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Journal of Developmental and Life-Course Criminology (2025) 11:294–322
https://doi.org/10.1007/s40865-025-00283-8

ORIGINAL ARTICLE

Using Risk Profiles To Differentiate Between Offending Trajectories in Childhood Arrestees

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Received: 29 November 2024 / Revised: 5 November 2025 / Accepted: 9 November 2025 /
Published online: 8 December 2025

Abstract

This study aims to explain heterogeneity in offending trajectories by examining its association with exposure to combinations of risk (or the lack thereof) across multiple life domains. Drawing on survey data and administrative crime records from the *Dutch Childhood Arrestees Study*, we examined the relationship between distinct risk profiles and offending trajectories in a sample of 348 children with a first police contact before age 12 (87% male, M_{age} a first contact = 10.63, SD = 1.48), who were followed from age 12 to 20. Alongside an a priori defined group of non-recidivists (55%), the trajectory analysis yielded four distinct offending patterns: low-rate desisting (14%), low-rate persisting (18%), high-rate desisting (5%), and high-rate persisting (8%). Using latent profile analysis, we constructed three distinct risk profiles based on individual, familial, peer, school, and neighborhood characteristics: low-problem (31%), cognitive- and neighborhood-problem (48%), and multi-problem (21%) profiles. Multinomial regression analyses showed that children with a low-problem profile were the least likely to persist in offending throughout the follow-up period. In comparison to low-problem children, those with a multi-problem profile were more likely to follow the low-rate persistent trajectory, whereas children exposed to cognitive and neighborhood problems were more likely to follow the high-rate persistent trajectory. The findings underscore the value of accounting for risk exposure across multiple life domains to explain variations in longitudinal offending patterns.

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Keywords Offending trajectories · Risk profiles · Justice-involved children

The study of heterogeneity in the development of offending behavior has advanced significantly through trajectory-based research, which models distinct patterns of criminal activity over time (for reviews see Jennings & Reingle, 2012; Piquero, 2008). These studies consistently extract subgroups with differing rates, durations, and peak ages of offending. Group-based studies commonly construct patterns that include minimal or no offending, adolescence-peaked, late-onset, and high-rate persistent trajectories. Notably, even among early-onset youth, multiple trajectories emerge (van Domburgh et al., 2009b; van Hazebroek et al., 2019), challenging assumptions of inevitable persistence.

Trajectory-based research has prompted efforts to explain why individuals follow one trajectory over another. Evidence indicates that risk factors from various life domains—individual (e.g., impulsivity, substance use), familial (e.g., inconsistent parenting, parenting stress, parental criminality), peer (e.g., peer delinquency), school (e.g., poor academic performance), and neighborhood (e.g., residing in disadvantaged areas)—are associated with offending trajectories (Baglivio et al., 2015; Chung et al., 2002b; Gushue & McCuish, 2021; Hoeve et al., 2008; Jennings et al., 2019; Lacourse et al., 2008; Monahan & Piquero, 2009; van der Geest et al., 2009; van Hazebroek et al., 2019; Wiesner & Capaldi, 2003). Individuals on persistent or chronic offending trajectories typically face a greater number of risk factors across these domains than non or sporadic offenders. Offenders assigned to other trajectory subgroups are often exposed to similar risks, indicating the pervasiveness of these factors across all derived trajectory subgroups (e.g., Assink et al., 2015; Baglivio et al., 2015; Jolliffe et al., 2017).

Despite these advancements, there is a tendency in trajectory-based literature to examine risk factors in isolation, potentially overlooking broader patterns of concurrent problems across life domains, which may enhance our understanding of the etiology of offending patterns. An important challenge when studying isolated risk factors is the considerable overlap in risk exposure across different trajectory groups, making it difficult to use specific risk factors to consistently distinguish between them (Assink et al., 2015; Baglivio et al., 2015; Jolliffe et al., 2017). This overlap complicates efforts to predict offending trajectories based on specific risk factors, particularly when attempting to distinguish persistent offenders from those with shorter offending patterns (Jolliffe et al., 2017). This challenge is especially pronounced among youths with an early onset of delinquency, as childhood-identified risk factors tend to be less informative in differentiating trajectories than those measured in adolescence (Day et al., 2012; Ward et al., 2010). It has however long been emphasized that offending behavior arises from multiple converging factors (Glueck & Glueck, 1952; Wolfgang & Ferracuti, 1967). Taxonomic theories (Moffitt, 1993, 2006; Patterson et al., 1989) and subsequent research (Assink et al., 2015; Jolliffe et al., 2017) reinforce the idea that risk factors of offending do not operate in isolation but rather co-occur and are often mutually reinforcing.

Instead of focusing on isolated risk factors, research in other fields has greatly progressed insight into heterogeneity in adolescent outcomes (e.g., internet addiction,

psychopathology, and internalizing problems) by using latent risk profiles to capture combinations of risk (Dunn et al., 2011; Li et al., 2017; Simpson et al., 2018). These studies group individuals based on shared risk exposure patterns rather than singular predictors. This allows researchers to adopt a holistic approach to risk exposure by emphasizing how various risk factors across life domains tend to cluster together and are jointly associated with behavioral outcomes (Andrews & Currim, 2003). Studies constructing such risk profiles suggest that distinct risk constellations are linked to different behavioral outcomes (Dunn et al., 2011; Li et al., 2017; Simpson et al., 2018). As differentiating between offending trajectories based on isolated risk factors is challenging, especially for early-onset youths, research could examine how specific *combinations* of risk factors shape these trajectories.

This study aims to contribute to life-course criminology by examining the relationship between childhood exposure to combinations of risk factors and offending patterns from early adolescence to early adulthood. Utilizing data from the *Dutch Childhood Arrestees Study*, it focuses on a high-risk sample of justice-involved children with a police contact before age 12. While early police contact indicates an increased risk for persistent offending (Krohn et al., 2001; Moffitt, 1993), it does not automatically lead to chronic criminal behavior (van Domburgh et al., 2009b; van Hazebroek et al., 2019). The observed heterogeneity in delinquent development among these children underscores the need to understand how patterns of risk exposure are associated with the development of offending over the course of juvenile and early adult years.

Accordingly, this study addresses the following research questions: (1) To what extent do justice-involved children follow distinct offending trajectories into early adulthood? (2) To what extent are these children exposed to distinct clusters of risk factors across individual, familial, peer, school, and neighborhood domains? and (3) To what extent can exposure to these risk clusters differentiate between the various offending trajectories observed in childhood arrestees?

Theoretical Framework

Several developmental theories argue that exposure to risk factors in childhood determines which children grow up to become persistent offenders. However, they offer distinct perspectives on how childhood risk exposure contributes to heterogeneity in the development of offending behavior.

Gottfredson and Hirschi's (1990) general theory of crime argues that variation in offending stems from differences in self-control, formed through risk exposure during early childhood. According to their theory, low self-control develops through inadequate parenting and is characterized by impulsivity, risk-seeking behavior, and insensitivity to long-term consequences, increasing the likelihood of criminal activity. They further assert that self-control stabilizes after early childhood, remaining largely unaffected by later life events in adolescence or adulthood. This framework implies that offending behavior varies along a continuum, with individuals positioned on this spectrum based on the intensity of their risk exposure during child-

hood—those exposed to higher levels of risk factors are more likely to display higher levels of offending.

Typological theories take a different approach, positing that children fall into distinct groups based on exposure to unique combinations of risk factors, each linked to different offending trajectories (Moffitt, 1993; Patterson & Yoerger, 1993). Most youth are thought to temporarily engage in delinquency during adolescence due to delinquent peer associations. However, a smaller group of children, exposed to heightened problems in individual (e.g. low estimated intelligence), familial (e.g. inconsistent parenting), peer (e.g. peer rejection), school (e.g. school failure), and neighborhood (e.g. residing in disadvantaged neighborhoods) domains, is expected to display persistent offending from childhood into adulthood.

