



# Trajectories of Psychopathic Traits, Anxiety, and Violence Exposure Differentially Predict Antisociality in Legal System-Involved Youth

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Accepted: 19 October 2022

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## Abstract

Psychopathic traits are associated with several forms of antisociality, including criminal offending, legal system involvement, and substance use. Some research suggests that primary (high psychopathic traits, low negative emotions) versus secondary (high psychopathic traits, high negative emotions and/or negative experiences and environments) variants confer different levels of risk for antisociality. However, research has not examined trajectories of co-occurring fluctuations in psychopathic traits, negative emotions, and negative experiences and environments or how trajectory membership relates to antisociality. We implemented group-based multi-trajectory modeling in a sample of 809 justice-involved male ( $n = 681$ ) and female ( $n = 128$ ) youth from the Pathways to Desistance Study to address these gaps. We identified four trajectories of co-occurring change in psychopathic traits, anxiety, and violence exposure spanning three years: Low (low levels of each factor); Moderate Psychopathic Traits, High Negative Emotions and Experiences (moderate-decreasing psychopathic traits and high-decreasing anxiety/violence exposure); Potential Primary Psychopathic Traits (elevated-decreasing psychopathic traits, moderate-decreasing anxiety, moderate-stable violence exposure); and High/Secondary Psychopathic Traits (high-stable psychopathic traits, elevated-stable anxiety, high-decreasing violence exposure). Compared to the Low trajectory, all trajectories predicted greater violent crime and substance use three and four years later. Additionally, compared to the Low trajectory, the Potential Primary Psychopathic Traits trajectory predicted more nonviolent offending three years later. Finally, the High/Secondary Psychopathic Traits trajectory showed the most persistent antisociality, predicting more nonviolent crime, higher substance dependence symptoms, and higher likelihood of arrest three and four years later. Youth with co-occurring high psychopathic traits, anxiety, and violence exposure appear most at risk for severe antisociality.

**Keywords** Psychopathic trait variants · Anxiety · Violence exposure · Developmental trajectories · Antisociality

Psychopathy is a syndrome characterized by interpersonal (e.g., manipulative, superficial), affective (e.g., callousness, deficient remorse), impulsive (e.g., irresponsibility, thrill seeking), and antisocial (e.g., law breaking, conduct disorder) personality traits. Psychopathic traits relate to dangerous antisocial outcomes including violence, arrests, and substance use (Geerlings et al., 2020; Skeem et al., 2011). Given the robust association between psychopathic traits and

antisociality, a growing number of studies seek to determine the developmental course of these traits (De Brito et al., 2021).

Clinical and empirical observations of psychopathic traits suggest that there are distinct primary and secondary variants that exhibit similar levels of psychopathic traits but differ in their etiology and presentation (Karpman, 1941; Lykken, 1995; Porter, 1996; Skeem et al., 2011). The primary psychopathic variant is believed to be the result of a biological predisposition to reduced empathy, low emotional arousal, and aberrations in self-regulation. Individuals with the primary psychopathic variant typically present as cold and unemotional (i.e., low in negative emotions). In contrast, the secondary psychopathic variant is presumed to be an adaptation to negative experiences and environments, wherein youth become less emotionally responsive as a way of coping with repeated exposure to those experiences

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and environments (Bennett & Kerig, 2014; Kerig et al., 2012; Porter, 1996). Individuals with the secondary psychopathic variant present with many of the same interpersonal, affective, and behavioral characteristics associated with primary psychopathic traits, but also display high levels of negative emotions (Waller & Hicks, 2019) and report more extensive trauma and abuse histories (Kimonis et al., 2011) and violence exposure than those with the primary psychopathic variant (Docherty et al., 2016).

There is some debate about the best ways to subdivide primary and secondary variants. Many studies differentiate the variants in adolescents using measures of anxiety and create groups through clustering methods, mean/median/tertile splits, or moderated regressions (Craig et al., 2021). Alternatively, given that differential exposure to negative experiences and environments is central to the primary/secondary psychopathic trait theory (Karpman, 1941), a handful of studies distinguish primary and secondary variants based on trauma exposure and negative characteristics of the developmental context (Craig et al., 2021). Recently, proposals have been made that combining indicators of negative emotionality and exposure to negative experiences and environments would better align with the original conceptualization of primary and secondary variants (Craig et al., 2021).

Regardless of the approach used to subdivide the primary and secondary variants, each variant confers risk for antisocial behavior. Individuals with primary and secondary psychopathic traits exhibit higher levels of antisocial behavior compared to their counterparts with low psychopathic traits. However, when comparing the variants to each other, evidence is mixed as to whether the primary or secondary variants are differently or similarly related to levels of antisocial behavior. There is evidence that individuals with primary psychopathic traits exhibit greater antisociality than those with secondary psychopathic traits (Drislane et al., 2014; Swogger & Kosson, 2007). For example, Pechorro et al. (2021) found that youth with traits akin to the primary variant exhibited more problematic patterns of criminal behavior and substance use than those with traits similar to the secondary variant. In contrast, other studies show that those with secondary psychopathic traits exhibit even more problematic patterns of nonviolent antisocial behavior, violence, and substance use compared to youth with primary psychopathic traits (Docherty et al., 2016; Goulter et al., 2021; Kahn et al., 2013; Kimonis et al., 2011; Mozley et al., 2018; Poythress et al., 2010). Finally, some work suggests that youth with primary and secondary psychopathic traits do not differ in their involvement in non-violent and violent offending or levels of substance use (Goulter et al., 2021; Waller & Hicks, 2019). Given these discrepancies, more research is needed to delineate the ways that psychopathic traits, negative emotions, and negative experiences

and environments relate to each other and predict future involvement in antisociality.

