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Regular Article

Impulsivity profiles across five harmonized longitudinal childhood preventive interventions and associations with adult outcomes

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Abstract

This study aimed to parse between-person heterogeneity in growth of impulsivity across childhood and adolescence among participants enrolled in five childhood preventive intervention trials targeting conduct problems. In addition, we aimed to test profile membership in relation to adult psychopathologies. Measurement items representing impulsive behavior across grades 2, 4, 5, 7, 8, and 10, and aggression, substance use, suicidal ideation/attempts, and anxiety/depression in adulthood were integrated from the five trials ($N = 4{,}975$). We applied latent class growth analysis to this sample, as well as samples separated into nonintervention ($n = 2{,}492$) and intervention ($n = 2{,}483$) participants. Across all samples, profiles were characterized by high, moderate, low, and low-increasing impulsive levels. Regarding adult outcomes, in all samples, the high, moderate, and low profiles endorsed greater levels of aggression compared to the low-increasing profile. There were nuanced differences across samples and profiles on suicidal ideation/attempts and anxiety/depression. Across samples, there were no significant differences between profiles on substance use. Overall, our study helps to inform understanding of the developmental course and prognosis of impulsivity, as well as adding to collaborative efforts linking data across multiple studies to better inform understanding of developmental processes.

Keywords: Adolescence; adulthood; childhood; impulsivity; preventive interventions; psychopathology

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Impulsivity is a broad construct, commonly defined as an individual difference, that manifests as a preference for immediate over delayed reward, a failure to plan, and impaired self-control (Beauchaine et al., 2017). Other definitions of this construct emphasize elevated urgency and sensation seeking and deficient premeditation and perseverance (e.g., Whiteside & Lynam, 2001). Extensive evidence has linked impulsigenic traits to heightened psychopathology (for a meta-analysis, see Berg et al., 2015). In fact, impulsivity is a criterion of 18 DSM-5 psychiatric disorders (American Psychiatric Association, 2013). Although critically involved in the development and maintenance of psychopathology, and particularly "externalizing" psychopathology (e.g., opposition, noncompliance, defiance, aggression), few studies have examined whether childhood preventive interventions targeting such problems of conduct mitigate risk for impulsivity, specifically, and associated maladaptive outcomes. The main objective of this study was to disentangle between-person heterogeneity in growth of impulsivity across childhood and adolescence in nonintervention and intervention participants recruited from five harmonized longitudinal preventive intervention trials. In addition, we also aimed to observe whether profile membership was associated with adult psychopathologies.

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Impulsivity as an underlying process

Impulsigenic traits have been identified as transdiagnostic phenotypes for multiple externalizing psychopathologies, including attention-deficit/hyperactivity disorder (ADHD), oppositional defiant disorder, and conduct disorder in early and middle childhood, as well as substance use disorder and antisocial personality disorder in adolescence and adulthood (Beauchaine et al., 2010, 2017). Impulsivity has also been identified as a specific measurement item that bridges (i.e., a symptom from one dimension that connects to symptoms from another dimension; Cramer et al., 2010) aggressive and delinquent behavior across childhood and into early adolescence (Goulter et al., 2022). Indeed, impulsivity has been hypothesized to contribute to externalizing heterotypic continuity, which refers to distinct behavioral manifestations of the same underlying liability (Beauchaine

et al., 2010, 2017). In addition to underpinning multiple forms of externalizing psychopathology, meta-analytic work has identified impulsivity as a mediator between childhood maltreatment and suicidal behavior (Pérez-Balaguer et al., 2022). Facets of impulsivity are also associated with suicidal behavior in young people and may represent critical markers of suicidal risk (Brezo et al., 2006; McHugh et al., 2019).

Etiological models of impulsivity point to dysfunction in early-maturational subcortical emotion-generation and later-maturational cortical emotion-regulation systems (Casey, 2015; Cubillo et al., 2012; Macdonald et al., 2016). Specifically, imaging research has shown that the mesolimbic dopamine system and its feedforward and feedback projections to and from the mesocortical dopamine system represent neural substrates characterizing dispositional impulsivity (Gatzke-Kopp, 2011). Molecular genetic research has also shown that dopamine functioning plays an important role in vulnerability to approach-related affect and impulsive behavior (Neuhaus & Beauchaine, 2017). In addition to these neurobiological influences, environmental factors have been implicated in the susceptibility of impulsive behavior. Particularly, childhood adversity (e.g., parental maltreatment) can alter functioning of cortical structures, such as the prefrontal cortex, further promoting impulsive behavior (Hanson et al., 2010; Mead et al., 2010). Thus, interventions with components addressing childhood cognitive, affective, and behavioral difficulties, in addition to targeting change in adverse environmental factors (such as social interactions within the home environment), have the potential to decrease the likelihood of the development of psychopathology through reductions in levels of impulsivity.

Childhood preventive interventions

Although few studies have examined childhood preventive intervention effects on impulsivity specifically, there is accruing evidence of the positive impact of intervention on aggressive and disruptive behavior through childhood, adolescence, and into early adulthood. For example, the Johns Hopkins trials found that children who received the Good Behavior Game [GBG]—a classroom-based behavior management intervention that aims to decrease disruptive behaviors—exhibited lower levels of aggressive behavior across childhood and adolescence, relative to children in a control condition (Dolan et al., 1993; Ialongo et al., 1999, 2019). Further, participation in the Linking the Interest of Families and Teachers (LIFT) intervention, which included a version of the GBG, was associated not only with reduced aggression on the playground but also reduced teacher-rated problem behavior during the middle school years (Eddy et al., 2003). Similarly, SAFE Children, a family-focused preventive intervention, significantly reduced children's aggressive and disruptive behaviors (Tolan et al., 2004), as did Fast Track (FT), a multimodal school-based preventive intervention (Conduct Problems Prevention Research Group, 2020).

Some of these interventions had long-term and multifaceted impacts. For example, in young adulthood, the GBG showed effects across multiple outcomes, including a reduction in the use of school-based mental health services (Poduska et al., 2008), and lower incidence of substance use disorders (Kellam et al., 2008), antisocial personality disorder (Petras et al., 2008), and suicidal ideation and attempts (Wilcox et al., 2008). Among those with the highest kindergarten-assessed risk of conduct problems, FT participants assigned to intervention, relative to control, showed significant reductions in delinquency and a reduced number of conduct disorder diagnoses in childhood and adolescence (Conduct Problems Prevention Research Group, 2007, 2011). The FT intervention also decreased the probability of suicidal ideation and hazardous drinking in adolescence and adulthood, and opioid use in adulthood (Godwin et al., 2020), as well as decreasing externalizing and internalizing psychopathology, substance use problems, and substance and violent convictions in adulthood (Dodge et al., 2015).

Drawing on developmental models grounded in the research literature on impulsivity and ADHD (Beauchaine et al., 2010, 2017), multimodal interventions designed to target conduct problems, including child-focused skills training, behavior therapy, social-emotional learning, and parent management training (such as the preventive interventions noted above), also might be well suited to reduce impulsivity among children and adolescents. There have been some promising findings in this regard. For example, the SAFE Children study found that the intervention predicted lower latent trajectory class membership of impulsivity for children across a 42-month period (Fowler et al., 2014). Similarly, Musci et al. (2014) found that the Family School Partnership and classroom-centered interventions significantly reduced impulsive (and aggressive) behavior for adolescents across the 6th to the 12th grades. Overall, preliminary findings from longitudinal studies of childhood preventive interventions demonstrate that psychosocial interventions that target and significantly reduce conduct problems may also have beneficial effects on impulsive behaviors specifically.

Integrative data analysis and mixture modeling

Studies of large-scale interventions often use specific methodological approaches to reduce attrition, such as including a concise battery of measures and planned missingness whereby incomplete data are collected by design. These approaches not only help to reduce participant burden—which can increase the overall quality of the collected data—but also reduce the financial cost of conducting the study (Little & Rhemtulla, 2013). Of course, such practices necessitate that some measurement occasions are omitted, and some key constructs are not fully assessed. By *synthesizing raw data across multiple trials* through pooled data analytic approaches such as integrative data analysis, sample sizes at measurement occasions can be increased and sufficient information about these constructs may be captured (Brincks et al., 2018; Hussong et al., 2013). Because integrated data increase the sample size and statistical power, heterogeneity of population characteristics may also be studied. Importantly, this can both optimize the examination of subgroup effects and enable the examination of impacts on low base-rate behaviors, such as suicidal behaviors. Mixture modeling is a methodological approach often used to parse variance and distinguish subgroups or profiles (Masyn, 2013). In particular, latent class growth analysis (LCGA) may be beneficial in identifying patterns across time.

Longitudinal studies charting the developmental course of impulsivity (and related constructs) have typically revealed decreasing or stable patterns across childhood, adolescence, and into adulthood. For example, research with several population cohorts found that hyperactive-inattentive scores decreased from early childhood through early adulthood (Wootton et al., 2022). In another study spanning multiple countries, self-regulation scores increased from preadolescence through early adulthood (Steinberg et al., 2018). However, other models have conceptualized impulsivity (and, more broadly, ADHD symptoms) as stable over time (Sonuga-Barke et al., 2022). By applying LCGA to longitudinal data of

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impulsivity, findings can help to inform understanding regarding heterogeneity in the developmental course of impulsive behavior across critical developmental periods. Using LCGA with large integrated datasets also serves to identify between-person differences in growth of impulsivity with more power and precision than when applied to single studies. In addition, parsing between-person differences in intervention samples can inform for whom interventions are effective (Fowler et al., 2014; Pasalich et al., 2022). For example, a robust finding in the literature shows that classroom-based behavior management interventions, such as the Good Behavior Game, are more effective for those with higher initial severity of conduct problems (Kellam et al., 2008; McMahon et al., 2021).

The present study

This study had three core aims. First, we aimed to harmonize items related to impulsive behavior from five randomized controlled trials focused on preventing aggressive and disruptive behavior in middle childhood by using individual participant data and applying integrative data processing. Second, we aimed to parse between-person heterogeneity in growth of impulsivity across six timepoints in childhood and adolescence (grades 2, 4, 5, 7, 8, and 10). To understand intervention effects on the development of impulsivity, we examined whether intervention status predicted profile membership in the combined nonintervention and intervention sample ($N = 4,975$; 53.6% male; 55.1% Black, 37.2% white, 7.5% other race/ethnicity). We also examined between-person differences in impulsivity in the nonintervention ($n = 2,492$; 53.0% male; 54.3% Black, 38.4% white, 7.2% other race/ethnicity) and intervention ($n = 2,483$; 54.2% male; 55.9% Black, 35.9% white, 7.8% other race/ethnicity) samples. Finally, we aimed to determine whether distinct profiles of impulsivity across childhood and adolescence were associated with theoretically relevant psychopathologies in adulthood (ranging from 18 to 25 years) and we examined sex, race/ethnicity, and baseline levels of aggression as predictors. Adult outcomes included aggressive behavior, substance use, suicidal ideation/attempts, and anxiety/depression. Findings have the potential to inform understanding of the developmental course and prevention of impulsivity during childhood and adolescence, as well as prognosis regarding psychopathological outcomes in adulthood.