Moffitt (2006) further argues that distinct combinations of risk factors explain differences in offending *within* the childhood onset group. Based on longitudinal studies identifying a small group of early onset offenders with low to moderate offending during adolescence (Moffitt et al., 1996; Nagin et al., 1995; Raine et al., 2005), Moffitt, (2006) divided the childhood onset group into those displaying high-rate persistent offending into adulthood (i.e., high-level chronic trajectory) and those exhibiting low offending rates during adolescence (i.e., low-level chronic trajectory). While early onset offenders are generally assumed to follow a high-level chronic trajectory, those with isolating individual characteristics, such as depression, are theorized to be excluded from deviant peer groups and thus follow a low-level chronic trajectory. It has even been argued that some early onset offenders may desist from crime at a young age when protected by an adaptive social environment (Lahey & Waldman, 2005).

Together, these theories suggest that both the degree (quantitative) and pattern (qualitative) of early risk exposure shape offending trajectories. Moreover, risk factors from multiple life domains are theorized to drive individuals to follow one trajectory rather than another. As theoretical assumptions can be extended based on prior empirical work, we first review prior research before presenting our expectations regarding offending trajectories, risk profiles, and their association.

Empirical Research

Risk Profiles of Offenders

Few studies have modeled risk profiles within offender populations. Those that have demonstrate heterogeneity in risk patterns among adolescent (e.g. Lopez-Romero et al., 2019; Schwalbe et al., 2008; van der Put et al., 2014), adult (e.g. Taxman & Caudy, 2015), and childhood arrestees populations (Geluk et al., 2014). These studies suggest that risk profiles can be categorized by level, such as low-, moderate-, and high-risk (Dembo et al., 2008), and by distinct clusters of risk factors where subgroups exhibit similar risk levels but different combinations of risks (e.g. Onifade et al., 2008; Schwalbe et al., 2008; van der Put et al., 2014). For instance, high familial and neighborhood risk factors (e.g., parental criminality, substance use, and inconsistent discipline, and low socio-economic status) often co-occur (Brennan et al., 2008), as do substance abuse and peer delinquency (Schwalbe et al., 2008). In

contrast, issues within individual and peer domains do not always overlap with familial problems (Bosick et al., 2015; Geluk et al., 2014).

Risk Profiles and Offending Behavior

Studies modeling distinct risk profiles have improved our understanding of how combinations of risk factors relate to offending likelihood and frequency. For instance, studies show that high-risk individuals are more likely to re-offend (e.g. Campbell et al., 2019) and commit more future offenses (e.g. Lopez-Romero et al., 2019). Youth with similar risk levels but different risk patterns also show varied offending rates (Onifade et al., 2008). Those characterized by high impulsivity, poor parental bonds, and delinquent peers are more likely to persist in offending than equally impulsive peers with stronger parental bonds and prosocial relationships. This highlights the role of both total risk and specific combinations in shaping offending outcomes (Campbell et al., 2019; Onifade et al., 2008).

Risk Profiles and Offending Trajectories

Drawing on interview data at age 18 from the Cambridge Study in Delinquent Development, Bosick et al. (2015) constructed four distinct risk profiles and modeled the offending trajectories for each profile. One group, with low impulsivity, few delinquent peers, and school completion, exhibited the lowest offending levels during the follow-up period. A second group—high in impulsivity, low IQ, and school dropout—engaged in high adolescent offending but desisted in adulthood. A third group, with high impulsivity and delinquent peers but fewer family problems, continued offending into late adolescence. The final group, marked by high impulsivity, substance use, poor parental bonds, delinquent friends, and early school dropout but no issues with sociability, exhibited persistent high-rate offending. These findings underscore the importance of both the level and combination of risk exposure in understanding delinquent development.

Current Focus

This study builds on prior work by prospectively examining associations between risk profiles and offending trajectories. While previous research has highlighted the importance of risk profiles in understanding heterogeneity in dichotomous or continuous measures of offending, their connection to offending trajectories remains underexplored. Unlike Bosick et al. (2015), this study constructs risk profiles and trajectories separately and then exmaines their association. This enables a deeper understanding of how distinct risk constellations contribute to varying patterns of offending. Furthermore, while longitudinal studies on so-called childhood arrestees are rare (Bosick et al., 2015), the current study utilizes data from the *Dutch Childhood Arrestees Study* on children registered by the police for displaying offending behavior. This provides a unique opportunity to explore the development of offending from childhood into adulthood in a population at heightened risk of prolonged

criminal justice involvement. Building on prior work, this study incorporates risk factors from individual, familial, peer, school, and neighborhood domains. Previous studies often overlooked neighborhood influences, despite evidence of its relevance for youth offending trajectories (e.g., Cauffman et al., 2015; Chung et al., 2002). Such a comprehensive approach is especially important in childhood, when relationships with parents, peers, schools, and the broader environment strongly shape behavioral development (Larson & Richards, 1991). The current study therefore allows for a holistic investigation of how early risk exposure shapes offending trajectories in justice-involved children, ultimately contributing to a better understanding of the etiology of offending behavior in high-risk populations.

Based on criminological theory and prior research, we expect to find three offending trajectories: (1) sporadic, (2) low-rate chronic, and (3) high-rate chronic. We also anticipate three risk profiles: (1) relatively low risk levels within this high-risk sample, (2) high risk levels across domains, and (3) specific combinations of risk, either in the family and neighborhood domains or individual and peer domains. These expectations reflect prior research showing that familial and neighborhood risks often co-occur (e.g., Brennan et al., 2008), as do peer and individual-level risks (e.g., Bosick et al., 2015; Schwalbe et al., 2008). Finally, we anticipate that (1) children with minimal risk will largely abstain from offending, (2) those with high multi-domain risks will follow a high-rate persistent trajectory, and (3) children with a specific set of individual risks—particularly isolating characteristics (e.g., depression)—may follow a low-rate persistent trajectory. These last expectations build on the empirical finding that high-risk individuals are more likely to re-offend at a higher rate (Campbell et al., 2019; Lopez-Romero et al., 2019), and Moffitt's (2006) theoretical distinction between high-level and low-level chronic offenders.

Method

Participants and Procedures

We used data from the *Dutch Childhood Arrestees Study*, a longitudinal study on children with police contact for a first offense before age 12, conducted by the Department of Child and Adolescent Psychiatry at Amsterdam University Medical Centers (VUmc). Although offenses committed under the age of 12 (the age of criminal responsibility in the Netherlands) are not recorded in national crime statistics, they are documented in local police systems. For this study, local police registries from three regions in the Netherlands—Gelderland-Midden, Utrecht, and Rotterdam-Rijnmond—were used to identify children whose behavior could have led to prosecution or fines had they been older. The current sample ($N = 348$) stems from the first wave of data collection, including questionnaires and interviews with children and their primary caregivers (hereafter "parents"), conducted at participants' homes when children were 5 to 13 years old ($M = 10.63$, $SD = 1.48$, $Median = 11$) (see van Domburgh et al., 2009 for more details).[1] Most children are male (87%, $n = 302$), and about half

[1] Because of potential problems with comprehensibility of the questionnaires, due to children being younger than eight years old or having below average verbal IQs, self-report questionnaires of a total of

is of non-Dutch origin (53%, $n=184$). Police registration occurred between 2003 and 2005 (M_{age} = 10.26, $SD=1.45$), for vandalism (58.7%, $n=178$), property crime (27.4%, $n=83$), and violent offenses (13.9%, $n=42$).

Measures

Measures Used for Trajectory Modelling

Offending trajectories were based on new arrests following the initial arrest before age 12, as recorded in the Dutch police system *Herkenningsdienstsysteem* (HKS) from February 2004 to February 2015. Frequency of offending between ages 12 and 20 was calculated based on the birth date and offense dates. Age 20 was chosen as the upper limit, as older ages included fewer than 100 individuals due to variation in age at first arrest and inclusion year. Missing years for younger participants were coded as missing to prevent contributions to trajectory estimations (see also van der Geest et al., 2009).[2]

Data on mortality and criminal sanctions from the Research and Policy Database Judicial Documentation (OBJD) of the Research and Documentation Centre of the Ministry of Justice (WODC) were used to calculate exposure time or 'street time' (i.e., time free to offend) (see Piquero et al., 2001). Since no mortality occurred during follow-up, we controlled for incarceration by estimating months not spent in custody at each age. For instance, one month of incarceration at age 19 resulted in 11 months coded as 'free'. Exposure time was included as a time-varying covariate (see also Piquero et al., 2001). About 30% of the re-arrested individuals had been incarcerated ($n=46$), with an average incarceration time of 6.6 months. No participant was incarcerated throughout the follow-up.