## Change and Heterogeneity in Psychopathic Traits, Negative Emotions, and Negative Experiences and Environments

Psychopathic traits initially were believed to be an immutable personality syndrome. However, more recently, studies employing person-centered analytic approaches, which identify groups of individuals who exhibit similar levels and patterns of change on a set of items or variables, indicate there is significant heterogeneity in the developmental course of psychopathic traits (Baskin-Sommers et al., 2015; Fontaine et al., 2010; Hawes et al., 2018; Lee & Kim, 2021). Further, there is evidence that the developmental trajectory of psychopathic traits is predictive of the type and severity of engagement in antisociality. For example, Salihovic et al. (2014) identified four groups of youth distinguished by their trajectory of psychopathic traits. Youth whose traits were highest at baseline and only declined slightly over time engaged in more delinquent behavior compared to those with low and moderate psychopathic traits that decreased over time. Thus, psychopathic traits generally are predictive of antisocial outcomes, but high and stable levels of these traits appear to confer the greatest risk for antisociality.

Few studies have examined co-occurring trajectories of psychopathic traits and factors associated with primary and secondary variants. Most studies rely on cross-sectional data (Kimonis et al., 2011) or single assessments (Docherty et al., 2016; Waller & Hicks, 2019) to classify youth into primary and secondary variants. This approach disregards evidence that indicators of primary/secondary psychopathic traits (i.e., anxiety, violence exposure) exhibit significant variability over time (Baskin & Sommers, 2014; Goulter et al., 2017; Lee & Kim, 2021). In the sole study examining trajectories of primary/secondary variants in adolescents, researchers identified stable primary and secondary variants using longitudinal data on callous-unemotional traits (i.e., the affective dimension of psychopathic traits) and anxiety in a sample of female youth by estimating separate trajectories of each factor (callous-unemotional traits and anxiety) and combining classes of interest (Goulter et al., 2017). The primary and secondary groups exhibited similar levels of callous-unemotional traits but differed in their levels of anxiety. Female youth in the secondary group also exhibited significantly higher levels of conduct disorder symptoms than those in the primary group, but there were no differences in their levels of aggression and substance use. However, there have been no studies that measure the simultaneous fluctuations in psychopathic traits, anxiety, and violence

exposure over time. Examining co-occurring trajectories would provide stronger evidence that factors theoretically integral to the designation of primary/secondary variants empirically align.

## Current Study

The current study used data from the Pathways to Desistance Study, a longitudinal study of youth officially arrested for serious crimes in Phoenix, AZ and Philadelphia, PA. A legal system involved sample is particularly conducive to studying the relation between psychopathic trait variants and antisociality, as many studies have shown that youth involved in the legal system are among the most likely to exhibit elevated levels of and variability in psychopathic traits and violence exposure (Vaughn & Howard, 2005). Data from the Pathways to Desistance Study has shown that psychopathic traits and violence exposure jointly predict greater involvement in antisocial behaviors during concurrent (Tsang, 2018) and future timepoints (Lee & Kim, 2022) and that primary and secondary variants (identified using only baseline levels of psychopathic traits and anxiety) exhibit similar patterns of substance use and dependency (Waller & Hicks, 2019). However, there has been no application of group-based multi-trajectory modeling to identify trajectories of simultaneous fluctuations in psychopathic traits, anxiety, and violence exposure.<sup>1</sup>

First, we used a person-centered approach to identify unique subgroups of youth based on co-occurring patterns of change in three factors implicated in the conceptualization of primary and secondary psychopathic variants: psychopathic traits, anxiety (i.e., negative emotionality), and violence exposure (i.e., negative experiences). While group-based multi-trajectory modeling is exploratory in nature (e.g., characteristics of the trajectories are not specified a priori), the selection of these specific factors was informed by prior theoretical work proposing how primary and secondary variants may be differentiated (Karpman, 1941; Porter, 1996). Methodologically, this study improves upon prior work examining the pattern of change in each individual factor or the co-occurrence of these factors during a single point in time—by examining psychopathic traits, anxiety, and violence exposure in unison and over an extended period, our results may accurately depict the interrelated and evolving nature of the factors relevant to primary and secondary variants. Second, we examined whether sociodemographic and broader environmental factors predicted trajectory

membership to understand who is most likely to end up in a particular trajectory. Finally, we tested whether trajectory membership differentially predicted engagement in three domains of antisociality (offending, legal system involvement, and substance misuse) three and four years following trajectory estimation to understand how the trajectories relate to antisocial outcomes in young adulthood. Given the discrepant findings regarding variant similarities and dissimilarities in antisocial behavior, these analyses are exploratory in nature. However, multiple antisocial outcomes theoretically and empirically linked to the primary and secondary variants of psychopathic traits were intentionally examined to allow for the detection of consistent and meaningful differences across variants. By examining how psychopathic traits, anxiety, and violence exposure vary together across adolescence, we are poised to better understand the various presentations of psychopathic traits and how they confer risk for antisociality.

## Method

A full description of the Pathways to Desistance study methods can be found in Mulvey et al. (2004). Briefly, participants completed a 4-h baseline assessment during which they provided information on a wide range of individual and social background factors. Youth under the age of 18 at the time of enrollment provided informed assent, and parental consent was obtained. Youth over the age of 18 provided informed consent. Six follow-up assessments were conducted every six months for the three years following the baseline interview; after three years, participants were reinterviewed annually for four years.

Participants were included in the study if they completed baseline and at least four of six 6-month follow-up assessments of psychopathic traits, anxiety, and violence exposure ( $n = 809$ ). Participants were required to have completed the baseline assessment to facilitate comparison of trajectory model solutions with and without covariates (Supplemental Method Sect. 8). Participants were required to have completed four of the six 6-month follow-up assessments so that multiple trajectory shapes (i.e., patterns of change over time) could be examined (Supplemental Method Sect. 7). The six 6-month follow-up assessments were chosen for trajectory analyses for three reasons. First, we wanted all assessments used in trajectory analyses to be sufficiently distant from the assessments used in outcome analyses to preserve temporal ordering. Second, uniformity in time between assessments influences the number of trajectories discovered and their interpretation (Van de Schoot et al., 2017), so we used all follow-up assessments that were approximately equally spaced and sufficiently distant from the outcome assessment

<sup>1</sup> We confirm that no other studies to date have performed the same analyses using the Pathways to Desistance dataset.

timepoints. Third, even amounts of time between assessments were desirable so that there were equal opportunities for violence exposure across assessment periods.