Method

Participants and procedure

The harmonized sample included 4,975 participants from five randomized controlled prevention trials: Johns Hopkins Prevention Intervention Research Center Generation (PIRC) Generation 1 ($n = 2,311$), PIRC Generation 2 ($n = 678$), LIFT ($n = 671$), SAFE Children ($n = 424$), and FT ($n = 891$). In each trial, legal guardians provided consent, participants assented to procedures, and all participants were provided monetary compensation for their time. All procedures were approved by the relevant Institutional Review Board (IRB) for each site and the harmonized dataset and analyses were approved by the Johns Hopkins IRB.

Prevention Intervention Research Center Generation 1 (PIRC 1)

In 1985, two successive first-grade cohorts ($n1 = 1,196$; $n2 = 1,115$; total $N = 2,311$) were recruited from 43 classrooms among 19 elementary schools located in five distinctly different sociodemographic urban areas of eastern Baltimore. Within each area, three or four schools were matched by socioeconomic status, size of the school, and ethnicity. In first grade, the students' mean age of participants was 6.5 years ($SD = 0.48$), and 52% received free or reduced-priced lunch—a proxy for low family income. Schools were randomly assigned to receive either the GBG intervention (Barrish et al., 1969), the Mastery Learning curriculum intervention (Dolan et al., 1993), or no intervention. In addition, within schools, teachers and students were randomly assigned to intervention or no intervention conditions. The GBG is a whole-class behavior management strategy that aims to decrease disruptive behaviors by assigning children to teams and only allowing the teams that do not exceed a specified criterion of precisely defined off-task, disruptive, and aggressive behaviors to "win." Participants assigned to the GBG condition received the intervention over the course of first and second grades, with the game being played several times per week. The Mastery Learning intervention involved extensive enrichment of the reading curriculum, with a special focus on clear instructional statements, communication of expectations, and a group-based approach to mastery. For the present analyses, participants were clustered into intervention (GBG + Mastery Learning: $n = 1,339$; 49.0% male; 68.2% Black, 30.1% white, 1.6% other race/ethnicity) and nonintervention ($n = 972$; 50.4% male; 63.6% Black, 35.0% white, 1.5% other race/ethnicity) groups.

Prevention Intervention Research Center Generation 2 (PIRC 2)

In 1993, 678 urban first graders were recruited from 27 classrooms in 9 elementary schools primarily located in western Baltimore. At baseline, participants ranged in age from 4.9 to 8.1 years with a mean age of 6.2 years ($SD = 0.37$), and 68.9% of the children received free or reduced-priced lunch. Classrooms were randomly assigned to the classroom-centered intervention (adapted from the GBG and Mastery Learning interventions), the Family-School Partnership intervention, or no intervention. The classroom-centered intervention was designed to reduce the early risk behaviors of poor achievement and aggressive behavior through enhancements to the curriculum, improvements in teacher instructional and classroom behavior management practices, and specific strategies for children not performing adequately (Ialongo et al., 1999). The Family-School Partnership intervention was developed to improve collaboration between parents, teachers, and school mental health professionals and to enhance parents' behavior management skills (Ialongo et al., 1999). For these analyses, participants were clustered into intervention (classroom-centered + Family-School Partnership: $n = 459$; 54.5% male; 86.5% Black, 13.3% white, 0.2% other race/ethnicity) and nonintervention ($n = 219$; 51.1% male; 85.8% Black, 14.2% white, 0% other race/ethnicity) groups.

Linking the interest of families and teachers (LIFT)

Across three cohorts recruited between 1991 and 1993, a total of 671 first or fifth-grade children were enrolled from 12 public elementary schools in three adjacent school districts in the Pacific Northwest. Either the entire set of first-grade classes (which included some second-grade students) or the entire set of fifth-grade classes (which included some fourth-grade students) within each school were invited to participate. School eligibility was based on living in "at-risk" neighborhoods, characterized by elevated rates of juvenile contact with police relative to local norms. Schools

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were randomly assigned to a multimodal intervention condition or a nonintervention condition. At baseline, approximately 25% of families were receiving some type of public financial assistance. In the intervention condition, the classroom component was intended to improve child social and problem-solving skills through 20 hour-long social-emotional learning skills training sessions over the course of the intervention; the playground component was a modified version of the GBG which reinforced child positive social behaviors during free (unstructured) play time; the family component was a group-based version of cognitive-behavioral parent management training emphasizing effective communication, positive reinforcement, supervision, discipline, and problem-solving skills. Parents met with a parent management training coach once a week, for 6 weeks, as well as received support via phone between sessions; finally, the linking component encouraged various avenues for teacher–parent communication while the other components were in play (Eddy et al., 2000; Reid et al., 1999). The present study included intervention participants ($n = 382$; 51.3% male; 1.3% Black, 85.9% white, 11.0% other race/ethnicity) and nonintervention participants ($n = 289$; 46.4% male; 2.4% Black, 81.3% white, 16.3% other race/ethnicity).

SAFE children (SAFE)

In 1997, 424 families consented to participate in the first-grade intervention of the SAFE Children study set within seven inner-city schools in Chicago (Tolan et al., 2004). A majority of the sample (59%) had a family income of below $20,000 per year. Randomization occurred at the individual level, weighing toward the intervention condition because of expected lower retention rates for the prevention program. The first component was a multiple-family group approach that focused on parenting skills, family relationships, understanding and managing expectable developmental and situational challenges to the families, increasing support among parents in the group, issues in engaging as a parent with the school, and managing issues such as neighborhood problems. This component was combined with a phonics-based reading tutoring program and relates to academic improvement among high-risk children during first grade (Conduct Problems Prevention Research Group, 2020). Participants included intervention ($n = 225$; 45.8% male; 39.1% Black, 5.3% white, 54.7% other race/ethnicity) and nonintervention ($n = 199$; 52.3% male; 46.2% Black, 3.0% white, 50.8% other race/ethnicity) groups.

Fast track (FT)

Between 1991 and 1993, 55 high-risk schools were selected based on crime and poverty rates of their communities across four sites (Durham, NC; Nashville, TN; rural Pennsylvania; and Seattle, WA; Conduct Problems Prevention Research Group, 2020). Within each site, clusters of schools were randomly assigned to intervention and nonintervention conditions. Children were selected for inclusion into the sample based on teacher and parent reports of behavior problems moving from the highest score downward until desired sample sizes were reached within sites, cohorts, and groups. This multi-stage screening procedure resulted in a total of 891 high-risk children. During the elementary school phase of the intervention (grades 1–5), all families were offered parent management training with home visiting, academic tutoring, and child social skills training. Parent and child group interventions were conducted during a 2-hour enrichment program. These sessions included social skill training "friendship groups" (Bierman et al., 2017), parent-training groups for parents, and guided parent–child interaction sessions (McMahon & Slough, 1996). Paraprofessionals also provided tutoring, as well as peer-pairing session to improve friendships with classmates. In addition, a universal intervention (a modified, grade-level version of the PATHS curriculum; Greenberg & Kusché, 2011) was provided to the classrooms in intervention schools through the elementary school years to promote social and emotional competence. The universal intervention included weekly teacher consultation for lessons and classroom behavior management (Bierman et al., 2017). During the middle and early high school phase (grades 6-10), there were three standard prevention activities offered to all FT intervention children: the middle school transition program, parent and youth groups on adolescent topics, and youth forums. Adolescent developmental issues were addressed with four meetings for parents and youth during grade 6. Parent groups focused on issues such as positive involvement and monitoring, and youth groups focused on issues such as coping with peer pressure. Parents and youth met together in groups to address romantic relationships and sex education, substances use and vocational goal setting. In grades 7 and 8, eight Youth Forums based on Oyserman's (2000) program were held with youth in small groups to address vocational opportunities, budgeting and life skills, job interview skills, and summer employment opportunities. In grades 7–10, individualized intervention plans were developed and implemented with each youth, based on regular assessments of risk and protective factors, conducted three times during each year. The present study used data from the intervention ($n = 445$; 72.4% male; 53.0% Black, 44.5% white, 2.5% other race/ethnicity) and high-risk nonintervention ($n = 446$; 66.4% male; 48.4% Black, 48.9% white, 2.7% other race/ethnicity) samples.

Measures

Impulsivity (grades 2, 4, 5, 7, 8, and 10)

Impulsivity was assessed with four measures including the Parent Observation of Classroom Adaptation-Revised (POCA; Ialongo et al., 1999), the Teacher Observation of Classroom Adaptation-Revised (TOCA; Werthamer-Larsson et al., 1991), the Child Behavior Checklist (CBCL; Achenbach, 1991a), and the Teacher's Report Form (TRF: Achenbach, 1991b). The POCA is a 42-item structured interview assessing child behavior and adaptation to the family environment. Items are scored on a 4-point scale (1 "never/almost never," 2 "sometimes," 3 "often," 4 "almost always"). A corresponding measure to the POCA, the TOCA is also a 42-item structured interview in which teachers report on their experiences with the child regarding different behaviors and characteristics. Items are scored on a 6-point scale (1 "*never/almost never*," 2 "*rarely*," 3 "*sometimes*," 4 "*often*" 5 "*very often*," 6 "*always*"). The CBCL is an empirically derived 113-item self- and parent-rated assessment of a child's behavior problems and social competence. Items are scored on a 3-point scale (0 "*not true*," 1 "*somewhat or sometimes true*," 2 "*very or often true*"). The TRF is the teacher's adaptation of the CBCL, which also includes 113 items assessing child behavior problems and social competence. Items are also scored on a 3-point scale (0 "*not true*," 1 "*somewhat or sometimes true*," 2 "*very or often true*"). Impulsivity items included: *waits for turn*, *interrupts others*, *blurts out answer*, *can't sit still*, *concentrates*, *pays attention*, and *stays on task* (see Supplementary Table S1 for which measures were administered at which grades, and Supplementary Table S2 for a list of item wordings for each measure). These items have been used in other studies examining impulsivity with high predictive validity (Musci et al., 2014).

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Adult outcomes

Aggressive behavior (ages 18–21)

In addition to items drawn from the above measures, self-report measures (and an adaptation of the Diagnostic Interview Schedule's [DIS] Antisocial Personality Module [Robins et al., 1981] was used in PIRC 1 and 2) were used to assess aggression including items such as: *gets into fights*, *takes others' property*, *lies*, *yells at others*, *hurts others physically*, and *destroys property*.