Risk Profile Indicators

Risk profile indicators covered individual, familial, peer, school, and neighborhood domains. To enhance interpretability, risk levels were based on norm scores when available and average scores for other continuous indicators (see also Brennan et al., 2008). Higher scores indicate more problems. Details on all 21 indicators are provided in Appendix I (see Appendix II for descriptives).

Individual domain. We measured pre/perinatal (indicators 1–2), cognitive (indicator 3), emotional (indicators 4–5), and behavioral (indicators 6–9) risk. Pre/perinatal risk included *prenatal substance exposure* to cigarettes, alcohol, or drugs, and *pre/perinatal complications*, such as preeclampsia, anemia, prematurity or forceps use (see Tzoumakis & Cale, 2019). Cognitive risk was classified on a six-point ordi-

46 participants were coded as missing.

[2] The age at the end of follow-up ranged from 15 to 23 ($M=20.28$, $SD=1.57$). Of the 95 participants (27.3% of the total sample) who did not reach age 20 during the observation period, 48 reached age 19, and 25 reached age 18. Participants who did and did not turn 20 did not differ in trajectory subgroup assignment, $\chi^2(4)=7.57$, $p=.11$.

nal scale using norm scores for intelligence, ranging from 1 = very high (IQ ≥ 130) to 6 = very low (IQ ≤ 69). Emotional risk encompassed a four-fold classification of *emotional problems* (i.e. close to average; slightly raised; high; very high), and a three-fold classification of *depression* (i.e. low; at risk; clinical range). Behavioral risk included classifications of *hyperactivity/inattention* (i.e. close to average; slightly raised; high; very high), the number of *substance types* children had ever used, and mean scores for *sensation seeking*. *Social understanding difficulties* were divided into seven norm-based categories ranging from very low to very high. Descriptives indicate slightly elevated risk in the individual domain, yet one-third of the sample had very low (≤ 79) to extremely low (≤ 69) estimated IQ, one-fourth experienced significant emotional problems, and 10.8% scored in the clinical range of depression.

Familial domain. In the family domain, we included parenting characteristics (indicators 10–13), familial criminality (indicator 14), parental mental health problems (indicator 15), and parenting stress (indicator 16). Children's perception on parenting characteristics was based on mean scores for *parental neglect* (opposite of parental supervision), *inconsistent parenting*, *parental indifference* (opposite of parental warmth), and *uninvolved parenting* (opposite of parental involvement). *Familial criminality* was assessed by determining whether a family member had ever been in contact with the criminal justice system. Norm scores for *parental mental health problems* and *parenting stress* ranged from 0 (very low) to 6 (very high). Descriptives show that children experienced relatively favorable parenting conditions, though 36.8% had a family member with a history of offending, and one-fourth of parents had high to very high mental health issues and parenting stress.

Peers domain. Peer problems were measured as mean scores for *bullying victimization* (indicator 17), and *affiliation with delinquent peers* (indicator 18). Descriptives indicate that children experienced some bullying and had virtually no delinquent friends.

School domain. *Poor school achievement* (indicator 19) was defined as failing a reading test, corresponding to reading performance one year below grade level (43.9% in the sample).

Neighborhood domain. Postal codes served as a proxy for *neighborhood socioeconomic status* (SES) (indicator 20) and *urbanization* (indicator 21), both measured in quintiles. Higher scores indicate lower SES and higher urbanization. Nearly half the sample resided in low to very low SES areas, and about 75% lived in highly urban neighborhoods.

Analytical Approach

Stage One: Offending Trajectories

We estimated offending trajectories using semi-parametric group-based trajectory models with the Trajectory Procedure (Jones & Nagin, 2013; Nagin, 2005) in STATA 13 (see also Baglivio et al., 2015; Gushue et al., 2021). We employed a zero-inflated Poisson (ZIP) model to address overdispersion and the excess of zero counts in the offending data, which reflect extended periods without recorded offenses. This model simultaneously estimates the likelihood of any offending and the expected number

of offenses at each age, making it well suited for behavioral data such as offending (Fergusson et al., 2000; Lambert, 1992). To capture non-linear changes in offending over age, we specified cubic trajectory forms. This decision was informed by findings from Sivertsson et al. (2024), who demonstrated that cubic functions outperform quadratic alternatives in modeling nuanced developmental patterns. Additional support comes from Bushway et al. (2009), who suggested that cubic specifications more accurately reflect the shape of offending trajectories. Parameters defining the level and shape of offending trajectories were allowed to vary freely across groups.

Participants without police records during follow-up ($n=155$) were excluded from trajectory models, as the risk of low-level recividists being pulled into the non-recidivists group would have complicated comparisons between non- and low-rate recidivists. This resulted in an analytical sample of 193 individuals—a relatively small sample size that raises concerns about overfitting and the potential extraction of spurious group structures. Nonetheless, group-based trajectory models have been applied successfully in similarly sized samples, including studies based on the Incarcerated Serious and Violent Young Offenders Study (e.g., Gushue et al., 2021), the Pathways to Desistance Study (Cauffman et al., 2015), and the Racine birth cohort (Jennings, 2008). Furthermore, simulation-based evaluations suggest that the number of modeled trajectory groups stabilizes around 200 participants (Sampson et al., 2004), and that meaningful classifications can still be obtained when model selection is guided by fit indices and theoretical plausibility (D'Unger et al., 1998). While our findings need to be interpreted with this sample size in mind, the model was selected using established statistical criteria and with attention to parsimony and substantive coherence.

We tested models with up to six groups, selecting the best-fitting model using the Bayesian information criterion (BIC), the Akaike information criterion (AIC), the average posterior probability (AvePP), and odds of correct classification (OCC). Following Nagin's recommendations (Nagin, 2005, 2010), lower BIC and AIC values, AvePPs surpassing 0.70, and OCCs exceeding 5.0 indicated adequate fit. When multiple models met these criteria, we selected the most parsimonious solution that offered meaningful new information (see also McCarthy et al., 2022; Ogilvie et al., 2023).

Stage Two: Risk Profiles

Latent profile analysis (Collins & Lanza, 2013) was conducted in Mplus 8.1 (Muthén & Muthén, 1998–2010) to model subgroups of justice-involved children with similar problems across individual, familial, peer, school, and neighborhood domains. Models were estimated using full maximum likelihood using information on participants with complete and partially complete data.[3]

Model fit was evaluated for one to five latent groups using BIC, AIC, AvePP, the Lo-Mendell-Rubin Test (LMR), the bootstrap likelihood ratio test (BLRT), and entropy. Significant LMR and BLRT tests suggest that the *k*-group model improves

[3] Of the 348 participants, 220 (63.2%) had some missing data; 28% on one profile indicator, and 80% on four or fewer. Missingness was not associated with risk profile assignment, $\chi^2(2)=3.41$, $p=.18$.

upon the $k - 1$ group model, and entropy closer to 1 indicates greater classification accuracy (Lo et al., 2001; Nylund et al., 2007; Vuong, 1989). After selecting the best-fitting model, group differences across profile indicators were examined using ANOVA for continuous and chi-square tests for dichotomous indicators.[4]

Stage Three: Distinguishing Offending Trajectories by Risk Profiles

Participants were assigned to their most likely trajectory and profile group, which is acceptable when assignment accuracy exceeds 80% (Clark & Muthén, 2009). These groups were used as observed variables in follow-up multinomial regression analyses to explore the relationship between offending trajectories and risk profiles. Each analysis treated trajectory subgroup membership as the outcome, and models were run for all possible comparisons, with each trajectory subgroup and risk profile alternately set as the reference category.

Results

Offending Trajectories

A four-group offending trajectory model was selected as the best-fitting model (see Appendix III for model fit indices). This model provided better fit based on BIC than the three-group model, while maintaining high classification accuracy. Specifically, average posterior probabilities exceeded 0.80, and OCC values were above 5.0, indicating adequate assignment accuracy across groups. Although the five-group model had a slightly better BIC, it was not preferred due to a decrease in relative change in BIC and a lack of additional nuance, as the fifth trajectory group (2.6% of the sample) overlapped conceptually with a larger trajectory in the four-group model and therefore offered no distinct interpretive benefit.