To examine how sociodemographic and broader environmental factors predicted trajectory membership, we used antecedents assessed at the baseline interview (i.e., prior to assessments used in trajectory estimation). To examine how trajectory membership predicted antisocial behavior at multiple future timepoints, we used outcomes assessed both three and four years following the final timepoint that was included in trajectory analyses (i.e., third and fourth annual follow-up visits, six and seven years after the baseline assessment). See Table 1 for sample characteristics and descriptive statistics. Cronbach's alphas for all measures and information on measure validity and reliability can be accessed at <https://www.pathwaysstudy.pitt.edu/codebook/measures.html>.

## Measures

### Trajectories

**Psychopathic Traits** The Youth Psychopathic Traits Inventory (YPI; Andershed et al., 2002) is a 50-item self-report measure. Items were rated on a four-point Likert scale ranging from 1 (Does not apply at all) to 4 (Applies very well). Higher scores indicated higher levels of psychopathic traits. There are no established norms or cutoff scores for the YPI. However, prior work has reported significant differences in total YPI scores between youth in non-clinical community (male:  $M = 98.2$ ,  $SD = 19.0$ ; female:  $M = 86.2$ ,  $SD = 17.8$ ) and institutionalized samples (male:  $M = 112.9$ ,  $SD = 22.3$ ; female:  $M = 107.1$ ,  $SD = 25.5$ ; Pihet et al., 2014).

**Anxiety** The Anxiety subscale of the Brief Symptom Inventory (BSI; Derogatis & Melisaratos, 1983) documented the extent to which participants were bothered by symptoms of anxiety in the past week. The Anxiety subscale consisted of six items that participants responded to using a 0 (Not at all) to 4 (Extremely) Likert-type scale, where higher scores indicated greater anxiety symptoms. Derogatis and Melisaratos (1983) established norms for the following groups: psychiatric outpatients ( $M = 1.70$ ,  $SD = 1.0$ ); psychiatric in-patients ( $M = 1.70$ ,  $SD = 1.5$ ); non-patients ( $M = 0.35$ ,  $SD = 0.45$ ); and adolescents ( $M = 0.78$ ,  $SD = 0.68$ ). Average scores for young adult males ( $M = 0.89$ ,  $SD = 0.69$ ) and females ( $M = 0.81$ ,  $SD = 0.54$ ) were reported in a follow up study (Cochran & Daniel Hale, 1985).

**Violence Exposure** A modified version of the Exposure to Violence Inventory (ETV; Selner-O'Hagan et al., 1998) assessed the frequency of exposure to violent events. Participants responded to each item based on a dichotomous choice (yes/no), and a total score was calculated using the

**Table 1** Sample Characteristic and Descriptive Statistics for Key Study Variables

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	Min	Max
<b>Demographics</b>					
Age (Baseline)	809	16.01	1.14	14.00	18.00
Racial Group—White	182				
Racial Group—Black	327				
Racial Group—Hispanic	258				
Racial Group—Other	42				
Biological Sex—Male	681				
Biological Sex—Female	128				
Socioeconomic Status <sup>a</sup>	804	50.96	12.39	11.00	77.00
Neighborhood Conditions	807	2.37	0.71	1.00	4.00
<b>Trajectory Analyses</b>					
Psychopathic Traits					
Baseline <sup>b</sup>	809	16.56	7.38	1.00	37.00
Timepoint 1	681	110.43	21.48	42.00	169.00
Timepoint 2	793	108.80	21.80	58.00	190.00
Timepoint 3	785	107.42	22.12	59.00	194.00
Timepoint 4	788	108.59	21.76	57.00	197.00
Timepoint 5	788	105.43	22.35	21.00	182.00
Timepoint 6	781	105.46	22.18	59.00	183.00
Anxiety					
Baseline	809	0.51	0.66	0.00	3.83
Timepoint 1	749	0.41	0.56	0.00	3.50
Timepoint 2	740	0.40	0.57	0.00	3.50
Timepoint 3	715	0.35	0.51	0.00	3.50
Timepoint 4	697	0.37	0.54	0.00	4.00
Timepoint 5	684	0.35	0.54	0.00	4.00
Timepoint 6	678	0.34	0.53	0.00	3.00
Violence Exposure					
Baseline <sup>c</sup>	809	5.50	2.91	0.00	13.00
Timepoint 1	788	1.63	2.00	0.00	10.00
Timepoint 2	793	1.47	1.86	0.00	11.00
Timepoint 3	786	1.34	1.87	0.00	11.00
Timepoint 4	791	1.14	1.76	0.00	10.00
Timepoint 5	790	1.12	1.63	0.00	10.00
Timepoint 6	782	0.95	1.55	0.00	10.00
<b>Outcomes Three Years after Trajectories</b>					
Nonviolent Crime Frequency	728	49.18	209.23	0.00	3125.00
Violent Crime Frequency	730	17.17	70.73	0.00	998.00
Arrested- Yes	189				
Arrested- No	544				
Number of Arrests	733	0.37	0.89	0.00	15.00
Substance Use	730	0.68	1.03	0.00	8.00
Substance Dependence	733	0.68	1.78	0.00	10.00
<b>Outcomes Four Years after Trajectories</b>					
Nonviolent Crime Frequency	704	38.47	144.40	0.00	1992.00
Violent Crime Frequency	707	10.86	50.46	0.00	425.00
Arrested—Yes	157				



**Table 1** (continued)

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	Min	Max
Arrested—No	551				
Number of Arrests	708	0.38	0.85	0.00	15.00
Substance Use	706	0.66	1.14	0.00	9.00
Substance Dependence	708	0.68	1.82	0.00	10.00

Minimum and maximum values refer to observed scores. <sup>a</sup> Socioeconomic status was assessed using the Index of Social Position (Hollingshead, 1957), where higher values indicate lower socioeconomic status. <sup>b</sup> Baseline psychopathic traits assessed using the Psychopathic Checklist: Youth Version (PCL-YV; Forth et al., 2003) because the Youth Psychopathic Traits Inventory was not administered at baseline. Higher scores on the PCL-YV indicated higher levels of psychopathic traits. <sup>c</sup> Baseline violence exposure scores reflect participants' lifetime violence exposure prior to inclusion in the study. Cronbach's alpha coefficients for all measures can be found at <https://www.pathwaysstudy.pitt.edu/codebook/measures.html>

sum of all items. Higher scores indicated higher violence exposure.

