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Developmental Associations between Psychopathic Traits and Childhood-Onset Conduct Problems

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Abstract

The three dimensions of psychopathic traits in childhood predict high levels of conduct problems. Theoretical conceptions suggest that, in addition to predicting the onset of conduct problems, traits also contribute to their developmental pathways. However, little is known about the associations between the trajectories of the three dimensions of psychopathic traits and the persistence and desistance of childhood-onset conduct problems. The objective of the present study was to examine the associations between 6-year trajectories of the three dimensions of psychopathic traits and 8-year trajectories of conduct problems among 316 children (41.8% girls) with childhood-onset conduct problems who were followed longitudinally from childhood to adolescence. Results showed that a higher probability of following high trajectories of each dimension of psychopathic traits significantly increases the odds of following a higher and less declining pattern of conduct problems over and above child sex and annual family income. Results also showed that the combination of a high trajectory of more than one dimension of psychopathic traits is a stronger indicator of a higher and less declining pattern of conduct problems than a high trajectory of only one dimension. These results support the importance of considering the three dimensions of psychopathic traits in understanding the heterogeneity of childhood-onset conduct problems pathways. They also point out the need to assess these traits early in order to give practitioners valuable information in the clinical assessment and treatment of antisocial children.

Keywords Psychopathic traits · Psychopathy · Conduct problems · Trajectories · Persistence · Desistance

Introduction

Conduct problems (CP) refer to a range of antisocial behaviors including aggression toward peers, destruction of others' property, deceitfulness or theft, and violation of rules (Achenbach and Rescorla 2001; American Psychiatric Association [APA] 2013). When CP are frequent in childhood and occur in a repetitive and persistent pattern, these antisocial behaviors are at high risk to persist throughout adolescence and adulthood (Moffitt et al. 2008; Russell et al. 2014). In fact, empirical longitudinal studies showed that 25% to 50% of children with high levels of CP will show persisting CP at least until adolescence (Barker and Maughan 2009; Lopez-Romero et al. 2015; Odgers et al. 2008). The persistence of childhood-onset CP is an important risk factor for a wide range of negative outcomes, including school dropout, perpetration of violence and criminal acts, convictions, substance use and mental health problems (e.g. anxiety, depression, posttraumatic stress) (Odgers et al. 2008; Kretschmer et al. 2014). Hence, childhood-onset CP are a matter of public interest, and the continuous risks children with CP face highlight the need to understand the heterogeneity of early CP pathways.

Influential theoretical conceptions of the etiology and persistence of CP have consistently underlined the importance of psychological factors (sometimes labelled *propensity*) in the explanation of the heterogeneity of CP pathways (e.g. Delisi and Vaughn 2014; Lahey and Waldman 2003; Moffitt 2006). In line with this conception, a substantial amount of empirical research supports that a high level of psychopathic traits increases the risk of CP persistence (Frick et al. 2014; Salekin 2017; Lee 2018). Many studies support a three-dimensional

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model of psychopathic traits in childhood: callous-unemotional traits (e.g. lack of empathy and guilt, shallow affect, unconcerned about others' feelings), narcissism-grandiosity traits (e.g. manipulation, lying, dishonest charm), and impulsivity-irresponsibility traits (e.g. sensation seeking, need for stimulation, behavioral impulsivity) (Frick and Hare 2001; Andershed et al. 2002; Colins et al. 2014; Bijttebier and Decoene 2009; Dong et al. 2014). Comprehensive research has shown that high levels of callous-unemotional traits are associated with persistent CP (see Frick et al. 2014 for a review), supporting the idea that deficits in empathy development could hamper the child's ability to refrain from repeated antisocial behaviors.

Comparatively little research has been conducted on narcissism-grandiosity and impulsivity-irresponsibility traits conceptualized as childhood dimensions of psychopathic traits. However, several previous studies have supported the view that impulsive traits play a central role in the origins of childhood-onset CP (Pardini et al. 2018; Snyder et al. 2004). These traits have been described as an underlying vulnerability which places children at risk of developing different behavioral difficulties across the life course, such as attention deficit/hyperactivity problems, oppositional defiant problems and CP (Beauchaine et al. 2010). These studies, as well as a few others that studied impulsivity-irresponsibility traits conceptualized as a dimension of psychopathic traits (Bégin et al. 2018; Salekin 2017) therefore suggest that these traits would lead to irresponsible and unplanned behaviors that could foster the persistence of childhood-onset CP, enacted through lack of behavioral inhibition.

Some empirical studies outside the psychopathy framework also lend support to the role of narcissistic traits in the etiology of childhood-onset CP (Muratori et al. 2018; Reijntjes et al. 2016). In addition, studies that conceptualized these traits as a dimension of psychopathic traits (Jezior et al. 2016; Salekin 2017) also point out their potential contribution to a better understanding of the heterogeneity of childhood-onset CP pathways. These studies suggest that narcissism-grandiosity traits would gradually induce a functioning pattern characterized by an exaggerated sense of self-importance, leading the child to frequently try dominating and manipulating others to gain personal benefits from their social interactions, and that such patterns could, in turn, contribute to the persistence of the child's CP.

Based on current knowledge, the three dimensions of psychopathic traits can therefore be expected to be related to early-onset CP pathways. However, the underlying conception supported by most studies on the relationship between psychopathic traits and CP is mainly one of predisposition, according to which the levels of traits are thought to contribute to the onset of CP (Morizot 2015). Only a few studies have taken into account that traits levels may change during childhood, and that these changes could also be related to the course of CP (i.e. to the persistence or desistance of childhood-onset CP). Furthermore, very few studies have considered the simultaneous contributions of the three dimensions of psychopathic traits to the persistence of childhood-onset CP, although their unique contributions (controlling for each other's effect) could differ from their independent contributions (Bégin et al. 2018; Fanti and Kimonis 2013; Van Baardewijk et al. 2011). Accordingly, the objective of this study is to examine the associations between trajectories of the three dimensions of psychopathic traits and trajectories of CP from childhood to adolescence in a sample of children presenting high levels of CP at study inception.