Figure 1 displays the offending trajectories modeled alongside the a priori defined group of non-recidivists (NON) (55.5%, $n = 193$): low-rate desisting (LR-D) (13.5%, $n = 47$), low-rate persisting (LR-P) (17.8%, $n = 62$), high-rate desisting (HR-D) (5.5%, $n = 19$), and high-rate persisting (HR-P) (7.8%, $n = 27$). Mean offending rates were low for both LR-D ($M = 0.29$, $SD = 0.18$) and LR-P ($M = 0.32$, $SD = 0.20$) groups, indicating these participants committed about one offense every three years. In contrast, HR-D ($M = 1.61$, $SD = 0.74$) and HR-P ($M = 1.58$, $SD = 0.62$) groups demonstrated higher offending rates, with a difference of 1.3 offenses per year between low- and high-rate groups. The desisting trajectories also differed from their persisting counterparts. The LR-D group showed an initial rise in offending, peaking in early adolescence and declining to near abstinence by age 18. In contrast, the LR-P group committed very few offenses until age 15 and showed a (low) peak at age 18. Among high-rate offenders, the HR-D group displayed high initial offending rates that increased somewhat until age 16, before steadily decreasing towards age 20. Con-

[4] Significant overall effects were followed by pairwise Bonferroni (equal variances assumed) or Tamhane (equal variances violated) post-hoc comparisons.

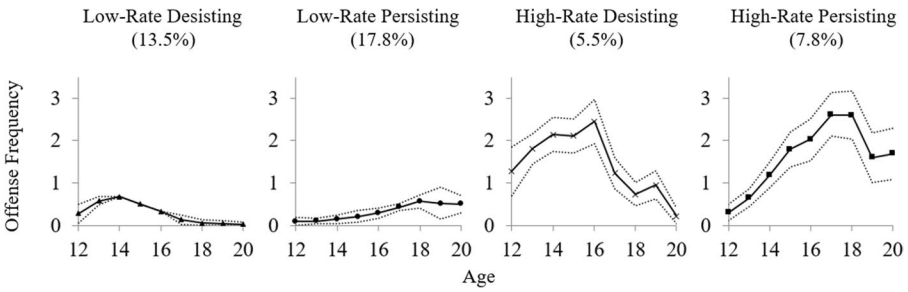

Fig. 1 Offending Trajectories for the Four-Group Model from Age 12 to 20 Corrected for Time Spent in Incarceration

versely, the HR-P group showed lower initial offending rates that rapidly increased to a peak around age 17–18 and persisted at a high rate into young adulthood.

Risk Profiles

A three-group latent profile was selected as the most appropriate solution (see Appendix III for model fit indices). This decision was supported by the LMR test, which showed no improvement when a fourth group was added. The three-group model showed good classification accuracy, with entropy exceeding 0.80 and average posterior probabilities surpassing 0.90 for each profile. While a four- and five-profile solution yielded a better BIC, the additional groups captures only small subsamples that did not provide substantial differentiation beyond the three-group structure.

Based on post-hoc comparisons (Table 1), risk profiles were labeled as: (1) low-problem group (30.5%, $n = 106$), (2) cognitive- and neighborhood-problem group (48.3%, $n = 168$), and (3) multi-problem group (21.3%, $n = 74$). The low-problem group included children with the lowest risk scores across domains, exhibiting low emotional problems, depression, and neighborhood adversity. Note that these children scored close to sample estimates on pre/perinatal indicators and school achievement, and exhibited slightly elevated levels of hyperactivity and sensation seeking. Despite low familial criminality compared to the cognitive- and neighborhood-problem and multi-problem groups, still 16.5% of children in the low-problem group had a family member with a history of offending. While this group exhibited the lowest risk levels within this high-risk sample, their risk exposure may still be elevated compared to children in the general population. The cognitive- and neighborhood-problem group consisted of children with low IQ estimates residing in highly urbanized, low-SES neighborhoods. Problems in familial, peer, and school domains were similar to the low-problem group, except for increased familial criminality and parental mental health issues. Children assigned to the cognitive- and neighborhood-problem group reported fewer problems on other parenting indicators (e.g., inconsistent parenting, parental indifference, parenting stress) than the multi-problem group. Overall, risk in the second latent profile suggests a more specific concentration of cognitive and structural disadvantage, with

Table 1 Parameter Estimates and Prevalence Rates for the Total Sample and across Risk Profiles

Risk Profile Indicator	Scale	Sample		Risk Profiles				
		Range	M (SD)/%	Profile 1 $n=106$ M (SD)/%	Profile 2 $n=168$ M (SD)/%	Profile 3 $n=74$ M (SD)/%	Profile Comparison	Post Hoc Comparison
1 Prenatal Substance Exposure (%)	0-100%		36.1%	29.5%	37.6%	42.3%	$\chi^2(2)=3.29$	
2 Pre/perinatal Complications (%)	0-100%		32.6%	29.1%	31.7%	40.0%	$\chi^2(2)=2.37$	
3 Low Intelligence (N)	0–6	1–6	3.96 (0.19)	3.21 (0.99)	**4.44** (1.13)	*3.91* (1.01)	$F=40.05$***	2>3>1
4 Emotional Problems (N)	0–3	0–3	0.74 (1.06)	0.30 (0.70)	*0.59* (0.92)	**1.69** (1.19)	$F=52.49$***	3>2>1
5 Depression (N)	0–2	0–2	0.34(0.67)	0.05 (0.23)	*0.29* (0.61)	**0.92** (0.88)	$F=24.88$***	3>2>1
6 Hyperactivity/Inattention (N)	0–3	0–3	0.91(1.16)	*0.78* (1.08)	0.44 (0.83)	**2.12** (1.02)	$F=80.43$***	3>1>2
7 Substance Use (M)	0–3	0–3	0.27 (0.56)	0.28 (0.55)	0.20 (0.46)	*0.43* (0.74)	$F=4.60$*	3>2; 1=2, 3
8 Sensation Seeking (M)	0–4	0-3.71	1.59 (0.82)	*1.75* (0.79)	1.31 (0.76)	*1.93* (0.79)	$F=16.51$***	1, 3>2
9 Social Understanding Difficulties (N)	0–6	0–6	1.40 (1.62)	0.64 (0.79)	0.74 (0.83)	**3.81** (1.33)	$F=289.17$***	3>1, 2
10 Parental Neglect (M)	0–3	0–2	0.58 (0.41)	0.58 (0.40)	0.56 (0.43)	0.63 (0.40)	$F=0.56$	
11 Inconsistent Parenting (M)	0–3	0-2.80	1.26 (0.57)	1.21 (0.52)	1.19 (0.54)	*1.50* (0.63)	$F=7.09$***	3>1, 2

Table 1 (continued)

Risk Profile Indicator	Scale	Sample		Risk Profiles				
12 Parental Indifference (M)	0–3	0–2	0.32 (0.34)	0.30 (0.33)	0.26 (0.28)	*0.47* (0.43)	$F = 8.56$***	3 > 1, 2
13 Uninvolved Parenting (M)	0–3	0-2.66	0.95 (0.54)	0.93 (0.47)	0.91 (0.54)	1.07 (0.59)	$F = 2.09$	
14 Familial Criminality (%)	0-100%		36.8%	16.5%	**47.3%**	**41.7%**	$\chi^2(2) = 26.77$***	2, 3 > 1
15 Parental Mental Health Problems (N)	0–6	0–6	2.50 (2.02)	1.55 (1.65)	*2.53* (2.00)	**3.81** (1.85)	$F = 27.34$***	3 > 2 > 1
16 Parenting Stress (N)	0–6	0–6	3.05 (1.90)	2.52 (1.71)	2.32 (1.54)	**5.25** (0.87)	$F = 97.65$***	3 > 1, 2
17 Bullying victimization (M)	0–3	0-2.77	0.77 (0.60)	0.70 (0.53)	0.71 (0.55)	*1.00* (0.72)	$F = 6.31$**	3 > 1, 2
18 Delinquent Friends (M)	0–3	0-1.50	0.38 (0.34)	0.34 (0.26)	0.35 (0.35)	*0.48* (0.39)	$F = 4.14$*	3 > 1; 2 = 1, 3
19 Poor School Achievement (%)	0-100%		43.9%	45.4%	43.5%	42.4%	$\chi^2(2) = 0.15$	
20 Socioeconomic status (M)	0–4	0–4	2.64 (1.27)	1.46 (0.81)	**3.36** (0.89)	*2.69* (1.30)	$F = 124.08$***	2 > 3 > 1
21 Urbanization (M)	0–4	0–4	3.07 (1.18)	1.98 (1.15)	**3.76** (0.47)	*3.13* (1.12)	$F = 126.15$***	2 > 3 > 1