**Trajectory Analysis Covariates** Baseline scores for psychopathic traits,<sup>2</sup> anxiety, violence exposure, and biological sex (male/female) were included as covariates in all trajectory analyses (Supplemental Method Sect. 8).

### Antecedents

**Age** Participants reported their current age at the time of the baseline interview.

**Socioeconomic Status** The Index of Social Position (Hollingshead, 1957) assessed parental socioeconomic status using information regarding the participant's biological parents' education level and occupational status at baseline. Scores were calculated from data for both parents, when available, or if only one parent was known, scores were calculated using that one parent's data. Higher scores indicated lower socioeconomic status.

**Neighborhood Conditions** An adapted version of the Neighborhood Conditions Measure was used to assess characteristics of the neighborhood in which the youth resided at baseline (Sampson & Raudenbush, 1999). Twenty-one items documented both physical (e.g., "cigarettes on the street or in the gutters") and social (e.g., "adults fighting or arguing loudly") neighborhood conditions. Items were rated on a four-point Likert scale ranging from 1 (Never) to 4 (Often). Higher scores represented worse neighborhood conditions.

<sup>2</sup> The Youth Psychopathic Traits Inventory was not administered at baseline, so baseline psychopathic traits were assessed using the Psychopathy Checklist: Youth Version (PCL-YV; Forth et al., 2003). Scores range from 0–40, with higher scores indicating higher levels of psychopathic traits.

### Outcomes

**Offending** The Self-Reported Offending (Huizinga et al., 1991) scale was used to measure 13 nonviolent (e.g., destroying property, selling drugs) and nine violent (e.g., shooting someone, being in a fight) crimes. Participants were asked if they had committed any of these crimes and, if yes, reported how many times they engaged in the crime during in the past year. Total frequency scores for offending were calculated based on how many times participants engaged in each crime. Higher scores indicated more offending.

**Legal System Involvement** Participants were asked if they were picked up and accused of something by police (i.e., arrested) in the past year using a dichotomous choice (yes/no). If yes, participants reported the number of times this occurred in the past year.

**Substance Misuse** The Substance Use/Abuse Inventory (Chassin et al., 1991) was used to measure participants' substance use and dependence. Data were collected when substance use disorders were classified into substance abuse and substance dependence using DSM-IV. The Substance Use subscale had participants report how many of 10 different types of illegal substances they used in the past year. Higher scores indicated more substances tried. The Substance Dependence subscale assessed past-year dependence symptoms for drug and/or alcohol use (e.g., "Have you had any problems or arguments with family or friends because of your alcohol or drug use?"). Higher scores indicated greater dependence on substances.

### Analytic Approach

#### Trajectories

Group-based multi-trajectory modeling was used to identify joint trajectories of psychopathic traits, anxiety, and violence exposure. Group-based multi-trajectory modeling is a form of latent class growth analysis that identifies subgroups of individuals who show similar patterns of change over time on multiple variables simultaneously (Nagin et al., 2018). This approach is an extension of the dual-trajectory approach, which estimates the association between two variables by measuring probability of a trajectory for the first variable given membership in a specific trajectory for the second variable. In contrast, the group-based multi-trajectory approach examines the association by defining trajectory groups based on patterns of change for multiple variables simultaneously (see Nagin et al. (2018) for more information on the formulas used to estimate trajectories).

Analyses were conducted using SAS software, version 9.4 using the PROC TRAJ procedure with MULTGROUPS option (Jones et al., 2001; Nagin et al., 2018). Models

simultaneously considered YPI, BSI, and ETV scores for the six 6-month follow-up assessments. We followed guidelines for reporting on latent trajectory modeling (Supplemental Method). Missing data in trajectory analyses was accounted for using a Full-Information-Maximum Likelihood Estimator (Supplemental Method Sect. 3c).

Following recommendations from Nagin et al. (2018), first we estimated trajectories for each indicator (i.e., YPI, BSI, and ETV scores) separately. Model solutions found in the individually estimated trajectories indicated that a 3- or 4-trajectory solution was likely to optimally characterize all three indicators (Supplemental Table 4). This information was used to inform optimal model selection in group-based multi-trajectory analyses using all three indicators. We evaluated 1- through 6-trajectory models (Supplemental Table 5), and model fits were compared using the Bayesian Information Criteria, where smaller values indicated a greater model fit; log likelihood, where smaller values indicated a greater model fit; average posterior probability, where values above 0.7 were considered adequate; odds of correct classification, where values above 5 were considered adequate; and the ratio of the probability of trajectory membership to the proportion of participants assigned to that trajectory, where values closer to 1 indicated a better fit (Nagin, 2005). Trajectory size (i.e., greater than 5%) and coherence of the trajectories (e.g., uniqueness, theoretical meaning) also were considered (Nagin et al., 2018).

### Antecedents

Three separate multinomial logistic regression analyses were used to determine if baseline age, socioeconomic status, and neighborhood conditions predicted trajectory membership. Analyses were conducted using the *nnet* package in R (Ripley et al., 2016). Casewise deletion was used to address missingness (see Table 1 for sample size by antecedent).

### Outcomes

Separate negative binomial regression analyses were used to determine if trajectory membership predicted nonviolent crime, violent crime, number of arrests, substance use, and substance dependence three and four years after the last assessment used in trajectory analyses (10 regression analyses total). Two separate binomial logistic regression analyses were used to determine if trajectory membership predicted the occurrence of an arrest three and four years after the last assessment used in trajectory analyses. Casewise deletion was used to address missingness (see Table 1 for sample size by outcome). For all regression analyses, the group with the lowest YPI, BSI, and ETV scores served as the reference group. Post-hoc simple contrasts were conducted to compare trajectories that significantly differed from the reference

group to each other. Regressions and contrasts were conducted using the *MASS* and *emmeans* packages in R (Lenth & Lenth, 2018; Ripley et al., 2013).

## Results

### Trajectories

A four-trajectory multivariate model solution optimally characterized the sample (Fig. 1, Supplemental Tables 4, 5, and 6).

