

Criminal Trajectories and Risk Factors in a Canadian Sample of Offenders

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Abstract

This study contributed to the criminal trajectory literature using a Canadian-based sample of juvenile offenders and examined childhood and adolescent predictors of trajectory group membership. The sample comprised 378 males who had been sentenced as youth, between 1986 and 1996, to one of two open custody facilities in Toronto, Canada. Official criminal records were obtained from late childhood and early adolescence into adulthood for an average follow-up of 12.1 years. Criminal trajectories were based on the rates of offending by age determined by adjusting the frequency of court contacts arising from a new set of charges by (a) time-at-risk and (b) an estimate of the offenders' age at the time of offense. Childhood and adolescent predictors reflecting individual, family, peer, and school domains were extracted from client files. The trajectory analysis yielded four groups, labeled heuristically as Moderate Rate (MR), Low Rate (LR), High Rate Adult Peaked (HRADL), and High Rate Adolescent Peaked (HRADOL). Multinomial regression analyses indicated that childhood and adolescent risk factors representing the family and peer domains differentiated the LR group from the MR, HRADL, and HRADOL groups. These results highlight the general and specific risk factors that could be targeted in prevention and intervention programs both within and outside the criminal justice system.

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Theoretical Frameworks

Long absent from criminological theories of offending has been a dynamic and developmental perspective to account for the onset, maintenance, and desistance of offending as well as the course of criminal behavior as it unfolds over time. Recently, the developmental, life course (DLC) perspective has been put forth as a theoretical framework from which to understand and study the longitudinal nature and pattern of offending (Farrington, 2003; Piquero & Mazerolle, 2001; Thornberry, 2005). DLC is concerned with temporal within-individual variability in crime over the life course and with identifying and investigating linkages between past events and future outcomes. Though more a collection of theories, including Moffitt's (1993) developmental taxonomy, Thornberry's (2005; Thornberry & Krohn, 2005) interactional theory, Catalano and Hawkins' (1996) social developmental model (SDM), and Farrington's (2003) Integrated Cognitive Antisocial Potential (ICAP) theory, than a singular theory in its own right (Farrington, 2005), the DLC perspective aims to advance knowledge about criminality within the context of developmental processes (i.e., relating to growth and maturation), as well as the interpersonal, intrapersonal, and environmental factors that influence them, and to consider the reasons underlying the changes and continuities in criminal offending over the life course. For example, while it has long been recognized that offending in adolescence is one of the best predictors of offending in adulthood, no causal mechanism linking these two sets of events, framed within a developmental context (e.g., proposing the importance of developmental transitions) has been suggested. As well, the age crime curve states that offending rises sharply in early adolescence, reaches a peak at about age 15-19 years, and subsequently drops off in young adulthood; but explaining why is still a matter of considerable debate. Moreover, the age-

crime curve belies an inherent heterogeneity in offending across individuals that is not captured by the bell-shaped trend. Last, an early age of onset is associated with a lengthy criminal career, though a precise explanation for the association has been elusive.

The collective effect of the DLC perspective has been to bring to the forefront important questions about changes and continuities in the pattern and nature of criminal behavior over time and about the dynamic processes that bring about this stability or change (Piquero, Farrington, & Blumstein 2003; Brame, Bushway, Paternoster, & Thornberry, 2005). These issues are of particular relevance to the chronic offender whose criminal career often begins at an early age and persists into adulthood. Representing about 5-10% of offender populations, chronic offenders are known to account for a large number of criminal convictions, commit serious and violent crimes, and pose considerable challenges to the criminal justice system (Piquero et al. 2003). Understanding their developmental trajectories and the causal mechanisms that influence the course of their offending could facilitate the development of more effective criminal justice policy and programs regarding incarceration, treatment, and rehabilitation.

Overlapping with the DLC approach, but also extending it in important ways (Farrington, 2005), is the criminal career paradigm. In their seminal two-volume work, Blumstein, Cohen, Roth, and Visher (1986) defined a criminal career as “the longitudinal sequence of offending committed by an individual offender” (p. 12) that is characterized during a lifetime by three components: an initiation or onset; a termination or end; and a duration or career length (Blumstein, Cohen, & Farrington, 1988). Criminal career research is concerned with how “careers are initiated, how they progress, and why they are discontinued” (Petersilia, 1980, p. 322). During their careers, offenders may display changes and continuities in criminal activity on various dimensions, including rate, type, timing, versatility, and severity. It is the pattern of

transition and stability on these sorts of variables across different developmental periods, as well as the underlying reasons for the observed patterns, that are of interest to researchers, theoreticians, practitioners, and policy makers (Barnett, Blumstein, & Farrington, 1987; Piquero & Mazerolle, 2001). For example, much has been learned from studies within a criminal career paradigm regarding changes by age in crime type (Steffensmeier, Allan, Harer, & Streifel, 1989), versatility (Britt, 1996; Lo, Kim, & Cheng, 2008; McGloin, Sullivan, Piquero, & Pratt, 2007), severity (Ramchand, MacDonald, Haviland, & Morral, 2009), and criminal career length (Elliot, Huizinga, & Morse, 1987; LeBlanc & Frechette, 1989; Piquero, Brame, & Lynam, 2004), as well as the stability of offending across major developmental periods (Day, Bevc, Duchesne, Rosenthal, Rossman, & Theodor, 2007; Paternoster, Brame, & Farrington, 2001; Piquero & Buka, 2002; Piquero, Brame & Moffitt, 2005). Recently, studies also have examined the dynamic interplay between criminal career dimensions such as offending frequency and offending diversity (Brame, Paternoster, & Bushway, 2004; Monahan & Piquero, 2009). Taken together, the DLC perspective and the criminal career paradigm have stoked a new generation of research on criminal behavior that addresses some fundamental questions in the field of criminology with a wider theoretical lens, a broader range of variables, and a more interdisciplinary framework (Thornberry, 2005).

Group-Based Trajectory Analysis: Making Sense of Heterogeneity

Parallel to the emergence of DLC theories and the criminal career paradigm has been the development of statistical tools that allow for the sophisticated analysis of longitudinal data (Nagin, 2005; Nagin & Land, 1993). Group-based trajectory analysis is a specialized application of finite mixture modelling that aims to parcel out underlying (unobserved) heterogeneity of within-individual trajectories of behavior into discrete subgroups or latent classes of common

pathways. In this way, trajectory analysis shares similarities with cluster analysis “but in trajectory space” (Maldonado-Molina et al., 2009, p. 177). Utilizing semiparametric mixed Poisson models, the procedure makes no specific assumptions about the distribution of the unobserved heterogeneity within the population (e.g., normal, gamma, log-normal) so that the parameters of the model are free to be estimated nonparametrically using maximum likelihood (D’Unger, Land, McCall, & Nagin, 1998). This is important, as “theory rarely will be strong enough to guide the specification of the distribution of the error term and that, even if theory were strong enough to do so, this choice may be incompatible with the data” (D’Unger et al., 1998, p.1600).

