying to hit the child. Items are rated on a 7-point scale ranging from 0 = *never* to 6 = *almost every day*. Internal consistency was acceptable for these subscales ($\alpha = .65-.76$).

Adult outcomes (age 25 years)

Psychopathology. Self- and peer reports of internalizing and externalizing problems were assessed with *T* scores from the 132-item Adult Self-Report and Adult Behavior Checklist-Friend (Achenbach, 1997). The externalizing broad-band scale is composed of items from the delinquent and aggressive behavior problem narrow-band scales; the internalizing broad-band scale

comprises items from the anxious/depressed, withdrawn, and somatic problem narrow-band scales. Items are scored on a 3-point scale (0 = *not true*, 1 = *somewhat or sometimes true*, 2 = *very or often true*). Internal consistency was excellent for the broad-band externalizing ($\alpha = .95$) and internalizing ($\alpha = .95$) scales. These measures also assessed psychiatric symptoms for anxiety, depression, avoidant personality, somatic problems, ASPD, and ADHD. Indicators were scored (1 = *yes*, 0 = *no*) using DSM-IV (*Diagnostic and Statistical Manual of Mental Disorders*, fourth edition) criteria. Across disorders, internal consistency was good ($\alpha = .77-.90$).

Substance use. Self- and peer reports of substance use were assessed with the 57-item Tobacco, Alcohol, and Drugs Survey – Version 3 adapted from the National Longitudinal Study of Adolescent Health (Bureau of Labor Statistics, 2002). The present study included three dichotomous indicators – binge drinking (defined as five or more drinks on one or more occasion in the last month and five or more drinks on 12 or more occasions in the last year), heavy cannabis use (defined as 27 or more days of use in the past month), and other substance use (defined as use of cocaine, crack, inhalants, heroin, LSD, phencyclidine, ecstasy, mushrooms, speed, or other pills not prescribed by a physician in the past month). Internal consistency was marginal to acceptable for these subscales ($\alpha = .53-.65$). In addition, a substance use problem indicator was created from the alcohol and drug module of the National Institute of Mental Health Diagnostic Interview Schedule (Robins, Helzer, Croughan, & Ratcliff, 1981). This was scored 1 if any of the substance use problems were met, or 0 otherwise.

Any problem. An “any problem” indicator was created, scored as 1 if criteria for any of the following problems were present, or 0 otherwise: anxiety, depression, avoidant personality, somatic problems, ASPD, ADHD, alcohol misuse, binge drinking, heavy cannabis use, or other substance use.

Sexual behavior. The 37-item Overview of Sexual Experiences (Capaldi, Stoolmiller, Clark, & Owen, 2002) assessed self-reported risky sexual behavior. Participants reported the number of lifetime partners on a 7-point scale (0 = 0, 1 = 1–2, 2 = 3–5, 3 = 6–10, 4 = 11–15, 5 = 16–20, 6 = 21–50, 7 = 50+). We are not suggesting that a greater number of sexual partners is maladaptive, but rather a greater number of sexual partners increases risk for certain health problems that can be maladaptive. In addition, a risky sexual behavior score was created by multiplying the number of partners in the past 12 months with a sum of two scales: new-partner condom non-use (0 = *no new partner*, 1 = *always use condom*, 2 = *most times use condom*, 3 = *about half time use condom*, 4 = *sometimes non-use*, 5 = *never use*) and regular-partner condom non-use (1 = *always use condom*, 2 = *most times use condom*, 3 = *about half time use condom*, 4 = *sometimes non-use*, 5 = *never use*).

Partner violence. Self- and peer reports of partner violence were measured with the self-report 47-item General Violence Questionnaire (Holtzworth-Munroe, Rehman, & Herron, 2000). Violent acts (i.e., threatened with a knife or gun; pushed, shoved, grabbed, slapped, or threw something; punched, hit, kicked, bit, or slammed against a wall; beat up or choked, strangled, burned, or scalded on purpose; or used a knife or gun) over the past 12 months perpetrated by participants towards romantic partners

were summed. In this sample, 502 participants reported having a romantic partner in the past 12 months. Internal consistency was acceptable ($\alpha = .75$).

Criminal offenses. Court records were supplemented using a national database (based on full name, birthdate, and social security number) that included all arrests, adjudications, diversions, and magistrate appearances. We limited offenses to convictions and diversions of violent, substance, and property or public order crime. Severity-weighted indices were created by multiplying frequencies with severity across all lifetime convictions (Conduct Problems Prevention Research Group, 2010). For violent crimes, severity levels ranged from 1 to 3 (severity 3 included aggravated/armed robbery, murder, rape, kidnapping, sex offenses, and first-degree assault; severity 2 included robbery and first-degree burglary; severity 1 included driving under the influence and carrying a concealed weapon). Severity levels for substance crimes ranged from 1 to 2 (severity 2 included manufacturing and possession with intent to sell; severity 1 included possession). Severity levels for property/public order crimes ranged from 1 to 3 (severity 3 included breaking and entering, identity theft, forgery, failure to register as a sex offender, and prostitution; severity 2 included possession of stolen property, vandalism, disorderly conduct, violation of protection order or contempt; severity 1 included loitering, littering, and public consumption).

Wellbeing and health. The 36-item Short-Form Health Survey (Ware & Sherbourne, 1992) was used to create a general health index that comprised a mean score across items, capturing overall health status, the presence of chronic conditions, magnitude of bodily pain, and the presence of physical health issues for self- and peer report. Self- and peer report on the Adult Self-Report were also used to compute personal strength and happiness scores. Internal consistency was acceptable to good for these subscales ($\alpha = .68-.88$). Using these scores and the general health index, an additional overall wellbeing score was created by averaging across the scores.

