

Delinquent development in a multi-year cohort of institutionalized boys and girls: shape and predictors of delinquent trajectories from age 18 to 30

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Abstract

Adolescents placed in residential youth care institutions face an elevated risk of persistent criminal involvement, yet little is known about how their offending develops across adulthood, or how life-course transitions relate to desistance in this population. Using Dutch official register data on 36,494 individuals (born 1978–1994) who resided in an institutional household in the Netherlands for more than three months between ages 12 and 18, this study combined fixed-effects Poisson models with group-based trajectory modelling (GBTM) to examine offending trajectories between ages 18 and 30, and their association with parenthood, employment, and cohabitation.

Fixed-effects models showed that employment and cohabitation were strongly associated with reduced offending among both men and women. The association between parenthood and offending, however, was gender-specific. For women, parenthood was significantly associated with reduced offending, even after controlling for employment and cohabitation. However for men, the effect of parenthood on offending disappeared after accounting for employment and cohabitation. GBTM identified five trajectories among men and four among women, with most individuals following a low-frequency and/or desisting offending pattern, and a smaller, predominantly male subgroup showing chronic high-frequency offending. Analyzing the effects of life-course transitions on offending within trajectory groups indicated group-specific effects, but only for parenthood.

Introduction

Adolescents placed in residential youth (care) institutions, including open residential care facilities, secure residential youth care, and juvenile justice institutions, form a particularly high-risk group of juveniles. Many of these adolescents have grown up in unsafe home environments and have been exposed to adverse childhood experiences (ACEs). Prior to their placement, they often exhibit externalizing behavioral problems, and delinquency often emerges as a prominent feature of their developmental trajectory. Prior research has consistently shown that placement in a residential youth institution is associated with educational disruption and problematic transitions into adulthood, including housing instability, early parenthood, low labor market participation (Kääriälä et al., 2019; Bornscheuer et al., 2025). These adverse outcomes in adolescence and early adulthood have been linked to an elevated risk of continued delinquent involvement.

The few Dutch studies on formerly institutionalized youth have reported persistently high levels of delinquency, with the majority of participants repeatedly involved in serious offending (Van der Geest et al., 2009). Yet these studies have generally focused on specific institutional settings, despite the fact that institutionalized youth represent a highly diverse population with different backgrounds, needs, and life-course experiences. Consequently, little is known about how delinquency develops across adulthood within the broader population of formerly institutionalized youth, or whether distinct developmental pathways can be identified. Studying a large and heterogeneous cohort that has now reached its thirties

offers the opportunity to examine long-term offending trajectories and to better understand why some individuals persist in offending while others desist.

Using individual-level data from Statistics Netherlands (Centraal Bureau voor de Statistiek; CBS), this study aims to advance knowledge about the criminal development in a sample of 36,494 individuals, born between 1978 and 1994, who had resided in a Dutch institutional household between the ages 12 and 18. Combining fixed-effects regression models with group-based trajectory analyses, we analyzed the effects of life-course transitions on delinquent development within individuals as well as within particular subgroups.

Early disadvantage and life-course criminology

In developmental and life-course criminology, delinquent behavior is generally viewed as a function of early disadvantage and subsequent developmental processes that unfold across adolescence and early adulthood (Blumstein et al., 1986; Farrington, 2006). Consistent with this perspective, one of the most robust findings in criminology is the age-crime curve, which shows that offending tends to increase during adolescence, peak in late adolescence or early adulthood, and decline thereafter. However, developmental and life-course theories argue that despite of this aggregate pattern, there is substantial heterogeneity in individual offending trajectories. Rather than reflecting a single developmental process, offending is considered to follow distinct pathways that differ in onset, duration, frequency, and severity.

Typological approaches, most notably Moffitt's (1993) developmental taxonomy, distinguish between adolescence-limited offenders, whose delinquency is largely confined to the teenage years, and life-course-persistent offenders, who exhibit antisocial behavior from childhood onwards and continue offending well into adulthood. Subsequent research has confirmed the existence of multiple offending trajectories, including chronic, escalating, and desisting patterns of offending (Piquero et al., 2008; Jennings & Reingle, 2012). In this regard, residentially institutionalized youth constitute a particularly relevant population. These young people are typically characterized by an accumulation of risk factors that have been linked to persistent offending across the life course. Many have grown up in adverse and unstable family environments, have been exposed to multiple adverse childhood experiences (ACEs), and display high rates of behavioral, emotional, educational, and mental health problems. Institutional placement is often preceded by serious externalizing behavior, including delinquency, suggesting that a substantial proportion of these youths may be on a high-risk developmental pathway.

Several developmental theories provide explanations for the elevated risk of persistent offending among institutionalized youth. Moffitt's taxonomy (1993) emphasizes neuropsychological vulnerabilities interacting with disadvantaged environments, while Farrington's developmental theory (2006) highlights the cumulative effects of family adversity, poor supervision, school failure, and delinquent peer associations. According to Sampson and Laub's age-graded theory of informal social control (1993, 2003), disruptions in conventional social bonds during childhood and adolescence may increase the risk of later offending by hindering successful life-course transitions and limiting opportunities for desistance. However, offending trajectories are not fixed and can be redirected through the formation of

strong social bonds in adulthood. From these perspectives, institutionalized youth represent a population in which multiple criminogenic risks cluster and accumulate over time, increasing the likelihood of long-term delinquent involvement. However, developmental and life-course criminology predicts considerable heterogeneity within this population and not all institutionalized youths will follow a life-course-persistent trajectory. Examining long-term offending trajectories among formerly institutionalized youth therefore provides an opportunity to assess whether distinct developmental pathways can be identified and to better understand the factors associated with persistence and desistance from crime.

A central claim of Sampson and Laub's (2003) age-graded theory of informal social control is that criminal trajectories may be redirected by important life events, or "turning points", that strengthen an individual's attachment to conventional society. Key turning points include stable employment, cohabitation or marriage, and parenthood. These transitions are thought to foster desistance by increasing informal social control, restructuring daily routines, strengthening commitments to conventional roles, and creating stakes in conformity. For example, employment may provide structure, supervision, and investment in a lawful future; cohabitation may strengthen social bonds and reduce exposure to delinquent peers; and parenthood may promote a sense of responsibility and a reevaluation of one's identity and future aspirations. Through these mechanisms, turning points can facilitate movement away from crime, even among individuals with a history of substantial delinquent involvement.

