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FINAL REPORT

THE INFLUENCE OF NEIGHBORHOOD, PEER, AND FAMILY CONTEXT: TRAJECTORIES OF DELINQUENT/CRIMINAL OFFENDING ACROSS THE LIFE COURSE[1,2]

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ABSTRACT

This study presents an integration of macro- and micro-level theories of crime to determine the impact of social context on longitudinal patterns of delinquent/criminal offending. Integrating theories of macro-level social disorganization, micro-level social control, and the life-course/developmental perspective on crime, this study examines the impact of demographic measures (race and sex), neighborhood context, family structure and support, and peer and school associations on offending trajectories.

Data used for this study are drawn from the 1942 and 1949 Racine Birth Cohort Studies. Longitudinal offending behavior, measured as contacts with the police, are combined with interview data for a subsample of males and females from the birth cohorts. Analyses are conducted in a stepwise manner. Semiparametric mixed Poisson regression models with minimal covariate information are first used to sort individuals into latent classes of offenders based on the similarity in their offending behavior over time. The optimal number of categories is determined through the use of the Bayesian Information Criterion and the substantive interpretability of the classes. Second, multinomial logit regression models are used to assess the predictive power of

neighborhood context, families, and peers in determining latent class membership. Social context variables are added to the model in clusters to determine the effect they have on the relationship between the demographic variables and the latent offender classes, as well as the direct relationship between social context and the offender classes.

The results indicate that five latent classes of offenders are optimal for the 1942 and 1949 Racine Birth Cohort sample as a whole. Five latent classes are also appropriate for the males in the sample, while three latent classes are appropriate for the females in the sample. Both males and females exhibit nonoffending patterns as well as chronic and peaked offending patterns. The low-chronic offenders are the most prevalent offender group and are responsible for the highest percentage of offenses in the cohort (38.8%). While race and sex are important predictors of latent class membership in the baseline models, the addition of social context (neighborhood, peers, and family) renders them insignificant. Family stability is found to be the most important predictor of chronic offending.

CHAPTER 1

INTRODUCTION

The ecological study of crime has been central to the development of sociological criminology in the United States over the past seventy-five years. From the early work in Chicago done by Park and Burgess (1925) and Shaw and McKay (1942), sociologists have been interested in how the context or social environment in which an individual lives impacts developmental outcomes. Researchers in the field of criminology have long recognized that various types of social environments play large roles in influencing delinquent/criminal behavior (e.g., Wilson and Kelling 1982; Byrne and Sampson 1986; Reiss and Tonry 1986; Bursik and Grasmick 1993; Sampson and Laub 1993; Sampson, Raudenbush, and Earls 1997). In Chicago, research pointed to low socioeconomic status, racial and/or ethnic heterogeneity, and high levels of residential mobility as being the root causes of socially "disorganized" neighborhoods. This, in turn, led to both the production of crime and the transmission of crime

across generations (Shaw and McKay 1942). Family life and peer groups both inside and outside of the school environment also play important parts in influencing a child's participation in delinquent offending, and have been central in the study of juvenile delinquency. In turn, the involvement in juvenile delinquency is one of the strongest predictors of adult crime (Cohen and Vila 1996).

The most recent research focus in the ecological study of crime has been on the community or neighborhood as an influence on delinquent/criminal behavior. Neighborhood contextual factors which tap into such things as the quality of life, culture, or organizational structure of individual neighborhoods have been the focus of criminological research, but with mixed results (Simcha-Fagan and Schwartz 1986; Bursik and Grasmick 1993; Elliott et al. 1996; Sampson 1997; Sampson, Raudenbush, and Earls 1997). The weak relationship between neighborhood context and behavioral outcomes can be attributed, in part, to the use of Census and other "macro" level data, using only official police records of juvenile delinquency, and a narrow focus on poverty as the most salient quality of the neighborhood (Elliott et al. 1996). Hence, the effect of more specific characteristics

of the neighborhood on individual development over time has not been deeply explored and the effect of other "levels" of social context, such as family and peers, has not been included. Researchers such as Sampson, Raudenbush, and Earls (1997) have more recently introduced concepts such as "collective efficacy," or the social cohesion among neighbors combined with their willingness to intervene on behalf of the common good which has been found to reduce levels of neighborhood disorganization and the associated crime and violence. These concepts remain relatively untested, however, and require detailed data for analysis on both the micro- and macro-level. Additionally, the interplay between the social structure, in the form of the community or neighborhood, and the individual has not been fully explored. Studying individuals within neighborhoods from a life-course perspective (e.g., Riley 1988) is one way in which to build this linkage.

The more recent focus on the neighborhood as an important social context in the study of delinquency and crime has coincided with another main development in the field of sociological criminology: the study of criminal careers (Blumstein et al. 1986; Greenberg 1991; Nagin and Land 1993). The delinquent/criminal career consists of a

longitudinal sequence of delinquent and criminal acts committed by an individual. In the aggregate, these careers represent the population's "age-crime curve,"[1] with rates of offending increasing rapidly through adolescence and peaking in the teen years, followed by a steady decline into the twenties and thirties. For the individual offender, the criminal career represents a trajectory of offending over time which may be affected by various individual-level and social factors. Recent research has suggested that there are many varying types (categories/classes) of offenders, each with a different trajectory or pattern of offending over time (Moffitt 1993; Nagin and Land 1993; Cohen and Vila 1996; D'Unger et al. 1998). In particular, two broad categories have been identified, in addition to those who are nonoffenders: *adolescence-limited* (also called *adolescent-peaked*[2], see D'Unger et al. 1998) and *life-course persistent* offenders.

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[1] See Figure 1 for an example of the age-crime curve at the population level.

[2] As discussed later in the text, Moffitt (1993; 1997a) calls such offenders "adolescence-limited" offenders because the majority of their offending is confined to the years of adolescence, with rates of offending declining precipitously in the early twenties. D'Unger et al. (1998) use the term "adolescence-peaked" offenders to add clarity to the concept: while the offenders exhibit a clear *peak* in the adolescent years with a subsequent decline, their offending may not be totally limited to the teen or adolescent years. The terms will be used interchangeably in the text.

While adolescent-peaked offenders have a peak in offending in the teen years and then rapidly desist from offending by the twenties, life-course persistent offenders maintain a steady non-zero rate of offending well into adulthood. Again, factors such as family structure, peer influences, and neighborhood context all become important because of the differing impact they may have on continuity and change in trajectories of criminal offending across the various classes of offenders (Sampson and Laub 1993).

The conjunction of the study of individual criminal careers with the study of neighborhood context has recently re-ignited interest in the ecological study of crime. Not only do criminologists study the criminal career of individuals, but also "community crime careers" (Reiss and Tonry 1986), examining changes in community crime rates which parallel changing population characteristics. What remains to be studied in greater detail is the interaction between these two perspectives: how does community context interact with other factors (e.g., family, peers) in an individual's life, shaping a unique trajectory of delinquent/criminal offending? In other words, what impact does neighborhood social structure, family context, and peer relationships have upon an individual's pattern of offending over time?

RESEARCH OBJECTIVES

This project is designed to explore the effect that neighborhood living conditions, in addition to more "traditional" factors such as family structure and bonding, associations with delinquent peers, and attachment to school have on trajectories of delinquent/criminal offending over time. To do this, the newly developed statistical tool of *semiparametric mixed Poisson regression* or *latent class analysis* (Land, McCall, and Nagin 1996; Land and Nagin 1996) will be utilized to analyze various classes of offenders. *Multinomial logit regression models* will then be used to assess the impact that social variables have upon their offending trajectories.

The data to be analyzed are drawn from the 1942 and 1949 Racine Birth Cohorts (Shannon 1991) and include data on subsamples of both males and females born in the city of Racine in the years 1942 and 1949. Components of the criminal career trajectory (e.g., peak age and rate of offending) will be compared for various groups, as will

the differential effect of contextual measures on each of these trajectories.

This research and methodology will measure the direct contextual effects of neighborhood, peers, and family on delinquency and crime, as well as how these variables mitigate the relationship between race/sex and trajectories of offending. It is possible that both contextual and demographic variables have a direct effect on offending trajectories, or that the addition of social context variables may decrease or buffer the effects of race and sex. Neighborhoods, families, and peer groups may influence different kinds of trajectories of offending in different ways, which can only be uncovered by disaggregating the singular age-crime curve.

OVERVIEW OF THE PROJECT

The following chapter, Chapter 2, will provide an overview of the relevant theoretical paradigms for the

current research. It will begin with an outline of the ecological study of crime dating back to the Chicago School of Sociology and its relationship to macro-level social disorganization theory. This will be followed by a discussion of micro-level social control theory and how families, peers, and schools act as agents of informal social control. A review of the theories will conclude with an overview of the criminal careers paradigm, the life-course theory behind its development, and recent research on the existence of multiple types of offenders. From these different theoretical perspectives, hypotheses will be generated about the latent classes of offenders (or nonoffenders) expected in the Racine Birth Cohort, as well as the relationships between the demographic and social context variables and these latent classes.

Chapter 3 will present the data from the Racine 1942 and 1949 Birth Cohorts to be used in analyses, as well as how the issue of missing data will be handled. In addition, each of the variables to be used in the analyses will be described in detail. The two statistical techniques of semiparametric mixed Poisson regression models, or latent class analyses, and multinomial logit regression models will be outlined, as well as how they will be applied to the data at hand.

Chapter 4 will be the first of two chapters to describe the results of the statistical analyses. Results from the latent class analyses will be discussed and the offending trajectories for each latent class discerned in the Racine Birth Cohort sample, as well as male- and female-only subsamples, will be graphed. In addition, descriptive statistics for each of the latent classes will be presented. Chapter 5 will present the results from the multinomial logit regression models used to predict category membership. Cumulative models which build upon a baseline model with only demographic variables will be tested. Chapter 6 will present an overview of the findings and their implications for the hypotheses outlined in Chapter 2. In addition, the results of cumulative models which incorporate demographic characteristics as well as the social contexts of neighborhood, families, and peer groups, but which produce contradictory and uninterpretable results due to collinearity among regressors, are presented in Appendix A. Results from pair-wise logistic regression are presented in Appendix B.

CHAPTER 2

THEORETICAL OVERVIEW

The purpose of this study is to examine the influence of neighborhood social context and (dis)organization, family structure, and peer groups on trajectories of delinquent/criminal behavior over time. In order to do this, the literature from several theoretical perspectives must be tied together to form a cohesive argument for multiple layers of contextual effects on offending behavior. The ecological study of crime, macro-level social disorganization theory, and micro-level social control are all important in informing this research. This chapter will overview the sociological and criminological theories and research pertaining to the influence of social contexts on crime and then tie them together with a series of hypotheses to be tested.

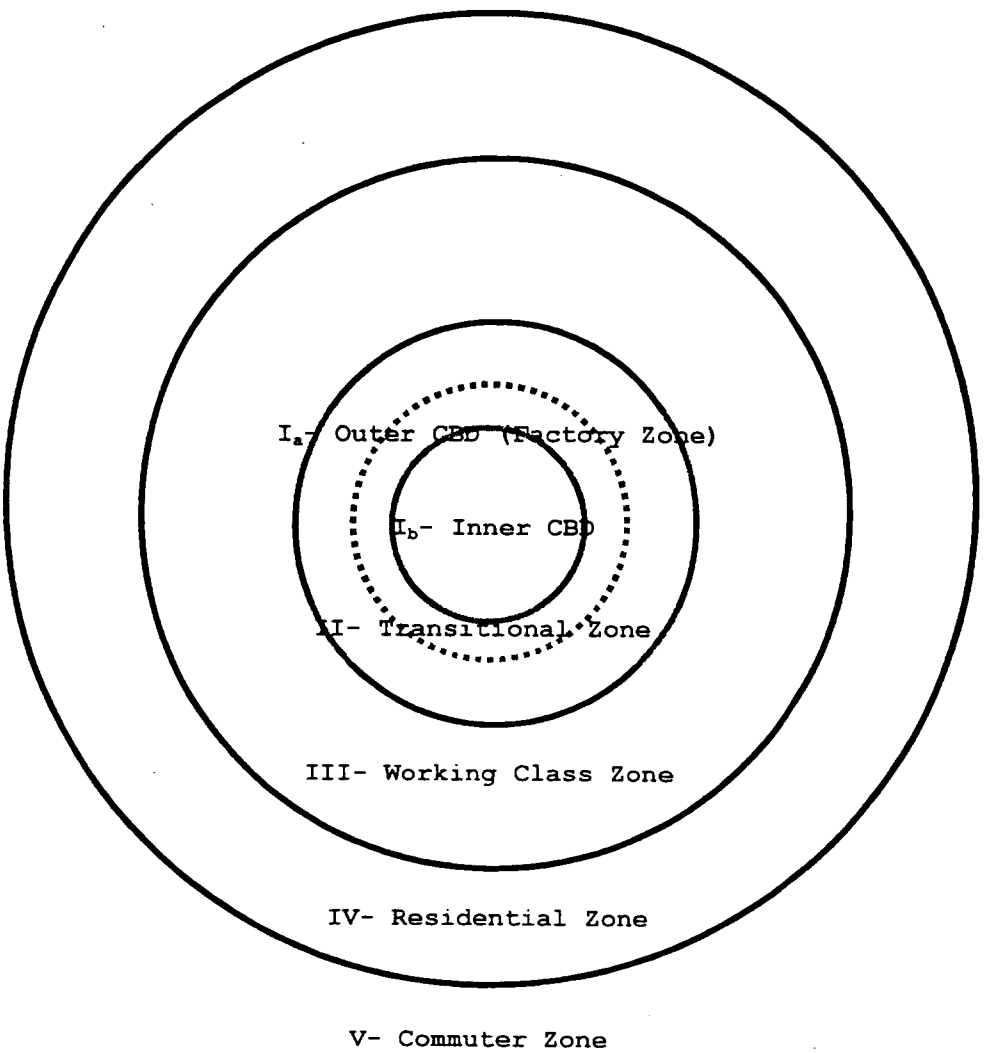
THE ECOLOGICAL STUDY OF CRIME

The study of the relationship between macro-social contexts and crime can be traced back to work done at the University of Chicago in the early part of the twentieth century. The ecological study of crime is a long-standing tradition in sociology, tracing its roots back to the works of Park and Burgess (1925) and Shaw and McKay (1942). The goal of Shaw and McKay's research (building on the work of Park and Burgess) was to identify the roots of crime at the population level, as opposed to the roots of individual criminal behavior. They sought to identify the antecedents of *crime* as opposed to the antecedents of *criminality*. In particular, Shaw and McKay sought to identify the sources of stability in delinquency rates within the city of Chicago, despite the rapid historical transitions in the racial and ethnic makeup of the city.

Based on their study in Cook County, Illinois (which includes the city of Chicago) and plots of the spatial distribution of juvenile delinquency over the city, Shaw and McKay concluded that delinquency rates remained remarkably stable over the period 1900-1933, despite rapid

changes in the ethnic composition of Chicago's many neighborhoods (Shaw and McKay 1942; Bursik and Grasmick 1993). They also concluded that rates of delinquency for a given area/neighborhood were negatively related to its physical distance from the central business district. Shaw and McKay's conclusions about the spatial relationship between area of residence and proximity to the central business district of the city were built upon Burgess' conceptualization of *concentric zones*, or circular zones which diffuse out from the *central business district* (CBD, or Zone I) toward the suburbs (Park and Burgess 1925). According to this argument, the most desirable land in a city is that where modes of transportation (e.g., bus lines, railroads, major highways) converge, which usually is in the center of the city or the CBD. Surrounding the CBD is a *transitional area* (Zone II) characterized by much lower land values, factories, substandard housing units, and higher levels of poverty. Zone III is the working class or *blue-collar zone*, composed of individuals and families with the resources to leave the poverty-stricken inner city, but

Figure 2.1: The Concentric Zones of City Growth



not to leave the city entirely. Zone IV is the predominantly *residential area*, with few commercial establishments, and Zone V is the *outer commuter zone* or the suburbs, composed of individuals and families with the economic resources which allow them to "flee" the city.[1] Figure 2.1 depicts the concentric zones as outlined by Burgess (1925) and Shaw and McKay (1942).

Shaw and McKay (1942) demonstrated that an "invasion" was happening between zones as residents of one zone diffused into the next one, leading to the gradual evacuation of the central areas of Chicago. This evacuation generally left behind concentrated pockets of extreme poverty in the inner city as those residents and businesses with the resources to do so left the city. Shaw and McKay concluded that this movement of the resident population (as well as opportunities for legitimate business) outward from the inner city as newer immigrants moved in led to the development of spatial areas with unique racial/ethnic, cultural, and socioeconomic characteristics (Burgess 1925; Bursik and Grasmick 1993). Park (1926) called these areas "natural

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[1] Today it is often referred to as "white flight," as it is usually whites with economic resources which enable them to leave the inner

areas" because they were the result of "natural mechanisms" inherent in a capitalist economic system. These areas have *community crime careers* of their own which rise and fall much like individual offending careers (Reiss 1986). Park (1926) believed that these natural forces of transition were the basis of the formation of the very diverse neighborhoods in Chicago.

The result of this neighborhood transition was the development of inner-city ghetto or slum areas characterized by *high levels of population turnover, high levels of ethnic heterogeneity or a high concentration of ethnic/racial minorities,* and *high levels of population density.* These three variables may act alone or in concert, and have a reciprocal relationship with levels of offending in the community. While population turnover and density and ethnic concentration may lead to crime, crime may also lead to increases in these three community characteristics (Morenoff and Sampson 1997).

These characteristics were the three key factors identified by Shaw and McKay (1942) as contributing to the proliferation of juvenile delinquency and crime over

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city—a phenomenon happening in cities such as Washington, DC, Chicago, IL, and Atlanta, GA (Wilson 1987).

generations within a given area. While individuals and families moved outward towards the suburbs in hopes of attaining higher levels of prosperity, what was left behind was a constantly repeating state of poverty and increased crime rates. As newer immigrants moved in to these areas over time, racial and ethnic compositions changed, but they remained spatial areas with high levels of crime.

William Julius Wilson (1987) has identified these people left behind in the inner city as "the truly disadvantaged," or those living in concentrated areas of poverty characterized by a high density of subsidized housing. The density of these housing conditions, as well as the fact that most are renter- rather than owner occupied, has been linked to increases in crime rates (Schuerman and Kobrin 1986). According to an argument presented in Sampson and Wilson (1995 p. 43), "public housing is a federally funded, physically permanent institution for the isolation of black families by race and class and must therefore be considered an important constraint on ecological area of residence." These areas are more conducive to crime, and particularly violent crimes (as opposed to property crimes). Krivo and Peterson (1996) point to the proliferation of guns for

self-protection and the lack of goods to steal in lower-SES areas as two contributing factors to the higher rates of violent crime and the lower rates of property crime.

Shaw and McKay's (1942) focus on community crime rates was an important contribution to sociological criminology, but left some important questions unanswered. In particular, what Shaw and McKay failed to do (or failed to do clearly enough for researchers at the time) was to explicate the causal link between these community characteristics, such as high population density or population turnover, and levels of offending, either at the population or individual level.[2] Many criminologists, in fact, misinterpreted the work of Shaw and McKay, making the assumption that they posited a *direct* relationship between population turnover, the concentration of racial/ethnic groups, population density, poverty, and crime (Bursik 1988; Bursik and Grasmick 1993). However, the relationship explicated by Shaw and McKay was not that simplistic. Rather, the mechanisms that give rise to increased rates of crime may be the same as those which give rise to instability or social disorganization in the

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[2] A lack of available data continues to be a problem with efforts to test the causal link between community context and offending. The

population. As Elliott et al. (1996) point out, neighborhood disorganization is not simply the concentration of poverty, but a "multidimensional cluster of traits" (p. 392) such as the structure of the local labor market, population mobility, housing policies, and family structure.

Because of this misunderstanding, the ecological study of crime by academics decreased in popularity, in favor of theories of individual criminal behavior. Later researchers (e.g., Bursik 1988; Bursik and Grasmick 1993; Sampson and Groves 1989) resurrected the early work of Shaw and McKay (1942) by further clarifying the causal link between community characteristics and crime rates.