Education and employment. Two dichotomous scores indicating whether (a) the participant had graduated from high school and (b) was currently employed full-time or enrolled in higher education were created from the National Longitudinal Survey (Howe & Frazis, 1992).

Data analyses

Missing data were estimated using multiple imputation (Newgard & Haukoos, 2007). In line with past research in the field (Craig et al., 2020), a two-step clustering procedure was used to identify CU variant groups based on CU traits and anxiety.² This method was selected to avoid the arbitrariness of *k*-means or hierarchical clustering in isolation, and because no a priori allocation of the number of clusters is required (Everitt, Landau, Leese, & Stahl, 2011). In addition, studies comparing statistical approaches have

²To identify CU variants, we also used latent profile analyses with items from the APSD CU subscale and the CBCL anxious/depressed narrow-band subscale. An optimal three-class solution was identified, representing a high CU and low anxiety group (primary CU variant), a high CU and high anxiety group (secondary CU group), and a low CU and low anxiety group (low group). When we examined whether these three classes were distinguished on our grouping and validating variables, all findings remained consistent (with the exception that there was no significant difference between primary and secondary CU variants on physical aggression).

identified the two-step approach as one of the most reliable methods to identify subgroups with high generalizability across diverse samples (e.g., Benassi et al., 2020; Gelbard, Goldman, & Spiegler, 2007; Kent, Jensen, & Kongsted, 2014). In the first step of the two-step procedure, the formation of pre-clusters is established using a distance measure. In the second step, the standard hierarchical clustering algorithm is used on the pre-clusters. This is a probabilistic approach that provides a range of solutions, which are then reduced to the optimal number of clusters on the basis of the Bayesian information criterion (BIC) or the Akaike information criterion (AIC). Next, differences between clusters on grouping, validating, and outcome variables were examined using one-way analysis of covariance for continuous variables and binary logistic regression for dichotomous variables.³ Covariates (initial risk screen, sex, socioeconomic status, urban/rural status, and race) were included in these analyses. We repeated analyses separately for sex.⁴

Results

Grouping and validating variables

The two-cluster solution had a BIC change score of -309.58 , an AIC change score of -328.07 , and a ratio of distance measure of 1.78. The three-cluster solution had a BIC change score of -162.56 , an AIC change score of -181.05 , and a ratio of distance measure of 2.92. The four-cluster solution had a BIC change score of -38.25 , an AIC change score of -56.74 , and a ratio of distance measure of 1.03. Thus, the clustering analysis identified an optimal three-group solution: a high CU and low anxiety group (primary CU variant, $n = 282$; high-risk, $n = 135$, normative, $n = 147$; male, $n = 187$, female, $n = 95$), a high CU and high anxiety group (secondary CU group, $n = 142$; high-risk, $n = 93$, normative, $n = 49$; male, $n = 84$, female, $n = 58$), and a low CU and low anxiety group (low group, $n = 328$; high-risk, $n = 137$, normative, $n = 191$; male, $n = 165$, female, $n = 163$).

As shown in Table 1, primary and secondary CU variants did not differ on the level of CU traits, but they scored higher than the low group. Conversely, primary CU variants and the low group did not differ on anxiety, but they scored lower than secondary CU variants. With regard to the validating variables, secondary CU variants scored higher than primary CU variants and the low group on withdrawn problems, somatic complaints, and physical aggression. Finally, all groups differed from each other on delinquency, aggression, and verbal aggression, with secondary CU variants scoring the highest, followed by primary CU variants, and then the low group. The findings remained mostly consistent when examining males and females separately (see Table 2).

Outcome variables

Maladaptive outcomes

As shown in Table 3, compared with primary CU variants and the low group, secondary CU variants scored higher on levels of internalizing and externalizing psychopathology. In addition, compared to primary CU variants and the low group, secondary CU variants were also more likely to endorse our “any problem”

variable, and clinical levels of anxiety, depression, avoidant personality, somatic problems, ASPD, and ADHD symptoms. Secondary CU variants also reported a greater number of sexual partners and risky sexual behavior compared with primary CU variants and the low group, and greater intimate partner violence compared with the low group. Finally, although both primary and secondary CU variants scored higher than the low group on property crime, secondary CU variants scored higher than both primary CU variants and the low group on violent crime. Groups did not differ on clinical levels of substance use or substance crime.

Adaptive outcomes

With regard to adaptive outcomes, primary CU variants and the low CU group had higher overall wellbeing and happiness scores than secondary CU variants. The low group scored higher on strength, and was more likely to have graduated high school and be employed or in higher education, than both primary and secondary CU variants. Primary CU variants were more likely to be employed or in higher education than secondary CU variants. Groups did not differ on the general health index.

Sex differences

Maladaptive outcomes

As shown in Table 4, male and female secondary CU variants scored higher on levels of internalizing symptoms, and were more likely to show clinical levels of depression and somatic problems compared with their primary CU and low counterparts. Compared with female primary CU variants and the low group, female secondary CU variants were more likely to endorse “any problem” and clinical levels of avoidant personality symptoms; groups did not differ on these variables in the male sample. Compared with male primary CU variants and the low group, male secondary CU variants were more likely to show clinical levels of anxiety; groups did not differ on anxiety in the female sample. With regard to externalizing problems, male primary and secondary CU variants did not differ from each other, but female secondary CU variants scored higher than female primary CU variants and the low group. Whereas male primary and secondary CU variants did not differ on ASPD symptoms, female secondary CU variants were more likely to show ASPD symptoms than female primary CU variants and the low group. Finally, male secondary CU variants were more likely to show clinical levels of ADHD symptoms than male primary CU variants; and female secondary CU variants were more likely to show ADHD symptoms, compared with both female primary CU traits and the low group. Female secondary CU variants scored higher than the low group on other substance use. There were no other group differences for the male and female samples on substance use.