The extent to which these mechanisms operate similarly among formerly institutionalized youth remains not well known. From a life-course perspective, residentially placed adolescents often enter adulthood with fewer resources than their peers, including lower educational attainment, weaker family support, mental health difficulties, and disrupted transitions into first employment and housing (Nijenstein et al., 2026). Consequently, they may have reduced access to stable employment and long-term relationships, transitions associated with desistance (Aaltonen et al., 2013; Van der Geest et al., 2011; Verbruggen et al., 2012; Zoutewelle-Terovan, 2015). However, while disadvantages in the transition to adulthood may accumulate among formerly institutionalized youth, this may also mean that if these transitions are successfully made, they may have particularly strong consequences for their life-course. Examining how conventional adult roles are associated with desistance among formerly institutionalized youth therefore provides an important test of life-course criminological theory.

In addition to transitions into employment and housing, similar considerations apply to parenthood. In the life-course literature, becoming a parent is often conceptualized as a turning point that may promote desistance by increasing responsibility, strengthening commitments to conventional roles, and creating new social bonds. However, among individuals with histories of adversity, parenthood may occur under less favorable circumstances, and coincide with financial strain, housing instability, limited social support, and ongoing mental health difficulties (Nijenstein et al., 2026). Under such circumstances, the mechanisms that are typically assumed to promote desistance may be weakened or even counteracted. Rather than functioning as a source of social control, parenthood may become an additional source of

stress in an already vulnerable life phase. Again, however, there are reasons to expect that parenthood may be particularly consequential for formerly institutionalized individuals. For those with limited access to conventional social bonds and social support, becoming a parent may represent one of the few socially valued adult roles available to them. Qualitative research among formerly institutionalized individuals suggests that parenthood can provide a strong sense of agency, identity, and motivation for change (Van der Geest et al., 2026). The very conditions that may constrain the effectiveness of parenthood as a turning point may also increase its significance.

The empirical evidence on the role of life-course transitions in the offending trajectories of formerly institutionalized youth remains limited. Much of the existing evidence regarding the effects of employment, intimate relationships, and parenthood on desistance originates from population-based studies, in which relatively low-risk individuals constitute the majority of respondents. Although these studies provide important insights into general life-course processes, it remains unclear to what extent their findings can be generalized to populations characterized by extensive childhood adversity, institutional placement, and elevated rates of offending. Studies that have specifically examined formerly institutionalized youth are relatively scarce and often focus on selective populations, such as males placed in juvenile justice institutions (Van der Geest, 2011) or other types of residential facilities. As a result, little is known about the extent to which life-course transitions operate similarly across the broader and more heterogeneous population of youths who experienced residential placement during adolescence.

The available evidence is further constrained by methodological limitations. Longitudinal studies of institutionalized youth are relatively rare, often rely on modest sample sizes, and frequently follow participants only into emerging adulthood. Consequently, many studies are unable to capture behavioral change occurring later in the life-course. In addition, the lack of longitudinal register data has limited opportunities to examine long-term interactions between offending trajectories and transitions in domains such as employment, family formation, and parenthood. Existing knowledge therefore provides only a partial picture of how the mechanisms proposed by life-course criminological theory operate in a population characterized by accumulated disadvantage and disrupted early life-course experiences.

Present study

In the present study we seek to contribute to the above literature by combining two complementary methodological approaches to understand patterns of criminal behavior and the role of life events among formerly institutionalized youth with a residential placement of at least three months between ages 12 and 18. First, we apply fixed-effects regression models, a variable-centered approach that focuses on within-person variation over time and thereby accounts for time-stable individual-level confounding factors. Second, we employ group-based trajectory modelling (GBTM; Nagin, 2005), a person-centered approach that groups individuals on the basis of similar patterns, on offending between the ages of 18 and 30. This makes heterogeneity within the population visible and shows what types of trajectories exist and how large each cluster is.

Using these approaches, we address three research questions. First, we investigate to what extent parenthood, employment and cohabitation are associated with within-individual changes in delinquent behavior between ages 18 and 30. Second, we investigate what developmental patterns of offending could be distinguished within this sample. We investigate how these trajectories compare to trajectories described in the life-course criminological literature, in terms of onset, shape, peak and persistence. Third, we elaborate on these findings and explore whether the effects of life-course transitions on offending differ between subgroups of individuals, both for men and for women, following a similar developmental pattern.

Method

2.1 Sample

The sample consisted of 36,494 individuals, born between 1978 and 1994, who had resided in an institutional household between the ages 12 and 18 for at least three consecutive months. The three-month threshold was applied to exclude crisis or emergency placements. Of the sample, 69.2% were men ($N = 25,253$) and 30.8% were women ($N = 11,241$).

For men, the mean age at first placement (of at least three months) was 14.55 years old ($SD = 2.76$), with a mean placement duration of 680.52 days ($SD = 520.24$), and on average 1.20 placements ($SD = 0.47$) between ages 12–18. These numbers include shorter observation times for 16 boys who died prior to age 18 (M age of death = 17.3, $SD = 0.68$ years) and who were excluded from the subsample that was used for estimating criminal trajectories from age 18 to 30. Estimating these trajectories, we controlled for censoring due to death after age 18 ($N = 732$; M age of death = 30.4, $SD = 6.71$). For these men, unobserved years were coded as missing and did not contribute to estimating the trajectories.

For women, the mean age at first placement (of at least three months) was 14.85 years old ($SD = 2.66$), with a mean placement duration of 607.59 days ($SD = 468.84$), and on average 1.23 placements ($SD = 0.51$) between ages 12–18. The number of deaths of women occurring prior to age 18 could not be disclosed due to the small absolute count falling below the minimum threshold imposed by Statistics Netherlands. After age 18, 192 women died at a mean age of 31.0 years ($SD = 6.94$). Similar to men, in these cases, the unobserved years were coded as missing.

2.2 Measures

All data from this study were drawn from the Statistics Netherlands (CBS) Microdata environment. These datafiles contain individual-level, anonymized, longitudinal data and are considered a high-quality, population-representative source for research across domains such as demography, education, employment, income, and health care use. These data were derived from multiple governmental and administrative sources. For the present study, we obtained access to a selection of variables described below.

Criminal involvement was measured using official police records available through the Statistics Netherlands Microdata environment. These records are derived from two national police registration systems: the *Herkenningsdienstsysteem* (HKS), which contains information on individuals registered as suspects of criminal offenses, and its successor *Basisvoorziening Handhaving* (BVH), the police incident registration system which also includes suspect data. Following the Dutch *Standard Crime Classification 2010* (*Standaardclassificatie Misdrijven, 2010*), only serious offenses were included in the analyses. Minor offenses were excluded, because they are relatively common in the general population (Van der Geest et al., 2006) and are therefore less indicative of persistent or serious criminal involvement. For ease of reporting, in our findings we may refer to offending in general, but all offending outcomes in our study are based on serious offending. Criminal involvement was assessed for the period between ages 18 and 30 and was operationalized as the presence of one or more police registrations as a suspect of a serious offense in either HKS or BVH during this age range. For our sample, which comprised individuals born between 1978 and 1994, police registration data did not extend sufficiently far back in time to consistently cover the full period from ages 12 to 18. Therefore, we chose to restrict the analyses to offenses from age 18 onward.