A Developmental Approach in the Study of Psychopathic Traits in Childhood

Personality traits, including psychopathic traits, originate and develop in childhood, and as such, are conceptualized as malleable during this period (Shiner 2015; Caspi and Shiner 2008; Roberts and DelVecchio 2000; Roberts et al. 2006). Meta-analyses on personality traits showed that rank-order correlations progressively increase from childhood to adulthood, indicating that personality traits evolve differently between children (Roberts and DelVecchio 2000) and that mean levels of traits change over time, illustrating that levels of traits also change within children (Roberts et al. 2006). Traits are therefore viewed as dynamic constructs that can change during childhood (Shiner 2015; Caspi and Shiner 2008).

The adoption of a developmental approach in the assessment of psychopathic traits also makes it possible to examine their associations with CP using the pathoplasticity/exacerbation and remission/desistance conceptual models. According to these models, traits maintain an influence on CP *after* their onset and contribute to their developmental course. The pathoplasticity/exacerbation model posits that trait trajectories (i.e. increasing/high-stable trajectories of pathological traits, or declining/low-stable trajectories of adaptive traits) contribute to the persistence or aggravation of CP, while the remission/desistance model posits that trait trajectories (i.e. declining/low-stable trajectories of pathological traits, or increasing/high-stable trajectories of adaptive traits) contribute to the desistance of CP (Morizot 2015).

Developmental Associations between the Three Dimensions of Psychopathic Traits and CP

A few empirical studies have used a developmental approach in the assessment of callous-unemotional traits, hence taking their continuity and change throughout childhood into account. Fanti et al. (2017) reported four callous-unemotional traits trajectories in a community-based sample of children followed from age 9 to 11, and then compared these trajectory groups on the evolution of CP using

repeated measures analysis of variance. Results indicated that children following a stable-high trajectory of callous-unemotional traits exhibited persistent CP over this period. The study also showed that a decrease in callous-unemotional traits level is associated with a decrease in CP over time. Similar results were reported in a community-based sample of children followed from age 7 to 12 (Fontaine et al. 2011), indicating that a stable-high trajectory of callous-unemotional traits is associated with a stable-high trajectory of CP, while a declining trajectory of callous-unemotional traits is associated with a stable-low trajectory of CP. These results support the pathoplasticity/exacerbation conceptual model, according to which a high and stable level of psychopathic traits is associated with high and stable levels of CP during childhood. Also, these studies support the remission/desistance hypothesis according to which a decrease in traits level could be related to a decrease in CP. These studies, however, were strictly conducted in childhood, and do not allow to assert that the CP of the children persisted until adolescence. To our knowledge, the only study that used a developmental approach in the assessment of callous-unemotional traits in childhood to predict CP in adolescence used a cross-sectional measure of CP (Muratori et al. 2016). This study showed that a higher and less declining pattern of callous-unemotional traits in a clinical sample of youths followed from age 9 to 15 years is associated to higher levels of CP at age 15. However, the cross-sectional measure of CP did not allow to test the pathoplasticity/exacerbation and remission/desistance models. Replication of these results using trajectories of childhood-onset CP is needed in order to test these conceptual models of the relation between callous-unemotional traits and the persistence/desistance of CP.

While no study, to our knowledge, has directly examined the developmental associations between the narcissism-grandiosity and impulsivity-irresponsibility dimensions of psychopathic traits and CP, some studies suggest that trajectories of these traits are related to the persistence of CP (Fanti et al. 2017; Klingzell et al. 2016; Lynne-Landsman et al. 2011; Reijntjes et al. 2016). For example, when comparing the two years joint trajectories of callous-unemotional traits and CP on repeated measures of narcissism-grandiosity and impulsivity-irresponsibility traits, Klingzell et al. (2016) reported that children following stable-high trajectories of both callous-unemotional traits and CP also display stable-high levels of narcissism-grandiosity and impulsivity-irresponsibility traits. Moreover, studies that assessed relatively similar traits also suggest that their trajectories are associated with CP trajectories. Most notably, in a community-based sample followed from age 10 to 13, Reijntjes et al. (2016) showed that boys who followed a stable-high trajectory of narcissism (excluding the grandiose facet of the psychopathic dimension), were more likely to follow a stable high trajectory of bullying. In a repeated measures analysis of variance, Lynne-Landsman et al. (2011) observed that youths from the community who followed a stable-high trajectory of sensation seeking traits (excluding the impulsive facet of the psychopathic dimension) from age 12 to 14 also engaged in stable high trajectories of aggressive and delinquent behaviors. In the light of these results, trajectories of narcissism-grandiosity and impulsivity-irresponsibility traits can be expected to be associated to CP trajectories from childhood to adolescence.