Male and female primary and secondary CU variants did not differ on number of sexual partners, but male and female secondary CU variants scored higher than their low symptom counterparts. This finding was consistent for males and risky sexual behavior; however, for the female sample, secondary CU variants scored higher than primary CU variants and the low group. Female primary and secondary CU variants did not differ on intimate partner violence, but female secondary CU variants scored higher than the low group. Whereas male secondary CU variants scored higher than both male primary CU variants and the low group on violent crime, there were no significant differences for the female sample. Finally, male primary and secondary CU

³Given multiple comparisons, we applied a Bonferroni corrected alpha of 0.002. Findings remained the same, with the exception of intimate partner violence and violent crime; for those variables, there were no longer significant differences between groups.

⁴Because our aim regarding sex differences was exploratory, we did not apply a Bonferroni correction to these analyses.

Table 1. Comparison of CU variants and low CU on grouping and validating variables

Variable	Primary CU	Secondary CU	Low CU	F	df	p
	M (SD)	M (SD)	M (SD)			
<i>Grouping variables</i>						
CU traits	.85 (.20) [5.25 (1.24)] _a	.90 (.28) [5.41 (1.69)] _a	.32 (.19) [1.70 (1.10)] _b	461.56	2, 707	<.001
Anxiety	1.94 (1.58) _a	8.91 (3.66) _b	2.36 (2.01) _a	434.26	2, 707	<.001
<i>Validating variables</i>						
Withdrawn problems	1.71 (1.51) _a	5.00 (2.91) _b	1.50 (1.56) _a	157.41	2, 707	<.001
Somatic complaints	.93 (1.35) _a	2.16 (2.48) _b	.91 (1.36) _a	28.65	2, 707	<.001
Delinquency	2.80 (2.28) _a	6.07 (3.89) _b	1.41 (1.46) _c	129.01	2, 707	<.001
Aggression	8.44 (5.23) _a	16.95 (7.11) _b	5.81 (4.13) _c	164.95	2, 707	<.001
Physical aggression	.28 (.48) _a	.42 (.66) _b	.15 (.33) _a	8.73	2, 707	<.001
Verbal aggression	1.22 (.87) _a	1.75 (1.07) _b	.89 (.76) _c	23.83	2, 707	<.001

Note: CU = callous-unemotional. [] = sum scores. Subscripts indicate significant differences between groups (i.e., different subscripts indicating significant differences).

variants scored higher than the low group on property crime, and there were no significant differences for the female sample.

Adaptive outcomes

Male and female primary CU variants and the low CU group had higher overall wellbeing and happiness scores compared with their secondary CU counterparts. Male and female groups did not differ on general health index scores. Males and females in the low group scored higher than their secondary CU counterparts on strength. Males and females in the low group were more likely to have graduated high school than both primary and secondary CU variants. Finally, males in the low group were more likely to be employed or in higher education than male primary and secondary CU variants, and females in the low group were more likely to be employed or in higher education than male secondary CU variants.

Discussion

The purpose of this study was to inform current developmental understanding of the phenotypic presentations of primary versus secondary CU variants. Almost all prior research on CU variants has used cross-sectional study designs and, although mixed-sex samples have been used, few studies have examined sex differences. This prospective longitudinal study found that individuals with primary and secondary CU traits identified in Grade 7, and validated against several theoretically relevant constructs in Grade 7, predicted distinct maladaptive and adaptive outcomes more than 10 years later at age 25. It is important to note that primary and secondary CU variants did not differ on level of CU traits, but they scored higher than the low CU and anxiety symptoms group. Furthermore, primary CU variants and the low group did not differ on anxiety, but they scored lower than secondary CU variants. These findings provide support for the identification of CU variants in the present sample and they are in line with past research (Kimonis et al., 2012a, 2016a).⁵ While some studies on CU

variants have also identified an anxiety-only group, these studies are often composed of clinical or self-reporting samples (e.g., Fanti et al., 2013; Kahn et al., 2013). In the present study, our sample was characterized as a high-risk community sample and parents reported on CU traits and anxiety symptoms. Many other studies on CU variants also do not identify an anxiety-only group (e.g., Euler et al., 2015; Fanti & Kimonis, 2017; Gill & Stickle, 2016), and these differences support the need for further research on CU variants across diverse samples.

With regard to adult outcomes, we found that, compared with individuals with primary CU traits and those with low symptoms, individuals with secondary CU traits reported greater adult internalizing and externalizing problems, a greater number of sexual partners and risky sexual behavior, and greater involvement in violent crime. Conversely, individuals with primary CU traits and low symptoms had greater wellbeing and happiness than those individuals with secondary CU traits, and those with low symptoms were more likely to have graduated high school and be employed or in higher education, compared with both primary and secondary CU variants. Primary CU variants were more likely to be employed or in higher education than secondary CU variants. We also found several differences across the male and female samples, which we discuss further below.