**Trajectory 1- Low** The first trajectory displayed low-decreasing levels of psychopathic traits, low-stable levels of anxiety, and low-stable violence exposure (28.92% of the sample,  $n = 234$ ). Psychopathic traits were best fit using a linear model, reflecting linear change over time. Anxiety and violence exposure were best fit by an intercept model, reflecting stability over time.

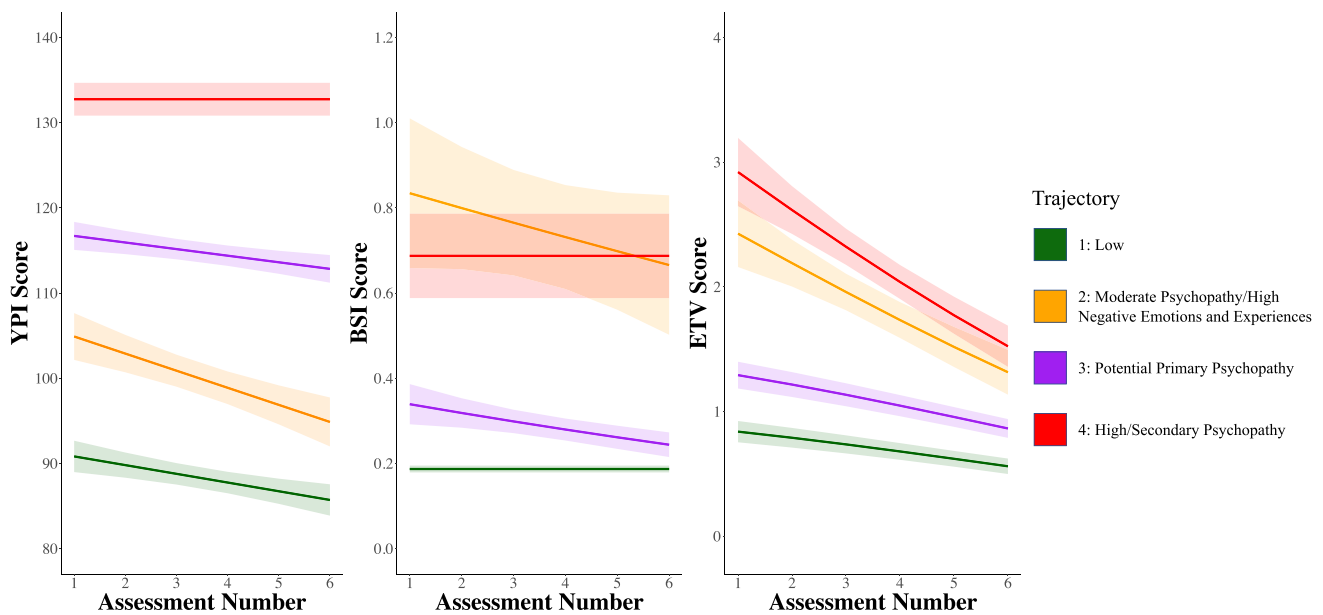
**Trajectory 2- Moderate Psychopathic Traits/High Negative Emotions and Experiences** The second trajectory was characterized by moderate-decreasing levels of psychopathic traits but high-decreasing levels of anxiety and violence exposure (13.72% of the sample,  $n = 111$ ). Psychopathic traits, anxiety, and violence exposure all were best fit using linear models, indicating linear change over time.

**Trajectory 3- Potential Primary Psychopathic Traits** The third trajectory (see Discussion for trajectory label justification) was marked by elevated-decreasing levels of psychopathic traits, moderate-decreasing levels of anxiety, and moderate-stable levels of violence exposure (44.00% of the sample,  $n = 356$ ). Psychopathic traits and anxiety were best fit using linear models, indicating linear change over time. Violence exposure was best fit by an intercept model, reflecting stability over time.

**Trajectory 4- High/Secondary Psychopathic Traits** The fourth trajectory reflected high-stable levels of psychopathic traits, elevated-stable levels of anxiety, and high-decreasing levels of violence exposure (13.35% of the sample,  $n = 108$ ). Psychopathic traits were best characterized by an intercept model, indicating stability over time. Anxiety and violence exposure were best fit using linear models, reflecting linear change over time.

### Antecedents

Poorer neighborhood conditions at baseline predicted likelihood of membership in trajectories 2 (Moderate Psychopathic



**Fig. 1** Group trajectory estimates for the optimal model solution

Traits/High Negative Emotions and Experiences) and 4 (High/Secondary Psychopathic Traits) compared to trajectory 1 (Low). Baseline age or socioeconomic status were not significantly related to trajectory membership (Supplemental Table 7).

## Outcomes

**Three Years after the Last Timepoint Used in Trajectories** On average, participants were 22 years old three years following trajectory estimation ( $M = 22.00$ ,  $SD = 1.14$ ). Membership in trajectories 3 (Potential Primary Psychopathic Traits) and 4 (High/Secondary Psychopathic Traits) predicted greater nonviolent crime three years later compared to trajectory 1 (Low). Membership in trajectories 2 (Moderate Psychopathic Traits/High Negative Emotions and Experiences), 3 (Potential Primary Psychopathic Traits), and 4 (High/Secondary Psychopathic Traits) predicted greater violent crime frequency, substance use, and substance dependence three years later compared to trajectory 1. However, post-hoc contrasts revealed that membership in trajectory 4 predicted more substance use three years later compared to trajectories 2 and 3. Membership in trajectory 4 (High/Secondary Psychopathic Traits) predicted greater likelihood of arrest and number of arrests three years later compared to trajectory 1 (Fig. 2; Table 2).