SOCIAL DISORGANIZATION THEORY

The hypothesized causal link between community characteristics and offending at the community level is *social disorganization*, or the ability of a community to

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over-reliance on official crime rates is also problematic (Sampson and Groves 1989; Sampson and Lauritsen 1994).

realize the common goals and values of its citizens and regulate behavior for the common good (Bursik 1988; Kornhauser 1978; Sampson and Groves 1989; Sampson, Raudenbush, and Earls 1997). If structural barriers exist between residents in a given community, then there is the possibility for a breakdown in both formal networks (e.g., community organizations such as Neighborhood Watch programs) and informal networks (e.g., friendships, monitoring of children on the streets) of social control. This breakdown subsequently harms the community's ability to provide "collective supervision," possibly leading to higher rates of delinquency/crime (Sampson and Groves 1989)[3]. In particular, the breakdown of informal social control can lead to the inability of a community to regulate the behavior of adolescents, an age at which most individuals (according to the *age-crime curve* discussed later in this chapter) are at the peak of their offending (Sampson 1997).

Community social disorganization may also impact individual-level behavior, with community structural

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[3] Veysey and Messner (1999) have found more limited support for Sampson and Groves's (1989) argument. They suggest that social disorganization is important in predicting crime, but that it does not mediate the effects of variables such as family structure and urbanization. These variables (family and urbanization) also have a

characteristics impacting "organizational networks" which, in turn, impact the individual's social bonds (Simcha-Fagan and Schwartz 1986 p. 671). Neighborhoods have been found to affect childhood IQ, births to teenagers, and dropping out of school (Brooks-Gunn et al. 1993). However, as noted by Simcha-Fagan and Schwartz (1986 p. 668):

> [though] an aggregate-level theory cannot be expected to provide a comprehensive explanation of individual delinquency or criminality, it should clarify those contextual characteristics which, independently of or in interaction with the adolescent's predisposition, affect individual behavior.

The relationship between community/neighborhood context and both formal and informal social control can also be reciprocal--while disadvantaged neighborhoods can discourage the exercise of social control, the lack of social control can also contribute to the increasing level of disadvantage in the neighborhood (Elliott et al. 1996).

The articulation of the link between specific community characteristics and crime extended the work of Shaw and McKay (1942) by separating social disorganization

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strong direct relationship with crime, as measured with structural equation models.

"from the processes that may lead to it (e.g., poverty, residential mobility), but also from the degree of criminal behavior that may be a result" (Sampson and Wilson 1995 p. 46; Sampson 1995). This distinction was important, given that a common critique of Shaw and McKay (1942) was that they did not distinguish between the *outcomes of social disorganization* (crime) and the *characteristics by which social disorganization can be measured* (also crime) (Bursik and Grasmick 1993).

As discussed above, several community characteristics have been identified which may contribute to breakdowns in social controls, thus leading to higher rates of offending. The first of the characteristics identified by Shaw and McKay (1942) was a high rate of population turnover. Such turnover leaves the citizens of a community or residents of a neighborhood "uninvested" in organizations which might promote social control. Because of this, individuals fail to form personal relationships with their neighbors under the assumption that either themselves or the neighbors will soon be leaving the community. Close personal relationships, as well as those relationships considered to be "weak ties" (e.g., neighbors who get together every few months rather than

daily), can be affected by population mobility. These ties have been shown to be some of the strongest in their ability to increase social control (Granovetter 1973; Bellair 1997).

Individuals who are not strongly tied to a given community, such as those who rent property rather than own it, may also fail to participate in community organization which might further enhance community social control. Renters may also not actively participate in the maintenance and appearance of their properties, leading to *neighborhood incivilities*, which may be a reflection of an indifference to the neighborhood (Wilson and Kelling 1982; Sampson 1995).

Because of both historical and present racism, diversity in racial and ethnic groups also impedes the formation of social networks in neighborhoods. This is especially the case when there are language barriers between the residents of a community, such as with Latinos who are recent immigrants to the city. The existence of "massive, segregated housing projects which become ghettos for minorities and the economically disadvantaged" (Roncek, Bell, and Francik, as quoted in Wilson 1987 p. 38) adds to the social isolation of people of color and

those without sufficient economic means with which to leave the city.

Large public housing projects, in addition to being barriers to integration which target racial minorities (particularly African-Americans), are characterized by high population density. This density leads to what Roncek called "anonymity" between the residents (Roncek 1981). With a high proportion of multi-unit dwellings, urban residents may fail to make the social connections which are more easily achieved in the suburbs (Sampson 1995). Examples of such multi-house units are abundant in big cities and often concentrated in areas of low socioeconomic status. The infamous Robert Taylor Homes (though now demolished) and Cabrini-Green in Chicago are two often-cited examples. In these housing projects, unlike the suburbs, fear of crime--especially violent crime--may keep residents in their homes, preventing individuals and families from making any connections with their neighbors.

The deterioration of social organizations/social networks in a neighborhood can result in a breakdown in the ability of residents to exert both formal and informal control over potential delinquent/criminal offenders, particularly youths. Outside agencies, such as the police

patrolling a particular neighborhood or the severity of sanctions imposed, may also contribute to the overall level of social control in a given community (Sampson 1986a). When social control in a community is low, individuals will have low adherence to a common set of norms and values, and any deviant and/or criminal behavior is more likely to go unnoticed and unsanctioned (Bursik 1988). In particular, low levels of social control can lead to a breakdown in a community's ability to "supervise and control teenage peer groups" which have the potential to turn into teenage offending "gangs" (Sampson and Groves 1989 p. 778; Sampson 1997).[4]

The Problem of Neighborhood Context

The articulation of the link between community characteristics and crime rates led to the re-emergence of the study of social disorganization and social control in the 1980s, particularly by those such as Byrne and Sampson

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[4] While juvenile delinquency is most frequently committed in groups, the term "gang" is being used loosely here. With the emergence of violent inner-city gangs, often involved in the drug trade, the definition of a "gang" has changed dramatically. In the current

(1986), Bursik (1988), Bursik and Grasmick (1993), and Sampson and Laub (1993). The focus of much of this work is specifically on the *neighborhood* as the most important form of community, and how neighborhood social characteristics lead to breakdowns in social control which, in turn, can impact individual offending (e.g., Elliott et al. 1996; Simcha-Fagan and Schwartz 1986).

One major difficulty impeding this work, however, is how one defines "neighborhood." Bursik and Grasmick (1993 pp. 6-7) suggest three components which, collectively, provide the most complete definition of neighborhood, and the one on which they base their work:

> (1) *a neighborhood is a small physical area within a larger area which people inhabit,*
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> (2) *a neighborhood has a "collective life" which emerges from the social networks of residents of the neighborhood as well as institutions in the neighborhood, and*
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> (3) *a neighborhood has an identity which has some continuity over time.*

Elliott et al. (1996 p. 391) conceptualize the neighborhood as "a transactional setting that influences individual behavior and development both directly and indirectly." These definitions of neighborhood almost

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context, the term is used to refer to a group of age peers who

necessitate the use of longitudinal data, given the changing social networks which form and (possibly) disband over time.

"Neighborhood" is also frequently defined in research based on the variables measured in the individual data set, as opposed to an extrinsic formulation of the concept of a neighborhood, as presented by Bursik and Grasmick (1993). Because of this, research has not been able to identify a conclusive causal link between neighborhood characteristics and criminal activity. In addition, the link between community characteristics and crime may be cyclical in nature, making it difficult to determine which is the precursory factor. As Schuerman and Kobrin (1986) note, the deterioration of a neighborhood may lead to increasing rates of crime, which then further accelerate neighborhood decline.

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frequently come together for the purpose of offending.

SOCIAL CONTROL THEORY

While social disorganization is a macro-level explanation of the link between community characteristics and crime, social control theory provides that theoretical link on the micro-level. Social control theory has its roots in the research of Travis Hirschi (1969), who examined the individual's bond to society and how this related to individual offending behavior. Hirschi hypothesized that individuals have social relationships which bond them with other individuals. These relationships, in turn, bond individuals to social institutions such as family, work, and school. Social bonds then act as mechanisms of social control which prohibit people from offending.

Hirschi (1969) articulated four main elements of the social bond: *attachment*, *belief*, *commitment*, and *involvement*. Of these four, Hirschi considered attachment to be the most important. Attachment is the emotional component of the social bond; it is the emotional ties which individuals have to each other and which make people concerned for others' welfare. It is attachment which

allows for the full internalization of societal norms and values. Belief is acceptance of the conventional values of society, in particular those values which put prohibitions on criminal behavior. Commitment refers to the individual's investments in society, whether time, money, effort, or status (Shoemaker 1990). While behavior which conforms to societal norms is often rewarded, nonconforming behavior can carry a penalty, damaging the investments made in society. An individual's level of commitment to society will inform how much he/she is willing to act in deviant or criminal ways (Vold and Bernard 1986). Involvement is the final aspect of the social bond. It refers to an individual's active participation in the conventional and legitimate activities of society: work, school, raising a family, community activities, religious worship, athletics, etc. Participation in conventional activities restricts opportunities for individuals to act in deviant ways and, more importantly, increases the strength of the social bond.

One of the consequences of not being strongly bound to both social institutions as well as the individuals within those institutions, is that an individual is "freed" to deviate from accepted group social norms. Weak

bonds with individuals and institutions (such as families, peers, and employers) across the life-course can lead to a *cumulative disadvantage* (Sampson and Laub 1997). Bonds broken early in the life-course will have a "genuine behavioral influence" with continuity over time. For example, delinquency can lead to school failure, which can lead to incarceration, leading to weak bonds to the labor market, increasing the probability of future adult crime (Sampson and Laub 1997 p. 144).

Sampson and Laub (1993) have further articulated the concepts of self-control theory in *their age-graded theory of informal social control* and have offered empirical support for the importance of micro-level social control. They assert three basic tenets in their age-graded theory (Sampson and Laub 1993 p. 7):

> (1) *the "structural context" of family and school social controls explain delinquency in childhood and adolescence,*
>
> (2) *this leads to a continuity in antisocial behavior from childhood through adulthood across many social domains, and*
>
> (3) *social bonds in adulthood to institutions such as family and employment explain changes in criminal behavior over the life-course, despite early criminal propensity.*

Sampson and Laub's model acknowledges the potential for both *stability* and *change* in criminal behavior over time.

While other psychologically-oriented models of individual criminal behavior provide a more static view of criminality within the individual over time (e.g., Gottfredson and Hirschi's *1990 self-control theory of crime*), the age-graded theory of social control allows for the possibility of changes in behavior fluctuating with changing levels of attachment or social bonding over time. While they acknowledge that "there is considerable evidence that antisocial behavior is relatively stable across stages of the life-course" (Sampson and Laub 1993 p. 11), there are many opportunities for the links in the "chain of adversity" to be broken over time (p. 15). Laub, Nagin, and Sampson (1998) build upon Sampson and Laub's age-graded theory of informal social control by suggesting that the investment in social bonds or relationships is cumulative in nature and, therefore, the effect of such bonds on desistance from offending will also be gradual and cumulative.

Sources of Social Control

At the macro-level, neighborhood social disorganization can affect the ability of community members to regulate the behavior of unruly or disruptive

neighbors. However, the neighborhood is not the only social context which is important in explaining the development of an individual's criminal behavior, particularly at the younger ages. Two key micro-level agents of childhood socialization or social control are the family and the peer group.[5] Researchers such as Vazsonyi and Flannery (1997) have found that family and peer influences, in the form of attachment to school, have independent effects on offending and account for upwards of 40 percent of the total variance of adolescent delinquent behavior.[6]

Families as Agents of Social Control

The family as a source of individual-level social control is particularly important, given that it is the site of the earliest socialization, and remains relatively constant throughout childhood and adolescence. Family variables, such as supervision provided by parents, parent-child attachment, and time spent together as a family are some of the most important predictors of

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[5] Peer groups are often studied within the context of school, given that is where children spend the majority of their day. This research will look both at school attachments as well as relationships with peers who may not *necessarily* be school-mates.

delinquent behavior among children (Loeber and Stouthamer-Loeber 1986).

Families provide three of the most important elements in the informal social control process. They are a) a source of guidance and monitoring, b) a source of discipline, and c) a source of affective attachment (Hirschi 1969; Krohn, Thornberry, and Jang 1992; Vazsonyi and Flannery 1997; Warr 1993a). As Warr (1993a) notes, parents who spend time with their children reduce the likelihood of involvement in delinquency by reducing the time the child could potentially spend with delinquent peers and/or by providing positive role models to discourage against law violation. Parents act as "access barriers" (Warr 1993a p. 248), restricting children's access and exposure to deviant peers. In addition, children who have strong affective bonds with their parents (which come about through spending time with them) seek approval from them and, hence, will avoid involvement in activities and with individuals who do not meet parental approval.

Conversely, "inept parenting" allows or encourages the affiliation with deviant or delinquent peers (Simons

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[6] Vazsonyi and Flannery (1997) looked specifically at *early*

et al. 1994) and may lead to low levels of individual self-control, making an individual more likely to offend if given the opportunity (Gottfredson and Hirschi 1990). Ineffective or inconsistent parenting not only allows for children's association with deviant peers, but also decreases levels of attachment between parents and children--one of the key components of the social bond as articulated by Hirschi (1969). Children with weak levels of bonding to their parent(s) will have a decreased possibility of acquiring the values which will help bond them with others outside of the family, such as teachers and other authority figures (Simons et al. 1994). Reiss (1986 p. 15) also notes that the control exerted by parents can be weakened by "a conflict of generational cultures," when the values of the parents' generation are in direct conflict with those of the children's generation. This is especially true with the native-born children of recent immigrants.

Another of the important components of the family's influence on children's behavior is through family structure. Many researchers hypothesize that family

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adolescent delinquent behavior.

dissolution has important consequences for both formal and informal community social control of adolescents (Sampson 1986b). In particular, single-parent (usually female-headed) families can be ineffective in providing adequate levels of social control. This is usually because of a lack of guardianship, thus allowing for increased criminal opportunities for children and adolescents. When one individual is left with all of the responsibility for family maintenance but lacking in support (psychological, physical, financial, etc.), delinquent opportunities for unsupervised children may be more likely to arise (Sokol-Katz, Dunham, and Zimmerman 1997).

Families which are disrupted by transitions such as divorce, remarriage, and the introduction of stepfamilies may also disrupt the socialization process of children, which can lead to law violation (McCord 1991; Sampson and Laub 1993; Coughlin and Vuchinis 1996). Family disruption, poor parenting skills, lack of guardianship, and lack of attachment of children to their parents all impact the potential offending career of the child. It is also true that the earlier these patterns are established or these disruptions occur, the more potential exists for damage to the child. The work of Moffitt and others has shown that parenting problems early in a child's life

often lead to early entrance into delinquency/crime and a longer involvement with offending (Gottfredson and Hirschi 1990; Moffitt 1993; Simons et al. 1994).

Peers and Schools as Agents of Social Control

In addition to the family, peers provide another important arena of socialization for children. Association with delinquent peers has consistently been shown to be one of the strongest correlates of delinquent/criminal activity (Hirschi 1969; Hagan 1991; Warr 1993a, 1993b). Peer groups exert their influences on individuals' behavior in different ways. Peers may provide an environment which encourages the social learning of delinquent behavior. In addition, peers may reinforce beliefs which are positive towards delinquency and/or negative towards either formal (e.g., the police) or informal (e.g., parents) agents of social control, thereby reinforcing criminal behavior over time (Sutherland 1947; Akers et al. 1979; Warr 1993b). Individuals who are already involved with delinquent/criminal behavior may also seek each other out.

From the social control perspective discussed above, it is not ties with deviant peers but, rather, a lack of ties (or very loose ties) to peers which can lead to

delinquency (Hirschi 1969; Sampson and Laub 1993; Thornberry et al. 1994). Children without ties to peer groups may feel rejected and develop a sense of isolation. Those who have low levels of attachment (as the most important component of the social bond) to school, one of the major arenas in which children interact, may feel rejected by both teachers and students. This may lead to poor academic performance, which may have repercussions later in the life-course, such as with success in the job market. This is supported by Hirschi's (1969) finding that educational and occupational aspirations were lower among delinquent youths than among law-abiding youths. Negative attitudes toward school, poor academic performance, and dropping out of school are all indicators of a low level of attachment to peers, teachers, and the importance of education emphasized in American society, which may then lead to delinquent and/or criminal behavior (Kasen, Cohen, and Brook 1998). Conversely, attachment to and involvement with school has a buffering effect on delinquency (Vazsonyi and Flannery 1997).

Decreased levels of attachment to peers and schooling free a child or adolescent from the constraints of normative law-abiding behavior, and may increase association with similar individuals, as suggested by

cultural or learning theories of delinquency. Hirschi (1969) acknowledges that attachment to peers who are delinquent may also increase levels of delinquent behavior, as suggesting by social learning theory, but only when other levels of social control (e.g., peers and family) are low. These attachments may also be reciprocal in effect. Delinquent peers may reinforce delinquent behavior, while decreasing levels of attachment to conventional or non-delinquent individuals and institutions, as well as increasing one's association with other delinquent peers (Thornberry et al. 1994). These peer associations are important predictors of an individual's offending behavior, particularly in later adolescence, when time spent away from parents and with peers tends to increase.

Taken together, the neighborhood, families, and peer and/or school attachments are three of the most important social contexts for the provision of social control and, in turn, for predicting offending behavior at the individual level. Those who live within a tightly-bound neighborhood with strong social networks will be more closely regulated than those living in a socially

disorganized neighborhood and, thus, less likely to offend.[7] Individuals who have tight bonds with their families, especially "intact" families which are better able to provide supervision and guardianship, are also less likely to offend because of the prohibitions against offending provided by the social bond. Strong attachment to peers and school also increase the strength of the link to conventional society and decrease the possibility of deviant or criminal behavior. The macro-level social disorganization and micro-level social control theories which underlie these three social domains are closely linked to the criminal careers paradigm and the life-course perspective on offending, which are discussed in the following section.

CRIMINAL CAREERS AND THE LIFE-COURSE AND DEVELOPMENTAL PERSPECTIVES OF DELINQUENT/CRIMINAL OFFENDING

The Criminal Career

The concept of the criminal career has been well

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[7] This, however, does not address the possibility of an individual who lives in a socially organized neighborhood committing crimes in a neighborhood in which he/she does not reside.

established within criminology--it is the longitudinal sequence of delinquent and criminal acts committed by an individual. The criminal career is composed of four key elements: *participation*, *frequency/incidence*, *seriousness*, and *career length* (Blumstein et al. 1986). Participation is a macro-level measure of the proportion of the population which is involved in offending behavior, while frequency is the rate of offending for those individuals who are active offenders. Seriousness refers to the level of seriousness of the offenses being committed by a given individual, while career length refers to the length of time that an individual is actively offending.

Frequency, seriousness, and career length can vary greatly among individuals, who may range from having one offense of a non-serious nature to "career criminals" (not to be confused with "criminal careers") with multiple, serious offenses across a broad span of time. Across the US population, Blumstein et al. (1986) suggest that participation rates vary between 25 and 45 percent, depending on how participation is measured. Visher and Roth (1986), in a meta-analysis of studies on US and British participation rates, find that the level of participation is about 30 percent for non-traffic related offenses. Averages are higher or lower depending on the measure of "participation," which can range from the mild

"contact with the police" (e.g., Shannon 1988; 1991) to the more stringent measure of "convicted of a crime" (e.g., West and Farrington 1973; 1977).

Despite these empirical findings, other questions about the criminal career remain unanswered. For example, do juvenile delinquents/criminals comprise a unique segment of the population (e.g., Blumstein et al. 1986) or is delinquency a behavior which is a "typical" part of the growing-up process? Are criminal propensities relatively constant across the life-span (e.g., Gottfredson and Hirschi 1990) or do they vary with age (e.g., Sampson and Laub 1993)? Can qualitative changes in social bonds associated with life-course transitions change the continuity or persistence in offending (e.g., Sampson and Laub 1993)? Given the nature of these questions, the life-course perspective (often referred to as the "developmental perspective" in the criminology literature), borrowed from sociology, is one with much utility for the study of criminal careers.

Life-course sociology, according to Elder (1992 p. 1121) is both "a concept and a theoretical perspective." It refers to both the "age-graded life patterns embedded in social institutions and subject to historical change" and a "field of inquiry. . .providing a framework that guides research" (Elder 1992 p. 1121). Life-course

sociology focuses on two major theoretical concepts: *trajectories* and *transitions*. Trajectories are patterns of behavior which extend through the individual's life in major social domains such as work, family, schooling, or crime. Transitions are those major life changes which have the potential to affect behavioral trajectories. These transitions usually involve a change in the individual's role in society, such as the transition to adulthood, parenthood, or a major career shift. In looking at a trajectory of offending behavior, some examples of major transitions affecting this trajectory could be incarceration or getting married and starting a family (which might halt offending) or losing a job (which might increase offending). The life-course is given meaning through the age-structure of society, as well as age norms, sanctions, social timetables for certain behaviors, and historical context (Elder 1975).