Maladaptive outcomes

Secondary CU variants scored significantly higher on Grade 7 withdrawn problems and somatic complaints validating variables, and were more likely to endorse clinical levels of anxiety and depression, compared with primary CU variants and the low

narrow-band scale ($Mdn = 2.70$) in Grade 7 were associated with distinct adult outcomes. In comparison with primary and secondary CU variants, these low and high anxiety groups did not significantly differ on adult clinical levels of avoidant personality symptoms, number of sexual partners, and risky sexual behavior. Conversely, although primary and secondary CU variants did not show significant differences, our low and high anxiety groups did significantly differ on strength. Given that the low and high anxiety groups did not significantly differ from each other on several maladaptive indices, we believe that these findings support the classification and examination of CU variants representing theoretically and clinically meaningful groups over and above classification on anxiety alone.

⁵To determine whether adult outcomes may be accounted for by anxiety alone, we also examined whether groups based on a median split of the CBCL anxious/depressed

Table 2. Comparison between male and female CU variants and low CU on grouping and validating variables

Variable	Primary CU	Secondary CU	Low CU	F	df	p
	M (SD)	M (SD)	M (SD)			
<i>Grouping variables</i>						
CU traits						
Male	.85 (.19) [5.24 (1.17)] _a	.92 (.28) [5.53 (1.66)] _a	.33 (.19) [1.72 (1.13)] _b	268.16	2, 406	<.001
Female	.84 (.22) [5.27 (1.39)] _a	.87 (.28) [5.24 (1.74)] _a	.31 (.18) [1.68 (1.09)] _b	190.75	2, 295	<.001
Anxiety						
Male	1.95 (1.54) _a	9.15 (4.03) _b	2.42 (1.88) _a	269.64	2, 406	<.001
Female	1.94 (1.65) _a	8.55 (3.02) _b	2.30 (2.13) _a	158.89	2, 295	<.001
<i>Validating variables</i>						
Withdrawn problems						
Male	1.71 (1.47) _a	5.17 (3.05) _b	1.51 (1.50) _a	106.68	2, 406	<.001
Female	1.71 (1.58) _a	4.76 (2.70) _b	1.49 (1.61) _a	48.59	2, 295	<.001
Somatic complaints						
Male	.92 (1.41) _a	2.17 (2.61) _b	.80 (1.08) _a	19.49	2, 406	<.001
Female	.95 (1.23) _a	2.14 (2.28) _b	1.03 (1.58) _a	9.66	2, 295	<.001
Delinquency						
Male	3.16 (2.40) _a	6.73 (4.31) _b	1.80 (1.64) _c	71.16	2, 406	<.001
Female	2.11 (1.86) _a	5.08 (2.91) _b	1.03 (1.10) _c	65.55	2, 295	<.001
Aggression						
Male	9.00 (5.26) _a	17.91 (7.54) _b	6.54 (4.14) _c	99.13	2, 406	<.001
Female	7.36 (5.02) _a	15.52 (6.22) _b	5.09 (4.01) _c	65.18	2, 295	<.001
Physical aggression						
Male	.27 (.46) _{ab}	.37 (.57) _a	.15 (.29) _b	4.52	2, 406	.011
Female	.29 (.51) _{ab}	.50 (.78) _a	.15 (.37) _b	3.85	2, 295	.022
Verbal aggression						
Male	1.22 (.85) _a	1.67 (1.09) _b	.94 (.72) _a	11.27	2, 406	<.001
Female	1.22 (.91) _a	1.86 (1.03) _b	.85 (.79) _a	12.45	2, 295	<.001

Note: CU = callous-unemotional. [] = sum scores. Subscripts indicate significant differences between groups (i.e., different subscripts indicating significant differences).

group. These findings support past cross-sectional studies (Fanti et al., 2013; Tatar et al., 2012), and we extend this research by showing that these associations are established over 10 years later. Compared with primary CU variants and the low group, secondary CU variants also showed a greater probability of endorsing adult avoidant personality clinical-range symptoms. Avoidant personality disorder (i.e., feelings of inadequacy and hypersensitivity to negative evaluation in social situations) (American Psychiatric Association, 2013) has not been examined previously with regard to CU variants, but our finding is perhaps not surprising given the link between avoidant symptoms and experiences of early life stress (Taillieu, Brownridge, Sareen, & Afifi, 2016).

In the externalizing domain, secondary CU variants scored significantly higher on Grade 7 delinquent and aggression validating variables and adult externalizing symptoms, compared with primary CU variants and the low group. As noted earlier, the research on externalizing problems among primary versus secondary CU variants is equivocal and the divergent findings may

be due to the level of emotionality associated with specific problems (e.g., proactive vs. reactive aggression) (Kahn et al., 2013; Kimonis et al., 2011; Vaughn et al., 2009). In other words, secondary CU variants may be more reactively aggressive than primary CU variants, who may be more instrumental in their aggressive behavior. It would be important for future research to further explore functions (i.e., reactive vs. proactive/instrumental) and forms (i.e., physical vs. psychological) of aggression among CU variants. Secondary CU variants were also more likely to endorse adult ASPD and ADHD clinical-range symptoms than primary CU variants and the low group. Similar to avoidant personality symptoms, ASPD symptoms have also been linked to experiences of early life stress and poor parenting behaviors (Taillieu et al., 2016). In addition, experiences of stress are associated with emotion dysregulation, which may have contributed to secondary CU variants endorsing greater adult ADHD clinical-range symptoms, compared with primary CU variants. ADHD is characterized by emotion dysregulation and reward dominance, and CU traits are also typified by reward dominance (Frick, Kimonis,

