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Bullying behaviors and conduct problems are two forms of antisocial behavior that frequently co-occur in childhood. However, it remains unclear whether their developmental trajectories are distinct and the extent to which different aspects of cognitive functioning account for their development. We aimed to disentangle the developmental trajectories of bullying behaviors and conduct problems, test their interrelations across childhood, and assess associations with children's early cognitive functioning (executive functions, intelligent quotient [IQ], and theory of mind). Participants included 2,232 children from the Environmental Risk (E-Risk) Longitudinal Twin Study. We performed dual group-based trajectory modeling on combined parent and teacher reports of children's bullying behaviors and conduct problems at 5, 7, 10, and 12 years. We assessed associations with age 5 cognitive functioning using regression analyses. We identified five developmental trajectories for bullying behaviors and four for conduct problems. The developmental course of both behaviors was interrelated most strongly among those with high levels. A subgroup of children was likely to transition from conduct problems to bullying behaviors as they got older. Lower IQ was associated with both antisocial behavior trajectories, whereas lower theory of mind was only associated with conduct problems trajectories. The developmental course of bullying behaviors and conduct problems is distinct but linked across childhood. Interventions targeting bullying behaviors or conduct problems could benefit from more integration and should take into account children's cognitive functioning.

Public Significance Statement

Bullying behaviors and conduct problems are forms of antisocial behavior that commonly co-occur in children. The present study provides evidence of both differences and links in their developmental course during childhood. This research highlights the contribution of distinct aspects of cognitive functioning in early childhood as potential risk factors in the development of these subtypes of antisocial behavior.

Keywords: bullying behaviors, conduct problems, developmental trajectories, cognitive functioning, childhood

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continued

Antisocial behavior in childhood is highly heterogeneous and can be conceptualized as composed of distinct subgroups based on the nature of the behaviors (Frick & Viding, 2009). These subgroups include covert or nonaggressive behaviors (e.g., rule breaking) and overt or physically aggressive behaviors (e.g., bullying others; Dishion & Patterson, 2006). Conduct problems are one of the most common forms of antisocial behavior and are defined as a set of repetitive and persistent behaviors in which the fundamental rights of others or social norms and rules are violated (e.g., destruction of materials, theft, and violation of rules; American Psychiatric Association, 2013). Another widespread form of antisocial behavior is bullying behaviors, which are defined as the aim of causing harm to peers through repeated and intentional victimization where it is difficult for victims to defend themselves (Olweus, 2013). This aggressive behavior occurs within the context of an asymmetrical relationship, characterized by an imbalance of power (e.g., physical, intellectual, or social) favoring the perpetrator in various social settings (Salmivalli, 2010; Volk et al., 2014). Bullying behaviors include, among others, teasing, name calling, and physical and verbal abuse (Gladden et al., 2014). Not every child with conduct problems will engage in bullying; although both behaviors share manifestations, they have distinct characteristics (Ganesan et al., 2021; Rodkin et al., 2015). Given the specificity of bullying behaviors characterized by repetition over time, involvement with peers, and an imbalance of power, exploring bullies as a distinct group of children may provide valuable insights into the developmental differences, similarities, and links with conduct problems across childhood.

Developmental Perspective on Bullying Behaviors and Conduct Problems in Childhood

A prominent taxonomy of antisocial behavior development theorized two primary subtypes based on the age of onset (i.e., early and late onset; Moffitt, 1993). However, this classification has faced scrutiny in light of recent research suggesting that the age of onset may conflate the development of aggressive and nonaggressive behaviors (Burt, 2012; Tremblay, 2010). Evidence has increasingly supported the existence of distinct etiological factors and developmental pathways differentiating children who predominantly engage in aggressive behaviors (e.g., bullying) from those with nonaggressive behaviors (e.g., other conduct problems; Burt, 2014; Jusyte et al., 2019). During childhood, aggression tends to be more prevalent than rule-breaking behaviors (Ettekal & Ladd, 2015). Furthermore, while broad genetic influences have been reported for aggression, environmental factors appear to play a more significant role in the latter (see meta-analysis; Burt, 2009). Additionally, intervention strategies targeting bullying behaviors typically involve school-based approaches (Andrews et al., 2023), whereas those for conduct problems are usually tackled by family-oriented programs (Leijten, 2021; Scott & Humayun, 2017).

Despite their distinctions, bullying behaviors and conduct problems often co-occur, with cross-sectional studies reporting a positive and moderate-to-strong association between these behaviors in school-age children and adolescents (Ahmed et al., 2022; Burt et al., 2015; Catone et al., 2021; Viding et al., 2009). Moreover, children with both behaviors are at particular risk for later behavioral, emotional, educational, and social problems up to early adulthood (Ganesan et al., 2021). However, it remains unclear at what time this relation emerges and how they intercorrelate over time, according to patterns of stability and change in their developmental course across childhood.

Bullying behaviors and conduct problems that manifest early in life are more likely to persist over time and increase the risk of developing an antisocial personality disorder in adulthood (Copeland et al., 2013; Reading, 2013). Children with these antisocial behaviors are also at a greater risk of experiencing detrimental outcomes concurrently and later in life, such as poor psychosocial functioning, mental health, and physical health; low education; unemployment; and criminality (Bevilacqua et al., 2018; Erskine et al., 2016; Ganesan et al., 2021; Wolke & Lereya, 2015). Families and victims of children with antisocial behavior can also experience considerable stress and emotional distress (Arseneault, 2018; Nazir, 2018; Otto et al., 2021). Thus, bullying behaviors and conduct problems constitute major public health problems (Armitage, 2021; Burt et al., 2018) and account for one of the most common reasons for referral to youth mental health services (Beelmann et al., 2023; Merikangas et al., 2011; Romeo et al., 2006).

Given that bullying involvement and conduct problems are apparent in early school years, there are opportunities for intervening rapidly and implementing prevention programs to buffer the long-term impact and promote positive outcomes (Otto et al., 2021). Choosing these strategies requires a solid understanding of the

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The data set reported in the current article is not publicly available due to the lack of informed consent and ethical approval but is available on request by qualified scientists. Requests require a concept article describing the purpose of data access, ethical approval at the applicant's institution, and provision for secure data access. Secure access is offered on King's College London campus. All data analysis scripts and results files are available for review. For the purposes of open access, the corresponding author has applied a Creative Commons Attribution (CC BY) license to any Author Accepted Manuscript version arising from this submission. This work has been prospectively registered (https://sites.duke.edu/moffittcaspiprojects/files/2022/06/TheriaultCouture_2022_bullying_trajectories.pdf).