Substance use (ages 18–25)

Substance use was defined as use of illicit substances in the past 12 months including opioids, cocaine, inhalants, stimulants, hallucinogens, and sedatives-tranquilizers. The origin of the substance use measurement varied across studies but was primarily derived from Composite International Diagnostic Interview (CIDI; Kessler et al., 1998), the National Survey on Drug Use and Health (U.S. Department of Health and Human Services), or the National Longitudinal Study of Adolescent Health (Bureau of Labor Statistics, US Department of Labor, 2002).

Suicidal ideation/attempts (ages 18–23)

Suicide ideation and attempts were measured by asking two questions: whether the participants had (1) any serious/repeated thoughts about suicide and (2) deliberately tried to hurt or kill themselves in the past 12 months. Questions were drawn from the CIDI (Kessler et al., 1998), DIS (Shaffer et al., 2000), and the Adult Self-Report (Achenbach, 1997).

Anxiety/depression (ages 18-21)

In addition to items drawn from the above measures, self-report measures were also used to create an anxiety/depression score including items such as: *I feel sad*, *I feel like crying*, *nothing makes me happy*, *I am tired.*

Predictors

Intervention status, baseline aggression, binary sex (1 = Male, 0 = Female), and race (1 = Black, 0 = white) were included as predictors. Baseline aggression was assessed with items from the same measures as impulsivity including items such as: *gets into fights*, *takes others' property*, *lies*, *yells at others*, *hurts others physically*, and *destroys property*.

Analytic approach

Analyses proceeded in two main steps: integrative data processing and mixture modeling.

Integrative data processing

To integrate impulsivity data across datasets, similar items from measures were identified and recoded as binary to adjust for differing Likert scales (such that, for the POCA and TOCA, 1 was recoded as 0 and all other scores were recoded as 1; and for the CBCL and TRF, 2 was recoded as 1). Items were then coded as an overall binary variable, such that if a participant endorsed any item, they received a score of 1 (otherwise a score of 0).[1] Overall binary variables were then mean scored for each timepoint. For baseline aggression and both adult aggression and anxiety/depression, items were *z*-scored and then mean scored within year (and across years for adult outcomes). Substance use and suicidal ideation/attempts were coded as a binary variable, such that if a participant endorsed these items at any timepoint, they received a score of 1 (otherwise a score of 0).

[1]We also coded our impulsivity items as *z*-scores and on a 0-2 Likert scale before creating mean scores across items. Results from LCGA using these types of coding are shown in Supplementary Table S12 and S13, respectively.

Mixture modeling

This step was completed separately for combined, nonintervention, and intervention samples. Using M*plus* version 8.6 (Muthén & Muthén, 2021), the manual Bolck, Croon, and Hagenaars (BCH) method was conducted to identify the number of impulsivity latent profiles and to compare profiles on predictors and adult outcomes (Asparouhov & Muthén, 2014). The BCH method is recommended for examining associations between identified profiles and distal outcomes because it accounts for measurement error (i.e., classification uncertainty) of the latent profiles and the unequal variances among the variables by using posterior probabilities as weighting to account for individual differences (Nylund-Gibson et al., 2019). In the first step, LCGA were conducted to identify groups of individuals based on impulsivity scores across six time points during childhood and adolescence. The optimal number of latent profiles was determined by comparing model fit across five models. Fit statistics included the Bayesian information criterion (BIC), sample-adjusted Bayesian information criterion (aBIC), Akaike information criterion (AIC), the Lo-Mendel-Rubin likelihood ratio test (LMR-LRT), and the Bootstrapped likelihood ratio test (BLRT) (Nylund et al., 2007). The model with the lowest BIC, aBIC, and AIC values is preferred, a nonsignificant χ^2 value ($p > .05$) for the LMR-LRT and BLRT statistics suggests that a model with one fewer class is preferred (i.e., *k*-1), and higher entropy values closer to 1.00 indicate clearer classification and greater power to predict class membership. Multiple random starting values (500 for each model) were used to avoid a local maximum. In addition, classification, accuracy, parsimony, and interpretability were also considered to ensure models fit with theory and previous research. In the second step, classification errors were computed, and the inverse logit of the error rates were transformed into weights. In the final step, using the established weights, we regressed class membership on intervention status (in the combined sample) and predictors (i.e., baseline aggression, sex, race/ethnicity), reported odds ratios (*OR*), and compared classes on adult outcomes (i.e., aggression, substance use, suicidal ideation/attempts, anxiety/depression) using difference testing. Full-information maximum likelihood (FIML) techniques were used to attain model estimates, which provides full-sample estimates that accommodate all observations regardless of whether missing data occurs for certain variables (Rubin & Little, 2002). Data were considered missing at random qualifying our use of FIML. For integrative data analytic techniques, data is argued to be missing at random when trials have "different measures, different follow-up times, and missingness on conditions to which they were not randomly assigned (e.g., active intervention if assigned to control)" (Brincks et al., 2018 p. 64). FIML is also highly robust when there are large amounts of missing data (Brown, 1990; Lavori et al., 2008; Siddique et al., 2008).

Results

Descriptive statistics

Missing data, descriptive statistics, and correlations of main study variables are presented in Supplementary Tables S4 (combined sample), S5 (nonintervention sample), and S6 (intervention sample). (Missing data, descriptive statistics, and correlations of

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main study variables are also provided for each trial in the Supplementary Materials [see Supplementary Tables S7-S11].)

Impulsivity profiles through childhood and adolescence

Model fit statistics are presented in Table 1. LCGA indicated an optimal four-class impulsivity solution for the combined sample, the nonintervention sample, and the intervention sample.

For the combined sample, profiles are shown in Figure 1 and described as: high (61.9%; [intercept = .86, $p < .001$; linear slope = .10, $p < .001$; quadratic slope = −.02, $p < .001$]), moderate (12.2%; [intercept = .82, $p < .001$; linear slope = −.02, $p = .001$; quadratic slope = −.00, $p = .017$]), low (10.8%; [intercept = .67, $p < .001$; linear slope = −.11, $p < .001$; quadratic slope = .01, $p < .001$]), and low-increasing (15.3%; [intercept = .32, $p < .001$; linear slope = −.24, $p < .001$; quadratic slope = .05, $p < .001$]).

For the nonintervention sample, profiles are shown in Figure 2a and described as: high (63.6%; [intercept = .86, $p < .001$; linear slope = .10, $p < .001$; quadratic slope = −.02, $p < .001$]), moderate (12.1%; [intercept = .80, $p < .001$; linear slope = −.02, $p = .116$; quadratic slope = −.00, p=.010]), low (11.4%; [intercept = .71, $p < .001$; linear slope = −.14, $p < .001$; quadratic slope = .02, $p < .001$]), and low-increasing (14.3%; [intercept = .34, $p < .001$; linear slope = −.26, $p < .001$; quadratic slope = .05, $p < .001$]).

For the intervention sample, profiles are shown in Figure 2b and described as: high (59.8%; [intercept = .86, $p < .001$; linear slope = .09, $p < .001$; quadratic slope = −.02, $p < .001$]), moderate (12.9%; [intercept = .83, $p < .001$; linear slope = −.03, $p = .003$; quadratic slope = −.00, p=.395]), low (11.4%; [intercept = .64, $p < .001$; linear slope = −.09, $p < .001$; quadratic slope = .01, $p < .001$]), and low-increasing (15.9%; [intercept = .30, $p < .001$; linear slope = −.22, $p < .001$; quadratic slope = .04, $p < .001$]).

Impulsivity profile comparisons on predictors and adult outcomes

Table 2 depicts the means and standard errors of adult outcomes for each profile for each sample. Table 3 depicts profile comparisons on predictors and adult outcomes. In the combined sample (rows 1-8), there were no intervention effects (row 1). Participants with higher levels of baseline aggression were more likely to belong to the high, moderate, and low profiles relative to the low-increasing profile (row 4, columns 3, 5, 6). Regarding adult outcomes, the high, moderate, and low profiles endorsed greater levels of aggression compared to the low-increasing profile (row 5, columns 3, 5, 6). The moderate and low profiles endorsed greater suicidal ideation/attempts than the high- and low-increasing profile (row 7, columns 1, 2, 5, 6). Finally, all profiles significantly differed on anxiety/depression (except for the moderate and low profiles) with the moderate profile showing the highest levels of anxiety/depression followed by the low, high, and low-increasing profiles (row 8). There were no significant differences in substance use (row 6).

In the nonintervention sample (rows 9-15), similarly, participants with higher levels of baseline aggression were more likely to belong to the high, moderate, and low profiles relative to the low-increasing profile (row 11, columns 3, 5, 6). Regarding adult outcomes, the high, moderate, and low profiles endorsed greater levels of aggression compared to the low-increasing profile (row 12, columns 3, 5, 6). The moderate profile endorsed greater suicidal ideation/attempts relative to the high- and low-increasing profiles (row 14, columns 1, 5), and the low profile endorsed greater suicidal ideation/attempts relative to the low-increasing profile (row 14, column 6). The moderate and low profiles reported higher levels of anxiety/depression compared to the high- and low-increasing profiles (row 15, columns 1, 2, 5, 6). There were no significant differences between profiles on substance use (row 13).

In the intervention sample (rows 16–22), as well, participants with higher levels of baseline aggression were more likely to belong to the high, moderate, and low profiles relative to the low-increasing profile (row 18, columns 3, 5, 6). Regarding adult outcomes, the high, moderate, and low profiles endorsed greater levels of aggression compared to the low-increasing profile (row 19, columns 3, 5, 6). The moderate profile endorsed greater suicidal ideation/attempts relative to the low-increasing profiles (row 21, column 5), and the low profile endorsed greater suicidal ideation/attempts relative to the high- and low-increasing profile (row 21, columns 2, 6). The moderate profile reported higher levels of anxiety/depression compared to the high- and low-increasing profile (row 22, columns 1, 5), and the low profile reported higher levels of anxiety/depression relative to the low-increasing profile (row 22, column 6). There were no significant differences between profiles on substance use (row 20).

Discussion

In this study, we integrated items representing impulsive behavior across several measures included in five preventive interventions targeting childhood conduct problems, as well as items representing aggression, substance use, suicidal ideation/attempts, and anxiety/depression across ages 18–25 years. We performed LCGA to parse between-person heterogeneity in growth of impulsivity through childhood and adolescence, in addition to testing profile membership with regards to adult outcomes.

Impulsivity profiles through childhood and adolescence

LCGA evidenced four profiles of impulsivity through childhood and adolescence. Specifically, across samples, profiles were represented by high (59.8–63.6%), moderate (12.1–12.9%), low (10.8–11.4%), and low-increasing (14.3–15.9%) impulsive levels. A general decreasing pattern of impulsivity across childhood and adolescence was observed, which is consistent with research examining similar constructs such as self-regulation (Steinberg et al., 2018). Although criticized as an oversimplified perspective of neurobiological development (Casey et al., 2016), the dual systems model suggests that increasing self-regulation (or decreasing impulsivity) across childhood and into late adolescence/early adulthood may be explained by the later-maturating cognitive control system inhibiting approach and risky behaviors (and balancing the early-maturating socioemotional system, which amplifies affinity to risky activities; Steinberg et al., 2018). Identification of the low-increasing profiles might highlight a reporter bias of impulsive behavior as children age, such that impulsivity in early childhood is considered more normative than similar behaviors expressed in later childhood and adolescence.