Table 3. Comparisons between CU variants and low CU on outcome variables

Variable	Primary CU	Secondary CU	Low CU	F/χ^2	df	p
	M (SD)	M (SD)	M (SD)			
<i>Psychopathology</i>						
Any problem	.69 (.46) _a	.83 (.38) _b	.61 (.49) _a	43.41	7	<.001
Internalizing	56.48 (7.35) _a	63.04 (11.75) _b	54.61 (8.78) _a	29.58	2, 707	<.001
Anxiety	.06 (.24) _a	.18 (.38) _b	.05 (.22) _a	24.99	7	.001
Depression	.07 (.26) _a	.30 (.46) _b	.07 (.26) _a	51.93	7	<.001
Avoidant personality	.05 (.22) _a	.22 (.41) _b	.06 (.24) _a	25.21	7	.001
Somatic problems	.11 (.32) _a	.32 (.47) _b	.11 (.31) _a	51.80	7	<.001
Externalizing	56.58 (7.89) _a	61.08 (9.54) _b	53.88 (7.29) _a	20.67	2, 707	<.001
ASPD	.15 (.35) _a	.29 (.45) _b	.09 (.28) _a	68.46	7	<.001
ADHD	.05 (.22) _a	.25 (.43) _b	.07 (.26) _a	54.86	7	<.001
<i>Substance use</i>						
Any substance problem	.50 (.50) _a	.51 (.50) _a	.46 (.50) _a	26.46	7	<.001
Alcohol misuse	.32 (.47) _a	.32 (.47) _a	.29 (.46) _a	13.78	7	.055
Binge drinking	.23 (.42) _a	.25 (.43) _a	.23 (.42) _a	41.46	7	<.001
Heavy cannabis use	.08 (.27)	.11 (.31)	.07 (.26)	9.01	7	.251
Other substance use	.12 (.33) _a	.15 (.36) _a	.12 (.33) _a	15.65	7	.029
<i>Sexual and partner experiences</i>						
Number of sexual partners	3.47 (1.71) _a	3.88 (1.89) _b	2.90 (1.58) _c	10.92	2, 707	<.001
Risky sexual behavior	10.63 (18.71) _a	18.55 (37.49) _b	7.75 (10.56) _a	7.65	2, 707	.001
Intimate partner violence	.96 (1.64) _{ab}	1.17 (1.89) _a	.56 (1.42) _b	4.63	2, 707	.010
<i>Criminal offenses</i>						
Substance crime	.58 (1.69)	.68 (1.56)	.31 (1.04)	.36	2, 707	.695
Violent crime	1.24 (3.63) _a	2.01 (4.44) _b	.53 (1.89) _a	5.24	2, 707	.006
Property crime	2.65 (4.95) _a	3.26 (6.27) _a	.82 (2.28) _b	8.86	2, 707	<.001
<i>Adaptive outcomes</i>						
Overall wellbeing	13.89 (1.63) _a	12.53 (2.63) _b	14.19 (1.84) _a	23.09	2, 707	<.001
General health index	.82 (.20)	.93 (1.83)	.81 (.18)	1.59	2, 707	.205
Happiness	23.69 (3.44) _a	20.33 (5.51) _b	23.95 (3.92) _a	29.61	2, 707	<.001
Strength	17.17 (2.34) _a	16.33 (2.74) _a	17.82 (2.55) _b	8.58	2, 707	<.001
Graduated high school	.77 (.42) _a	.68 (.47) _a	.94 (.25) _b	98.91	7	<.001
Employed or higher education	.52 (.50) _a	.36 (.48) _b	.70 (.46) _c	89.07	7	<.001

Note: CU = callous-unemotional, ASPD = antisocial personality disorder, ADHD = attention-deficit/hyperactivity disorder. Subscripts indicate significant differences between groups (i.e., different subscripts indicating significant differences).

Dandreux, & Farell, 2003). The present findings add to preliminary evidence linking dysregulated ADHD symptoms to secondary CU traits (Craig & Moretti, 2019; Kahn et al., 2013).

Although secondary CU variants had a greater number of violent offenses relative to primary CU variants and the low group, primary and secondary CU variants were undifferentiated on property offenses. We hypothesized that secondary CU variants would score higher on criminality than primary CU variants, given the link between secondary variants and criminality in the youth literature (Vaughn et al., 2009); our findings suggest that this may be specific to violent crime. Further, compared

with individuals with primary CU traits and the low group, those with secondary CU traits reported a greater number of sexual partners and greater risky sexual behavior – in line with past research linking early adversity and risky sexual behavior (Homma et al., 2012). Finally, we did not find that primary and secondary CU variants were distinguished on substance use or intimate partner violence. As mentioned earlier, to our knowledge, the present study is the first to examine intimate partner violence and risky sexual behavior among CU variants. Thus, further research is needed to further explore the associations between these variables.