Recently, a number of studies suggested that the cumulative presence of high levels of psychopathic traits on more than one dimension could be a stronger predictor of later antisocial outcomes than each dimension considered separately (e.g. Andershed et al. 2018; Bergstrom and Farrington 2018; Colins et al. 2018; Fanti et al. 2018; Frogner et al. 2018a). In one of these studies, the presence of high levels of all three dimensions and CP in childhood was a stronger indicator of future high levels of CP than was the presence of a high level of callous-unemotional traits only and CP (Colins et al. 2018). In another, the combination of a high level of CP and of the three dimensions of psychopathic traits was reported to be a stronger predictor of later CP and attention deficit/hyperactivity symptoms than the combination of a high levels of CP and callous-unemotional traits only (Frogner et al. 2018a). Since the measure of psychopathic traits was cross-sectional in these studies, their results still need to be replicated using longitudinal measures of psychopathic traits. Nonetheless, these studies offer valuable insight into the potential utility of considering the trajectories of all dimensions of psychopathic traits in a single analysis, as well as in different combinations. This would make it possible to assess their unique associations (i.e. over and above the effects of the other dimensions of psychopathic traits) and to determine whether their cumulative presence constitutes a stronger indicator of developmental pathways of childhood-onset CP.

The Current Study

Very few studies have examined the associations between psychopathic traits trajectories and childhood-onset CP trajectories, and most of them did not conduct follow-ups during adolescence The current study therefore aims to examine the associations between 6-year trajectories of the three dimensions of psychopathic traits and 8-year trajectories of CP, controlling for the effects of the other dimensions of psychopathic traits, in a sample of children with high levels of CP at study inception who were followed from childhood to adolescence. The study also aims to examine the associations between different combinations of psychopathic traits trajectories and CP trajectories. All associations are tested controlling for the effects of sex and family income.

Method

Participants and Procedure

The initial sample consisted of 370 children (40.3% girls) who took part in a larger longitudinal study on childhood CP. They were recruited from 2008 to 2010 in 155 elementary schools from four regions (urban and rural) of the province of Quebec (Canada) through the school boards' lists of students referred to school-based psychosocial services for CP. In the aim of obtaining roughly similar proportions of boys and girls in this sample of referred children, all girls under 10 years old receiving these services, and approximately one out of four boys, were selected to participate in the study. Participation rate was 75.1%. No differences emerged between participants and non-participants in terms of sex ratio, grade level or deprivation index of schools attended. Eighty-six percent of children attended regular classes at study inception, 98.7% were born in Canada, and 68.5% of their families were non-intact.

Of the 370 referred children, 54 obtained a T-score lower than the at-risk threshold score set at 65 on the instrument used to assess the level of CP at study inception (see the "Measures" section). These children were excluded from the sample to obtain a more homogeneous sample of children with high levels of CP at study inception, to better target and study the persistence and desistance of CP. The final sample consisted of 316 children (41.8% girls), aged 6 to 9 years old (mean = 8.50 years; *s.d.* = 0.93) and presenting a mean T-score of CP of 74.71 (*s.d.* = 6.92; min = 65; max = 98) at the first assessment. These children underwent a total of eight annual assessments during which 25 children (7.9%) left the study. Participants did not differ from dropouts in terms of proportions of boys and girls ($\chi^2(1) = 0.04$, $p = .85$) and mean levels of annual family income ($t(25.03) = -0.58$, $p = .57$), CP ($t(314) = 0.26$, $p = .79$), callous-unemotional traits ($t(304) = 0.74$, $p = .46$), narcissism-grandiosity traits ($t(31.20) = 1.31$, $p = .20$), and impulsivity-irresponsibility traits ($t(304) = -1.03$, $p = .31$) at their first assessment.

Data were restructured according to the age of children at each assessment to better reflect the underlying developmental postulates of the study. This implies that individual trajectories, which cover a 5-year period for psychopathic traits (six annual assessments) and a 7-year period for CP (eight annual assessments) were combined to estimate trajectories covering time spans of 6 years for psychopathic traits and 8 years for CP. The procedures of this reorganization are described in the "Data analysis" section.

All procedures of the current study were approved by the University research ethics board. Participants gave their informed consent and received incentives at every assessment. Graduate-level students administered questionnaires to parents at their homes and obtained parental consent to contact the child's teacher. Teacher reports were completed by telephone.

Measures

Psychopathic Traits The dimensions of psychopathic traits were assessed with the French-Canadian translation (Deshaies et al. 2009) of the Psychopathy Screening Device (Frick et al. 1994), now called the Antisocial Process Screening Device (Frick and Hare 2001). The instrument was administered to a parent and a teacher at the first six annual assessments. The three dimensions were measured with the three scales of the Antisocial Process Screening Device: a six-item callous-unemotional scale (e.g. "does not show feelings or emotions", "feels bad or guilty when he/she does something wrong" – reversed score), a seven-item narcissism-grandiosity scale (e.g. "seems to think that he/she is better than other people", "brags excessively about his/her abilities"), and a five-item impulsivity-irresponsibility scale (e.g. "engages in risky or dangerous activities", "gets bored easily"). Items were scored on a 3-point ordinal rating scale ranging from 0 (*not at all true*) to 2 (*definitely* true). The internal consistency of the scales, as well as the structural validity of the three-factor model of the instrument, have been supported in previous research conducted among referred samples of children (Dong et al. 2014; Fite et al. 2009), and the longitudinal invariance of the three-factor model has been reported in the initial sample of 370 children of the current study (see the Participants section; Bégin et al. 2019). The external validity of the three scales was also supported by research showing significant associations between them and externalizing behaviors (Bijttebier and Decoene 2009). Across the different ages at which psychopathic traits were assessed, ordinal alpha coefficients in the current sample varied from .60 to .74 for callous-unemotional traits, .74 to .84 for narcissism-grandiosity, and 60 to .70 for impulsivity-irresponsibility (with the exception of one assessment age point with an alpha of .48) and are considered acceptable. Ordinal alphas provide a more accurate estimation of the internal consistency of ordinal items than other internal consistency indices (Gadermann et al. 2012). Previous studies have reported similar or lower internal consistency coefficients using this instrument (Barry et al. 2008; Bergstrom and Farrington 2018).

