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IDENTIFYING GENDERED TRAJECTORIES OF OFFENDING FOR A PANEL OF  
FIRST TIME YOUTH OFFENDERS: EXPLORING THE INFLUENCE  
OF TIME-STABLE COVARIATES

by

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A DISSERTATION

Submitted in partial fulfillment of the requirements  
for the degree of Doctor of Philosophy  
in the School of Social Work  
in the Graduate School of  
The University of Alabama

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## ABSTRACT

Gendered trajectories of juvenile offending over an eight year observation period are specified for a retrospective longitudinal sample of 15,959 female and male first time offenders up to age 18 in a southeastern state. Semiparametric group modeling is used to specify offending trajectories for a response variable operationalized as a frequency count of unique complaints by age. Time-stable psychosocial and systems-level covariates are also investigated as predictors of likely trajectory group membership. The probability of trajectory group membership is investigated as a predictor for secure incarceration.

Results specify a three-solution model for juvenile females and a six-solution model for juvenile males. Prior child maltreatment – substantiated as well as alleged but dismissed - is a predictor of moderate- to higher-level offending across all gendered trajectories (with the exception of one higher-level but decreasing male trajectory). Living in a blended family (mother plus stepfather or father plus stepmother), living with grandparents, and living with relatives at first offense are all correlated with moderate -level offending for male juveniles. Living in foster care at first offense is a predictor for both lower-level and higher-level female offending. Both the three-solution female model and the six-solution male model predict incarceration.

Further research is warranted to investigate severity of offending as a response variable for the juvenile offending trajectories identified in the dissertation study.

## DEDICATION

This dissertation is dedicated to the G.R.O.W.T.H. girls and staff. I will remember you.

## LIST OF ABBREVIATIONS AND SYMBOLS

BIC	Bayesian information criterion
CI	Confidence interval
$H_0$	Null hypothesis, hypothesis under test
$n$	Number of cases (in a subsample)
$N$	Total number of cases
$p$	Probability associated with the occurrence under null hypothesis of a value as extreme or more extreme than the observed value
$P^j(Y_i)$	Represents the probability of $Y_i$ given membership in group $j$
$\beta$	The model's coefficients - $\beta^j_0$ , $\beta^j_1$ , and $\beta^j_2$ - determine the shape of the trajectory and are superscripted by $j$ to denote that the coefficients are not constrained to be the same across the $j$ groups
$\lambda^j_{it}$	Is the expected number of occurrences of the event of interest (e.g., juvenile complaints) of subject $i$ at time $t$ given membership in group $j$
$\pi_j$	Represents the probability of membership in group $j$
<	Less than
>	Greater than
=	Equal to

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## **I. Introduction**

### **The Problem**

Recent studies have documented the negative health and mental health impacts that juvenile justice involvement has on child and youth well-being (Gatti, Tremblay, & Vitaro, 2009; Huizinga, Schumann, Ehret, & Elliott, 2004; Mendel, 2007; Thornberry, Huizinga, & Loeber, 2004). The existing system exacerbates the disruption of adolescent development; fails to identify and respond to correlated mental health and psychosocial problems of court-involved youth; contributes to escalated offending for low- and medium-risk youth offenders who experience unnecessary incarceration, and; is largely unsuccessful in ameliorating antisocial behavior among serious youth offenders (Andrews & Bonta, 2006; Mendel; Thornberry et al.). A recent study indicated that these iatrogenic effects increased in direct proportion to increasingly restrictive sanctions and placements, and that these sanctions were disproportionately applied to youth living in poverty – regardless of the severity of first offense (Gatti et al.). System-generated responses to youth offending further disrupted already precarious youth development and well-being, and greatly increased the likelihood of adult offending and incarceration (Gatti et al.; Thornberry et al.). Using empirical data to strengthen risk assessment and case planning at first juvenile intake is one important strategy for improving the juvenile justice system in the United States.

### **The Issue Being Investigated**

Identifying grouped patterns of offending and correlated risk profiles for subgroups of youth offenders provides essential data for empirically distinguishing between low-, medium-,

and high-risk first time youth offenders. Such trajectory modeling studies lay the groundwork for future juvenile justice assessment technology reform and targeted case planning, as we consider not merely the initial offense, but the likely pattern of future offending. This is important because the future development of empirically informed “first contact” assessment instruments for juvenile intake has the potential to strengthen juvenile justice practice by: 1) avoiding unnecessary system penetration for low- and even medium-risk youth, and; 2) targeting limited resources so that practitioners can implement evidence-based practice interventions with high-risk first time youth offenders early in the cycle of serious or chronic juvenile offending, rather than later, when expensive and all too often ineffective incarceration is the only sentencing option.

Analysis of time-stable indicators present at first offense adds a psychosocial component to trajectory modeling. Initial status covariates that are easily identifiable at first offense intake are particularly useful tools in distinguishing low- from high-risk youth offenders, and can also provide intervention targets for case planning. Exploring trajectory group membership as a predictor for incarceration also provides valuable data for guiding the effective allocation of limited resources within juvenile justice practice (Yessine & Bonta, 2008). For example, incarcerating low-risk youth may not only be an ineffective use of scarce resources, but may also escalate the empirically documented iatrogenic effect of system penetration (Gatti et al., 2007). Considered together, a better understanding of these dimensions of offending provides valuable information for the future development of data driven, gender-specific assessment instruments designed to identify the programming and treatment needs of first time youth offenders.

Several recent studies identified latent classes of offenders across the adolescent, teen, and adult years (Blokland, Nagin, & Nieuwebeerta, 2005; Chung, Hill, Hawkins, Gilchrist, &

Nagin, 2002; D'Unger, Land, & McCall, 2002; Wiesner, Capaldi, & Kim, 2007; Yessine & Bonta, 2008); however, “the actual number and type of distinct offending trajectories is still somewhat unsettled” (Yessine & Bonta, p. 4). For the most part, females continue to be under-represented in trajectory studies, and there are calls in the literature for more longitudinal studies with substantial sample sizes of females to identify patterns of offending among this sub-group of youth offenders (D'Unger et al.; Tremblay et al., Hawkins, Graham, Williams, & Zahn, 2009; Thornberry, Lizotte, Krohn, Smith, & Porter, 2003; Yessine & Bonta).

### **Purpose**

The goal of this dissertation study is to fill gaps in our current knowledge of grouped patterns of offending among female and male youth offenders. Trajectory model specification examines official court complaint data for a retrospective longitudinal panel of 15,959 male and female first time youth offenders from a southeastern state. The heterogeneous age panel first offended in the year 2000, and is followed through 2007 to specify gendered offending trajectories. Analysis identifies initial status (time-stable) covariates of trajectory group membership present at first offense. Time incarcerated is accounted for to avoid over-representing youth who would appear in the data to desist from offending during the observation period, but are actually incarcerated (Blokland et al., 2005). Few trajectory building studies have made this important adjustment (Blokland et al.). Finally, trajectory group membership as a predictor for incarceration is also investigated. The dissertation study is funded by a 2009 National Institute of Justice (NIJ) Research Fellowship (2009-IJ-CX-0024).

### **Research Questions**

1) Are there distinct trajectories of offending among female youth offenders? 2) How do these female offending trajectories compare with those of male youth offenders? 3) Are time-

stable psychosocial and systems-level indicators present at first offense covariates for trajectory group membership? 4) Is membership in gendered offending trajectories predictive of juvenile incarceration?

## **Goals and Objectives**

**Goal 1.** Identify gendered offending trajectories for female and male youth offenders.

Objective 1.1 Investigate gendered patterns of offending up to age 18 for a year 2000 panel of 15,959 first time male and female youth offenders (2000 – 2007) using a frequency count of unique complaints by age as the response variable for semi-parametric group modeling (SGM) (Jones, Roeder, & Nagin, 2001).

**Goal 2.** Identify time-stable covariates of gendered trajectory group membership.

Objective 2.1 Investigate time-stable indicators present at first offense as covariates of trajectory group membership using multinomial logistic regression.

**Goal 3.** Identify gendered trajectories predictive of incarceration. Objective 3.1

Investigate trajectories of youth offending predictive of secure incarceration using multinomial logistic regression.

## **Major Concepts**

The design of the dissertation study is guided by the theoretical framework of developmental criminology (Loeber & LeBlanc, 1990), where issues of “within-individual stability and change in criminal activity over time” are of particular concern (Yessine & Bonta, 2008, p. 3). Specifically, two major constructs associated with developmental life course theory (DLC) are integral to the study design. Trajectories are long-term developmental pathways measured by individual behavior in major domains of life experience, such as school, family, interpersonal relationships, work, juvenile justice involvement, etc. Transitions are life events

embedded within trajectories, such as child maltreatment, first arrest, first incarceration, first job, high school graduation, first childbirth, first marriage, divorce, etc. The dimensions of offending are measured by onset, continuation, escalation, and desistance of offending (Sampson & Laub, 1992).

Within the larger framework of developmental criminology and the assumptions and constructs of DLC, there has also been a focus on explaining individual and psychosocial factors correlated with antisocial behavior over time (Yessine & Bonta, 2008). Empirical studies of DLC theory among high-risk community-sampled youth identified social experiences and individual characteristics correlated with the onset, escalation, continuation, and desistance of antisocial behavior – risk and protective factors (Hawkins et al., 2003; Huizinga, Weiher, Espiritu, & Esbensen, 2003; Loeber et al., 2003; Piquero, Farrington, & Blumstein, 2007; Thornberry, Lizotte, Krohn, Smith, & Porter, 2003). Poor family management, low school attachment, and association with delinquent peers are just a few of the constructs empirically documented as covariates of problem youth behavior (Hawkins et al.; Huizinga et al., Thornberry et al., 2003).

The influence of these covariates is hypothesized to be exerted through socializing agents such as family, school, peers, the community, and possibly even by macro-level systems/institutions of control (Catalano & Hawkins, 1996; Gatti, Trembley, & Vitaro, 2009; Thornberry, Huizinga, & Loeber, 2004). The same risk or protective factors may differ only in their valencing toward prosocial or antisocial influence (Hawkins et al.). Studies have also pointed toward a victimization/delinquency relationship (Huizinga et al., Thornberry et al.), and four recent prospective investigations documented a relationship between childhood victimization and some form of delinquent behavior (Wiig, Widom, & Tuell, 2003).

### **Significance of the Study – Gendered Volumes of Offending across a Range of Charges**

The proposed study broadens the lens through which we examine patterns of gendered offending. The response variable for trajectory modeling uses official court data for a frequency count by age of unique complaints across a full range of charges (this includes less serious offenses, such as truancy, running away from home, children in need of supervision, as well as technical violations of probation). Severity of first offense is not a reliable indicator for future serious offending (Andrews & Bonta, 2006; Gatti et al., 2009; Huizinga et al., 2003). As a result, it is important to include youth who enter or remain in the system on non-indexed charges as well as more serious and violent offenders as we model trajectories for future juvenile offending. Elimination of non-indexed offenders from samples may underestimate the number of offending trajectories for males when using official court data rather than youth self-report (Wiesner, Capaldi, & Kim, 2007) and under represent females in the sample (D’Unger et al, 2002). Investigating issues such as unnecessary system penetration for low- and medium risk youth requires a broad response variable for trajectory modeling.

Recent developments in software designed to sort patterns of behavior over time led to an increase in studies designed to identify offending trajectories among juvenile and adult study samples (Nagin & Tremblay, 2005); however, “knowledge is still weak on certain important issues” (Yessine & Bonta, 2008, p. 4). A major issue still to be resolved is that “the actual number and type of distinct offending trajectories for males is still somewhat unsettled” (Yessine & Bonta, p. 4). Some studies (Yessine & Bonta; Moffitt, Caspi, Harrington, & Milne, 2002) reported a confirmation of the two-solution trajectory model for males postulated by Moffitt’s adolescence-limited/life course persistent taxonomy (1993; Moffitt et al.), while several other



studies reported three-, four-, five- or six-solution trajectory models for juvenile and young adult males (Blokland et al., 2005; Chung et al., 2003; Fergusson, Horwood, & Nagin, 2000; Wiesner & Capaldi, 2003).

In the dissertation study, trajectories are modeled for 5,938 first time female offenders. This large sample size is important, as females continue to be underrepresented in trajectory modeling (D'Unger et al., 2002). Identifying pathways to delinquency for female juveniles is particularly important, as high rates of teen pregnancy among this population contribute to a cycle of intergenerational violence, school drop-out, substance abuse, and antisocial behavior (Tremblay et al., 2003). Contemporary longitudinal samples that include significant numbers of females are needed (D'Unger et al.; Yessine & Bonta, 2008). Mother-specific risk factors (younger than 20 at birth of child; low educational attainment, and use of harsh physical punishment) showed main effects correlations with juvenile delinquency across several longitudinal studies of antisocial behavior (Loeber et al., 2003; Hawkins et al., 2003; Huizinga et al., 2003; Thornberry et al., 2003; Tremblay et al.). Tremblay et al. noted

girls who have behavior problems, who use drugs, who fail in school, and mate with a difficult partner will clearly not be in a position to offer the necessary environment for their child's adequate brain development. Poor brain development and disorganized family environments are more likely to lead to poor socialization and hence to antisocial behavior. (p. 244)

For this underserved and inter-generationally influential population of female juvenile offenders, identifying female-specific offending trajectories and their psychosocial covariates moves beyond justice intake risk assessment application. This level of gender-specific data has the potential to inform the development of secondary delinquency prevention interventions for

delinquent parenting teen mothers and their children (D'Unger et al., Hawkins et al., Tremblay et al.)

The dissertation study identifies covariates of moderate- and higher-level juvenile offending that are easy to identify during the initial months of case processing for first time juvenile offenders. These indicators include prior child maltreatment, school status, referral source, and the use of detention at first offense. These indicators can be associated with constructs already identified as covariates of youth problem behaviors in the literature; for example, family conflict, family violence, low school attachment, family management problems, and association with delinquency peers (Hawkins et al., 2003; Huizinga et al., 2003; Thornberry et al., 2003). Considering these easy to identify covariates of likely escalated offending at first offense intake adds a psychosocial component to risk management strategies that use data to empirically distinguish between high-, medium-, and low-risk first time youth offenders. This is important for two reasons: 1) the covariates of high-risk youth offending trajectories provide important opportunities for treatment intervention, and; 2) it is equally important to be able to identify the covariates of lower-level offending trajectories in order to avoid unnecessary system penetration.

## **II. Theoretical Considerations**

### **Theories for Delinquency**

In criminology and sociology, two very different theoretical perspectives influenced the contemporary study of juvenile delinquency: static theories that were tested using cross-sectional methods, and dynamic theories that were tested using prospective longitudinal methods. The former investigated between-individual differences, and the latter investigated within-individual differences. Another difference between these two approaches is the question of whether delinquency is a manifestation of a single underlying trait or criminal propensity, such as low self-control, or is the result of static individual characteristics and dynamic social contexts, all of which wield shifting influences as youth develop over time. Control theory has been the most influential static theory for delinquency (Hirschi & Gottfredson, 1990), although strain theory has also had its proponents (Agnew, 1992). Developmental criminology took a much more dynamic approach to understanding delinquency (Loeber & LeBlanc, 1993). Within developmental criminology, developmental life-course theory (DLC) continues to be one of the most influential dynamic theories for delinquency (Sampson & Laub, 1992).

Classic control theory took a static view of antisocial behavior by identifying low self-control as the major cause for crime across all stages of the life course. Low self-control is established in childhood, primarily as the result of socialization processes, after which it is stable across all ages. This low self-control can be exacerbated by weakened social bonds with agents of control, such as parents, school, and prosocial peers (Agnew, 1992). Aggregate age/crime

curve data consistently reported that youth offending peaks at age 17 and declines rapidly thereafter (Hirschi & Gottfredson, 1995). Because control theory assumed a single underlying trait that is static over time, cross-sectional designs were sufficient for testing hypotheses about differences between individuals. Farrington noted, however, that “this argument depends on the implicit assumption that within-individual correlations between risk factors and offending are the same as between-individual correlations between risk factors and offending, which is not necessarily true” (2003, p. 229).

In contrast, developmental life-course (DLC) theory assumed dynamic human development over time; age-graded changes in antisocial behavior are assumed to occur in an orderly way. Social experiences as well as individual characteristics affect childhood development and outcomes; childhood socialization affects adolescent development and outcomes, which in turn affect adult development and outcomes. Thus, life events shape antisocial behavior over time, both before and after offending begins (Loeber et al., 2003). Behavioral stability is often present, but change is also possible. DLC hypothesized risk and protective factors predictive of offending at different developmental stages, although the causal processes for the influence of these factors are still under investigation, and may well be different from individual to individual (Huizinga et al., 2003; Loeber et al.). DLC theories and models drew upon the constructs of numerous theories, including social learning, social control, cognitive behavioral, strain, labeling, social bonding, and attachment. There are several models within the theoretical framework of DLC that focused on specific aspects of the development process, hypothesizing predictors for the onset, continuation, escalation, and desistence of delinquency among children and youth.

All DLC theories share three underlying assumptions: 1) experiences and events in one developmental period influence subsequent stage-based development and outcomes; 2) the influence of risk and protective factors changes as development unfolds across time; 3) the covariates of delinquency are different based on age of onset, and the covariates for escalation and desistance also shift with age (Catalano & Hawkins, 1996; Huizinga et al., 2003; Loeber, Keenan, & Zhang, 1997; Thornberry, 1987). Three major constructs are important in on-going empirical tests of DLC. Trajectories are long-term

developmental pathways measured by individual behavior in major domains of life experience, such as school, family, interpersonal relationships, work, juvenile justice, etc. Transitions are life events embedded within trajectories, such as child maltreatment, first job, first marriage, divorce, first criminal offense, etc. A turning point is a major change in a trajectory, which can be positive or negative, sudden and dramatic, or manifested in long-term behavioral change (Sampson & Laub, 1992).

A brief summary of the most influential DLC theories and models for antisocial behavior is helpful given the overlap in many of their constructs and assumptions (Farrington, 2003). Moffitt postulated a dual taxonomy for male offending based on age at onset: life-course persistent offending is distinguished by early onset, and; adolescence-limited offending is distinguished by teen-onset of offending (1996, Moffitt, Caspi, Harrington, & Milne, 2002). Moffitt's dual taxonomy theory is still used as a comparison for current trajectory-modeling studies (Blokland et al., 2005; D'Unger et al., 2002; Wiesner et al., 2007).

Several other DLC theories also merit discussion. The social development model (SDM) hypothesized both antisocial and prosocial developmental pathways, where the same risk and protective factors share causal mechanisms, differing only in their valencing toward prosocial or

antisocial influence (Catalano & Hawkins, 1996). Farrington's integrated cognitive antisocial potential theory attempted to explain delinquency among low-income male youth (2003). A three-pathways model hypothesized an offense-specific sequencing of antisocial behavior based on youth self-report and official offending among male youth (Loeber et al., 1997). Cumulative disadvantage theory integrated labeling theory into an age-graded informal social control approach to understanding the onset and escalation of delinquency (Sampson & Laub, 2001). Interactional theory posited bidirectional causal factors that exert different levels of influence as youth develop over time (Thornberry, 1987).