Relative to other related symptoms, such as inattention, impulsivity is considered to manifest with greater stability and persistence (Willcutt et al., 2012). However, our findings add to a growing literature that undulations (see grade 5 in the Figures) or later onsets in neurodevelopmental traits may be more common than originally thought (Sibley et al., 2022). Shifts in the expression of such traits may be the consequence of time-varying environmental factors (e.g., the dip at grade 5 may reflect changes in the environment during the transition from primary to middle school) or underlying neurobiological susceptibilities (Sibley et al., 2022; Sonuga-Barke et al., 2022).

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Table 1. Model fit statistics from the BCH method

Classes	BIC	aBIC	AIC	Entropy	LMR-LRT	BLRT	*N*(%)
Combined							
1	14,491.87	14,463.28	14,434.07	–	–	–	4549(100)
2	9501.56	9460.25	9418.07	.90	< .001	< .001	3584(78.1), 965(21.9)
3	7077.31	7023.29	6968.12	.89	< .001	< .001	2963(65.1), 713(15.7), 873(19.2)
4	**4265.99**	**4199.26**	**4131.11**	**.90**	**< .001**	**< .001**	**554(12.2), 694(15.3), 2812(61.8), 489(10.8)**
5	2387.76	2308.32	2227.19	.91	< .001	< .001	2759(60.7), 609(13.4), 350(7.7), 138(3.0), 693(15.2)
Nonintervention							
1	6939.31	6910.71	6887.80	–	–	–	2259(100)
2	4620.71	4579.40	4546.31	.91	.006	< .001	1856(82.2), 403(17.8)
3	3458.55	3404.54	3361.27	.88	< .001	< .001	334(14.8), 437(19.3), 1488(65.9)
4	**1897.80**	**1831.08**	**1777.62**	**.89**	**< .001**	**< .001**	**273(12.1), 227(10.0), 322(14.3), 1437(63.6)**
5	921.48	842.05	778.41	.90	< .001	< .001	73(3.2), 324(14.3), 1405(62.2), 303(13.4), 154(6.8)
Intervention							
1	7594.16	7565.57	7542.53	–	–	–	2290(100)
2	4939.45	4898.15	4864.88	.90	< .001	< .001	1763(77.0), 527(23.0)
3	3710.17	3656.16	3612.66	.90	< .001	< .001	372(16.2), 1485(64.8), 433(18.9)
4	**2425.35**	**2358.63**	**2304.89**	**.90**	**< .001**	**< .001**	**1369(59.8), 296(12.9), 260(11.3), 365(15.9)**
5	1532.78	1453.35	1389.37	.92	< .001	< .001	362(15.8), 66(2.9), 1357(59.3), 308(13.5), 197(8.6)

Note. Bolded text indicates the best-fitting model. BIC = Bayesian information criterion, aBIC = sample size adjusted Bayesian information criterion, AIC = Akaike information criterion, LMR-LRT = Lo-Mendel-Rubin likelihood ratio test, BLRT = Bootstrapped likelihood ratio test.

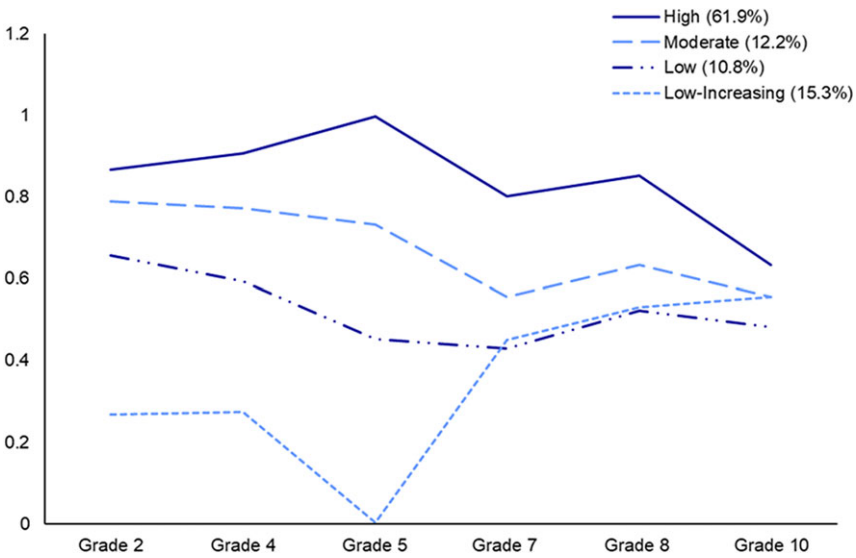

Figure 1. Impulsivity profiles from grades 2, 4, 5, 7, 8, and 10 – combined sample.

Findings may also relate to our measurement of impulsivity. Trials included in the present study were developed in the late 1980s and early 1990s. Although transdiagnostic and dimensional perspectives of mental health and illness were increasingly discussed during this time, it is only more recently that there has been a greater appreciation for processes that underlie psychopathology at multiple levels (Insel et al., 2010; Kotov et al., 2017). Despite our ability to capture several items relevant to impulsive behavior, most operationalizations of impulsivity emphasize a multidimensional structure. For example, the UPPS structures impulsivity through four or five distinct but correlated dimensions: *urgency* (negative and positive), lack of *premeditation*, lack of *perseverance*, and *sensation seeking* (Whiteside & Lynam, 2001). Other researchers have disentangled impulsivity from disinhibition (Joyner et al., 2021). Specifically, the authors found that impulsive traits were associated with both externalizing problems and negative affect, whereas disinhibition was only associated with externalizing psychopathology. Thus, while our study provides information that represents an advance in understanding of impulsigenic traits throughout childhood and adolescence,

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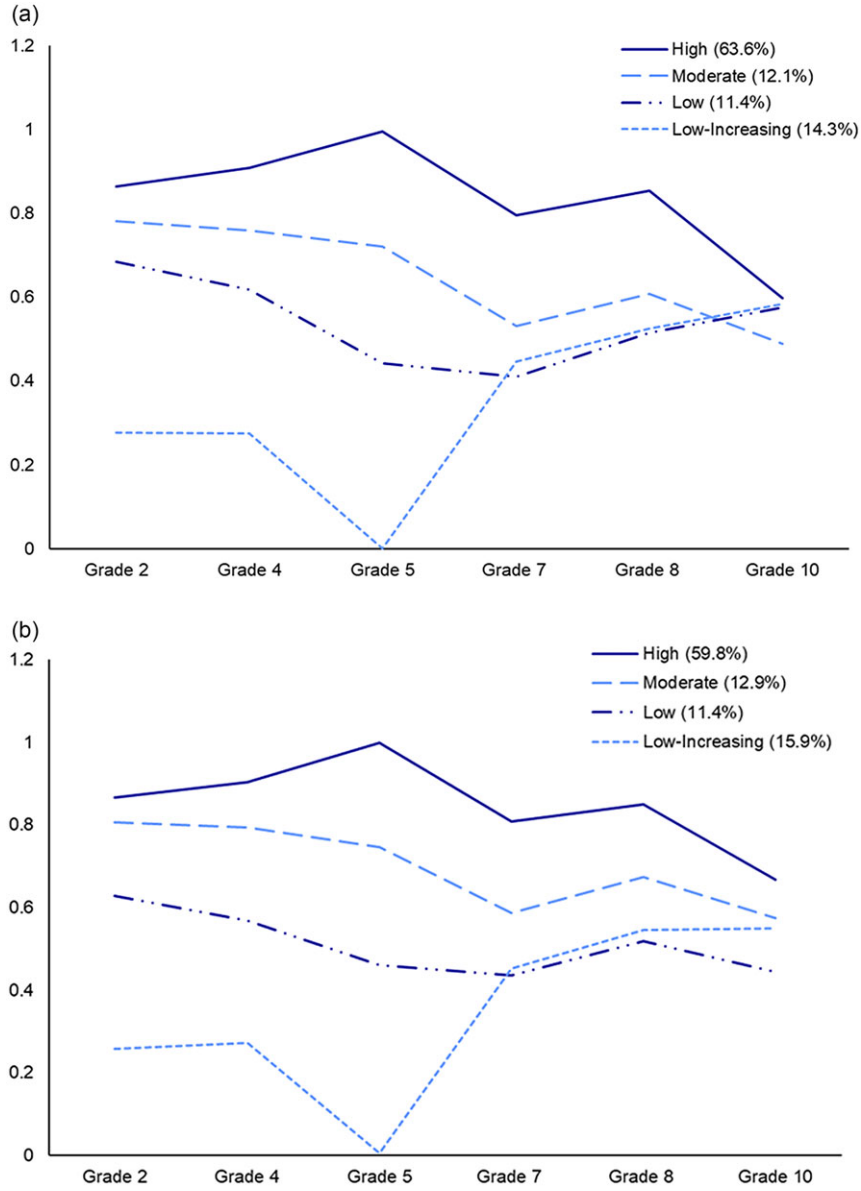

Figure 2. ***a***. Impulsivity profiles from grades 2, 4, 5, 7, 8, and 10 – nonintervention sample. ***b***. Impulsivity profiles from grades 2, 4, 5, 7, 8, and 10 – intervention sample.

findings are constrained by our limited measurement. Clearly, similarly large-scale studies are needed that employ a more comprehensive assessment, including indicators of multiple dimensions of impulsivity.

It is also important to consider the design specifics of each trial and the integrative data processing when interpreting findings that synthesize multiple trials. As shown in the Supplementary Materials, there were a greater number of measures within trials in earlier timepoints and greater missing data levels across trials in later timepoints. Both factors may have contributed to the decreasing patterns observed in the high and moderate profiles. In addition, studies that draw on integrative data processing of multiple trials introduce many "researcher degrees of freedom" or require many decisions at every integrative stage (Simmons et al., 2011), each of which can have substantial impacts on final results. For example, we also coded our impulsivity items as *z*-scores and on a 0-2 Likert scale before creating mean scores across items. Both forms of coding resulted in poorer model fit (see Supplementary Materials), as well as differences in the shape of profiles. However, the psychopathology field has moved away from dichotomous coding except where necessary. Here, we want to loudly voice the importance of retaining continuous scores where possible in these emerging integrative data methodological practices. Integrative data analytic studies are a burgeoning approach and much more research is needed testing the implications of various decision-making steps (we refer the reader to the following papers for in-depth discussions of integrative data processing; Brincks et al., 2018; Hussong et al., 2013).