Furthermore, because of the nonparametric nature of the analyses, the number of trajectory groups and the form of the trajectories (i.e., linear, quadratic, cubic) must be specified prior to the analyses. Following estimation of the model parameters, each individual is assigned to a trajectory group based on the posterior probabilities associated with each latent class; the highest posterior probability suggests the class to which the person belongs. Finally, decisions about the optimal number of trajectory groups that best represent the data are conventionally based on the Bayesian Information Criterion (BIC) (Nagin, 1999, 2005).

Once individuals are sorted into discrete trajectory groups, a multinomial regression framework (or other statistical approach) may be applied to identify the best set of developmental predictors (e.g., risk and protective factors) that differentiates the groups. This approach has been referred to as a “classify/analyze” paradigm (Piquero, 2008; Roeder, Lynch & Nagin, 1999). Typically, childhood and adolescence variables reflecting various life domains (e.g., individual, family, peer, school, and neighborhood) are recorded, which are then subjected to analysis. Consistent with the DLC perspective, this research could potentially identify

common and specific factors that distinguish one trajectory group from another in an effort to uncover unique causal processes producing distinct patterns of offending over the life course. In other words, different trajectory groups may have distinctive etiological pathways that could be precisely identified through the classify/analyze approach (Osgood, 2005; van der Geest, Blokland, & Bijleveld, 2009). This research framework has important potential implications for the development of policy and programming within the juvenile justice system as well as for early intervention and prevention efforts provided outside the justice system.

The past decade has seen a tremendous growth in the number of longitudinal studies of criminal behavior that have used the classify/analyze paradigm. This research has greatly contributed to an understanding of the inherent heterogeneity underlying criminal behavior and the factors that distinguish among trajectory groups. However, much of this research has been conducted with either high risk or community samples rather than known offender groups. Reviewing studies with offenders is of theoretical and practical importance to underscore the factors that differentiate among subgroups of offenders rather than identify the factors that differentiate offenders from nonoffenders. If a primary goal of prevention and early identification is to target the highest risk children (Walsh & Farrington, 2007), research with known offenders may be the best way to point these programs in the right direction. Given that longitudinal studies that use offender samples are most relevant to the present investigation, this literature is reviewed below.

Previous Research

Four studies were found that used the classify/analyze approach with offender samples. In all cases, the samples were youthful offenders at the beginning of the study. Two were

conducted in the Netherlands (van Domburgh, Vermeiren, Blokland, & Doreleijers, 2009; van der Geest et al., 2009), one in New Zealand, (Livingstone, Stewart, Allard, & Ogilvie, 2008), and one in Canada (Yessine & Bonta, 2009).

van der Geest, Blokland, and Bijleveld (2009) followed the criminal activity of a sample of 270 male youth over an 18-year period, from early adolescence into adulthood. The youth had been sentenced to a juvenile justice facility in the Netherlands. Criminal data were based on official records obtained from the Ministry of Justice for all convictions accrued by the sample. Extensive personal and background information, including intelligence, sensation-seeking, social skills, alcohol and drug use, depression, ADHD, suicide attempts, delinquent peers, as well as parental psychopathology, criminal family members, and broken family, was extracted from clinical files. Trajectory analysis of counts of convictions by age, controlling for time-at-risk (Eggleston, Laub, & Sampson, 2004) was conducted using the Proc Traj macro (Jones, Nagin, & Roeder, 2001) in SAS. Results indicated that five trajectory groups best fit the data. These groups were labeled Adolescence Limited Serious (ALS), Low Frequency Desisters (LFD), Late Bloomers (LB), High Frequency Desisters (HFD), and High Frequency Chronics (HFC). The ALS, LGD, and HFD groups comprised 35.6%, 37.4% and 15.2% of the sample, respectively, and the LB and HFC groups each comprised 5.9% of the sample. Canonical correlations were conducted to identify the personal and background factors associated with the five trajectory groups. Results indicated that the ALS and LFD groups were characterized by birth complications, impulsiveness and hyperactivity, parental psychopathology, as well as some positive traits such as good social skills, an absence of drug use, and prosocial peer relations. The LB group was characterized by poor social skills, high daring behavior, low neuroticism, psychopathology, and early alcohol use. The HFC group was associated with criminal family

members, antisocial peer relations, and a history of suicidality. Last, the HFD group was associated with criminal family members, family unemployment, and poor moral insight.

Also using a sample of offenders from the Netherlands, van Domburgh, Vermeiren, Blokland, and Doreleijers (2009) followed-up over a five-year period the criminal activity of 287 boys. The boys were all under the age of 12 years at the time of the follow-up period (*M* age was 10 years) and all had had police contact as a result of committing an offense for which they could be held criminally responsible if they were 12 years or older. The criminal data included all offending behavior registered by the police. As periods of incarceration were rare in this sample, the data were not adjusted by time-at-risk. The background predictor variables included socio-demographics, neighborhood characteristics, and first offense characteristics and were gathered from various sources, including records from The Child Welfare Agency and the Dutch agency responsible for diversion programs. A trajectory analysis was performed with the Proc Traj macro (Jones et al., 2001) in SAS using both frequency of offending data and seriousness of offending data. However, for comparability across studies, only results for the frequency data are reported here. Analyses yielded three trajectory groups, a low-rate group (68.3%), an escalating group (24.7%), and a high rate group (7.0%). Using chi-square analyses to examine characteristics that differentiated the groups, contrary to expectation, the low frequency youth had an earlier age of onset of offending and were more likely to have a criminal family member than the escalating or high frequency youth. At the same time, the low frequency group was more likely to come from a higher SES family background. Despite these mixed results, compared with the other two groups, the high frequency youth were most likely to have subsequent contact with a child welfare agency as a result of experiencing abuse at home, suggesting that these youth were at risk for additional detrimental outcomes.

Livingstone, Stewart, Allard, and Ogilvie (2008) examined the criminal trajectories and predictors of trajectory group membership in a sample of 4,470 Australian males and females who had at least one criminal conviction as a youth (ages 10-16 years). Their criminal activity was followed-up for a period of 6 years and the data were based on official government records from the Department of Families and the Queensland Police Service for juvenile offenses and the Department of Justice and Attorney General for adult offenses. It was not specified whether the criminal count data were adjusted by time-at-risk. Predictor variables included socioeconomic status, remoteness of residence, sex, and Indigenous status. Group-based trajectory analysis, performed using the Proc Traj macro in SAS (Jones et al., 2001), yielded three groups, referred to as early-peaking moderate offenders (EPMO), late onset-moderator offenders (LOMO), and chronic offenders (CO). The EPMO, LOMO, and CO groups comprised 21%, 68%, and 11% of the sample, respectively. Multinomial regression analyses found that sex and Indigenous status distinguished the groups, such that, compared with the EPMO group, LOMO and CO offenders were more likely to be male and Indigenous.