To account for the reduced exposure to delinquent opportunities for offending during periods of incarceration or institutionalization, annual time spent in an institutional household (i.e. detention or care facilities) was taken into account. Following Van der Geest et al. (2009, 2011), an adjusted exposure measure was calculated as $1 - (\text{number of days incarcerated} / 730)$. To avoid disproportionately high adjusted offense rates resulting from overlapping conviction and incarceration dates in the registration data, the minimum exposure was set at 0.5 rather than 0. The annual number of serious offenses was adjusted using this exposure measure. The exposure-adjusted offense counts were subsequently used in both the fixed-effects Poisson models and the group-based trajectory models.

Three measures of life-course transitions were used as time-varying binary covariates, each coded 0 or 1 per year from ages 18 to 30. We discuss them briefly.

Parenthood was based on the kinship data from the Personal Records Database from Statistics Netherlands (in Dutch: BasisRegistratie Personen; BRP), which was coded 1 in the year an individual had their first biological child and in all subsequent observation years. It was coded 0 in all prior years or if someone did not become a parent between ages 18 and 30.

Employment was based on data that provide monthly information on individual's labor market status, indicating whether an individual was employed (either self-employed or employed under a temporary or permanent contract), received social security benefits, was enrolled in education or was coded under the category 'other without income. This indicator was coded 1 if an individual was employed for at least six months in a given year, and 0 otherwise. The six-month threshold was applied to distinguish substantive labour market attachment from brief or incidental employment (which are unlikely to constitute a meaningful turning point).

Cohabitation was based on the household file of Statistics Netherlands, and coded 1 if an individual shared a household with a partner (either with or without children) for more than six months within a given year, and 0 otherwise. Again, a six-month threshold was applied to differentiate periods of relatively stable cohabitation from periods characterized by non-cohabitation or frequent changes in cohabitation status.

For individuals who died between the ages 18 and 30, all time-varying indicators and criminal trajectories were coded as missing for the years following the year of death. These individuals contributed person-years to the analysis up to and including the year of death, after which they were right-censored.

2.3 Data analysis

Building on a descriptive foundation, this study is structured around two complementary statistical methodologies: fixed-effects regression models and group-based trajectory modeling (GBTM). Although both models draw on the same indicators of social bonds, they serve distinct purposes, together allowing us to examine both the within-subject dynamics of criminal offending across early adulthood (fixed-effects) and the between-subject heterogeneity in criminal trajectories across early adulthood, including whether the effects of social bonds differ between trajectory subgroups (GBTM). This is consistent with typological approaches suggesting that distinct developmental patterns of offending are associated with a preset of underlying early developmental and neuropsychological factors (Moffitt, 1993). Estimating the effects of life-course transitions on offending within trajectory subgroups allows us to control for unobserved bias that is associated with this developmental heterogeneity.

2.3.1 Offending characteristics

As a first descriptive step, age-crime curves were constructed separately for men and women, plotting the mean annual number of registered serious offenses (λ) against ages 18 to 30. Prior research has consistently shown that men and women differ not only in the overall level of offending, but also in the timing of onset, the shape, and the rate of desistance across the life course (Kratzer & Hodgins, 2006).

2.3.2 Fixed-effects model

To examine whether the occurrence of a turning point was associated with changes in criminal offending within individuals, fixed-effects panel regression models were estimated. Fixed-effects models rely on within-person variation over time by comparing each individual to themselves across repeated measures, thereby controlling for all observed and unobserved time-invariant individuals characteristics (e.g. personality traits, early childhood adversity, and cognitive ability). As a result, the estimated associations are solely based on changes occurring within individuals over time, which provides a stronger basis for causal inference than cross-sectional or between-person designs.

The outcome variable was the exposure-corrected annual rate of registered serious offenses. Parenthood, employment, and cohabitation were included as time-varying binary covariates (see 2.2 Measures). Age was accounted for by including both linear and quadratic terms in the model.

2.3.3 Group-based trajectory models

To identify distinct developmental patterns of offending between ages 18 and 30, group-based trajectory modeling (GBTM; Nagin, 2005) was applied. GTBM approximates heterogeneity in offending trajectories by identifying a discrete number of latent groups that follow distinct developmental patterns over age. Given the highly skewed distribution of offending and the large number of zero observations, trajectories were estimated using a zero-inflated Poisson (ZIP) model, in which the zero-inflation component was not specified separately for each trajectory group. Individuals were assigned to the trajectory group for which they had the highest posterior probability of assignment. To account for variation in exposure time, the annual exposure measure was adjusted for periods of incarceration. In addition, right-censoring due to varying follow-up lengths or death during the observation period was accommodated by treating unobserved years as missing. Offending frequencies were top-coded at the 99th percentile. Trajectory models were estimated separately for men and women.

To examine whether the effects of social bonds varied across trajectory subgroups, three time-varying measures of different life-course transitions, namely parenthood, employment, and cohabitation (see Section 2.2 for operationalizations), were included as covariates in the trajectory models. These variables were coded annually between ages 18 and 30, indicating the presence (1) or absence (0) of each status in a given year. The inclusion of time-varying covariates allowed us to assess within-group associations between changes in social bonds and changes in offending over time, while accounting for heterogeneity in developmental trajectories. All trajectory analyses were conducted using the *traj* plugin in Stata (Jones & Nagin, 2018; Nagin et al., 2005)

Candidate models between two and eight trajectory groups were fitted and compared. The optimal number of trajectory groups was determined using a combination of multiple complementary criteria, including the Bayesian Information Criterion (BIC), Akaike Information Criterion (AIC), log-likelihood (LL), average posterior probabilities of assignment (AvePP), Odds of Correct Classification (OCC), entropy score, trajectory group sizes, and interpretability of the resulting trajectories.

Finally, to assess the robustness of the selected trajectory models, split-sample validation was performed by randomly dividing the full sample of men, and the full sample of women, each separately, into two independent subsamples of equal size. The selected trajectory model was re-estimated separately in each subsample. Consistency of the trajectory shapes and group sizes across the two subsamples was then examined. The high degree of correspondence observed between the two subsamples confirmed the stability and replicability of the identified trajectory groups of men and women.