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expected developmental course of each behavior and the identification of risk factors that can be assessed and targeted early in development.

Developmental Trajectories of Bullying Behaviors and Conduct Problems in Childhood

Some studies have investigated trajectories of conduct problems in childhood, typically identifying four distinct groups (Barker & Maughan, 2009; Gutman et al., 2019; Odgers et al., 2008; Oliver et al., 2011; Sentse et al., 2017; Shaw et al., 2019). Research on the development of bullying behaviors has mainly been conducted with preschoolers or spans from late childhood through adolescence (Espelage et al., 2018; Farrell & Vaillancourt, 2021; Pepler et al., 2008; Zhang et al., 2022). Throughout childhood, only the joint development of bullying victimization and perpetration has been explored (Chow et al., 2023). Overall, these studies have identified between two and five distinct patterns of bullying involvement, suggesting considerable heterogeneity in the development of this behavior. However, no study has examined the developmental trajectories of bullying behaviors and conduct problems simultaneously, nor their interrelations over time. Thus, the extent to which the development of bullying behaviors and conduct problems is distinct and how they are interlinked through childhood is still poorly understood. It is helpful to understand these associations across time as they can increase the likelihood of each other later in development. This would imply that interventions could have cross-domain benefits. In light of the unique characteristics and potential developmental differences between bullying behaviors and conduct problems, their developmental trajectories could show distinct patterns of change during childhood and be related to different cognitive correlates.

Cognitive Functioning and Antisocial Behavior During Childhood

Cognitive abilities, such as executive functions (EF), intelligence quotient (IQ), and theory of mind (ToM), play an essential role in many spheres of child development and mental health (Diamond, 2016; Imuta et al., 2016; Mathiassen et al., 2012; Zelazo, 2020). A number of studies provide compelling evidence for the role of these cognitive abilities as risk factors for the emergence and maintenance of antisocial behavior across the lifespan (Coolidge et al., 2004; van de Groep et al., 2023; Wallinius et al., 2019; Zeier et al., 2012). EF deficits have been linked to poor behavioral inhibition and lower anticipation of consequences, punishment, and reward (Ogilvie et al., 2011). Low IQ increases the likelihood of misunderstanding rules and makes it harder to negotiate conflict effectively (Lynam & Henry, 2001). Differences in ToM alter the ability to generate socially appropriate behavior through a lower capacity to detect social cues needed to understand intention and emotion (Shakoor et al., 2012).

Mounting evidence suggests that considering cognitive factors in interventions designed to tackle antisocial behavior represents a promising strategy, given that cognitive impairments are frequently observed in children engaged in such harmful behaviors (Acquaviva et al., 2018; van Goozen et al., 2022). However, recent work has proposed that cognitive risk factors may vary among different forms of antisocial behavior (De Wit-De Visser et al., 2023; Séguin et al., 2015). Only a limited number of studies have specifically examined the role of cognitive factors in relation to bullying behaviors or conduct problems in childhood. Some research has shown associations between impairments in EF, IQ, or ToM and children's conduct problems (Anastassiou-Hadjicharalambous & Warden, 2008; Austin et al., 2020; Fanti et al., 2016; Holl et al., 2021; Lynam & Henry, 2001; Poletti & Adenzalo, 2013). For bullying behaviors, mixed results have been found, showing negative, positive, or insignificant associations with EF, IQ, or ToM (Caetano et al., 2021; Caravita et al., 2010; Jenkins et al., 2017; Liu et al., 2017; Medeiros et al., 2016; Renouf et al., 2010; Wen et al., 2023). As a result, the role of cognitive factors in children involved in bullying remains elusive, underscoring the necessity for further investigation. Overall, most of these studies focused on a single cognitive function in relation to either bullying behaviors or conduct problems, without accounting for the other co-occurring antisocial behavior. Additionally, these studies predominantly involved older children or preadolescents and are either cross-sectional or cover only a short time span. Thus, it remains unclear which early cognitive abilities independently contribute to the development of such behaviors and above other important determinants including socioeconomic conditions and sex. Moreover, whether these contributions are specific to or shared across bullying behaviors and conduct problems is poorly understood. Therefore, the present study aimed to address gaps in the literature by deepening our understanding of the predictive role of early cognitive functioning (EF, IQ, and ToM) in the distinct developmental course of bullying behaviors and conduct problems across childhood.

The Present Study

Using data from a U.K. nationally representative longitudinal cohort, the study aimed to (a) identify developmental trajectories of bullying behaviors and conduct problems according to patterns of stability and change during childhood (5, 7, 10, and 12 years); (b) examine patterns of interrelations in the developmental course of both behaviors in childhood; and (c) test associations between early childhood (5 years) cognitive factors, including EF, IQ, and ToM, and trajectories of bullying behaviors and conduct problems.

Method

Transparency and Openness

The present study follows the American Psychological Association-Style Journal Article Reporting Standards (Kazak, 2018). The data set reported in the current article is not publicly available due to the lack of informed consent and ethical approval but is available on request by qualified scientists. Requests require a concept article describing the purpose of data access, ethical approval at the applicant's institution, and provision for secure data access. Secure access is offered on the King's College London campus. All data analysis scripts and results files are available for review. All analyses were conducted in Stata (Version 17, StataCorp, 2021), and trajectories were computed using the TRAJ plugin (Jones & Nagin, 2013). The study design and its analyses

have been prospectively registered at https://sites.duke.edu/moffittcaspiprojects/files/2022/06/TheriaultCouture_2022_bullying_trajectories.pdf, and the analysis code is available at https://github.com/TheriaultCoutureFrederic/Bullying-conduct-problems-trajectories.