In the only available Canadian-based study, Yessine and Bonta (2009) examined the criminal trajectories and predictors of trajectory group membership in a sample of 439 male juvenile offenders from the province of Manitoba. Just over half the sample were Aboriginals (53.5%) and the remainder were non-Aboriginal (46.5%). The criminal activity of the offenders was followed over a 19-year period. The data were derived from the RCMP's Criminal Records Branch (i.e., the Canadian Police Identification Centre [CPIC]). Predictor variables were coded by probation officers upon the youth's entry into supervision after conviction and reflected eight life domains: peer associates, family, education, criminal history, accommodation, financial management, substance use, and attitudes toward probation. The trajectory analysis was

performed using MPlus (Muthén & Muthén, 2006). The dependent variable, which controlled for time-at-risk, used a combination of seriousness and frequency information. Separate analyses were conducted for the Aboriginal and non-Aboriginal groups. Both sets of trajectory analyses yielded two groups, labeled Stable Low (81.3% and 87.7% for the Aboriginal and non-Aboriginal groups, respectively) and Chronic High (18.7% and 12.3% for the Aboriginal and non-Aboriginal groups, respectively). Binary logistic regression analyses were performed to identify the risk factors associated with offending trajectories. For the Aboriginal group, peer associates, family, and substance use differentiated the Chronic High trajectory group from the Stable Low trajectory group. For the non-Aboriginal group, only accommodation differentiated the Chronic High trajectory group from the Stable Low trajectory group. The greater number of identified risk factors for the Aboriginal group was attributed to the more impoverished backgrounds from which these youth came, which included a greater prevalence of family dysfunction and substance use and lower levels of parental monitoring and supervision.

The results of these studies are quite mixed in terms of both the number of trajectory groups identified, which ranged from two to five, and the predictors associated with trajectory group membership. As a result, drawing firm conclusions from this research is difficult and is complicated by the lack of consistency across studies on some methodological variables, such as sample size, sample characteristics, length of follow-up, and type of criminal data used. There was a similar lack of consistency in the types of predictor variables that were examined in relation to the trajectory groups. In some cases, the number of predictors entered into the analyses was quite limited and it was not always clear whether the predictors reflected childhood or adolescent variables. Nonetheless, despite these limitations, a number of conclusions may be drawn from the above-reviewed studies. First, high rate chronic groups, which comprised

between 6% and 13% of the offender samples, showed the worst risk factors. Second, with regard to specific predictors, parental criminality, family adversity, and antisocial peer associations in adolescence differentiated the high rate from low rate trajectory groups.

The Present Study

The present study builds on the above literature in a number of ways. First, the criminal data were tracked for an average of 12 years, extending from adolescence into adulthood. In this way, the trajectory groups covered a peak period for offending in adolescence and extended beyond, into early adulthood. Second, the study uses an offender sample, which affords the opportunity to sub-classify developmental trajectories with a group of childhood/adolescent onset offenders. As most studies are based on either high risk or general population samples, research with an offender sample makes an important contribution to the literature. Third, the study uses a Canadian-based group, adding data that are relevant to the Canadian experience. Last, a range of predictor variables, delineated as childhood and adolescent, was incorporated into the regression analyses selected on the basis of a comprehensive review of the literature on risk factors associated with the onset and maintenance of delinquency.

Method

Sample

The sample for this study comprised 378 male offenders who had been sentenced as youth, between 1986 and 1995, to one of two open custody facilities operated by a children's mental health centre in Toronto, Canada. This sample represents a 50% random selection of all youth at the two facilities during this period. The average age at admission was 17.6 years ($SD =$

.9) and the average sentence length was 124.6 days ($SD = 109.8$). For 26.7% of the sample, their admission into the youth home was not their first custodial (open or secure) placement.

Criminal Data

Official records for juvenile and adult offenses were obtained from the (Ontario) Ministry of Community and Social Services (MCSS), the (Ontario) Ministry of Correctional Services (MCS), the Canadian Police Information Centre (CPIC), and Predisposition Reports (PDR) from the client files maintained by the children's mental health agency. Four data sources were used to ensure a high degree of completeness and accuracy for the sequenced, longitudinal conviction data, which is essential for research that requires an accurate temporal sequencing of criminal convictions (Smith, Smith, & Norma, 1984). Although the use of official criminal records has been called into question (Dunford & Elliot, 1984), studies have reported a high degree of concordance between self-report delinquency and official records (Moffitt, Caspi, Dickson, Silva, & Stanton, 1996). As well, official records are appropriate for our purposes because they provide the requisite precision with regard to the timing and sequence of offending (Smith et al., 1984).

From these sources, counts by age of all their unique court contacts arising from a new set of charges¹ were recorded up until March 17, 2001, the end of the follow-up period. The criminal count data were adjusted for both time-at-risk (Eggleston et al., 2004) and an estimate of the offenders' age at offense rather than at court contact. For the age data, we modelled the time lag as a random unknown quantity, following an exponential distribution, whose mean value of 157.6 days was estimated from supplementary data obtained from the Metropolitan Toronto Police Service (MTPS) (see Day et al., 2007 for details on these adjustments).

Their criminal activity was tracked for an average of 12.1 years ($SD = 3.0$), from late childhood/early adolescence² into adulthood, with 73% of the sample being followed for 10 years or more. Their mean age at first conviction was 15.5 years ($SD = 1.8$) and the sample was 27.5 years ($SD = 2.6$) at the time of the most recent follow-up. The average trajectory length was 8.4 years ($SD = 4.5$). During the tracking period, the sample amassed a total of 4,964 court contacts, which amounted to an average of 13.1 court contacts.

Predictors

Personal and background information was extracted from client files maintained by the children's mental health centre that operated the open custody facilities. Of a possible 378 client files, 362 files were reviewed and coded. The remaining 16 files could not be located, possibly due to lost or incomplete files or an alternative storage location. Documents that were reviewed for coding included intake forms, PDRs, psychological and psychiatric reports and notes, discharge summaries, and other pertinent sources on file such as case notes, social work reports, and police synopses.