In his 2002 Sutherland Award address to the American Academy of Sociology, Farrington identified the following similarities between these DLC theories and models (2003). His own integrated cognitive antisocial potential (ICAP) theory proposes antisocial potential as the key construct. As a result of antisocial potential, offending is facilitated (strain and modeling) or inhibited (socialization, life events); however, whether or not an offense is ultimately committed is still filtered by individual cognitive processes (Farrington). Farrington noted that although Catalano and Hawkins' SDM (1996) proposed bonding as the central construct for both prosocial and antisocial developmental pathways, whether or not an offense is committed is also filtered in a cost/benefit (cognitive) calculation of consequences or rewards. Like the SDM, Sampson and Laub's (2001) age-graded informal social control theory focused on bonding as a key construct, but only in inhibiting offending (little detail is provided about the role of bonding in contributing to delinquency) (Farrington). On the other hand, ICAP and Sampson and Laub's age-graded theory both incorporated labeling as a consequence of offending (Farrington). Le Blanc's integrated theory (1997) combined many of the same social learning decision-making processes as these other theories, but the key construct was control (Farrington).

There are other similarities. Although one of Moffitt's distinguishing constructs for the life-course persistent male trajectory was neuropsychological deficiency, the "evocative interactions" (1993, p. 106) that exacerbated these deficiencies were similar to Thornberry's (1987) hypothesis for bidirectional interactions between youth and those in their social environment. Thornberry's hypothesis placed much more emphasis on these reciprocal relationships as causal, however, while Moffitt went into much greater detail about individual youth traits or characteristics (neuropsychological) than did any other of the other DLC theorists. The Loeber et al. (1997) three-pathways model for age-graded offending onset and sequencing was clearly influenced by Moffitt's earlier work, and it is no surprise that Moffitt became a member of the Pittsburgh Youth Study research team as they developed the three-pathways model (Loeber et al., 2003).

Farrington also noted differences between these DLC theories (2003). Only Farrington's ICAP theory and Moffitt's (1993) AL/LCP theory included the assumption that strain theory was an explanation for youth motivations to commit delinquent acts (Farrington). In fact, Moffitt called for qualitative studies to better understand this hypothesized strain, as well as other youth motives for offending (Moffitt). Only ICAP and LeBlanc's integrated theory (1997) made a distinction between delinquency and the actual event of offending, incorporating a larger perspective that included situational factors that also lead to offending (opportunities and victims, for example) (Farrington). Attitudes and beliefs are causes for delinquency in Catalano and Hawkins' SDM (1996) and Thornberry's interactional theory (1987), but in Farrington's ICAP they are indicators of antisocial potential (Farrington). Thornberry's theory was also the only one to reject the idea of persistent heterogeneity (a stable antisocial trait underlying antisocial behavior) (Farrington).

Andrews and Bonta (2006) criticized sociological theory building during the 1960s through the 1980s for a stubborn insistence that only between-individual differences were important in predicting delinquency, no matter the mounting empirical evidence to the contrary. Piquero, Farrington, and Blumstein went so far as to contend that “much of criminological theory is nonscientific, not because the authors do not value science but because the rush to theory limits the facts they consider. One study produces findings that generate a theory” (2007, p. xi). Huizinga et al. (2003) noted that in the longitudinal Denver Youth Study (DYS) a wide variety of risk and protective factors were analyzed because no one theory addresses all risk factors for the onset and escalation of antisocial behavior among youth. Their on-going goal is to develop theories for the onset and continuation of offending among different subgroups of offenders who may follow different pathways to delinquency (Huizinga et al.).

D’Unger et al. (2002) hypothesized that gendered patterns of offending could be explained by Cohen and Vila’s suggestion that the two major (conflicting) theories for delinquency may actually predict behavior for two different trajectories of offenders: 1) Hirschi and Gottfredson’s low self-control theory may apply to the trajectories of chronic (male) offenders, whereas; 2) Sampson and Laub’s informal social-control theory may apply to adolescence-peaked female offending trajectories. “Changing levels of social control associated with the transition to adulthood . . . “ (D’Unger et al., p. 373) may be more influential for females as they transition into the adult/childbearing years. D’Unger et al. called for more research in this area, particularly with more recent birth cohort samples that follow female offending further into the life span.



## **Empirical Studies – Offending Trajectories**

In general, two approaches prevail in modeling trajectories of antisocial behavior: 1) modeling trajectories for high-risk community-based samples that use youth self-report to compare nonoffenders with offenders, and; 2) modeling trajectories for offender-only samples using official court data to compare sub-groups of offenders. Eight recent studies in the U.S., Canada, the Netherlands, and New Zealand identified latent classes of offenders across the adolescent, teen, and adult years (Blokland, Nagin, & Nieuwbeerta, 2005; Chung, Hill, Hawkins, Gilchrist, & Nagin, 2002; Day, Bevc, Duchesne, Rosenthal, & Sun, 2008; D’Unger, Land, & McCall, 2002; Moffitt et al., 2002; Wiesner & Capaldi, 2003; Wiesner, Capaldi, & Kim, 2007; Yessine & Bonta, 2008); however, “the actual number and type of distinct offending trajectories is still somewhat unsettled” (Yessine & Bonta, p. 4). Wiesner and Windle noted that “more research with multiple samples is needed in order to learn more about the generalizability of findings” (2004, p. 432). Other longitudinal studies that investigated the covariates of youth problem behaviors, such as violence, substance abuse, school drop-out, and teen pregnancy, also called for trajectory modeling to investigate the influence of risk factors, such as prior child maltreatment, on grouped patterns of offending (Huizinga, Weiher, Espiritu, & Esbensen, 2003).

Recent studies used advances in statistical methods to identify offending trajectories that distinguished between different sub-groups of offenders in terms of their offending patterns over time. Semi-parametric group modeling (SGM) has been particularly influential in this context. Nagin and Tremblay noted that “charting developmental trajectories and studying their causes are among the most fundamental and empirically important research topics in medicine and the social and behavioral sciences as well as in criminology” (2005, p. 875). Nagin and Land (1993) developed semi-parametric group modeling (SGM), a group-based statistical method for

analyzing such trajectories. Proc TRAJ, their customized SGM plug-in/macro for the SAS or STATA platforms, was made available in 2001 (Jones, Nagin, & Roeder, 2001). Since that time, trajectory-building has increased dramatically in the literature (Jones & Nagin, 2007). Proc TRAJ and attendant documentation can be downloaded free of charge at <http://www.andrew.cmu.edu/user/bjones/index.htm>.

Several of these recent trajectory modeling studies are discussed to introduce conceptual and methodological issues that influence the interpretation of the dissertation study results. A review of data collection methodologies for operationalizing offending is helpful. As a part of the Seattle Social Development Study, Chung et al. used youth self-report (survey) to collect data about offending as well as attitudes and beliefs for nonoffenders and offenders aged 13 to 21 living in high risk neighborhoods ( $n = 808$ ) (2002). D'Unger et al. included a significant number of females ( $n = 3,000$ ) in their re-examination of the 1958 Second Philadelphia Cohort to investigate gendered trajectories of offending among nonoffenders and offenders aged 10 to 26 (2002). Their study used a count of police contacts as well as arrests as the response variable for trajectory modeling (D'Unger et al.). As a part of the Oregon Youth Study, Wiesner, Capaldi, and Kim investigated the congruence between offending trajectories identified through youth self-report with trajectories identified through official court data for the same sample of high-risk community-sampled 12/13 year old male youth ( $n = 204$ , up to age 26/27) (Wiesner et al., 2007). Moffitt et al. (2002) reported a confirmation and extension of the dual taxonomy for males up to age 26 ( $n = 1,037$ ) in a follow-up of the Dunedin, New Zealand longitudinal study. The follow-up study identified a third group of chronic low-level adult male offenders who were aggressive but not delinquent as adolescents (Moffitt et al.). Data collection included self-report, official

records, and validated assessment scales for five adult outcome domains (criminal activity, personality, psychopathology, personal life, and occupation) (Moffitt et al.)

Two Canadian studies (Day et al., 2008; Yessine & Bonta, 2008) and one Dutch study (Blokland et al., 2005) used official justice conviction and/or disposition data in trajectory modeling among youth and adults; however, all three studies focused exclusively on serious offenders. The Dutch study sample did include females ( $n =$  not specified) (Blokland et al.). These authors pointed out the importance of considering not just charge severity, but system response to crime (Yessine & Bonta) and/or crime mix (Blokland) when developing a response variable for modeling trajectories of offending among court-involved youth and adults.

A closer look at three trajectory modeling studies conducted in the United States with juvenile-to-young adult samples is relevant to the dissertation study. D'Unger, et al. (2002) investigated gender differences in offending trajectories among a random sample of females and males in a re-analysis of the Second Philadelphia Cohort study ( $n = 3,000$  females;  $n = 1,000$  males). The study specified three female trajectories: Nonoffenders (84.37 %); Low-Rate Adolescence Peaked (10.37 %), and High-Rate Adolescence Peaked (51.27 %). This is the first study to investigate gender differences in offending trajectories using SGM; the methodological approach of the study uses the GAUSS application of semiparametric group modeling (SGM). The sample includes both nonoffenders and offenders. The authors begin by discussing the lack of longitudinal studies designed to identify offending trajectories among females, and the corresponding lack of studies that compare the offending trajectories of female and male offenders. D'Unger et al. noted that the identification of “gendered patterns of offending” (p. 351) “would support the notion that typologies being applied to male offenders cannot simply be generalized to include females” (p. 351). Although their study did not include

the investigation of covariates of trajectory group membership, the authors noted that the identification of gender-specific patterns of offending may reflect “differing attachments to various social institutions through various stages of the life course” (D’Unger et al., p. 353).

In the D’Unger et al. study, participants were followed from age eight until age 26 (1968 – 1984). In addition to a three-solution female model, a five-solution model was also identified for males. For both male and female youth 18 or younger, the dependent variable was measured by frequency of police contacts. For youth and young adults 19 to 26 years of age, the dependent variable was operationalized by a count of official arrest data. The authors noted that “because females’ offenses are often status violations or less serious infractions (e.g. shoplifting), it would be improper to solely use arrests [during the adolescent years] as the measure of offending” for youth (D’Unger et al., 2002, p. 358).

The most striking contrast between female and male trajectories in the D’Unger et al. study was the absence of a chronic trajectory for females, although D’Unger et al. (2002) noted the ability to identify chronicity among females may require a longer observation period. While the High-Rate Adolescence Peaked female trajectory declined after age 17 (followed up to age 26 in the study), it “falls somewhere between the low- and high-rate chronic offender patterns found among the males of the sample, making it somewhat ambiguous to classify” (p. 363). D’Unger et al. noted that because the age curves among the High-Rate Adolescence-Peaked female trajectory were more comparable to low-rate chronic males, it may actually represent a life-course persistent (low-rate chronic) offending pattern for females, similar to that hypothesized by Moffitt (1993) for males.

Congruent with the findings of other studies of high-risk male youth (Loeber et al., 2003; Huizinga et al., 2003), adolescence-limited trajectories in the D’Unger et al. study hit their

highest point of offending during the late teen years (16-18) and declined dramatically thereafter for both males and females (2002). Gendered outcomes included: 1) females in both offending trajectories exhibited a later onset of offending than males; 2) low-rate adolescent females desisted three years earlier than their male counterparts; 3) low-rate females peaked earlier (15) than high-rate females (17), where the former coincided with peak ages for low-rate males, but high-rate adolescent limited females peaked one year later than males of the same category; 4) an early age of onset (8) was correlated with high-rate trajectory group membership for both males and females; 5) frequency of offending was higher among high-rate adolescent peaked males than females of the same category. Finally, it was also noteworthy that the intermittency of offending is similar for males and females (similar probability of starting and stopping offending), and “episodes of offending are not independent of one another” (D’Unger et al., p. 365) for either gender.

As previously discussed, D’Unger et al. hypothesized that social-control theory (Sampson & Laub, 1993) may explain adolescence-peaked female offending trajectories. D’Unger et al. (2002) suggested that the latter may be particularly applicable to females as they move into the childbearing years and become responsible for the care of children. They called for more research in this area of female-specific offending patterns and correlated risk and protective factors (D’Unger et al.).

As part of the Oregon Youth Study, Wiesner and Capaldi used youth and caregiver report to specify juvenile offending trajectories from age 12 up to age 24 for two cohorts of male youth living in high crime neighborhoods in a Pacific Northwest metropolitan community ( $n = 204$ ). Youth and their caregivers were recruited into the study at youth ages nine or 10. Although the sample was not racially diverse (90 % White), 75 % of the study families were lower-working

class. Study males were considered at heightened risk for delinquency based on these characteristics.

In the Wiesner and Capaldi study (2003), offending was operationalized as an annual total score that considered severity and frequency of youth self-report offending using the Elliott Delinquency Scale. The study used the Proc TRAJ application for semiparametric group modeling. Based on youth self-report data, six male offender trajectories were identified: Nonoffenders (4.9 %); Rare Offenders (11.3 %), Chronic High-Level Offenders (15.7 %), Decreasing High-Level Offenders (27.9 %), Decreasing Low-Level Offenders (21.6 %), and Chronic Low-Level Offenders (18.6 %).

Various multi-method measures were administered during childhood (Wiesner & Capaldi, 2003). Measures included questionnaires, interviews with youth and adult caregivers, home observations, videotaped sessions of family problem solving, and videotaped sessions of problem-solving with a friend. Questionnaires collected data about youth antisocial behavior, attention problems, academic achievement, parental supervision, high risk behaviors, and peer associations. Additional data included parental history of arrest and school data. Covariates included “various childhood measures, that is, antisocial behavior, attention problems, harsh and inconsistent parental discipline, and low parental supervision” (Wiesner & Capaldi, p. 247). The Chronic High-Level offenders were the comparison group for a multinomial logistic regression that investigated covariates of offending trajectories. Results indicated “relatively few factors that discriminated among differing offender trajectories” (Wiesner & Capaldi, p. 254).

In a follow-up trajectory modeling study, Wiesner et al. (2007) specified only three juvenile male offending trajectories for the same sample ( $n = 204$ ) using official arrest data rather than youth self-report (2007): Rare Offenders (68.5 %); Low-Level Chronics (22.3 %),

and; High-Level Chronic (9.2 %). Wiesner et al. concluded that their second study “demonstrated limited convergence of trajectory findings across official records versus self-report measures of offending behavior” (p. 836).

As a part of the Seattle Social Development Project (SSDP) study, Chung et al. specified offending trajectories from age 10 up to age 21 for all male and female students ( $n = 808$ ) in 18 Seattle public schools located in high risk neighborhoods (2002). Five trajectories that included males and females were specified: Nonoffenders (24 %), Late On-Setters (14.4 %; no offending at 13 but gradual increase to low seriousness by 21), Desisters (35.3 %; low seriousness at age 13 and largely desisted by age 21), Escalators (19.3 %; low seriousness at age 13 but committing serious offenses by 21), and Chronic (7 %; serious offending throughout). The authors noted that the term Desister referred only to youth who stopped offending during the observation period (up to age 21). Some of these youth may offend later in life, and the same applied to Nonoffenders (Chung et al.).

The sample was a homogeneous age panel of nonoffenders and offenders, and the study used youth self-report (in-school administration of a youth survey) for data collection. Data collection for youth self-report of offending began when youth were 10 years of age, and continued annually until youth were 16 years old. Self-report data for antisocial behavior was again collected when youth were 18, and again at age 21. Predictors of offense trajectory membership were measured at ages 10 and 12 using the Child Behavior Checklist (teacher ratings for individual predictors) and the SSDP Youth Survey (family, peer, school, and neighborhood predictors). The shorter observation period available in the Chung et al. study is similar to this dissertation study (where youth are followed for eight years, from a heterogeneous

age at first offense in 2000 up to age 18 in the year 2007). Limitations in identifying desistence in offending apply to both studies.

A three level offense seriousness scale was developed to operationalize the response variable for the Chung et al. study (2002), which conducted SGM using Proc TRAJ (Jones et al., 2001). The scale for the response variable was based on 16 items from the SSDP Youth Survey. Youth were assigned a score at each data collection age for the most serious self-reported offense they committed that year. The authors noted that seriousness represents only one dimension of offending. While "seriousness and frequency tend to correlate highly, they are not interchangeable. . ." therefore, "the seriousness scale was used to compensate for the shortcomings of frequency measures of offending" (Chung et al., p. 66).

In stage two of SSDP statistical analysis, multinomial logistic regression tested three models with two different dependent variables (level of severity for offending at age 13; divergence of offense trajectories) (Chung et al., 2002). The three models were: 1) inclusion of demographic (poverty, gender, and ethnicity) factors as well as individual and family factors; 2) inclusion of demographic, peer, school, and neighborhood factors, and; 3) inclusion of all the factors from the first two models. Demographic variables were control variables in all three models. All these predictor variables were measured at ages 10 to 12 (initial status covariates). Development of these three models was based on *a priori* assumptions associated with risk and protective factor constructs from the social development model (SDM) (Catalano & Hawkins, 1996).

In investigating level of offending severity at age 13, the five trajectories were collapsed into three trajectories based on level of offending at age 13: 1) No Onset at 13 (combined Nonoffenders and Late Onsetters); 2) Minor Offending at 13 (combined Escalators and



Desisters), and 3) Serious Offending at 13 (Chronics) (Chung et al., 2002). Aggressiveness (individual), association with antisocial peers, and drug availability (neighborhood) present at ages 10/12 were significant predictors of level of offending at age 13 in all between group contrasts. Aggression combined with symptoms of anxiety and depression at ages 10/12 distinguished Late Onsetters from Nonoffenders. Factors from the following domains distinguished Desisters from Escalators: 1) peers (low association with delinquent peers); 2) school (high bonding); neighborhood (not living in neighborhoods where availability of drugs was high). The authors observed that their study did not investigate gender and racial differences in trajectory group membership, and called for studies that investigate gendered patterns of offending (Chung et al.). They also noted that their study did not distinguish offense type, and called for studies that investigate developmental patterns of offending by offense type: violent, property, and drug offenses (Chung et al.).

A brief review highlights methodological differences between these studies, as well as differences between these studies and the dissertation study. The D'Unger et al. (2002) gendered trajectory study investigated a response variable of frequency of offending (police contacts as well as arrests). The Chung et al. study developed a severity scale based on youth self-report to measure antisocial behavior (2002). The first Wiesner and Capaldi study (2003) also used youth self-report to develop a response variable that was a calculated annual score (frequency plus severity). The second Wiesner et al. (2007) study used official arrest data only to model trajectories for offending. All these studies sample high-risk community-based samples (nonoffenders and offenders). All these studies sample a homogeneous age panel or cohort.

### **Developmental trajectories – conceptual issues.**

Nagin and Tremblay reported the need to clarify several common conceptual misunderstandings about group-based modeling (2005) as a result of the increased use of SGM. Two group-based modeling issues that are particularly relevant to the conceptualization and interpretation of the dissertation study are: 1) “individuals actually belong to a trajectory group” (Nagin & Tremblay, p. 882), and; 2) “trajectories of group-members follow group-level trajectory in lock step” (p. 892). According to the authors, the first misconception has led to a tendency to “reify” (Nagin & Tremblay, p. 883) groups when SGM is used. It is important to remember that “groups are used as a device for approximating a more complex underlying reality” (Nagin & Tremblay, p. 878); in other words, they are a statistical tool for organizing and reporting the results of complex longitudinal data.

Nagin and Tremblay discussed two different uses for group-based prediction analysis: prevention within the population at large and type classification within the population at large (2005). They expressed concern that “reifying the group as a distinct entity – rather than as an extreme on a continuum – may provoke Draconian responses to the behavior,” particularly when used to identify children and youth in the population at large who are likely to follow an undesirable behavioral trajectory based on risk profiles (Nagin & Tremblay, 2005, p. 883). The development of assessment instruments that target categories of high-risk “undesirable” (Nagin & Tremblay, p. 883) children and youth – particularly youth in the general population - run the risk of “dehumanizing a ‘them’ ” (Nagin & Tremblay, p. 883).