Participants

The participants were members of the Environmental Risk (E-Risk) Longitudinal Twin Study, which tracks the development of 2,232 British children. The sample was drawn from a larger birth cohort of twins born in the United Kingdom and Wales in 1994–1995 (Trouton et al., 2002). Full details about the sample are reported elsewhere (Moffitt & the E-Risk Study Team, 2002). Briefly, E-Risk was constructed in 1999–2000, when 1,116 families (93% of those eligible) with same-sex 5-year-old twins participated in home-visit assessments. This sample comprised 56% monozygotic and 44% dizygotic twin pairs; sex was evenly distributed within zygosity (49% male); 90% of participants were of White ethnicities. The sample represents the range of socioeconomic status (SES) in the United Kingdom, as reflected in the families' distribution on neighborhood-level socioeconomic indices (Odgers et al., 2012; Reuben et al., 2020). SES groups of low, middle, and high status were derived based on household income and highest education qualification. Follow-up home visits were conducted when the children were aged 7 (98% participation), 10 (96%), and 12 (96%). Visits included assessments with participants and their mothers (primary caretakers). The Joint South London and Maudsley and the Institute of Psychiatry Research Ethics Committee approved each phase of the study. Parents gave informed consent, and participants gave assent.

Measures

Antisocial Behavior in Childhood

We assessed bullying behaviors using mothers' and teachers' reports when participants were aged 5, 7, 10, and 12 with three items from the Child Behavior Checklist (Achenbach, 1991a) and Teacher's Report Form (Achenbach, 1991b). Mothers report for the items "bullying or threatening people," "cruel or nasty to other people," and "teases a lot." Teachers report for the items "cruelty, bullying, or meanness to others," "teases a lot," and "threatens people." Mothers and teachers were asked to rate each item as 0 (*not true*), 1 (*somewhat or sometimes true*), or 2 (*very or often true*). The internal consistency reliabilities for the combined mother and teacher ratings were 0.59 at age 5; 0.66 at age 7, 0.69 at age 10, and 0.66 at age 12.

We measured conduct problems—other than bullying behaviors—at the same ages using 12 items from the Delinquent Behavior (e.g., lying or cheating) and Aggressive Behavior scales (e.g., temper tantrums or hot temper) of the Child Behavior Checklist (Achenbach, 1991a) and Teacher's Report Form (Achenbach, 1991b) supplemented with the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders* items assessing conduct disorder (e.g., uses force to take something from another child). The internal consistency reliabilities for combined ratings from mothers and teachers were 0.65 at age 5, 0.67 at age 7, 0.69 at age 10, and 0.71 at age 12.

Similar to other studies (Chow et al., 2023; Rupp et al., 2018; Wienke Totura et al., 2009), scores were averaged across informants to create a summary measure capturing bullying behaviors and conduct problems. Combining mother and teacher ratings allowed us to capture behaviors in the school and home environments. Interrater reliability estimates were comparable between the bullying behavior scales (mothers–teachers age 5, $r = 0.17$; age 7, $r = 0.26$; age 10, $r = 0.23$; age 12, $r = 0.24$) and the conduct problems scales (mothers–teachers age 5, $r = 0.26$; age 7, $r = 0.28$; age 10, $r = 0.27$; age 12, $r = 0.24$). These correlations are consistent with previous parent and teacher correlations for children's behavior and are likely accounted for by situational specificity (Achenbach et al., 1987; De Los Reyes et al., 2015; Santos et al., 2020). The low agreement suggests that each informant provides a unique perspective on children's bullying behaviors and conduct problems (Wertz et al., 2016).

Cognitive Functioning at Age 5

Executive functions were measured using a composite mean score comprising three tasks: Mazes Task (planning skills; Wechsler, 1990), the Day–Night Task (inhibitory control; Gerstadt et al., 1994), and the Sentence Working Memory Tasks (working memory; Case et al., 1982). The total scores for executive functions were created by summing scores across each task, which were then transformed to create uniform scales ranging from 0 to 24. Scores ranged from 1.5 to 20 ($M = 11.60$, $SD = 3.09$), with lower scores representing poorer executive functions.

IQ was assessed using a short form of the Wechsler Preschool and Primary Scale of Intelligence–Revised, comprising Vocabulary and Block Design subtests (Wechsler, 1990). Children's IQs were prorated following procedures described by Sattler (1992). Scores were standardized to a mean of 100, a standard deviation of 15, and ranged from 55 to 151, with lower scores representing poorer IQ.

ToM was measured by administering eight tasks in a set order of increasing difficulty (Hughes et al., 2005). Four "standard" tasks tapped children's ability to attribute a first-order false belief to a story character (e.g., a mistaken belief about an object's identity or location). Four "advanced" tasks tapped children's ability to make inferences from an attributed false belief (e.g., to predict how a character would feel as a result of his/her false belief) or to attribute a second-order false belief (i.e., a mistaken belief about a belief) to a story character. Children's scores across the eight different tasks were summed, ranging from 0 to 12 ($M = 4.52$, $SD = 3.28$), with lower scores representing poor ToM. The standard and advanced false-belief tasks show acceptable 1-month test–retest reliability (>.7) in 5-year-old children across a wide range of abilities (Hughes et al., 2000).

Statistical Analyses

We conducted dual group-based trajectory modeling (dual GBTM) to identify developmental trajectories of child bullying behaviors and conduct problems and to assess their dynamic interrelations (Bentrup, 2020; Nagin & Odgers, 2010). This approach identifies clusters of individuals following similar developmental trajectories over time for two distinct, but related, constructs. Dual GBTM estimates three key components: first, the proportion of the population belonging to trajectory groups, estimated simultaneously for both outcomes; second, the conditional probabilities of belonging to a specific trajectory group (e.g., bullying behaviors) conditional upon membership to a given trajectory group (e.g., conduct problems); and third, the joint probabilities of membership in

each trajectory groups simultaneously (e.g., bullying behaviors and conduct problems). This provides a detailed summary of the connections between the developmental trajectories of bullying behaviors and conduct problems evolving over time. Missing data were handled by maximum likelihood estimations that provide asymptotically unbiased parameter estimates when data are missing at random (i.e., unrelated to the measures' outcome; Nagin & Odgers, 2010).

As an initial step, we established trajectories for bullying behaviors and conduct problems separately (univariate GBTM) based on the search of two univariate models for each outcome of interest. Once we identified the number and shape of the trajectories for both univariate models, we estimated the dual trajectory model using these univariate parameters.

We selected the best-fitting models using several procedures. First is estimating a one-group censored normal model and then subsequently increasing the number of groups with refitted polynomial terms (i.e., the shape of the trajectories). We employed this procedure until the model did not yield additional useful information. Second is considering the model interpretability, theoretical meaningfulness, and the group size (i.e., at least 1% of the sample in each group; Jung & Wickrama, 2008). Third is by standard statistical fit indices such as lower Akaike information criterion and Bayesian information criterion and higher entropy (classification accuracy; Nagin & Odgers, 2010). The accuracy of the model's classification was examined using average posterior probabilities of assignment (>.70 for each group), the odds of correct classification based on the posterior probabilities of group membership (>5 for each trajectory group), and the mismatch (i.e., the difference between the estimated probability of group membership and the proportion of individuals classified in that group based on the highest posterior probability: Adequate fit is found when correspondence is close to 0). The same model fit and classification criteria were used for univariate and dual trajectories.