We used a scoring method that reflects the expected relative stability of traits across contexts (Roberts 2009) and that is coherent with the clinical assessment of callous-unemotional traits recommended in the DSM-5 in which a trait is present if it is observed in multiple relationships and settings (APA 2013). In this approach, parent and teacher reports for each item are aggregated using an algorithm reflecting this requirement. For example, if an item is rated "1" by the parent and "2" by the teacher, the item receives a score of "1". If the item is rated "0" by the parent and "1" by the teacher, the item receives a score of "0". We have already used this scoring approach to establish the trajectories of psychopathic traits in

a study of their continuity and change (Bégin et al. 2019). Since this previous study was conducted with the initial sample of 370 children referred for CP, we conducted these analyses again in the current study, with the same scoring procedure, in order to establish the trajectories of psychopathic traits, this time in the sample of 316 children with the most severe CP (see the "Participants and procedures" section).

Conduct Problems CP were assessed with the French-Canadian translation of the parent and teacher versions of the DSM-oriented conduct problems scales of the Achenbach System of Empirically-Based Assessment (ASEBA; Achenbach and Rescorla 2001). The scales contain 17 and 13 items for the parent and teacher versions, respectively. Items are scored on a 3-point ordinal rating scale ranging from 0 (*not true*) to 2 (*very true or often true*). The scales were administered to a parent and a teacher at eight annual assessments. At each assessment, raw scores were converted to T-scores following the age, sex, and informant appropriate norms of this instrument (Achenbach and Rescorla 2001). Since disruptive behaviors in children are known to be context-specific (De Los Reyes et al. 2009), we retained the highest T-score between the parent and the teacher at every assessment in order to tap the full amplitude of the child's CP. Across the different ages at which CP were assessed, ordinal alphas ranged between .89 and .93 for the parent version, and from .89 to .94 for the teacher version, and are thus considered excellent.

Covariates Sex and annual family income were used as covariates. Annual family income was assessed with a 20-point ordinal scale ranging from 1 (*$0 to $999*) to 20 (*more than $160,000*) completed by the parent at study inception. The scale was weighted to ensure an equal distance between each of its units.

Data Analysis

The dataset was first restructured according to the chronological age of the children instead of assessment time points. To that end, the age of children at their first assessment was rounded to the closest unit, and data from all eight annual time points were classified according to these initial rounded ages. After retaining only the ages at which data from a sufficient number of children were available, this procedure led to the following numbers of children with psychopathic traits data: 8-year-olds = 137, 9-year-olds = 224, 10-year-olds = 266, 11-year-olds = 259, 12-year-olds = 250, 13-year-olds = 222, 14-year-olds = 139, and the following numbers of children with CP data: 8-year-olds = 145, 9-year-olds = 251, 10-year-olds = 292, 11-year-olds = 289, 12-year-olds = 287, 13-year-olds = 281, 14-year-olds = 277, 15 year-olds = 233, 16 year-olds = 144.

Analyses were conducted with Mplus 8.1 (Muthén and Muthén, 1998-2018) and IBM SPSS Statistics 25. Full information maximum likelihood was used in order to retain children with missing assessments in the analyses. Latent class growth analysis (LCGA) models with 2 to 5 classes using the seven assessments of traits were first conducted to identify trajectories of the three dimensions of psychopathic traits. The retained models were identified with the conventional indices for assessing the best fitting model: A lower Bayesian information criterion (BIC) is indicative of a better fit, a non-significant Lo-Mendell-Rubin test (LMR) suggests that a model with one fewer class is preferred, and an entropy of .70 or higher suggests a clear classification of individuals among classes (Wang and Wang 2012; Nagin and Tremblay 2005). If two different models presented similar fit indices, the most parsimonious model that is consistent with theories and empirical studies of the field was retained.

LCGA models with 2 to 5 classes using the nine CP assessments from ages 8 through 16 were also conducted to identify CP trajectories. The number of classes was determined with the previously mentioned conventional indices used to assess model fit in LCGA. Children were then classified according to their most likely CP trajectory class membership based on posterior probabilities of class membership of the retained model. With the aim of examining the associations of psychopathic traits trajectories with CP trajectories, the posterior probabilities of membership to the high trajectory groups for the three dimensions of psychopathic traits were simultaneously entered as independent variables in the same binary logistic regression model. In this model, CP trajectory class membership was entered as the dependent variable, and sex and annual family income were entered as covariates. Then, to examine the associations between different combinations of psychopathic traits trajectories and CP trajectories, children were classified to their most likely trajectory of each of the three dimensions of psychopathic traits, and binary variables were created based on combinations of different trajectories of traits. These binary variables are described in the corresponding section of the results. The associations of each binary variable referring to a specific combination of psychopathic traits trajectories were tested with a model of binary logistic regression with CP trajectory class membership entered as the dependent variable and using the same covariates. Since multiple models were conducted, the criterion for statistical significance was set at $p < .01$ in all regression analyses.

Results

Trajectories of Psychopathic Traits and CP

The results of the analyses of the trajectories of the three dimensions of psychopathic traits are presented in Fig. 1.