While implications for policy and practice relevant to the dissertation study are discussed in greater detail in Section IV Discussion and Implications, it should be noted that Nagin and Tremblay’s cautionary statements (2005) highlight important ethical considerations relevant to

the predictive analysis of likely youth offending. The dissertation study focuses exclusively on adjudicated youth, whose behavior has already been targeted as problematic on a juvenile justice charge index, technical violation, or status offense. One possible practice implication for trajectory modeling among adjudicated samples is the refinement or development of empirically derived screening and assessment instruments designed to more accurately distinguish between low-, medium-, and high-risk first time offenders. Such efforts have the potential to avoid mistakenly targeting all court-involved youth as high-risk (or undesirable). This involves: 1) more accurately identifying higher-risk first time offenders who can benefit from timely, effective intervention services early in their likely sequence of continued or escalated offending, and 2) avoiding unnecessary system penetration for low- and even medium-risk adjudicated youth.

The second pertinent group-based modeling misconception discussed by Nagin and Tremblay clarified the fact that members of a group trajectory do not follow the behavioral pattern of that group in “lock step” (2005, p. 892); rather, the group membership “summarizes the average behavioral trend of a collection of individuals” (Nagin & Tremblay, p. 892). Within clusters of similar behaviors that form trajectory groups, there is always individual behavioral variability relative to the trend of the group. (In fact, Nagin and Tremblay noted that investigating factors correlated with intra-group individual variation merits more study.) This cautionary statement is particularly relevant for policy issues related to “first contact” screening and assessment for status offenders in juvenile justice. Status offenders have committed no crimes, and any intervention services offered based on screening results for *likely* future offending must be purely voluntary; however, incentives such as reduced probation time or charge expungement can be developed to encourage participation by youth and caregivers.

Yessine and Bonta suggest that during the first few months of probation supervision, a heightened attention to high-risk first time offenders is warranted to respond in a timely and effective manner to continued high-risk behaviors and probation noncompliance (2008).

### **Empirical Studies – Investigating the Correlates of Delinquency**

A closer look at five longitudinal empirical studies testing DLC theories and models provides important information about the covariates of antisocial behavior (delinquency, violence, school drop-out, substance abuse, teen pregnancy), generally discussed in the literature as risk and protective factors. Prospective longitudinal studies are required to provide this level of information (Moffitt, 1993), as cross sectional studies have not proven effective at investigating such issues at the individual level (Sampson & Laub, 1992). On-going data collection for the five seminal DLC studies ranges from a low of 17 years to a high of 40 years. Four of the five studies proposed new theories for specific aspects of the delinquency development process. Three of these five longitudinal empirical studies make up the OJJDP Program of Research on the Causes and Correlates of Crime. The three OJJDP-funded sites are the Denver Youth Survey (Huizinga et al., 2003), the Pittsburgh Youth Study (Loeber et al., 2003), and the Rochester Youth Development Study (Thornberry et al., 2003). The Causes and Correlates studies provided data on delinquent behavior from 1987 to the present, and included more than 100,000 personal interviews with over 4,000 youth and young adults, ages seven to 30 (Thornberry, Huizinga, & Loeber, 2004). Risk and protective factor constructs identified as covariates of antisocial behavior across these studies are presented in Appendix A. The dissertation study investigates indicators that can be easily identified at first offense intake that are associated with these constructs.

Many common measures are used across the three Causes and Correlates sites, including a self-report youth survey. The Cambridge Study in Delinquent Development (CSDD) has been collecting data for high-risk British males for over 40 years, and is now beginning a data collection wave with the children of the original study youth (Piquero et al., 2007). The Montreal Longitudinal and Experimental Study (Tremblay et al., 2003) and the Seattle Social Development Study (Hawkins et al., 2003) also collected youth self-report survey data and nested interventions within their study samples.

Considering risk factors correlated with antisocial behavior as dynamic or static (Andrews & Bonta, 2006) is helpful in identifying intervention targets that can reduce recidivism. While similar risk factors may affect all youth, several studies hypothesized that the causal processes within which risk factors unfold vary by age (Hawkins et al., 2003; Huizinga et al., 2003; Loeber et al., 2003; Thornberry et al., 2003). It appears that individual traits or characteristics are more influential for the development of antisocial behavior among children, whereas psychosocial factors have more of an effect on adolescent-onset delinquent youth (Loeber et al.). It is also generally agreed that a constellation of risk factors leads to delinquency, and the make-up of this constellation looks different for individual youth, who may or may not be a part of sub-groups that followed discrete offending trajectories (Huizinga et al.; Loeber et al.; Thornberry et al.). Association with delinquent peers had the strongest, most consistent main effect of any risk factor, yet even this is not without controversy. Farrington contended that association with delinquent peers may be just another way of measuring delinquency (2003). There also seems to be some level of consensus that social structural variables (disadvantaged neighborhood, economic hardship, high crime neighborhood) affect delinquency indirectly, particularly through their direct influence on increasing parental distress, which in turn

negatively influences parenting (Huizinga et al.; Loeber et al.; Thornberry et al.). The negative influence of these social structural variables on parenting may be exacerbated in single parent households, particularly where social support for the caregiver is low or unavailable. Two levels of parenting were particularly influential: control (supervision and monitoring) and support (bonding and attachment).

Although all these empirical studies were guided by the assumptions and constructs of the overarching DLC theoretical framework, specific theories and DLC models focus the lens through which data is collected, interpreted, and applied. For example, the three-pathways model of Loeber et al. (2003) and their subsequent interpretation of the Pittsburgh Youth Study results has greater application for systems-level issues, such as assessment in either prevention or juvenile justice settings (Loeber et al.). To-date, practice-level application in the prevention arena has been the primary intervention result for the social development model (SDM) and the results of Seattle Social Development Project (although required grantee use of the SDM did guide the state-level competitive grant process for Title V secondary prevention funding from OJJDP in the late 1990s). With its focus on underlying relationship dynamics, the bidirectional effects of delinquency, and family process, Thornberry's interactional theory and interpretation of the Rochester Youth Development Study results also had particular relevance for family-level interventions (Thornberry et al., 2003). In contrast, Huizinga et al. used a much wider lens to investigate a variety of risk and protective factors without theoretical limitations; they contended that no one theory addresses all risk factors (2003). The approach of DLC does seem to support this orientation, with its foundation of constructs synthesized from numerous theories. The ongoing goal of Huizinga et al. is to develop theories for the onset and continuation of offending

among different subgroups of offenders who may follow different pathways to delinquency (2003).

Three of the DLC empirical studies (Huizinga et al., 2003; Loeber et al., 2003; Piquero et al., 2007) supported the position of Andrews and Bonta (2006) that seriousness of offense was not the risk factor of importance when classifying first time offenders for the likelihood of future chronic or serious offending. Instead, frequency of offending (including self-report/parent report of antisocial behavior prior to first court contact) was the most important indicator for assessing the likelihood of chronic and/or escalated delinquent behavior. This continues to have implications for how the response variable “offending” can best be operationalized in trajectory modeling studies.

Diverting first time offenders from detention and incarceration also takes on a new urgency, as all three of the Causes and Correlates studies implicated these secure confinement justice responses as potential risk factors for continued delinquency (Thornberry et al., 2004). A recent study indicated that the iatrogenic effects of system penetration increased in direct proportion to increasingly restrictive sanctions and placements, and that these sanctions were disproportionately applied to youth living in poverty – regardless of the severity of first offense (Gatti et al., 2009). Given the disproportionate minority confinement so prevalent in juvenile justice (Feld, 2000), social justice issues also play a role in diversion and community-based treatment strategies in lieu of detention and incarceration.

### **III. Research Design and Methods**

The dissertation study conducted secondary data analysis for a de-identified retrospective longitudinal panel of court-involved male and female youth who committed their first offense in the year 2000. The data set included official juvenile justice complaint dates, charges, disposition dates, and dispositions for the years 2000 through 2007. Time-stable covariates of trajectory group membership were also investigated. The de-identified data set was made available for the dissertation study by the juvenile justice authority in a southeastern state.

#### **Sample**

A total of 17,830 male and female youth who committed their first offense in the year 2000 were included in the de-identified eight year retrospective longitudinal data set. Study youth were year 2000 first time juvenile offenders from all 67 counties in the dissertation study state. Youth younger than five years of age at first offense and youth older than 18 at first offense were not included in the analysis, leaving a total sample of  $N = 15,959$  for trajectory model specification ( $n = 5,938$  females and  $n = 10,021$  males).

First time youth offenders as young as six at first offense and youth as old as 18 at first offense make up the study sample; therefore, heterogeneity in age at first offense is a sample characteristic. All data were de-identified, and therefore protective of the confidentiality of individual juveniles. Over 39% of males and over 37% of females in the study sample were African American. Native Americans as well as Asians represented just under 1% of both males and females in the sample respectively. Hispanics represented 1.5% of the female sample and



1.15% of the males. Over 59% of males and over 59% of females in the study sample were White.

## **Procedures**

Data analyses proceeded in three stages: 1) trajectory model specification; 2) investigation of time-stable covariates of trajectory group membership, and 3) investigation of the trajectory solution models as predictors for incarceration. In all stages, gender differences were examined.

During stage one analysis, gendered patterns of offending from 2000 through 2007 were investigated using the Proc TRAJ (Jones et al.) application of semiparametric group modeling (SGM). A count of all unique complaints filed during each one year observation period (2000 through 2007) was the dependent, or response variable, for trajectory model specification. In stage two analysis, time-stable covariates of trajectory group membership present at first juvenile offense were investigated using multinomial logit regression. Stage three analysis investigated the two gendered trajectory solution models as predictors for incarceration using logit regression.

### **Stage One Statistical Analysis - Model Specification**

Nagin and Land (1993) developed semiparametric group modeling (SGM), a latent class modeling approach that identifies unobserved heterogeneity in a population by identifying clusters of individuals following similar behavioral trajectories over time. "The approach is nonparametric because no functional relationship is assumed between age and risk of offending" in studies of criminal behavior over time (Fergusson et al., 2000, p. 529). SGM modeling is based on the assumption that there are cross-group differences in the shape of behavioral trajectories (Chung et al., 2002). Fergusson et al. noted that the SGM procedure is an improvement over previous methodologies that relied on "the use of subjective categorization

rules to create groups with seemingly distinct developmental trajectories,” (p. 527) as such approaches must be based on *ex ante* assumptions about heterogeneous groups and cannot be tested.

SGM is particularly well-suited to the analysis of longitudinal data because the parameters ( $\lambda_k$ ) depend on time (Jones et al., 2001). Proc TRAJ is a customized SAS plug-in/macro that is used to conduct the SGM analysis for the dissertation study. Proc TRAJ is based on the principles of SGM and was developed by Jones et al. (2001). Proc TRAJ provides options for measuring three types of distributions over time: an analysis of count; psychometric scale, or; dichotomous data (Jones et al.). A frequency count (annual number of unique complaint counts) is the response variable for the dissertation study.

The statistical model for a "count" response variable in SGM builds from the Poisson distribution (a probability distribution that arises when counting the number of occurrences of an event over time), where it is assumed that:

$$(1) \quad \log(\lambda_{it}^j) = \beta_0^j + \beta_1^j \text{Age}_{it} + \beta_2^j \text{Age}_{it}^2$$

where  $\lambda_{it}^j$  is the expected number of occurrences of the event of interest (e.g., convictions) of subject  $i$  at time  $t$  given membership in group  $j$ .  $\text{Age}_{it}$  is subject  $i$ 's age at time  $t$ , and  $\text{Age}_{it}^2$  is the square of subject  $i$ 's age at time  $t$ . The model's coefficients -  $\beta_0^j$ ,  $\beta_1^j$ , and  $\beta_2^j$  - determine the shape of the trajectory and are superscripted by  $j$  to denote that the coefficients are not constrained to be the same across the  $j$  groups. The conditional probability of the actual number of events,  $P(y_{it}^j|j)$ , given  $j$  is assumed to follow the well-known Poisson distribution.

Nagin, 1999, p. 144

The shape of the trajectory is defined by the parameters  $\beta_0^j$ ,  $\beta_1^j$ , and  $\beta_2^j$ , which are "left free to differ across groups " (Nagin, p. 15). This flexibility in SGM modeling allows for identification of unobserved groups across two levels: behavior at a given age, and behavior over time.

According to Nagin (1999) the resulting trajectories are the product of maximum-likelihood estimation, where:

- (2) Vector  $Y_i = \{Y_{i1}, Y_{i2}, \dots, Y_{iT}\}$ , represents the sequence of individual  $i$ 's behavior over periods of longitudinal periods of observation (T)
- (3)  $P^j(Y_i)$  represents the probability of  $Y_i$  given membership in group  $j$
- (4)  $\pi_j$  represents the probability of membership in group  $j$

He points out that membership in a trajectory is not observed; rather, construction of the likelihood of an individual's membership in a trajectory is accomplished through the:

aggregation of the  $J$  conditional likelihoods,  $P^j(Y_i)$ , to form the unconditional probability of the data,  $Y_i$ ; and

$$(5) \quad P(Y_i) = \sum_j \pi_j P^j(Y_i),$$

where  $P(Y_i)$  is the unconditional probability of observing individual  $i$ 's longitudinal sequence of behavioral measurements. It equals the sum across the  $J$  groups of the probability of  $Y_i$  given membership in group  $j$  weighted by the proportion of the population in group  $j$ . The log of the likelihood for the entire sample is thus the sum across all individuals that compose the sample of the log of Equation 5 evaluated for each individual  $i$ . . . the parameters of interest -  $\beta_0^j$ ,  $\beta_1^j$ , and  $\beta_2^j$ ,  $\pi_j$  - can be estimated by maximization of this log likelihood.

Nagin, p. 146

To complete model selection, the Bayesian Information Criterion (BIC) is used to select the most parsimonious trajectory solution model (Nagin). The model with the lowest BIC value (i.e., the most parsimonious model) is generally selected (Chung et al. 2002; Jones et al., 2001).

Bobby L. Jones, Ph.D., one of the designers of Proc TRAJ, was a paid consultant to the NIJ-funded dissertation study. Jones provided guidance in conceptualization issues related to trajectory modeling (how to approach a heterogeneous age panel at first offense) and statistical analysis using Proc TRAJ. His unique expertise facilitated the accurate application of Proc TRAJ to the data, and strengthened the rigor of final data interpretations. Dr. Jones is a Fellow and Instructor with the Department of Statistics at Carnegie Mellon University.

#### **The response variable for gendered trajectory building.**

The response variable was a count by age of the number of unique complaints accrued by each study youth annually from 2000 through 2007. Modeling offending trajectories as a function of age rather than years is an appropriate methodological response to a heterogeneous age cohort, as is the case in the proposed dissertation study sample (Jones, personal communication, 2009; Yessine & Bonta, 2008). A full range of charges was included in the count: from violent felony offenses to CHINS offenses. This level of available charge data resulted in a diverse measure of official court-contact for the study cohort, moving beyond the investigation of serious (male) offenders only to include youth whose chronic involvement with the system may lead to system entanglement through further system penetration and even incarceration (Mendel, 2007). In their 2002 investigation of gendered patterns of offending, D'Unger et al., noted that "because juvenile females' offenses are often status violations or less serious infractions (e.g. shoplifting), it would be improper to solely use arrest as the measure of offending. Instead we include both official arrests and police contacts before the age of 18"

(2002, p. 358). A count of unique complaints as the response variable for trajectory specification accomplished the goal of D’Unger et al. by including the maximum number of court-involved females in the proposed study analysis.

Time at risk for offending (non-incarcerated time) was factored into the analysis using the “exposure time adjustment that is available in the Possion-based model” of Proc TRAJ (Blokland, et al., 2005, p. 928). This adjustment avoided over-representing youth who would appear in the data to desist from community offending during the seven-year observation period, because they are incarcerated or in a residential placement (Blokland et al.). Few studies have made this important adjustment (Blokland et al.; Yessine & Bonta, 2008). The actual number of days incarcerated for each juvenile offender in the sample was not available. Average lengths of stay by commitment type were calculated to define the parameter of exposure time adjustment (see Table 1). These average incarceration stays were used as a proxy for exposure time in the dissertation study.

Table 1

*Time at Risk for Offending - Estimated Adjustment*

Code	Average Days Incarcerated	Disposition Description
1	35 days	Probation Order includes Boot Camp
2	35 days	Probation Continued – Modified to include Boot Camp
3	35 days	Committed to State Juvenile Justice- Boot Camp placement
4	153 days	Committed to State Juvenile Justice (secure facility)
5	442 days	Committed to State Juvenile Justice – Multi Needs and SJO (Serious Juvenile Offender)
6	442 days	Committed to State Juvenile Justice SJO
7	153 days	Committed to State Juvenile Justice – Specific Institution

## Stage Two Statistical Analysis – Investigating Psychosocial and Systems-level Correlates of Trajectory Group Membership

Available data included potential time-stable psychosocial and systems-level covariates for trajectory group membership (Hawkins et al., 2003; Huizinga et al., 2003; 2003). (see Table 2). These hypothesized covariates were introduced into a Proc TRAJ multinomial logit model during stage two analysis to investigate their ability to predict trajectory group membership. Data was randomly missing for the School Status at 1<sup>st</sup> and Use of Detention at 1<sup>st</sup> variables. Study subjects with missing data for these variables were not included in the covariate model, resulting in adjusted sample numbers for the covariate model of females  $n = 4,553$  and males  $n = 7,908$ . A path model for the hypothesized risk process is seen in Figure 1

Figure 1. Hypothesized Psychosocial and Systems-Level Covariates of Offending Trajectories