To assess how bullying behaviors and conduct problems trajectory groups were associated with age 5 cognitive functioning, we conducted univariate multinomial regressions for all variables separately. We then added all age 5 cognitive functioning predictors into a multivariate multinomial regression, controlling for sex and SES. We examined if the associations remained while controlling for the age 5 other related antisocial behaviors (i.e., bullying behaviors or conduct problems). We used robust standard errors to account for the nonindependence of twin observations (Williams, 2000). The trajectory group that reflected the lowest bullying behaviors or conduct problems was used as the reference group for each model. As a sensitivity check, analyses were repeated to adjust for classification errors with a conservative threshold (i.e., only with individuals with >.80 posterior probability of being in their class membership).

Results

Average scores of bullying behaviors appeared relatively stable across childhood, whereas conduct problems tended to decrease from ages 5 to 12 (Table 1). The mean levels of bullying behaviors and conduct problems were higher for boys than girls (Supplemental Table S1). Bullying behaviors (r_m = .47) and conduct problems (r_m = .53) were moderately stable across time (Table 1). Bullying behaviors were moderately correlated with conduct problems at all ages (r_m = .64, Table 2). We observed weak but significant correlations between age 5 cognitive functions with bullying behaviors (r_m = −.12) and conduct problems (r_m = −.13) across ages (Table 1). Age 5 cognitive functions (EF, IQ, and ToM) were, on average, moderately associated (r_m = .34).

Trajectories of Bullying Behaviors and Conduct Problems Across Childhood

Based on the results of two separate univariate trajectory models, the best-fitting models identified five groups for bullying behaviors and one with four groups for conduct problems. The statistical fit

Table 1
Descriptive Statistics and Correlations Between Cognitive Functioning and Antisocial Behavior in Childhood

				Correlation across ages of children's antisocial behavior				Correlation between age 5 cognitive functioning and antisocial behavior		
				Age						
Bullying behavior	*M*	*SD*	Range	5	7	10	12	IQ	EF	ToM
Age										
5	0.60	0.82	0–6	—	.51***	.40***	.41***	−.17***	−.08**	−.11***
7	0.57	0.80	0–5.5		—	.47***	.47***	−.17***	−.10***	−.14***
10	0.64	0.90	0–6			—	.57***	−.17***	−.08**	−.12***
12	0.63	0.87	0–6				—	−.15***	−.07**	−.13***
Conduct problems										
5	1.37	1.57	0–9	—	.58***	.48***	.44***	−.17***	−.09***	−.13***
7	0.96	1.40	0–9		—	.55***	.51***	−.16***	−.11***	−.13***
10	0.77	1.33	0–11			—	.62***	−.17***	−.07**	−.15***
12	0.74	1.35	0–10				—	−.15***	−.09***	−.14***
Age 5 cognitive functioning										
IQ	100	15	55–151					—	.30***	.44***
EF	11.60	3.09	1.5–20						—	.27***
ToM	4.52	3.28	0–12							—

Note. IQ = intelligent quotient; EF = executive functions; ToM = theory of mind.
** $p < .01$. *** $p < .001$.

Table 2
Concurrent and Across Ages Correlations Between Children's Bullying Behaviors and Conduct Problems

	Conduct problems			
Bullying behavior	Age 5	Age 7	Age 10	Age 12
Age 5	.60***	.43***	.34***	.35***
Age 7	.44***	.62***	.43***	.40***
Age 10	.43***	.46***	.66**	.49***
Age 12	.42***	.43***	.51***	.64***

** $p < .01$. *** $p < .001$.

indices for these univariate models and classification accuracy of the groups were optimal while remaining parsimonious (Supplemental Tables S2–S4). A dual group-based trajectory model was then estimated using those parameters and yielded similar optimal fit indices and classification accuracy (Supplemental Tables S5 and S6).

Bullying Behavior Trajectories

The bullying behavior trajectories showed distinct developmental trends across time and high levels of engagement in childhood (Figure 1). A total of 33.6% of E-Risk participants never bullied others at any point in childhood (not involved). Nearly half of the sample (49.3%) rarely but occasionally bullied others (low stable). Two small groups increasingly engaged with bullying behaviors as they got older: 10.2% did not bully others at age 5 but did later on (low increasing), while 2.1% frequently bullied others at a young age and reached a peak at the end of childhood (high increasing). Furthermore, some children (4.9%) occasionally bullied others at age 5 but did not engage with this behavior as frequently as they got older (moderate decreasing).

Conduct Problems Trajectories

The conduct problems trajectories showed overall different downward developmental patterns of change over time (i.e., a general decline in this behavior across ages; Figure 1). Fewer children (58%) in the sample displayed some levels of conduct problems across childhood compared with bullying behaviors. The first trajectory group (41.4%) represented children who did not show conduct problems at any ages (not involved). Two groups included children who initially showed few conduct problems at age 5, but this lessened as they got older (low decreasing, 44.4%; moderate decreasing, 12.4%). The smallest group (1.9%) captured children who displayed frequent conduct problems from age 5 up until age 12 (high chronic).

Developmental patterns according to sex and SES are provided in Supplemental Tables S7 and S8. Overall, children from lower SES and boys were in groups characterized by higher levels of bullying behaviors and conduct problems.

Dynamic Interrelations Between Trajectories of Bullying Behaviors and Conduct Problems Across Childhood

Conditional Probability Models

When conditional on conduct problems group membership, we found several developmental patterns for the bullying trajectory group membership (upper Figure 2). First, among children with limited (not involved) or low levels (low decreasing) of conduct problems at age 5, a substantial portion (25% and 88%, respectively; see blue bars) were likely to belong to the low stable bullying group. Children with high levels of conduct problems at all four ages (high chronic) were likely to increasingly bully others as they aged (88% for both increasing groups; see first row, yellow and orange bars). Interestingly, children who showed moderate levels of conduct problems at age 5 and then less over time (moderate decreasing) had the highest probability of displaying low levels but increased levels of bullying behaviors from an early age to age 12 (low increasing, 77%; see second row, yellow bar). Accordingly, they also had a low probability of showing a decrease in their bullying behaviors over time (18%).