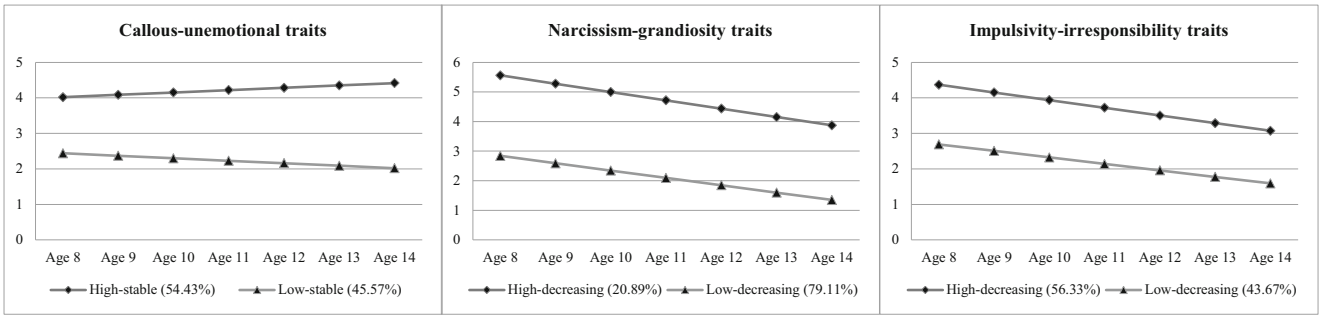

Fig. 1 Psychopathic traits trajectories from 8 to 14 years old. Note. Vertical axis values correspond to raw total scores on the dimensions' respective scales. Each item was rated using the lowest score between the parent and teacher reports to ensure that the child's traits are at least observed by both informants. Fit indices of the callous–unemotional traits models: two–trajectory model: Bayesian information criteria (BIC) = 5857.63, Lo-Mendell–Rubin likelihood test (LMR–LRT): $p < .01$, entropy = 0.69, three–trajectory model: BIC = 5847.07, LMR–LRT: $p = .08$, entropy = .65, four–trajectory model: BIC = 5853.59, LMR–LRT: $p = .18$, entropy = .61, five–trajectory model: BIC = 5870.86, LMR–LRT: $p < .01$, entropy = 0.66. Fit indices of the narcissism–grandiosity traits models: two–trajectory model: BIC = 6362.77, LMR–LRT: $p = .01$, entropy = .75, three–trajectory model: BIC = 6308.49, LMR–LRT: $p = .03$, entropy = 0.66, four–trajectory model: BIC = 6287.80, LMR–LRT: $p = .04$, entropy = 0.74, five–trajectory model: BIC = 6280.90, LMR–LRT: $p = .11$, entropy = 0.69. Fit indices of the impulsivity-irresponsibility models: two–trajectory model: BIC = 5589.62, LMR–LRT: $p < .01$, entropy = 0.60, three–trajectory model: BIC = 5590.61, LMR–LRT: $p = .39$, entropy = .71, four–trajectory model: BIC = 5597.08, LMR–LRT: $p = .17$, entropy = 0.55, five–trajectory model: BIC = 5600.38, LMR–LRT: $p = .26$, entropy = 0.64

The three retained models included two trajectories. Higher trajectories were labelled "high" because of the scoring method used in this study which reduced their observed mean levels. The three identified models were as follows: A high-stable (54.43% of the sample, intercept mean = 4.02; $p < .01$; slope mean = 0.07; $p = .08$), and a low-stable (45.57%, intercept mean = 2.44; $p < .01$; slope mean = −0.07; $p = .07$) trajectory of callous-unemotional traits, a high-decreasing (20.89%, intercept mean = 5.56; $p < .01$; slope mean = −0.28; $p = .03$), and a low-decreasing (79.11%, intercept mean = 2.84; $p < .01$; slope mean = −0.25; $p < .01$) trajectory of narcissism-grandiosity, and a high-decreasing (56.33%, intercept mean = 4.37; $p < .01$; slope mean = −0.22; $p < .01$), and a low-decreasing (43.67%, intercept mean = 2.69; $p < .01$; slope mean = −0.18; $p < .01$) trajectory of impulsivity-irresponsibility. There were no differences in proportions of boys and girls between the two trajectories of callous-unemotional traits ($\chi^2(1) = 0{,}04$, $p = 0{,}85$), narcissism-grandiosity traits ($\chi^2(1) = 1{,}00$, $p = 0{,}32$), or impulsivity-irresponsibility traits ($\chi^2(1) = 3{,}69$, $p = 0{,}06$). Fit indices of all tested models are presented below Fig. 1. The retained LCGA models presented in Fig. 1 are very similar to those previously reported with the larger sample (Bégin et al. 2019), except for the model of impulsivity-irresponsibility traits which also included a low-stable trajectory (5.13% of the participants in the original sample). This difference could be the result of the exclusion, in the present sample, of children with the lowest CP scores at study inception (see the Participants section).

The fit indices of models with two to five trajectories of CP are presented below Fig. 2, which depicts the retained LCGA model. The two-trajectory model was selected even if the BIC slightly decreased from the two to the three-trajectory model. In fact, these two models presented equally satisfying indices, but in addition to allowing a clear classification of subjects, the two-trajectory model showed very good consistency with theoretical conceptions (e.g. childhood limited and persistent trajectories of Moffitt's taxonomy [2006]), as well as with previous empirical results (e.g. Odgers et al. 2008). This most parsimonious model was therefore retained as the best representation of trajectories of CP in our sample. The model includes two trajectories showing a significant declining linear pattern of change from 8 to 16 years old. One trajectory, labelled "high-decreasing" (59.81% of the sample, intercept mean = 71.04, $p < .01$, slope mean = −1.62, $p < .01$), showed an initial level of CP over the clinical cut-off score of the