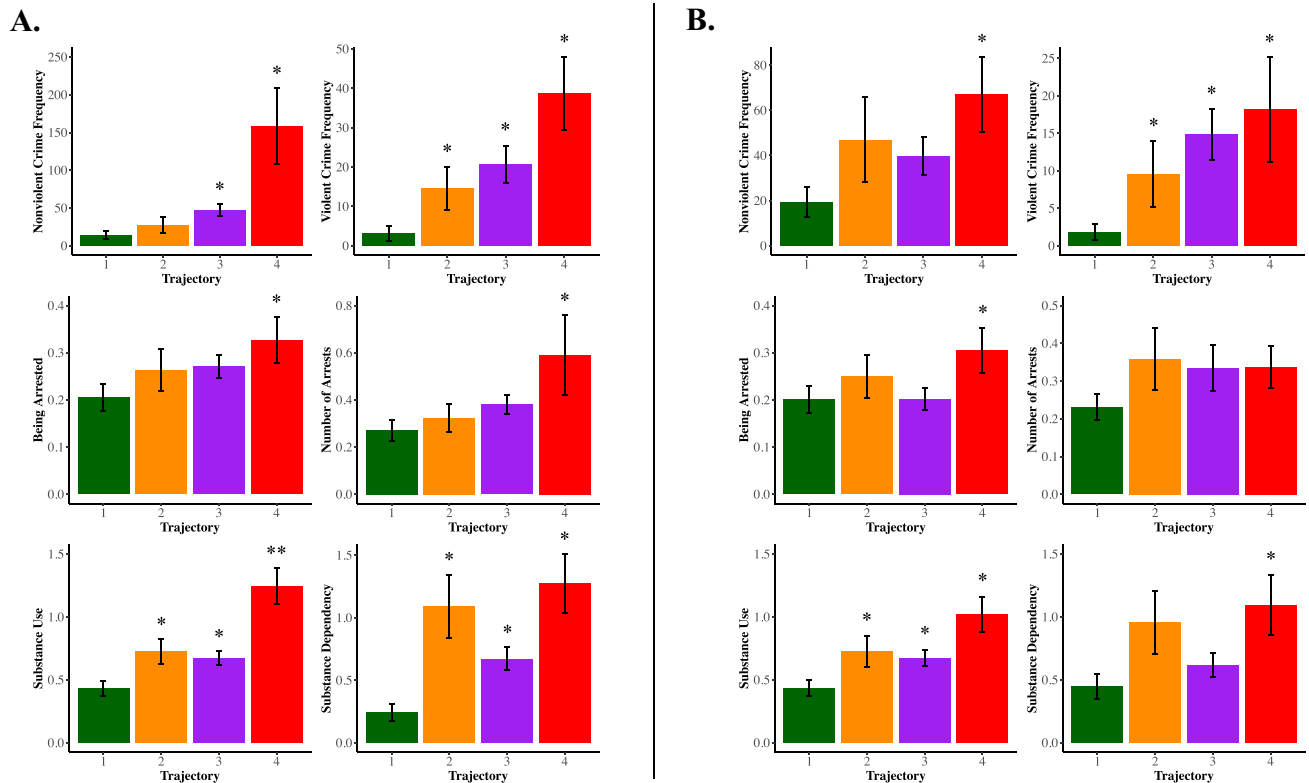
**Four Years after the Last Timepoint Used in Trajectories** On average, participants were 23 years old three years following trajectory estimation ( $M = 23.02$ ,  $SD = 1.15$ ). Membership in trajectory 4 (High/Secondary Psychopathic Traits) predicted

greater nonviolent crime, likelihood of arrest, and substance dependence four years later compared to trajectory 1 (Low). Membership in trajectories 2 (Moderate Psychopathic Traits/High Negative Emotions and Experiences), 3 (Potential Primary Psychopathic Traits), and 4 (High/Secondary Psychopathic Traits) predicted greater violent crime and substance use four years later compared to trajectory 1. No post-hoc contrasts were significant for any variable. There was no relationship between trajectory membership and number of arrests four years later (Fig. 2; Table 2).<sup>3</sup>

## Discussion

Youth who exhibit unique patterns of psychopathic traits, anxiety, and violence exposure over time may differ in their risk for the most serious expressions of antisociality, but empirical inquiry into how these factors co-occur over time and relate to antisociality has been limited. Using group-based multi trajectory modeling, we identified four groups of individuals based on their level and pattern of change

<sup>3</sup> Although individuals are still able to engage in antisocial behavior while they reside in settings that limit access to the community (e.g., prison), opportunities for antisocial behavior may be less frequent. Robustness analyses that considered the proportion of time youth spent with community access were conducted. All relationships between trajectory membership(s) and outcomes assessed three and four years after the final timepoint included in trajectory analyses remained significant, except for the relationship between membership in trajectory 4 (*High/Secondary Psychopathic Traits*) and likelihood of arrest, which dropped to a  $p$ -value of 0.051.



**Fig. 2** Average engagement in different types of antisocial behaviors by trajectory

in their psychopathic traits, anxiety, and violence exposure. We found that these trajectories differed in their antecedents (e.g., neighborhood conditions) and that there were some similarities and differences documented in the relationships among trajectory membership and offending, legal system involvement, and substance misuse.

**Group-Based Trajectories of Psychopathic Traits, Anxiety, and Violence Exposure**

There is a long history in research on psychopathic traits of examining primary and secondary variants. Anxiety often is used to distinguish the variants (Craig et al., 2021). Little work has implemented appropriate methods to identify whether these primary and secondary variants emerge using data on the phenotypic (i.e., negative emotions) and etiological (i.e., negative experiences and environments) differences between primary and secondary variants. Relying on anxiety as the primary distinguishing factor may in part explain why several studies were unable to identify primary/secondary variants (e.g., Colins, et al., 2018; Lee et al., 2010) or find consistent differences in antisociality (Craig et al., 2021).

In the present study, the group-based trajectory modeling approach classified one trajectory as being high on psychopathic

traits, anxiety, and violence exposure (High/Secondary Psychopathic Traits). This group appears consistent with the conceptualization of the secondary psychopathic traits (Craig et al., 2021; Karpman, 1941). Further supporting the classification of this group as a secondary variant, the High/Secondary Psychopathic Traits trajectory was predicted by poorer neighborhood conditions, suggesting that this trajectory partly is a product of negative experiences and environments.