In order to differentiate the childhood (i.e., birth to 12 years) from adolescent (i.e., 13 to 19 years) variables, two sets of coding schemes were developed for this study, one for each developmental period. The coding schemes were designed to include as much relevant information from the client files as possible³. Selection of the variables was based on a comprehensive review of the theoretical and empirical literature and reflected four life domains: individual, family, peer, and school. These four areas were consistently found in the literature to be related to the onset and maintenance of antisocial and criminal behavior⁴ (Borum, 2000; Farrington, 2003; Farrington & Welsh, 2007; Hawkins, Herrenkohl, Farrington, Brewer,

Catalano, & Harachi, 1998; Leschied, Chido, Nowicki, & Rodger, 2008; Lipsey & Derzon, 1998; Loeber & Stouthamer-Loeber, 1998; Rutter, Giller, & Hagell, 1998; Thornberry, 2005).

In the individual domain, variables included low intelligence/poor academic achievement, hyperactivity-impulsivity-inattention, antisocial behavior, alcohol and/or drug use, callousness, lacks responsibility or accountability for bad behavior, health problems, low self-esteem, and extra-familial sexual abuse. In the family domain, variables included criminal family members, parental psychopathology, poor child-rearing methods, familial abuse, relationship difficulties among family members, broken home/family transitions (e.g., separation, divorce, change in caregivers), involvement with alternative care (e.g., institutional or foster care, child welfare), and biological mother was age 17 or younger at the time of childbirth. The school and peer domains included one variable each, poor regard for school (i.e., truancy, expulsions, suspensions) and poor peer relations (i.e., peer rejection, antisocial peer associates), respectively. While the childhood and adolescent coding schemes overlapped on most items, there were some areas of divergence. For example, only the childhood coding scheme included the item of whether the biological parent was under the age of 17 at the time of the offender's birth and only the adolescent coding scheme included the items concerning callousness and lacks responsibility for bad behavior. Coding for the predictors was dichotomous such that 0 = absent/unknown and 1 = present/suspected.

The coding was conducted by the first author who was unaware of the trajectory group membership assignments. Inter-rater reliability was conducted by two independent raters (AW and DD) on two separate occasions using a 20% random sample of files (11% at Time 1 and 9% at Time 2). Inter-rater reliability was found to be moderate to good with average kappas of .76

and .64 for the childhood variables at Time 1 and Time 2, respectively, and .76 and .59 for the adolescent variables at Time 1 and Time 2, respectively.

Data Analysis

The data analysis proceeded in three stages. First, using the SAS (Version 9.1) Proc Traj procedure of Jones et al. (2001), we fit the data to different latent class models with different numbers of K classes. A zero-inflated Poisson model was fitted to account for the relatively large number of zero court contacts in the data set. Our Poisson model was:

$$\log(\lambda_u^k) = \beta_0^k + \beta_1^k \text{Age}_{it} + \beta_2^k \text{Age}_{it}^2 + \beta_3^k \text{Age}_{it}^3$$

where the parameter λ_u^k is the predicted rate of court contacts for individual i at age t given membership in group k . The β parameters were estimated by the method of maximum likelihood under the assumption that, within the trajectory groups, the number of court contacts followed a Poisson process with rate parameter λ_u^k (Jones, Nagin & Roeder, 2001). Trajectory group membership was based on the highest individual posterior probability associated with each trajectory group. Determining the optimal number of groups was based either on the conventional method of selecting K groups that corresponds to the largest BIC value (i.e., the least negative) or a novel method that employs a cross-validation error (CVE) criterion (Day et al., 2007; Sun, Rosenthal, Nielsen, Day, Bevc, & Duchesne, in preparation). It is known that the BIC provides a somewhat problematic solution to the number of groups issue (Nagin, 2005); an alternative method, minimizing the CVE, provides a clearer solution for determining the number of K groups that best represent the data.

Next, given the large number of predictor variables, a two-step approach was taken to eliminate variables for entry into the multinomial regression analyses. First, predictors were

excluded that had either a base rate of 10% or less or zero cell counts across the trajectory groups. Second, following the procedure outlined by Hosmer and Lemeshow (2000), each of the remaining predictors was entered into a univariate multinomial regression analysis to assess its appropriateness in the model. This was done by examining the impact of the presence and absence of each predictor on the overall goodness-of-fit and chi-square Likelihood Ratio Test (LRT) statistic. A variable was retained if the corresponding chi-square LRT statistic was statistically significant at $p < .25$ (Hosmer & Lemeshaw, 2000). Lastly, backward stepwise multinomial logistic regression analyses were performed on the final set of background variables to determine the relationship between the best combination of predictors and the trajectory groups. Backward stepwise regression is a useful procedure when important predictors have not been identified and when the association between the predictors and outcome variables are not well understood (Hosmer & Lemeshow, 2000). As well, the stepwise approach provided an effective method for creating the most parsimonious models for each set of predictors. SPSS 16.0 was used for the regression analyses.

RESULTS

Criminal Trajectories

As shown in Table 1, the BIC and AIC values continued to increase as the number of groups increased. Hence, the BIC and AIC criteria both suggest at least a six-group model and probably even more groups (if we could do the relevant computations). However, the CVE was minimized for the four-group model. Therefore, the cross-validation criterion clearly recommends choosing $K=4$. Once we fix $K=4$, we can then identify the most likely probability-based group membership for each subject. Criminal trajectories for the four-group model are

graphed in Figure 1. The mean posterior probability coefficients were quite high across all four groups, exceeding .94, indicating that the model had little ambiguity when making group assignments.

Table 1 about here

Figure 1 about here

As shown in Figure 1, the trajectory analyses yielded four groups labeled heuristically as follows: Moderate Rate (MR), comprising 21.7% of the sample; Low Rate (LR), comprising 65.1% of the sample; High Rate, Adult-Peaked (HRADL), comprising 7.7% of the sample; and High Rate, Adolescence-Peaked (HRADOL), comprising 5.6% of the sample. To examine mean differences across the four trajectory groups on various criminal career dimensions, multivariate and univariate analyses of variance were performed. As shown in Table 2, the LR group had the shortest criminal career, lasting, on average, 6.7 years. Their average age at first court contact was 15.9 years and the average age at last court contact was 22.5 years. The MR and HRADL groups had the longest criminal careers, lasting, on average, 12.0 years and 12.1 years, respectively.

Not surprisingly, individuals following the HRADL trajectory incurred the most (corrected) court contacts ($M = 84.7$) and the LR group incurred the fewest (corrected) court contacts ($M = 9.3$) (not shown in Table 2). However, the HRADOL group incurred the most (corrected) court contacts in adolescence ($M = 21.5$). Likewise, the HRAD group incurred the

most (corrected) court contacts in adulthood ($M = 73.3$). With regard to specific types of offenses, the HRADL committed the largest number of property and violent offenses, though post hoc tests (Scheffe) revealed that they did not differ significantly from the HRADOL group.