Impulsivity profile comparisons on predictors and adult outcomes

We observed no significant intervention effects on profile membership. Collectively, our interventions included similar components targeting conduct problems underpinned by similar theoretical models. Nonetheless, trials differed in the number of years intervention components were applied, and we took an inclusive approach by clustering interventions within trials with

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Table 2. Means and standard errors of adult outcomes for each profile from the BCH method

Combined	*High*	*Moderate*	*Low*	*Low–Increasing*
Aggression	− .00(.02)	− .02(.03)	− .01(.05)	− .26(.03)
Substance use	.14(.01)	.14(.02)	.14(.02)	.15(.02)
Suicidal ideation/attempts	.09(.01)	.13(.02)	.15(.02)	.06(.02)
Anxiety/depression	− .21(.01)	− .08(.03)	− .13(.03)	− .29(.03)
Nonintervention	*High*	*Moderate*	*Low*	*Low–Increasing*
Aggression	.02(.03)	.04(.04)	.07(.08)	− .25(.08)
Substance use	.12(.01)	.13(.02)	.13(.03)	.14(.03)
Suicidal ideation/attempts	.09(.01)	.14(.02)	.14(.03)	.06(.02)
Anxiety/depression	− .22(.02)	− .08(.04)	− .10(.04)	− .29(.04)
Intervention	*High*	*Moderate*	*Low*	*Low–Increasing*
Aggression	− .02(.02)	− .07(.03)	− .06(.06)	− .24(.02)
Substance use	.15(.01)	.15(.02)	.14(.03)	.16(.03)
Suicidal ideation/attempts	.09(.01)	.12(.02)	.16(.03)	.05(.02)
Anxiety/depression	− .20(.02)	− .08(.05)	− .15(.04)	− .29(.04)

multiple intervention components (e.g., PIRC1: GBG + Mastery Learning; PIRC2: classroom-centered + Family-School Partnership), which may have contributed to null findings.[2] However, there is extensive evidence of intervention effects on conduct problems from individual analyses of each trial (e.g., Conduct Problems Prevention Research Group, 2020; Eddy et al., 2003; Ialongo et al., 2019; Tolan et al., 2004).

Some preliminary findings also support intervention impacts within these trials on impulsive behavior specifically (e.g., Fowler et al., 2014; Musci et al., 2014). Numerous questions remain, however, regarding the role of impulsivity in intervention effects. For example, is impulsivity a target or indirect target within these interventions? Emerging decomposition research on mechanisms of intervention-related change found that approximately a third of FT's impact on antisocial outcomes was accounted for by improvements in both social and self-regulation skills (including prosocial behavior, emotion regulation, and problem-solving; Sorensen et al., 2016). Compared to research on moderators (Goulter & Fleming, 2023; McMahon et al., 2021), much less work has been conducted investigating mechanisms of change. Further research is needed testing theoretical mechanisms of action, and the cascading effects of these mechanisms on change in impulsivity and change in other constructs, such as conduct problems, seems of prime interest. Although we observed no significant intervention effects on profile membership, which may be in part due to decisions made in the integrative data processing stages as alluded to earlier, this form of research tapping questions such as "what outcomes?" and "under what conditions?" is important for advancing this field.

Across all samples, participants with higher levels of baseline aggression were more likely to belong to the high, moderate, and low profiles relative to the low-increasing profile, and participants in these profiles also reported higher levels of adult aggression than the low-increasing profile. These findings point to impulsivity as critical in externalizing psychopathology (Beauchaine et al., 2010, 2017). However, across all samples, there were no significant differences between profiles on adult substance use. Relative to the role of impulsivity in substance use during childhood and adolescence, these findings may suggest that impulsivity does not underlie illicit substance use in adulthood.

By applying an integrative process to data from five randomized controlled trials, we produced a dataset with a large sample size and statistical power to optimally test subgroups, as well as increasing the number of participants with low base-rate behaviors such as suicidal ideation/attempts. In preventive interventions designed to address conduct and disruptive behavior disorders, this enables better evaluation of "cross-over" effects on outcomes not specifically targeted by the intervention (Ayer et al., 2023; Goulter et al., 2019; Musci et al., 2023; Reider et al., 2014). The lack of research across these preventive trials on suicidal ideation/attempts may be because individually these studies were not adequately powered to test for such cross-over effects—a limitation that can be circumvented by integrating multiple studies. Across samples, in general, the moderate and low profiles endorsed greater levels of adult suicidal ideation/attempts relative to the high- and low-increasing profiles. It may be the case that the interventions impacted adolescent suicidal behaviors, but not adult suicidal behaviors which tend to be less impulsive in nature—an important avenue for future research (Godwin et al., 2020). In addition, although meta-analytic work has identified impulsivity as an important marker of suicidal risk (McHugh et al., 2019; Pérez-Balaguer et al., 2022), another meta-analysis has stressed that many of the impulsivity measures used in this research have not adequately captured the impulsivity construct (Moore et al., 2022). Across samples, almost all profiles differed in adult anxiety/depression with the moderate profile showing the highest levels of anxiety/depression followed by the low, high, and low-increasing profiles.

Research and clinical implications

In this study, we leveraged data from multiple large, longitudinal databases, and in doing so, we have added to a growing pool of studies capitalizing on integrative data processes to answer

[2]Because the PIRC1 Mastery Learning intervention was focused on academic skills, we also repeated analyses with this intervention coded as nonintervention. Again, no significant intervention effects on profile membership were identified.

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Table 3. Profile comparisons from the BCH method

	OR / β (*SE*)	95% CI / *p*	*OR* / β (*SE*)	95% CI / *p*	*OR* / β (*SE*)	95% CI / *p*	*OR* / β (*SE*)	95% CI / *p*	*OR* / β (*SE*)	95% CI / *p*	*OR* / β (*SE*)	95% CI / *p*
Columns	1		2		3		4		5		6	
Combined	H v M		H v L		H v LI		M v L		M v LI		L v LI	
Predictors												
1. Intervention	.90(.10)	.73, 1.11	.88(.11)	.69, 1.12	.97(.14)	.73, 1.28	.98(.14)	.73, 1.30	1.08(.18)	.78, 1.48	1.10(.20)	.78, 1.56
2. Sex	1.19(.13)	.96, 1.47	1.32(.17)	1.03, 1.69	2.53(.40)	1.86, 3.44	1.11(.17)	.83, 1.49	2.13(.38)	1.50, 3.00	1.92(.37)	1.32, 2.79
3. Race	1.23(.14)	.98, 1.54	1.56(.20)	1.21, 2.01	2.00(.29)	1.50, 2.66	1.27(.20)	.94, 1.73	1.63(.28)	1.17, 2.27	1.28(.24)	.90, 1.84
4. Baseline aggression	1.04(.07)	.92, 1.17	1.01(.08)	.88, 1.17	6.40(1.69)	3.82, 10.73	.97(.09)	.82, 1.15	6.15(1.65)	3.64, 10.40	6.32(1.73)	3.70, 10.82
Outcomes												
5. Aggression	.02(.04)	.619	.00(.05)	.955	.26(.04)	< .001	− .01(.05)	.792	.24(.04)	< .001	.25(.06)	< .001
6. Substance use	− .01(.02)	.649	.00(.02)	.963	− .01(.02)	.657	.01(.03)	.709	− .00(.03)	.938	− .01(.03)	.701
7. Suicidal ideation/attempts	− .05(.02)	.014	− .06(.02)	.006	.03(.02)	.064	− .02(.03)	.568	.08(.02)	.001	.09(.03)	.001
8. Anxiety/depression	− .13(.03)	< .001	− .08(.03)	.006	.08(.03)	.007	.05(.04)	.231	.22(.04)	< .001	.17(.04)	< .001
Nonintervention	H v M		H v L		H v LI		M v L		M v LI		L v LI	
Predictor												
9. Sex	1.08(.17)	.80, 1.45	1.09(.20)	.76, 1.56	2.03(.43)	1.34, 3.06	1.01(.22)	.66, 1.55	1.88(.45)	1.17, 3.01	1.86(.49)	1.11, 3.13
10. Race	1.19(.19)	.86, 1.63	1.38(.26)	.96, 1.99	2.37(.47)	1.61, 3.50	1.17(.26)	.75, 1.81	2.00(.47)	1.27, 3.16	1.72(.44)	1.04, 2.85
11. Baseline aggression	1.09(.09)	.93, 1.29	.93(.09)	.78, 1.12	4.44(1.30)	2.50, 7.87	.85(.10)	.69, 1.06	4.06(1.21)	2.26, 7.29	4.76(1.45)	2.61, 8.66
Outcomes												
12. Aggression	− .02(.06)	.771	− .05(.09)	.610	.27(.09)	.002	− .03(.09)	.755	.29(.09)	.002	.31(.13)	.012
13. Substance use	− .01(.03)	.652	− .01(.03)	.805	− .02(.03)	.623	.00(.04)	.905	− .00(.04)	.908	− .01(.04)	.835
14. Suicidal ideation/attempts	− .05(.03)	.039	− .06(.03)	.072	.03(.03)	.272	− .00(.04)	.976	.08(.03)	.014	.08(.04)	.028
15. Anxiety/depression	− .14(.04)	.001	− .12(.04)	.006	.07(.04)	.118	.02(.06)	.743	.21(.05)	< .001	.19(.06)	.001
Intervention	H v M		H v L		H v LI		M v L		M v LI		L v LI	
Predictor												
16. Sex	1.25(.19)	.92, 1.69	1.51(.26)	1.07, 2.12	3.03(.70)	1.93, 4.76	1.21(.25)	.80, 1.82	2.43(.63)	1.47, 4.03	2.01(.55)	1.17, 3.45
17. Race	1.19(.20)	.86, 1.67	1.70(.31)	1.20, 2.43	1.57(.35)	1.01, 2.42	1.43(.31)	.93, 2.20	1.31(.33)	.80, 2.15	.92(.24)	.55, 1.54
18. Baseline aggression	1.03(.10)	.85, 1.24	1.13(.13)	.89, 1.42	10.77(4.82)	4.48, 25.90	1.09(.15)	.84, 1.44	10.48(4.75)	4.31, 25.46	9.57(4.45)	3.85, 23.81
Outcomes												
19. Aggression	.05(.04)	.217	.05(.06)	.444	.23(.03)	< .001	− .00(.06)	.945	.17(.04)	< .001	.18(.07)	.006
20. Substance use	.00(.03)	.970	.01(.03)	.761	− .01(.04)	.757	.01(.04)	.824	− .01(.04)	.770	− .02(.04)	.649
21. Suicidal ideation/attempts	− .03(.03)	.220	− .06(.03)	.037	.04(.02)	.074	− .03(.04)	.354	.07(.03)	.019	.11(.04)	.004
22. Anxiety/depression	− .11(.05)	.033	− .05(.04)	.232	.09(.05)	.059	.06(.06)	.306	.20(.07)	.002	.14(.06)	.019

Note. Class membership is regressed on intervention status (in the combined sample) and predictors (i.e., baseline aggression, sex, race/ethnicity) and odds ratios (*OR*) are reported. Classes are compared on adult outcomes (i.e., aggression, substance use, suicidal ideation/attempts, anxiety/depression) using difference testing. H = high; M = moderate; L = low; LI = low–increasing; Intervention: 1 = Intervention, 0 = Nonintervention; Sex: 1 = Male, 0 = Female; Race: 1 = Black, 0 = white.

important developmental research questions (e.g., Brown et al., 2018; Musci et al., 2023). As stated by Hussong et al., (2013, p. 3), "this amassing of rich data archives and advanced statistical analysis intersects with a scientific zeitgeist emphasizing collaborative (particularly transdisciplinary) efforts, fueling a "big science" initiative." Integrative data processing, in conjunction with group-based analyses such as mixture modeling, opens the door for investigating effects that may not emerge in smaller samples, such as heterogenous subgroups, predictors and moderators of subgroup membership, lower base-rate behaviors, and cross-over effects.