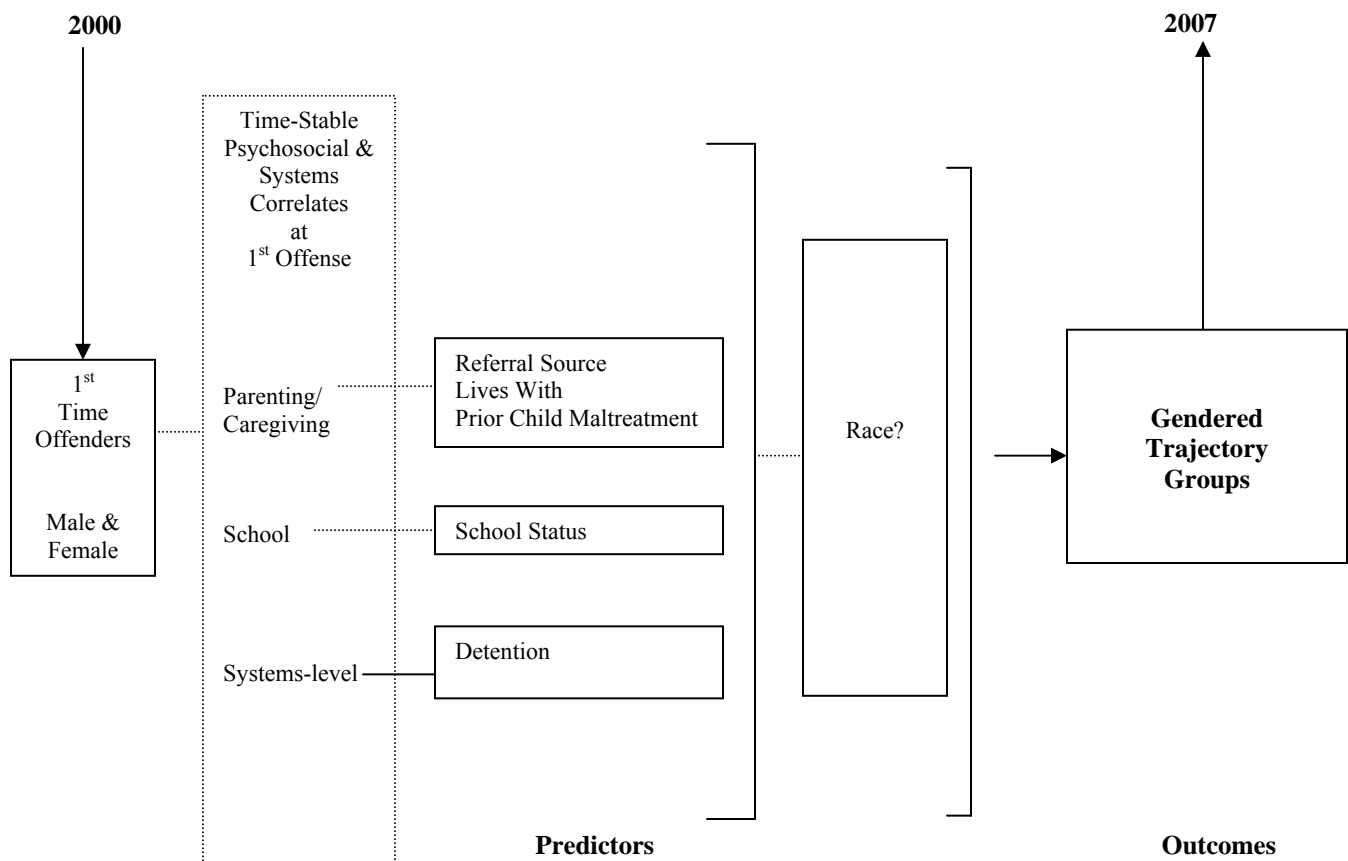


Table 2

*Time-Stable Indicators Present at First Offense*

Variable	Indicators
Prior Child Maltreatment	0 = No Prior Involvement, 1 = Prior/Dismissed (Unsubstantiated), 2 = Prior/Substantiated and Transferred to Relative or Child Welfare
Referral Source	1 = Law Enforcement, 2 = School, 3 = Probation Officer, 4 = Parents/Relative, 5 = Victim, 6 = Social Agency, 7 = Traffic Court, 8 = Other Court, 0 = Other
School Status	1 = Enrolled, 2 = GED Referral, 3 = Home Schooled, 4 = Educational Exceptionality (Learning disabled), 5 = Homebound, 6 = C.I.T.Y Alternative school program), 7 = Alternative School, 8 = Truancy, 9 = Suspended, 10 = Expelled, 11 = Drop Out, 12 = Other
Lives With	1 = Natural or Legal Parents, 2 = Mother Only, 3 = Father Only, 4 = Grandparent, 5 = Mother + Stepfather, 6 = Father + Stepmother, 7 = Foster Home, 8 = Group Home, 9 = Institution, 10 = Job Corps, 11 = Relatives, 0 = Other
Detention	1 = Not Detained, 2 = Detention Facility, 3 = Detention Home/Shelter Care, 4 = Jail/Detention

**Stage Three Statistical Analysis – Trajectory Membership as a Predictor of Incarceration**

The third stage of investigation tested a multinomial logit model to predict the dependent variable Incarceration. The dependent variable was coded as a dichotomous variable (Yes/No), based on disposition data. See Table 1 for dispositions coded as “Yes” for the dependent variable Incarceration. Gendered trajectory solution models specified in stage one analysis served as predictor variables for the dichotomous dependent variable, Incarceration (Yes/No), in the logit model.

## **IV. Results**

### **Three Gendered Trajectories of Offending for Females**

The following section presents the results of: 1) two gendered trajectory model specifications; 2) logit models that identified psychosocial covariates for gendered trajectory groups; and; 3) logit models for gendered trajectory groups as predictors of incarceration. A comparison of the two gendered trajectory models reported in the dissertation study to other trajectory models identified in the literature (D'Unger et al., 2003; Wiesner et al., 2007), as well as a discussion of the results, can be found in the Discussion and Implications section that follows.

The trajectories were specified using the zero-inflated Poisson (ZIP) model as a part of the Proc TRAJ modeling process for semiparametric group modeling (Jones et al., 2001). The ZIP models the conditional distribution of a simple count of data where there are more zeros than the Poisson assumption assumes (Jones et al.). It is not unusual to have more study youth who do not offend during each observation period in a longitudinal sample of delinquent youth because offending of any kind is generally concentrated in a small portion of the sample (Wiesner et al., 2007). Choosing the three-group solution for females was guided by consideration of the Bayesian Information Criterion (BIC) output for each possible model; BIC rewards parsimony, and as a result, the model with three groups (maximum BIC) was chosen for females in the study sample (Jones et al.). Other models were tested but rejected based on the results of the BIC (see Table 3).



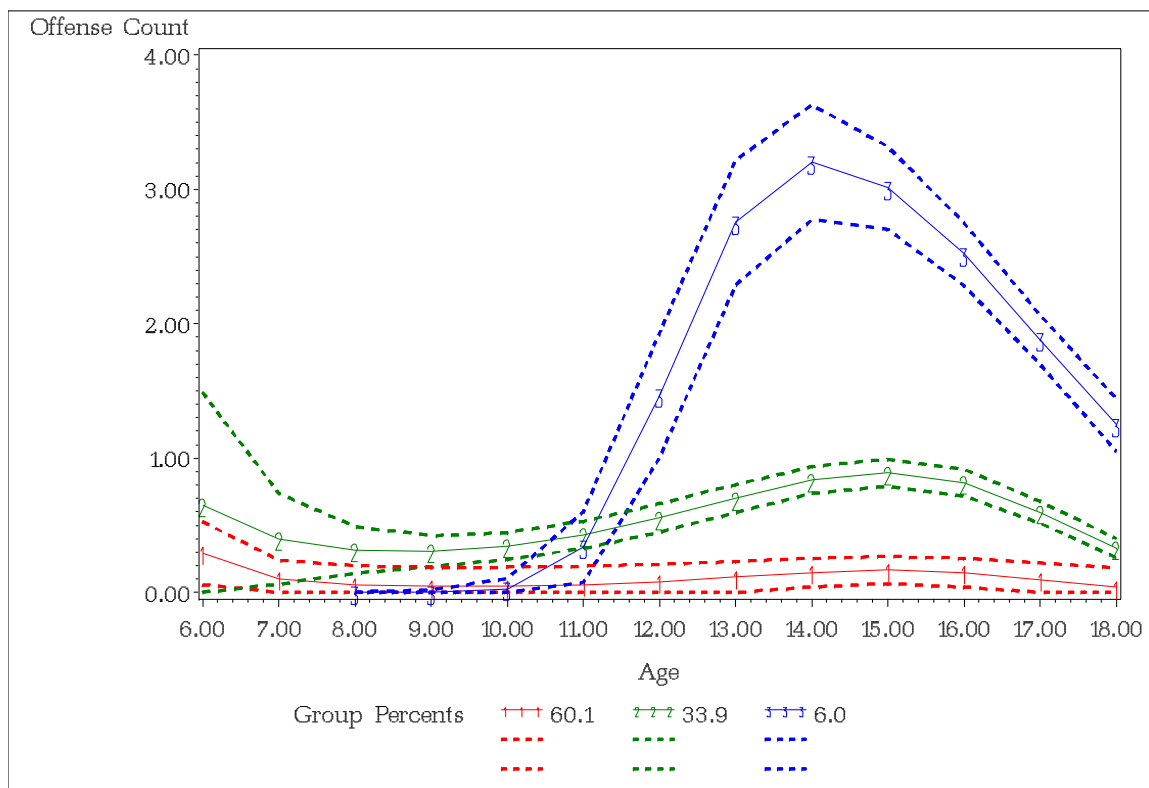
Table 3

*Model Selection Results for Juvenile Females*

Number of Groups	BIC
2	-11155.27
3	-11023.73
4	-11066.72

Three sub-groups of female offenders with distinct trajectories of offending were identified based on a frequency count of officially recorded unique complaints from first offense in the year 2000 through 2007. See Figure 2.

Figure 2. Three-Solution Female Frequency Model for Offending



Group 1 Low-Level Desister Females  $n = 4,167$ ; Group 2 Low-Level Peaked Females  $n = 1,537$ ; Group 3 High-Level Peaked Females  $n = 234$

Figure 2 depicts a three-solution female model ( $N = 5,938$ ). These groups are described as Low-Level Desister Females (Group 1 Red), Low-Level Peaked Females (Group 2 Green), and High-Level Peaked Females (Group 3 Blue). The solid plot lines represent the fitted model and the dashed lines represent the confidence intervals. Membership in these three trajectory groups is reflected in Table 4, where two different percentages are reported. Standard percentages represent the percentage of females in each trajectory based on the total female  $N = 5,948$ . Probability percentages report the average probability of being in a trajectory.

Table 4

*Female Trajectory Percentages*

Female Trajectory Groups	Percentage of $N = 5,938$	<u>Probability Percentage</u> CI
Low-Level Desister Females	70%	60.1% [54.8%, 65.4%]
Low-Level Peaked Females	26%	33.9% [28.7%, 39.1%]
High-Level Peaked Females	4%	6.0% [4.8%, 7.2%]

When reviewing the model, it is important to remember that for a heterogeneous age at first offense panel, offending is modeled as a function of age, rather than year recorded. For example, a female who first offends at age 14 is sorted into a trajectory made up of similar females (based on similar grouped patterns of offending); some of the females in that trajectory first offended before age 14 and some of the yet-to-be assigned females in that trajectory will offend for the first time after age 14. As that 14-year old female is sorted into her trajectory group, her pattern of offending affects the shape of that trajectory from that point forward; likewise, the shape of her trajectory group before her point of entry into that group is affected by other females in that trajectory who first offended before age 14.

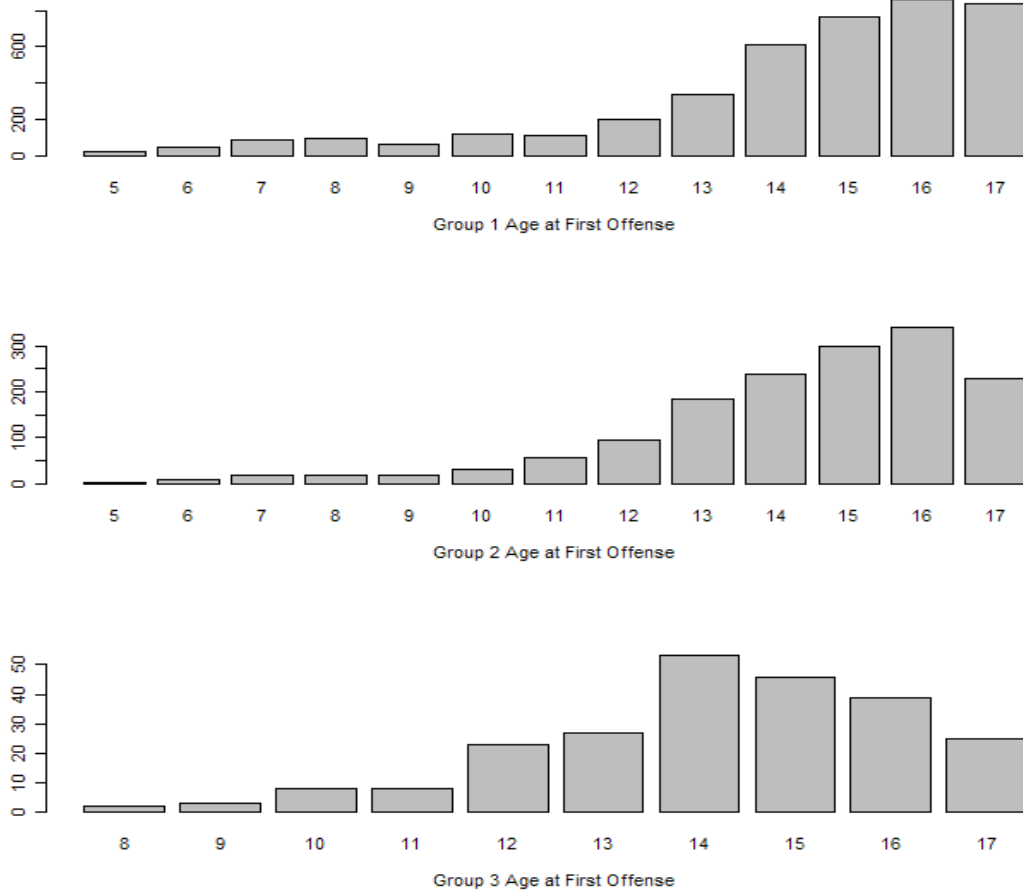
Variance in age at first offense by female trajectory groups was investigated as a result of this heterogeneity in age at first offense characteristic of the study sample. Table 5 reports the mean age at first offense for each female trajectory group as well as the percent of group members 14 or older at first offense. The latter is generally accepted as a cut-off age for early offending (14 or < at first offense) (Wiesner & Capaldi, 2003). Both the visual bar plot in Figure 3 and the percentages indicate High-Level Peaked Females were somewhat more likely to have group members who were younger females at first offense (<14 at first offense), but not at statistically significant levels.

Table 5

*Mean Ages at First Offense for Females*

Trajectory	Mean Age at First Offense	Percent 14 or Older at 1 <sup>st</sup>	Standard Error
Group 1/Red = Low-Level Desister Females	14.32	73.8% 14 > at 1 <sup>st</sup>	0.04
Group 2/Green = Low-Level Peaked Females	14.37	71.8% 14 > at 1 <sup>st</sup>	0.06
Group 3/Blue = High-Level Peaked Females	14.18	69.7% 14 > at 1 <sup>st</sup>	0.13

Figure 3. Ages at First Offense by Female Juvenile Trajectory Group



Group 1/Red = Low-Level Desister Females (73.8% 14 > at 1<sup>st</sup>); Group 2/Green = Low-Level Peaked Females (71.8% 14 > at 1<sup>st</sup>); Group 3/Blue = High-Level Peaked Females (69.7% 14 > at 1<sup>st</sup>)

### Low-level desister females.

The Low-Level Desister Females group included: 1) juvenile female offenders who did not offend again after their first offense complaint date (in other words, after their first offense in 2000, they did not offend again for the balance of the year 2000 through the end of 2007), and, 2) juvenile females who exhibited very low levels of offending volume across the study period (2000 through 2007). A four-solution female model that separated Low-Level Desister Females into two groups (One-Time Only Female Offenders and Low-Level Desister Females) was also

tested, but there was very little difference between these two groups in terms of practical juvenile justice application: both groups require few if any services and are best served by strategies that avoid unnecessary supervision and system penetration into the juvenile justice system. As a result, the decision was made to combine One-Time Only Female Offenders and Low-Level Desister Females into one trajectory.

Low-Level Desister Females declined in volume of offending soon after trajectory onset (age six for the first members of this group) until the group reached age 12, when a very slight rise in volume of offending began and culminated in a bump in offending volume by group age 15 (still < .25 complaints). After age 15, offending volume for Low-Level Desister Females declined to near zero by group age 18 (or the end of the observation period, year 2007).

Desistence can only be inferred for Low-Level Desister Females, as they may offend again after the end of the observation period (Chung et al., 2002); however, this group does appear to be moving toward desistence. A cautionary note about desistence: the dissertation study data set contains juvenile records only (up to maximum age 18). Juvenile trajectories that appear to be desisting or moving toward desistence cannot be definitively categorized because of this data set limitation. The addition of adult offending data is required for such future specification of desistence.

#### **Low-level peaked females.**

The Low-Level Peaked Females displayed a volume of offending that was higher than the Low-Level Desister Females at the beginning of their trajectory (age six for the first members of this trajectory). Low-Level Peaked Females exhibited a subsequent decline in offending until group age 10, when a more substantial rise in offending volume began until it peaked as the group reached age 15. The mean age of first offense for Low-Level Peaked

Females was 14.37 (SE .06). After this peak in offending volume at group age 15, Low-Level Peaked Females showed a subsequent decline until the end of the observation period (year 2007, or up to group age 18). Although the decline in offending frequency seen in Low-Level Peaked Females was not as close to zero at age 18 as the Low-Level Desister Females, it does appear that Low-Level Peaked Females are moving toward desistence by age 18. See the Discussion section for clinical implications of this likely pattern of offending.

### **High-level peaked females.**

Of the three female groups, High-Level Peaked Females displayed the lowest volume of offending (near zero) at the beginning of their trajectory (age eight for the first members of this trajectory). Offending for High-Level Peaked Females actually paralleled that of Low-Level Desister Females for the first three years of the High-Level Peaked Females trajectory; a very low volume of offending (near zero) was seen for both groups. High-Level Peaked Females then exhibited a “steep rise” (Bokland et al., 2005, p. 930) in volume of offending that began at group age 10 and peaked at age 14. The mean age at first offense for High-Level Peaked Females was 14.18 (SE.13). This dramatic peak in volume of offending at age 14 occurred earlier for High-Level Peaked Females than the more modest increases in volume of offending seen for either Low-Level Desister Females (age 15) or Low-Level Peaked Females (age 15). By group age 18, the volume of offending for High-Level Peaked Females was declining from their peak at age 14; however, unlike the other two female groups, High-Level Peaked Females were still offending at a volume higher than one unique complaint per year by group age 18, or the end of the observation window in 2007. Thus, High-Level Peaked Females do not appear to desist from offending at the end of the study observation period, “putting them in an ambiguous place between ‘adolescence peaked’ and ‘chronic’ offending” (D’Unger et al., 2002, p. 363). In the

case of the dissertation study, more data on adult offending for High-Level Peaked Females is necessary to clarify this ambiguity between a potentially chronic adult female trajectory and a desisting adult female trajectory (D'Unger et al., 2002).

### **Correlates of Juvenile Female Offending Trajectories**

Multinomial logit regression investigated time-stable psychosocial and systems-level covariates for trajectory group membership present for females at first offense in the year 2000. Low-Level Desister Females served as the comparison group for the logit covariate model. Table 6 presents significant results only ( $*p < .05$   $**p < .01$   $***p < 0.0001$ ) for the covariate model. Trajectory-specific numbers for variables in the covariate model are not available; however, non-trajectory specific numbers for these variables are reported in the Notes section of Table 6. Table 7 provides the Proc TRAJ parameter estimates for the female covariate model. Note that parameter estimates with a negative value indicate fewer instances of a variable attribute in a trajectory group compared with the Low-Level Desister Females, and positive parameter estimates indicate more instances of a variable attribute in a trajectory group compared with the Low-Level Desister Females.

Table 6

*Covariates for Female Trajectory Groups*

Variable	Low-Level Peaked Females	High-Level Peaked Females
	Group 2/Green	Group 3/Blue
Race		
White	0.0354*	0.1979
African American	0.0361*	0.0836
Prior Child Maltreatment		
Dismissed	0.0018**	<0.0001***
Substantiated (Transferred to Relative or Child Welfare)	0.0001***	<0.0001***
Referral Source		
School	0.0003**	<0.0001***
Parent	0.0203*	0.1857
School Status		
Drop Out	< 0.0001***	<0.0001***
GED Referral	< 0.0001***	<0.0001***
Truant	0.0701	<0.0001***
Lives With		
Independent	0.2041	0.0044**
Foster Home (Child Welfare System)	0.0447*	0.0030**
Grandparent	0.0112*	0.1879

*Note.* Comparison group = Low-Level Desister Females. Non trajectory-specific numbers for these variables in the  $n = 5,938$  female sample are: Child Mal Tx Dismissed  $n = 250$ ; Child Mal Tx Substantiated  $n = 392$ ; Referral School  $n = 1,829$ ; Referral Parent  $n = 891$ ; School Drop Out  $n = 175$ ; School GED Referral  $n = 40$ ; School Truant  $n = 87$ ; Lives With Independent  $n = 29$ ; Lives With Foster Home  $n = 58$ ; Lives With Grandparent  $n = 188$ .