We found a similar pattern for the reverse set of conditional probabilities (i.e., the probability of membership in each of the conduct problems trajectories conditional on belonging to a specific bullying behaviors trajectory; lower Figure 2). Children who only occasionally bullied others (low stable; see fourth row) were also more likely to show few conduct problems (not involved, 21%) or only occasionally at age 5 and then progressively less as they grew up (low decreasing, 79%). Likewise, children who frequently and increasingly bullied others up until age 12 (high increasing) had a higher likelihood of regularly engaging in conduct problems (high chronic, 70%; see first row, orange bar). We also found two distinct patterns of interrelations over time. First, children who did not bully others were less likely to show conduct problems across ages (93%; see fifth row, gray bar) compared with findings observed in the reverse set of conditional probabilities. Second, children who initially bullied others at age 5 but less as they got older (moderate decreasing) were more likely to display fewer—instead of higher—conduct problems over time (51% low decreasing and 44% moderate decreasing; see third row, blue and green bars).

Joint Probabilities Model

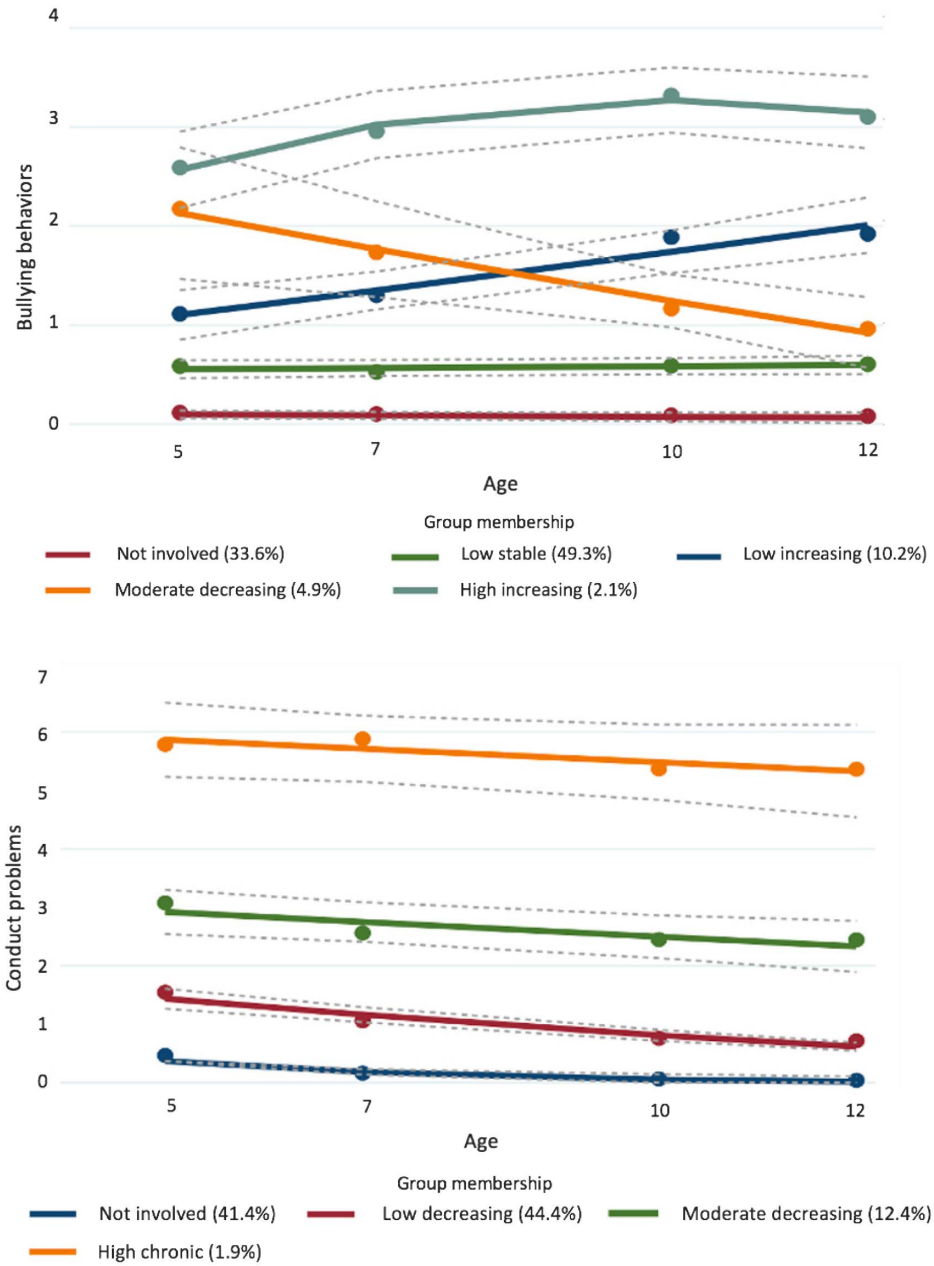
The joint probabilities model showed membership patterns consistent with findings from the conditional models (Figure 3). Half of the sample comprised children who showed a probability of bullying others occasionally (low stable) and initially displayed few conduct problems that declined with age (39%, low decreasing) or none throughout childhood (10%, not involved). The next largest group described children with a probability of engaging in neither behavior during childhood (31%, not involved in bullying behaviors and conduct problems). Another notable group characterized 10% of children who showed some conduct problems at younger ages, but no bullying behaviors. However, as they aged, they tended to bully others more regularly (low increasing) while simultaneously displaying fewer conduct problems (moderate decreasing). Finally, a small group (1.5%) included children who frequently showed both conduct problems (high chronic) and bullying behaviors across all ages (high increasing).