Results

3.1 Offending characteristics

Men exhibit substantially higher levels of delinquent involvement than women between ages 18 and 30. At age 18, their serious offending rate is more than three times that of women. Figure 1 depicts the developmental trajectories of serious offending. Between ages 18 and 30, the average number of serious offenses decreases substantially, with values roughly halving over this period for both men and women. This pattern is consistent with the well-established age-crime curve, indicating a gradual reduction in criminal involvement as individuals transition into adulthood.

3.2 Life-course transitions characteristics

Table 2 presents the descriptive results for parenthood, employment and cohabitation. On average, women entered parenthood earlier and were more likely to become parents than men. A similar pattern emerged for cohabitation, defined as living together for at least six consecutive months, with women cohabiting both earlier and more frequently than men. Employment rates were comparable between men and women.

Table 2
Descriptive statistics of life-course transitions.

Parenthood (N; % from age 18–30)	Men	Women
	N = 25,237	N = 11,239
	8612 (34.1%)	7341 (65.1%)
Employment (N; % from age 18–30)	21,012 (83.2%)	8753 (77.9%)
Cohabitation (% from age 18–30)	14,338 (56.8%)	7962 (80.0%)
Mean age at first parenthood (SD; in years)	24.9 (3.3)	22.3 (3.5)
Mean age at first employment (SD; in years)	19.1 (2.1)	19.1 (2.3)
Mean age at first cohabitation (SD; in years)	23.8 (3.3)	21.8 (3.2)

3.3 The effects of life-course covariates on offending for men

In the univariate fixed-effects Poisson models for men, each life-course transition was examined separately and was significantly associated with reductions in serious offending (see Table 3). Sustained employment showed the strongest association with reduced offending: holding a job was associated with a 43.1% lower rate of offending (IRR = 0.569). When all three life-course transitions were simultaneously included in the adjusted fixed-effects Poisson model for men, the association between parenthood and serious offending was substantially reduced and no longer statistically significant (see Table 3). This finding suggests that parenthood had no independent association with serious offending and that the association with serious offending reflected its association with age or the occurrence of other adult social roles in the model (i.e. employment and cohabitation). In contrast, employment and cohabitation both remained strongly and significantly associated with lower rates of serious offending

after controlling for age and other covariates, indicating that each exerted an independent protective effect on serious offending.

3.4 The effects of life-course covariates on offending for women

In the univariate fixed-effects Poisson models for women, all three covariates were significantly associated with reduced serious offending (see Table 3). Cohabitation showed the strongest association with reduced offending (IRR = 0.671). In the adjusted fixed-effects Poisson model for women, the effects of all three life-course transitions remained statistically significant, suggesting that the protective mechanisms reflected in these effects operate independently (see Table 3).

Table 3
Fixed-effects Poisson models of men (N = 19,696) and women (N = 7,176).

	Crude			Adjusted		
	β	SE	p	β	SE	p
Men						
Age	-	-	-	-0.280	0.025	< .001
Age ²	-	-	-	0.004	0.0005	< .001
Parenthood	-0.119	0.03	< .001	0.024	0.03	.39
Employment	-0.588	0.02	< .001	-0.564	0.02	< .001
Cohabitation	-0.494	0.02	< .001	-0.441	0.02	< .001
Observations	254,454			254,454		
Adj. Pseudo R ²	<i>a</i>			0.287081		
BIC	<i>a</i>			826,548.9		
Women						
Age	-	-	-	-0.188	0.051	< .001
Age ²	-	-	-	0.002	0.001	.031
Parenthood	-0.182	0.05	< .001	-0.168	0.05	< .001
Employment	-0.285	0.04	< .001	-0.281	0.04	< .001
Cohabitation	-0.399	0.04	< .001	-0.372	0.04	< .001
Observations	92,969			92,969		
Adj. Pseudo R ²	<i>b</i>			0.120293		
BIC	<i>b</i>			195,947.0		

a: Fit statistics of the crude models of men (resp. BIC; adj. pseudo R²): parenthood (835,557.5; 0.27671), employment (828,580.3; 0.284724), cohabitation (833,020.3; 0.279624).

b: Fit statistics of the crude models of women (resp. BIC; adj. pseudo R²): parenthood (196,482.7; 0.116486), employment (196,340.8; 0.117461), cohabitation (196,154.0; 0.118743).

3.5 Group-based trajectory models for men

To examine whether different patterns of offending underly the average age-crime curves in Fig. 1, several multi-group models were tested separately for men (Appendix I). The optimal number of

trajectory groups was determined by considering model fit diagnostics alongside considerations of parsimony and interpretability. Given that for men, the five-group quadratic model performed well on all criteria of model fit (Appendix II), we chose this model for further analysis.

Figure 2 depicts the five trajectories. We labeled the trajectory groups as follows: Low Frequency Desisters (LFD; Cluster 1), Late-Onset Moderate offenders (LOM; Cluster 2), Early Adulthood Limited offenders (EAL; Cluster 3), High Frequency Desisters (HFD; Cluster 4), and High Frequency Chronics (HFC; Cluster 5). The LFD- and LOM-group made up almost three quarters of the sample (71.8%; see also Table 4). The two high-frequency offending groups (HFD and HFC) jointly constituted approximately one eighth of the sample (13.0%), while the EAL-group comprised 15.1%.

The LFD-trajectory was characterized by a low and stable level of offending throughout the observation period, with neither the linear nor the quadratic term reaching significance, indicating a largely flat trajectory across ages 18 to 30. Late-Onset Moderate offenders started from a very low initial level of offending, but showed an increase in offending during early adulthood. Subsequently, this leveled off from the mid-twenties onward, resulting in a moderate and relatively stable rate of offending by age 30. The EAL-trajectory displayed a high initial level of offending, followed by a steep and significant decline, such that by the mid-twenties this group's offending had dropped to a level comparable to that of the LFD-trajectory. The HFD-trajectory began at the highest initial level, remained elevated through the early twenties, and then declined significantly toward age 30, though less steeply and later than the EAL-group. Finally, the HFC-trajectory was distinguished by a consistently high and stable level of offending across the entire observation period, with no significant linear or quadratic change, indicating persistent high-frequency offending from age 18 to 30.

4.4 Differential effects of life-course transitions on offending for men

Based on our previous trajectory-group model for men, we analyzed the effect of parenthood, employment and cohabitation on offending within trajectory subgroups, thereby controlling for between-individual differences associated with the trajectory of offending.

Table 4
Zero-inflated Poisson quadratic model with five groups of men.