Table 2 about here

Multinomial Regression Analyses

Childhood Model. Table 3 presents the results of the multinomial logistic regression analysis for the childhood variables. After eliminating variables based on the aforementioned criteria, four predictors were entered into the model: antisocial behavior, relationship difficulties, broken home/family transitions, and involvement with alternative care. The Low Rate (LR) group served as the reference category. The overall model was significant ($\chi^2(6) = 20.14, p = .003$) with broken home/family transitions and involvement with alternative care significantly contributing to the model. The proportion of variance in trajectory group membership, as measured by the Nagelkerke pseudo R^2 statistic, was 6.3% and the classification accuracy of the model 64.6%. Offenders who experienced a broken home/family transitions were more likely to be classified to the MR trajectory group than offenders who came from an intact family (OR = 1.82, $p < .05$, 95% CI = 1.03 – 3.22), compared to the LR group. As well, when the offenders had been involved in alternative care, they were more likely to belong to either the HRADL group (OR = 3.14, $p < .05$, 95% CI = 1.33 – 7.39) or the HRADOL group (OR = 3.82, $p < .05$, 95% CI = 1.40 – 10.49), as those who had not been involved in alternative care, compared to the LR group.

Table 3 about here

Adolescent Model. The results for the adolescent model are presented in Table 4. After eliminating variables that did not meet criteria for the analysis, seven predictors were entered into the model: hyperactivity-impulsivity, criminal family members, familial abuse, broken home/family transitions, involvement with alternative care, poor peer relations, and poor regard for school. The Low Rate (LR) group served as the reference category. The backward stepwise procedure generated a significant model ($\chi^2(15) = 43.12, p = .001$) comprising the following predictors: criminal family members, familial abuse, broken home, involvement with alternative care, and poor peer relations. The Nagelkerke pseudo R^2 statistic showed that the proportion of variance in trajectory group membership accounted for by these variables was 13.1%, and the overall classification accuracy of the model was 65.2%.

Table 4 about here

In the presence of criminal family members, offenders were more likely to belong to the MR group (OR = 2.83, $p < .01$, 95% CI = 1.37 – 1.5.87), the HRADL group (OR = 3.09, $p < .05$, 95% CI = 1.08 – .8.82), or the HRADOL group (OR = 4.51, $p < .05$, 95% CI = 1.39 – 14.62), as those who had no criminal family members, compared to the LR group. When offenders had involvement with alternative care, they were more likely to be classified to the HRADL group (OR = 2.38, $p < .05$, 95% CI = 1.03 – 5.53) or the HRADOL group (OR = 2.76, $p < .05$, 95% CI = 1.03 – 7.37), as those who had not experienced alternative care, compared to the LR group.

The presence of poor peer relations decreased the likelihood of belonging to the MR group (OR = .50, $p < .05$, 95% CI = .30 – .86) or the HRADOL group (OR = .38, $p < .05$, (95% CI = .15 – 1.00), as those who had not experienced poor peer relations, compared to the LR group. As well, offenders were less likely to belong to the HRADL group (OR = .12, $p < .05$, 95% CI = .02 – .94) when familial abuse occurred, as those who had not experienced familial abuse, compared to the LR group. Last, when youth experienced a broken home/family transitions, they were less likely to belong to the HRADOL group (OR = .26, $p < .05$, 95% CI = .07 – .95), as those who came from an intact family, compared to the LR group.

Discussion

The aims of this study were to identify the criminal trajectories and childhood and adolescent predictors of trajectory group membership in a Canadian sample of offenders whose criminal activity was tracked from late childhood/early adolescence into adulthood. The results of the trajectory analysis reflected the underlying heterogeneity of the sample and yielded four trajectory groups, a moderate rate group, a low rate group, a chronic and high rate group whose offending pattern peaked in adulthood, and a high rate group whose offending pattern peaked in adolescence. While it is not surprising that the low rate group had the shortest criminal career and committed the fewest offenses, it is surprising that they comprised the vast majority of the sample. Even within this juvenile offender sample, nearly two thirds desisted their offending within six years, on average, of onset. Similarly, van der Geest et al. (2009) found that three quarters of their offender sample were identified as low rate offenders. These findings reflect the limited time involvement in criminal activity that can be expected from the majority of individuals involved in antisocial and delinquent behavior. What accounts for the desistance, however, remains a question for further study. Some research suggests that life course events

such as completion of high school (Natsuaki, Ge, & Wenk, 2009) and marriage to a prosocial partner, employment, or involvement in military service (Sampson & Laub, 2005) may be contributing factors.

At the other end of the trajectory spectrum, about eight percent of the sample persisted in their offending into adulthood and committed offenses at a very high rate. These individuals represent the chronic offenders, such as those identified in the birth cohort studies of Wolfgang (Wolfgang, Figlio, & Thorsten, 1972) and whose developmental pathway, as life-course persisters (LCP), was described by Moffitt's (1993) dual taxonomy theory. Efforts need to be made toward the early identification and prevention of individuals at risk for a serious and protracted criminal trajectory.

Third, comprising the second largest group in the sample, the moderate rate offenders represent an interesting and perhaps challenging subgroup for the justice system, largely because of their persistence in offending. While not committing offenses at a high rate, these individuals appear to be holding firm to their active involvement in a criminal lifestyle. This may be the result of being "stuck" in a situation from which they cannot easily extricate themselves, perhaps due to the presence of such psychosocial problems as substance use and abuse (this group did have the largest average number of drug offenses), low level of social support, maladaptive coping, and so forth, rather than to a hardened commitment to a criminal lifestyle. Interestingly, Monahan and Piquero (2009) also found substance abuse to be associated with a moderately chronic offense trajectory. As such, this group may be a prime target for treatment interventions and rehabilitation programming by the justice system. However, this hypothesis is in need of further investigation. Last, the high rate adolescent-peaked group represents another interesting and somewhat unique group compared to other trajectory analysis studies. This group showed a

very high rate of offending during adolescence, which declined sharply in early adulthood. Our continued follow-up of this sample may shed light on the observed pattern of desistence of this group.

These findings accord with the results of other longitudinal studies. For example, the Cambridge Study in Delinquent Development (CSDD) (Piquero, Farrington, & Blumstein, 2007), which followed 411 high risk males to age 40 years, yielded five groups, four of which showed a similar pattern in the shape (but not the distribution) to the present study (the fifth group comprised 62.3% of the sample and consisted of nonoffenders). The four groups and their distributions, corresponding to the four trajectory groups yielded in the present sample (i.e., MR, LR, HRADP, HRADOP) were Very Low Rate Chronics (11.3%), Low Adolescence Peaked (18.6%), High-Rate Chronics (2.5%), and High Adolescence Peaked (5.4%). Both studies provide evidence in support of Moffitt's (1993) two-group developmental taxonomy of an adolescent limited group and a high rate stable offender group. At the same time, identification of other trajectory groups suggests that more than two groups are needed to round out the heterogeneity picture of offense trajectories.