Studying any subject from a life-course perspective thus implies the use of longitudinal data that follows individuals over time. In criminology, this has been difficult due to a lack of available resources, hampering the development of testable theories of crime and delinquency. In particular, longitudinal data on females is rare. As Sampson and Laub (1993 p. 23) have pointed out in a recent work, "criminology has been dominated by

narrow sociological and psychological perspectives, coupled with a strong tradition of research using cross-sectional data on adolescents." This combination of a lack of data, limited theoretical perspective, and limited methodological technique has particularly hampered the ability to understand the criminal career, which is both longitudinal and dynamic in nature.

Criminologists who focus on the study of the criminal career have borrowed heavily from life-course sociologists. As such, they study offending as a trajectory of behavior over time that can be influenced by both micro- and macro-level factors such as community or neighborhood context, family relationships, and peer associations. A life-course or developmental perspective implies that the causation of delinquency/crime is dynamic, varying across the life-span (e.g., Sampson and Laub 1993), as opposed to more general or static theories which assume one underlying cause of delinquency (e.g., Gottfredson and Hirschi 1990).

The most prominent of the dynamic theories of crime is Sampson and Laub's age-graded theory of informal social control, discussed earlier in this chapter. The age-graded theory of informal social control allows for both stability and change in behavioral trajectories such as offending. Because it is a theory of social control,

Sampson and Laub (1993) hypothesize that shifting social bonds over the life-course cause an individual to either desist or persist in his/her offending. While life events such as marriage may increase social ties to conventional society (Sampson and Laub 1993; Laub, Nagin, and Sampson 1998) or decrease an individual's association with delinquent peers (Warr 1998) and, therefore, decrease offending, failure to make such transitions may cause an individual to persist in offending.

Conversely, the most prominent of the "static" theories of crime is Gottfredson and Hirschi's (1990) self-control theory of crime. Gottfredson and Hirschi assert that a singular underlying individual characteristic, self-control, is predictive of offending behavior across the life-span. Self-control is established early in life (before the age of 8) and is related to parental child-rearing techniques. Those parents who are able to consistently and fairly discipline children and teach them to resist impulsive behavior will instill in their children a high level of self-control. Across the life-span, an individual's level of self-control will remain stable but can manifest itself in many different ways. Childhood antisocial behavior, adolescent and adult criminality, problem drinking, excessive speeding, or any other impulsive and/or deviant activity

could be traced back to low levels of self-control, according to Gottfredson and Hirschi (1990). This perspective is in sharp contrast to the more dynamic developmental approach taken by Sampson and Laub (1993), among others. These competing paradigms suggest a different causation of delinquency, different methodologies for studying delinquency, and different intervention strategies (Bartusch et al. 1997).

Given the dynamic nature of the developmental perspective, it makes it appropriate for the current research, given its longitudinal nature and the focus on both micro- and macro-level variables. The marriage of the life-course and criminal careers perspectives with recent innovations in statistical modeling have potential to offer a more complete and dynamic picture of offending as it happens over the life-span.

Crime as a Developmental Process

According to Loeber and Stouthamer-Loeber (1996), studying crime/criminal careers from a life-course or developmental perspective implies three major goals:

> (1) *encouraging the description of within-individual changes in offending across time,*

(2) *identifying the causal factors of the longitudinal course of offending, and*

(3) *studying the impact of life transitions and relationships on offending behavior.*

The aims of developmental theories of crime, as articulated this way, not only further the understanding of crime as it develops across the life-course, but also how individuals *differ* in their development of offending. Specifically, the questions raised are: (a) which individuals are most likely to become chronic or long-term offenders, and (b) which individuals are most likely to desist from offending (Loeber and Stouthamer-Loeber 1996 p. 15)? These aims are not inconsistent with social control theory as discussed above, though Hirschi (1969), who presented one of the earliest and most complete articulations of social control, did not take an explicitly developmental perspective. However, the major components of the social bond (attachment, involvement, commitment, and belief) are dynamic in nature and form "progressively through interaction with others and society" (Loeber and Stouthamer-Loeber 1996 p. 13).

Support for a developmental perspective on crime is abundant. Bartusch et al. (1997) find that an individual's age is indeed important in the development of

offending, which it would not be in a more static model. They suggest that, "identical antisocial behaviors [e.g., delinquency] represent somewhat different underlying constructs when the behaviors are measured during childhood versus during adolescence" (Bartusch et al. 1997 p. 39). In addition, the causality of antisocial behavior is different for children than for adolescence--while individual characteristics such as hyperactivity and low levels of verbal ability are more predictive of childhood antisocial behavior, peer delinquency is more predictive of antisocial behavior in adolescents.

Paternoster and Brame (1997) also find more limited support for the developmental perspective. While association with delinquent peers and prior offending behavior--both of which change over time--are important predictors of serious delinquent activity, there also remain time-invariant between-individual differences in offending. Paternoster and Brame (1997) suggest that crime is best studied taking into account both static and dynamic models by assuming a "theoretical middle ground" (Paternoster and Brame 1997 p. 49).

Simons et al. (1998) find a dynamic and reciprocal causal chain of events which support a developmental perspective of offending, as opposed to a direct

relationship between childhood and adolescent misconduct, which would be suggestive of a latent trait or static approach. This research suggests that problem behavior in childhood is related to a decreased quality of parental disciplining and monitoring, a decreased level of school performance, and an increased level of association with delinquent peers. In turn, these predict deviant behavior in adolescence. Though a direct relationship between childhood and adolescent behavioral problems does exist, it is eliminated when school, peer, and parenting variables are included in the structural equation models.

Farrington (1986) and others (Nagin and Paternoster 1991; Nagin and Farrington 1992a; 1992b; Nagin, Farrington, and Moffitt 1995) highlight the importance of a developmental perspective on crime by examining two important questions of the criminal careers paradigm: what is the relationship of past to future offending?; and what is the relationship between age and crime (often known as the *age-crime curve*)? On the relationship of past to future offending, there are two competing paradigms. The first is *state dependence* (Nagin and Paternoster 1991; Nagin and Farrington 1992b) which implies that the commission of a crime may raise the

probability that an individual may commit a subsequent crime. According to state dependence, prior participation in offending has an "actual behavioral effect" (Nagin and Paternoster 1991 p. 163) on subsequent offending (a dynamic approach). On the other hand, *population heterogeneity* implies that past and future offending are related only inasmuch as they are both related to an unmeasured criminal propensity which is stable over time within the individual (a static approach). Mixed conclusions have been drawn from this vein of research: support has been found for both the hypotheses of state-dependence (Nagin and Paternoster 1991; Nagin and Farrington 1992a) and population heterogeneity (Loeber and Snyder 1990; Nagin and Farrington 1992a; 1992b).

The second focus of the research by those such as Farrington, Nagin, and Paternoster is on the *age-crime curve*. When looking at the aggregated offending behavior of individuals in a population across time, the age-crime curve takes on a characteristic unimodal bell-curved shape. The curve begins to rise in childhood and into adolescence, reaching a peak at approximately age 18, though variations in the peak age exist between the sexes and when looking at specific types of crime, such as

violent versus property crimes (see Figures 4.1 and 4.2 for an illustration of the age-crime curve).

What the unimodal age-crime curve may mask, however, is the possibility of heterogeneity between different kinds of offenders or offender groups which is lost at the aggregate level. Recent research (Nagin and Land 1993; D'Unger et al. 1998) has suggested that the aggregated age-crime curve for the population may mask the existence of qualitatively different classes of offenders who have distinct trajectories with differing ages of offending onset, and peak ages and rates of offending. In addition, the assumption of a singular age-crime curve may hamper empirical research, particularly if different variables predict membership into different classes of offenders. It may also hamper theoretical development if theories are based on an incorrect assumption of a singular offending curve.[8]

MULTIPLE CATEGORIES OF OFFENDERS

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[8] Contrary to life-course or developmental criminologists, theorists such as Gottfredson and Hirschi (1983) assert that the age-crime curve is singular. They believe that the age distribution of crime is invariant across time, space, the sexes, and types of offenses. Though they assert that age is a very important predictor of offending, it is invariant and its effect cannot be explained. Therefore, Gottfredson and Hirschi believe that it is not necessary to include age in theoretical explanations of offending.

The idea that there may exist several different types of offender groups which underlie the singular age-crime curve has implications for both theoretical development and methodological techniques. Specifically, theories predicated on the assumption of a singular crime-curve may be under-developed and ignore the fact that offending trajectories may take different shapes attributable to different individual and/or social factors. Methodologically, the idea of divergent trajectories of offending would encourage the use of longitudinal data and the appropriate methods with which to study them.

Recent theoretical developments in criminology have suggested that there are many different types of offenders, and empirical evidence for this assertion has been found. In particular, the development of *latent class analysis* (or *semiparametric mixed Poisson regression models*) has allowed researchers to disaggregate offenders groups with multiple pathways of offending over time (Nagin and Land 1993; Land, McCall, and Nagin 1996; Land and Nagin 1996).

Empirical Evidence for Multiple Categories of Offenders

The first major application of the criminal careers paradigm and latent class analysis to longitudinal data was done by Nagin and Land (1993). This research used panel data collected by Farrington and West in Cambridge, England beginning in the years 1961-1962 (West and Farrington 1973; 1977). Most of the individuals in the all-male sample were eight years old when data collection began, and were followed until the age of 32, yielding a sample of 403 individuals with complete information. The measure of offending was conviction for a crime, and 36% of the sample had at least one such conviction. Of those with at least one, the average number of convictions from ages 10-32 was 4.4.

In this research, only minimal covariate information was included in the model determining trajectories of offending over time: a single index variable which measured IQ, parental child-rearing behavior, parental criminal involvement, and a scale of involvement in daring/risk-taking adventurous behavior. Using semiparametric mixed Poisson regression, Nagin and Land (1993) determined that four distinct categories/classes of offenders existed in the Cambridge cohort: nonoffenders (i.e., those who did not have any *recorded* convictions,

whether or not they had actually been involved in delinquent/criminal behavior), individuals whose offending was limited predominantly to the teen years, and two categories of chronic offenders--one with a low-rate and the other with a high-rate of offending.

The article was one of the first to provide empirical evidence of multiple types of offenders having distinct patterns of offending over time. However, because it contained only a limited number of covariates, it was not able to establish the predictors of group membership (for example, what predicts that an individual will become a chronic offender?).

Subsequent latent class analysis of criminal careers offered further support for the notion of multiple types of delinquent/criminal offenders across many different types of data. D'Unger et al. (1998) provide evidence that multiple categories of offenders are present across several data sets with a high level of consistency. Using all-male data from the Cambridge cohort utilized by Nagin and Land (1993), the 1958 Second Philadelphia Birth Cohort (Wolfgang, Figlio, and Sellin 1972; Tracy, Wolfgang, and Figlio 1990), and the Racine 1942, 1949, and 1955 Birth Cohorts (Shannon 1988; 1991), D'Unger et al. concluded that:

> rather than merely representing a discrete approximation to an underlying continuous distribution of unobserved delinquent/criminal propensity, the small number of latent offending categories estimated in [the] models may *represent distinct classifications of cohort offenders with respect to age trajectories of offending that are meaningful in and of themselves* (1998 p. 1622 emphasis added).

Across all samples from various cohorts and with differing measures of offending (e.g., arrests, convictions) as the dependent variable, several basic patterns emerged: the *adolescent-peaked offender*, the *chronic offender*, and the *nonoffender*. These categories sometimes bifurcated into "higher-" and "lower-" rate groups, but the shape of the offending trajectories across samples was remarkably consistent. Looking at data from the Second Philadelphia Cohort males and female, D'Unger, Land, and McCall (forthcoming) found three analogous classes of offenders among the females of the sample. In addition to a large class of nonoffenders, there existed two classes of adolescent-peaked offender, bifurcating into higher- and lower-rate groups. There was an absence of chronic offenders among the female offenders which were present among the male offenders. However, this research still

did not answer the question: what predicts membership in various offender/nonoffender classes?

In a more recent attempt to answer the above question, Nagin, Farrington, and Moffitt (1995) looked at the impact of several types of factors on the four offending categories initially delineated by Nagin and Land (1993) in the Cambridge cohort: (1) imprudent behavior, (2) intelligence and school/labor market attainment, (3) impulsivity or attention deficit, (4) relationships with family and friends, (5) parental child-rearing skills and parental antisocial behavior, and (6) socioeconomic deprivation. Using both self-report and conviction data on the Cambridge cohort, several significant differences were found between the predictors of the four offender categories. In particular, evidence was found in support of the distinctiveness of the high-rate chronic offenders. At their peak, these offenders were more likely to be engaged in violent behavior, smoke cigarettes, use drugs, and having sexual intercourse. By age 32, all three of the offending groups (high-rate chronic, low-rate chronic, and adolescence-limited) were more likely to be fighting, using drugs, and abusing alcohol than the nonoffenders, based upon their self-reported offending. All three offender groups also

suffered in the job market--being more likely to be unemployed, have high levels of employment instability, and be employed in unskilled labor--than nonoffenders. By the age of 32, the two groups of chronic offenders were of lower socioeconomic status, had poorer housing conditions, and were more likely to be considered "social failures" compared with both the adolescent-limited and nonoffenders. While there were no notable between-group differences in relationships with partners up to the age of 18, and all groups were equally likely to be married or cohabiting, by the age 32 all offender groups were more likely than the nonoffenders to be separated or divorced and have a child not living at home. Despite this, adolescence-limited offenders were still more successful in the labor force and in their relationships with their spouses than either of the chronic groups by the age of 32. High-level chronic offenders were especially lacking in mental concentration and were more likely to have grown up in a socioeconomically-disadvantaged family.

Using data on males from the National Youth Survey, McDermott and Nagin (1998) also attempted to delineate the predictors of offending-class membership. It was determined that three classes of offenders exist in this sample, analogous to findings from other latent class

research on offending: nonoffenders, an adolescent-peaked group which rises to a peak early (at approximately the age of 12) but then slows down and reaches zero by the age of 24, and a higher-rate group which exhibits an increasing rate of offending until the age of 18--characteristic of chronic offenders--but then acts erratically between the ages of 18 and 24 (the final year of measurement). McDermott and Nagin (1998) determined that variables such as involvement with delinquent peers and deviant labels imposed by parents were most significant for predicting changes in the offending index, while measures of social control offered conflicting evidence. Supporting the research at hand, the authors did suggest that the, "nature of the influence [of covariates] appears to differ according to the pattern of offending, that is, according to the offender group" (McDermott and Nagin 1998 p. 26). More research examining the predictors of latent class membership needs to be conducted in order to establish more clearly the relationships that exist between social/contextual factors and trajectories of offending.

Offender Categories: Chronic Versus Peaked Patterns

As discussed above, much research has detailed the existence of several different types of offenders. This notion is very important for the testing and further development of criminological theories, as most previous work in criminology has posited the existence of a simple dichotomy of classes: offenders and nonoffenders. Criminological theories have been built on the assumption that there are only two types of people: those who offend and those who do not. Recent research challenging this dichotomy, including the works previously discussed, seem to point to the existence of several stable types of categories beyond offender/nonoffender.

In particular, Moffitt's (1993; 1997a) work on *adolescence-limited* (called *experimenters* by Loeber and Stouthamer-Loeber 1996) and *life-course persistent* (called *persisters* by Loeber and Stouthamer-Loeber 1996) offenders offers theoretical support for the existence of and distinctions between these two types of individuals. It also suggests why there may be a continuity in offending behavior over time among some individuals, coupled with a dramatic increase in levels of offending in the teen

years--one piece of evidence for what Cohen and Vila (1996) call the "paradox of persistence." The paradox is this: while most juvenile delinquents do not grow up to be adult offenders (e.g., deviant behavior is a "normal" part of the teen years), almost all adult offenders were juvenile delinquents. Moffitt's distinction between adolescent-limited and life-course persistent offenders may offer some explanation for this.

Moffitt (1993) points to neuropsychological problems, often occurring in the fetal brain and inhibiting temperamental, behavioral, and cognitive development, interacting with a poor or "criminogenic" social environment, as the cause for chronic offending which persists beyond the adolescent years. Unlike the adolescence-limited offenders, the cause of the antisocial behavior exhibited by chronic offenders is often located in the earliest years of socialization. Wolfgang, Figlio, and Sellin (1972) hypothesize that this chronic group of offenders comprises about 6 percent of the total sample and 18 percent of the offenders, and account for 52 percent of the delinquent acts committed by the cohort before the age of 17. These offenders also account for 63 percent of the crimes recorded in the FBI's Uniform Crimes Reports. Similarly, West and Farrington (1973; 1977)

hypothesize that the chronic offenders, whom they call "recidivist juvenile delinquents," comprise approximately 6 percent of the sample through the age of 24 and 17 percent of convicted youths, but are responsible for one half of all convictions.

Moffitt's (1993; 1997a) theory is in accordance with one of the major theories in criminology today: Gottfredson and Hirschi's self-control theory offending (1990). As discussed previously, Gottfredson and Hirschi contend that deviant and/or criminal behavior is a manifestation of low-levels of self-control which are established and fixed very early in the life-span. Moffitt's theory also posits that, for some offenders, antisocial behavior is established early and is related to both neurological and sociological factors, including family environment. However, while Gottfredson and Hirschi see self-control as a trait with levels distributed across the population, Moffitt sees persistent or chronic offenders as being a unique category. In addition, Gottfredson and Hirschi would most likely assert that adolescence-limited offenders simply have more self-control than chronic offenders but less than nonoffenders, while Moffitt views limited offenders as merely mimicking the behavior of chronic offenders during the teen years.

The early deficit identified by Moffitt, combined with the lack of a supportive childhood environment and problematic child-parent interactions, causes a persistence in deviant behavior, including offending, over time. Moffitt (1993 p. 681) points out that, "children with cognitive and temperamental disadvantages are not generally born into supportive environments, nor do they even get a fair chance of being randomly assigned to good or bad environments." Cumulative consequences of their behavior continue to narrow their options in the world of "legitimate" or normative behavior. Moffitt (1997b) goes one step further to assert that neuropsychological problems can interact specifically with neighborhood social context to either enhance antisocial or delinquent behavior. Looking at African-American males from the Pittsburgh Youth Study (Loeber et al. 1989), Moffitt (1997b) finds that living in a good neighborhood seemed to protect boys from involvement with delinquency, but only if they were neuropsychologically healthy. Boys suffering from neuropsychological problems were always more likely to be delinquent than those not suffering from such problems, regardless of neighborhood status.

Unlike their chronic counterparts, Moffitt hypothesizes that adolescence-limited offenders do not

come from the same environmentally-deficit backgrounds or have the same neurological problems, nor do they suffer from the effects of cumulative disadvantage.[9] Rather, Moffitt asserts that such behavior confined in the teen years is, "motivated by the gap between biological maturity and social maturity" (1993 p. 685). Antisocial behavior, including involvement with juvenile delinquency is "social mimicry" which is used by young individuals to achieve a higher level of status in the teenage world, with its subsequent power and privileges. Adolescence-limited offenders mimic the behavior that they see exhibited by chronic offenders during the teen years but, because they have not severed major bonds with society, may come from more stable families, and are not suffering from the same neurological damage, they are able to easily desist from offending as they reach the early years of adulthood. This aspect of Moffitt's hypothesis is consistent with the age-graded theory of social control put forth by Sampson and Laub (1993), who hypothesize that social bonds are what cause people to refrain from offending. If those bonds are broken, individuals are

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[9] Cumulative *advantage* may also be at work for the adolescence-limited offenders. Research by Laub, Nagin, and Sampson (1998)

freed from the social norms which prohibit offending. The breaking of social bonds to institutions and to the people within those institutions also has a cumulative effect. Individuals who have had a consistent pattern of broken bonds through childhood and adolescence may be ill-equipped or unable to make them as an adult, being cut off from mainstream society.