Variable	Men				
	Cluster 1 (LFD)	Cluster 2 (LOM)	Cluster 3 (EAL)	Cluster 4 (HFD)	Cluster 5 (HFC)
n (%)	14,449 (57.2%)	3689 (14.6%)	3813 (15.1%)	1931 (7.6%)	1371 (5.4%)
Estimated model parameters					
Intercept	-0.279	-9.619 ***	17.275 ***	-5.305 ***	0.880 ***
Linear	-0.039	0.759 ***	-1.281 ***	0.707 ***	0.025
Quadratic	-0.002	-0.015 ***	0.021 ***	-0.019 ***	-0.001
Parenthood	0.522 ***	0.020	0.285 ***	0.005	-0.049 **
Employment	-0.632 ***	-0.772 ***	-0.566 ***	-0.476 ***	-0.657 ***
Cohabitation	-0.493 ***	-0.448 ***	-0.486 ***	-0.255 ***	-0.277 ***
<i>Note: LFD = Low-Frequency Desisters, LOM = Late-Onset Moderate, EAL = Early Adulthood-Limited, HFD = High-Frequency Desisters, HFC = High-Frequency Chronics</i>					

As Table 4 shows, employment and cohabitation were independently, significantly and negatively associated with offending across all five groups, indicating that being employed or cohabiting for at least six months per year were consistently linked to reduced offending, regardless of group membership. The magnitude of the employment effect was strongest in the LOM-group (IRR = 0.462) and weakest in the HFD-group (IRR = 0.621). The effect of parenthood was less consistent across groups. Parenthood was significantly associated with increased offending in the LFD-group (IRR = 1.685) and EAL-group (IRR = 1.330), whereas it showed a small but significant negative association in the HFC-group (IRR = 0.952). In the LOM- and HFD-group, the effect of parenthood was not statistically significant.

Taken together, these results suggest that while employment and cohabitation are consistently associated with reduced offending across all trajectory groups, the role of parenthood varies by group. It is positively associated with offending in the largest and initially highest offending groups (LFD- and EAL-group), while showing no association in the LOM- and HFD-group. In the HFC-group, parenthood even shows a small association with reduced offending.

3.6 Group-based trajectory models for women

For women, we selected the optimal number of trajectory groups the same way as for men, namely based on model fit statistics, parsimony, and interpretability (see Appendix I). Although quadratic models with five or more trajectory groups showed slightly better model fit statistics, they resulted in one or

more groups containing only a small proportion of the sample of women (< 5%). As these additional groups contributed little to the interpretation, the four-group quadratic model was considered the most interpretable solution. Given that for women, the four-group quadratic model performed well on all other criteria of model fit (Appendix II), we chose this model for further analysis.

Figure 3 depicts the four trajectories identified for women, using the same Y-axis scale as Fig. 2 to facilitate comparison. In the visualizations of some of these trajectories, the values at some ages were manually set to zero for reasons of disclosure control, imposed by Statistics Netherlands, as they reached near zero. This was solely for visualization and not in the analysis. We labeled the trajectory groups as follows: Late-Onset Moderate (LOM; Cluster 1), Low-Frequency Desister (LFD; Cluster 2), Early Adulthood-Limited Serious (EAL; Cluster 3), and Persistent Moderate offender (PM; Cluster 4). The LFD-group constituted by far the largest proportion of the sample (68.0%; see also Table 5). The PM-group was the smallest, with 5.1% of the sample. The LOM- and EAL-groups account for 10.4% and 16.6% of the sample, respectively.

The LFD-group followed a low and essentially stable trajectory throughout adulthood, with offending levels remaining consistently low from age 18 through age 30 and no significant linear or quadratic term. The LOM-group followed a modest, gradually rising trajectory. The EAL-group, by contrast, displayed the steepest decline of all four trajectories. Starting at a high initial level comparable to the PM-group, offending dropped sharply and continuously from age 18 onwards, approaching near-zero levels just comparable to the LFD-group. The HFC-group even increased further to reach a peak around age 23, before gradually declining through the late twenties. Though, this PM-group remained the highest-offending of all four even by age 30.

4.2 Differential effects of life-course transitions on offending for women

Building on our previous trajectory-group model for women, we examine the effects of parenthood, employment and cohabitation on serious offending within trajectory subgroups.

Table 5
Zero-inflated Poisson quadratic model with five groups of women.

Variable	Women			
	Cluster 1 (LFD)	Cluster 2 (LOM)	Cluster 3 (EAL)	Cluster 4 (PM)
n (%)	7642 (68.0%)	1164 (10.4%)	1865 (16.6%)	570 (5.1%)
Estimated model parameters				
Intercept	2.173	-23.720 ***	0.001	-4.142 ***
Linear	-0.286	1.673 ***	0.170	0.372 ***
Quadratic	0.003	-0.031***	-0.010 ***	-0.008 ***
Parenthood	0.091	0.000	-0.116 *	-0.202 ***
Employment	-0.410 ***	-0.972 ***	-0.382 ***	-0.568 ***
Cohabitation	-0.412 ***	-0.418 ***	-0.408 ***	-0.236 ***
<i>Note: LOM = Late-Onset Moderate, LFD = Low-Frequency Desister, EAL = Early Adulthood-Limited, PM = Persistent Moderate</i>				

Table 5 presents the parameter estimates and time-varying covariates for the four-group quadratic model for women. Comparable to men, employment and cohabitation were significantly negatively associated with offending across all four groups. Women who were employed or cohabited for at least six months per year consistently scored lower within each group, with the strongest negative association for employment observed in the LOM-group (IRR = 0.378) and the weakest in the EAL-group (IRR = 0.683). For cohabitation, the effect was likewise consistently negative. Parenthood showed a less uniform pattern than the other two covariates: in the LOM- and LFD-groups, the effect of parenthood was not significant, whereas in the EAL- and PM-groups parenthood was significantly negatively associated with offending in any group of women. Instead, parenthood showed either no or a dampening effect in the two initially highest-offending groups (EAL- and PM-group), while employment exerted a consistent dampening effect on offending across all groups.

3.7 Differences between men and women

The overall age-crime curves showed that women offended considerably less than men throughout, with an average lambda at age 18 of 0.819 for men versus 0.256 for women. This lower magnitude was also reflected in the group-based trajectory models, where women's trajectories followed a broadly similar shape to men's but were substantially lower throughout.

Comparing findings of the life-course transitions that were included in both the fixed-effects and group-based trajectory models reveals a consistent pattern for men and women: employment and cohabitation were strongly associated with reduced serious offending, whereas the role of parenthood diverged markedly. In the fixed-effects models, the crude protective effect of parenthood among men disappeared after adjustment for employment and cohabitation, whereas among women it remained significant and negative even after adjustment. Employment emerged as the strongest crude predictor of reduced offending among men, while cohabitation played this role for women.