A second aim of the study was to identify the developmental precursors associated with specific trajectory groups. Identifying childhood and adolescent predictors of criminal trajectories has both theoretical and practical implications. If certain risk and protective factors could be consistently identified across studies with different sample characteristics, that also have theoretical links to offending outcomes, these factors should be targeted early in the life course. Moreover, as Farrington (2007) noted, common risk factors tend to be associated with different deviant and/or negative outcomes, including property and violent offending, alcohol and drug use, and early school failure and dropout. Therefore, prevention efforts that

successfully mitigate the influence of a risk factor have the potential to reduce the likelihood of a range of psychosocial problems and maladaptive outcomes.

Among the childhood variables, two family factors differentiated the moderate and high rate groups from the low rate group. It should not be surprising that experiencing a broken home/family transitions and involvement in alternative care emerged as significant predictors of trajectory group membership as other studies also have found a relationship between family disruption and delinquency (e.g., Krohn, Penly Hall, & Lizotte, 2009). In a review of the literature, Rodgers and Pryor (1998) reported that the risk of delinquency was twice as high for children from a broken home than for children from an intact home. Life-course theories explain the association by considering family separation as a series of stressful events that may include marital conflict, loss of a parent, compromised economic circumstances, changes in parental figures, and poor family management practices (Krohn et al., 2009). Empirical support for a life course perspective was provided by Juby and Farrington (2001). In their study, boys from a broken home engaged in a greater amount of delinquency than boys from an intact home and boys who lived with their mothers after parental separation had the same delinquency rate as boys from intact low-conflict families. In addition, as the number of parental transitions increased (e.g., death of a parent, change in caregivers), so did the rate of delinquency.

From a developmental perspective, early stressors as a result of family breakdown may result in a disruption of normative developmental processes for the child, including a failure to achieve normative developmental tasks, such as experiencing success in school, learning to engage in socially appropriate conduct, and forming positive peer relations (Masten & Coatsworth, 1998). The cumulative effects of these perturbations in normative developmental pathways could contribute to the individual experiencing as a challenge the transition from one

developmental period to the next. This shortcoming may serve to maintain and perpetuate a range of maladaptive outcomes well into adolescence and beyond. Of course, not all children from a broken home or who experience family transitions become a juvenile delinquent. Therefore, the role of protective factors in reducing the risks associated with family transitions also should be investigated. As well, developmental pathways are malleable and it may be expected that appropriately targeted early intervention and prevention programs could offset the deleterious effects of negative family experiences for the child.

The finding that involvement in alternative care predicted trajectory group membership is consistent with many studies that show that youth involved in child welfare are at high risk for involvement with the juvenile justice system (Leschied et al., 2008; Nicol, Stretch, Whitney, Jones, Garfield, Turner, & Stanion, 2000; Ryan & Testa, 2005). However, our study extends this finding further to suggest that such youth are at risk not just for involvement with the justice system but for a lengthy and protracted criminal trajectory that also involves a high rate of offending. In Ontario, the term “crossover kids” has been applied to the disproportionate number of youth who transition from the child welfare system to the juvenile justice system (Finlay, 2003). Problems lie in the lack of social support services to address the complex needs of these young people. Additionally, instability within the child welfare system, such as experiencing changes in case workers or having multiple out-of-home placements, places children and youth at further risk of delinquency. Indeed, experiences of displacement, trauma, and loss associated with loss of family, loss of peers, and loss of home, permeate the lives of these young people (Finlay, 2003).

Among the adolescent variables, the presence of criminal family members was associated with the moderate and high rate offending groups. This factor emerged in both the van der Geest

et al. (2009) and van Domburgh et al. (2009) study, though in the latter, contrary to expectation, it was associated with low rate offending. Family criminality, as well as a positive familial attitude toward crime, has been the subject of considerable research recently (e.g., Bijeveld & Farrington, 2009) and has been shown to increase the risk of delinquency among adolescents (Baker & Mednick, 1984; Farrington, 1989). This relationship has been shown to be particularly strong for mothers and fathers who have frequent and ongoing contact with the child (Thornberry, Freeman-Gallant, & Lovegrove, 2009). Henggeler (1989), however, noted that the effects may be more indirect than direct. While modeling antisocial and aggressive behavior is likely a part of the offspring's socialization process, criminal parents rarely involve their children in their offending. Henggeler suggests that criminal parents have interpersonal and cognitive deficits and experience high levels of stress that undermine their parenting practices. The delinquent behavior of the adolescent may be related to ineffective parenting and poor relations between the parent and youth.

Involvement with alternative care in adolescence also was associated with high rate offense trajectories. However, it is likely that this factor represents a continuation of involvement into adolescence from childhood rather than the introduction of a new risk factor during adolescence. For example, 74.5% of the present sample who were involved in alternative care during childhood continued to be involved in alternative care during the adolescent period. The percentages for the HRADL and HRADOL groups, respectively, were 88.9% and 100% and about 70% each for the MR and LR groups. In light of this significant risk factor, the influence of criminal family members might also be accounted for by the criminal activity of siblings.

Last, although they showed a low rate of time-limited offending, individuals in the LR group were not immune from the presence of risk factors. During adolescence, these individuals

were more likely to have experienced poor peer relations, familial abuse, and a broken home/family transition. The finding that poor peer relations predicted low rate offending is consistent with Moffitt's (1993) adolescent-limited (AL) group. However, the latter two findings are not. Research has found that child maltreatment occurring before age 18 is a risk factor for general maladaptive outcomes (Smith & Thornberry, 1995; Zingraff, Leiter, Myers, & Johnsen, 1993). In a review of the literature, Leschied et al. (2008) concluded that, in general, risk factors measured in adolescence are strong and reliable predictors of adult offending, while predictors occurring in childhood were weaker predictors. Leschied et al. reported that family structure variables, including parental separation, marital status, and child welfare involvement, were particularly strong predictors when they occurred in adolescence.

It was somewhat surprising that none of the variables in the individual domain, such as low intelligence, early onset for antisocial behavior, and impulsivity, was identified as a significant predictor in spite of the strong association these risk factors have with adult criminality (Leschied et al., 2008). Perhaps, while associated with offending, in general, these variables lacked sufficient explanatory power to differentiate among trajectory groups. In other words, individual risk factors may have characterized many of the individuals in the sample without showing a differential pattern across the four criminal trajectory groups.