\* $p < .05$  \*\* $p < .01$  \*\*\* $p < 0.0001$



Table 7

*Proc TRAJ Parameter Estimates for Female Covariate Model*

<b>Group</b>	<b>Parameter</b>	<b>Parameter Estimate</b>	<b>Standard Error</b>	<b>T for H<sub>0</sub>: Parameter=0</b>	<b>Prob &gt;  T </b>
<b>Group 2 Low-Level Peaked Females</b>					
2	Constant	-3.38325	1.20397	-2.810	0.0050
	white	2.47363	1.17566	2.104	0.0354
	black	2.47216	1.17945	2.096	0.0361
MalTxDis	BFstDHR1	1.23923	0.32889	3.768	0.0002**
MalTx	BFstDHR2	1.03574	0.25672	4.035	0.0001***
	RefCode0	0.26187	0.42751	0.613	0.5402
School	RefCode2	-0.57259	0.15849	-3.613	0.0003**
Parent	RefCode4	0.42769	0.18422	2.322	0.0203
	RefCode5	-0.05345	0.24306	-0.220	0.8259
Drop Out	SchlDX	24.51645	.	.	<.0001***
	SchlE	-0.09105	0.17575	-0.518	0.6044
GEDRefer	SchlG	22.99704	.	.	<.0001***
	SchlT	-1.25991	0.69563	-1.811	0.0701
	LivFstM	0.31776	0.17543	1.811	0.0701
	LivFstF	0.32964	0.30163	1.093	0.2745
	LivFstI	1.12578	0.88645	1.270	0.2041
Foster	LivFst96	1.37188	0.68335	2.008	0.0447*
	LivFst97	-0.22123	0.36501	-0.606	0.5445
	LivFst98	0.05087	0.56894	0.089	0.9288
	LivFstR1	0.06890	0.44771	0.154	0.8777
Grandprt	LivFstGp	0.87541	0.34506	2.537	0.0112*
	LivFstOt	-0.10394	0.23806	-0.437	0.6624
	FChgDF	-0.01721	0.28845	-0.060	0.9524
	FChgDHS	-0.07697	0.34923	-0.220	0.8256
	FChgJD	-0.15880	2.26656	-0.070	0.9441
<b>GROUP 3 High-Level Peaked Females</b>					
3	Constant	-4.65204	1.25199	-3.716	0.0002
	white	1.55869	1.21065	1.287	0.1979
	black	2.09456	1.21063	1.730	0.0836
MalTXDIS	BFstDHR1	1.71520	0.38425	4.464	0.0000***
MalTX	BFstDHR2	1.35969	0.31675	4.293	0.0000***
	RefCode0	-1.53134	0.85053	-1.800	0.0718
School	RefCode2	-1.52146	0.30765	-4.945	0.0000***
	RefCode4	0.31629	0.23897	1.324	0.1857
	RefCode5	-0.03049	0.33054	-0.092	0.9265
Drop Out	SchlDX	25.79488	.	.	<.0001***
	SchlE	0.15633	0.28431	0.550	0.5824
	SchlG	23.99970	.	.	<.0001
Truant	SchlT	-17.53615	.	.	<.0001***
	LivFstM	0.24691	0.29108	0.848	0.3963
	LivFstF	0.59895	0.44654	1.341	0.1798
Ind	LivFstI	2.45392	0.86179	2.847	0.0044**
Foster	LivFst96	2.12911	0.71688	2.970	0.0030**
	LivFst97	0.56245	0.42665	1.318	0.1874
	LivFst98	0.60678	0.70195	0.864	0.3874
	LivFstR1	-1.00415	0.91674	-1.095	0.2734

<b>Group</b>	<b>Parameter</b>	<b>Parameter Estimate</b>	<b>Standard Error</b>	<b>T for H<sub>0</sub>: Parameter=0</b>	<b>Prob &gt;  T </b>
<b>GROUP 3 High-Level Peaked Females (continued)</b>					
	LivFstGp	0.67997	0.51634	1.317	0.1879
	LivFstOt	0.23569	0.38420	0.613	0.5396
	FChgDF	0.17659	0.37598	0.470	0.6386
	FChgDHS	0.17733	0.40856	0.434	0.6643
	FChgJD	2.04715	1.44651	1.415	0.1570

### **Race**

African-American and White females were more likely to be Low-Level Peaked Females than Low-Level Desister Females; this may be the result of unequal group sizes.

### **Child maltreatment prior to first offense - females.**

There was more substantiated child maltreatment present at first offense (MalTx) in the Low-Level Peaked Females ( $p < 0.0001^{***}$ ) and the High-Level Peaked Females ( $p < 0.0001^{***}$ ) groups than in the Low-Level Desister Females group. Because data for child maltreatment were made available through court dependency records, the variable Prior Child Maltreatment included three categories: 0 = No Prior Case; 1 = Case Dismissed/Unsubstantiated; 2 = Child Maltreatment Substantiated with Transfer to Relatives or Child Welfare.

### **Referral source - females.**

There were fewer school referrals for first offense (School)) for Low-Level Peaked Females ( $p = 0.0003^{**}$ ) and High-Level Peaked Females ( $p < 0.0001^{***}$ ) than for Low-Level Desister Females. By contrast, there were more parental referrals for first offense (Parent) for Low-Level Peaked Females ( $p = .0203^*$ ) than Low-Level Desister Females.

### **School status - females.**

There were more school drop outs at first offense (Drop Out) for both Low-Level Peaked Females ( $p < 0.0001^{***}$ ) and High-Level Peaked Females ( $p < 0.0001^{***}$ ) than in the Low-Level Desister Females group. There were more referrals for youth to complete the GED

(GEDRefer) at first offense for both Low-Level Peaked Females ( $p < 0.0001^{***}$ ) and High-Level Peaked Females ( $p < 0.0001^{***}$ ) than in the Low-Level Desister Females group. There was less truancy (Truant) at first offense among High-Level Peaked Females ( $p < .0001^{***}$ ) than Low-Level Desister Females.

#### **Lives with - females.**

There were more females with an emancipated status at first offense (Ind) in the High-Level Peaked Females group ( $p = 0.0044^{**}$ ) than in the Low-Level Desister Females group. There were more Low-Level Peaked Females ( $p = 0.0447^*$ ) and High-Level Peaked Females ( $p = 0.003^{**}$ ) living in a foster home at first offense (Foster) than Low-Level Desister Females. There were more Low-Level Peaked Females ( $p = 0.0112^*$ ) living with a grandparent at first offense (Grandprt) than Low-Level Desister Females.

#### **Use of Detention at First Offense**

The systems-level time-stable variable Use of Detention at First Offense was not significantly correlated with trajectory group membership for females. This may indicate that juvenile female offenders in the dissertation study state are less likely to be detained at first offense than boys.

#### **Trajectories as Predictors of Incarceration for Females**

Multinomial logit regression tested the three-solution trajectory model as a predictor for the dependent variable Incarceration. The dependent variable was a time-varying dichotomous variable (Yes/No). Time-varying status indicated that the incarceration could have occurred any time during the eight year observation period, from the year 2000 through 2007. The independent variables were the probabilities of group membership calculated by Proc TRAJ. Table 2 in the Methods section lists all the secure incarceration dispositions for the state under study coded as

Yes for the dependent variable Incarceration. Results indicated that probability of group membership predicts incarceration ( $p = 0.046$ ). Incarceration percentages are reported in Table 8.

Table 8

*Incarceration Percentages by Female Trajectory Group*

Female Trajectory Group	Percent Incarcerated	95% CI
Low-Level Desister Females	0%	[0%, 0%]
Low-Level Peaked Females	34.8%	[32.3%, 37.3%]
High-Level Peaked Females	76%	[76.0%, 81.3%]

**Six Gendered Trajectories of Offending for Males**

The male trajectories were specified using the zero-inflated Poisson (ZIP) model as a part of the Proc TRAJ modeling process for semiparametric group modeling (Jones et al., 2001). The ZIP models the conditional distribution of a simple count of data where there are more zeros than the Poisson assumption assumes (Jones et al.). It is not unusual to have more study youth who do not offend during each observation period in a longitudinal sample of delinquent youth because offending of any kind is generally concentrated in a small portion of the sample (Wiesner et al, 2007). Choosing the six-group solution for males was guided in part by consideration of the Bayesian Information Criterion (BIC) output, which rewards parsimony (see Table 9). Blokland et al. (2005) note that as a formal framework for selecting the optimal model, “BIC does not provide the sole criterion, and more subjective criteria based on knowledge of the phenomenon and study objectives” (p. 929) may also be taken into consideration. In the present study, a decision was made to choose the six group model rather than the seven group model for males based on the merits of slightly larger group sizes for higher-rate offenders in a six group model and the results of previous empirical trajectory studies for males (Wiesner et al., 2007).

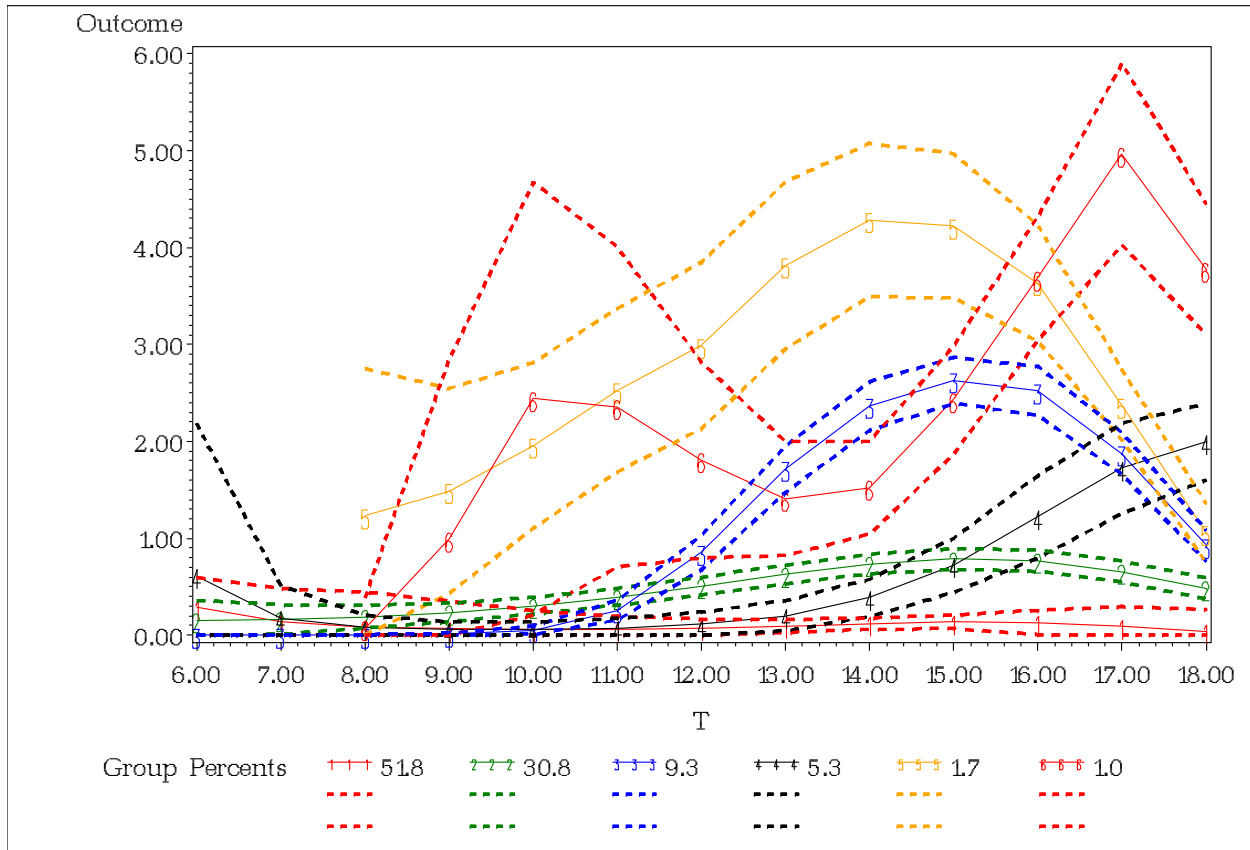
Table 9

*Model Selection Results for Juvenile Males*

<b>Number of Groups</b>	<b>BIC</b>
2	-31328.50
3	-30858.34
4	-30694.53
5	-30632.55
6	-30538.55
7	-30463.03

Six sub-groups of male offenders with distinct trajectories of offending were identified based on a frequency count of officially recorded unique complaints from first offense in the year 2000 through 2007. See Figure 4.

Figure 4. Six-Solution Male Frequency Model for Offending



Group 1 Low-Level Desister Males  $n = 6246$ ; Group 2 Decreasing Low-Level Males  $n = 2778$ ; Group 3 Decreasing Moderate-Level Males  $n = 612$ ; Group 4 Late Escalator Males  $n = 265$ ; Group 5 Decreasing High-Level Males  $n = 63$ ; Group 6 High-Level Chronic Males  $n = 57$

Figure 4 depicts a six-solution male model ( $N = 10,021$ ). These groups are described as Low-Level Desister Males (Group 1 Red); Decreasing Low-Level Males (Group 2 Green); Decreasing Moderate-Level Males (Group 3 Blue); Late Escalator Males (Group 4 Black); Decreasing High-Level Males (Group 5 = Yellow), and; High-Level Chronic Males (Group 6 Orange). The solid plot lines represent the fitted model and the dashed lines represent the confidence intervals. Membership in these six trajectory groups is reflected in Table 10 where two different percentages are reported. Standard percentages represent the percentage of males

in each trajectory based on the total male  $N = 10,021$ . Probability percentages report the percentage probability of being in a trajectory.

Table 10

*Male Trajectory Percentages*

Male Trajectory Groups	Percentage of $N = 10,021$	<u>Probability Percentage</u> 95% CI
Low-Level Desister Males	62%	51.8% [49%, 54.6%]
Decreasing Low-Level Males	28%	30.8% [28.1%, 33.5%]
Decreasing Moderate-Level Males	6%	9.3% [8.4%, 10.2%]
Late Escalator Males	3%	5.3% [4.5%, 6.1%]
Decreasing High-Level Males	1%	1.7% [1.4, 2.0]
High-Level Chronic Males	1%	1.0% [0.8%, 1.2%]

When reviewing the model, it is important to remember that for a heterogeneous age at first offense panel, offending was modeled as a function of age, rather than year recorded. Variance in age at first offense by male trajectory groups was investigated as a result of this heterogeneity in age at first offense characteristic of the study sample. Table 11 reports the mean age at first offense of each male trajectory group as well as the percent of group members 14 or older at first offense. The latter is generally accepted as the cut-off age for early offending (14 or < at first offense( (Wiesner & Capaldi, 2003). Both the visual bar plot in Figure 5 and the percentages indicate that Decreasing High-Level Males and High-Level Chronic Males were more likely to have group members who were 14 or younger at first offense, but not at statistically significant levels. Of these two groups, the High-Level Chronic Males group had the highest number of offenders who were 14 or younger at first offense.

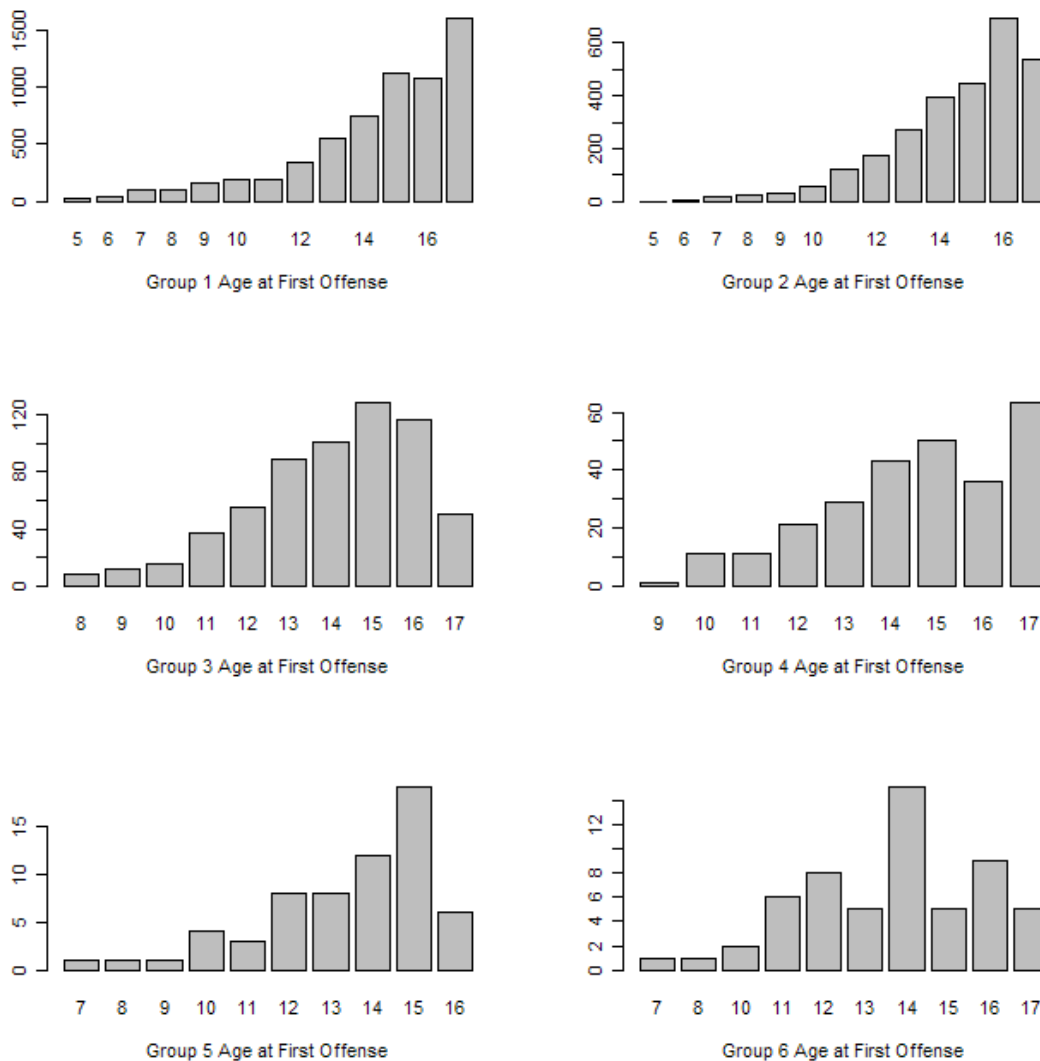
Table 11

*Mean Ages at First Offense for Males*

Trajectory		Mean Age at First Offense	Percent 14 or Older at 1 <sup>st</sup>	SE
Group 1 Red =	Low-Level Desister Males	14.44	72.5% 14 > at 1 <sup>st</sup>	0.03
Group 2 Green =	Decreasing Low-Level Males	14.62	74.4% 14 > at 1 <sup>st</sup>	0.04
Group 3 Blue =	Decreasing Moderate Level Males	14.06	64.7% 14 > at 1 <sup>st</sup>	0.08
Group 4 Black =	Late Escalator Males	14.60	72.5% 14 > at 1 <sup>st</sup>	0.11
Group 5 Yellow =	Decreasing High-Level Males	13.43	58.7% 14 > at 1 <sup>st</sup>	0.26
Group 6 Orange =	High-Level Chronic Males	13.61	59.6% 14 > at 1 <sup>st</sup>	0.30



Figure 5. Ages at First Offense by Male Juvenile Trajectory Groups



Group 1/Red = Low-Level Desister Males (72.7% 14 > at 1<sup>st</sup>); Group 2/Green = Decreasing Low-Level males (74.4% 14 > at 1<sup>st</sup>); Group 3/Blue = Decreasing Moderate-Level Males (64.7% 14 > at 1<sup>st</sup>); Group 4/Black = Late Escalator Males (72.5% 14 > at 1<sup>st</sup>); Group 5/Yellow = Decreasing High-Level Males (58.7% 14 > at 1<sup>st</sup>); Group 6/Orange = High-Level Chronic Males (59.6% 14 > at 1<sup>st</sup>).