Table 4. Comparison between male and female CU variants and low CU on outcome variables

Variable	Primary CU	Secondary CU	Low CU	F/χ^2	df	p
	M (SD)	M (SD)	M (SD)			
<i>Psychopathology</i>						
Any problem						
Male	.72 (.45) _a	.79 (.41) _a	.68 (.47) _a	15.24	6	.019
Female	.62 (.49) _a	.90 (.31) _b	.54 (.50) _a	31.92	6	<.001
Internalizing						
Male	57.01 (6.91) _a	61.47 (11.90) _b	54.18 (8.94) _a	13.27	2, 406	<.001
Female	55.43 (8.08) _a	65.37 (11.22) _b	55.03 (8.63) _a	19.36	2, 295	<.001
Anxiety						
Male	.06 (.25) _a	.19 (.40) _b	.04 (.20) _a	20.76	6	.002
Female	.05 (.22)	.16 (.37)	.06 (.23)	5.96	6	.428
Depression						
Male	.06 (.24) _a	.25 (.44) _b	.10 (.30) _a	20.70	6	.002
Female	.11 (.31) _a	.36 (.48) _b	.05 (.22) _a	38.14	6	<.001
Avoidant personality						
Male	.05 (.23)	.19 (.40)	.06 (.24)	11.85	6	.065
Female	.05 (.22) _a	.26 (.44) _b	.06 (.24) _a	18.46	6	.005
Somatic problems						
Male	.10 (.30) _a	.25 (.44) _b	.07 (.25) _a	23.05	6	.001
Female	.14 (.35) _a	.43 (.50) _b	.15 (.36) _a	26.86	6	<.001
Externalizing						
Male	57.74 (7.86) _{ab}	60.50 (9.30) _a	54.84 (7.71) _b	7.72	2, 406	.001
Female	54.31 (7.50) _a	61.94 (9.92) _b	52.94 (6.76) _a	15.95	2, 295	<.001
ASPD						
Male	.19 (.40) _a	.33 (.47) _a	.13 (.34) _a	23.98	6	.001
Female	.05 (.22) _a	.22 (.42) _b	.04 (.19) _a	25.28	6	<.001
ADHD						
Male	.03 (.18) _a	.17 (.37) _b	.07 (.25) _b	20.94	6	.002
Female	.08 (.28) _a	.36 (.48) _b	.07 (.26) _a	32.56	6	<.001
<i>Substance Use</i>						
Any substance problem						
Male	.54 (.50) _a	.49 (.50) _a	.57 (.50) _a	14.84	6	.022
Female	.42 (.50)	.53 (.50)	.35 (.48)	9.11	6	.168
Alcohol misuse						
Male	.35 (.48)	.30 (.46)	.38 (.49)	7.77	6	.255
Female	.24 (.43)	.34 (.48)	.21 (.41)	4.97	6	.548
Binge drinking						
Male	.26 (.44) _a	.26 (.44) _a	.31 (.46) _a	35.38	6	<.001
Female	.17 (.38)	.22 (.42)	.14 (.35)	4.60	6	.597
Heavy cannabis use						
Male	.10 (.30)	.12 (.33)	.10 (.30)	1.54	6	.957
Female	.05 (.22)	.09 (.28)	.04 (.20)	2.45	6	.874

(Continued)

Table 4. (Continued.)

Variable	Primary CU	Secondary CU	Low CU	F/X^2	<i>df</i>	<i>p</i>
	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>			
<i>Other substance use</i>						
Male	.12 (.33) _a	.11 (.31) _a	.16 (.37) _a	20.03	6	.003
Female	.12 (.32) _{ab}	.21 (.41) _b	.09 (.28) _a	15.14	6	.019
<i>Sexual and partner experiences</i>						
<i>Number of sexual partners</i>						
Male	3.80 (1.78) _{ab}	4.27 (1.82) _a	3.26 (1.68) _b	6.70	2, 406	.001
Female	2.84 (1.37) _{ab}	3.31 (1.86) _a	2.55 (1.40) _b	4.53	2, 295	.011
<i>Risky sexual behavior</i>						
Male	11.94 (22.04) _{ab}	20.47 (42.78) _a	9.26 (13.30) _b	3.48	2, 406	.032
Female	8.06 (8.78) _a	15.69 (27.94) _b	6.27 (6.62) _a	6.84	2, 295	.001
<i>Intimate partner violence</i>						
Male	.78 (1.31)	.79 (1.41)	.47 (1.27)	.92	2, 406	.399
Female	1.32 (2.10) _{ab}	1.73 (2.28) _a	.64 (1.55) _b	3.97	2, 295	.020
<i>Criminal offenses</i>						
<i>Substance crime</i>						
Male	.74 (1.94)	.98 (1.73)	.59 (1.40)	.56	2, 406	.572
Female	.28 (.98)	.23 (1.12)	.03 (.23)	1.74	2, 295	.177
<i>Violent crime</i>						
Male	1.68 (4.34) _a	3.00 (5.39) _b	.97 (2.58) _a	4.61	2, 406	.010
Female	.38 (.97)	.53 (1.57)	.09 (.46)	2.83	2, 295	.060
<i>Property crime</i>						
Male	3.17 (5.53) _a	4.12 (7.12) _a	1.18 (2.62) _b	5.88	2, 406	.003
Female	1.63 (3.36) _a	1.97 (4.48) _a	.48 (1.82) _a	4.02	2, 295	.019
<i>Adaptive outcomes</i>						
<i>Overall wellbeing</i>						
Male	13.79 (1.61) _a	12.92 (2.57) _b	14.22 (1.84) _a	7.75	2, 406	<.001
Female	14.08 (1.66) _a	11.96 (2.64) _b	14.17 (1.85) _a	17.99	2, 295	<.001
<i>General health index</i>						
Male	.83 (.22)	1.06 (2.35)	.81 (.18)	1.89	2, 406	.153
Female	.81 (.17)	.75 (.28)	.81 (.17)	.87	2, 295	.420
<i>Happiness</i>						
Male	23.45 (3.37) _a	21.25 (5.24) _b	24.19 (3.75) _a	10.86	2, 406	<.001
Female	24.15 (3.54) _a	18.97 (5.66) _b	23.71 (4.08) _a	21.66	2, 295	<.001
<i>Strength</i>						
Male	17.10 (2.35) _{ab}	16.45 (2.67) _a	17.66 (2.80) _b	3.16	2, 406	.043
Female	17.30 (2.33) _{ab}	16.15 (2.85) _a	17.98 (2.27) _b	5.82	2, 295	.003
<i>Graduated high school</i>						
Male	.78 (.42) _a	.67 (.47) _b	.92 (.27) _c	53.16	6	<.001
Female	.76 (.43) _a	.71 (.46) _a	.95 (.22) _b	51.20	6	<.001
<i>Employed or higher education</i>						
Male	.53 (.50) _a	.32 (.47) _b	.71 (.46) _c	56.33	6	<.001

(Continued)

Table 4. (Continued.)