The hypothesized existence of these two groups of offenders suggests two important points. First, it would explain the huge increase in individual rates of offending which happen in the adolescent years, followed by the precipitous decline exhibited in the population-level age-crime curve. It would seem to suggest that this change happens because fewer people are offending in the later years: the adolescence-limiteds have stopped, while the smaller group of chronic offenders keeps going. This is in contrast to the notion that there is a general decline in offending across all groups, and that changes in population-level rates of offending are due to the decline in *all* offenders' deviant behavior, as opposed to the cessation of some offenders. The former idea is supported by social control theorists such as Sampson and Laub

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suggests that social bonds, such as found in a "quality" marriage,

(1993), while the latter is supported by self-control theorists such as Gottfredson and Hirschi (1990).

Secondly, it also points to the necessity of conducting longitudinal research. If, at their peaks in offending, adolescence-limited and life-course persistent offenders are similar in their behavior, there is little way to distinguish between the two groups. However, longitudinal research can map trajectories over time which highlight the differences between categories of offenders.

BRINGING IT ALL TOGETHER: THE CURRENT STUDY

The current project will integrate the research on the life-course study of criminal careers, neighborhood social disorganization, and individual social control by looking at the influence of three social domains on longitudinal patterns of delinquent/criminal offending: family structure and support, peer and school affiliation,

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may facilitate desistance from criminal offending.

and neighborhood sociodemographic characteristics. In addition, the demographic variables of race and sex will be included.

To do this, the recently-developed statistical tool of semiparametric mixed Poisson regression models (also called latent class analysis or SMP regression models) will be used to analyze a combined sample from the 1942 and 1949 Racine Birth Cohort Studies, as well as male-only and female-only subsamples. This type of analyses allows for the grouping of individuals into categories/classes based on the similarity of their patterns of offending over time. The components of each of the trajectories (e.g., peak age and rate of offending) can then be compared across the various groups. Once the grouping of individuals into offender classes is complete, the relative impact of family, peer, and neighborhood can be assessed, as well as any potential interactions between group membership and these contextual effects. The variables measuring social context will be added in "clusters," building upon a baseline multinomial logit model which includes only race and sex. In doing so, the impact of social context on the relationship between the demographic variables and latent offender class can be

tested, as can the direct relationship between social context and offender class.

Based upon the theories of social disorganization and social control at both the individual and community level, as well as the theoretical and empirical support for the existence of multiple categories of offenders, several hypotheses have been formulated. Variables to be used in the analyses will be discussed in detail in Chapter 3.

Hypotheses

Based upon research done by D'Unger, Land, and McCall (forthcoming), it is hypothesized that males and females will have differential patterns of offending over time, with males having more heterogeneity in chronic offending. Because of the racially-biased concentration of poverty, Africa-Americans will be more likely to be chronic offenders.

Hypothesis 1: Greater heterogeneity will be found among male offenders than among female offenders; hence there will be greater heterogeneity among the latent offender classes present in the male subsample than in the female subsample.

Hypothesis 2: Males and African-Americans will be more likely to be chronic offenders than females and non-blacks.

Hypothesis 3: There will be no chronic offenders among the female subsample.

Based upon the assumptions of social disorganization theory, it is hypothesized that areas of higher socioeconomic disadvantage will produce more chronic or persistent offenders. Individuals living in neighborhoods with a high level of formal social control in the form of police patrol of the area will have lower rates and less chronic offending.

Hypothesis 4: The level of neighborhood socioeconomic disadvantage will impact membership in the latent offender classes.

- H_{4a}- Individuals who grow up in neighborhoods of higher socioeconomic disadvantage will be more likely to be high-rate or chronic offenders when compared to adolescent-peaked or nonoffenders.

- H_{4b}- Individuals who grow up in neighborhoods characterized by higher levels of police patrol will be less likely to be high-rate or chronic offenders when compared to adolescent-peaked or nonoffenders.

Based upon the assumptions of social control theory, it is hypothesized that individuals living in stable families with a stable source of finances and adequate supervision will be less likely to be chronic offenders.

Hypothesis 5: The structure and support level provided by families will impact membership in the latent offender classes.

- H_{5a}- Individuals living in households with a more stable family formation (two parents present during the entire childhood) will be less likely to be high-rate or chronic offenders when compared to adolescent-peaked or nonoffenders.

- H_{5b}- Individuals living in households with fewer numbers of children, because of increased parental supervision, will be less likely to be high-rate or chronic offenders when compared to adolescent-peaked or nonoffenders.

- H_{5c}- Individuals living in households where the head of the household was employed consistently throughout the respondent's childhood will be less likely to be high-rate or chronic offenders when compared to adolescent-peaked or nonoffenders.

- H_{5d}- Individuals living in households where the head of the household's occupational status was high will be less likely to be high-rate or chronic offenders when compared to adolescent-peaked or nonoffenders.

- H_{5e}- Individuals living in households where an adult was present in the home after school hours will be less likely to be high-rate or chronic offenders when compared to adolescent-peaked or nonoffenders.

- H_{5f}- Individuals living in households where the mother or stepmother was employed outside of the home during the respondent's childhood will be

more likely to be high-rate or chronic offenders when compared to adolescent-peaked or nonoffenders.

Based upon the assumptions of social control theory, it is hypothesized that those with stronger commitments to school will be less likely to be chronic offenders. However, association with delinquent peers will make an individual more likely to be a chronic offender.

Hypothesis 6: Attachment to peers and school and association with delinquent peers will impact membership in the latent offender classes.

- **H_{6a}**- Individuals who report less positive feelings toward high school will be more likely to be high-rate or chronic offenders when compared to adolescent-peaked or nonoffenders.

- **H_{6b}**- Individuals who drop out of school will be more likely to be high-rate or chronic offenders when compared to adolescent-peaked or nonoffenders.

- **H_{6c}**- Individuals who report higher levels of involvement among their friends across multiple levels of the police and juvenile justice system will be more likely to be high-rate or chronic offenders when compared to adolescent-peaked or nonoffenders.

- **H_{6d}**- Individuals who report involvement with the police among their 2-3 closest friends will be more likely to be high-rate or chronic offenders when compared to adolescent-peaked or nonoffenders.

Based upon the finding of Nagin and Land (1993) and D'Unger et al. (1998), the prevalence and offending activity of three latent offender classes is hypothesized.

Hypothesis 7: Nonoffenders will be the most prevalent group of individuals.

Hypothesis 8: Adolescent-peaked offenders will be the most prevalent of the offender groups and adolescent-peaked offenders will have a lower mean offending rate across the years of data collection and account for fewer cohort offenses than the chronic offenders.

Hypothesis 9: Chronic offenders will be the least prevalent of the offender groups and chronic offenders will have a higher mean offending rate across the years of data collection and account for more cohort offenses than the adolescent-peaked offenders.

Chapter 3 will present the data to be used in the present analyses, as well as descriptions of how each of the above hypotheses will be operationalized.

CHAPTER 3

DATA AND METHODOLOGY

A crucial element hampering research on the impact of neighborhood and other social contexts on offending behavior has been a lack of suitable data, particularly from a life-course perspective. In addition, researchers such as Sampson and Laub (1993 p. 23) have identified the "strong tradition of using cross-sectional data on adolescents" as one of the problems with much of the empirical research done in the field of sociological criminology.

The 1942 and 1949 Racine Birth Cohorts collected by Lyle Shannon and used in these analyses provide a unique opportunity to look at multiple social domains and their impacts on the offending behavior of adolescents. These data sets also provide twenty years of offending data which is linked to detailed interview data, thus avoiding the problems associated with both cross-sectional research and research which focuses on a single age-group. In addition, the Racine Birth Cohorts have information on

both male and female offenders, another unique aspect relative to most cohort studies from this time period.

DATA

The data used were drawn from two of the three birth cohort studies conducted by Lyle Shannon in the mid-sized Midwestern industrial city of Racine, Wisconsin (Shannon 1988, 1991). Shannon collected information on the Racine birth cohorts from the years 1942, 1949, and 1955. The 1942 Cohort was selected to be the first because Shannon felt that by 1950 (when the 1942 Birth Cohort members were eight years old), the police records of the city had been "well established" (1988 p. 18) and, therefore, the possibility of errors associated with faulty record-keeping would be lowered. Information on multiple cohorts was collected to assure that findings from the data were not merely the by-product of cohort effects. In the present analyses, data from the 1942 and 1949 birth cohorts were pooled into a single sample. Because of the fewer years of follow-up data, the 1955 birth cohort was not included in the current analyses.

The City of Racine, Wisconsin

In the 1950s and 1960s Racine, Wisconsin was a midsize city with a relatively homogenous population, recorded at approximately 89,000 in the 1960 census.[1] As with most cities in the United States, the population of Racine rose through the 1960s to approximately 95,000 in 1970. The population then declined between 1970 and 1980 to a total of approximately 86,000 people. Shannon (1988 p. 81) suggests that the increasing percentage of young people in the city in need of work, coupled with the increasing proportion of women entering the labor market and the slow-down of persons leaving the labor market for retirement caused employment declines which, in turn, may have contributed to population decline as individuals moved elsewhere searching for jobs.

Shannon and his colleagues collected data on all of the individuals born in 1942, 1949, and 1955 in Racine beginning--for most of the individuals in the sample--in their sixth year (e.g., 1948 for the 1942 cohort). For those individuals who had a contact with the police before

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[1] Of these totals, the percent nonwhite was 5.4% in 1960, 11% in 1970, and 21.1% in 1980 (when it was separately estimated that 14.7% of the population was African-American).

the age of six, those contacts were recorded but, in the current analyses, offenses recorded before the age of 6 are not included in order to maintain a uniform baseline age. There were a total of 1,352 individuals in the 1942 cohort, 2,099 in the 1949 cohort, and 2,676 in the 1955 cohort, divided approximately evenly between males and females.

Of particular interest to Shannon were those adolescents considered to be in "continuous residence" within the city of Racine through their eighteenth birthdays (regardless of whether they moved within the city limits). The continuous-residence samples included 633 people from the 1942 cohort, 1,297 from the 1949 cohort, and 2,149 from the 1955 cohort, which indicates a significant out-migration, particularly for the 1942 cohort.[2] Of the continuous residents of Racine, Shannon selected random subsamples of the three cohorts for the

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[2] Shannon does not address the reason for this out-migration, but he does indicate that Latinos and African-American men had the highest rates of out-migration. It should be noted that it could be a possible source of bias for the 1942 cohort in particular. However, Shannon's analyses indicate that there were no significant differences between those **whites** interviewed and all other white continuous residents, no matter the neighborhood. For African-Americans males in the 1942 Cohort, non-interviewed individuals had higher seriousness score than interviewed individuals, while for the 1949 Cohort, the relationship was in the opposite direction.

collection of in-person interview data. Interviews were begun on June 1, 1976, when the members of the cohorts were ages 34 and 27, respectively. The possibility of some recall error in sample responses thus cannot be ruled out. For the present analyses, information from the 1942 and 1949 continuous-residence-and-interviewed subsamples were used.

The 1942 and 1949 continuous-residence-and-interviewed data sets were pooled, and a "tag" variable for birth year was created in order to control for any possible cohort effects. Initial analyses suggested that cohort membership was not a confounding factor, so the tag variable was not included in subsequent analyses. The total pooled sample included 799 individuals. After computing sample frequencies of all of the variables of interest, it was noted that 11 individuals were missing data on a significant number of variables--in some cases, all of the independent variables of interest. Deletion of these cases left a total sample size of 788. Of the 788, 714 (90.6%) were classified as non-Black[3], 397 (50.4%) were female, and 287 (36.4%) were from the 1942 cohort. Because of the great increase in the size of the birth

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[3] Which includes Whites or any non-Black ethnicity such as Latino/a.

cohorts in Racine between 1942 and 1949 during the Baby Boom years, the 1949 Cohort constitutes 63.6 percent of the final sample.

The Dependent Variables

There are two major dependent variables of interest for the following analyses:

- the trajectories of delinquent/criminal involvement of the 788 individuals in the interviewed continuous-residence pooled subsample from the 1942 and 1949 Birth Cohorts, and
- dichotomous measures of the offender class to which each individual belongs.[4]

The first step of the analysis utilizes semiparametric mixed Poisson regression models to determine the number and shape of the latent classes of offending, which is the first of the dependent variables. The second step of the analysis utilizes multinomial logit regression models to measure the ability of the various social contexts to predict membership into the latent classes delineated in

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[4] Delinquent/criminal involvement will be primarily discussed here. Offender class will be further described in the discussion of the

the first step. For this, dichotomous measures of class membership are used as the dependent variables.

Delinquent/criminal involvement was measured by the number of contacts with the police for each individual year of age from 6 to 30 for the 1942 Cohort and from age 6 to 25 for the 1949 Cohort.[5] Because contacts were measured for five fewer years for the 1949 Cohort, the analyses were limited to ages 6 to 25 for the pooled 1942 and 1949 sample. The police contacts used in the analyses were limited to those in which the individual came into contact with a Racine police officer for a crime of which he/she was suspected to have committed or did commit. Those instances *not* counted as police contacts included, (a) when an individual was a victim of a crime, (b) when an individual called the police for assistance, (c) when an individual was mentioned as being associated with a certain act, or (d) those contacts considered "safety measures for children."[6] Of all the continuous residents

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multiple stages in the analyses.

[5] As previously indicated, contacts with the police before the age of six were recorded for all three entire Birth Cohorts. In the pooled 1942/1949 subsample, there are no individuals who had a contact with the police before the age of 6. Six of the 788 had their first contact at the age of 6.

[6] For example, a child was playing in a dangerous street and came into contact with an officer.

(including both the non-interviewed and the interviewed subsamples), 68% of the members of the 1942 Birth Cohort and 69% of the members of the 1949 Birth Cohort had at least one recorded police contact meeting these criteria.[7]

The Explanatory Variables

This work examines the influence of three major social domains on longitudinal delinquent/criminal careers:

- neighborhood context (social organization or disorganization),
- family life, and
- peer involvement.

The independent variables of interest are measures of the these three domains, in addition to basic demographic measures, for the 788 individuals in the pooled subsample. The *demographic measures* include:

- the sex of the respondent,
- the race of the respondent (Black, non-Black),

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[7] Because the dependent variable is measured through police contacts, it is an "official" rather than self-reported measure of criminal involvement. It therefore is likely that many of the members of the cohort study samples engaged in delinquent/criminal acts during the study period that were not recorded.

- a measure controlling for the level of offense seriousness for each individual.[8]

Means, standard deviations, and the range of each of the explanatory variables are given in Table 3.1.

Table 3.1: Means of the Explanatory Variables (N=788)

Variable	Mean	SD	Minimum	Maximum
Individual Demographic Variables				
Black	0.094	0.292	0	1
Female	0.504	0.500	0	1
Cohort (dichotomous)	0.636	0.482	0	1
Serious Total Contacts	9.373	21.063	0	245
Neighborhood Context				
Neighborhood SES Score	11.888	6.508	1	26
Police Patrol	1.162	0.817	0	3
Family Context				
Family Stability	0.871	0.336	0	1
HOH's Employment Status[a]	0.939	0.239	0	1
HOH's Occupational Status	3.510	2.023	1	8
Mother's Employment	0.551	0.498	0	1
Number of Children	4.175	2.398	1	17
Adult Home After School	0.344	0.475	0	1
Peer Context				
High School Dropout	0.077	0.267	0	1
Feelings About High School	2.908	1.714	1	7
Peers' Delinquency (scale)	3.042	7.464	0	31
Peers' Delinquency (dichotomous)	0.332	0.471	0	1

[a]HOH = Head of Household

[8] The measure is a scale constructed by Lyle Shannon. It is a sum of the product of each offense, multiplied by its score on a six point seriousness scale. The seriousness scale ranges from 1 to 6 and is coded as follows: 1- lowest degree of seriousness (suspicion, information); 2- juvenile status offenses (e.g., vagrancy, truancy); 3- minor misdemeanor (e.g., disorderly conduct, traffic offenses); 4- major misdemeanor (e.g., theft, forgery); 5- felony against property

The *context of the neighborhood* in which each of the individuals lived was measured using a socioeconomic rank ordering of identifiable Census blocks, clustered into neighborhoods.[9] The rank ordering of neighborhoods consisted of a score for groups of city blocks which formed each individual neighborhood, based on information taken from the United States Census of Housing. Shannon identified 65 such neighborhoods in the city of Racine, taking into account both homogeneity of the areas and "all natural and man-made boundaries that would discourage or even preclude social interaction" (1988 p. 55). These 65 neighborhoods were then ranked according to a composite score of five ecological/socioeconomic measures: average dollar value of owner-occupied housing, average rent, percent of housing units lacking some or all plumbing, percent of housing units renter-occupied, and percent of housing units overcrowded.[10] For those individuals who were in continuous residence in Racine but moved between

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(e.g., burglary, auto theft); 6- felony against persons (e.g., robbery, assault, homicide).

[9] Shannon refers to them as "natural areas of socialization."

[10] In a few cases, the total neighborhood score was based on a very small number of blocks, resulting in an extreme or possibly biased score. For these cases, the rank assigned to the area was based on

neighborhoods, the average of the ranks of the neighborhoods was used. For a detailed map of the breakdown of city blocks in the city of Racine, see Figure 3.1a and Figure 3.1b.

The rank ordered scores of the natural areas of socialization (neighborhood) were used as a proxy variable for social disorganization. As discussed in Chapter 2, Shaw and McKay (1942) identified three key factors associated with social disorganization: *low economic status, ethnic heterogeneity and/or concentration*, and *residential mobility*. While these factors do not cause crime directly, they contribute to social disorganization, defined as the breakdown of both informal and formal social networks and the ability of a neighborhood or community to self-regulate and "maintain effective social controls" (Sampson and Wilson 1995 p. 45). Social disorganization, in turn, is associated with increased rates of crime.