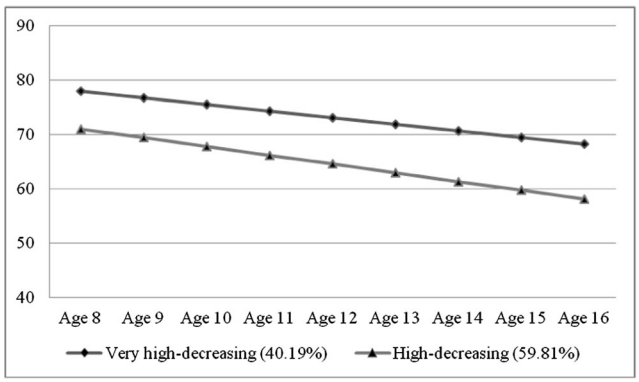

Fig. 2 Early conduct problems trajectories from 8 to 16 years old. Note. Vertical axis values are T-scores on the CP scale. Fit indices of the two-trajectory model: BIC = 14,818.06, LMR-LRT: $p < .01$, entropy = .76. Fit indices of the three-trajectory model: BIC = 14,696.76, LMR-LRT: $p < .01$, entropy = .76. Fit indices of the four-trajectory model: BIC = 14,681.91, LMR-LRT: $p = .26$, entropy = .70. Fit indices of the five-trajectory model: BIC = 14,679.63, LMR-LRT: $p = .31$, entropy = .67

instrument of T > 70, and a final level of CP under the at-risk cut-off score of T > 65. A second trajectory, labelled "very high-decreasing" (40.19% of the sample, intercept mean = 77.95, $p < .01$, slope mean = −1.21, $p < .01$), also showed an initial level of CP over the clinical cut-off score of T > 70, but its final level of CP remained over the at-risk cut-off score of T > 65 at age 16, therefore indicating that levels of CP remained high across this period, despite a statistically significant decrease. Furthermore, the two trajectory groups showed significant differences in the individual slopes of CP trajectory, with the high-decreasing trajectory group showing a significantly steeper negative slope than the very high-decreasing trajectory group ($t(314) = -58.17$, $p < .01$).

Associations of Trajectories of the Three Dimensions of Psychopathic Traits with Childhood-Onset CP Trajectories

The associations of each dimension of psychopathic traits with CP trajectories were first tested by simultaneously entering the posterior probabilities of membership to the high trajectories of each of the three dimensions in one regression model. This allowed the dimensions to control for each other's effect in examining their associations with CP trajectories. Since the three variables were significantly associated to CP trajectory class membership, we proceeded to gradually include covariates of sex and annual family income. In the final model presented in Table 1, all covariates' contributions fell under the level of statistical significance. However, the effects of the three variables referring to probabilities of membership to the high trajectories of psychopathic traits remained statistically significant. A higher probability of presenting a high-stable trajectory of callous–unemotional (odds ratio, OR = 5.09, $p < .01$), a high–declining trajectory of narcissism–grandiosity (OR = 6.70, $p < .01$), and), and a high-declining trajectory of impulsivity–irresponsibility (OR = 3.40, $p < .01$) traits significantly increased the odds of following the very high-decreasing, compared to the high-decreasing, trajectory of childhood-onset CP. Inversely, a lower probability of presenting the high trajectories of traits increased the likelihood of following the high-decreasing, compared to the very high-decreasing trajectory of CP. These effects were observed after controlling for the two covariates included in the model.

Associations of Combinations of High Trajectories of Dimensions of Psychopathic Traits with Childhood-Onset CP Trajectories

Children in the sample presented different combinations of high trajectories of psychopathic traits dimensions. For example, 23.7% of the children followed no high trajectory, 32.6% followed one high trajectory of either callous-unemotional, narcissism-grandiosity, or impulsivity-irresponsibility traits, 32% followed a high trajectory of two dimensions, and 11.7% followed a high trajectory of all three dimensions. In order to test the associations between different combinations of high psychopathic traits trajectories and CP trajectories, six binary variables were computed on the basis of (1) membership to at least one of the three high trajectories, (2) membership to at least two of the three high trajectories, (3) membership to high narcissism-grandiosity and high impulsivity-irresponsibility trajectories, (4) membership to high narcissism-grandiosity and high callous-unemotional trajectories, (5) membership to high impulsivity-irresponsibility and high callous-unemotional, and (6) membership to high trajectories on all three dimensions. Binary logistic regression models were conducted for each of these six binary variables. Each model included covariates of sex and annual family income.

Table 2 shows group frequencies of the six binary variables each referring to a specific combination of psychopathic traits trajectories. These frequencies show that the majority of children from the two groups followed at least one high trajectory of psychopathic traits: this was the case for approximately 90% of children in the very high-decreasing group, and for 66% of those in the high-decreasing group. However, the frequencies of children following at least two high trajectories of traits were much more contrasted between groups: this was the case for approximately 70% children in the very high-decreasing group and 25% of those in the high-decreasing group. Controlling for the effects of sex and annual family

Table 1 Binary logistic regression predicting membership to CP trajectories

Variables	Groups means (s.d.)		Predictive associations		
	VHD ($n = 127$)	HD ($n = 189$)	β	OR	95% CI
Sex (girls)	0.47 (0.50)	0.38 (0.49)	0.67	1.95	(1.11–3.44)
Family income	3.80 (2.66)	4.78 (3.14)	−0.07	0.94	(0.85–1.03)
High CU	0.74 (0.38)	0.42 (0.41)	1.63*	5.09	(2.60–9.96)
High NAR	0.38 (0.41)	0.12 (0.25)	1.90*	6.70	(2.92–15.38)
High IMP	0.74 (0.35)	0.46 (0.39)	1.22*	3.40	(1.62–7.14)
Nagelkerke's pseudo-$R^2 = 0.37$					

*: statistical significance at $p < .01$

CP conduct problems, *s.d.* standard deviation, *VHD* very high-decreasing CP trajectory, *HD* high-decreasing CP trajectory, *OR* odds ratio, *CI* confidence interval, *High CU* posterior probabilities of membership to the high-stable callous-unemotional trajectory, *High NAR* posterior probabilities of membership to the high-decreasing narcissism-grandiosity trajectory, *High IMP* posterior probabilities of membership to the high-decreasing impulsivity-irresponsibility trajectory