Policy and Practice Implications

From a developmental perspective, the factors that give rise to the onset of antisocial and delinquent behavior will be different than the factors that maintain the behavior (Piquero, 2008). For example, for those with an early onset for antisocial and delinquent behavior, childhood risk factors, such as those identified in the present study, may lead to the onset of the behavior and

adolescent risk factors may serve to maintain the behavior. Therefore, for maximum impact, intervention and prevention programs should be targeted toward the specific factors that either give rise to or maintain the behavior and be provided during the developmentally appropriate periods of the life course. Based on the findings of the present study, and addressing the predictors of a protracted criminal career (i.e., the MR and HRADL groups), focusing on family factors in childhood, such as family breakdowns, family transitions (e.g., frequent moves), and other disruptions associated with involvement in child welfare, may interrupt the development of the deviant behavior before it begins, or at least delay its development until later, whereas focusing on criminal family members and continued involvement in child welfare during adolescence may address the factors that perpetuate the behavior after it has emerged. Among the low rate offender trajectory, addressing their needs may involve focusing on poor peer relations and family problems in adolescence.

Additionally, the results of the present study suggest that the particular type and intensity of interventions that are applied to an individual would depend on the particular criminal trajectory group to which the individual belongs. Based on the risk, need, responsivity (RNR) principles of Andrews and Bonta (2007), high intensity services would be applied to individuals in the moderate and high rate trajectory groups and low intensity services would be applied to individuals in the low rate trajectory group, in keeping with their criminogenic and responsivity factors .

Study Limitations

Ideally, programs and policies should be empirically-based and theory-driven. However, a limitation of the trajectory methodology is the absence of theory to guide analyses and

interpretation of study findings (Lo et al. 2008). As a result, research results tend to be more exploratory and atheoretical, resulting in “a gap between theory and research” (Osgood, 2005, p. 202). What is needed is experimental research on the effectiveness of prevention and early interventions on targeted risk factors. As well, there is a need for evaluations of the DLC models to test predictions about the causal links between predictor variables and criminal outcomes (Farrington, 2007). At the same time, DLC research can play an important role in informing the development of prevention and early intervention programs by specifying mechanisms of risk and protective factors for children on a developmental pathway towards a lengthy, protracted, and high rate criminal trajectory.

Several limitations of the study methodology should be noted. First, the predictor variables were coded as either “Yes/Suspected” or “Unknown.” Whether a factor was absent because the youth had not experienced it or because the factor was not mentioned in the documents on file could not be confirmed. Second, information on the sample’s demographic characteristics, such as socioeconomic status and ethnicity, was not available in the files. Blumstein et al. (1986) noted that demographic factors, including age, ethnicity, and sex, have strong relationships to participation in crime but are weakly associated with individual crime frequency. Therefore, statistically controlling for demographic variables may result in a loss of effects of risk factors. The above limitations notwithstanding, the present study contributed to the literature on trajectory analyses of criminal offending by identifying childhood and adolescent risk factors associated with trajectory group membership in a Canadian-based sample of offenders.

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Footnotes

¹Unique court contacts included those that resulted in a conviction and disposition (e.g., secure or open custody, fine, etc.), including a suspended sentence; those that resulted in a finding of guilt but not a conviction (e.g., absolute or conditional discharge); and those that resulted in either a withdrawal of charges, stay of proceedings, or determination that the person was unfit to stand trial (e.g., due to cognitive competence). These latter types of court contacts, which involved neither a finding of guilt nor a conviction, only accounted for 5.7% of the total number of court contacts. Last, for 9.7% of the court contacts, the final status in the Ministry's records was "remand," and, as such, no specific outcomes were available.

²Offenses committed under the age of 12 years were charges that occurred under the Juvenile Delinquents Act (JDA), for which the minimum age of criminal liability was 7 years.

³The coding schemes include both risk and protective factors. However, due to a low rate of occurrence among the protective factors, these variables were dropped from the analyses and so are not reported on here.

⁴While neighborhood factors (e.g., high crime neighborhood) also have been consistently found to be related to later offending, this type of information was not available in our client file data sources.

Table 1

BIC, AIC, and CVE Values for Number of Trajectory Groups

No. of Groups	BIC	AIC	CVE
2	-9696.10	-9635.16	.9209227
3	-.9271.24	-.9231.89	.8940834
4	-.9138.49	-.9085.37	.8543107
5	-.9023.55	-.8956.66	.8636708
6	-.8948.43	-.8867.77	.8605368

Table 2

Multivariate and Univariate Mean (SD) Comparison Tests Across Four Trajectory Groups

Variable	Trajectory Group				Multivariate F (df)	η^2	Univariate F (df)
	MR (n = 82)	LR (n = 246)	HRADL (n = 29)	HRADOL (n = 21)			
Age at First/Last Court Contact					24.6** (6,748)	.17	
Age at First Court Contact	15.1 _a (1.8)	15.9 _b (1.6)	14.5 _{ac} (2.2)	14.3 _{ac} (1.2)			12.7** (3,374)
Age at Last Court Contact	27.1 _a (2.7)	22.5 _b (3.5)	26.6 _a (3.2)	24.1 _b (3.4)			45.3** (3,374)
Criminal Career Length in Years	12.0 _a (3.1)	6.7 _b (4.0)	12.1 _{ac} (3.4)	9.8 _{ac} (4.0)			52.3** (3,374)
Total No. Court Contacts (Corrected) in Adolescence/Adulthood					132.31** (6,748)	.51	
Adolescence	7.6 _a (5.4)	4.5 _b (3.5)	11.4 _c (9.0)	21.5 _d (10.0)			86.2** (3,374)
Adult	23.6 _a (10.7)	4.8 _b (4.0)	73.3 _c (30.0)	35.0 _d (20.0)			382.4** (3,374)
No. of Offenses					17.81** (18,1113)	.22	
Property ¹	14.4 _a (7.3)	4.8 _b (4.0)	20.8 _c (11.4)	17.2 _{ac} (8.7)			53.7** (3,374)
Violent	7.4 _a (5.2)	3.2 _b (3.1)	11.4 _c (6.8)	9.7 _{ac} (6.3)			112.4** (3,374)
Drug	2.2 _a (3.1)	.67 _b (1.3)	1.8 _a (2.7)	1.9 _{ab} (2.6)			13.7** (3,374)
Sex	.5 (1.2)	.5 (1.0)	.4 (.9)	.4 (.8)			.11 (3,374)
Breach	7.4 _a (4.0)	2.6 _b (2.5)	9.0 _{ac} (5.1)	10.2 _c (6.0)			80.3** (3,374)
Other	4.0 _a (3.2)	1.0 _b (1.6)	4.8 _a (3.7)	4.6 _a (3.7)			54.5** (3,374)

¹Note: Property offenses include arson, break and enters, and theft; violent offenses include murder, robbery, and assault; drug offenses include trafficking and possession; sex offenses include sexual assault and invitation to sexual touching; breach offenses include failure to abide by conditions of probation, and escape lawful custody; other offenses include obstruction of justice and driving dangerously.

All values in rows with different subscripts are significantly different from each other at the .05 level.