The components of the neighborhood scale, while not comprehensive measures, attempted to get at the factors highlighted by Shaw and McKay (1942) using the relatively sparse amount of US Census data available at the block

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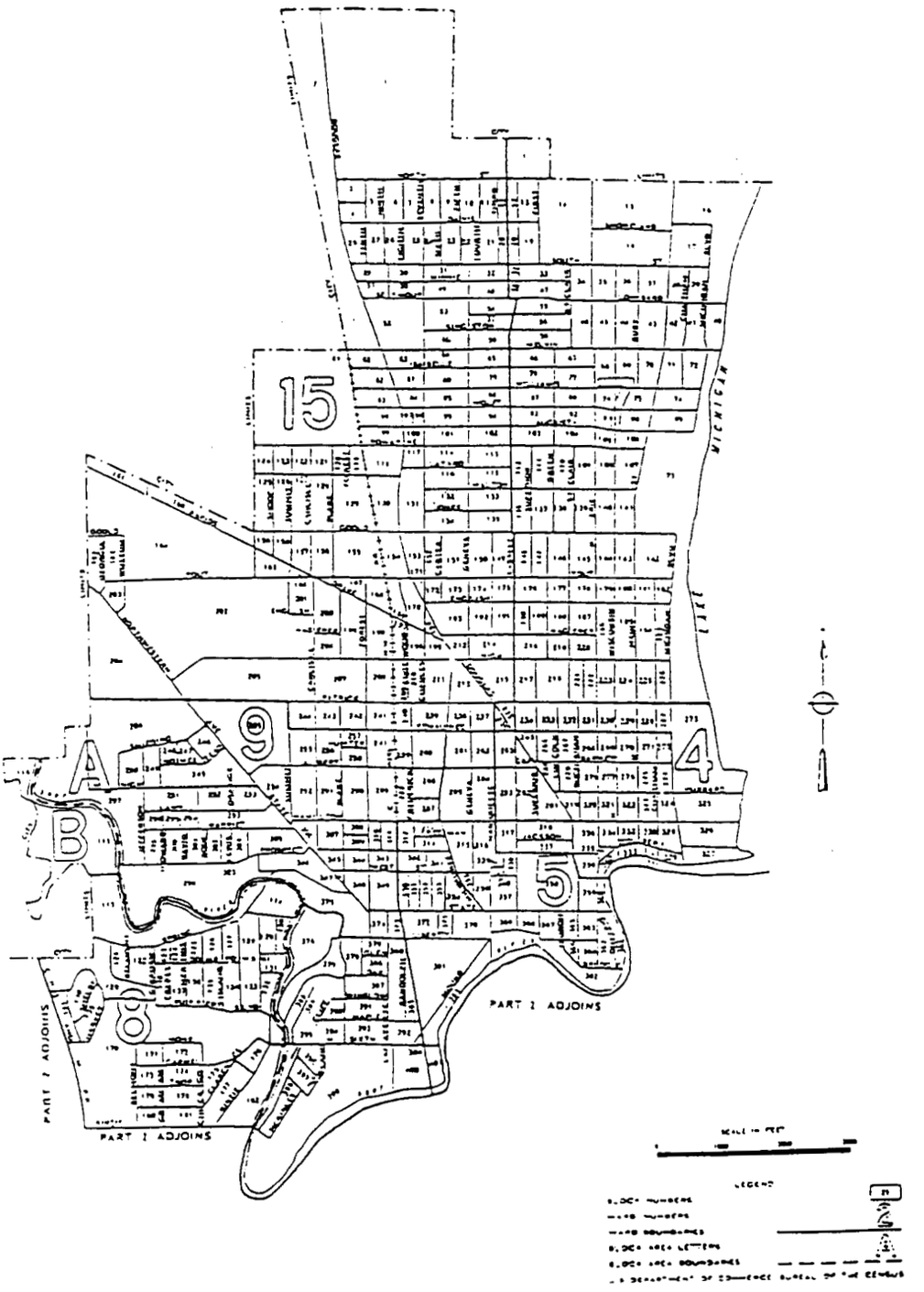
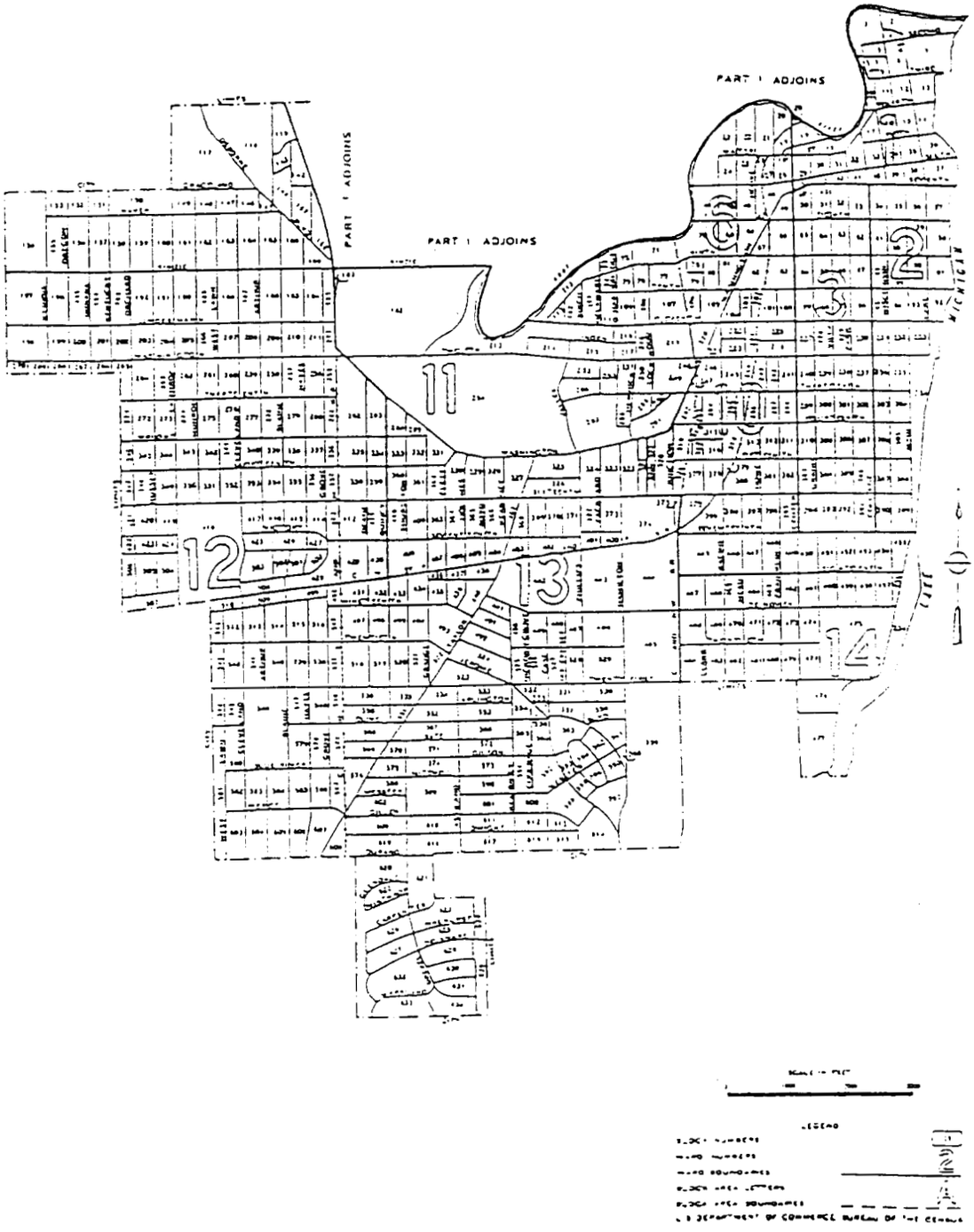
the average factor score for all of the individual variables used to

Figure 3.1a: Racine, Wisconsin, By Wards and Blocks (Part 1 of 2)



measure neighborhood SES.

Figure 3.1b: Racine, Wisconsin, By Wards and Blocks (Part 2 of 2)



level during the 1950s through 1970s (particularly in the earlier years). Levels of residential mobility, while not measured directly, were approximated by the percentage of housing units on a block which were being rented as opposed to owner-occupied. As owning a home creates deeper economic as well as personal commitments to an area, conversely, it can be inferred that renters would be less tied to an area, hence more mobile and less able and/or willing to create deeper social ties in the community. Measures of average housing values and average rent are direct measure of socioeconomic status, while the measure of the percentage of housing units overcrowded is a direct measure of population density, which Land et al. (1990) linked to increased homicide rates at the level of the Standard Metropolitan Statistical Area.[11] Wilson (1987) also noted the importance of housing density, as it leads to a high concentration of poverty--often in the heart of the inner city area and particularly in African-American communities--which, in turn, leads to social isolation and social disorganization.

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[11] Land et al. (1990) referred to "urbanization," which was a combination of population density and population size.

In his original ecological analyses in Racine, Shannon (1988, p. 51) expected to find "small, homogeneous" natural areas/neighborhoods clearly delineated on the basis of measures such as race and levels of crime. Instead, he found overlap in neighborhoods and the involvement in criminal activity of their occupants. Despite the higher amount of heterogeneity than anticipated by Shannon, the natural area scores provided "an aggregate-level measure of the socioeconomic characteristics of the area(s) in which the cohort member lived during the ages 6-17" (Shannon 1981, p. A-26) and, thus, were used as the measure of neighborhood context.

In addition to the socioeconomic measure of neighborhood context, Shannon (1988) also constructed a measure of more institutionalized social control in the form of police patrol of the neighborhood in which the individual lived as a juvenile. This was measured as a scale ranging from 0 to 3, with 0 being no patrol to 3 being heavily patrolled, providing a measure of formal social control in the neighborhood.[12]

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[12] It should be noted that this variable is not a measure taken directly from police records but, rather, as reported by the respondent. A possible bias in this measure could be that

Information on *the context of family life and peer groups* was obtained through detailed interviews conducted with the respondents. The variables selected for analyses in the present study were chosen because of their suitability for measuring the given theoretical constructs but was also limited to those variables which did not have a significant proportion of missing data.

As a measure of the family structure in which the respondent was socialized, a measure of "family type" was used. This variable was based on a scale created by Shannon (1988) which combined responses to several items regarding family composition during the juvenile years. The original scale ranged from 1 to 20, with 1 representing what Shannon believed to be the most stable family structure (two parents present during the entire childhood/juvenile period) and 20 the least stable (lived only with grandparents, never with parents). For two reasons, the scale was collapsed into a dichotomous variable for the purpose of analyses.[13] First, living in

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individuals who have had more and/or negative interactions with the police will perceive, and therefore report, more police patrol of the neighborhood regardless of the actual level of patrol.

[13] A score of 1 means the individual lived in a two-parent family for the entire period, while a score of 0 indicates any of the other possible family configurations.

anything but a two-parent family throughout childhood was anomalous at this time.[14] Second, the ordering of the family types scored 2-20 (anything other than a consistent two-parent family) could easily be questioned. For example, "mother only during the entire period" was ranked as being a less stable family formation than "mother only during the early period (0-8), remarried during the later period (9-18)," yet this did not take into account the possibility that the stepfather in the later period was abusive, making family life more unstable. Of course, this could be argued about any of the 20 categories, including the category considered to be the most stable. Collapsing the variable into a dichotomous measure decreased this potential variation. An additional measure of family structure was a count of the number of children in the family, including the respondent.

In addition to the structure of an individual's family, the possible level of supervision provided by parents was important, as was the possibility for parent/child interaction. This was measured in two ways. First, the analyses included a dichotomous measure of

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[14] Approximately 87% of the sample lived in a home where both parents were present throughout the childhood years.

whether an individual's mother or stepmother was employed outside of the home at any time while he/she was growing up (ages 6-18). Second, to account for the possibility that there might have been another adult present in the home[15] despite the mother's involvement in the labor force, a dichotomous measure of whether an adult was present when the individual returned home from school was also included.

The employment history of the head of the household for each respondent's childhood/juvenile home was used as a measure of the socioeconomic status of the family. It was measured in two ways: whether the head of the household was regularly employed throughout the years the individual was growing up[16] and a scale of the head of the household's occupational prestige.[17]

The third social domain of interest was the quality of the respondent's peer involvement, measured using four different variables. The first variable was one of two

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[15] An adult other than the mother or father, such as an adult sibling or a grandparent.

[16] A dichotomous measure.

[17] It ranges from 1 (professional/managerial) to 8 (agriculture).

direct measures of the respondent's peers' involvement with delinquent/criminal activity--a dichotomous variable measuring whether two or three of the individual's closest friends (during junior high school and high school) ever got in any kind of trouble with the police.[18] The second measure was a more detailed scale indicating the level of involvement the peers had with the police and the juvenile justice system.[19]

Attachment to school is an important element in peer relationships, as well as being important for social bonding in the broader sense. Throughout some of childhood and all of the teen years, the peer social group is considered to be one of the most important influences in an individual's life.[20] Because of the time spent there, school is a primary arena in which peer interaction occurs; therefore, a respondent's feelings about it are important. The first indicator of school/peer attachment

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[18] This is a self-reported measure not based on official police data.

[19] It includes being questioned by the police, arrested, sent to juvenile court, put on probation, referred to a social welfare agency/agencies, and being sent to a juvenile institution.

[20] In the earliest years of childhood, family is considered to be more important than the peer group.

was a dichotomous measure of whether the respondent graduated from high school (i.e., was the individual a dropout?). The second indicator was a scale ranging from 1 to 7 measuring the respondent's feelings towards high school and, by association, to peers.[21] Though the fact that an individual dropped out of school would seem to imply that he/she disliked school, preliminary analyses suggested that this was not the case for all individuals. A few who were dropouts nonetheless reported some level of attachment to school. Hence, both variables were included in the analyses.

METHODOLOGY

This project employed a variety of different analytical techniques, applied in a stepwise manner. The first and most basic step in the analyses plan was to "clean" the data and deal with all missing cases. Second, a statistically and substantively viable number of latent

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[21] Ranging from a score of 1 for those who reported liking school "a lot" to a score of 7 for those who "disliked school very much."

classes of offenders (including the nonoffenders) were established using semiparametric mixed Poisson regression models and offending trajectories of each of the classes graphed over time. The third step in the analyses was to assign class membership to each individual in the sample using his/her record of police contacts by age and a maximum probability assignment rule. This allowed for descriptive statistics to be generated for each latent offending class (e.g., sex and race composition, average number of offenses, etc.). Finally, multinomial logit and logistic regression models were estimated to assess the power of neighborhood context, family structure, and peer interactions in predicting membership into the various latent offending classes.

Recoding of Missing Data

For those cases which had missing data on one or more explanatory variables, values were imputed for each of the missing variables. Overall, levels of missing data fluctuated greatly across the entire Racine 1942 and 1949 Birth Cohort interview data. However, among the variables selected for the current analyses, levels of missing data were small, with most variables missing for only 1-3% of the cases. For the basic demographic variables of race,

sex, and cohort membership, there were no missing data. In addition, the composite scale of neighborhood socioeconomic status did not contain any missing cases.

For the dichotomous variables included in the analyses, the method of stochastic imputation for data which is missing at random was used to replace the missing cases. In this method, each missing value is replaced by a regression-generated score plus an error term using an imputation model that includes other independent variables from the analyses (Landerman, Land, and Pieper 1997). This method is effective if the percentage of missing is small and the predictive power of the imputation model is high (Landerman, Land, and Pieper 1997 p. 26).[22] Both of these conditions were satisfied by the merged subsample data.

For the continuous variables, the method of group-specific means imputation was used. To do this, the sample was sorted into four race/sex specific groups (black males, black females, non-black males, non-black

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[22] The percentage of cases missing for each variable were as follows: offense counts for ages 6 - 25, none; race, none; sex, none; cohort, none; neighborhood, none; level of police patrol, 2%; family type, 2%; number of children, none; mother's employment, 8.6%; adult home after school, 1.4%; head of household's employment status, 1.6%; head of household's occupation, 2.6%; dichotomous measure of friends' involvement with the police, 1.5%; scale of friends' involvement with

females). For each variable with missing cases, the mean value for each race/sex specific group was calculated. This value was then imputed for each of the missing cases according to the race and sex of the respondent.

Semiparametric Mixed Poisson Regression

The next step in the analytical process was to model latent categories/classes of offenders based upon individuals' similarity in offending trajectories over time. Such longitudinal patterns of criminal offending[23] cannot be identified by application of traditional statistical models--such as the conventional Poisson and negative binomial regression models (Cameron and Trivedi 1986)--for dealing with sequences of events which are rare occurrences.

Poisson-based models incorporate the assumption that the events of interest occur independently over time. Given the nature of criminal activity, this assumption of independence is most likely violated. The commission of a

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the police, none; feelings about high school, 3.8%; education/dropout, 1.4%; scale of serious police contacts, none.

[23] Also called "criminal careers."

crime may raise the probability that an individual may commit a subsequent crime, called *state dependence* (Nagin and Paternoster 1991; Nagin and Farrington 1992b) or events/crimes may occur in "spells" that are not independent of each other. Such features of criminal careers make the traditional Poisson model and its assumption of independence across events inappropriate.

A second major limitation of the conventional Poisson regression model is its requirement of equality of the mean and variance of the offense rate conditional on the explanatory variables. This mean, denoted by the parameter λ_{it} ($lambda_{it}$), represents the expected rate at which specific events (in the present case, delinquent or criminal) are expected to occur for individual *i* per unit of time *t*, or the mean rate of occurrence. One way of relaxing this requirement of equality of the mean and variance in the conventional Poisson regression model is through the addition of an error term, allowing for randomness in λ_{it}. Such a term can account for errors caused by misspecification of the regression model.[24]

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[24] Misspecification can be attributed to such things as the omission of a relevant independent variable, or other unexplained randomness found in λ_{it}.

With the incorporation of such an error term, sources of both *observed* and *unobserved heterogeneity* may be taken into account.[25]

The problem of unobserved heterogeneity is conventionally corrected through the specification of a gamma distribution (among members of the population from which a sample is drawn) for the error term in the regression model determining λ_{it}. The gamma family of distributions is a class of continuous distributions for random variables which take on only positive or nonnegative values. When the error term in the regression model for the λ_{it} is distributed in the population according to a gamma distribution, the random variable Y, or number of events per individual per unit of time, takes on a negative binomial distribution.

The benefit of combining the Poisson distribution of events with a gamma distribution of errors for λ_{it} in order to yield a negative binomial distribution of events, is the increased flexibility of the model. Specifically, unlike in the Poisson regression model, the conditional variance of the negative binomial regression model is not

constrained to be equal to its mean. While this combination still allows for the modeling of rare events under the assumptions of the Poisson distribution (events are rare within the total population and for most individuals), the addition of the gamma distribution of errors to create the *negative binomial regression model* allows individuals with identical values on the regressor variables to have expected rates of delinquent/criminal acts (i.e., λ_{it}) which are gamma distributed rather than set to the same conditional mean rate.

The development of *semiparametric mixed Poisson regression models* increases the flexibility of tools available to researchers for modeling longitudinal patterns of criminal careers (Nagin and Land 1993; Land, McCall, and Nagin 1996; Land and Nagin 1996). Semiparametric models generalize mixtures of Poisson distributions as discussed above. In Poisson mixture models, the error term is conceived of as unique to each individual in a longitudinal sample but also invariant across time (i.e., over the life span of an offender). The traditional negative binomial model assumes this

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[25] See Land, McCall, and Nagin (1996) for a discussion of *unobserved* or *hidden heterogeneity*.

persistent unobserved (population) heterogeneity is gamma distributed, whereas the semiparametric mixed Poisson models make no specific parametric assumptions about how the hidden heterogeneity is distributed throughout the population. Rather, it is approximated nonparametrically. Such a technique is desirable given that theory rarely will dictate the specification of the distribution of the error term (Land, McCall, and Nagin 1996). This innovation of the nonparametric error term combined with parametric estimation of the regression component of the model using Poisson regression allows for more flexibility in the estimation of longitudinal models of delinquent/criminal careers.

Semiparametric mixed Poisson regression models developed by Nagin and Land (1993) utilize *semiparametric maximum likelihood* (SPML) estimators to produce estimates of the model parameters. Consider a model which includes two points of support, dividing the sample into two latent classes or categories: the lambdas for the two groups of individuals may be estimated using the regression specification (Nagin and Land 1993):

$$\ln \lambda^{a}_{it} = (\beta_0 + \varepsilon_a) + \mathbf{X}_{it}\beta,$$

$$\ln \lambda^{b}_{it} = (\beta_0 + \varepsilon_b) + \mathbf{X}_{it}\beta, \quad (1)$$

where the distribution of the mixing variable is approximated by two points of support, denoted by ε_a and ε_b, β_0 is the overall constant of the model, and $\mathbf{X}_{it}$ and β are the matrix of regressor observations and regression coefficients from which the unit vector and intercept terms have been deleted, respectively. These two equations represent the *rates of offending* of individuals in the sample population whose hidden heterogeneity is approximated by one of the two points of support, a or b, corresponding to the specification of two latent categories or classes of delinquent/criminal careers.

The model itself generates appropriate numerical estimates for the points of support--as opposed to fixing points prior to estimation--by maximizing an appropriate likelihood for all of the data, including the nonoffenders.[26] The model also generates estimates of m_a and m_b, the proportions of the population at each point of support, with the constraint that $m_a + m_b = 1$.

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[26] Nonoffenders are those who have *no recorded police contacts*. This does not take into account the existence of offenses which were not detected by the police.

Utilizing the SMP models and their associated semiparametric maximum likelihood estimators, models with varying numbers of points of support may be estimated and compared against each other in an attempt to assess the optimal number of points of support and, therefore, classes of offenders. There still remains the question of how to define the optimal number of latent classes or the appropriate statistical tests and decision rules for judging optimality.

This question is addressed with the use of the Bayesian Information Criterion (BIC) which, under some conditions, can be interpreted as a Bayes factor which is an index of the weight of the empirical evidence for one model as compared to another (D'Unger et al. 1998, Kass and Wasserman 1995). The BIC is calculated as:

$$BIC = \log(L) - 0.5 * \log(n) * (k) \qquad (2)$$

where L is the model's maximized likelihood, n is sample size, and k is the number of parameters included in the model.

As an overall criterion for making decisions about the optimal numbers of latent classes of offending careers in models for cohort studies, models were chosen

which minimized the BIC and/or had "meaningful" parameter estimates (i.e. parameters that are sufficiently uncorrelated that their standard errors could be computed).