Table 2 Effects of combinations of psychopathic traits trajectories in logistic regression models predicting membership to CP trajectories

Combinations	Groups frequencies		Predictive associations			
	VHD (n = 127)	HD (n = 189)	β	OR	95% CI	Pseudo-R^2
Any-1	90.6%	66.7%	1.58*	4.85	(2.45–9.58)	0.14
Any-2	70.1%	25.9%	1.93*	6.86	(4.08–11.54)	0.27
NAR + IMP	29.9%	7.4%	1.63*	5.09	(2.58–10.04)	0.14
NAR + CU	30.7%	3.2%	2.63*	13.83	(5.52–34.62)	0.22
IMP+CU	58.3%	21.7%	1.64*	5.17	(3.10–8.62)	0.21
All-3	24.4%	3.2%	2.28*	9.79	(3.87–24.75)	0.17

*: statistical significance at $p < .01$

CP conduct problems, *VHD* very high-decreasing CP trajectory, *HD* high-decreasing CP trajectory, *OR* odds ratio, *CI* confidence interval, *Any-1* membership to at least one of the three high trajectories of psychopathic traits, *Any-2* membership to at least two of the three high trajectories of psychopathic traits, *NAR + IMP* membership to high narcissism-grandiosity and high impulsivity-irresponsibility trajectories, *NAR + CU* membership to high narcissism-grandiosity and high callous-unemotional trajectories, *IMP+CU* membership to high impulsivity-irresponsibility and high callous-unemotional. All-3: membership to high trajectories on all three dimensions of psychopathic traits. All models were conducted with sex and annual family income as covariates (not shown)

income, all six variables referring to combinations of high trajectories of psychopathic traits showed significant associations with CP trajectory groups membership. On the basis on the odd ratios of each variables, the combination of high trajectories of narcissism-grandiosity and callous-unemotional traits appeared to be the best indicator of the dependent variable.

Discussion

The current study showed that among youths presenting high levels of CP in childhood a higher probability of following a high or a high-declining trajectory of each of the three dimensions of psychopathic traits has a unique effect in increasing the odds of following a CP trajectory in which the CP levels are likely to remain close to clinical significance at least until adolescence. Conversely, a lower probability of following these high trajectories of traits increases the likelihood of following a CP trajectory that declines more rapidly and reaches the normal zone during adolescence. The non-significant effect of the sex covariate and the non-significant differences in proportions of boys and girls in the psychopathic traits trajectories suggest that our pattern of results apply to both boys and girls. These results give partial support to the pathoplasticity/exacerbation model. Since we did not observe increasing trajectories of traits and CP in this sample of children with very high levels of CP at study inception, we did not witness the exacerbation effect of psychopathic traits on CP trajectories. In fact, except for the trajectories of the callous-unemotional dimension, which were stable over time, the trajectories of the two other dimensions were declining. Nevertheless, the high-declining trajectories of the narcissism-grandiosity and impulsivity-irresponsibility dimensions identified subgroups of youths who maintain high levels of traits over time (Bégin et al. 2019), and the probabilities of being classified in these high-declining trajectories were also associated to a less declining CP trajectory. This result therefore suggests that high trajectories of psychopathic traits are related to the persistence of childhood-onset CP, which is consistent with the pathoplasticity/exacerbation model. In addition, our results support the remission/desistance model, as they indicate that the likelihood of the remission of childhood-onset CP increases when the levels of psychopathic traits are consistently low or are initially low and decline over time.

Regarding the callous-unemotional dimension, our results are consistent with those of previous studies conducted in community-based samples (Fanti et al. 2017; Fontaine et al. 2011; Klingzell et al. 2016) and among children with CP (Muratori et al. 2016), as they suggest that the developmental trajectories of callous-unemotional traits can help distinguish persisting from desisting CP among children with childhood-onset CP. It therefore appears that, among these children, stronger deficits in empathy-related abilities, such as remorse, guilt and concerns for others, seem to impede the progressive decline of CP that is more likely to occur from childhood to adolescence if these deficits are lower. What's more, since the two callous-unemotional traits trajectories observed in our study were stable, the level of these traits during childhood could be an indicator of the trajectory of childhood-onset CP that could be as valid as the developmental trends of these traits.

With regard to the narcissism-grandiosity and the impulsivity-irresponsibility dimensions, our results are also consistent with the few previous studies that suggested these traits could be related to CP trajectories (Reijntjes et al. 2016; Lynne-Landsman et al. 2011). A high (though declining)

trajectory of these traits could reflect a deficit or a delay in the development of certain adaptive capabilities that would be expected to reduce CP levels. For example, among children with childhood-onset CP, those with increasing altruism or caring abilities (hence low-declining narcissism-grandiosity traits levels) and increasing behavioral inhibition or cognitive planning abilities (hence low-decreasing impulsivity-irresponsibility traits) could be more likely to follow declining CP pathways. Additionally, since our study shows that the trajectories of these two dimensions decline over time, it supports the idea that narcissism-grandiosity and impulsivity-irresponsibility traits could be more subject to change than callous-unemotional traits in children with childhood-onset CP.