Variable	Primary CU	Secondary CU	Low CU	F/X^2	df	p
	M (SD)	M (SD)	M (SD)			
Female	.51 (.50) _{ab}	.41 (.50) _b	.68 (.47) _a	37.53	6	<.001

Note: CU = callous–unemotional, ASPD = antisocial personality disorder, ADHD = attention-deficit/hyperactivity disorder. Subscripts indicate significant differences between groups (i.e., different subscripts indicating significant differences).

Adaptive outcomes

Given the construct of successful psychopathy (Lykken, 1995) in the adult psychopathy literature, it is surprising that no research has examined adaptive outcomes of primary and secondary CU variants, with the exception of the work of Fanti and Kimonis (2017). Our findings that primary CU variants scored higher on several adaptive outcomes, compared with secondary CU variants, contribute significantly to this research base. Primary CU variants scored higher on adult overall wellbeing (which included general physical health) and happiness, than secondary CU variants. Antisocial and violent behaviors were not included as characteristics of psychopathy in original conceptualizations (Cleckley, 1976). Thus, the adaptive findings may be the consequence of primary and secondary CU variants' putative etiologies, such that primary CU variants have escaped the poor parenting behaviors and heightened negative emotionality experienced by secondary CU variants in early childhood and it is these experiences that shape the development of poorer physical health among the secondary group (Felitti et al., 1998; Norman et al., 2012). Given the role of other psychopathy dimensions in adaptive outcomes (i.e., narcissism; Smith & Lilienfeld, 2013), it would also be important for future research to examine narcissism in the context of CU variants.

Sex differences

We identified several sex differences, and these showed that there was differentiation on outcomes between female primary and secondary CU variants and male primary and secondary CU variants. Research on CU traits has focused on male samples and even less research has examined sex differences among CU variants more specifically. Of the variant studies that have examined sex, two cross-sectional studies did not find significant differences between male and female CU variants on negative affect (Craig & Moretti, 2019; Gill & Stickle, 2016). In the present longitudinal study, compared with females with primary CU traits, females with secondary CU traits reported greater levels of externalizing symptoms and risky sexual behavior, and were more likely to endorse a clinical range of avoidant and ASPD symptoms. Female primary and secondary CU variants were not differentiated on anxiety. Porter (1996) suggested that the development of CU traits among secondary variants is an adaptive developmental mechanism involving emotional suppression or numbing to cope with their experiences of early life trauma – described as “acquired callousness” by some researchers (Bennett & Kerig, 2014; Kerig, Bennett, Thompson, & Becker, 2012). The present study is the first to examine an extended timeframe for outcomes; perhaps by adulthood, female secondary CU variants have suppressed their psychological distress and they no longer recognize or sense their anxiety symptoms. Subsequent longitudinal research should examine adolescent-to-adult trajectories of anxiety symptoms among individuals with secondary CU traits to empirically examine Porter's

(1996) thesis and determine the developmental timing of secondary CU variants' dissociation of affect.

Conversely, male primary and secondary CU variants were not distinguished on these variables. Where male CU variants diverged was on clinical levels of anxiety and violent offending, such that male secondary CU variants were more likely to endorse clinical levels of anxiety and have higher levels of violent crime compared with male primary CU variants and the low symptoms group. Past research has suggested that adverse environmental factors play a greater role in the development of CU traits in female samples relative to male samples, for whom genetic factors are more strongly associated with CU development (Fontaine et al., 2010). Adverse experiences, particularly poor parenting behaviors, often result in a developmental “cascade” of negative psychosocial consequences that continues throughout the life course (Cicchetti, 2016, p. 2). Thus, among female populations, the greater impact of environmental factors on the development of CU traits may result in female primary and secondary CU variants to appear quite distinct over time. However, these differences may only become apparent when examining CU variants longitudinally. Among male samples, the greater genetic heritability on the development of CU traits may result in male primary and secondary CU variants appearing phenotypically similar and in line with the prototypical presentation. However, this has yet to be tested empirically. It is thus important for future research to examine sex-contingent differences in environmental versus genetic influences on primary and secondary developmental pathways. These findings are, however, in line with theoretical frameworks on the development of secondary CU traits (Karpman, 1941; Porter, 1996) and may explain why cross-sectional studies do not find differences between male and female CU variants (Craig & Moretti, 2019; Gill & Stickle, 2016). It is important to note that this study was the first to examine the effect of sex on adult outcomes among CU variants and thus the aim and analyses were exploratory in approach. While our provisional findings on possible sex differences, particularly as they pertain to differences between primary and secondary CU variants (rather than across sex) add to this literature, further research is needed examining the role of sex (including as a potential moderator) on the development of primary versus secondary CU traits and adult outcomes.