This divergence was also reflected in the group-based trajectory models. Among men, parenthood was associated with an increase in offending in the two largest and initially highest-offending groups (LFD and EAL), whereas among women, parenthood was associated with a decrease in offending in the comparable high-offending groups (EAL and PM). Employment and cohabitation exerted, comparable to the fixed-effects models, a consistently protective effect across all trajectory groups for both men and women.

Discussion

This study followed a large cohort of formerly institutionalized youth from age 18 into adulthood and examined differences between men and women in developmental trajectories of serious offending. At the aggregate level, serious offending declined steadily between ages 18 and 30 for both men and women, yet offending was substantially more prevalent among men, whose offending rate was approximately three times that of women across the observation period. Group-based trajectory analyses identified five offending trajectories among men and four among women. Relating offending with key life-course transitions, namely parenthood, employment and cohabitation, findings were largely consistent with life-course theoretical expectations. However, important differences between men and women emerged in the strength and persistence of these associations. Our findings therefore suggest that pathways of persistence and desistance are shaped by developmental processes that may differ between men and women.

An important characteristic of our sample is that it was drawn from a highly vulnerable population with a history of out-of-home placement during adolescence. Although such experiences are often associated with childhood adversities, behavioral problems, and an elevated risk of delinquency, the majority of participants followed a low-frequency offending trajectory. More than half of the men and nearly two-thirds of the women exhibited little involvement in serious offending throughout emerging adulthood. From Moffitt's (2006) developmental taxonomy, this finding is consistent with the proposition that most individuals desist from offending as they mature and adapt to adult roles, with recovery occurring primarily between ages 20 and 30. It also aligns with Sampson and Laub's (2003) assertion that desistance, rather than persistence, is the most common pattern across the life course. Given that our study used a broad definition of serious offenses, allowing us to detect a broad range of antisocial behavior, it is likely that these low rates of offending reflect a genuine reduction in offending rather than a shift to non-serious offending. At the same time, a small subgroup, consisting of men, followed

persistent high-frequency offending trajectories. For most of these men, offending rates declined substantially over time, such that most had largely desisted from offending by age 30.

Life-course theories attribute the development of offending to variation in the timing and strength of adult social bonds and role transitions. Our findings suggest that these mechanisms operate differently for men and women in this vulnerable population. Using fixed-effects Poisson models, we examined the extent to which within-individual changes in parenthood, employment, and cohabitation were associated with within-individual changes in serious offending over time. For men, each of these transitions was associated with lower offending rates when considered separately, with employment emerging as the strongest correlate of desistance. However, when the transitions were considered simultaneously, the association between parenthood and offending disappeared, suggesting that the apparent protective effect of fatherhood largely reflected its co-occurrence with other life-course transitions. For women, all three transitions were associated with lower offending rates, although cohabitation showed the strongest association. In contrast to the findings for men, parenthood remained negatively associated with offending when all life-course transition statuses were included simultaneously in the model, indicating an independent protective effect for each transition. Taken together, these findings indicate that adult role transitions may promote desistance through different pathways for men and women. Whereas men's reductions in offending appear to be more closely tied to relational (and perhaps economic) and social changes, for women, parenthood is the most salient turning point in their pathways away from serious offending.

Life-course theories and prior empirical research suggest that the impact of adult role transitions is likely to depend on an individual's level of criminal embeddedness, with social bonds exerting different effects for chronic offenders than for those already exhibiting relatively low levels of offending (Van der Geest et al., 2011). To address this issue, we examined the effect of parenthood, employment, and cohabitation across distinct offending trajectories. For men, the association between parenthood and offending varied across trajectory groups. While the fixed-effects Poisson models did not show an overall independent effect of parenthood for men, the group-based trajectory analyses demonstrated that this overall effect masked differential effects among trajectory groups, with parenthood being associated with a lower rate of offending among low-frequency offenders, but not among most high-frequency offenders. Employment and cohabitation, on the other hand, were associated with lower offending across all male trajectory groups. A similar pattern emerged among women. While the effect of parenthood differed across trajectories, employment and cohabitation showed consistent negative associations with offending regardless of developmental pathway. Parenthood, however, was significantly associated with a lower rate of offending, but only among women in the highest frequency trajectories. These findings suggest that employment and cohabitation represent positive markers of increasing independence, which may be particularly important in the lives of formerly institutionalized individuals given the vulnerabilities they face during the transition to adulthood. Parenthood, on the other hand, does not appear to be a universal turning point. Its effects may be conditional on the timing and circumstances surrounding the transition to parenthood, which typically differs for men and women. Parenthood under less favorable conditions may coincide with vulnerable parenting circumstances and

increased stress, and therefore have a different effect on persistence or desistance. This emphasizes the importance of considering offender's developmental heterogeneity when evaluating life-course explanations of persistence and desistance.

Several strengths of this study should be acknowledged. A major strength is the use of a large population-based cohort of vulnerable youth with a history of out-of-home placement, followed prospectively from age 18 to 30. This design allowed us to examine offending trajectories during the transition to adulthood in a population that is at heightened risk of persistent offending due to the overrepresentation of childhood adversities, family instability and behavioral problems. Further strengths include the long follow-up period, the inclusion of both men and women, the use of official police registrations of serious offending, and the availability of rich longitudinal demographic data on key life-course transitions. Our study combined multiple analytical strategies. The fixed-effects Poisson models estimated within-individual changes in offending over time and thereby controlled for all stable individual characteristics, both observed and unobserved. As a result, the reported associations between life-course transitions and offending are less susceptible to bias arising from stable differences between individuals and provide relatively robust estimates of within-person change. In contrast, the trajectory analyses focused on heterogeneity in developmental pathways by grouping individuals with similar offending patterns, and thereby allowed us to examine whether the effect of life-course transitions differed across distinct subgroups of men and women. Together, these approaches offer a better understanding of offending development than either method in isolation.

Several limitations should also be considered. First, offending could only be observed from age 18 onwards, because police data were unavailable for earlier periods. Consequently, we were unable to assess juvenile offending trajectories or directly distinguish between adolescence-limited and life-course-persistent pathways as conceptualized by developmental theories such as Moffitt (1993, 2006). Second, information on the reasons for placement in a residential youth care facility, the type of youth care facility, and childhood adversities prior to placement was unavailable. Such information could have provided insight into important correlates of offending patterns during emerging adulthood, and the mechanisms linking childhood disadvantage to adult outcomes. Third, our measures of parenthood, employment, and cohabitation represent relatively crude indicators of life-course success and social integration. The quality, stability, and subjective meaning of these transitions may vary considerably and may be just as important as their occurrence. Our analyses should therefore be considered as exploratory, providing first insight into the differential effects of life-course transitions on offending. Moreover, the fixed-effects models only include individuals with at least one registered serious offense between ages 18 and 30, as individuals without variation do not contribute to within-person estimates and are therefore excluded. The estimated associations of the fixed-effects models thus pertain to individuals who offended at least once and may not generalize to those who never had a serious offence in this period. The group-based trajectory models, in contrast, were estimated on the full sample. Finally, although periods of incarceration were accounted for through corrected exposure measures, the potential causal effects of legal sanctions themselves were not examined.