** p < .001.

Table 3

Backward Stepwise Analysis of Trajectory Group Membership as a Function of Childhood Predictors (Reference Group is the Low Rate Trajectory Group).

Comparison	Criminal Predictor	B	SE	Odds Ratio	Wald
MR ^a vs. LR ^b	Broken home or family transitions	.60	.29	1.82	4.22*
	Involvement with alternative care	.16	.28	1.17	.30
	Intercept	-1.50	.23		43.84
HRADL ^a vs. LR ^b	Broken home or family transitions	-.04	.44	.96	.01
	Involvement with alternative care	1.14	.44	3.14	6.85*
	Intercept	-2.62	.36		53.61
HRADOL ^a vs. LR ^b	Broken home or family transitions	-.81	.51	.45	2.49
	Involvement with alternative care	1.34	.52	3.82	6.74*
	Intercept	-2.70	.38		49.37

Note. ^aMR = Moderate rate offender group. ^bLR = Low rate offender group. ^cHRADL = High rate adult-peaked offender group. ^dHRADOL = High rate adolescence-peaked group.
* = $p \leq .05$, ** = $p \leq .01$.

Table 4

Backward Stepwise Analysis of Trajectory Group Membership as a Function of Adolescent Predictors (Reference Group is the Low Rate Trajectory Group).

Comparison	Criminal Predictor	β	SE	Odds Ratio	Wald
MR ^a vs. LR ^b	Involvement with alternative care	.25	.28	1.28	.81
	Familial abuse	-.67	.42	.51	2.56
	Criminal family members	1.04	.37	2.83	7.86**
	Broken home or family transitions	.30	.28	1.35	1.14
	Poor relations with peers	-.69	.27	.50	6.43*
	Intercept	-.99	.25		15.96
	HRADL ^a vs. LR ^b	Involvement with alternative care	.87	.43	2.38
Familial abuse		-2.12	1.05	.12	4.07*
Criminal family members		1.13	.54	3.09	4.45*
Broken home or family transitions		.51	.42	1.66	1.48
Poor relations with peers		-.54	.41	.58	1.73
Intercept		-2.45	.42		33.59
HRADOL ^a vs. LR ^b		Involvement with alternative care	1.02	.50	2.76
	Familial abuse	-1.57	1.08	.21	2.11
	Criminal family members	1.51	.60	4.51	6.31*
	Broken home or family transitions	-1.35	.66	.26	4.13*
	Poor peer relations	-.97	.49	.38	3.84*
	Intercept	-2.23	.43		26.30

Note. ^aMR = Moderate rate offender group. ^bLR = Low rate offender group. ^cHRADL = High rate adult-peaked offender group. ^dHRADOL = High rate adolescence-peaked group.

*= $p \leq .05$, **= $p \leq .01$.

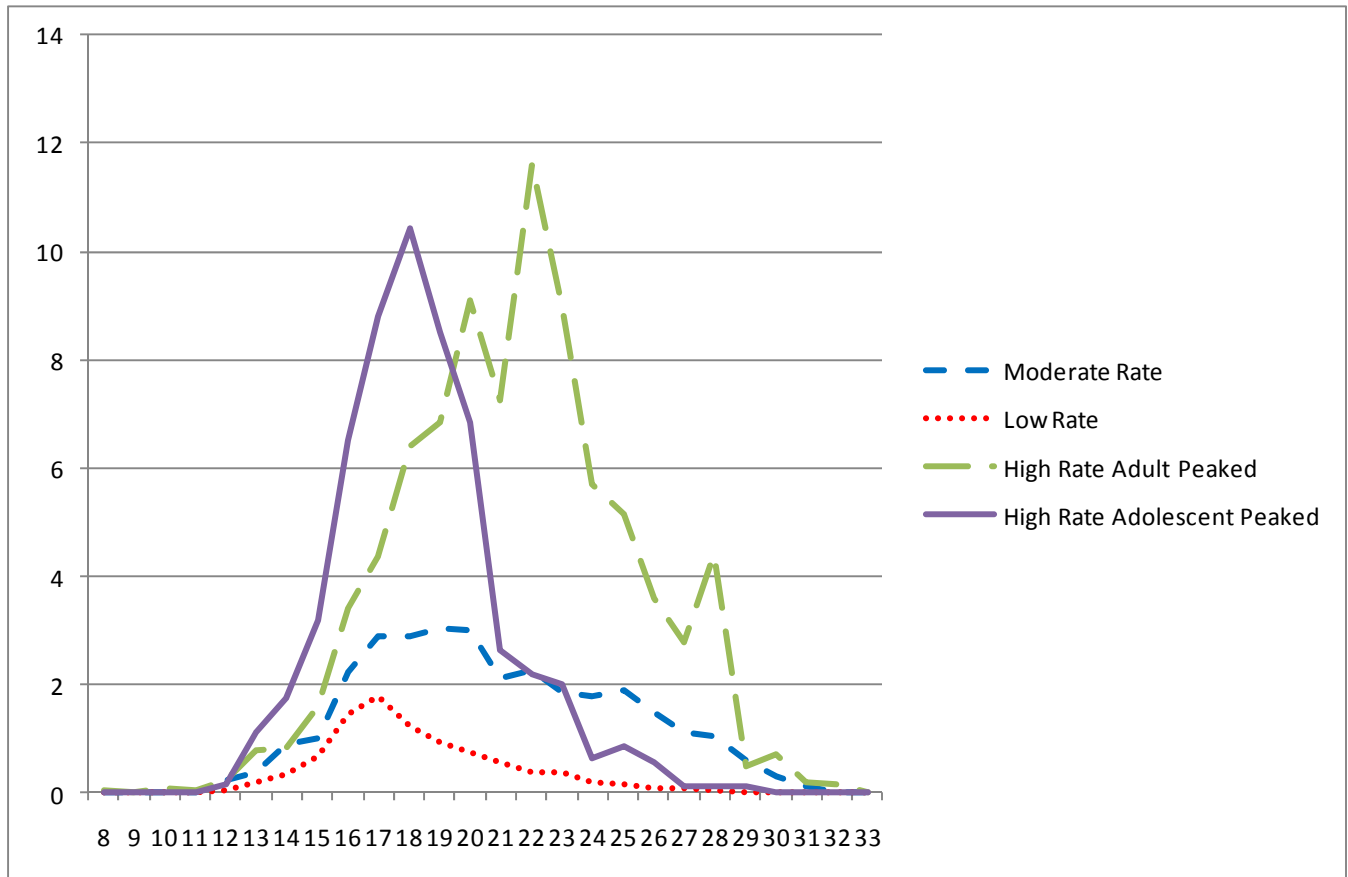


Figure Caption:

Figure 1: Criminal Trajectories for Four-Group Model