From a clinical standpoint, one implication is that our findings provide important information regarding prevalence and developmental course of impulsivity, as well as prevalence of psychopathologies related to impulsivity. In addition, recent research emphasizes the importance of noncognitive skills across intrapersonal (e.g., emotion regulation) and interpersonal (e.g., prosocial behavior) domains (Godwin et al., 2020; Sorensen et al., 2016), and our findings add to this growing literature of possible noncognitive skills in relation to later outcomes. Our findings also point to potential differences in sex and racialized constructs/ethnicity (see Table 3, rows 2, 9, 16 and rows 3, 10, 17), respectively. It is important to note that race and ethnicity may serve as proxies for systemic inequalities. In our study, we were limited by the use of a binary sex and race variables, and further research is needed with samples of greater diversity and from the Majority World (Yu et al., 2023).

An important future direction includes the examination of trait versus state impulsivity. Recent advances in technology (e.g., smart phones and wearables) and intensive longitudinal statistical approaches have produced a flurry of studies testing the dynamics or fluctuations of emotional and behavioral problems at micro timescales (Zheng & Goulter, 2023; for a review, see Urben et al., 2022). Some research has also identified state-like fluctuations in other neurodevelopmental traits that were considered relatively stable (i.e., callous-unemotional traits; Goulter et al., 2023). Future intervention work might consider incorporating a measurement burst design combining micro and macro longitudinal methods to test the effects of environmental experiences on short-term impulsive dynamics and relations with long-term change.

Strengths and limitations

Methodological strengths of the present study include its integration of five randomized controlled trials. Preventive intervention trials included in the present analysis were large samples drawn from several sites across the U.S. The present study employed an integrative and mixture modeling data analytic process to extract multi-informant information (i.e., parent, child, and teacher reports) across childhood and adolescence. We also examined how profiles compared on a range of self-reported adult psychopathologies. Despite these strengths, some limitations should be considered. As noted earlier, impulsivity is best conceptualized as a multidimensional construct, and future randomized controlled trials are encouraged to attempt to balance the difficult methodological task of including an optimal number of measurement occasions and comprehensive assessment of key constructs while limiting participant burden. Abbreviated versions of multidimensional measures of impulsivity have now been validated in youth samples (Watts et al., 2020), which may help to facilitate the assessment of this construct in resource-intensive designs. Specific measures of impulsivity, however, have typically been precluded from large-scale interventions, which require a suite of tools that provide information accessible and actionable to key stakeholders (e.g., prevalence of psychiatric disorders or criminal behavior). Future work might, similarly, extract and harmonize items related to impulsivity across a variety of related measures using integrative data analytic techniques to increase power and optimally test for effects. Another limitation is that although synthesizing data across several trials enables a much larger sample size and we applied appropriate missing data methods, some measurement occasions still had missing data that may not be best estimated with these methods (see Supplementary Materials for missing data levels and Brincks et al., (2018) for a discussion of missing data methods in integrative designs).

Conclusion

In sum, this study evaluated between-person effects in impulsive characteristics across childhood and adolescence among participants derived from five longitudinal preventive interventions. We observed meaningful differences in stratified profile slopes, as well as how these profiles differed with respect to adult psychopathological outcomes. Overall, this study adds to emerging scientific collaborative efforts linking data across multiple studies to better inform understanding of developmental processes (Brown et al., 2018; Musci et al., 2023).

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/S0954579424000828.

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Prevention Intervention Research Center Generation 2 (PIRC 2)

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Linking the interest of families and teachers (LIFT)

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Competing interests. Drs. Bierman, Coie, Dodge, Greenberg, Lochman, McMahon, and Pinderhughes are the Principal Investigators on the FT Project and have a publishing agreement with Guilford Publications, Inc. Royalties from that agreement are donated to a professional organization. They are also authors of the PATHS curriculum and donate all royalties from PATHS Program LLC. to a professional organization. Dr Greenberg is a developer of the PATHS curriculum and has a separate royalty agreement with PATHS Program LLC. Bierman, Coie, Dodge, Greenberg, Lochman, and McMahon are the developers of the FT curriculum and have a publishing and royalty agreement with Guilford Publications, Inc. McMahon is a coauthor of Helping the Noncompliant Child and has a royalty agreement with Guilford Publications, Inc. Dr Crowley has no conflicts.

References

Achenbach, T. M. (1991a). *Manual for the child behavior checklist*. University of Vermont, Department of Psychiatry.

Achenbach, T. M. (1991b). *Manual for the teacher's report form*. University of Vermont, Department of Psychiatry.

Achenbach, T. M. (1997). *Manual for the young adult self-report and young adult behavior checklist*. University of Vermont, Department of Psychiatry.

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). American Psychiatric Publishing.

Asparouhov, T., & Muthén, B. (2014). Auxiliary variables in mixture modeling: Three-step approaches using Mplus. *Structural Equation Modeling: A Multidisciplinary Journal*, *21*(3), 329–341. https://doi.org/10.1080/10705511.2014.915181

Ayer, L., Stevens, C., Reider, E., Sims, B., Colpe, L., & Pearson, J. (2023). Preventing youth suicide: Potential, crossover effects, of existing school-based orograms. *Prevention Science*, *24*(2), 382–392. https://doi.org/10.1007/s11121-022-01473-2

Barrish, H. H., Saunders, M., & Wolf, M. M. (1969). Good behavior game: Effects of individual contingencies for group consequences on disruptive behavior in a classroom 1. *Journal of Applied Behavior Analysis*, *2*(2), 119–124. https://doi.org/10.1901/jaba.1969.2-119

Beauchaine, T. P., Hinshaw, S. P., & Pang, K. L. (2010). Comorbidity of attention-deficit/hyperactivity disorder and early-onset conduct disorder: Biological, environmental, and developmental mechanisms. *Clinical Psychology: Science and Practice*, *17*(4), 327–336. https://doi.org/10.1111/j.1468-2850.2010.01224.x

Beauchaine, T. P., Zisner, A. R., & Sauder, C. L. (2017). Trait impulsivity and the externalizing spectrum. *Annual Review of Clinical Psychology*, *13*(1), 343–368. https://doi.org/10.1146/annurev-clinpsy-021815-093253

Berg, J. M., Latzman, R. D., Bliwise, N. G., & Lilienfeld, S. O. (2015). Parsing the heterogeneity of impulsivity: A meta-analytic review of the behavioral implications of the UPPS for psychopathology. *Psychological Assessment*, *27*(4), 1129–1146. https://doi.org/10.1037/pas0000111

Bierman, K. L., Greenberg, M. T., Coie, J. D., Dodge, K. A., Lochman, J. E., & McMahon, R. J. (2017). *Social and emotional skills training for children: The fast track friendship group manual*. Guilford Press.

Brezo, J., Paris, J., & Turecki, G. (2006). Personality traits as correlates of suicidal ideation, suicide attempts, and suicide completions: A systematic review. *Acta Psychiatrica Scandinavica*, *113*(3), 180–206. https://doi.org/10.1111/j.1600-0447.2005.00702.xCit

Brincks, A., Montag, S., Howe, G. W., Huang, S., Siddique, J., Ahn, S., Sandler, I. N., Pantin, H., & Brown, C. H. (2018). Addressing methodologic challenges and minimizing threats to validity in synthesizing findings from individual-level data across longitudinal randomized trials. *Prevention Science*, *19*(1), 60–73. https://doi.org/10.1007/s11121-017-0769-1

Brown, C. H. (1990). Protecting against nonrandomly missing data in longitudinal studies. *Biometrics*, *46*(1), 143–155. https://www.jstor.org/stable/2531637

Brown, C. H., Brincks, A., Huang, S., Perrino, T., Cruden, G., Pantin, H., Howe, G., Young, J. F., Beardslee, W., Montage, S., & Sandler, I. (2018). Two-year impact of prevention programs on adolescent depression: An integrative data analysis approach. *Prevention Science*, *19*(1), 74–94. https://doi.org/10.1007/s11121-016-0737-1

Bureau of Labor Statistics, US Department of Labor 2002). *National longitudinal survey of youth 1997 Cohort, 1997-2001*. US Department of Labor, Bureau of Labor Statistics.

Casey, B. J. (2015). Beyond simple models of self-control to circuit-based accounts of adolescent behavior. *Annual Review of Psychology*, *66*(1), 295–319. https://doi.org/10.1146/annurev-psych-010814-015156

Casey, B. J., Galván, A., & Somerville, L. H. (2016). Beyond simple models of adolescence to an integrated circuit-based account: A commentary. *Developmental Cognitive Neuroscience*, *17*, 128–130. https://doi.org/10.1016/j.dcn.2015.12.006

Conduct Problems Prevention Research Group (2007). Fast track randomized controlled trial to prevent externalizing psychiatric disorders: Findings from grades 3 to 9. *Journal of the American Academy of Child & Adolescent Psychiatry*, *46*(10), 1250–1262. https://doi.org/10.1097/chi.0b013e31813e5d39

Conduct Problems Prevention Research Group (2011). The effects of the fast track preventive intervention on the development of conduct disorder across childhood. *Child Development*, *82*(1), 331–345. https://doi.org/10.1111/j.1467-8624.2010.01558.x

Conduct Problems Prevention Research Group (2020). *The fast track program for children at risk: Preventing antisocial behavior*. Guilford Press.