All in all, future research could further advance life-course theory by incorporating more dynamic factors that fluctuate during emerging adulthood, such as substance abuse, mental health problems, and criminal justice interventions. Such factors may help explain why offending trajectories diverge at particular stages of the life course and why identical life-course transitions do not exert the same influence on all individuals. Understanding how multiple life-course transitions interact over time is an important challenge for life-course criminology, particularly in vulnerable populations facing multiple and overlapping transitions into adulthood.

Declarations

Author Contribution

JN acquired funding for this research study. Both authors (VG and JN) contributed to the conceptualization and methodology of the study. JN performed the data curation, formal analysis, and visualization. Both authors (VG and JN) wrote the original draft and reviewed and edited the manuscript.

Data Availability

Original data from Statistics Netherlands are not publicly available due to privacy regulations. Data that have been approved for research purposes can be made available upon reasonable request.

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Figures

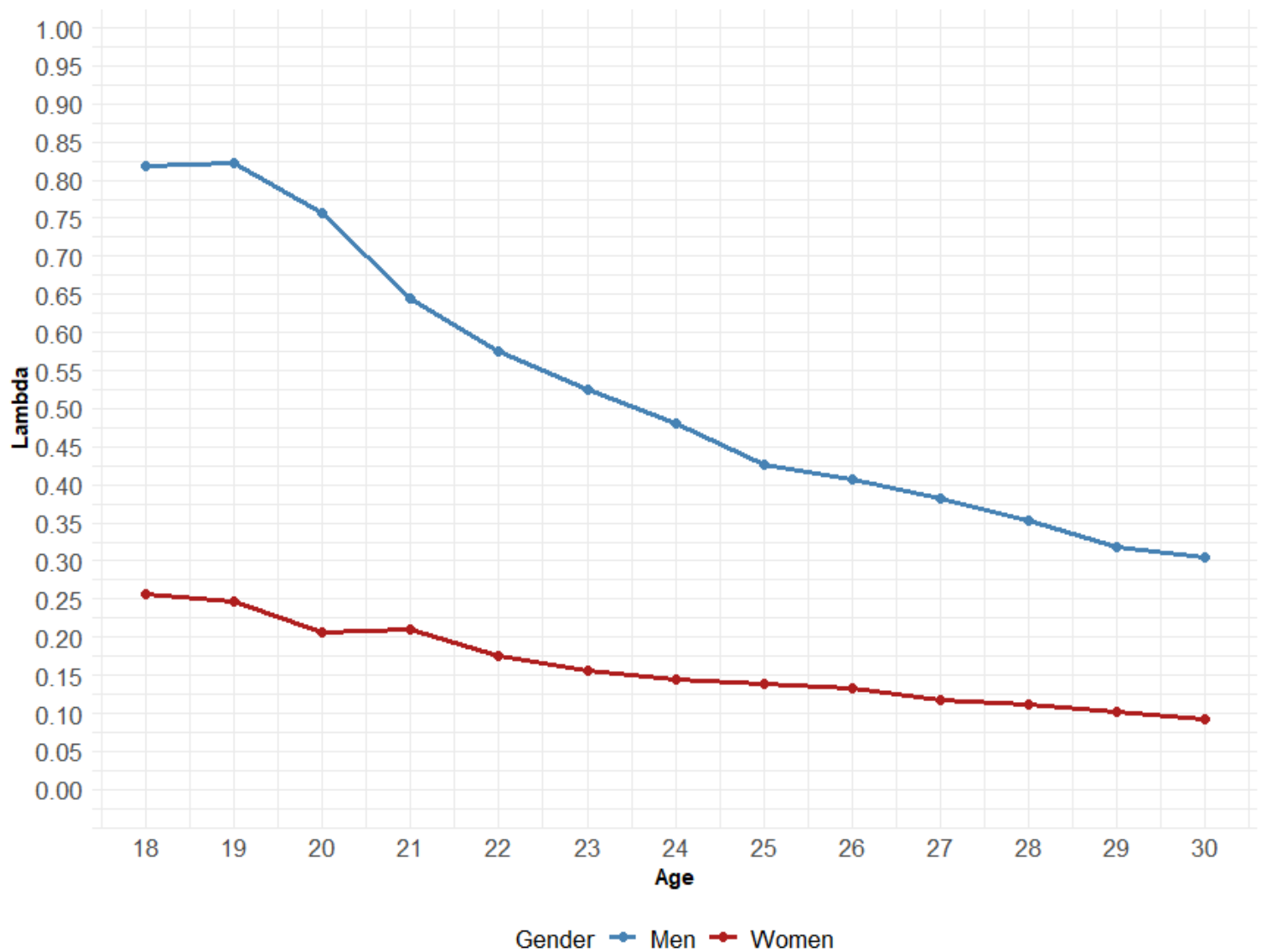


Figure 1

Age-crime curves of serious offending of men and women between ages 18-30.