Strengths and limitations

The present longitudinal study examined adult outcomes associated with adolescent primary and secondary CU variants, contributing significantly to the current research base, which primarily consists of cross-sectional studies. We also examined several outcomes that past research has neglected and identified several sex-specific findings. However, our findings must be considered within the context of several methodological limitations.

First, CU traits were assessed with the APSD. Although the APSD has been established as a strong instrument for assessing

multidimensional psychopathic traits in youth samples, there is debate with regard to the CU subscale due to inconsistencies in the items across prior factor analytic studies. Future CU variant studies might consider employing a more comprehensive measures of CU traits, such as the Inventory of Callous–Unemotional Traits (Frick, 2004). In addition, as indicated throughout, CU traits were not assessed with the APSD at any other time point, and thus we were unable to determine the stability of primary and secondary CU traits from adolescence to adulthood. Given that primary CU variants are theorized to be underpinned by a genetic constitution and secondary CU variants are suggested to have environmental origins (Karpman, 1941), it is plausible that secondary CU traits are less stable than primary CU traits. Research examining early low prosocial emotions provides preliminary support for the stability of primary CU traits relative to secondary CU traits (Craig *et al.*, 2021). This is an important avenue for future research to explore – understanding the stability of primary versus secondary CU traits has significant clinical implications for treatment timing and response.

Second, the other variable included in the cluster analysis was the CBCL anxious/depressed narrow-band scale. Although the majority of studies in this field use anxiety, our measure also included depression symptoms. However, this measure has been used in a number of youth CU variant studies (Craig *et al.*, 2020). The CBCL anxious/depressed narrow-band scale is also a better representation of posttraumatic symptoms than the six-item DSM-oriented anxiety scale, and more closely aligns with the original theory and conceptualizations of secondary CU traits (Karpman, 1941; Porter, 1996). Secondary CU traits are thought to be a trauma response; thus, using measures that comprise anxiety, depression, and posttraumatic items, which are common among individuals with trauma histories (Gardner, Thomas, & Erskine, 2019), may more accurately identify secondary CU variants than anxiety alone.

Third, while the present study is the first to examine adult outcomes of adolescent primary and secondary CU traits, the majority of adolescent variant studies cluster on CU traits and the majority of adult variant studies cluster on the broader psychopathy construct. Given that our findings cover multiple developmental periods (*i.e.*, adolescence and adulthood), we drew upon both the adolescent and adult variant research base to interpret the findings. However, as noted, these bodies of research have used different measures (*i.e.*, CU traits vs. psychopathy, respectively) and thus our findings should be interpreted with caution until replicated across multiple approaches. Our field has also used varying methodologies to identify variants. In a recent systematic review examining CU variants in youth samples ($k = 41$), 28 studies used clustering methods (*e.g.*, two-step approach) or mixture models (*e.g.*, latent profile analyses), and some studies used moderation ($k = 5$) or clinical cutoffs ($k = 4$) (Craig *et al.*, 2020). Other methods included median or tertile splits, or using a certain standard deviation above the mean. We elected to use clustering analyses to most closely align with the field; however, other approaches may be more appropriate in some instances and further research is needed examining differing methodological approaches for identifying CU variants.

Implications and Conclusion

Examining developmental outcomes of primary and secondary CU variants has important theoretical and clinical implications. Theoretical perspectives on primary and secondary CU variants

propose that individuals with primary CU traits may be innately deficient in affect, whereas secondary CU traits could be a developmental process resulting in dysfunctional affect (Karpman, 1941; Porter, 1996). However, much of this research has been cross-sectional in design, and thus, our findings demonstrating distinct adult emotion-related outcomes (*e.g.*, internalizing and externalizing symptoms) between primary and secondary CU variants inform these theoretical models by demonstrating that affective differences may persist into adulthood. In addition, it is these emotion-related outcomes that may also have implications for intervention development. For example, individuals identified as having secondary CU traits in early adolescence reported higher levels of internalizing and externalizing psychopathology in adulthood, relative to individuals with primary CU traits and those with low symptoms, suggesting that these individuals may benefit from interventions targeting emotion dysregulation. In contrast, intensive interventions focused on empathy skills and reward-oriented approaches may be more effective for those individuals with primary CU traits (Kimonis *et al.*, 2019). However, research examining treatment response among individuals with primary versus secondary CU traits is lacking, constituting an important area for future clinical development and research.

It is important to note that, for many outcomes, individuals with primary CU traits did not differ significantly from those with low CU and anxiety symptoms. However, compared with the low symptoms group, primary CU variants were more likely to have been convicted of property offenses and less likely to have graduated high school and to be employed or in higher education. These findings support research suggesting that CU traits are important in differentiating individuals at risk for a number of negative outcomes (Frick *et al.*, 2014). The diverse adult outcomes among individuals with primary versus secondary CU traits perhaps appear to pertain to their distinct etiologies. That is, primary CU variants, with their theorized temperamentally fearless disposition, showed greater adult criminality compared to those with low symptoms, but also greater adaptive outcomes compared to those with secondary CU traits. Conversely, secondary CU variants, with their distinct early life experiences (Craig *et al.*, 2021), showed greater negative emotionality as assessed by a number of outcomes. Of note, primary and secondary CU variants were indistinguishable on adolescent CU traits, and although we were unable to determine whether this persisted into adulthood, the present findings support the importance of considering subtyping or clustering approaches given the divergent future pathways of CU variants. Our findings also point to the importance of longitudinal research for informing sex differences in developmental models of CU variants. In sum, studying various developmental pathways results in more accurate conceptualization of antisocial behavior, which in turn can serve as the foundation for more successful intervention efforts.

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Conflicts of Interest. None.

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