Note. Profile defining parameters are outlined, with elevated scores presented in italics and high scores presented in bold. M = Mean; N = norm score; Profile 1 = low-problem group; Profile 2 = cognitive- and neighborhood-problem group; Profile 3 = multi-problem group

fewer emotional or relational difficulties than those observed in the multi-problem group. The multi-problem group experienced the highest levels of risk exposure across individual, familial, and peer domains, with increased emotional problems, depression, hyperactivity, and social understanding difficulties. These children were also more frequently exposed to inconsistent parenting, parental indifference, offending family members, parental mental health issues, parenting stress, bullying, and delinquent peers. Multi-problem children typically lived in neighborhoods with low to average SES and average urbanization, indicating that neighborhood-related problems were less pronounced than in cognitive- and neighborhood-problem group yet more prominent than in the low-problem group.

Distinguishing Offending Trajectories by Risk Profiles

Tables 2 and 3 show that trajectory subgroup membership varied across risk profiles. Children in the cognitive- and neighborhood-problem group and the multi-problem group were more likely to follow persistent rather than nonpersistent trajectories than children in the low-problem group. Specifically, findings suggest that children in the cognitive- and neighborhood-problem group were uniquely linked to the high-rate persisting trajectory, whereas children in the multi-problem group were likely to follow the low-rate persisting trajectory. For example, 13.7% of children in the cognitive- and neighborhood-problem group followed the high-rate persisting trajectory, compared to 2.8% in the low-problem group and 1.4% in the multi-problem group (see Table 2). Likewise, 27.0% of children in the multi-problem group followed the low-rate persisting trajectory, compared to 13.2% in the low-problem group and 16.7% in the cognitive- and neighborhood-problem group.

These differences are reflected in the regression results (see Table 3). Compared to the low-problem group, children in the cognitive- and neighborhood-problem group were more likely to populate the high-rate persisting group than the non-recidivist (OR = 6.63), low-rate desisting (OR = 4.29) or low-rate persisting (OR = 3.83, p = .053) groups. Compared to the low-problem group, the multi-problem group was more likely to be assigned to the low-rate persisting than the non-recidivist group (OR = 2.38). The cognitive- and neighborhood-problem and multi-problem groups also differed in their likelihood of following specific offending trajectories. Compared to the cognitive- and neighborhood-problem group, the multi-problem group was less likely to populate the high-rate persisting group than the non-recidivist (OR = 0.08), low-rate persisting (OR = 0.06) or low-rate desisting (OR = 0.14, p = .069) groups.

Table 2 Percentage Distribution of Offending Trajectory Groups Within Each Risk Profile

Risk Profile	NON	LR-D	LR-P	HR-D	HR-P
Low-problem group (n = 106)	66.0%	13.2%	13.2%	4.7%	2.8%
Cognitive- and neighborhood-problem group (n = 168)	48.2.%	14.9%	16.7%	6.5%	13.7%
Multi-problem group (n = 74)	56.8%	10.8%	27.0%	4.1%	1.4%

Table 3 Odds Ratios and Confidence Intervals from Multinomial Regression Analysis: Risk Profile Membership on Offending Trajectory Membership

	Risk Profiles	LR-D vs. NON	LR-P vs. NON	HR-D vs. NON	HR-P vs. NON	LR-P vs. LR-D	HR-D vs. LR-D	HR-P vs. LR-D	HR-D vs. LR-P	HR-P vs. LR-P	HR-P vs. HR-D
Model 1	Low (*n* = 106)	*ref*	*ref*	*ref*	*ref*	*ref*	*ref*	*ref*	*ref*	*ref*	*ref*
	Cog/ Nbh (*n* = 168)	1.54 [0.75–3.20]	1.73 [0.84–3.54]	1.90 [0.63–5.74]	6.63** [1.91–23.01]	1.12 [0.45–2.80]	1.23 [0.36–4.27]	4.29* [1.09–16.89]	1.10 [0.32–3.79]	3.83† [0.98–14.99]	3.49 [0.70-17.29]
	Multi (*n* = 74)	0.95 [0.37–2.46]	2.38* [1.10–5.21]	1.00 [0.23–4.40]	0.56 [0.06–5.52]	2.50 [0.83–7.55]	1.05 [0.20–5.60]	0.58 [0.05–6.59]	0.42 [0.09–2.05]	0.23 [0.02–2.48]	0.56 [0.04–8.09]
Model 2	Low (*n* = 106)	0.65 [0.31–1.34]	0.58 [0.28–1.19]	0.53 [0.17–1.59]	0.15** [0.04–0.52]	0.89 [0.36–2.23]	0.81 [0.23–2.81]	0.23* [0.06–0.92]	0.91 [0.26–3.13]	0.26† [0.07–1.02]	0.29 [0.06–1.42]
	Cog/ Nbh (*n* = 168)	*ref*	*ref*	*ref*	*ref*	*ref*	*ref*	*ref*	*ref*	*ref*	*ref*
	Multi (*n* = 74)	0.62 [0.26–1.49]	1.38 [0.70–2.73]	0.53 [0.14-2.00]	0.08* [0.01–0.64]	2.23 [0.84–5.96]	0.85 [0.19–3.84]	0.14† [0.02–1.17]	0.38 [0.09–1.55]	0.06** [0.01–0.49]	0.16 [0.02–1.71]

Note. $N = 348$. $R^2 = .07$ (Cox & Snell), .08 (Nagelkerke). Model $^2(8) = 26.24$***

Lower group is reference category. NON = non-recidivists (*n* = 193); LR-D = low-rate desisting (*n* = 47); LR-P = low-rate persisting (*n* = 62); HR-D = high-rate desisting (*n* = 19); HR-P = high-rate persisting (*n* = 27); Low = low-problem group; Cog/Nbh = cognitive and neighborhood-problem group; Multi = multi-problem group. Odds ratios greater than 1.00 indicate increased probability of group membership

†p < .10, *p < .05 **p < .01, ***p < .001

Sensitivity Analyses

Sensitivity analyses were conducted to test the robustness of the results by addressing potential uncertainty in group assignment. We (1) re-estimated the multinomial regressions for participants with a 70% or higher probability of assignment to risk profiles and offending trajectories (*n* = 292, 83.91% of the sample) and (2) weighted the analysis by participants' posterior probabilities for each risk profile. The results aligned with the main findings, showing similar significance levels, directions, and odds ratios. Hence, children in the low-problem group were least likely to persist in offending, and associations between the cognitive- and neighborhood-problem group and the high-rate persisting trajectory, and between the multi-problem group and the low-rate persisting trajectory remained. Thus, these additional analyses strengthen the reliability of our primary findings, as uncertainty in group assignment did not appear to influence our results.

We also performed two additional analyses to reflect on our data-reduction methods, using alternative definitions of risk (based on the sum score of risk exposure) and offending groups (based on offense frequency). When children were grouped based on the sum of risk exposure across all 21 profile indicators, results showed that risk exposure was fairly similar across trajectory subgroups, ranging from 5.90

(*SD* = 3.16) in the non-recidivist group to 8.20 (*SD* = 2.04) in the high-rate desisting group.[5] Furthermore, when participants were grouped based on offense frequency, multinomial regression analyses showed that children in the cognitive- and neighborhood problem group were particularly likely to be classified as high-level recidivists compared to those in the low-problem and multi-problem groups.[6] However, the unique link between the multi-problem group and low-rate persistent offending was lost when offending was solely defined by frequency. These additional findings highlight the value of considering specific patterns of risk when studying variation in the development of offending behavior.