### **Low-level desister males.**

As with the female model, the Low-Rate Desister Male group included: 1) juvenile male offenders who did not offend again after their first offense complaint date in the year 2000, and; 2) juvenile male offenders who exhibited very low levels of offending volume across the study period (2000 through 2007). Low-Level Desister Males declined in volume of offending soon after trajectory onset (age six for the first members of this group) until the group reached age 12, when a very slight rise began and peaked at age 14; thereafter, offending volume declined to near zero by the end of the observation period (year 2007, or up to group age 18). This pattern of offending for Low-Level Desister Males mirrored the pattern of offending seen in Low-Level Desister Females. Like the females, Low-Level Desister Males appeared to be desisting from offending by group age 18. The same cautions regarding the use of the label “desister” apply here as for females: because the dataset for the dissertation study is a juvenile data set for offending, desistence cannot be confirmed until adult offending data is collected for this retrospective longitudinal panel of juvenile offenders.

### **Decreasing low-level males.**

The frequency of offending trajectory for Low-Level Peaked Males was very similar to that of Low-Level Peaked Females: a gradual increase in offending that peaks by group age 15 and appeared to be declining toward desistence by the end of the observation period (age 18). Although it is likely Decreasing Low-Level Males were moving toward desistence, more data collection years would be required to confirm this pattern.

### **Decreasing moderate-level males.**

Decreasing Moderate-Level Males began offending at the very lowest volume of all the juvenile male trajectories. As the group moved into age 10 they began a steady rise in offending

which peaked at just under three unique complaints during age 15. Decreasing Moderate-Level Males never reached the high level of offending exhibited by the Decreasing High-Level Males; however, at different volumes of offending, the age curves of their trajectories from group ages 12 to 18 were quite similar. Decreasing Moderate-Level Males declined to one complaint by age 18, but cannot be said to be desisting because offending is still above zero; rather, Decreasing Moderate-Level Males may be moving into low-level chronic offending during the early adult years.

**Late-onset escalator males.**

Like Decreasing Moderate-Level Males, Late-Onset Escalation Males exhibited a low level of offending until group age 12, when a steady rise in volume of offending occurred. This volume of offending was just under two complaints by age 18; however, this group was still escalating in volume of offending at age 18. Late-onset Escalator Males were the only one of the six male trajectories that did not show a decline in offending at the end of the observation period.

**Decreasing high-level males.**

Decreasing High-Level Males had the second highest peak of offending of the six trajectories, at a high of four complaints during group age 14; this was second only to the High-Level Chronic Males. After a steady climb in offending frequency from age eight up to age 12, Decreasing High-Level Males showed a broad arc of high-level offending from years 13 through 15. After age 15, Decreasing High-Level Males showed a dramatic decrease in offending. Like the Decreasing Moderate-Level Males, they appeared to be headed toward desistence or low-level chronicity by age 18; however, more data collection into young adulthood is necessary to determine whether Decreasing High-Level Males become low-level chronics or desisters in early adulthood.

### **High-level chronic males.**

High-Level Chronic Males showed a roller-coaster pattern of offending volume that peaked early, declined, but then exhibited a steep increase in offending at group age 17. It is noteworthy that this pattern is not influenced by unaccounted for periods of residential placement or incarceration; such periods of “off the street” time were accounted for using the exposure time adjustment available in Proc TRAJ. High-level Chronic Males showed the highest peak in frequency of offending of all six juvenile male trajectory groups, with a count of five complaints at age 18. Although High-Level Chronic juvenile males exhibited a modest decline in offending between the ages 17 and 18, their offending frequency was still very high at age 18, with just under four unique complaints. More data collection into adulthood is necessary to confirm the label “chronic” for these High-Level Chronic Males; however, their continued high-level of offending appears to be moving toward a pattern of reduced, but possibly chronic and even sustained, elevated offending frequency in the adult years.

### **Correlates of Juvenile Male Offending Trajectories**

Multinomial logit regression investigated time-stable psychosocial and systems-level covariates for trajectory group membership present for males at first offense in the year 2000. Low-Rate Desister Males were the comparison group for the logit regression covariate model. Table 12 presents significant results only ( $*p < .05$   $**p < .01$   $***p < 0.0001$ ). Trajectory-specific numbers for variables in the covariate model are not available; however, non-trajectory specific numbers for these variables are reported in the Notes section of Table 12. Table 13 provides the Proc TRAJ parameter estimates for the male covariate logit model; note that parameter estimates with a negative value indicate fewer instances of a variable attribute in a trajectory group compared with the Low-Level Desister Males, and positive parameter estimates

indicate more instances of a variable attribute in a trajectory group compared with the Low-Level Desister Males.

Table 12

*Covariates for Trajectory Groups Males*

Covariates	Decreasing Low-Level Males	Decreasing Moderate- Level Males	Late Escalator Males	Decreasing High-Level Males	Chronic High-Level Males
	Group 2 Green	Group 3 Blue	Group 4 Black	Group 5 Yellow	Group 6 Orange
<b>Race</b>					
African American	0.0717	0.1890	0.9641	0.3409	0.7431
White	0.2993	0.9638	0.4536	0.5434	0.7873
<b>Prior Child Maltreatment</b>					
Dismissed	0.0018**	<0.0001***	0.0391*	0.2866	0.9172
Substantiated	0.0945	0.0001***	0.0029**	0.3432	0.0024**
<b>Referral Source for 1<sup>st</sup></b>					
School	0.0006**	<0.0001***	0.1108	0.0088**	0.0334*
Parent		0.0180*	0.0288*	0.4304	0.8350
<b>School Status at 1<sup>st</sup></b>					
Drop Out	0.9553	0.9399	0.9423	0.9447	0.9454
Expelled	0.0008**	0.8779	0.2870	0.4790	0.0490*
GED Referral	0.9704	0.9657	0.9695	0.9680	0.9997
Truant	0.3601	0.6441	0.9860	0.9821	0.4760
<b>Lives With at 1<sup>st</sup></b>					
Mother + Stepfather	0.0140*	0.0051**	0.3582	0.6597	0.9916
Father + Stepmother	0.0554	0.0005**	0.7594	0.1258	0.8526
Relatives	0.0294*	0.8249	0.2053	0.9873	0.4903
Grandparent	0.0163*	0.0097**	0.0691	0.1863	0.4738
Other	0.0483*	0.5192	0.3617	0.5754	0.1950
<b>Use of Detention at 1<sup>st</sup></b>					
Detention Facility	0.0123*	0.5051	0.3232	0.6029	0.0723
Shelter Care	0.0129*	0.0726	0.9893	0.9817	0.9825
Jail	0.1378	0.9874	0.9868	0.0377*	0.9816

*Note.* Comparison group = Low-Level Desister Males. Non trajectory-specific numbers for these variables in the  $n = 10,021$  male study sample are: Child Mal Tx Dismissed  $n = 358$ ; Child Mal Tx Substantiated  $n = 426$ ; Referral School  $n = 2,353$ ; Referral Parent  $n = 912$ ; School Expelled  $n = 5,787$ ; Lives With Mom + Step  $n = 482$ ; Lives With Father+ Step  $n = 133$ ; Lives With Relatives  $n = 209$ ; Lives With Grandparent  $n = 324$ ; Use of Detention at 1<sup>st</sup>  $n = 732$ ; Use of Shelter Care at 1<sup>st</sup>  $n = 95$ .

\* $p < .05$  \*\* $p < .01$  \*\*\* $p < 0.0001$

Table 13

*Proc TRAJ Parameter Estimates for Male Covariate Model*

<b>Group</b>	<b>Parameter</b>	<b>Parameter Estimate</b>	<b>Standard Error</b>	<b>T for H<sub>0</sub>: Parameter=0</b>	<b>Prob &gt;  T </b>
<b>Group 2 Decreasing Low-Level Males</b>					
2	Constant	-1.03340	0.51744	-1.997	0.0458
	white	0.49244	0.47443	1.038	0.2993
	black	0.86460	0.48007	1.801	0.0717
MalTXDis	BFstDCD1	0.91742	0.29395	3.121	0.0018
MalTX	BFstDCD2	0.46304	0.27688	1.672	0.0945
	RefCode0	-0.44885	0.40383	-1.111	0.2664
School	RefCode2	-0.62689	0.18248	-3.435	0.0006
	RefCode4	0.00398	0.20086	0.020	0.9842
Victim	RefCode5	-0.31514	0.18738	-1.682	0.0926
	SchlDX	10.99195	160.11467	0.069	0.9453
	SchlE	-0.53215	0.15883	-3.351	0.0008
	SchlG	15.20780	409.44092	0.037	0.9704
	SchlT	-0.45348	0.49547	-0.915	0.3601
	LivFstM	0.16880	0.14588	1.157	0.2472
	LivFstF	-0.13365	0.22937	-0.583	0.5601
	LivFstI	0.48126	0.70769	0.680	0.4965
	LivFst96	0.19319	0.75573	0.256	0.7982
Mom+Step	LivFst97	0.59534	0.24227	2.457	0.0140
Dad+Step	LivFst98	0.90044	0.46997	1.916	0.0554
Relatives	LivFstR1	0.78626	0.36098	2.178	0.0294
Grandprt	LivFstGp	0.72436	0.30166	2.401	0.0163
Other	LivFstOt	-0.42335	0.21442	-1.974	0.0483
Detention	FChgDF	0.50118	0.20018	2.504	0.0123
Shelter	FChgDHS	1.14375	0.45978	2.488	0.0129
	FChgJD	1.14825	0.77373	1.484	0.1378
<b>Group 3 Decreasing Moderate-Level Males</b>					
3	Constant	-2.83573	0.96868	-2.927	0.0034
	white	-0.04215	0.92855	-0.045	0.9638
	black	1.21594	0.92576	1.313	0.1890
MalTXDis	BFstDCD1	1.46842	0.32511	4.517	0.0000
MalTX	BFstDCD2	1.11488	0.27726	4.021	0.0001
	RefCode0	0.41422	0.37621	1.101	0.2709
School	RefCode2	-1.09634	0.23527	-4.660	0.0000
Parent	RefCode4	0.53701	0.22697	2.366	0.0180
	RefCode5	0.05989	0.22908	0.261	0.7938
	SchlDX	12.07804	160.11434	0.075	0.9399
	SchlE	-0.03920	0.25511	-0.154	0.8779
	SchlG	17.59461	409.44084	0.043	0.9657
	SchlT	-0.67379	1.45840	-0.462	0.6441
	LivFstM	0.21825	0.23667	0.922	0.3565
	LivFstF	0.23753	0.33930	0.700	0.4839
	LivFstI	0.72489	0.67711	1.071	0.2844
	LivFst96	0.55590	0.73651	0.755	0.4504
Mom+Step	LivFst97	0.99399	0.35527	2.798	0.0051
Dad+Step	LivFst98	1.67506	0.47841	3.501	0.0005
	LivFstR1	0.10799	0.48817	0.221	0.8249
Grandprt	LivFstGp	0.92086	0.35626	2.585	0.0097

Group	Parameter	Parameter Estimate	Standard Error	T for H <sub>0</sub> : Parameter=0	Prob >  T
<b>Group 3 Decreasing Moderate-Level Males (continued)</b>					
	LivFstOt	-0.22347	0.34671	-0.645	0.5192
	FChgDF	0.21685	0.32533	0.667	0.5051
	FChgDHS	0.90728	0.50535	1.795	0.0726
	FChgJD	-13.42025	852.81983	-0.016	0.9874
<b>Group 4 Late Escalator Males</b>					
4	Constant	-2.03575	0.68505	-2.972	0.0030
	white	-0.45984	0.61361	-0.749	0.4536
	black	0.02848	0.63257	0.045	0.9641
MaltXDis	BFstDCD1	1.04134	0.50474	2.063	0.0391
MaltX	BFstDCD2	1.17995	0.39551	2.983	0.0029
	RefCode0	-1.58514	2.10755	-0.752	0.4520
	RefCode2	-0.47153	0.29571	-1.595	0.1108
Parent	RefCode4	0.62286	0.28496	2.186	0.0288
	RefCode5	-0.70563	0.43341	-1.628	0.1035
	SchlDX	11.58752	160.11674	0.072	0.9423
	SchlE	-0.34239	0.32156	-1.065	0.2870
	SchlG	15.66936	409.44172	0.038	0.9695
	SchlT	-13.39602	763.35172	-0.018	0.9860
	LivFstM	0.39168	0.27158	1.442	0.1492
	LivFstF	-0.76502	0.61885	-1.236	0.2164
	LivFstI	-12.59604	755.76480	-0.017	0.9867
	LivFst96	-13.43731	784.96026	-0.017	0.9863
	LivFst97	0.50499	0.54955	0.919	0.3582
	LivFst98	0.36803	1.20188	0.306	0.7594
	LivFstR1	0.71514	0.56464	1.267	0.2053
Grandprt	LivFstGp	0.84871	0.46692	1.818	0.0691
	LivFstOt	-0.37573	0.41196	-0.912	0.3617
	FChgDF	0.34002	0.34416	0.988	0.3232
	FChgDHS	-11.14185	833.95374	-0.013	0.9893
	FChgJD	-12.18400	736.68677	-0.017	0.9868
<b>Group 5 Decreasing High-Level Males</b>					
5	Constant	-2.05264	1.18315	-1.735	0.0828
	white	-0.65844	1.08358	-0.608	0.5434
	black	-1.08831	1.14266	-0.952	0.3409
	BFstDCD1	1.05509	0.99017	1.066	0.2866
	BFstDCD2	0.58130	0.61323	0.948	0.3432
	RefCode0	-14.10305	999.73601	-0.014	0.9887
School	RefCode2	-1.52186	0.58052	-2.622	0.0088
	RefCode4	-0.62742	0.79577	-0.788	0.4304
	RefCode5	-0.10269	0.46892	-0.219	0.8267
	SchlDX	11.10082	160.11899	0.069	0.9447
	SchlE	-0.32503	0.45909	-0.708	0.4790
	SchlG	16.41686	409.44188	0.040	0.9680
	SchlT	-12.26814	545.65037	-0.022	0.9821
	LivFstM	-0.03886	0.44772	-0.087	0.9308
	LivFstF	-0.80395	0.89904	-0.894	0.3712
	LivFstI	0.96853	1.20955	0.801	0.4233
	LivFst96	-11.25427	489.96867	-0.023	0.9817
	LivFst97	0.33153	0.75296	0.440	0.6597
	LivFst98	1.28210	0.83740	1.531	0.1258

Group	Parameter	Parameter Estimate	Standard Error	T for H <sub>0</sub> : Parameter=0	Prob >  T
<b>Group 5 Decreasing High-Level Males (continued)</b>					
	LivFstRl	-13.69582	857.97536	-0.016	0.9873
	LivFstGp	0.91382	0.69139	1.322	0.1863
	LivFstOt	-0.34860	0.62229	-0.560	0.5754
	FChgDF	0.34382	0.66080	0.520	0.6029
	FChgDHS	-11.16024	485.62471	-0.023	0.9817
Jail	FChgJD	2.44506	1.17678	2.078	0.0377
<b>Group 6 High-Level Chronic Males</b>					
6	Constant	-4.85741	5.93102	-0.819	0.4128
	white	1.55309	5.75473	0.270	0.7873
	black	1.88347	5.74738	0.328	0.7431
	BFstDCD1	-0.12699	1.22094	-0.104	0.9172
MalTX	BFstDCD2	1.65497	0.54604	3.031	0.0024
	RefCode0	-13.76884	897.52922	-0.015	0.9878
School	RefCode2	-1.07126	0.50360	-2.127	0.0334
	RefCode4	0.11321	0.54356	0.208	0.8350
	RefCode5	-0.38499	0.56642	-0.680	0.4967
	SchlDX	10.95980	160.11641	0.068	0.9454
Expelled	SchlE	-0.83313	0.42324	-1.968	0.0490
	SchlG	-1.60302	5100.14731	-0.000	0.9997
	SchlT	0.82154	1.15266	0.713	0.4760
	LivFstM	-0.07893	0.46186	-0.171	0.8643
	LivFstF	0.60272	0.57398	1.050	0.2937
	LivFstI	-12.17455	646.61107	-0.019	0.9850
	LivFst96	0.09142	1.33412	0.069	0.9454
	LivFst97	0.01014	0.95897	0.011	0.9916
	LivFst98	0.29696	1.59851	0.186	0.8526
	LivFstRl	0.60605	0.87857	0.690	0.4903
	LivFstGp	-0.82083	1.14596	-0.716	0.4738
	LivFstOt	-0.88046	0.67935	-1.296	0.1950
	FChgDF	0.85108	0.47352	1.797	0.0723
	FChgDHS	-10.50766	478.04972	-0.022	0.9825
	FChgJD	-10.31349	447.34710	-0.023	0.9816

## Race

ace was not a correlate of trajectory group membership for males.

## Child maltreatment prior to first juvenile offense - males

There was more substantiated child maltreatment present at first offense (MalTx) for Decreasing Moderate-Level Males ( $p < 0.0001^{***}$ ), Late Escalator Males ( $p = 0.0029^{**}$ ) and High-Level Chronic Males ( $p = 0.0024^{**}$ ) than Low-Level Desister Males. Because data for prior child maltreatment was collected from court dependency records, the variable Prior Child



Maltreatment included three categories: 0 = No Prior Case; 1 = Case Dismissed; 2 = Child Maltreatment Substantiated with Transfer to Relatives or Child Welfare. There was more alleged but dismissed child maltreatment prior to first offense (MalTxDis) for Decreasing Low-Level Males ( $p = 0.0018^{**}$ ), Decreasing Moderate-Level Males ( $p < 0.0001^{***}$ ), and Late Escalator Males ( $p = 0.0391^*$ ) than Low-Level Desister Males. Only Decreasing High-Level Males showed no more child maltreatment – either alleged and dismissed or substantiated – prior to first offense than Low-Level Desister Males ( $p = 0.286$ ;  $p = 0.3432$  respectively).

#### **Referral source for first juvenile offense - males.**

There were fewer school referrals for first offense (School) for Decreasing Low-Level Males ( $p = 0.0006^{**}$ ), Decreasing Moderate-Level Males ( $p = 0.0000^{***}$ ), Decreasing High-Level Males ( $p = 0.0088^{**}$ ), and High-Level Chronic Males ( $p = 0.0334^*$ ) than Low-Level Desister Males. Only Late Escalator Males did not have fewer school referrals than Low-Level Desister Males. There were more parental referrals for first offense for Decreasing Moderate-Level Males ( $p = 0.0180^*$ ) and Late Escalator Males ( $p = 0.0288^*$ ) than Low-Level Desister Males.

#### **School status at first offense - males.**

There were fewer Decreasing Low-Level Males ( $p = 0.0008^{**}$ ) and fewer High-Level Chronic Males ( $p = 0.0490^*$ ) already expelled from school at first offense (Expelled) than Low-Level Desister Males.