Associations Between Age 5 Cognitive Functioning and Trajectories of Bullying Behaviors and Conduct Problems

Lower IQ and ToM at age 5 were individually associated with group memberships of bullying behaviors and conduct problems in childhood such that membership in all groups was increased relative

Figure 1

Dual Group-Based Trajectory Modeling for Children's Bullying Behaviors and Conduct Problems in Childhood

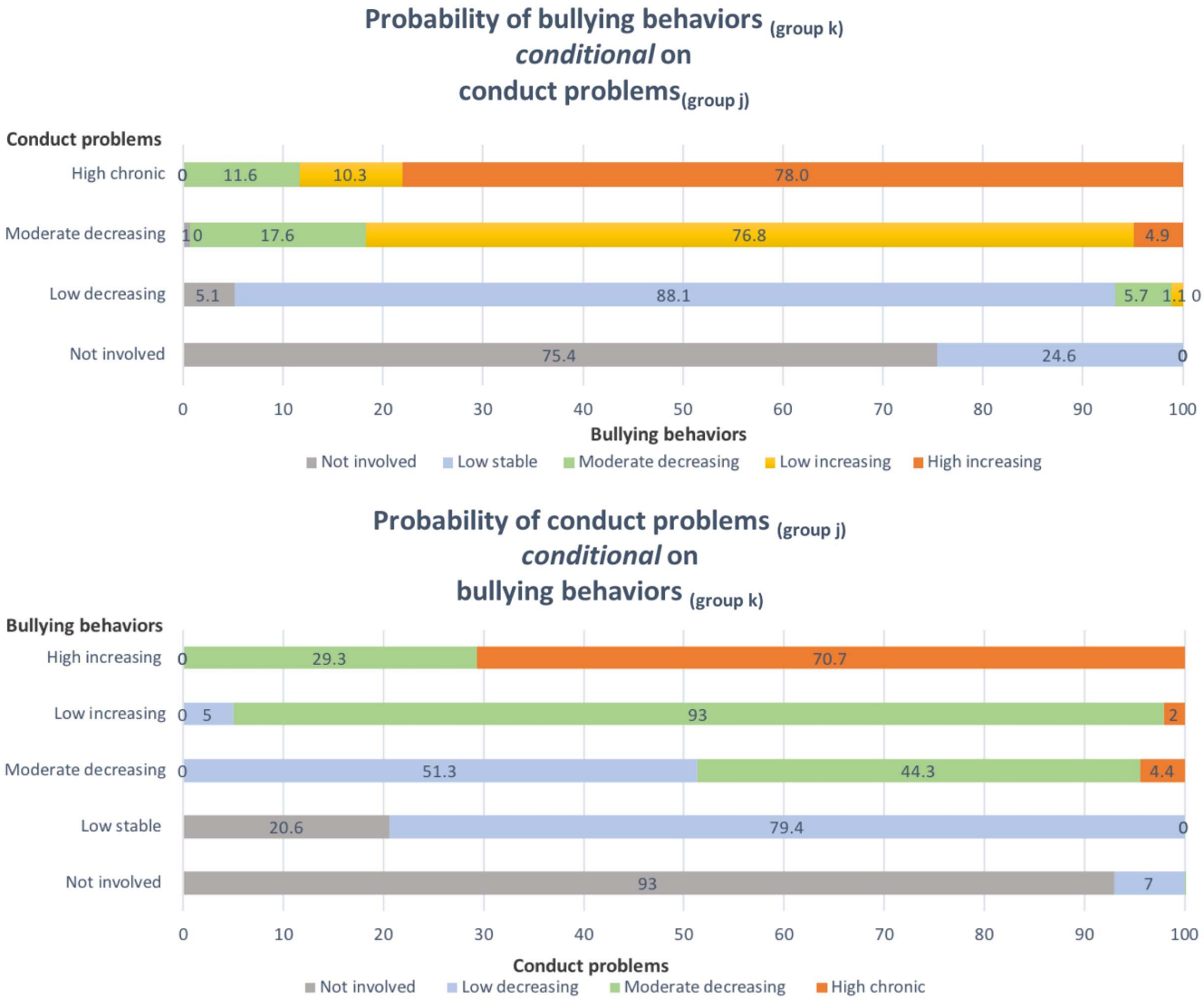


Note. Dotted lines: 95% confidences intervals. See the online article for the color version of this figure.

to the reference category (Table 3). Lower EF at age 5 was associated with an increased likelihood of being in the low decreasing and high chronic conduct problems trajectory groups and marginally predicted likelihood of belonging to two increasing bullying behavior trajectory groups (low and high). When all measures of cognitive functioning were simultaneously entered in the regression models, lower IQ predicted group membership for both antisocial behavior trajectories, while lower ToM was specifically associated with group membership for conduct problems trajectories. Children with a lower IQ had the highest odds of following three trajectories of bullying behaviors (moderate decreasing and low and high increasing). When controlling for age 5 conduct problems, all associations remained except between lower IQ and the high increasing group. When accounting for age 5 bullying behaviors, children with lower IQ and ToM had increased odds of following the moderate decreasing and high chronic conduct problems trajectories. Children with lower ToM also had increased odds of being in the low decreasing conduct problems trajectory relative to the not-involved group.

Figure 2

Conditional Probability Models of Membership in Bullying Behaviors and Conduct Problems Trajectories Across Childhood



Note. See the online article for the color version of this figure.