Our findings also revealed that the different combinations of traits trajectories were associated to CP trajectories to various degrees. These results underline the importance of considering all three dimensions of psychopathic traits in the study of the heterogeneity of childhood-onset CP trajectories from childhood to adolescence. While previous research had investigated the associations between cross-sectional measures of combinations of psychopathic traits and CP (i.e. Bergstrom and Farrington 2018; Colins et al. 2018; Frogner et al. 2018b), this study is the first, to our knowledge, to provide evidence of developmental associations between combinations of trajectories of psychopathic traits and trajectories of childhood-onset CP. First, these results showed that following a high trajectory of any psychopathic traits was related to a more persistent pattern of CP, while presenting none of these high trajectories was associated with a lower and more rapidly declining CP trajectory. However, while most children with persisting or desisting patterns of CP followed a high trajectory of at least one psychopathic dimension, children following high trajectories of at least two dimensions of psychopathic traits were much more likely to be in the persisting CP group than in the desisting CP group; only a minority of children in the latter group followed two high trajectories of traits. This result suggests that, among children with childhood-onset CP, presenting a high trajectory of more than one dimension of psychopathic traits could be a better indicator of the risk of following a more stable pattern of childhood-onset CP than presenting a high trajectory of one dimension only. In terms of specific combinations of traits, our results tend to indicate that the combination of high trajectories of narcissism-grandiosity and callous-unemotional traits is the combination associated with the greatest odds of following a very-high declining CP trajectory. However, the fact that this specific combination was an even stronger indicator of CP trajectories membership than the combination of all three dimensions of psychopathic traits could be a statistical artifact. Indeed, all children from the desisting CP trajectory group who followed the high narcissism-grandiosity and callous-unemotional traits also followed the high impulsivity-irresponsibility traits. Consequently, the combination of high trajectories of all three dimensions could not produce a stronger prediction of CP trajectory groups. At most, the association could have been of an identical magnitude if all children from the persisting CP trajectory group following the high narcissism-grandiosity and callous-unemotional traits also followed the high impulsivity-irresponsibility traits. Future research will need to clarify if a specific combination is truly a more robust indicator of childhood-onset antisocial pathways than the combination of all three dimensions of psychopathic traits.

As mentioned in the introduction of this article, traits are conceptualized as dynamic constructs across the life-course (Morizot 2015). Following the plasticity, cumulative continuity, and maturation principles of traits development (Roberts et al. 2008), psychopathic traits were expected to change during childhood, and we hypothesized that this change would be related to childhood-onset CP trajectories. Our results support this hypothesis by showing change in two dimensions of psychopathic traits, as well as associations between trajectories of traits and trajectories of CP. The psychopathic traits trajectories obtained in our study showed that, among children with high levels of conduct problems, these traits are likely to either remain stable or to decline slightly over time, as no increasing trajectory was found for any of the psychopathic traits dimension. However, the consistently high levels of the high and high-declining trajectories of all psychopathic traits indicate that, among children with CP, high levels of psychopathic traits in childhood are likely to remain high during adolescence, while lower levels of traits are likely to remain low through this period. Thus, considering the initial levels of psychopathic traits among children with CP appears to give valuable information to clinicians about the trajectories of childhood-onset CP. In addition, the combination of high levels of more than one dimension should be interpreted as a stronger risk factor for CP persistence.

With regard to treatment of antisocial children, our results suggest that clinicians could indirectly influence CP pathways by targeting the three dimensions of psychopathic traits. By reducing levels of these traits early in a child's development, CP levels could be expected to decline accordingly. To induce such change, professionals could take advantage of the acute malleability of traits during childhood in order to inflect their trajectories before they stabilize later in life. Some studies conducted among children with CP have shown that interventions aiming to improve parental practices (McDonald et al. 2011; Pasalich et al. 2016) and an intervention combining a parental practices component with a child emotion recognition and problem–solving skills component (Lochman et al. 2014) appeared to reduce the levels of the three dimensions of psychopathic traits. More studies will need to investigate the underlying mechanisms through which clinicians can expect to influence the trajectories of the different dimensions of psychopathic traits, as the most beneficial interventions in reducing each dimension could differ.

Strengths and Limitations

This study includes several strengths, such as its longitudinal design covering a time-span that captured developmental change in CP and psychopathic traits and a sample containing roughly similar proportions of boys and girls with high levels of CP. Moreover, the use of multi-informant methods offered more valid assessments of psychopathic traits and CP. In this study, the multi-informant approach was used to capture traits as it is recommended in the DSM-5 (APA 2013). To the extent that this assessment approach could have underestimated the levels of traits, we conducted again the analyses, this time using a more sensitive approach in which the highest score between informants was retained for each item. The pattern of results was very similar and supported the same conclusions. There are limitations to the current study to consider as well. First, school-based services received by children in our sample could have influenced the observed trajectories of CP, or those of narcissism-grandiosity and impulsivity-irresponsibility, which were declining. However, no studies, to our knowledge, have been conducted on the effects of these general services delivered in schools on these dimensions of psychopathic traits, and studies have concluded that their effect on CP is particularly limited (Dempsey et al. 2016; Morgan et al. 2010). In addition, since all children in the sample received such services at study inception, their influence on the associations observed between traits and CP trajectories should be limited. Second, our design does not cover the period of early childhood. Therefore, it does not allow to observe the developmental trends of psychopathic traits during this period, nor does it allow to verify the early effects traits could have on later CP. More research is needed to further examine the early effects of psychopathic traits on the persistence of CP throughout child development. Finally, this study suggests that its results apply similarly to both boys and girls. However, since a relatively small amount of research have been conducted on this matter among girls presenting high levels of CP, these results should be replicated or extended by further studies.

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Compliance with Ethical Standards

Conflict of Interest Vincent Bégin, Michèle Déry and Yann Le Corff declare that they have no conflict of interest.

Experiment Participants All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study was also approved by the Education and Social Sciences Ethics Committee of the Université de Sherbrooke (Quebec, Canada).

Informed Consent Informed consent was obtained from all individual participants included in the study.

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