#### **Lives with at first offense - males.**

There were more Decreasing Low-Level Males ( $p = 0.0140^*$ ) and Decreasing Moderate-Level Males ( $p = 0.0051^{**}$ ) living with a mother and a stepfather at first offense (Mom+Step) than Low-Level Desister Males. There were also more Decreasing Moderate-Level Males ( $p =$

0.0005\*\*) living with a father and a stepmother at first offense (Dad+Step) than Low-Level Desister Males. There were more Decreasing Low-Level Males ( $p = 0.0294^*$ ) living with relatives at first offense (Relatives) than Low-Level Desister Males. There were more Decreasing Low-Level Males ( $p = 0.0163^*$ ) and Decreasing Moderate-Level Males ( $p = 0.0097^{**}$ ) living with grandparents (Grandprt) at first offense than Low-Level Desister Males. There were also more Decreasing Low-Level Males ( $p = 0.0483^*$ ) living with someone other than a parent, relative, or grandparent at first offense (Other) than Low-Level Desister Males.

#### **Use of detention - male.**

There was more use of detention and shelter care at first offense for Decreasing Low-Level Males than Low-Level Desister Males (Detention Facility  $p = 0.0123^{**}$  and Detention/Shelter Care  $p = 0.0129^*$ ). There was more use of jail at first offense for Decreasing High-Level Males ( $p = 0.0377^*$ ) than Low-Level Desister Males. Use of jail, generally signifies a transfer or waiver to adult criminal court for juvenile offenders.

#### **Trajectories as Predictors of Incarceration for Males**

Multinomial logit regression tested the six-solution male trajectory model as a predictor for the dependent variable Incarceration. The dependent variable was a time-varying dichotomous variable (Yes/No). Time-varying status indicates that the incarceration could have occurred any time during the eight year observation period, from the year 2000 through 2007. The independent variables were the probabilities of group membership calculated by Proc TRAJ. Table 2 in the Methods section lists all the secure incarceration dispositions for the state under study coded as Yes for the dependent variable Incarceration. Incarceration percentages are reported in Table 14. Results indicated that probability of group membership predicts incarceration ( $p = 0.04$ ).

Table 14

*Incarceration Percentages by Male Trajectory Group*

Male Trajectory Group	Percent Incarcerated	95 % CI
Low-Level Desister Males	0%	[0%, 0%]
Decreasing Low-Level Males	27.8%	[25.6%, 30.2%]
Decreasing Moderate-Level	81.6%	[79.2%, 83.8%]
Late Escalator Males	65.2%	[60.1%, 69.9%]
Decreasing High-Level Males	68.5%	[61.3%, 75.0%]
High-Level Chronic Males	100%	[99.9%, 100%]

#### **IV. Discussion and Implications**

Results of the three-solution female trajectory model and the six-solution male trajectory model are compared with two models from the existing empirical literature (D'Unger et al., 2002; Wiesner et al., 2007). Similarities and differences in patterns of offending are noted and discussed. Psychosocial covariates significantly correlated with likely patterns of female and male offending are also discussed in terms of their implications for day-to-day juvenile justice practice.

##### **Important Sample Characteristics**

Prior to a comparison of results with other current trajectory modeling studies, a brief review of sample characteristics unique to the dissertation study is helpful. The dissertation study sample specifies trajectories for an offender-only population using a count of official unique complaints to operationalize offending. Other comparable trajectory modeling studies in the United States that use semiparametric group modeling specify trajectories for high-risk juvenile populations that compare non-offenders with offenders; some of these studies use youth self-report (Chung et al., 2002; Wiesner & Capaldi, 2003), and some use official arrest, police contacts, or a combination of these two data collection strategies (D'Unger et al., 2002; Wiesner et al., 2007). Variations in how the response variable "offending" is operationalized affect the degree of "fit" observed between models. In general, the high-risk youth in comparison studies are sampled from higher-crime areas in metropolitan areas (Chung et al.; D'Unger et al.; Wiesner et al.). All dissertation study sample youth have offended at least once, in the year 2000. All 60+ counties in the southeastern dissertation study state are represented in the dissertation sample.

This includes several large metropolitan areas, suburban areas, and extremely rural areas.

Variations in study sample characteristics also affect the degree of “fit” observed between any of these models and the models specified in the dissertation study.

Age homogeneity and age heterogeneity call for different methodological approaches when using semiparametric group modeling. Age homogeneity is a shared sample characteristic of most previous trajectory modeling studies conducted in the United States (Chung et al., 2002; D’Unger et al., 2002; Wiesner & Capaldi, 2003; Wiesner et al., 2007). In these studies, offending trajectories are specified as a function of year recorded because all study youth are the same age at the first observation period. Age heterogeneity is a sample characteristic of the dissertation study; offending trajectories are specified as a function of age rather than year recorded. Despite these differences in methodology, it is crucial to remember that for both homogeneous age cohorts/panels and heterogeneous age panels, *age at onset varies within trajectories*. As the trajectory modeling process moves forward, fitted trajectory models use empirical data to include new arrivals and move prior group members who exhibit either decreased or increased offending levels into other trajectories based on their probability of group membership. In essence, the estimation process of semiparametric group modeling provides opportunities to look beyond age at onset by identifying grouped patterns of offending that are common to youth across a range of ages at onset. Trajectory modeling studies with heterogeneous age samples that use official court data to operationalize offending, capture the larger reality of day-to-day juvenile justice intake, risk assessment, and case processing – where female and male youth across a range of ages and across a range of charges come into first contact with the juvenile justice system.

Likewise, the time-stable covariates available for investigation in the dissertation study are easily available at first offense intake. Some covariates in the dissertation study are common

predictors across trajectories. Some covariates in the dissertation study distinguish between trajectories. The covariates available for investigation in the dissertation study can only be interpreted as indicators of the more illustrative and meaningful psychosocial circumstances and individual personality traits that have been investigated in other longitudinal studies (Chung et al., 2002; Farrington & Hawkins, 1991; Fergusson, Horwood, & Nagin, 2000; Hawkins et al., 2003; Huizinga et al., 2003, Moffitt et al., 2007; Thornberry et al., 2003; Wiesner et al., 2007). This focus on the day-to-day practical reality of juvenile justice intake and case processing is the context for interpretation of dissertation study trajectory modeling results.

### **Comparison of the Three-Solution Female Model to D'Unger et al (2002)**

The three-solution female model specified in the dissertation study compares well with the three-solution female model specified by D'Unger et al. in their re-examination of the 1958 Second Philadelphia Cohort: Nonoffenders; Low-Rate Adolescence Peaked, and High-Rate Adolescence Peaked (2002). The D'Unger et al. study used semiparametric group modeling to specify female trajectories for nonoffenders and offenders living in high-risk neighborhoods from age eight up to age 26 ( $n = 3,000$ ).

The response variable for the D'Unger et al. study (2002) was a frequency count of number of police contacts and arrests within the juvenile division of the Philadelphia police department. The trajectory label "rate" is appropriate for this data collection method, where offending is operationalized as unique police contact dates or unique arrest dates. In comparison, the trajectory label "level" seems more appropriate for describing female trajectories in the dissertation study, where offending is operationalized as a count of unique complaints associated with one complaint date. Data collection that uses a count of unique complaints considers volume (or level) of offending, in addition to rate (offense dates). Both the D'Unger et al. data

collection strategy (police contacts and/or arrests) and the dissertation data collection strategy (unique complaint counts) move beyond arrests in order to provide a maximum sample of females, whose court-involvement is generally hypothesized to result from less severe offending.

D'Unger et al. use the trajectory label "peaked" to describe offending that rises and then decreases (2002). In comparison, Wiesner and Capaldi use the trajectory label "decreasing" in the same fashion in their trajectory study of male juveniles (2003). D'Unger et al. also use the label "adolescence" peaked to distinguish where the peak in offending occurs, as their sample includes offending up to age 26. There was no need to include the trajectory label "adolescence peaked" in the dissertation study, as the data set follows female juveniles up to age 18 only.

Low-Level Peaked Females(26%) and High-Level Peaked Females (4%) in the dissertation study parallel the Low-Rate Adolescence Peaked (10.37%) group and the High-Rate Adolescence Peaked (5.27%) group described in the D'Unger et al. study (2002). Neither Low-Level Peaked Females nor High-Level Peaked Females in the dissertation study reach peaked offending at a frequency as high as Low-Rate Adolescence Peaked females nor High-Rate Adolescence Peaked females in the D'Unger et al. study (see Table 15). This may reflect differing data collection methodologies for the response variable "offending." Police contacts are counted, in addition to arrests, in the D'Unger et al. study. It is somewhat unclear what "police contacts" includes, but such contacts may have been more informal (and possibly more frequent) than the official charges (unique complaints) counted in the dissertation study. It is also noteworthy that High-Level Peaked Females in the dissertation study reach a peak age of offending much earlier (14) than their counterparts in the D'Unger et al. study (17). D'Unger et al. called for female-specific trajectory modeling with more contemporary samples than their

1958 Second Philadelphia Cohort. This earlier peak in female offending observed in the dissertation study may be a reflection of a more contemporary sample (1958 vs. 2000).

Table 15

*Comparison of Female Offending Rates/Levels with Other Study*

<u>D'Unger et al. (2003) Females</u>					<u>Dissertation Study Females</u>			
Group	Peak Rate [Police Contacts/ Arrests]	Peak Age	Level at 18	Exit Rate at 26	Group	Peak Level [Official]	Peak Age	Level at Exit Age 18
Low-Rate Adolescence Peaked	1.75	15	> 1.5	0	Low-Level Peaked Females	Near 1	15	0.25
High-Rate Adolescence Peaked	4.5	17	3.5	<1	High-Level Peaked Females	3.25	14	1.25

D'Unger et al. noted the ambiguity regarding possible desistence or chronicity among their High-Rate Adolescence Peaked female group (2002). Like High-Level Peaked Females in the dissertation study, the High-Rate Adolescence Peaked female group in the D'Unger et al. study also exhibited a frequency of offending above zero at the end of their study (age 26). The rate/level of offending for High-Level Peaked Females in the dissertation study is even higher at age 18 than their counterparts in the D'Unger et al. study (1.25), making it difficult to determine if High-Level Peaked Females are peaked but declining, or perhaps reflect a low-level chronic offending group of females in the adult years (D'Unger et al.). Chronicity for dissertation study High-Level Peaked Females may be inferred based on the results of the D'Unger et al. three-resolution female model, but further data collection into the adult years is required to confirm desistence or chronicity among this group of females.



### **Comparison of the Six-Solution Male Model to Wiesner and Capaldi (2003)**

The six-solution male trajectory model specified in the dissertation study compares reasonably well with a six-solution male model specified by Wiesner and Capaldi (2003). This is somewhat surprising because the Wiesner and Capaldi study used youth self-report of offending - rather than official court data – to specify trajectories for a high-risk sample of non-offenders and offenders. Wiesner and Capaldi used semiparametric group modeling to specify juvenile offending trajectories for two cohorts of 9 and 10 year old males living in high crime neighborhoods (1983/84; 1984/85) up to age 24 ( $n = 204$ ). In a follow-up trajectory modeling study, Wiesner et al. specified only three juvenile male offending trajectories for the same sample ( $n = 204$ ) using official arrest data (2007). Wiesner et al., concluded that their second study “demonstrated limited convergence of trajectory findings across official records versus self-report measures of offending behavior” (p. 836).

Wiesner et al. (2007) summarized the characteristics of both data collection methods: official arrest data captures only those who are caught by police and may exclude less-serious offending; self-report data can reflect a more accurate catalog of offending frequency and severity as well as age at onset, but is subject to biases, such as faulty memory and a hesitation to reveal negative behaviors. This helpful summary pinpoints why the dissertation study may confirm the six-solution model for males first identified in the Wiesner and Capaldi study that used youth self-report, even though the dissertation study uses official court data. The official court data used to operationalize the response variable for trajectory modeling in the dissertation study moves beyond investigation of youth who are “caught by police” because data collection is based on a frequency count of unique complaints that includes status offenses (parental referral,

school referral) and technical violations (violations of probation filed by the juvenile probation officer).

As noted previously, D'Unger et al. commented on the merits of data collection strategies that move beyond arrests for female trajectory modeling (2002). They used the same approach to specify a five-solution male model from age eight up to 26 in their re-examination of the Second Philadelphia Cohort ( $n = 1,000$ ) (D'Unger et al.). The D'Unger et al. five-solution male trajectory model specified only one dramatic male offending peak in the juvenile years, and as a result does not compare as well with the six-solution male model specified in the dissertation study. It is unclear whether D'Unger et al. adjusted for time incarcerated in trajectory modeling; if not, this could account for the lower peaks in offending in their male model (youth would seem to desist who were actually incarcerated).

When comparing Wiesner and Capaldi's (2003) six-solution male trajectory model with the dissertation study results, it is important to remember that their study followed male youth offending from age 12 up to age 24. The dissertation study only follows male juvenile offenders up to age 18. The heterogeneous age at first offense sample characteristic of the dissertation study therefore includes much earlier onset of official offending for the first members of all six of the trajectory groups in the dissertation study (as early as age 6). Thus, trajectory plots for the dissertation study begin earlier than the Wiesner and Capaldi trajectory plots, and the Wiesner and Capaldi trajectory plots continued further into adulthood. It is helpful to follow the Wiesner and Capaldi plot patterns up to age 18 only when comparing them with dissertation study plots.

It is noteworthy that level of offending in the Wiesner and Capaldi study never approaches the volume observed in the dissertation study (see Table 16). Wiesner et al. postulated that "because official arrest rates reflect the 'tip of the iceberg' and provide a

conservative estimate of the actual amount of criminal activity, it is unlikely that mixture modeling of arrests will result in as many pathway groups as is the case with self-report data” (2007, p. 837). Their 2007 follow-up study to the 2003 Oregon Youth Study trajectory modeling study specified fewer male trajectories using arrest data (three trajectories compared with six for youth/caregiver self-report) (Wiesner et al.). By investigating volume of offending (operationalizing offending as a frequency count of unique complaints), the dissertation study results may capture a middle ground for juvenile offending that falls between the self-report strategy for the 2003 Wiesner and Capaldi study and the 2007 Wiesner et al. arrest-only study. Investigating volume of offending would seem to be an important aspect of offending that has been under-studied.

Four of the six trajectories specified in the Wiesner and Capaldi (2003) study roughly compare with those identified in the dissertation study. Their Nonoffenders group (4.9%) does not apply to the offender-only model of the dissertation study (Wiesner and Capaldi). Wiesner and Capaldi’s Rare Offenders (11.3%) group generally reflects the pattern of Low-Level Desister Males (62%) in the dissertation study; however, group memberships as percentages of the samples are quite different (2003). Differing sample characteristics may account for this difference in percentages (non-offenders/offenders in the Wiesner and Capaldi study vs. an offender-only sample in the dissertation study). The difference may also be attributable to a dissertation study methodology that includes two categories of very low-level offenders in the Low-Level Desister Male trajectory: youth who offended only once in 2000 and did not offend again through 2007, and males who offended at very low volumes throughout the observation period.

Table 16

*Comparison of Male Offending Rates/Levels with Other Study*

Group	<u>Wiesner and Capaldi (2003) Males</u>				Group	<u>Dissertation Study (Males)</u>		
	Peak Level	Peak Age	Offending Level at 18	Exit Level at Age 23/24		Peak Level	Peak Age	Level at Exit Age 18
Non Offenders					NA	NA	NA	NA
Rare Offenders	Just above zero	20-21	Just above zero	Near zero	Low-Level Desister Males	<0.25	15	Near zero
Decreasing Low-Level Offenders	<0.50	12-13	0.25	Near zero	Decreasing Low-Level Males	<1.00	15	0.25
Decreasing High-Level Offenders	1.25	13-14	<0.50	Near zero	Decreasing Moderate Level Males & Decreasing High-Level Males	2.00+ 4.00	15 14	<1.00 1.00
Chronic Low-Level Offenders	1.25	19-20	.75	.5	Late Escalator Males	<2.00	18	<2.00
Chronic High-Level Offenders	1.75	15 16	>1.5	1.0	High-Level Chronic Males	4.75	17	4.00

Note also that Wiesner and Capaldi (2003) did not use the label “desister,” even for other sub-groups in their study who offended at fairly high levels and decreased to near zero by age 23/24. It was previously noted that the desistance label should only be assigned to trajectories that show at least some level of offending and then decrease toward zero at the end of the observation period (Blokland et al., 2005; Chung et al., 2002). It is not clear why Wiesner and Capaldi did not use the label “desister” for Decreasing Low-Level Offenders and Decreasing High-Level Offenders in their study. More data collection waves are required to confirm desistance for the Low-Level Desister Males in the dissertation study.

Wiesner and Capaldi’s (2003) Decreasing Low-Level Offenders (21.6%) trajectory is somewhat similar to Decreasing Low-Level Males (28%) in the dissertation study; both offend at a low level and appear to also be moving toward desistance. Decreasing Low-Level Males in the dissertation study exhibit a peak in offending frequency at age 15, whereas the Decreasing Low-Level Offenders in the Wiesner and Capaldi study peak at the first observation period (ages 12 and 13 for each cohort respectively) and decline gradually thereafter. The offending behavior for Decreasing Low-Level Offenders in the Wiesner and Capaldi study prior to age 12 cannot be observed, as it can for the Decreasing Low-Level Offenders in the dissertation study.

Wiesner and Capaldi’s Decreasing High-Level Offenders (27.9%) roughly parallel both the Decreasing Moderate-Level Males (6%) and the Decreasing High-Level Males (1%) in the dissertation study. The similarities in the plots are only apparent when the plots in the dissertation study are observed at a later age (15). Again, the fact that the offending of Decreasing High-Level Offenders in the Wiesner and Capaldi study was not observed until ages 12/13, and dissertation males are observed from first offense (at any age) may account for some of this difference in trajectory patterns. The comparison is complicated by the fact that

Decreasing Moderate-Level Males and Decreasing High-Level Males in the dissertation study peak at a much higher volume than Decreasing High-Level Offenders in the Wiesner and Capaldi study (see Table 16). All three trajectories are declining toward zero by age 18, however.

Escalation of offending frequency at age 18 seems quite similar in the two studies, although Wiesner and Capaldi did not label their Chronic Low-Level Offenders (18.6%) group as an escalation group (2003) because the additional observation years available in their study (up to age 24) showed a decline for Chronic Low-Level Offenders somewhere between ages 19 and 20. The label Late Escalator Males (1%) as used in the dissertation study is informed by Chung et al. (2002), who followed youth up to age 21 and identified an Escalator (19.3%) trajectory that seems closest to the Late Onset Escalation Males in the dissertation study. To date, only the Chung et al. study has identified an Escalator trajectory. More data collection waves are required to resolve the issue of escalation, chronicity, and desistence for the Late Escalator Males specified in the dissertation study.

Up to age 18, Chronic High-Level Offenders (15.7%) in the Wiesner and Capaldi study (2003) followed a trajectory similar to High-Level Chronic Males (1%) in the dissertation study; both increase dramatically during the later teen years, exhibiting the highest peak in offending of all the male trajectories. The striking difference in group percentages may reflect self-report vs. official offending (getting away with it vs. getting caught). The additional observation years in the Wiesner and Capaldi study showed that Chronic High-Level Offenders “decrease toward their initial levels of offending” (p. 243) during early adulthood, but remain at a chronic low-level up to age 23/24. While both these groups decline in offending, they cannot be said to be moving toward desistence, and are therefore labeled as chronic. Even at age 18, Chronic High-Level Offenders in the Wiesner and Capaldi study offend at a much lower rate than the offending

volume seen in both Decreasing High-Level Males and High-Level Chronic Males in the dissertation study.