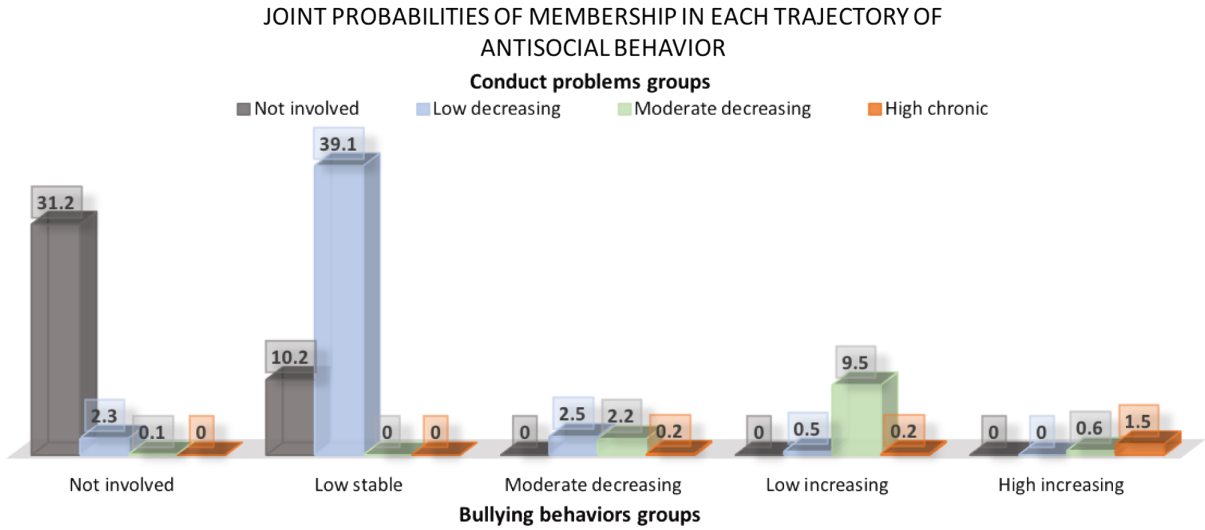
Discussion

We found distinct patterns of change in the developmental course of bullying behaviors and conduct problems from ages 5 to 12. While the two behaviors were closely linked at high levels, they were less related at low levels. Moreover, a subsample of children shifted from conduct problems to bullying behaviors as they aged. Furthermore, we demonstrated that lower IQ is longitudinally associated with both behaviors, while lower ToM is uniquely for children with conduct problems. Our results underscore the importance of taking into account both children's behaviors and cognitive profiles when planning interventions to prevent or reduce future bullying behaviors and conduct problems.

Bullying behaviors are a criterion for conduct disorder diagnosis (American Psychiatric Association, 2013), and both are known to co-occur (Catone et al., 2021; Ganesan et al., 2021). However, they appear to manifest distinctly during childhood and potentially peak at different developmental stages. For bullying behaviors, while some children were not involved in bullying others, most of the sample tended to occasionally bully others up until age 12. Moreover, two groups of children showed an increasing involvement in bullying behaviors as they advanced in age. In contrast, children with conduct problems showed an overall tendency to decline over time. In children not highly involved in this behavior, it appeared more frequent at a young age but less as children got older. These findings are consistent with prior studies indicating that conduct problems are generally less prevalent during childhood, except for a small percentage of children exhibiting this behavior at an early onset and persistently (Burt et al., 2016; Tremblay, 2010). However, bullying behaviors appeared to be less stable and

Figure 3

Joint Probabilities Model of Membership in Bullying Behaviors and Conduct Problems Trajectories Across Childhood



Note. See the online article for the color version of this figure.

more contingent on social context, which may offer children increased opportunities to engage in bullying as they age (Farrell & Vaillancourt, 2021). One explanation could be that bullying behaviors take place in the context of social relationships, whereas conduct problems are linked to the transgression of rules in various settings beyond social relationships (e.g., stealing or damaging goods; Achenbach, 1991a). Another explanation could be the distinct underlying motivations. For instance, such motivation for bullying behaviors might be the willingness to exert power and provoke distress in others to establish social status and hierarchy (Rodkin et al., 2015; Wolke & Lereya, 2015). For conduct problems, disregarding rules may serve as a way for children to express or cope with intense emotions such as anger and frustration (Deater-Deckard et al., 2007; Paulus et al., 2021). Our results offer novel empirical and conceptual support for the relevance of distinctly investigating bullying behaviors and conduct problems in childhood, given their developmental differences throughout this period.

Despite several studies indicating that bullying behaviors and conduct problems are highly comorbid in children (Ahmed et al., 2022; Catone et al., 2021; Ganesan et al., 2021), our results revealed more nuanced patterns of interrelations over time. Both behaviors overlapped at high levels but appeared much more independent at lower levels. Children who rarely or never engaged in conduct problems were still likely to bully others occasionally across ages. Those results are consistent with Pepler et al. (2008), who found that most adolescents report bullying others at some point during their school years. Childhood is characterized by experimenting with various demeanors to learn socially acceptable ways to resolve frustrations and interpersonal conflicts (Dishion & Patterson, 2006; Tremblay, 2010). Thus, by testing out their behavioral and social skills, children who bully others at low levels but consistently throughout their early years may be learning to handle conflictual situations in their environment and discovering what may or may not be acceptable given societal rules (Pepler et al., 2008). Interestingly, a subsample of children might become disengaged in conduct problems as they age and start bullying others increasingly instead. Previous research suggests that some children can desist from specific behaviors to engage in novel forms of antisocial behavior as they age (Dishion & Patterson, 2006; Granic & Patterson, 2006). This change in the manifestation of antisocial behavior forms could be explained by social relationships that expand beyond the family context with age. Thus, children might become more prone to frequently bullying their peers, which could be perceived as more acceptable behavior in their different environments. An alternative interpretation could be the desire to gain higher social standing by dominating others. That is, children who showed increased bullying behaviors possibly strategically used this behavior as a way of manipulating their social status and gaining power (Guy et al., 2019; Wolke & Lereya, 2015). Although this tendency is usually found among adolescents, it is possible that some children start practicing this tactic early on.

Our results aimed to clarify the role of early cognitive functioning in the developmental course of bullying behaviors and conduct problems in childhood. IQ was a common cognitive correlate among children with varying levels of involvement in both behaviors. This finding is consistent with studies showing that poorer intellectual abilities are linked to an increased propensity for aggressive and hostile reactions (Sánchez de Ribera et al., 2019; Wallinius et al., 2019). However, lower ToM in early childhood was related only to children engaged to various degrees in conduct problems over time. ToM is considered an essential prerequisite for responding to distress signals from others. If a child has difficulty adequately understanding the mental states of others, they will be limited in their cognitive ability to discriminate between affective cues (Sharp, 2008). Surprisingly, lower ToM was not involved in bullying behaviors. This suggests that children who bully others could correctly represent the mental states of their peers but still bully with the intention of hurting them. However, for conduct problems, children could react

Table 3
Multinomial Logistic Regressions Between Age 5 Cognitive Functioning and Bullying Behaviors and Conduct Problem Trajectories Across Childhood