Discussion

Despite longstanding research interest in justice-involved children, knowledge about heterogeneity in their offending trajectories and underlying mechanisms remains limited. In addition to examining offending trajectories in childhood arrestees, the current study addresses two key shortcomings in prior research: 1) the limited integration of risk factors across multiple domains in trajectory-based studies, and (2) the predominant focus on static outcomes in studies modeling risk profiles, which overlooks the development of offending behavior over time. By incorporating administrative and survey data covering risk factors from multiple domains, we examined how constellations of childhood risk factors relate to reoffending patterns into early adulthood. Our study is among the first to integrate individual, familial, peer, school, and neighborhood-level data to model risk profiles among justice-involved children and link these profiles to offending trajectories.

Five Offending Trajectory Subgroups

Trajectory analysis revealed substantial heterogeneity among childhood arrestees. In addition to a predefined non-recidivist group, four distinct trajectories emerged—two low-rate and two high-rate patterns, with peaks in adolescence or early adulthood. The observed heterogeneity in offense patterns among childhood arrestees, while not completely unanticipated (Baglivio et al., 2015; van Domburgh et al., 2009b; van Hazebroek et al., 2019) thus extends beyond theoretical predictions (Moffitt, 1993, 2006). The presence of both low- and high-rate recidivists across two trajectories resonates with patterns seen in adolescent and adult offender samples, reinforcing their robustness (Baglivio et al., 2015; Broidy et al., 2015;

[5] These numbers are based on a sample of 128 children out of 348 due to missing data. When comparing risks across different domains with a range from 0 to 5 (no risk; risk in all 5 domains, $n = 281$), results were similar: children assigned to distinct trajectories were exposed to risk in more than three domains with mean scores ranging from 3.22 (*SD* = 1.08) in the non-recidivist group to 3.65 (*SD* = 0.93) in the HR-D group.

[6] Offender groups were defined as follows: (1) non-recidivists (i.e., no arrest during follow-up), (2) sporadic recidivists (i.e., one or two arrests), (3) low-level recidivists (i.e., three of four arrests), and (4) high-level recidivists (i.e., more than four arrests).

Day et al., 2012; Hoeve et al., 2008; Ward et al., 2010; Wiesner & Capaldi, 2003). The detection of low-rate offending trajectories in the current sample aligns with prior research showing that some children with high childhood antisocial behavior exhibit reduced adverse behavior in adolescence (Moffitt et al., 1996; Raine et al., 2005). These findings suggest that theories on the development of offending should account for age-related declines in offending rates, with social-environmental factors potentially curbing offending behavior even in youth with an early onset of delinquency (see for example Sampson & Laub, 1993). Given the relatively small size of some modeled trajectory groups—such as the high-rate desisting subgroup—their interpretation should be approached with caution. Their emergence does however align with theoretically and empirically grounded expectations about heterogeneity in offending, suggesting that these patterns are not merely statistical artifacts. Considering the exploratory nature of the current study and its novel integration of risk profiles and longitudinal outcomes, the modeling of such subgroups offers important preliminary insights that can inform future research and replication efforts in larger or more diverse samples.

More than half of our sample fell into the non-recidivist group. Although this finding diverges from theoretical expectations (Moffitt, 1993, 2006), the current sample of childhood arrestees can still be considered at increased risk of displaying offending behavior, given that only 14% of the general Dutch population is registered by the police between ages 12 and 22 (Blokland et al., 2010). In comparison, just 20% of boys in the Pittsburgh Youth Study (PYS) desisted between ages 14 and 19 (van Domburgh et al., 2009a; Domburgh et al., 2009b). Both the PYS and the current study suggest that children from highly urbanized, low socio-economic areas have a higher likelihood of continued offending. The high desistance rate in our study may thus reflect more adaptive environments for many justice-involved youth in the current sample, potentially mitigating delinquent pathways (Lahey & Waldman, 2005).

Three Risk Profiles

Latent profile analysis yielded three profiles: a low-problem, cognitive- and neighborhood-problem, and multi-problem group. The low-problem group exhibited minimal risk exposure, while the cognitive- and neighborhood-problem group was characterized by low estimated intelligence and neighborhood disadvantage. The multi-problem group faced elevated levels of risk across individual, familial, and peer domains. As in prior research (see Dembo et al., 2008; Onifade et al., 2008; Schwalbe et al., 2008), risk profiles reflected both differences in level and combinations of risk. The findings particularly align with Bosick et al. (2015), who derived similar risk profiles among adolescent boys, grouping them into low-risk, high-risk, and low-IQ profiles.

Findings further underscore the high-risk nature of the sample, as all three risk profiles were characterized by pre/perinatal and school problems, and about 70% of the sample (the cognitive- and neighborhood-problem and multi-problem groups)

suffered from problems in multiple life domains. This prevalence of risk exposure underscores the association between pre/perinatal risk, poor school performance and early onset delinquency (Moffitt, 1993). It is therefore important to recognize that the low-problem classification is relative to our sample, which consists of children with early police contact. Even the low-problem group may face elevated risks compared to children in the general population. Adjectives such as "low" and "high" should thus be interpreted as relative within the context of our particular sample. At the same time, their relatively favorable outcomes—e.g., lower levels of reoffending—highlight that even within high-risk samples, meaningful variation in risk exposure and developmental outcomes can be observed.

Risk Profiles Differentiate Offending Trajectory Subgroups

Regarding the third research question, our findings highlight that both quantitative and qualitative differences in risk exposure shape offending trajectories. Consistent with Gottfredson and Hirschi's (1990) general theory of crime and findings from Bosick et al. (2015), children with low levels of risk exposure were least likely to persist in offending, while higher levels of risk exposure were associated with high-rate offending. Specific risk factor combinations also play a critical role in explaining variation in offending trajectories (Moffitt, 2006). For instance, children in the multi-problem group, marked by elevated levels of individual, familial, and peer-related problems, tended to follow a low-rate persistent trajectory. Meanwhile, the cognitive- and neighborhood-problem group, characterized by low IQ estimates and adverse neighborhood conditions, were disproportionately likely to follow high-rate persistent offending trajectories. Interestingly, Bosick et al. (2015) found that their low-IQ group displayed a decline in offending from ages 19 to 70. Given that our trajectories span ages 12 to 20, future research could explore whether cognitive- and neighborhood-challenged individuals exhibit a similar decline in offending in adulthood or if exposure to disadvantaged neighborhoods increases the likelihood of an escalating trajectory (as seen in Chung et al., 2002).

A comparison between our findings and Moffitt's (1993, 2006) typology of early onset offenders suggests notable parallels. The multi-problem group, for instance, closely resembles Moffitt's low-level chronic offenders, displaying a combination of individual, familial and peer-related problems, and low yet persistent levels of offending throughout adolescence. Their increased levels of emotional problems, depression, social understanding difficulties, and bullying victimization could be interpreted as isolating individual characteristics, which further validates the argument that multi-problem children can be classified as Moffitt's (2006) low-level chronic group. In contrast, the cognitive- and neighborhood-problem group resembles Moffitt's high-level chronic offenders, facing challenges across multiple life domains yet fewer isolating characteristics, making them more susceptible to maintaining high offending rates into early adulthood. However, while this group shares elevated familial criminality with the multi-problem group, it exhibited fewer problems in parenting style, parental mental health, and parenting stress. This rela-

tively lower level of relational and emotional family risk distinguishes them from the broader family-related challenges observed in the multi-problem group, and deviates from the more complex familial patterns typically associated with high-level chronic offenders. This suggests that additional factors such as anxiety may be necessary to further distinguish between low- and high-level chronic offenders.

In conclusion, while our findings support key aspects of developmental criminological theories, they also reveal complexities, such as the critical role of risk factor combinations and the broader heterogeneity of offending trajectories, which warrant further exploration. Our findings demonstrate that specific risk profiles can predict distinct offending trajectories, emphasizing the need for criminology to develop a more nuanced theory that captures how unique combinations of risk factors contribute to additional variation in offending patterns. Such a theory would enhance our understanding of how distinct constellations of risk uniquely shape developmental trajectories in offending behavior.