Data from the pooled 1942 and 1949 Racine Birth Cohorts were analyzed using semiparametric mixed Poisson regression models with programs written using GAUSS statistical software (Aptech Systems 1992). Based upon the previous work of Nagin and Land (1993) and Land, McCall, and Nagin (1996), a model which included *intermittency*, or periods of criminal activity possibly interspersed with periods of inactivity, was tested against a model which did not contain intermittency. The concept of intermittency generalizes the notion of criminal career onset and termination, structural elements which essentially divide the population into two classes: offenders and nonoffenders (Avi-Itzhak and Shinnar 1973). An intermittency parameter, denoted p_{it} can account for periods during a usually active criminal career in which the rate of occurrence, or λ_{it}, is equal to zero.[27] An individual in the sample is assumed to be in an active portion of his/her career during all time periods t with a

probability p_{it} and considered to be inactive during periods with a probability $1 - p_{it}$. The addition of this intermittency parameter, if it is significant, allows researchers to capture an important part of the theory behind the criminal careers paradigm: periods of inactivity may not be the sign of the termination of a delinquent or criminal career. Rather, they may only reflect a brief period of dormancy (Land, McCall, and Nagin 1996). The regression specification for the intermittency parameter variable includes a lag term, Y_{t-1}, coded 1 if individual *i* had been convicted in the previous period and 0 otherwise.

Based on tests between models of similar numbers of latent classes with an intermittency parameter and those without, it was determined that the addition of the intermittency parameter did not add to the predictive power of the model for the combined 1942 and 1949 subsample. To avoid estimating a model with an unnecessary parameter, all subsequent regression analyses of these data were estimated without intermittency in the models.

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[27] For example, during a period of incarceration.

Baseline semiparametric mixed Poisson regression equations were estimated using parameters for age and age-squared entered into each of the regression specifications (e.g., into the $\mathbf{X}_{it}$ matrix for the model of equations (1) above) for the offending rate for individual i in period t, λ_{it}. Models of varying number of categories were tested against each other for the sample as a whole (n=788), the male subsample (n=391), and the female subsample (n=397) in order to determine which was substantively and statistically the most viable.

After the optimal number of categories was determined for each of the three groups, sample members were "sorted" into the respective categories using a maximum probability assignment rule. Using the model coefficient estimates, the probability of observing each individual's pattern of offending was computed conditional on being a member of each of the latent offender classes. The individual was then assigned to the group with the highest probability (Land and Nagin 1996). Offending trajectories for each of the groups were graphed, and basic descriptive statistics were generated about the constituents of each of the

latent classes using both the total sample and the male and female subsamples.[28]

Multinomial Logit and Logistic Regression Analyses

While the identification of the latent classes of offending was a crucial first step in the analyses, it did not answer the question of what, if any, social factors explain offender class membership. To do this, pair-wise logistic regression and multinomial (polytomous) logit were used, treating the latent classes as dependent variables and the social and demographic indicators of interest as independent variables.

Logistic regression is used when the dependent variable of interest is a binary or dichotomous measure, taking an outcome of either 1 (success) or 0 (failure), also called a Bernoulli trial. To estimate the probability of either success or failure in a Bernoulli trial, the function (Powers and Xie 1999):

$$\Pr(y|p) = p^{y}(1-p)^{1-y}, \qquad (3)$$

[28] Both the aggregate actual trajectories of the members of each latent class and the trajectories predicted by the model will be plotted. The descriptive statistics for the latent classes can be found in Chapter 4, Tables 4.2a, 4.2b, 4.3a, and 4.3b.

is used, where the probability of success is $Pr(y=1) = p$ and the probability of failure is $Pr(y=0) = 1-p$ (Powers and Xie 1999).

Logit models are used to explain the impact of explanatory variables on the relative risks of various outcomes, often measured as Bernoulli outcomes. The "logistic transformation" is interpreted as the log of the odds of achieving success versus failure. The log transformation of the probability of success (p) is given by (Powers and Xie 1999),

$$\text{logit}(p_i) = \left(\frac{p_i}{1 - p_i}\right) \qquad (4)$$

The logit model can be used to generate odds ratios, which measures the odds of "success" (a 1 in a Bernoulli trial) associated with one group versus another (Powers and Xie 1999). When two groups have the same odds of success they will have an odds ratio of 1, and odds ratios can be either positive or negative. For continuous variables, odds ratios imply a *multiplicative effect*, meaning that a one unit change in the independent variable increases/decreases the odds of success for one group or the other (Powers and Xie 1999).

Logistic regression was used for each of the latent classes of offenders, treating membership in each class as a (0,1) dependent Bernoulli variable, with a 1 indicating that individual is a member of that particular latent class. Independent variables including the race, sex, and birth cohort of the respondent, in addition to measures of neighborhood, family, and peer group context were used to predict membership into each of the classes.

While logit models are one technique for analyzing class membership outcomes, they do have one drawback: while a score of 1 indicates membership into one particular category, a score of 0 indicates membership in *any* of the other categories, from nonoffenders to the highest rate offenders. This problem of shifting reference groups may make the odds ratios unstable across models.

To combat this problem in the current analyses, multinomial (polytomous) logit models were used. The multinomial logit model is used to deal with unordered categorical dependent variables, or outcome variables in which there is no hierarchical order to the responses. In the case of these analyses, class of membership is treated as the outcome variable. The individual binary responses

used in the logistic models are collapsed into one categorical response variable.[29]

Multinomial logit models can handle both continuous and discrete independent variables, like ordinary regression models. The generalized logit model is,

$$\log[\pi_j(\mathbf{x}_i)/\pi_J(\mathbf{x}_i)] = \beta_j'\mathbf{x}_i, \quad j=1,\ldots,J-1. \qquad (5)$$

where $\pi_j(\mathbf{x}_i)$ is the probability of response j, $j=1,\ldots,J$ at the *ith* setting of values of k explanatory variables $\mathbf{x}_i = (1, x_{i1},\ldots, x_{ik})'$ (Agresti 1990).

The results from the semiparametric mixed Poisson regression models and the multinomial logit regression models are reported in Chapter 4 and Chapter 5. Because of the problems using logistic regression models discussed above, the results from these models are discussed only in Appendix B.

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[29] For example, for three latent offender classes, the three individual logistic models would treat class 1 = (0,1), class 2 = (0,1), and class 3 = (0,1) as three separate dependent variables. For the multinomial logit models, these three variables would be collapsed into one categorical variable with class = (1,2,3).

CHAPTER 4

RESULTS, I: LATENT CLASS ANALYSES

The first step in establishing the relationship between the social contexts of neighborhoods, families, and peer groups, and trajectories of criminal behavior was to determine the existence of latent classes at the sample or population level. These latent classes capture similarities in the frequency, peak rate, and "chronicity" in offending across individuals and group them according to these similarities.

For this, semiparametric mixed Poisson regression models were used to group offenders into latent categories based upon their similarities of offending trajectories over time. Models of varying categories, ranging from 1 to 6 in number, were tested against each other to determine the optimal number. These analyses were conducted on both the sample as a whole (n=788) as well as the male (n=391) and female (n=397) subsamples.

After the statistically and substantively appropriate number of latent classes was established, the actual and

predicted offending trajectories of each of the latent classes were graphed for the sample as a whole, as well as the male and female subsamples. Residuals between the actual and predicted trajectories were also graphed. Sorting offenders into their respective latent classes using the maximum probability assignment rule also allowed for descriptive characteristics of each of the latent classes to be generated. Finally, multinomial logit models were used to test the strength of the demographic variables, neighborhood context, family, and peers in predicting membership in each of the latent categories. The results of all semiparametric mixed Poisson regression models are presented in the following sections. Results from the multinomial logit and logistic regression models are presented in Chapter 5 and Appendices A and B.

ESTABLISHING LATENT CLASSES OF DELINQUENT/CRIMINAL OFFENDERS

The Optimal Number of Latent Classes

Models of varying numbers of latent classes, from one to six, were tested against each other to determine the

optimal number of classes, both substantively and statistically. Using the Bayesian Information Criterion (BIC statistic) as a decision-making tool, it is concluded that models with three to five categories of offenders are best able to capture the trajectories of offending over the twenty years of data collected for the three samples.

For the Racine 1942 and 1949 pooled sample, five categories of offenders is the optimal number. The baseline model is a one-class model which made no distinctions between offenders and nonoffenders. Moving to a two-class model, which makes the distinction between offenders, or those with *recorded* police contacts, and nonoffenders, the BIC statistic decreases sharply, as reported in Table 4.1. The BIC continues to decline sharply as the number of classes is increased from two to three and from three to four. At five latent classes of offenders, the BIC is minimized at 9587.3, a decrease of 4771.4 from its original starting value of 14358.7 with the one category model. Adding an additional class, the BIC jumps back up by 28.6 to 9615.8. An examination of the breakdown of the percentages of individuals in the sample who fall into each latent class shows that only 0.1 percent of the sample (one case) is categorized as belonging to the sixth class. Evidently, it is not

sufficiently different from the other five classes relative to the increased number of parameters estimated for the sixth class, hence the increase in the BIC statistic.

Table 4.1: BIC Values for the Racine 1942 & 1949 Birth Cohort Total, Male, and Female Subsamples

BIC Values			
Number of Classes	**Total Sample (n=788)**	**Male Sample (n=391)**	**Female Sample (n=397)**
1	14358.7	10772.9	3937.3
2	12747.2	8551.9	3620.6
3	12775.4	6968.1	3491.0[a]
4	9842.5	6658.0	2995.6
5	9587.3[a]	6460.3[a]	2949.6
6	9615.9	6478.7	2991.8

[a] Denotes optimal model for each sample.

For the male subsample, the results are very similar. The BIC begins at a high of 10772.9 with the one category

model, decreases with the two, three and four category models to a minimum of 6460.3 with five categories. With the addition of the sixth category, the BIC again increases to 6478.7, indicating that the added category is not sufficiently distinct from the other five relative to the number of parameters added to the model. As with the total sample, less that 0.1 percent of the sample is sorted into this sixth class of offenders.

Results from analyses of the female subsample suggest a different configuration of trajectories than found in either the total sample or the male subsample. From the purely statistical standpoint, it is suggested that the optimal model is the five-class model. The BIC is minimized in the five-class model at 2949.6, compared with 3937.3 for the one-class model, 3620.6 for the two category offenders versus nonoffenders model, 3491.0 for the three-class model, and 2995.6 for the four-class model.[1] However, when looking at the proportion of the sample which fall into each category, the four- and five-class models are not appropriate, despite having smaller BIC statistics.

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[1] The BIC for the females increased to 2991.8 for the six-class model.

In the four-class model for the females, only 0.5 percent of the sample, or slightly less than two people, fall into the fourth class. The rest are divided between the three other classes. Similarly, in the five-class model, the fourth and fifth classes each have one person in them, with the rest of the sample (395 people) being divided among the other three classes. When the trajectories of offending for each of the classes are represented graphically, the additional categories in the four- and five-class models overlap very substantially with one of the other existing categories. Because the additional classes contain such a small number of sample cases, the three-class model for the female subsample is judged to be optimal.

The latent classes established in these three analyses suggest that the patterns of the offending trajectories of the males are largely the driving force behind the five-class model for the entire sample. In other words, the female trajectories are "subsumed" by the male trajectories. This was not surprising given that male rates of offending in the sample are higher than

female rates across all ages.[2] This supports Hypothesis 1, that there is more heterogeneity among male offenders than female offenders, at least within the Racine 1942 and 1949 pooled subsample.

In addition, Hypothesis 2 is supported, while Hypothesis 3 is not. While male offending does take on three distinct chronic patterns, there is also a chronic pattern exhibited among the female offenders, which is counter to Hypothesis 3. Results from these analyses also corroborate the conclusions drawn from analyses on males and females from another study of delinquent/criminal careers in a birth cohort. In an analysis of data from the Second Philadelphia Cohort (following all of the individuals born in the city of Philadelphia in 1958), D'Unger et al. (forthcoming) found a higher level of heterogeneity among male than female offenders as well as overall higher levels of offending for males across the ages. However, the more chronic pattern found among the females in the Racine Birth Cohorts are not present in the Second Philadelphia Cohort. Rather, the Philadelphia

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[2] While the highest-rate female offenders peaked at slightly less than 1 offense per year, the comparable male offenders peaked at 9 offenses.

females exhibit two distinct adolescent-peaked patterns, in addition to the nonoffenders.

Trajectories of Offending

The second step in the analyses was to plot the age curves of each of the optimal latent class models.[3] To do this, both the *actual* offense counts, averaged across the members of each category, and the *expected* offense counts (as predicted by the model) were graphed.

Figure 4.1 shows the actual (or average observed) overall age-specific offense rates of the combined 1942 and 1949 Racine Cohorts. This *age-crime curve* shows the rise in offending into the teen years, peaking in the late teens, and then declining into adulthood. However, this overall curve masks the possible heterogeneity between offenders and nonoffenders as well as among types of offenders. Figure 4.2 displays the age-crime curve for the Racine Cohort as predicted by a conventional single-Poisson regression model.

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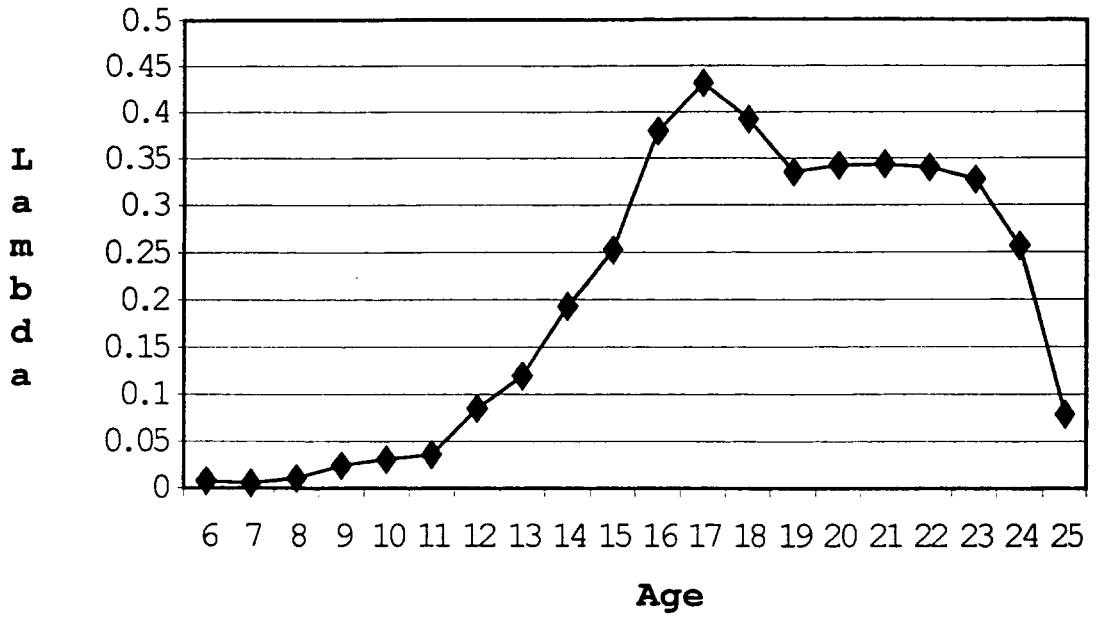
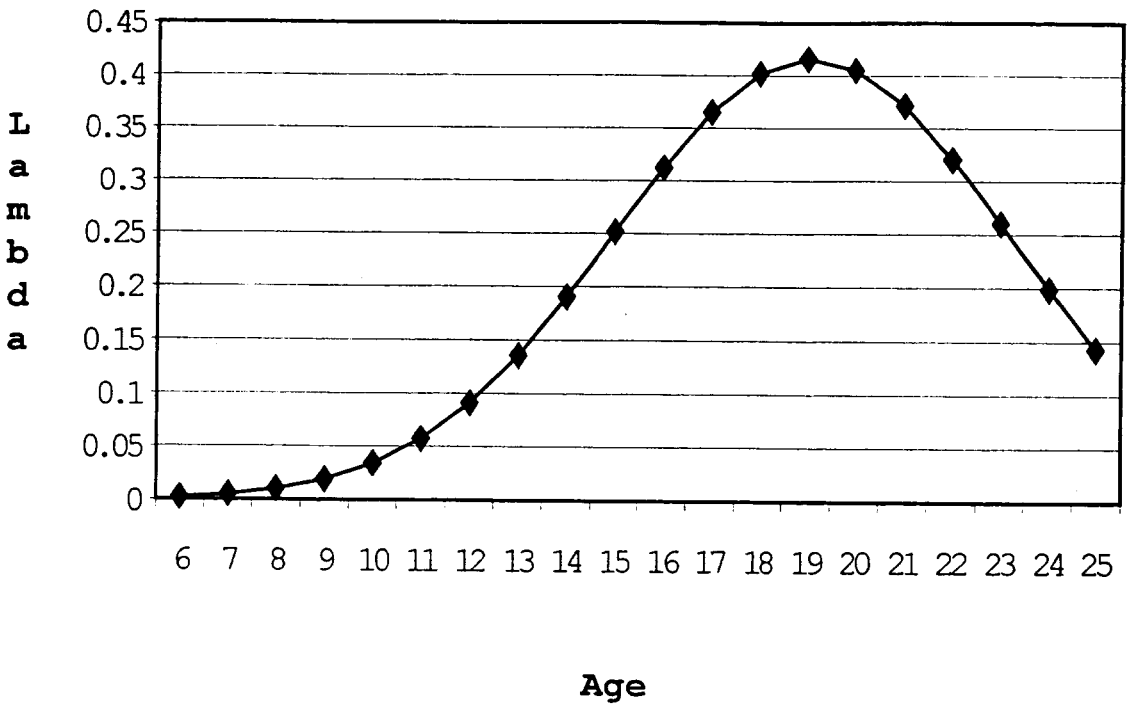
[3] Five classes for the total sample, five classes for the male subsample, and three classes for the female subsample.

Figure 4.1: Actual Age-Crime Curve for the Combined 1942 and 1949 Racine Cohorts



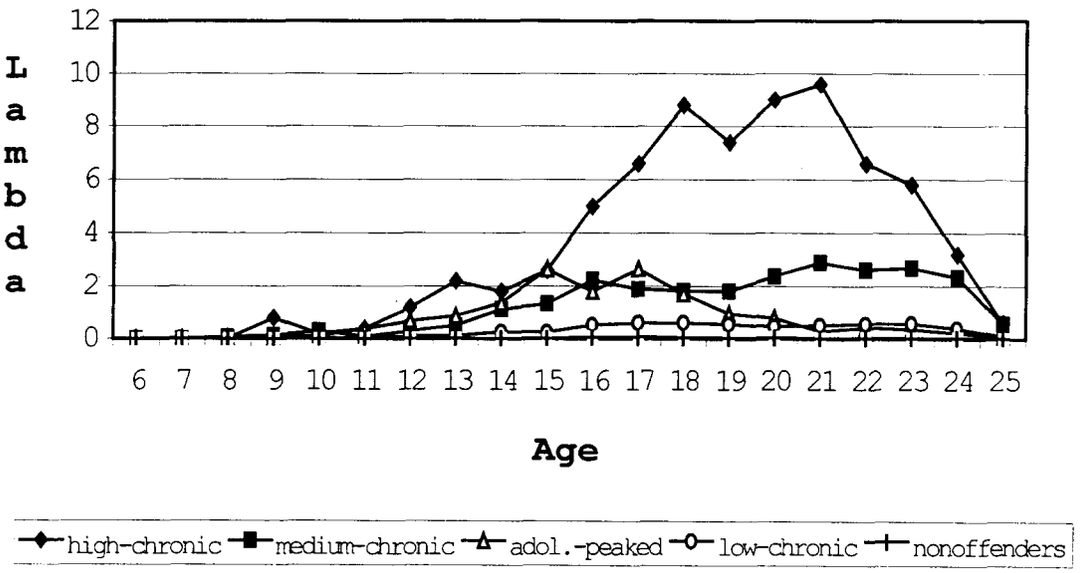
Moving on to the multi-class models, Figure 4.3 shows the actual rates of offending per year for each of the five latent offender classes. Once individuals had been sorted into the latent classes, the offense counts were averaged for each year for all of the members of a given offender category. This produced the trajectories shown in Figure 4.3. In addition, the proportion and number of individuals in each class was determined. For the total

Figure 4.2: Predicted Age-Crime Curve for the Combined 1942 and 1949 Racine Cohorts



sample of 788, 518 (65.7%) are classified as *nonoffenders.* Their trajectory of "offending" is flat along the x axis.

Figure 4.3: Five-Class Actual Model for the Combined 1942 and 1949 Racine Cohorts



Among those who are not nonoffenders, five individuals (0.6% of the sample) are classified as *high-chronic offenders*. These offenders begin offending at an early age, have a very high peak at approximately age 20 (almost 9 police contacts per year), and remain at an above-zero level of offending at the end of the data collection period.