Another trajectory exhibited elevated psychopathic traits and moderate negative emotions and experiences (Potential Primary Psychopathic Traits) also was identified. Using scores from prior work differentiating community and forensic samples as benchmarks (Pihet et al., 2014; Cochran & Daniel Hale, 1985; Derogatis & Melisarators, 1983), we concluded that this trajectory exhibited a combination of psychopathic traits and anxiety that was consistent with the conceptualization of primary psychopathic traits (i.e., high psychopathic traits, low anxiety). However, “potential” was included in the label given that this trajectory exhibited levels of psychopathic traits that were significantly lower than those exhibited by the High/Secondary Psychopathic Traits trajectory. This pattern is inconsistent with the original conceptualization of the primary and secondary variants, which were theorized to be “phenotypically (and diagnostically) indistinguishable in most respects” (Porter, 1996, p. 183). While several empirical studies since have reported variant differences in the level of



**Table 2** Regression coefficients for outcomes assessed three and four years after trajectory analysis

Variable	Trajectory	Three Year Follow-up				Four Year Follow-up					
		<i>B</i>	<i>SE</i>	<i>z</i> -value	<i>p</i> -value	Significant Comparisons	<i>B</i>	<i>SE</i>	<i>z</i> -value	<i>p</i> -value	Significant Comparisons
Nonviolent Crime Frequency	2: Moderate Psychopathic Traits/High Negative Emotions and Experiences	0.65	0.51	1.28	0.202		0.89	0.54	1.64	0.102	
	3: Potential Primary Psychopathic Traits	1.18	0.37	3.21	0.001		0.72	0.39	1.86	0.063	
Violent Crime Frequency	4: High/Secondary Psychopathic Traits	2.41	0.52	4.63	<0.001		1.24	0.54	2.31	0.021	
	2: Moderate Psychopathic Traits/High Negative Emotions and Experiences	1.55	0.46	3.39	<0.001		1.66	0.49	3.40	<0.001	
Being Arrested	3: Potential Primary Psychopathic Traits	1.90	0.33	5.73	<0.001		2.10	0.35	5.97	<0.001	
	4: High/Secondary Psychopathic Traits	2.52	0.46	5.45	<0.001		2.30	0.48	4.76	<0.001	
Number of Arrests	2: Moderate Psychopathic Traits/High Negative Emotions and Experiences	0.32	0.29	1.14	0.256		0.28	0.30	0.95	0.344	
	3: Potential Primary Psychopathic Traits	0.36	0.21	1.73	0.084		0.01	0.22	0.03	0.980	
Substance Use	4: High/Secondary Psychopathic Traits	0.63	0.28	2.28	0.023		0.56	0.28	1.97	0.049	
	2: Moderate Psychopathic Traits/High Negative Emotions and Experiences	0.17	0.27	0.66	0.510		0.44	0.28	1.56	0.118	
Substance Dependence	3: Potential Primary Psychopathic Traits	0.78	0.19	1.75	0.080		0.37	0.21	1.75	0.080	
	4: High/Secondary Psychopathic Traits	0.78	0.24	3.23	0.001		0.38	0.28	1.34	0.180	
	2: Moderate Psychopathic Traits/High Negative Emotions and Experiences	0.51	0.16	3.25	0.001	2 vs. 4 3 vs. 4	0.51	0.21	2.45	0.014	
	3: Potential Primary Psychopathic Traits	0.44	0.12	3.54	<0.001		0.43	0.16	2.75	0.006	
	4: High/Secondary Psychopathic Traits	1.06	0.14	7.55	<0.001		0.85	0.20	4.33	<0.001	
	2: Moderate Psychopathic Traits/High Negative Emotions and Experiences	1.50	0.38	3.91	<0.001		0.76	0.40	1.91	0.056	
	3: Potential Primary Psychopathic Traits	1.02	0.29	3.46	<0.001		0.33	0.29	1.12	0.265	
	4: High/Secondary Psychopathic Traits	1.66	0.39	4.28	<0.001		0.90	0.39	2.29	0.022	

Italics denote that trajectory membership significantly predicted the outcome of interest compared to trajectory 1 either three or four years following the final timepoint included in trajectory analyses. All regression coefficients represent the estimate for the group compared to the reference group (Low). *Z*-value refers to the regression estimate (*B*). Trajectory sizes were as follows: trajectory 1, *n* = 234 (28.92%); trajectory 2, *n* = 111 (13.72%); trajectory 3, *n* = 356 (44.00%); and trajectory 4, *n* = 108 (13.35%). Ns for each analysis can be found in Table 1. The magnitude of the effect size (*B*) was considered “small” if the estimate was between 0.20 and 0.49, “medium” if it was between 0.50 and 0.79, and “large” if it was above 0.80 (Ferguson, 2009)

psychopathic traits (Kimonis et al., 2011, 2012; Goulter et al., 2017; Wareham et al., 2009), the differences in the total or sub-dimensions scores are not consistent across the studies. Additionally, the Potential Primary Psychopathic Traits trajectory exhibited consistently higher violence exposure and anxiety levels than those exhibited by the Low trajectory. It is possible that the focus on adolescence and the use of a legal system involved sample obscured the potential to identify a “classic” primary psychopathic traits group with high psychopathic traits but low anxiety and negative experiences, given that the developmental period of adolescence and legal system involvement are associated with considerable anxiety and exposure to negative experiences and environments (Lee et al., 2010). Further, inconsistent findings regarding variant differences in antisociality may in fact be a product of the different classification criteria used in each study, which impedes our ability to synthesize the results and further our understanding of the multiple developmental pathways to higher psychopathic traits. Greater consensus on the criteria that reliably and consistently differentiates primary and secondary psychopathic trait variants is needed to thoroughly test the theoretical framework supporting these variants and establish a clear understanding of the behavioral risks associated with each.

The group-based multi-trajectory approach also revealed an important feature about the joint changes in psychopathic traits, anxiety, and violence exposure. We found that most youth in our sample exhibited significant declines in psychopathic traits regardless of their level of anxiety and violence exposure. This is consistent with studies documenting the potential for change in personality traits previously thought to be stable (e.g., Hawes et al., 2018; Salihovic et al., 2014). Thus, despite some clinicians, legal actors, and lay people perpetuating narratives that psychopathic traits are immutable and that youth with these traits are biologically predetermined to engage in antisocial behavior, our results add to a growing body of research that suggests most youth with psychopathic traits show decreases in these traits across adolescence. Further, our results indicate that environmental factors matter for predicting and contributing to the trajectory of psychopathic traits. That said, prior work suggests that individual differences in the initial levels and stability of psychopathic traits may be the result of a genetic predisposition rather than environmental conditions or life experiences (Fontaine et al., 2010). Additional research is needed to identify the specific biological, environmental, and/or behavioral factors that contribute to stability and change in psychopathic traits across adolescence.