Finally, it is important to emphasize that the trajectory groups and risk profiles derived in this study should not be interpreted as real or discrete groups. Rather, both are best understood as analytical constructs that summarize complex patterns in the data (Skardhamar, 2010). Group-based modeling is exploratory by nature and tends to produce distinct groups in most datasets (Morizot, 2019). In addition, these techniques may fail to capture outlier patterns (Liu & Bushway, 2019) and can therefore oversimplify variation in offending behavior and constellations of risk factors. Nonetheless, as Nagin and Tremblay (2005) argue, distinguishing meaningful differences in developmental patterns—and their associated risk constellations—can be valuable for advancing our understanding of (the etiology of) delinquent development across age.

Limitations and Future Directions

While this study advances our understanding of the relationship between risk exposure and offending trajectories, several limitations warrant consideration. First, the risk indicators were measured during childhood and early adolescence, limiting our ability to capture changes in exposure over time. This restricts insight into dynamic processes such as emerging protective factors or escalating risks during adolescence. Second, peer delinquency showed low internal consistency ($\alpha = 0.52$), and most children did not report having friends with police contact. As we operationalized delinquent peers as "friends arrested by police," this likely underestimated peer-related risk, as many of these children may be the first in their peer networks to encounter the justice system. Third, the study focused on general offending frequency rather than offense types. Risk profiles may be differentially associated with specific forms of delinquency (e.g., violent vs. property offenses). For instance, the cognitive- and neighborhood-problem group may be more prone to serious or violent offenses, as prior research suggests that early socioeconomic disadvantage is associated with such behaviors (Beardslee et al., 2021).

Future research could address these limitations in several ways. Longitudinal designs incorporating repeated risk measurements—such as dynamic risk profiles or latent transition models—could capture changes over time. In addition, broader definitions or self-report measures of peer delinquency may offer more accurate insight into social influences among early-onset youth. Studies that differentiate offense types may provide greater insight into the unique contributions of specific risk constellations, though the low degree of offense specialization during adolescence (see for example Nieuwbeerta et al., 2011) should be taken into account when interpreting such distinctions. Expanding data on parental, school, and residential environments is also critical. Our findings suggest that neighborhood context, often overlooked in offender risk research, shapes risk profiles and, by extension, offending trajectories. Further research should track justice-involved youth into adulthood, as extended follow-up may reveal additional changes in modeled trajectory patterns (see for example Farrington et al., 2013). Additionally, studies using general offender samples could uncover a wider range of risk profiles and unique links to offending trajectories. Finally, exploring how risk profiles relate to other adverse adolescent outcomes could be highly informative, as risk profiles may also explain issues like substance abuse and young parenthood (e.g. Dembo et al., 2008; Moffitt, 1993; Moffitt et al., 2002)—even among youth who desist from offending in early adolescence (Jennings et al., 2016; Moffitt et al., 2002).

Conclusions and Implications

Despite limitations, this study offers valuable insights into how risk profiles relate to offending trajectories in children with police contact before age 12. Our findings highlight the potential of advancing trajectory-based research by adopting a holistic view of risk exposure. By describing risk profiles that reflect functioning across multiple life domains, we can better explain the diversity in offending patterns among justice-involved children.

The risk profiles uncovered in this study warrant further investigation, particularly to inform targeted prevention efforts aimed at reducing chronic or high-rate offending during adolescence. To translate findings into practice, differentiated intervention strategies are needed for the cognitive- and neighborhood-problem group and the multi-problem group. For children with cognitive deficits and neighborhood disadvantage, early access to educational support may be key to improving long-term outcomes. Community-level investments–such as after-school programming, youth mentoring, and neighborhood revitalization–could help mitigate environmental stressors and reduce exposure to criminogenic settings. In contrast, children in the multi-problem group may benefit most from multi-modal interventions addressing emotional regulation, family dysfunction, and peer dynamics. Although children in the low-problem group were least likely to persist in offending, continued monitoring may still be appropriate for those who remain justice-involved despite low overall risk. Tailoring prevention efforts to the dominant risk patterns in each profile may increase the likelihood of effectively reducing persistent offending.

Appendix 1

Table 4 Description of Profile Indicators

Risk Profile Indicator	Instrument[1]	C/P[2]	Items	Alpha[3]	Description or Sample Item (Response options)	Final Scale Risk Profile Indicator[4]	
Individual							
1 Prenatal Substance Exposure	-	P	3	-	Whether mother had used substances (cigarettes, alcohol, drugs) during pregnancy (0 = *no*, 1 = *yes*)	D	0 = *no substance use*, 1 = *substance use*
2 Pre/perinatal Complications	-	P	3	-	Whether mother had experienced complications during pregnancy (e.g., preeclampsia or anemia) and/or childbirth (e.g., prematurity or forceps use) (0 = *no*, 1 = *yes*)	D	0 = *no complications*, 1 = *complications*
3 Intelligence	WISC-III	C	-	-	Test score on vocabulary (i.e. verbal intelligence) and block design (i.e. performal intelligence)	N	0 = *upper extreme* (IQ ≥ 130), 6 = *lower extreme* (IQ ≤ 69)
4 Emotional Problems	SDQ	C+P	5	.64	Often unhappy, down-hearted or tearful (0 = *not true*, 2 = *certainly true*)	N	0 = *close to average*, 3 = *very high*
5 Depression	KdvK	C	9	.79	I've been feeling down lately (0 = *not true*, 2 = *certainly true*)	N	0 = *not depressed*, 2 = *clinical depression*
6 Hyperactivity / Inattention	SDQ	C+P	5	.65	Restless, overactive, cannot stay still for long (0 = *not true*, 2 = *certainly true*)	N	0 = *close to average*, 3 = *very high*
7 Substance Use	OAB	C+P	5	-	Whether the child had ever used substances (i.e. alcohol, tobacco, and drugs) (0 = *no*, 1 = *yes*)	M	0 = *0 types of substances*, 3 = *3 types of substances*

Table 4 (continued)

Risk Profile Indicator	Instrument[1]	C/P[2]	Items	Alpha[3]	Description or Sample Item (Response options)	Final Scale Risk Profile Indicator[4]	
8 Sensation Seeking	SAHA	C	7	.71	I like trying new things, even when they are not allowed (0 = *strongly disagree*, 4 = *strongly agree*)	M	0 = *strongly disagree*, 4 = *strongly agree*
9 Social Understanding Difficulties[5]	CSBQ	P	49	.94	Over-reacts to everything and everyone; Takes in information with difficulty (0 = *does not apply at all*, 3 = *applies very well*)	N	0 = *very low*, 6 = *very high*
Familial							
10 Parental Neglect	SAHA	C	8	.50	My parents [do not] want to know who I am meeting up with (0 = *never*, 3 = *often*)	M	0 = *never*, 3 = *often*
11 Inconsistent Parenting	SAHA	C	5	.43	My parents forget a rule that they've made themselves (0 = *never*, 3 = *often*)	M	0 = *never*, 3 = *often*
12 Parental Indifference	SAHA	C	6	.65	My parents [do not] hug me (0 = *never*, 3 = *often*)	M	0 = *never*, 3 = *often*
13 Uninvolved Parenting	SAHA	C	6	.60	My parents [do not] spend time with me (0 = *never*, 3 = *often*)	M	0 = *never*, 3 = *often*
14 Familial Criminality	SAHA	P	1	-	Whether a family member had ever been in contact with the criminal justice system (0 = *no*, 1 = *yes*)	D	0 = *no*, 1 = *yes*
15 Parental Mental Health Problems	SCL-90	P*	90	.97	Headaches; Feelings of guilt; Being scared (0 = *not at all*, 4 = *very much*)	N	0 = *very low*, 6 = *very high*
16 Parenting Stress	NOSIK	P*	17	.95	My child demands more attention from me than I can give (0 = *strongly disagree*, 3 = *strongly agree*)	N	0 = *very low*, 6 = *very high*
Peers							

Table 4 (continued)