### **Comparison of Gendered Outcomes in the Dissertation Study**

D'Unger et al. (2002) compared gendered outcomes for their three-solution female model and five-solution male model on the following dimensions of offending: age at onset; peaks by age, Frequency of offending (volume of offending in the dissertation study), and; desistence. Using this framework for comparison of the gendered trajectories specified in the dissertation study the following observations apply. High-Level Peaked Females peak earlier (14) than all other male trajectories except Decreasing High-Level Males, who also peak at age 14. High-Level Peaked Females and High-Level Chronic Males display similar patterns in age at onset, where both groups display an earlier age at onset peak compared with all other groups (age 14 for both groups) (see Table 6 and Table 12); however, High-Level Chronic Males show higher levels of onset at 11 and 12 than do High-Level Peaked Females. Volume of offending is higher among both high-level male groups (Decreasing High-Level Males [just > 4] and High-Level Chronic Males [just < 5]) than females of the same category (High-Level Peaked Females [just > 3]). Low-Rate Peaked Females and Decreasing Moderate-Level Males begin a move toward desistence at the same age (15). High-Level Peaked Females and Decreasing High-Level Males both display a decline in offending at age 14, but High-Level Peaked Females remain above a lambda of one complaint at age 18, while Decreasing High-Level Males are just under a lambda of one complaint at age 18.

### **Trajectory Results and the Dual Taxonomy of Moffitt (1996)**

Dissertation study results specify more distinctive juvenile male offending trajectories than would be predicted by Moffitt's dual taxonomy (1993; Moffitt et al., 2002). The recent

follow-up study of Moffitt et al. specified two juvenile trajectories and one adult onset offending trajectory for males in the Dunedin, New Zealand birth cohort. Numerous studies using mixture modeling strategies have specified three or more trajectories for male juvenile offending followed into early adulthood (Blokland et al., 2005; Chung et al., 2005; D'Unger et al., 2003; Fergusson et al., 2000; Wiesner & Capaldi; Wiesner et al., 2007).

Overall, Decreasing High-Level Males are less impacted by psychosocial indicators than any other trajectory in the dissertation study. They are the only moderate- to high-level trajectory group that shows no correlation between prior child maltreatment (alleged or substantiated) and trajectory group membership. The likely pattern of offending observed for Decreasing High-Level Males also most closely resembles the age curve of the adolescent limited trajectory identified by Moffitt et al. (1996; 2002), where association with delinquent peers would be predicted as one of the most important covariates of male juvenile offending, rather than family-level or school-level covariates

### **Discussion – Gendered Psychosocial Covariates of Trajectory Group Membership**

Time-stable indicators in the dissertation study reflect data routinely collected at first offense intake as a part of juvenile justice case processing. Most of these indicators can be linked to constructs widely documented to be correlated with youth problem behaviors, such as family conflict, family violence, low school attachment, poor family management, and association with delinquent peers (Catalano & Hawkins, 1996; Hawkins et al., 2003).

#### **One time-stable covariate significant across trajectories and genders.**

##### ***Child maltreatment as a risk factor.***

Prior child maltreatment is a significant risk factor that distinguishes low-peaked, moderate-decreasing, escalator, high-peaked, and chronic offending trajectories from the very



lowest, rare youth offenders across genders. This includes substantiated child maltreatment and/or alleged but dismissed child maltreatment prior to first offense. Only Decreasing High-Level Males do not have more prior child maltreatment (either alleged or substantiated) than the lowest-level male offenders.

Dual status youth are defined in the literature as youth who are involved in both the child welfare system and the juvenile justice system, either consecutively or concurrently (Siegel & Lord, 2004). Dissertation study youth with substantiated prior child maltreatment as well as alleged but dismissed cases of prior abuse would be considered “consecutively” involved with both systems, although they could also be concurrently involved if their child welfare case is still open at first offense juvenile justice intake. Practice and policy challenges and strategies related to effective case processing for dual status youth are documented in the current literature (Petro, 2008; Siegel & Lord, 2004). Multi-system responses that often conflict with agency protocols are nonetheless required for effective dual status case planning (Siegel & Lord, 2004).

According to the Child Welfare League of America (CWLA), previous studies examining the relationship between child maltreatment and delinquency suffered from methodological weaknesses, but “four [more recent] prospective investigations in different parts of the United States documented a relationship between childhood victimization and some form of delinquent behavior” (Wiig, Widom, & Tuell, 2003, p. 2). One recent study of dual status youth documented running away and prostitution as two high-risk outcomes for abused and neglected children (Kaufman & Widom, 1999). The OJJDP-funded Girls Study Group reports 2003 arrest percentages by gender for these offenses: 70% of juvenile females were arrested for prostitution (30% males) and 59% of juvenile females were arrested for running away from home (41% males). Patterns of juvenile female offending that include running away and/or arrests for

prostitution – combined with alleged or substantiated prior child maltreatment – require cross-system partnerships designed to alleviate maltreatment and reduce high-risk offending behaviors. Development and early implementation of female-specific interventions that target these three variables has the potential to create a turning point at first offense for female juvenile offenders who fit this profile. This level of female-specific and female-sensitive programming is particularly important for delinquent parenting teen mothers when these three risk variables are identified as a part of first offense case processing. Interventions that offer evidence-based programming designed to strengthen mother/infant bonding, attachment, and prosocial nurturing (Olds, 2006) provide valuable secondary delinquency prevention opportunities, as well as a possible interruption in the likely pattern of adult mother-offending (Tremblay et al., 2003).

Another study of dual status youth reported that three types of child maltreatment were correlated with an increased risk of arrest for violence when compared with matched controls: physical abuse (30.3% more arrests); neglect (31.3% more arrests), and; emotional maltreatment (32.1% more arrests) (English, Widom, & Brandford, 2002). Limitations of the dissertation study data set do not allow specification of the type of prior child maltreatment. Dissertation study results do confirm that substantiated child maltreatment and the potential family conflict associated with alleged but dismissed child maltreatment are highly correlated with frequency of juvenile offending across two female offending trajectories and four out of five male offending trajectories investigated. Next step analysis for the data set will operationalize the SGM response variable using a composite score for severity of offending plus severity of disposition to further investigate the relationship between prior child maltreatment and increased violent offending.

Further consideration of the significance of alleged but dismissed child maltreatment is relevant. One interpretation of this relationship across trajectories and genders might be that

exposure of the family system to child welfare and juvenile justice investigation and scrutiny as a result of alleged child maltreatment increases parental distress. Parental distress indirectly and negatively impacts Parental Supervision/Control, a construct associated with increased risk of delinquency and other problem behaviors among youth (Huizinga et al., 2003). Another interpretation might posit that on-going, un-remediated family violence or child maltreatment that does not reach the threshold required for official child welfare system substantiation is nonetheless a significant covariate for onset and escalation of juvenile offending. Abuse investigations may also be flawed for older youth victims of child abuse who will soon “age out” of the child welfare system. Systems-level child welfare case processing issues, such as high caseloads and scarce resources, may also come to bear in alleged but dismissed child maltreatment cases, where the level and duration of intensive investigation required is not always an option.

### **Time-stable covariates that distinguish between trajectory groups**

Identifying time-stable covariates that distinguish between juvenile offender trajectory groups, both within and across genders, provides data that can be useful in the future development of empirically derived intake assessment instruments designed to more accurately distinguish between low-, medium-, and high-risk first time youth offenders. Dissertation study results regarding time-stable covariates should be interpreted with caution due to two study limitations. There were 3,498 sample youth with randomly missing covariate data for School Status at 1<sup>st</sup> Offense and Use of Detention at 1<sup>st</sup> Offense. Study youth with missing covariate data for these two variables were eliminated from the covariate analysis, bringing the total covariate sample down to  $n = 12,461$ . The future use of multiple imputation for missing data in the study sample may shed more light on the significance of time-stable covariates for trajectory

membership. The number of youth in the individual covariate cells is also not reported in the dissertation study covariate model, and as a result the importance of the significance reported in the covariate model may be in question.

***School referral for first offense.***

Compared with the lowest-level female and male offenders in the dissertation study, females and males following more moderate to higher-level offending trajectories are less likely to be referred to juvenile court by the school. This school referral indicator distinguishes the lowest-risk first time offenders, and provides intake assessment opportunities to divert school-referred female and male first time youth offenders from unnecessary system penetration.

***Parent/relative referral at 1<sup>st</sup> offense.***

Compared with the lowest-level female and male offenders in the dissertation study, females and males following moderate-decreasing trajectories and late escalator males are more likely to be referred for their first juvenile offense by parents or relatives. This may indicate that moderate-level youth offenders are influenced negatively by poor family management (Catalano & Hawkins, 1996). Parent or relative referral for first youth offense can provide valuable intake assessment opportunities to divert these youth and their families through the use of evidence-based family interventions, such as Functional Family Therapy (Zazzali et al., 2008) and Multi-systemic Therapy (Henggeler, Letourneau, Chapman, Borduin, Schewe, & McCart, 2009).

***School status at first offense.***

To large degree, a negative school status at first offense is more predictive of moderate-to higher-level offending among females than males. This includes females who are drop outs at first offense and females who are referred for GED preparation as part of first offense intake processing. High-rate female offenders are also less likely to be truant at first offense than the

lowest-level female offenders. A school status of Truant at first offense distinguishes the lowest-risk first time female offenders from higher-risk females, and provides valuable intake assessment opportunities to divert truant females from unnecessary system penetration through the use of early warning truancy programs. This is also true for decreasing- and chronic-level male offenders, who are less likely to be expelled at first offense than the lowest-level male offenders. A school status of Expelled at first offense distinguishes the lowest-risk first time male offenders from higher-risk males, and provides valuable intake assessment opportunities to divert these youth from unnecessary system penetration through the use of alternative schools.

***Lives with at first offense.***

Living in alternative family arrangements at first offense is more predictive of low-decreasing and moderate-decreasing offending among juvenile males than females. These alternative living arrangements consist of blended families, living with relatives, and living with grandparents. Low-decreasing and moderate-decreasing male offenders are more likely to live in alternative living arrangements than the lowest-level male offenders. Grandparent-care also distinguishes low-level female offenders from the lowest level/rare female offenders. Since all these trajectories represent low- or moderate-level offending, identification of youth offenders living in alternative family arrangements at first offense provides valuable opportunities to divert youth from unnecessary system penetration through the implementation of evidence-based family therapy (Zazzali et al., 2008) or caregiver education and support programs.

Females living in foster care at first offense are significantly more likely to follow a moderate to higher-level offending trajectory than the lowest-level female offenders. The covariate Foster Home also distinguishes these two types of female offenders from male offenders. Female youth offenders living in foster care at first offense are dual status youth who

are concurrently involved in the child welfare and juvenile justice systems. Female-specific cross-systems case planning is necessary for all first time juvenile female offenders living in foster care at first offense. This is particularly crucial for juvenile female offenders living in foster care at first offense who also have a history of child maltreatment (alleged or substantiated).

Female juveniles who have emancipated legal status at first offense are more likely to follow the highest-level offending trajectory. In the dissertation study state, a female who is 18 years of age can file a court petition for emancipated status, and the following criteria apply: she has parental consent; her parent is insane or has abandoned the female as a minor for at least a year; both parents are dead (Code § 26-13-1, 1975). Married juvenile female offenders often apply for emancipated status, as well. A Lives With status of Emancipation for first time female offenders provides valuable intake assessment opportunities to identify older first time female juvenile offenders who are likely to follow a high-level and possibly chronic offending trajectory into adulthood. Many of these females may be dual status youth who are aging out of the child welfare system. The development of female-specific transitions services for these older female juvenile offenders has the potential to interrupt a likely adult trajectory of low-level chronic offending (D'Unger et al., 2002; Tremblay et al., 2003).

### **Systems-level Covariates of Gendered Trajectories**

Use of a detention facility at first offense is more predictive of juvenile males who follow a decreasing low-level of offending than the lowest-level/rare male offenders. It is surprising that this variable is not more predictive of higher-level first time male offending, and may reflect an inefficient use of resources. Likewise, use of shelter care at first offense is more predictive of juvenile males who follow a decreasing low-level or moderate-level of offending than the

lowest-level/rare male offenders. This use of shelter care at first offense for decreasing low- to moderate- level male offenders may be a system response to the possible poor family management associated with the alternative living arrangements (blended families, relatives, grandparents) present at first offense for these groups. In comparison with the lowest-level/rare male offenders, jail is used more at first offense for high-level males who will eventually display a decreasing level of offending.

### **Secure Incarceration as a Predictor for Trajectory Group Membership**

Both trajectory solution models are predictive of time-varying incarceration over the eight year observation period. Incarceration percentages increase as volume of offending increases. For the dissertation study, the dependent variable is coded simply as a Yes/No nominal variable. Further analysis is required to investigate a more nuanced categorization of time-varying incarceration (for example,  $\leq 35$  days,  $\leq 152$  days,  $>152$  days).

## V. Conclusions

### Trajectories of Offending

The dissertation study identifies three distinct offending pathways for female juveniles and six distinct offending pathways for male juveniles. There is mounting empirical evidence that there are more than two distinct patterns of offending for male juvenile offenders (Chung et al., 2002; D'Unger et al., 2002; Wiesner & Capaldi, 2003, Wiesner et al., 2007), although some studies reported a confirmation of a dual taxonomy (Moffitt, 1996; Moffitt et al., 2007; Yessine & Bonta, 2008). In the United States and Canada alone, several different methods have been used to operationalize juvenile offending as a response variable for semiparametric group modeling: self report (Chung et al., 2002, Wiesner & Calaldi, 2003); official police contacts and arrests (D'Unger et al., 2002); official arrests (Wiesner et al., 2007), and severity of offending (Yessine & Bonta, 2008). Piquero et al. (2007) urged scholars not to allow theory to limit the facts they consider in investigating trajectories of offending. Along these lines, considering volume of juvenile offending/court contact across a full range of charges expands the facts we consider in trajectory modeling. The dissertation study investigates juvenile court contact by specifying offending trajectories using a frequency count of unique complaints (rather than unique complaint dates) as the response variable. Including status offenses and violations of probation as well as more serious, indexed charges in the facts we consider for trajectory modeling expands the juvenile offender population we investigate; this may be particularly important given recent empirical evidence of the iatrogenic effects of juvenile justice system penetration (Gatti et al., 2009).



Nagin and Tremblay noted that “charting developmental trajectories and studying their causes are among the most fundamental and empirically important research topics in medicine and the social and behavioral sciences as well as in criminology” (2005, p. 875). Charting female-specific patterns of offending from the juvenile years into adulthood may be the most important trajectory-modeling work still to be done. Delinquent juvenile females on an antisocial trajectory are at risk for perpetuating an inter-generational cycle of family conflict and poor parenting as adults (Tremblay et al., 2003). For this underserved population of female juvenile offenders, identifying female-specific offending trajectories and their psychosocial covariates moves beyond justice intake risk assessment application. This level of gender-specific data application has the potential to inform the development of secondary delinquency prevention interventions for delinquent parenting teen mothers and their children (D’Unger et al., Hawkins et al., Tremblay et al.).

### **The Covariates of Gendered Trajectories**

Dissertation study results report some time-stable covariates present at first offense that are trajectory specific risks for moderate- to higher-level offending, such as living in foster care at first offense for females. Study results also identify some time-stable covariates present at first offense that distinguish lower-level offending trajectories, such as a referral from school for first offense. The nature of the covariates available for the dissertation study does not allow a confirmation nor a refutation of the assumption of biophysical trajectory-specific covariates, such as childhood neurological impairment for early onset life course-persistent offenders (Moffitt, 1993). Rather, the dissertation study investigates time-stable psychosocial indicators easily available at first juvenile offense intake. While it has been previously noted that the results of the dissertation study covariate model should be interpreted with caution due to study

limitations, further investigation of these time-stable indicators may have the potential to inform the development of first offense juvenile justice intake instruments designed to: 1) strengthen our ability to distinguish between low-, medium-, and high-risk first time youth offenders, and; 2) identify intervention targets for effective case planning.

Perhaps the most important finding of the dissertation study is that prior child maltreatment – both substantiated prior child maltreatment and alleged but dismissed prior child maltreatment – is significantly correlated with moderate- to higher-level offending trajectories for both males and females (except Decreasing High-Level Males). The resolute social activists and social workers who founded the first juvenile court in 1899 presaged this correlation between child maltreatment and juvenile offending (Breckinridge & Abbott, 1912).

Attending to the victimization, trauma, and psychosocial situations that negatively impact female and male youth offenders is an advocacy issue that those in social work, criminal justice, and psychology must support through research and evidence-based program development and evaluation. Advocating for the establishment of policies and procedures that make inter-agency collaboration possible is particularly critical for improving the juvenile justice response to dual status youth, which requires the development and maintenance of cross-systems partnerships between child welfare, juvenile justice, mental health, school systems, and scholarly researchers (Wigg et al., 2003; Siegel & Lord, 2004). Development of these partnerships at the local and state levels is important; the development of policies and funding initiatives at the federal level that supports these cross-systems partnerships is crucial. This is difficult work, perhaps a life's work, but re-directing the troubled trajectories of justice-involved children and youth has the potential to change the face of juvenile justice as we know it.

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## Appendix A

Table A1

### *Overview of Risk and Protective Factors Hypothesized to be Predictors of Antisocial Behavior*

Psychosocial Domains	Indicators	Static or Dynamic
Individual Youth Characteristics	Early Onset < 9 at 1 <sup>st</sup> self-report; < 14 at 1 <sup>st</sup> official	Static
	Gender = male	Static
	Impulsivity/ADHD	Dynamic
	Low IQ	Static
	Early Aggression	Dynamic
	Substance Abuse	Dynamic
Peers	Association with Delinquent Peers	Dynamic
Family	Parenting <i>Control</i> - inconsistent rules or extremely harsh punishment; lack of monitoring and supervision <i>Support</i> - attachment, involvement, communication	Dynamic  Dynamic
	Family History/Attitudes Supportive of Antisocial Behavior Parents with a Criminal History Substance Using Parents	Static Dynamic
	Mother < 20 at birth Low education Use of Harsh Physical Punishment	Static Dynamic Dynamic
	Low Achievement (grades) Behavior Problems (truancy, suspension) Attachment/Bonding	Dynamic Dynamic Dynamic
Victimization	Child Abuse or Neglect Victim of Violent Crime	Static/Dynamic Static
Social Structural	Disadvantaged Neighborhood Economic Hardship	Dynamic Dynamic

## Appendix B

December 7, 2009

Office for Research  
Institutional Review Board for the  
Protection of Human Subjects

THE UNIVERSITY OF  
**ALABAMA**  
R E S E A R C H

Cynthia Weaver, MSW  
School of Social Work  
The University of Alabama  
Box 870314

Re: IRB # 09-OR-340 "Investigating Gendered Trajectories of Offending  
for a Longitudinal Panel of First Time Youth Offenders"

Dear Ms. Weaver:

The University of Alabama Institutional Review Board has granted approval for your proposed research

Your application has been given expedited approval according to 45 CFR part 46. You have also been granted the requested waiver of informed consent. Approval has been given under expedited review category 5 as outlined below:

*(5) Research involving materials (data, documents, records, or specimens) that have been collected, or will be collected solely for nonresearch purposes (such as medical treatment or diagnosis).*

Your application will expire on December 7, 2010. If your research will continue beyond this date, complete the relevant portions of Continuing Review and Closure Form. If you wish to modify the application, complete the Modification of an Approved Protocol Form. When the study closes, complete the appropriate portions of FORM: Continuing Review and Closure.

Should you need to submit any further correspondence regarding this proposal, please include the above application number.

Good luck with your research.

Sincerely,



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