Cramer, A. O., Waldorp, L. J., Van Der Maas, H. L., & Borsboom, D. (2010). Complex realities require complex theories: Refining and extending the network approach to mental disorders. *Behavioral and Brain Sciences*, *33*(2-3), 178–193. https://doi.org/10.1017/S0140525X10000920

Cubillo, A., Halari, R., Smith, A., Taylor, E., & Rubia, K. (2012). A review of fronto-striatal and fronto-cortical brain abnormalities in children and adults with attention deficit hyperactivity disorder (ADHD) and new evidence for dysfunction in adults with ADHD during motivation and attention. *Cortex*, *48*(2), 194–215. https://doi.org/10.1016/j.cortex.2011.04.007

Dodge, K. A., Bierman, K. L., Coie, J. D., Greenberg, M. T., Lochman, J. E., McMahon, R. J., & Pinderhughes, E. E. (2015). Impact of early intervention on psychopathology, crime, and well-being at age 25. *American Journal of Psychiatry*, *172*(1), 59–70. https://doi.org/10.1176/appi.ajp.2014.13060786

Dolan, L. J., Kellam, S. G., Brown, C. H., Werthamer-Larsson, L., Rebok, G. W., Mayer, L. S., Laudolff, J., Turkkan, J. S., ford, C., & Wheeler, L. (1993). The short-term impact of two classroom-based preventive

interventions on aggressive and shy behaviors and poor achievement. *Journal of Applied Developmental Psychology*, *14*(3), 317–345. https://doi.org/10.1016/0193-3973(93)90013-L

Eddy, J. M., Reid, J. B., & Fetrow, R. A. (2000). An elementary school-based prevention program targeting modifiable antecedents of youth delinquency and violence: Linking the interests of families and teachers (LIFT). *Journal of Emotional and Behavioral Disorders*, *8*(3), 165–176. https://doi.org/10.1177/106342660000800304

Eddy, J. M., Reid, J. B., Stoolmiller, M., & Fetrow, R. A. (2003). Outcomes during middle school for an elementary school-based preventive intervention for conduct problems: Follow-up results from a randomized trial. *Behavior Therapy*, *34*(4), 535–552. https://doi.org/10.1016/S0005-7894(03)80034-5

Fowler, P. J., Henry, D. B., Schoeny, M., Gorman-Smith, D., & Tolan, P. H. (2014). Effects of the SAFE children preventive intervention on developmental trajectories of attention-deficit/hyperactivity disorder symptoms. *Development and Psychopathology*, *26*(4pt1), 1161–1179. https://doi.org/10.1017/s0954579414000170

Gatzke-Kopp, L. M. (2011). The canary in the coalmine: The sensitivity of mesolimbic dopamine to environmental adversity during development. *Neuroscience & Biobehavioral Reviews*, *35*(3), 794–803. https://doi.org/10.1016/j.neubiorev.2010.09.013

Godwin, J. W., Coie, J. D., Crowley, D. M., Dodge, K. A., Greenberg, M. T., Lochman, J. E., McMahon, R. J., & Pinderhughes, E. E. (2020). & conduct problems prevention research Group2, 2020, the fast track intervention's impact on behaviors of despair in adolescence and young adulthood. *Proceedings of The National Academy of Sciences of The United States of America*, *117*(50), 31748–31753. https://doi.org/10.1073/pnas.2016234117

Goulter, N., Cooke, E., & Zheng, Y. (2023). Callous-unemotional traits in adolescents' daily life: Associations with affect and emotional and conduct problems. *Research On Child and Adolescent Psychopathology*, *52*(1), 1–13. https://doi.org/10.1007/s10802-023-01077-6

Goulter, N., & Fleming, G. E. (2023). Psychosocial interventions for children and adolescents with conduct problems. *PsyAirXiv*, 1–52. https://doi.org/10.31234/osf.io/xta3y

Goulter, N., McMahon, R. J., & Dodge, K. A. (2019). & conduct problems prevention research group, 2019, does the fast track intervention prevent later psychosis symptoms? *Prevention Science*, *20*(8), 1255–1264. https://doi.org/10.1007/s11121-019-01041-1

Goulter, N., McMahon, R. J., Lansford, J. E., Bates, J. E., Dodge, K. A., Crowley, D., & Pettit, G. S. (2022). *Externalizing psychopathology from childhood to early adolescence: Psychometric evaluation using latent variable and network modeling* (pp. 1–15). Psychological Assessment, https://doi.org/10.1037/pas0001163

Greenberg, M. T., Kusché, C. A., & **Conduct Problems Prevention Research Group** (2011). *Grade level PATHS curriculum.* Channing-Bete.

Hanson, J. L., Chung, M. K., Avants, B. B., Shirtcliff, E. A., Gee, J. C., Davidson, R. J., & Pollak, S. D. (2010). Early stress is associated with alterations in the orbitofrontal cortex: A tensor-based morphometry investigation of brain structure and behavioral risk. *Journal of Neuroscience*, *30*(22), 7466–7472. https://doi.org/10.1523/JNEUROSCI.0859-10.2010

Hussong, A. M., Curran, P. J., & Bauer, D. J. (2013). Integrative data analysis in clinical psychology research. *Annual Review of Clinical Psychology*, *9*(1), 61–89. https://doi.org/10.1146/annurev-clinpsy-050212-185522

Ialongo, N. S., Domitrovich, C., Embry, D., Greenberg, M., Lawson, A., Becker, K. D., & Bradshaw, C. (2019). A randomized controlled trial of the combination of two school-based universal preventive interventions. *Developmental Psychology*, *55*(6), 1313–1325. https://doi.org/10.1037/dev0000715

Ialongo, N. S., Werthamer, L., Kellam, S. G., Brown, C. H., Wang, S., & Lin, Y. (1999). Proximal impact of two first-grade preventive interventions on the early risk behaviors for later substance abuse, depression, and antisocial behavior. *American Journal of Community Psychology*, *27*(5), 599–641. https://doi.org/10.1023/A:1022137920532

Insel, T., Cuthbert, B., Garvey, M., Heinssen, R., Pine, D. S., Quinn, K., & Wang, P. (2010). Research domain criteria (RDoC): Toward a new classification framework for research on mental disorders. *American Journal of Psychiatry*, *167*(7), 748–751. https://doi.org/10.1176/appi.ajp.2010.09091379

Joyner, K. J., Daurio, A. M., Perkins, E. R., Patrick, C. J., & Latzman, R. D. (2021). The difference between trait disinhibition and impulsivity—and why it matters for clinical psychological science. *Psychological Assessment*, *33*(1), 29–44. https://doi.org/10.1037/pas0000964

Kellam, S. G., Brown, C. H., Poduska, J. M., Ialongo, N. S., Wang, W., Toyinbo, P., Petras, H., Ford, C., Windham, A., & Wilcox, H. C. (2008). Effects of a universal classroom behavior management program in first and second grades on young adult behavioral, psychiatric, and social outcomes. *Drug and Alcohol Dependence*, *95*, S5–S28. https://doi.org/10.1016/j.drugalcdep.2008.01.004

Kessler, R. C., Wittchen, H-U., Abelson, J. M., Mcgonagle, K., Schwarz, N., Kendler, K. S., Knäuper, B., & Zhao, S. (1998). Methodological studies of the composite international diagnostic interview (CIDI) in the US national comorbidity survey (NCS). *International Journal of Methods in Psychiatric Research*, *7*(1), 33–55. https://doi.org/10.1002/mpr.33

Kotov, R., Krueger, R. F., Watson, D., Achenbach, T. M., Althoff, R. R., Bagby, R. M., Brown, T. A., Carpenter, W. T., Caspi, A., Clark, L. A., Eaton, N. R., Forbes, M. K., Forbush, K. T., Goldberg, D., Hasin, D., Hyman, S. E., Ivanova, M. Y., Lynam, D. R., Markon, K., Miller, J. D., Moffitt, T. E., Morey, L. C., Mullins-Sweatt, S. N., Ormel, J., Patrick, C. J., Regier, D. A., Rescorla, L., Ruggero, C. J., Samuel, D. B., Sellbom, M., Simms, L. J., Skodol, A. E., Slade, T., South, S. C., Tackett, J. L., Waldman, I. D., Waszczuk, M. A., Widiger, T. A., Wright, A. G. C., & Zimmerman, M. (2017). The hierarchical taxonomy of psychopathology (HiTOP): A dimensional alternative to traditional nosologies. *Journal of Abnormal Psychology*, *126*(4), 454–477. https://doi.org/10.1037/abn0000258

Lavori, P. W., Brown, C. H., Duan, N., Gibbons, R. D., & Greenhouse, J. (2008). Missing data in longitudinal clinical trials part A: Design and conceptual issues. *Psychiatric Annals*, *38*(12), 784–792. https://doi.org/10.3928/00485713-20081201-04

Little, T. D., & Rhemtulla, M. (2013). Planned missing data designs for developmental researchers. *Child Development Perspectives*, *7*(4), 199–204. https://doi.org/10.1111/cdep.12043

Macdonald, A. N., Goines, K. B., Novacek, D. M., & Walker, E. F. (2016). Prefrontal mechanisms of comorbidity from a transdiagnostic and ontogenic perspective. *Development and Psychopathology*, *28*(4pt1), 1147–1175. https://doi.org/10.1017/S0954579416000742

Masyn, K. E. (2013). Latent class analysis and finite mixture modeling. In T. Little (Ed.), *Oxford handbook of quantitative methods* (pp. 551–611). Oxford University Press.

McHugh, C. M., Lee, R. S. C., Hermens, D. F., Corderoy, A., Large, M., & Hickie, I. B. (2019). Impulsivity in the self-harm and suicidal behavior of young people: A systematic review and meta-analysis. *Journal of Psychiatric Research*, *116*, 51–60. https://doi.org/10.1016/j.jpsychires.2019.05.012

McMahon, R. J., Goulter, N., & Frick, P. J. (2021). Moderators of psychosocial intervention response for children and adolescents with conduct problems. *Journal of Clinical Child and Adolescent Psychology*, *50*(4), 525–533. https://doi.org/10.1080/15374416.2021.1894566

McMahon, R. J., Slough, N., & **Conduct Problems Prevention Research Group** (1996). Family-based intervention in the fast track program. In R. D. Peters, & R. J. McMahon (Ed.), *Preventing childhood disorders, substance use, and delinquency* (pp. 90–110). Sage.