The third trajectory observed is the *medium-chronic offender* class. This category consists of 29 individuals

(3.7% of the sample) offending at approximately half the rate of the high-chronic offenders. They peak in their early twenties at about 3 police contacts per year and, like the high-chronics, remain at an above-zero level of offending through the end of data collection. While their peak level of offending is much lower, the shape of their trajectory mirrors the offending trajectory of the high-chronic offenders.

The fourth type of "chronic" offender is the *low-chronic offender*. There are 204 individuals in this category (25.9% of the sample), which peaks at approximately 0.6 offenses per year at age 19. While the trajectory of this latent class appears flat relative to the high- and medium-chronic offenders, it still did not take on the distinct peaked pattern of an adolescent-peaked/adolescent limited class. In addition, the mean offense rate of the low-chronic offenders remains *slightly* above 0 at the end of data collection, hence their classification as a chronic rather than limited/peaked pattern.

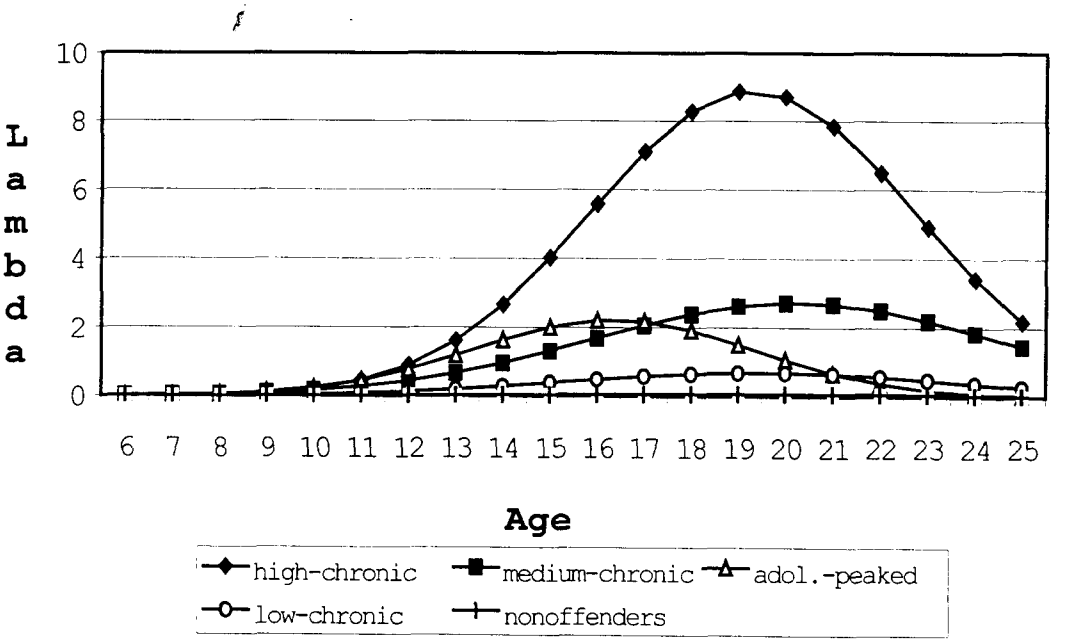
Adolescent-peaked offenders comprise the fifth offender class. There are 32 individuals (4.1% of the sample) in this class. Their offending trajectory falls

between the medium- and high-chronic trajectories for several years, but then peaks at 2.7 police contacts per year at approximately age 16 and returns to 0 by the age of 23. The earlier peak age of offending and the more precipitous decline towards 0 offenses make this class distinct from the other 3 offender classes. It is interesting to note that the proportion falling into the adolescent-peaked category (n=32) is counter to what was hypothesized (Hypothesis 8): while it was hypothesized that the adolescent-peaked offender would be the most "normal" type of offender (hence there would be more of this type of offender than any other), in fact, there are more low-chronic offenders. It should be noted that the *shape* of the low- chronic and adolescent-peaked trajectories are very similar. The primary difference between the two is the older peak age for the low-chronics as compared to the adolescent-peaked (age 19 as opposed to age 16).

For comparison to the foregoing observed offending trajectories, Figure 4.4 depicts the trajectories of offending for each latent class as predicted by the semiparametric mixed Poisson regression model. The expected patterns of offending for each class are very similar to the actual patterns, though the model-based

trajectories are "smoothed" as compared to the empirical curves. The relative peak ages can also be more easily compared on the predicted graph.

Figure 4.4: Five-Class Predicted Model for the Combined 1942 and 1949 Racine Cohorts

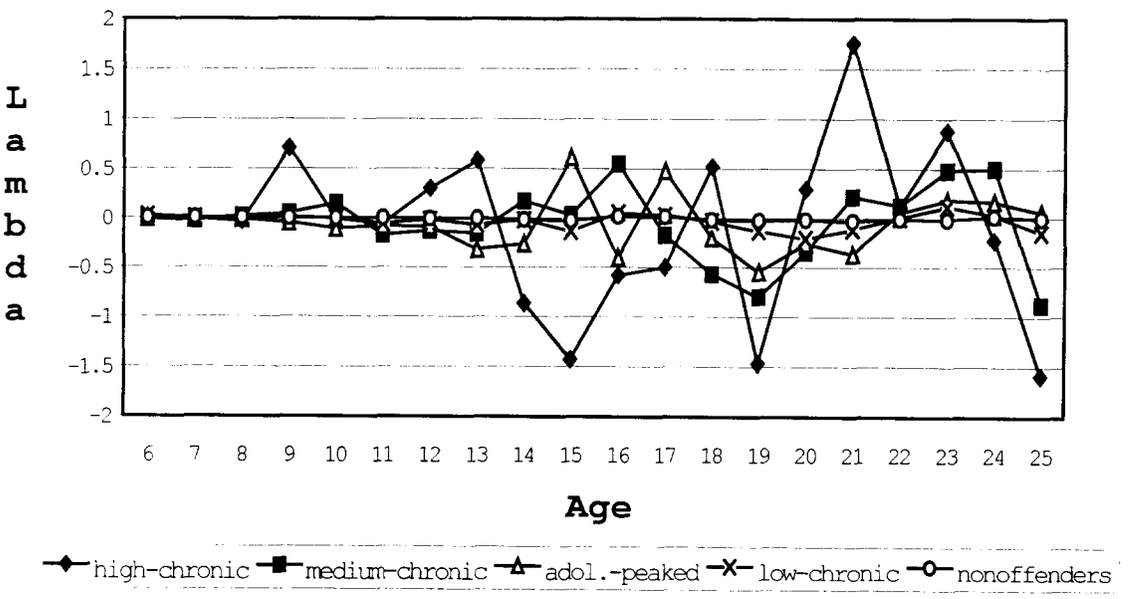


Discrepancies between the actual/empirical and predicted offending rates can be ascertained by calculating and plotting the residuals. Figure 4.5 shows the residuals across the ages. For the lower rate and nonoffenders, the difference between the actual rates of

offending and the predicted rates is small. For the higher rate offenders (and the high-chronics in particular) and at the older ages (above 19), the discrepancies between actual and predicted are higher. However, even at their highest, the predicted offending rates still fall within 2 offenses of the actual offending rates.

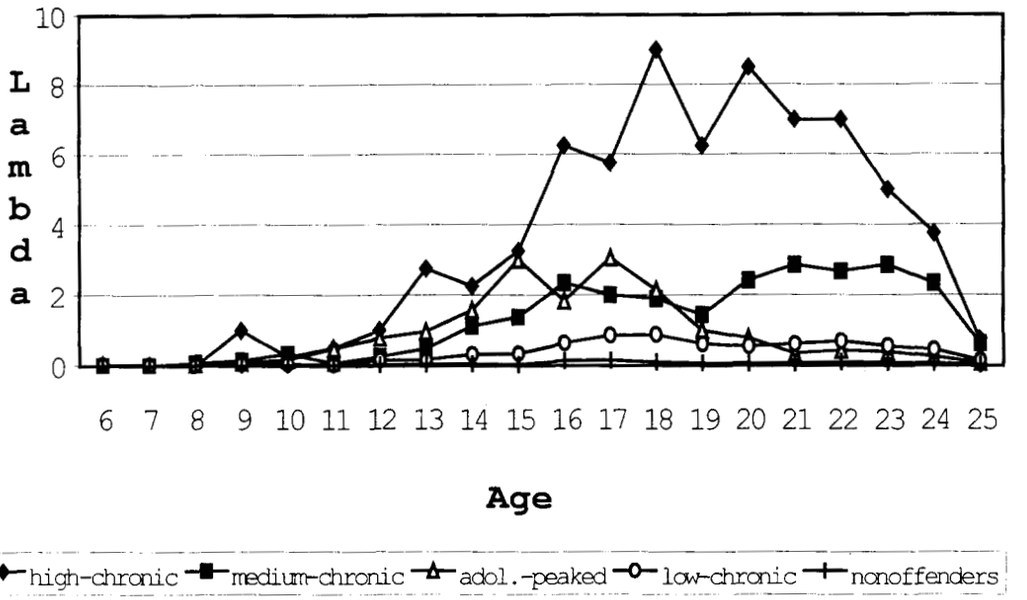
The trajectories of the five latent classes of offenders in the male subsample are shown in Figures 4.6 and 4.7. Figure 4.6 depicts the actual trajectories of

Figure 4.5: Residuals for the Five-Class Model, Combined 1942 and 1949 Racine Cohorts



offending, which are very similar to the patterns for the sample as a whole. Of the 391 males, 209 (53.5%) are classified as *nonoffenders*, or those with no recorded police contacts. Four individuals (1.0% of the sample) are classified as *high-chronic offenders*,[4] peaking at approximately age 20 with offense counts at slightly over 8 per year. Twenty-seven individuals (6.9%) are *medium-*

Figure 4.6: Five-Class Actual Model for the Combined 1942 and 1949 Racine Cohort Males



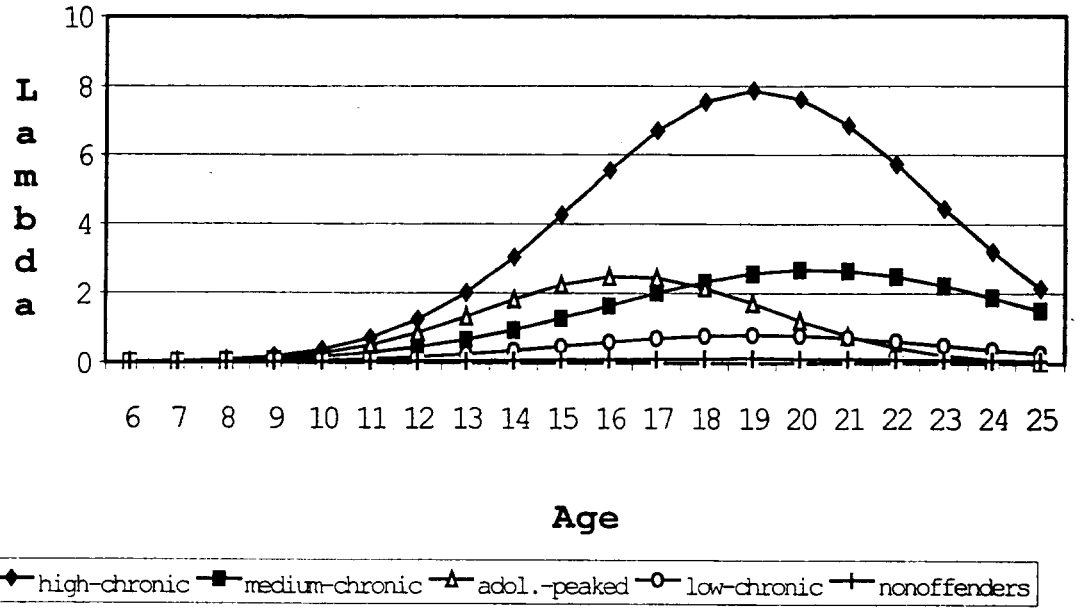
[4] Meaning that the fifth person in this category in the total model was a female.

chronic offenders, peaking in the early twenties with a rate of less than half of the high-chronic offenders. As seen with the total sample, the trajectory of the medium-chronic offenders is similar in shape to the high-chronics, but lower in overall rate. Both groups remain at an above-zero level at the end of data collection. The male adolescent-peaked category, as in the total sample, is relatively small; 23 males (5.9%) are classified as adolescent-peaked offenders in the actual model and peak at a rate of approximately 3 offenses per year at age 17. Also similar to the total sample, there is a large class of low-chronic offenders, with 128 males being classified as such (32.7% of the male sample).

Figure 4.7 depicts the trajectories of offending for the male subsample as predicted by the regression model. The residuals for the male subsample are depicted in Figure 4.8. As with the total sample, the discrepancies between actual and predicted offending rates are greatest for the highest rate offenders and at the older ages. Also similar to the total sample, the residuals are less than 2 offenses per year for even the highest rate offenders, which indicates that the offense counts

predicted by the regression model are a good fit to the actual offense counts.

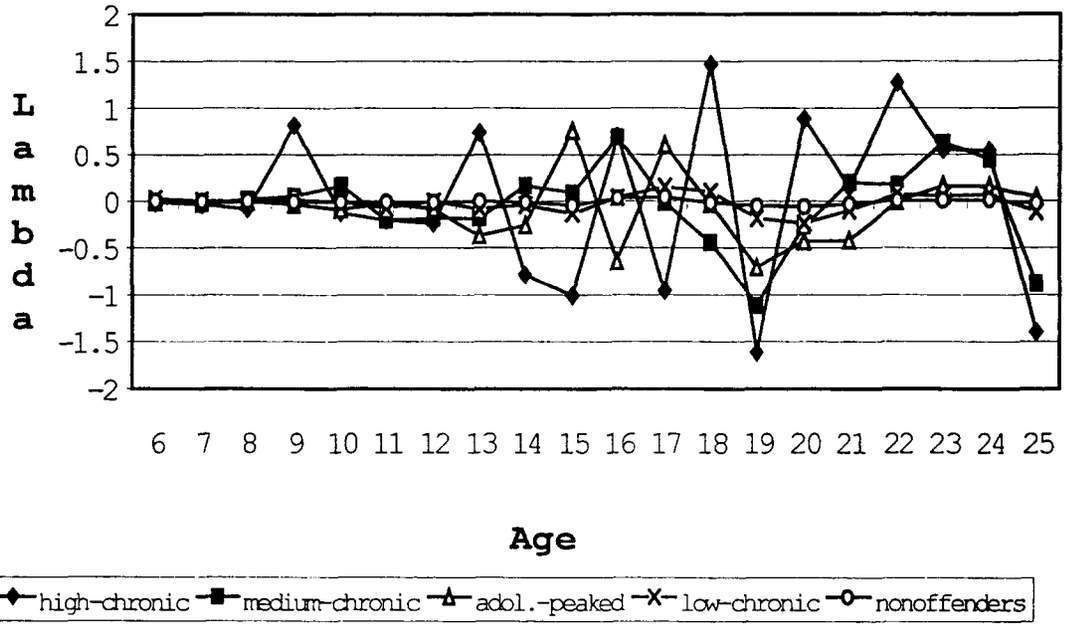
Figure 4.7: Five-Class Predicted Model for the Combined 1942 and 1949 Racine Cohort Males



The actual and predicted offending trajectories for the female subsample are depicted in Figures 4.9 and 4.10. Unlike the total sample and the male subsample, only 3 classes of offenders are detected among the females. Of the total sample of 397 females, 201 are classified as nonoffenders (50.6% of the female sample).

Of those classified as offenders, 118 (29.7%) are adolescent-peaked offenders. These individuals peak at approximately age 16 with an offense rate of 0.3 per year and decline to an average rate of offending of 0 by the age of 23. This is very different from those who are

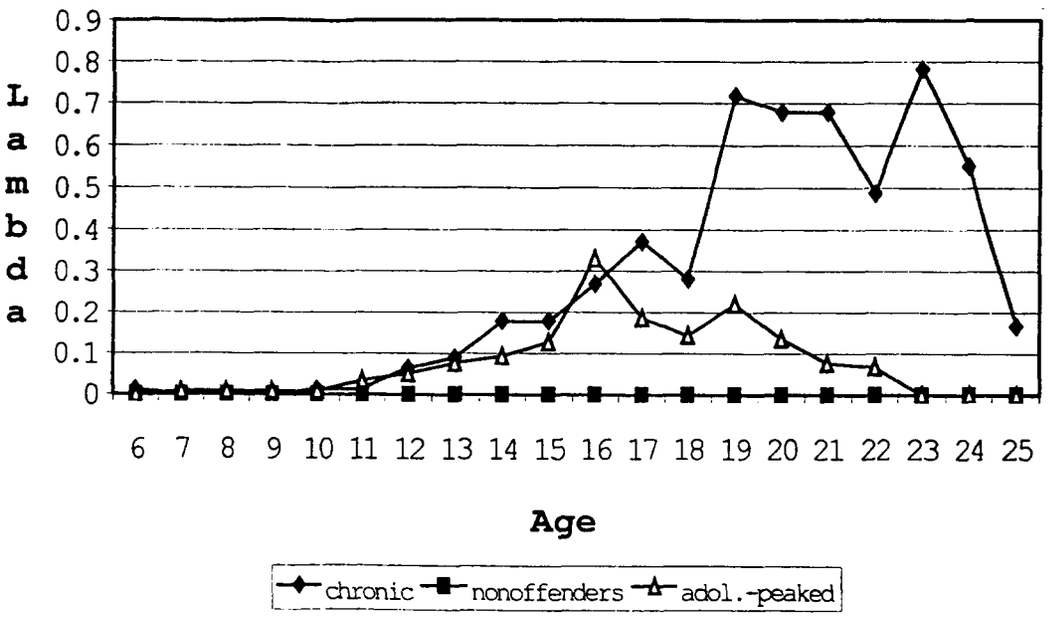
Figure 4.8: Residuals for the Five-Class Model, Combined 1942 and 1949 Racine Cohort Males



classified as chronic offenders. The 78 female chronic offenders (19.6%) peak in the early twenties at a rate of

0.7, like their male counterparts, and remain at an above-zero level through the end of data collection. While the shapes of both the adolescent-peaked and chronic offenders (high-chronic among the males) are the same for both the males and females, there is a noticeable difference in

Figure 4.9: Three-Class Actual Model for the Combined 1942 and 1949 Racine Cohort Females



average rates of offending. The male high-chronic offenders have a peak offending rate approximately 9 times that of the female chronic offenders, while the male adolescent-peaked offenders have a peak rate approximately 5 times higher than the female adolescent-peaked offenders.

Figure 4.10 depicts the trajectories for the three latent classes of female offenders as expected from the regression model. Much like the other two samples (the total sample and the male subsample), the predicted trajectories are "smoothed" versions of the actual ones. The residuals for the actual versus predicted offense rates over time for the females are found in Figure 4.11. As with the total sample and the male subsample, the discrepancies between actual and predicted offense counts are higher for the chronic offenders and at the older ages. Even at their highest, the residuals fall within 0.25 offenses per year. It must be noted, however, that the overall offense rates are lower for the females than for the males, so the residuals cannot be compared across the two subsamples nor can the females be compared to the sample as a whole.