Risk Profile Indicator	Instrument[1]	C/P[2]	Items	Alpha[3]	Description or Sample Item (Response options)	Final Scale Risk Profile Indicator[4]
17 Bullying Victimization	SAHA	C	9	.82	How often have children from school called you names (0 = *never*, 3 = *often*)	M 0 = *never*, 3 = *often*
18 Delinquent Friends	SAHA	C	6	.52	How many of your friends have been arrested by the police (0 = *none*, 3 = *most or all*)	M 0 = *none*, 3 = *most or all*
School						
19 Poor School Achievement	OMRT	C	-	-	Whether test scores on one-minute reading test indicated insufficient reading abilities	N 0 = *no*, 1 = *yes*
Neighborhood						
20 Socio-economic Status	-	SCP	-	-	Neighborhood mean income, unemployment, and education levels (0 = *very high*, 4 = *very low*)	M 0 = *very high* , 4 = *very low*
21 Urbanization	-	ST	-	-	Number of households per km² (0 = *very low: less than 500 households per km²*, 4 = *very high: 2.500 or home households per km²*)	M 0 = *very low*, 4 = *very high*

[1]Instrument: WISC-III = Wechsler Intelligence Scale for Children-Revised – version III; SDQ = Strengths and Difficulties Questionnaire; KdvK = Short Form Depression Questionnaire for Children; OAB = Observed Antisocial Behavior Questionnaire; SAHA = Social and Health Assessment; CSBQ = Children's Behavior Questionnaire; SCL-90 = Symptom Checklist; NOSIK = Nijmeegse Ouderlijke Stress Index; OMRT = One-Minute Reading Test

[2]Informant: C = Child; P = Parent; SCP = Social and Cultural Planning Office of the Netherlands 2002; ST = Statistics Netherlands, 2006. C+P indicates that the final score was determined by the informant reporting the most problems. P* indicates that the final score was determined by the parent reporting the most problems

[3]Some of the profile indicators display low internal reliability (e.g. parental neglect and inconsistent parenting) as they are aimed at screening the entire concept with only a limited number of items. Previous studies using the SAHA to measure perceptions of parental behavior have reported similar reliability coefficients (e.g., Berry et al., 2021)

[4]Scale: D = dichotomous; N = norm scores; M = mean scores

[5]The CSBO consists of six subscales. Sample items are subtracted from subscales with the highest correlationwith the total score in the current sample

Appendix 2

Table 5 Descriptive Statistics of Profile Indicators

Risk Profile Indicator[1]	N	Range	Mean / Proportion	SD[2]	Norms (valid %)[3]						
					0	1	2	3	4	5	6
1 Prenatal Substance Exposure (D)	341	0-100%	36.1%								
2 Pre/perinatal Complications (D)	337	0-100%	32.6%								
3 Low Intelligence (N)	319	0-6	3.96	1.19	0	1.3	5.3	34.8	27.6	16.9	14.1
4 Emotional Problems (N)	342	0-3	0.74	1.06	61.1	14.9	12.9	11.1			
5 Depression (N)	203	0-2	0.34	0.67	76.8	12.3	10.8				
6 Hyperactivity/Inattention (N)	342	0-3	0.91	1.16	54.1	19.0	9.1	17.8			
7 Substance Use (M)	347	0-3	0.27	0.56	77.8	17.6	4.0	0.6			
8 Sensation Seeking (M)	285	0-4	1.59	0.82							
9 Social Understanding Difficulties (N)	309	0-6	1.40	1.62	38.2	27.5	13.3	8.4	3.6	7.4	1.6
10 Parental Neglect (M)	285	0-3	0.58	0.41							
11 Inconsistent Parenting (M)	286	0-3	1.26	0.57							
12 Parental Indifference (M)	286	0-3	0.32	0.34							
13 Uninvolved Parenting (M)	286	0-3	0.95	0.54							
14 Familial Criminality (D)	340	0-100%	36.8%								
15 Parental Mental Health Problems (N)	267	0-6	2.50	2.02	25.1	12.7	14.2	12.4	13.9	13.9	7.9
16 Parenting Stress (N)	301	0-6	3.05	1.90	12.6	12.0	12.6	22.9	13.6	13.0	13.3
17 Bullying victimization (M)	286	0-3	0.77	0.60							
18 Delinquent Friends (M)	283	0-3	0.38	0.34							
19 Poor School Achievement (N)	317	0-100%	43.9%								
20 Socio-economic status (M)	348	0-4	2.64	1.27	5.7	12.9	31.6	11.2	38.5		
21 Urbanization (M)	331	0-4	3.07	1.18	4.5	9.1	11.5	25.1	49.8		

Note. Valid percentage exclude missing data, and represent the share of the sample that was exposed to that specific risk factor. SD = Standard Deviations

[1] Risk Profile Indicator: D = dichotomous; N = norm scores; M = mean scores

[2] SD is not reported for dichotomous variables

[3] Norms: *Intelligence*, *Social understanding difficulties*, *Parental mental health problems*, *Parenting stress*: 0 = very low, 1 = low, 2 = below average, 3 = average, 4 = above average, 5 = high, 6 = very high; *Emotional problems*, *Hyperactivity/Inattention*: 0 = close to average, 1 = slightly raised, 2 = high, 3 = very high; *Depression*: 0 = not depressed, 1 = at risk of depression, 2 = clinical depression; *Substance use*: 0 = 0 substance types, 1 = 1 substance type, 2 = 2 substance types, 3 = 3 substance types; *Socio-economic status*: 0 = very high, 1 = high, 2 = average, 3 = low, 4 = very low; *Urbanization*: 0 = very low, 1 = high, 2 = average, 3 = high, 4 = very high

Appendix 3

Table 6 Fit Statistics of Risk Profiles and Offending Trajectories

#TRAJ[1]	BIC	2(ΔBIC)2	AIC				Lowest AvePP[3]	OCC[4]	Trajectory subgroup membership	
									n	%
1	-1741.20		-1733.59				1	-	155	100
2	-1547.66	387.08	-1530.92				.96	22; 54	111; 44	71.61; 28.39
3	-1534.44	26.44	-1508.57				.83	8; 13; 54	70; 43; 42	45.16; 27.74; 27.10
4	**-1519.82**	**29.24**	**-1484.83**				**.83**	**9; 11; 40; 73**	**62; 47; 27; 19**	**40.00; 30.32; 17.42; 12.26**
5	-1513.52	12.6	-1469.39				.79	6; 60; 21; 86; 565	82; 23; 23; 18; 9	52.90; 14.84; 14.84; 11.61; 5.81
#RP[5]	BIC	2(ΔBIC)	AIC	LMR (*p*value)[6]	BLRT (*p* value)[6]	Ent	Lowest AvePP[3]		Risk profile membership	
									n	%
1	14650.65		14504.26	-	-	-	1		348	100
2	14261.55	38.91	14030.41	<.01	<.001	.89	.92		269; 79	77.30; 22.70
3	**14197.71**	**6.384**	**13881.83**	**.01**	**<.001**	**.83**	**.92**		**168; 106; 74**	**48.28; 30.46; 21.26**
4	14147.13	5.058	13746.50	.45	<.001	.88	.87		203; 62; 42; 41	58.33; 17.82; 12.07; 11.78
5	13599.50	54.76	13114.12	.20	<.001	.90	.92		136; 87; 61; 48; 16	39.08; 25.00; 17.53; 13.79; 4.60

Note. Bold text represents model fit indices for final group-model. We used a set of 600 random starting values to estimate each of the risk profile models. #TRAJ = number of offending trajectories in estimated model; BIC = Bayesian Information Criterion; AIC = Akaike Information Criterion; #RP = number of risk profiles in estimated model; LMR = Lo-Mendell-Rubin Test; BLRT = bootstrap likelihood ratio test; Ent = Entropy

[1]*N* = 155: participants with a police registration during follow-up

[2]ΔBIC indicates the relative change in BIC values

[3] AvePP = Average posterior probability of group classification for most likely group membership. Average posterior probabilities above .70 indicate satisfactory assignment accuracy (Nagin, 2010)

[4]OCC > 5.0 indicates high assignment accuracy (Nagin, 2005)

[5]*N* = 348

[6]Significant LMR and BLRT tests indicate that the model with an additional subgroup (the *k*-group model) constitutes an important improvement over the *k* – 1 group model (Lo et al., 2001; Nylund et al., 2007; Vuong, 1989)

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