Mead, H. K., Beauchaine, T. P., & Shannon, K. E. (2010). Neurobiological adaptations to violence across development. *Development and Psychopathology*, *22*(1), 1–22. https://doi.org/10.1017/S0954579409990228

Moore, F. R., Doughty, H., Neumann, T., McClelland, H., Allott, C., & O'Connor, R. C. (2022). Impulsivity, aggression, and suicidality relationship in adults: A systematic review and meta-analysis. *EClinicalMedicine*, *45*, 101307. https://doi.org/10.1016/j.eclinm.2022.101307

Musci, R. J., Bradshaw, C. P., Maher, B., Uhl, G. R., Kellam, S. G., & Ialongo, N. S. (2014). Reducing aggression and impulsivity through school-based prevention programs: A gene by intervention interaction. *Prevention Science*, *15*(6), 831–840. https://doi.org/10.1007/s11121-014-0504-0

Musci, R. J., Kush, J. M., Masyn, K. E., Esmaeili, M. A., Susukida, R., Goulter, N., McMahon, R., Eddy, J. M., Ialongo, N. S., Tolan, P., Godwin, J., Coie, J. D., Crowley, D. M., Dodge, K. A., Greenberg, M. T., Lochman, J. E.,

McMahon, R. J., Pinderhughes, E. E., & Wilcox, H. C. (2023). Psychosis symptom trajectories across childhood and adolescence in three longitudinal studies: An integrative data analysis with mixture modeling. *Prevention Science*, *1-12*(8), 1636–1647. https://doi.org/10.1007/s11121-023-01581-7

Muthén, B. O., & Muthén, L. K. (2021). *Mplus version 8.6: user's guide*. Authors.

Neuhaus, E., & Beauchaine, T. P. (2017). Impulsivity and vulnerability to psychopathology. In T. P. Beauchaine, & S. P. Hinshaw (Ed.), *Child and adolescent psychopathology* (pp. 178–212). Wiley.

Nylund, K. L., Asparouhov, T., & Muthén, B. O. (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: A monte Carlo simulation study. *Structural Equation Modeling*, *14*(4), 535–569. https://doi.org/10.1080/10705510701575396

Nylund-Gibson, K., Grimm, R. P., & Masyn, K. E. (2019). Prediction from latent classes: A demonstration of different approaches to include distal outcomes in mixture models. *Structural Equation Modeling: A Multidisciplinary Journal*, *26*(6), 967–985. https://doi.org/10.1080/10705511.2019.1590146

Oyserman, D. (2000). *School-to-jobs facilitators manual: After-school program*. University of Michigan.

Pasalich, D. S., Craig, S. G., Goulter, N., O'Donnell, K. A., Sierra Hernandez, C., & Moretti, M. M. (2022). Patterns and predictors of different youth responses to attachment-based parent intervention. *Journal of Clinical Child & Adolescent Psychology*, *51*(5), 796–809. https://doi.org/10.1080/15374416.2021.1923022

Pérez-Balaguer, A., Peñuelas-Calvo, I., Alacreu-Crespo, A., Baca-Garcia, E., & Porras-Segovia, A. (2022). Impulsivity as a mediator between childhood maltreatment and suicidal behavior: A systematic review and meta-analysis. *Journal of Psychiatric Research*, *151*, 95–107. https://doi.org/10.1016/j.jpsychires.2022.04.021

Petras, H., Kellam, S. G., Brown, C. H., Muthén, B. O., Ialongo, N. S., & Poduska, J. M. (2008). Developmental epidemiological courses leading to antisocial personality disorder and violent and criminal behavior: Effects by young adulthood of a universal preventive intervention in first-and second-grade classrooms. *Drug and Alcohol Dependence*, *95*, S45–S59. https://doi.org/10.1016/j.drugalcdep.2007.10.015

Poduska, J. M., Kellam, S. G., Wang, W., Brown, C. H., Ialongo, N. S., & Toyinbo, P. (2008). Impact of the good behavior game, a universal classroom-based behavior intervention, on young adult service use for problems with emotions, behavior, or drugs or alcohol. *Drug and Alcohol Dependence*, *95*, S29–S44. https://doi.org/10.1016/j.drugalcdep.2007.10.009

Reid, J. B., Eddy, J. M., Fetrow, R. A., & Stoolmiller, M. (1999). Description and immediate impacts of a preventive intervention for conduct problems. *American Journal of Community Psychology*, *27*(4), 483–518. https://doi.org/10.1023/A:1022181111368

Reider, E. E., Robertson, E. B., & Sims, B. E. (2014). Does early intervention prevent health risking sexual behaviors related to HIV/AIDS? *Prevention Science*, *15*(S1), 1–5. https://doi.org/10.1007/s11121-013-0455-x

Robins, L. N., Helzer, J. E., Croughan, J., & Ratcliff, K. S. (1981). National institute of mental health diagnostic interview schedule: Its history, characteristics, and validity. *Archives of General Psychiatry*, *38*(4), 381–389. https://doi.org/10.1001/archpsyc.1981.01780290015001

Rubin, D. B., & Little, R. J. (2002). *Statistical analysis with missing data*. Wiley.

Shaffer, D., Fisher, P., Lucas, C. P., Dulcan, M. K., & Schwab-Stone, M. E. (2000). NIMH diagnostic interview schedule for children version IV (NIMH DISC-IV): Description, differences from previous versions, and reliability of some common diagnoses. *Journal of the American Academy of Child & Adolescent Psychiatry*, *39*(1), 28–38. https://doi.org/10.1097/00004583-200001000-00014

Sibley, M. H., Arnold, L. E., Swanson, J. M., Hechtman, L. T., Kennedy, T. M., Owens, E., Molina, B. S. G., Jensen, P. S., Hinshaw, S. P., Roy, A., Chronis-Tuscano, A., Newcorn, J. H., Rohde, L. A., & **for the MTA Cooperative Group** (2022). Variable patterns of remission from ADHD in the multimodal treatment study of ADHD. *American Journal of Psychiatry*, *179*(2), 142–151. https://doi.org/10.1176/appi.ajp.2021.21010032

Siddique, J., Brown, C. H., Hedeker, D., Duan, N., Gibbons, R. D., Miranda, J., & Lavori, P. W. (2008). Missing data in longitudinal trials-part B, analytic issues. *Psychiatric Annals*, *38*(12), 793–801. https://doi.org/10.3928/00485713-20081201-09

Simmons, J. P., Nelson, L. D., & Simonsohn, U. (2011). False-positive psychology: Undisclosed flexibility in data collection and analysis allows presenting anything as significant. *Psychological Science*, *22*(11), 1359–1366. https://doi.org/10.1177/09567976114176

Sonuga-Barke, E. J., Becker, S. P., Bölte, S., Castellanos, F. X., Franke, B., Newcorn, J. H., Nigg, J. T., Augusto Rohde, L., & Simonoff, E. (2022). Perspectives on progress in ADHD science-from characterization to cause. *Annual Research Review, Journal of Child Psychology and Psychiatry*, *64*(4), 506–532. https://doi.org/10.1111/jcpp.13696

Sorensen, L. C., Dodge, K. A., & Conduct Problems Prevention Research Group. (2016). How does the Fast Track intervention prevent adverse outcomes in young adulthood? *Child Development*, *87*(2), 429–445. https://doi.org/10.1111/cdev.12467

Steinberg, L., Icenogle, G., Shulman, E. P., Breiner, K., Chein, J., Bacchini, D., Chang, L., Chaudhary, N., Giunta, L. D., Dodge, K. A., Fanti, K. A., Lansford, J. E., Malone, P. S., Oburu, P., Pastorelli, C., Skinner, A. T., Sorbring, E., Tapanya, S., Tirado, L. M. U., Alampay, L. P.ña, Al-Hassan, S. M., & Takash, H. M. S. (2018). Around the world, adolescence is a time of heightened sensation seeking and immature self-regulation. *Developmental Science*, *21*(2), e12532. https://doi.org/10.1111/desc.12532

Tolan, P., Gorman-Smith, D., & Henry, D. (2004). Supporting families in a high-risk setting: Proximal effects of the SAFEChildren preventive intervention. *Journal of Consulting and Clinical Psychology*, *72*(5), 855–869. https://doi.org/10.1037/0022-006X.72.5.855

Urben, S., Constanty, L., Lepage, C., Rosselet Amoussou, J., Durussel, J., Turri, F., Wouters, E., Mürner-Lavanchy, I., & Plessen, K. J. (2022). *The added value of a micro-level ecological approach when mapping self-regulatory control processes and externalizing symptoms during adolescence: A systematic review* (pp. 1–11). European Child & Adolescent Psychiatry, https://doi.org/10.1007/s00787-022-01972-1

Watts, A. L., Smith, G. T., Barch, D. M., & Sher, K. J. (2020). Factor structure, measurement and structural invariance, and external validity of an abbreviated youth version of the UPPS-P impulsive behavior scale. *Psychological Assessment*, *32*(4), 336–347. https://doi.org/10.1037/pas0000791

Werthamer-Larsson, L., Kellam, S. G., & Wheeler, L. (1991). Effects of first grade classroom environment on shy behavior, aggressive behavior, and concentration problems. *American Journal of Community Psychology*, *19*(4), 585–602.

Whiteside, S. P., & Lynam, D. R. (2001). The five factor model and impulsivity: Using a structural model of personality to understand impulsivity. *Personality and Individual Differences*, *30*(4), 669–689. https://doi.org/10.1016/S0191-8869(00)00064-7

Wilcox, H. C., Kellam, S. G., Brown, C. H., Poduska, J. M., Ialongo, N. S., Wang, W., & Anthony, J. C. (2008). The impact of two universal randomized first-and second-grade classroom interventions on young adult suicide ideation and attempts. *Drug and Alcohol Dependence*, *95*, S60–S73. https://doi.org/10.1016/j.drugalcdep.2008.01.005

Willcutt, E. G., Nigg, J. T., Pennington, B. F., Solanto, M. V., Rohde, L. A., Tannock, R., Loo, S. K., Carlson, C. L., McBurnett, K., & Lahey, B. B. (2012). Validity of DSM-IV attention deficit/hyperactivity disorder symptom dimensions and subtypes. *Journal of Abnormal Psychology*, *121*(4), 991–1010. https://doi.org/10.1037/a0027347

Wootton R. E., Riglin L., Blakey R., Agnew-Blais J., Caye A., Cadman T., Havdahl A., Gonçalves H., Menezes A. M. B., Wehrmeister F. C., Rimfeld K., Davey Smith G., Eley T. C., Rohde L. A., Arseneault L., Moffitt T. E., Stergiakouli E., Thapar A., & Tilling K. (2022). Decline in attention-deficit hyperactivity disorder traits over the life course in the general population: Trajectories across five population birth cohorts spanning ages 3 to 45 years. *International Journal of Epidemiology*, *51*(3), 919–930. https://doi.org/10.1093/ije/dyac049

Yu, R. A., Goulter, N., Godwin, J. W., & McMahon, R. J. (2023). Child and adolescent psychopathology and subsequent harmful behaviors associated with premature mortality: A selective review and future directions. *Clinical Child and Family Psychology Review*, *26*(4), 1008–1024. https://doi.org/10.1007/s10567-023-00459-y

Zheng, Y., & Goulter, N. (2023). Introduction to the special issue: Novel insights into the externalizing psychopathology spectrum in childhood and adolescence from intensive longitudinal data. *Research On Child and Adolescent Psychopathology*, *52*(1), 1–6. https://doi.org/10.1007/s10802-023-01154-w