Age 5 cognitive functioning	Bullying behaviors trajectory				Conduct problems trajectory		
	Low stable	Low increasing	Moderate decreasing	High increasing	Low decreasing	Moderate decreasing	High chronic
			RRR (95% CI)				
Univariate regressions							
Theory of mind	**.96*** (.93, .99)	**.93**** (.88, .98)	**.88**** (.81, .97)	**.83**** (.73, .94)	**.95**** (.92, .98)	**.92**** (.87, .97)	**.77***** (.67, .88)
IQ	**.99*** (.98, .99)	**.97***** (.96, .98)	**.96***** (.94, .98)	**.95***** (.93, .97)	**.99*** (.98, 1.00)	**.97***** (.96, .98)	**.94***** (.92, .97)
Executive functioning	.98 (.95, 1.01)	.95† (.90, 1.01)	.96 (.88, 1.04)	.90† (.80, 1.01)	**.96*** (.93, 1.00)	.96 (.91, 1.01)	**.86*** (.77, .96)
Multivariate regressions							
Theory of mind	.97 (.94, 1.01)	.97 (.91, 1.03)	.92 (.84, 1.02)	.88† (.77, 1.01)	**.95**** (.92, .99)	.96 (.91, 1.01)	**.83*** (.71, .96)
IQ	.99 (.99, 1.00)	**.97***** (.96, .99)	**.97**** (.96, .99)	**.96**** (.94, .98)	1.00 (.99, 1.01)	**.97***** (.96, .99)	**.95***** (.93, .98)
Executive functioning	.99 (.96, 1.03)	.99 (.94, 1.05)	1.01 (.92, 1.11)	.97 (.87, 1.08)	.98 (.95, 1.01)	1.00 (.95, 1.06)	.94 (.84, 1.05)
Multivariate regressions controlling for the age 5 other behavior							
Theory of mind	.98 (.94, 1.02)	.96 (.90, 1.02)	.92 (.83, 1.02)	.86† (.72, 1.01)	**.96*** (.92, .99)	**.94*** (.89, 1.00)	**.76**** (.64, .90)
IQ	.99 (.99, 1.00)	**.98**** (.96, .99)	**.97*** (.95, 1.00)	.97 (.94, 1.00)	1.00 (.99, 1.01)	**.98*** (.97, 1.00)	**.97*** (.94, 1.00)
Executive functioning	1.00 (.96, 1.03)	1.01 (.94, 1.07)	1.02 (.93, 1.13)	1.00 (.87, 1.14)	.98 (.94, 1.01)	1.00 (.94, 1.06)	.94 (.83, 1.06)

Note. The not-involved trajectory group was the reference group for both behaviors' trajectories. All regressions controlled for sex and SES. Significant associations are formatted in bold. Sensitivity analyses with posterior probabilities, to account for classification uncertainty, yielded overall similar findings (Supplemental Table S9). RRR = relative risk ratio; CI = confidence interval; IQ = intelligent quotient; SES = socioeconomic status.
$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

more aggressively because they wrongly assign hostile intentions in their environments due to difficulty understanding others' mental states (Happé & Frith, 1996; Hartmann et al., 2020).

In contrast with previous findings (Austin et al., 2020; Bonham et al., 2022; Medeiros et al., 2016), EF were unrelated to the developmental course of both children's antisocial behavior. However, the three tasks used in the present study targeted uniquely cool components of EF, which support goal-directed behavior in nonemotional contexts (Zelazo et al., 2016). Hot EF (i.e., emotional processes related to affective and motivational decision-making in daily life) often underlie more externalizing problems, including antisocial behavior, than cool EF (Medeiros et al., 2016; Woltering et al., 2016). Moreover, research suggests that cool EF are related to general intelligence (Engelhardt et al., 2016; Wilson et al., 2021). In our study, EF were predictive of conduct problems trajectories in univariate analyses but became non-significant once in the multivariate model that included IQ. These findings underscore the potential challenge of isolating children's EF from other cognitive factors, such as IQ, when predicting trajectories of bullying behaviors and conduct problems.

The present study has some limitations. First, we used the same instrument to assess bullying behaviors and conduct problems by extracting items from a scale assessing antisocial behavior. Using two distinct measures could have allowed for capturing a more specific and extensive range of symptoms relevant to each behavior. Second, the small proportion of girls involved in bullying behaviors and conduct problems in our sample did not allow us to distinguish antisocial behavior trajectories according to sex differences. Nevertheless, although more boys are involved in antisocial behavior, girls' antisocial trajectories are found to be more similar than dissimilar to those of boys (Russell et al., 2014). Third, most of the children in our sample were White. It is unclear if the results are generalizable to children of other ethnicities. Fourth, our results from a cohort of twins may not generalize to singleton populations. However, Gjone and Nøvik (1995) found that the parenting rating of externalizing problems in twins and the general population sample was similar. Finally, our study was informed by existing literature and theoretical foundations, which guided the trajectory analyses based on established knowledge. However, the data-driven nature of these analyses comes with inherent limitations. Models might become overly tailored to specific data sets, potentially hindering their generalizability. Additionally, the interpretability of complex models can be challenging, and the reliability of the results is contingent upon the quality and accuracy of the input data.

Our findings have implications for informing interventions and future research. We highlight that the severity and persistence of antisocial behavior, such as bullying behaviors and conduct problems, are not uniform across children and can differ in their trajectories. Despite these distinct developmental patterns found in bullying behaviors and conduct problems, their links across development suggest frequent co-occurrence. Some children consistently display both behaviors, while others could disengage from conduct problems and instead bully others more as they age. Thus, interventions aimed at preventing these behaviors could benefit from greater integration. Despite the common characteristics of these two behaviors, interventions targeting each behavior are distinct. Conduct problems focus on family-oriented interventions to enhance parenting skills (de Graaf et al., 2008), while bullying behaviors are tackled with school-based interventions (e.g., discussion or game roles to modify attitudes toward bullying; Ttofi & Farrington, 2011). Early interventions targeting conduct problems

could potentially reduce the likelihood of children's involvement in bullying others later in childhood. Moreover, the present study highlights that children with conduct problems showed a broader range of early cognitive problems than those with bullying behaviors. While lower IQ was common in both behaviors, poor ToM abilities were also at play in children with conduct problems. Training strategies aimed at improving early ToM skills could be beneficial in reducing the risk of children engaging in antisocial behavior (Westby & Robinson, 2014).

Conclusion

Our results revealed that bullying behaviors and conduct problems follow distinct developmental trajectories but frequently co-occur across childhood. They emphasize the importance of understanding the role of EF, IQ, and ToM in driving different subdimensions of children's antisocial behavior development, in addition to other relevant cognitive characteristics. Thus, intervention strategies could be combined while also targeting cognitive problems to prevent the developmental course of these vulnerable children. To guide clinicians in offering services based on targeted prevention and early intervention strategies that underlie children's profile of vulnerability and strengths, more longitudinal research is required. Future studies should track the interplay between bullying behaviors and conduct problems during adolescence and their etiology and underlying mechanisms. Studies should also include other broader and relevant risk and protective factors that stem from child characteristics, family environment, and social factors.

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