### **Antecedents and Outcomes of Group-Based Trajectories**

Consistent with prior research indicating that psychopathic traits and/or negative experiences and environments are risk

factors for antisociality (Baskin-Sommers et al., 2022; De Brito et al., 2021; Skeem et al., 2011), all trajectories with moderate, elevated, or high levels of psychopathic traits, anxiety, and violence exposure were related to higher levels of violent crime and substance use three and four years later. Additionally, these trajectories were related to substance dependence symptoms at the three-year follow-up timepoint. Furthermore, at the three-year follow-up timepoint, the two trajectories with elevated or high levels of psychopathic traits (with varying levels of anxiety/violence exposure) predicted nonviolent crime. Taken together, these findings support the notion that there are equifinal pathways to antisocial behavior. For some, personality traits or environmental factors may be driving influences, but for others, the interactions among these factors result in their antisociality.

Despite several trajectories with varying levels of psychopathic traits, anxiety, and violence exposure clearly conferring risk for antisociality, the High/Secondary Psychopathic Traits showed the highest level of antisociality across forms and the most persistent indication of antisociality across the three- and four-year follow-up timepoints. Specifically, this trajectory predicted significantly more substance use at the three-year timepoint than any other trajectory, substance dependence symptoms that were apparent at the four-year follow-up timepoint compared to the Low trajectory, and a higher likelihood of arrests compared to the Low trajectory at the three- and four-year timepoints. These findings suggest that youth exhibiting secondary psychopathic traits are at the highest risk for antisociality (Docherty et al., 2016; Goulter et al., 2021; Kimonis et al., 2011; Mozley et al., 2018).

Youth in the High/Secondary Psychopathic Traits trajectory may experience a dual burden of the effects of their psychological and environmental conditions. As noted above, youth living in neighborhoods characterized by higher levels of disorder were more likely to be grouped into High/Secondary Psychopathic Traits trajectory than the Low trajectory. This is consistent with evidence that violence is more prevalent in neighborhoods characterized by greater disadvantage (Estrada et al., 2021). Residents of disadvantaged neighborhoods also are more likely to be subjected to increased police surveillance (Braga et al., 2019), which may in part explain why youth in the High/Secondary Psychopathic Traits trajectory were more likely to be arrested. Furthermore, youth in the High/Secondary Psychopathic Traits may be using substances more frequently as means of coping with the psychological distress resulting from experiences of anxiety and/or violence exposure (Goulter et al., 2017; Kerig et al., 2012; Kimonis et al., 2012). Together, these findings suggest that the severity of psychopathic traits, anxiety, and violence exposure and their association with antisociality must be understood through a multi-level lens that considers internal and external conditions.

## Limitations and Conclusions

Before concluding, several limitations should be noted. First, the group-based multi-trajectory models identified trajectories of psychopathic traits, anxiety, and violence exposure that were measured during the same time. As a result, we could not assess whether psychopathic traits were driving anxiety/violence exposure or vice versa. For example, existing research provides some evidence that violence exposure has a unidirectional effect on psychopathic traits (Baskin-Sommers & Baskin, 2016). However, youth with higher levels of psychopathic traits may be more likely to evoke violent behaviors from others or self-select into violent situations. Additional work is needed to determine whether psychopathic traits have a bidirectional association with anxiety or violence exposure.

Second, our data only included psychopathic traits, anxiety, and violence exposure assessed in mid- to late-adolescence. Hawes et al. (2018) identified characteristically different trajectories of psychopathic traits in childhood and adolescence and found that trajectory membership was not stable across childhood and adolescence. We were not able to establish whether the psychopathic traits, anxiety, and violence exposure trajectories were consistent in earlier developmental periods (i.e., childhood and early adolescence) or if the trajectories that appeared stable may actually be increasing or decreasing trajectories when observed earlier in development. Future research should utilize data across childhood and adolescence to understand how trajectory membership changes as the result of demands specific to a developmental period.

Finally, our analyses did not examine patterns of co-occurrence among the subdimensions of psychopathic traits, violence exposure, or anxiety. Examining the dimensions of psychopathic traits in combination (rather than individually) limited our ability to compare our results to previous studies that only utilized measures of the affective subdimension of psychopathic traits (e.g., callous-unemotional traits) to identify primary and secondary variants. Similarly, violence exposure could be examined by type (e.g., witnessing versus direct) or context (e.g., community versus family violence) of exposure. Recent work suggests that these aspects of violence exposure are differentially related to antisocial behavior and psychopathology (Estrada et al., 2021). Future work could consider parsing heterogeneity across these dimensions to allow for comparisons across studies and to determine whether certain patterns of co-occurrence in dimensions of psychopathic traits, anxiety, and/or violence exposure may be more strongly related to antisociality.

In sum, the findings of the present study highlight the importance of examining how personality traits, negative emotions, and negative experiences and environments change together across adolescence. Overall, our results suggest there

is variation in the antecedents and antisocial outcomes associated with joint fluctuations in psychopathic traits, anxiety, and violence exposure. Importantly, youth with co-occurring high psychopathic traits, negative emotions, and violence exposure present the highest risk for severe future antisociality. Therefore, in order to most effectively address the individual and societal burdens associated with antisociality, prevention and intervention efforts must take into account and address the unique risks experienced by different populations of antisocial youth (Baskin-Sommers et al., 2022).

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s10802-022-00989-z>.

**Data Availability** This study used publicly available data from the Pathways to Desistance Study (ICPSR 29961; <https://doi.org/10.3886/ICPSR29961.v2>).

## Compliance with Ethical Standards

**Conflicts of Interest** The authors declare that they have no conflict of interest.

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