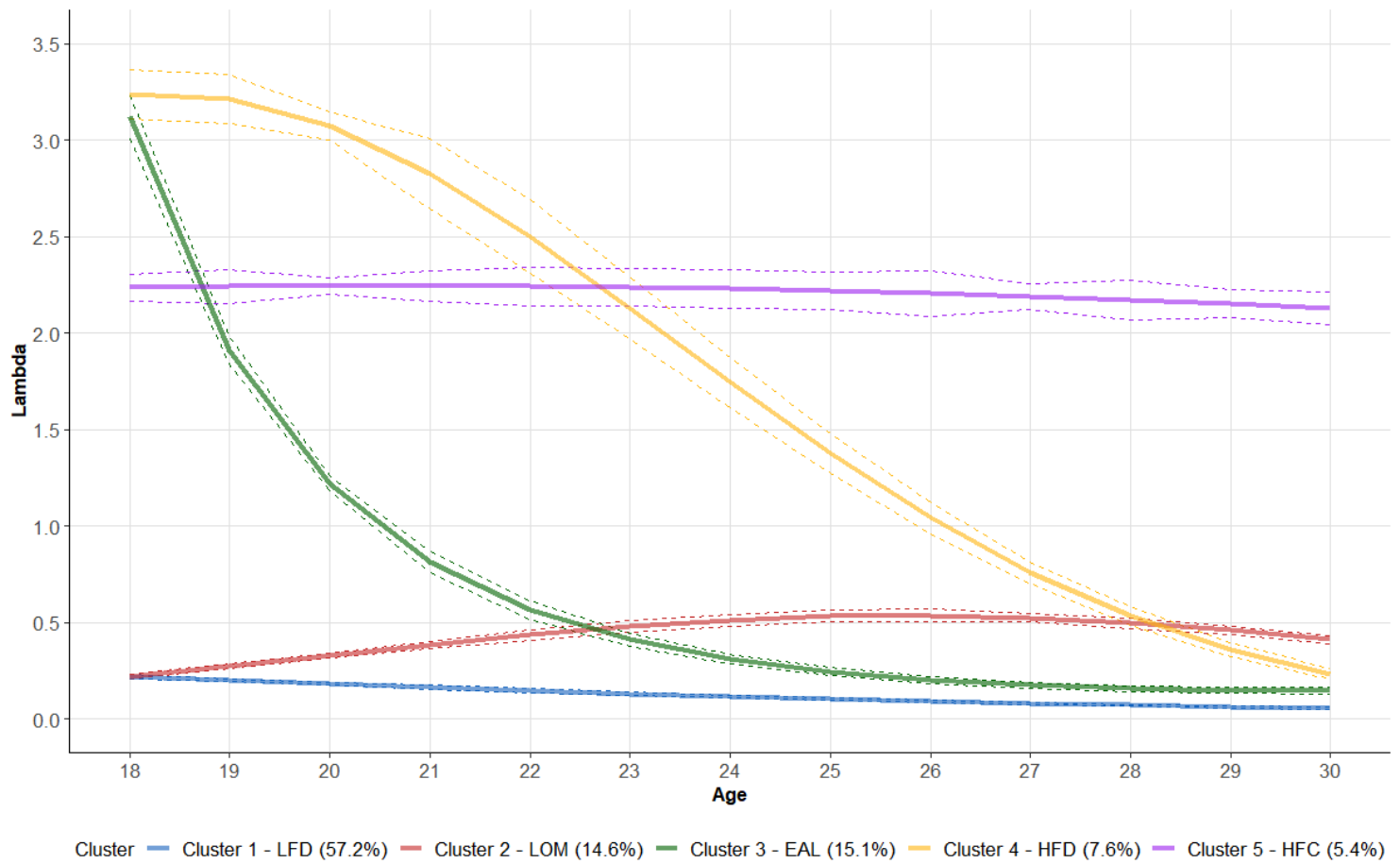


Figure 2

Developmental trajectories of serious offending of men from age 18 to 30.

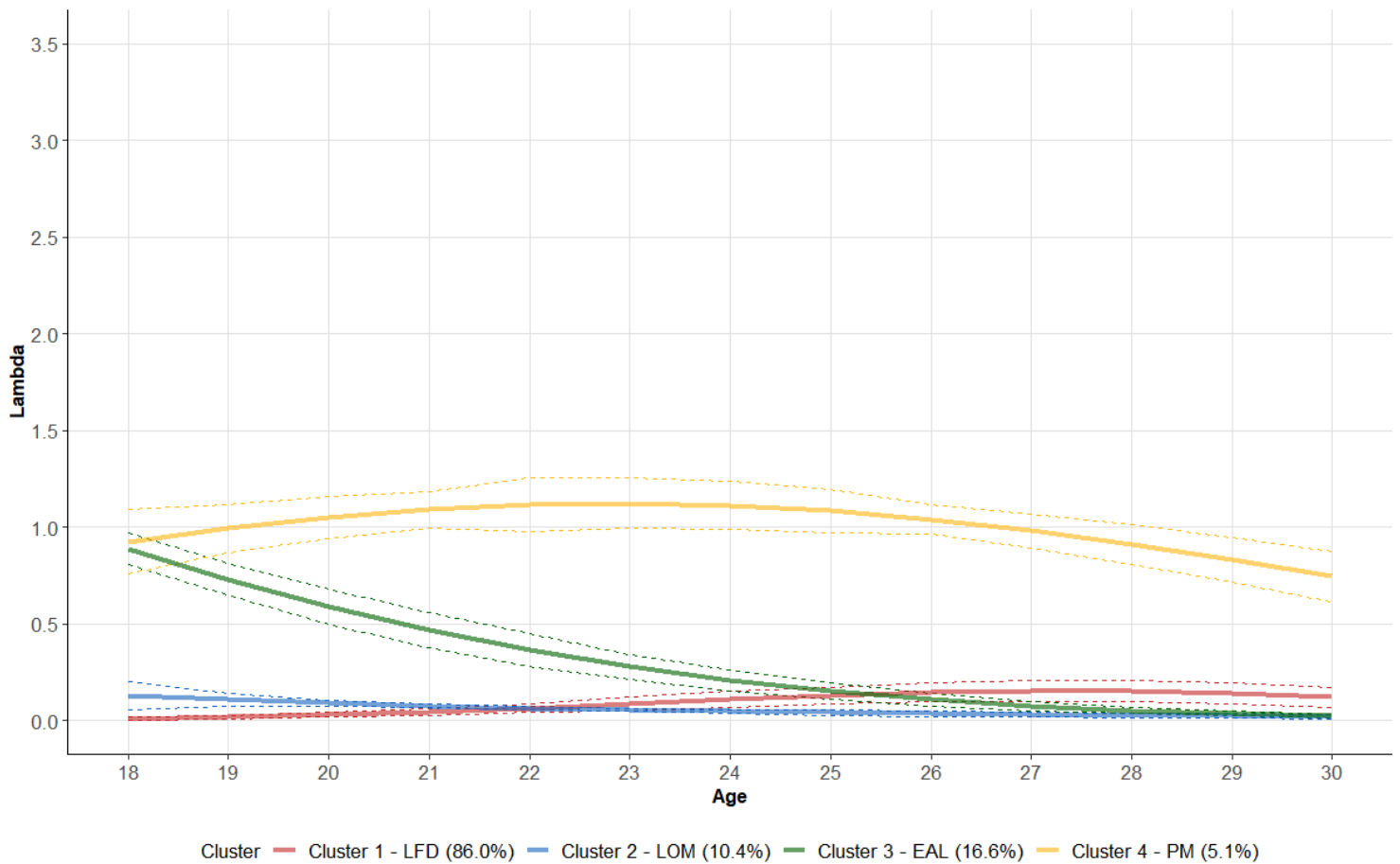


Figure 3

Developmental trajectories of serious offending of women from age 18 to 30.

Supplementary Files

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- [Appendix.docx](#)