Figure 4.10: Three-Class Predicted Model for the Combined 1942 and 1949 Racine Cohort Females

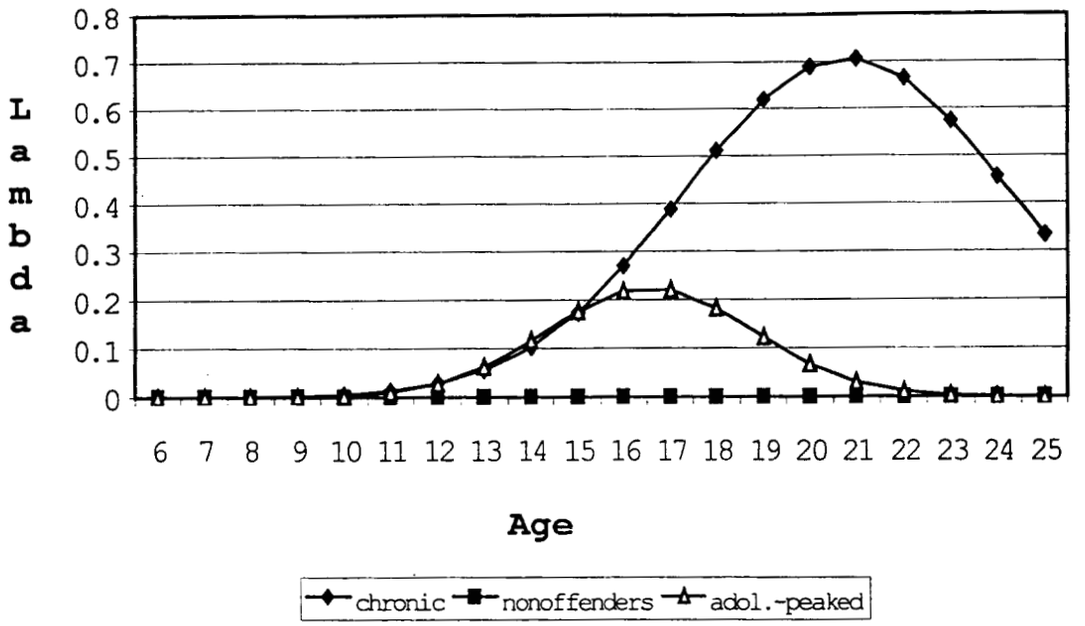
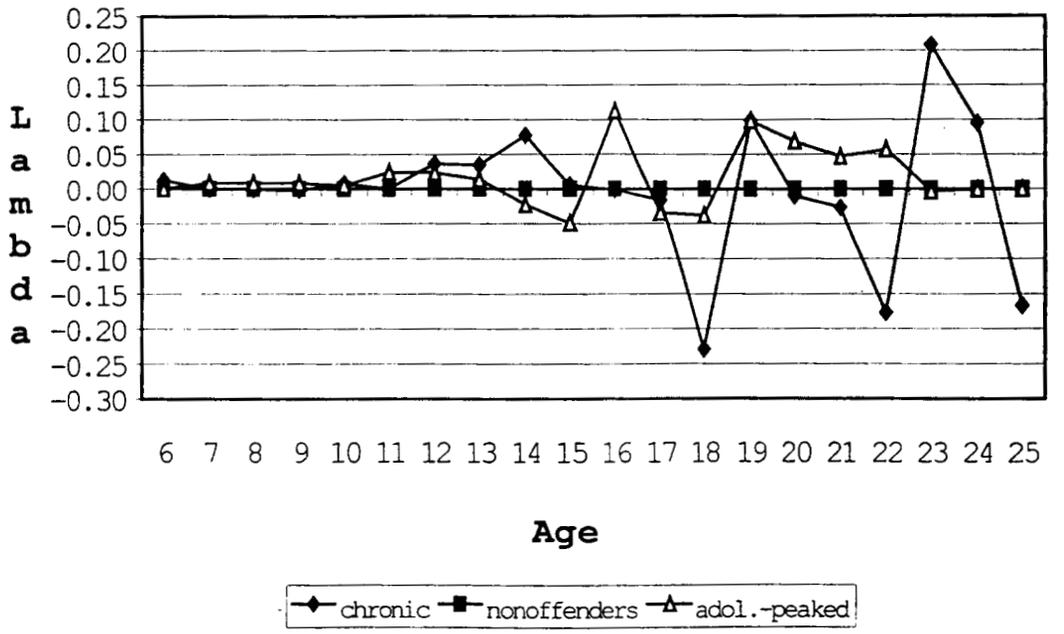


Figure 4.11: Residuals for the Three-Class Model, Combined 1942 and 1949 Racine Cohort Females



Characteristics of the Latent Classes

After establishing the latent classes and the shapes of the offending trajectories over ages 6 to 25, the third step in the analytical plan was to generate descriptive statistics for each of the categories found in the full sample, as well as the male and female subsamples. Of primary interest is: (a) the basic demographic control variables of race and gender as well as the neighborhood measure, (b) the mean number of police contacts per individual in each class and the total number of contacts for the class as a whole, and (c) the difference between offenders (in general) and nonoffenders.

Results of basic descriptive analyses of the three samples are presented in Tables 4.2a, 4.2b, 4.3a, and 4.3b. Overall, the mean number of police contacts for a single individual in the sample across ages 6 to 25 is 4.0, with a standard deviation of 8.0. When looking only at those who were "pure" offenders, meaning they had at least 1 contact over the 20 year period,[5] the mean number is 6.0, with a standard deviation of 10.0. In the total sample, 271 persons have no recorded police contacts (34.4%) and 517 have at least 1 recorded police contact

(65.6%). Among the males, 70 have no recorded police contacts (17.9%) and 321 have at least one (82.1%). For the entire male subsample, the mean number of police contacts is 6.5 with a standard deviation of 10.2, while among those with at least one contact the mean number is 7.9 with a standard deviation of 10.7. Among the females, the number/percentage of those with no recorded police contacts is higher than among the males: 201 (50.6%) have no contacts, while 196 (49.4%) have at least one. For the entire female subsample, an average individual has 1.6 contacts across ages 6 to 25, with a standard deviation of 4.8. Among those with at least one contact, the mean is 3.2 with a standard deviation of 6.4.

A basic profile of each of the latent offender classes for the three samples[6] can be obtained from Tables 4.2a and 4.2b. In the total sample, race appears to be a factor in the latent classes.[7] The percentage of African-Americans increases with increasing rates of police

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[5] In other words, excluding all "pure" nonoffenders (no police contacts).

[6] The total sample and the male and female subsamples.

[7] The basic descriptive statistics indicate which variables (e.g., race, sex, neighborhood) *appear* to have a relationship with the offending classes. The actual predictive power of these variables, as well as the other independent variables in the model, will be determined by the logistic and multinomial logit models discussed later in Chapter 5 and Appendices A and B.

contacts by a factor of 10: while only 6.4 percent of the nonoffenders are African-American, 60.0 percent of the high-chronic offenders are. Gender also appears to be a significant factor. Females make up a majority of the nonoffenders (64.7%), but a minority of all of the other classes. The strongest female presence is in the low-chronic offenders, where females make up 27.0 percent.

Table 4.2a: Characteristics of Offending Classes in the Total, Male, and Female Subsamples

	n	% in Class	% Black	% Female	Mean Neighborhood Score
Total Sample (n=788)					
Nonoffenders	518	65.7	6.4	64.7	12.6
Adol.-Peaked	32	4.1	9.4	12.5	10.6
Low-Chronic	204	25.9	11.3	27.0	11.0
Med.-Chronic	29	3.7	41.4	6.9	8.4
High-Chronic	5	0.6	60.0	20.0	2.2
Male Sample (n=391)					
Nonoffenders	209	53.5	4.8	0.0	12.3
Adol.-Peaked	23	5.9	8.7	0.0	11.7
Low-Chronic	128	32.7	8.6	0.0	11.2
Med.-Chronic	27	6.9	40.7	0.0	7.7
High-Chronic	4	1.0	75.0	0.0	2.3
Female Sample (n=397)					
Nonoffenders	201	50.6	7.0	100.0	13.0
Adol.-Peaked	118	29.7	7.6	100.0	12.2
Chronic	78	19.6[a]	18.0	100.0	10.5

[a]Percentages in each class do not total 100.0 due to rounding error.

Although they also make up 20 percent of the highest rate offenders, this is only among a total sample of 5. Finally, neighborhood also appears to be significant to the latent classes. The average neighborhood score (on a scale from 1-26 with 1 being the neighborhood of lowest socioeconomic status) is highest for those who are nonoffenders, and decreases with an increasing rate of offending. While the low-chronics and the adolescent-peaked have approximately the same neighborhood score, the medium and high-chronics have scores which are much lower.

Table 4.2b contains the mean number of police contacts over ages 6 to 25 for an average member of a given latent class and the aggregated number of police contacts by the sample members in that class. High-chronic offenders have the highest mean number of police contacts, almost 72.0 over the 20 years of data collection, or 3.6 per year. This class of offenders accounts for 359 total contacts, which is 11.4 percent of the contacts for the entire sample.

The police contact information for the high-chronic offenders offers support for Hypotheses 9. High-chronic offenders are the least prevalent offender type and have the highest mean number of police contacts, however they

do not account for the highest percentage of all cohort contacts. Rather, the low-chronic offenders have the majority of contacts despite their much lower mean rate of offending.

The high-chronics are followed by the medium-chronic (25.2), adolescent-peaked (15.6), low-chronic (6.0), and nonoffenders (0.6) in mean number of contacts per year. The low-chronic offenders (n=204) account for the highest percentage of police contacts. They have a total of 1220 contacts, which is 38.8 percent of the

Table 4.2b: Characteristics of Offending Classes in the Total, Male, and Female Subsamples

	n	Mean Police Contacts	Total Police Contacts	% of Total Police Contacts
Total Sample (n=788)				
Nonoffenders	518	0.6	334	10.6
Adol.-Peaked	32	15.6	499	15.9
Low-Chronic	204	6.0	1220	38.8
Med.-Chronic	29	25.2	732	23.4
High-Chronic	5	71.8	359	11.4[a]
Male Sample (n=391)				
Nonoffenders	209	1.2	245	9.7
Adol.-Peaked	23	17.4	400	15.8
Low-Chronic	128	7.2	918	36.3
Med.-Chronic	27	25.3	682	27.0
High-Chronic	4	70.3	281	11.1[a]
Female Sample (n=397)				
Nonoffenders	201	0.0	0.0	0.0
Adol.-Peaked	118	1.6	186	30.1
Chronic	78	5.5	432	69.9

[a]Percentages in each class do not total 100.0 due to rounding error.

total sample contacts. The medium-chronic offenders follow with 23.3 percent of the contacts (732 total), the adolescent-peaked with 15.9 percent of the contacts (499 total), and the nonoffenders with 10.6 percent of the contacts (334 total).

The results detailed in Table 4.2b present a profile not only of the cohort members' criminal activity, but also the level of police response and the "burden" carried by the police in monitoring this cohort. For example, the high-chronic offenders are clearly an active group, with members averaging almost 4 contacts with the police per year, though they are only a small percentage of the birth cohort. Though the low-chronic offenders average only 6.0 offenses per individual across the twenty years of data collection, the large size of this latent class (n=204) means that low-chronic offenders committed a total of 1220 crimes. The "burden" then placed on the police in monitoring the low-chronic offenders is actually quite high, given their sheer numbers. Conversely, the relatively high levels of offending may also be indicative of police responses which are exogenous to the actual behavior of the sample members. Given the small-town context of Racine, supervision by the police could be done more closely than in a larger urban area, hence higher

numbers of police contacts for a sample whose behavior was not any more deviant than a comparable birth cohort.

The close supervision and monitoring of the police is reflected in the offending behavior of the "nonoffenders." Those who are considered "nonoffenders" do actually have an average number of police contacts over the 20 years of 0.6. While this is a trivial amount, it is still a non-zero number, and means that the "nonoffenders" have a total of 334 contacts with the police. It must be remembered that the assignment of class membership was relative to each of the other classes. Because the offending level of those in the nonoffender class was not "fixed" to a 0 level a priori, those who had a very few number of contacts could have been classified as nonoffenders. This is different from the "nonoffenders" mentioned above in the discussion of the percentage of the sample which is nonoffender versus any other type of offender (e.g., 34.4% of the sample had *no recorded police contacts*, 65.6% had at least one recorded contact). In this case, the sample is broken down into "pure" nonoffenders versus offenders; those with *zero* contacts versus those with 1+ contacts. This is distinct from the

latent class of "nonoffenders" established by the semiparametric mixed Poisson regression models.

The results for the male subsample are similar to those for the total sample. Again, this is primarily because the offending patterns of the males in the sample dominate the trajectories due to their heterogeneity and higher levels of offending (relative to the females). Race appears to be important for the latent classes, with only a small minority of the nonoffenders being African-American (4.8%) compared to the sample-wide 9.4 percent of African-Americans. Conversely, the majority of the highest rate offenders are African-American (75.0%). A similar pattern also emerges for the neighborhood scale, with the nonoffenders living in neighborhoods of the highest socioeconomic status, down to the high-chronics living in neighborhoods of very low socioeconomic status.

Males account for the majority of the total police contacts (80.3%) and, among the males, the low-chronics account for the highest percentage (36.3%), the same pattern as was found in the total sample. The low-chronics have an average of 7.2 police contacts, for a total of 918. The adolescent-peaked offenders have an average of 17.4 contacts, for a total of 400, or about 15.8 percent of the total, the medium-chronic offenders

have an average of 25.3 police contacts for a total of 682 (27.0%), and the high-chronic offenders have an average of 70.3 contacts, for a total of 281, or 11.1 percent of the police contacts which can be attributed to the males.

A slightly different picture emerges for the female offenders in Table 4.2a. Race appears to remain important to the latent classes, with 18 percent of the chronic offenders being African-American, relative to 7.0 percent of the nonoffenders and 7.6 percent of the adolescent-peaked offenders. Neighborhood socioeconomic status also remains important, with the nonoffenders having an average neighborhood score of 13.0, down to the chronic offenders with an average score of 10.5. However, it should be noted that, among the female offenders, the difference between the neighborhood scores for the nonoffenders and the highest rate offenders is much less than among the sample as a whole or the male subsample. While the high-chronic offenders in the total sample have an average neighborhood score of 2.2 and the same offenders in the male subsample have an average score of 2.3, the chronic female offenders have a score of 10.5. Thus, neighborhoods do not appear to be as important for female offending as for male offending.

Among the females, the nonoffenders are truly that:

individuals who have *no police contacts* across the 20 years of data collection. In contrast, the adolescent-peaked offenders have an average of 1.6 police contacts, for a total of 186 (30.1% of the total female contacts). The chronic offenders have an average of 5.5 contacts from ages 6 to 25, for a total of 432 (69.9% of the total).

Tables 4.3a and 4.3b present additional characteristics of the latent offending classes: the actual and predicted police contact rates at age 10, the actual and predicted police contact rates at age 25, the actual and predicted maximum rates of police contacts, and the age at which those maximum rates were attained. Results for the sample as a whole, the male subsample, and the female subsample are presented.

Table 4.3a: Characteristics of Offending Classes in the Total, Male, and Female Subsamples (Actual Rates)

	Rate: Age 10	Rate: Age 25	Max. Rate	Age at Max. Rate
Total Sample (n=788)				
Nonoffenders	0.004	0.025	0.081	17
Adol.-Peaked	0.125	0.094	2.656	17
Low-Chronic	0.039	0.127	0.623	18
Med.-Chronic	0.310	0.586	2.897	21
High-Chronic	0.200	0.600	9.600	21

Table 4.3a continued...

Male Sample (n=391)				
Nonoffenders	0.010	0.033	0.158	17
Adol.-Peaked	0.174	0.087	3.043	17
Low-Chronic	0.047	0.156	0.875	18
Med.-Chronic	0.333	0.630	2.852	21
High-Chronic	0.250	0.750	9.000	18
Female Sample (n=397)				
Nonoffenders	0.000	0.000	0.000	N/A
Adol.-Peaked	0.008	0.000	0.331	16
Chronic	0.013	0.167	0.718	19

In looking at Tables 4.3a and 4.3b, it is seen that the model tends to slightly overestimate the rates of offending, especially at age 25. For example, the actual rate of offending/police contacts at age 25 for the medium-chronic offenders in the total sample is 0.586, while the predicted rate at age 25 is 1.462. The model also tends to slightly underestimate the maximum rate of offending that each group attains. Again, looking at the medium-chronic offenders in the total sample, the actual maximum rate is 2.897 at the age of 21, while the predicted maximum rate is 2.726 at the age of 20.

Table 4.3b: Characteristics of Offending Classes in the Total, Male, and Female Subsamples (Predicted Rates)

	Rate: Age 10	Rate: Age 25	Max. Rate	Age at Max. Rate
Total Sample (n=788)				
Nonoffenders	0.009	0.032	0.080	19
Adol.-Peaked	0.238	0.036	2.215	16
Low-Chronic	0.049	0.279	0.697	19
Med.-Chronic	0.164	1.462	2.726	20
High-Chronic	0.216	2.187	8.866	19
Male Sample (n=391)				
Nonoffenders	0.019	0.056	0.127	19
Adol.-Peaked	0.264	0.042	2.472	16
Low-Chronic	0.058	0.269	0.802	19
Med.-Chronic	0.166	1.151	2.673	20
High-Chronic	0.375	2.146	7.862	19
Female Sample (n=397)				
Nonoffenders	0.000	0.000	0.000	N/A
Adol.-Peaked	0.033	0.000	0.221	17
Chronic	0.005	0.333	0.706	21

Once the latent classes of offenders were established, the next step in the analyses plan was to utilize multinomial logit regression models to test the predictive power of the various social contexts on membership into the latent classes. Results from the multinomial logit models are presented in Chapter 5 and in Appendix A.

CHAPTER 5

RESULTS, II: MULTINOMIAL LOGIT ANALYSES

Establishing latent classes of offenders and generating statistics to describe the basic demographics of each of the classes points to what might be important in predicting category membership. But only through regression analyses can these relationships be estimated and tested simultaneously in a multivariate context. Both multinomial logit and logistic regression models were estimated using the rates of offending, by class, as the dependent variable. While the latent categories were established for the sample as a whole (5 classes) as well as for the male (5 classes) and female subsamples (3 classes), the multinomial logit analyses were conducted only on the sample as a whole, using sex as a control variable in all models. Results from the multinomial logit models will be discussed in the current chapter and in Appendix A, while highlights from the logistic regression will be given in Appendix B.

BASELINE AND NEIGHBORHOOD CONTEXT MODELS

As discussed in Chapter 3, analyses were conducted in a step-wise fashion: after establishing a baseline model, measures of neighborhood, family, and peer context were individually added to the model. The most basic model used latent class membership as the dependent variable, broken into 5 levels (coded 1-5) to represent the 5 latent offending classes. The omitted or comparison group was the nonoffenders, which was compared to the adolescent-peaked, low-chronic, medium-chronic, and high-chronic offenders. Explanatory variables in the baseline model included only race and sex.

The Baseline Model

Results from the baseline multinomial logit model are found in Table 5.1 and odds ratios are found in Table 5.1a. Based upon the chi-square (7.64 with 4 degrees of freedom, $p<0.1057$) and the pseudo-R^2 of the overall model (0.0096), this baseline model provides a relatively poor

fit. However both race and sex show highly statistically significant associations with latent class membership.[1]

The fit of the overall model is judged by a likelihood ratio goodness-of-fit test, where degrees of freedom are,

$$[(\text{number of populations}*J-1)-(\Sigma \text{ of DF for the parameters})], \quad (6)$$

where J is the number of categories of the dependent variable and the degrees of freedom for each *individual* parameter is J-1. For this test, probabilities closest to $p<1.0000$ are most significant. In addition, model fit is assessed with a pseudo-R^2 statistic. The pseudo-R^2 statistic is bounded by zero and one, with scores closer to one indicating a better fitting model. The statistic measures the reduction in error of prediction for a given model. The pseudo-R^2 is expressed as a transformation of the likelihood ratio chi-square of the model, such that:

$$\text{pseudo-}R^2 = 1 - \exp(-G^2/N) \quad (7)$$

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[1] $p<0.00001$

where G^2 is the likelihood ratio chi-square for the model and N is the sample size (Long 1997).

In the baseline model, race is very significant in predicting membership in all of the classes except for the high-chronic: African-Americans are 460 percent more likely to be low-chronic offenders (as opposed to nonoffenders), 260 percent more likely to be adolescent-peaked offenders, and 270 percent more likely to be medium-chronic offenders. Despite the fact that race is not significant in predicting membership in the high-chronic category, it must be noted that this class is comprised of only 5 people, which would add possible bias to any model predicting membership in this category.

Sex also is a highly significant predictor in the overall baseline model, but it is only significant in predicting membership in one individual latent class: the low-chronic ($p<0.04$). Females are 70 percent less likely to be low-chronic offenders than males.

Table 5.1: Multinomial Logit Estimates for the Baseline and Neighborhood Context Models

Model	χ^2	DF	Probability
Baseline			
Intercept	146.44	4	0.0000
Race	42.32	4	0.0000
Sex	110.39	4	0.0000
Likelihood Ratio	7.64	4	0.1057
Pseudo-R^2	0.0096		
Baseline + Total Serious Contacts			
Intercept	159.94	4	0.0000
Race	10.61	4	0.0313
Sex	5.03	4	0.2840
Serious Contacts	182.77	4	0.0000
Likelihood Ratio	225.47	500	1.0000[a]
Pseudo-R^2	0.2488		
Baseline + Neighborhood SES			
Intercept	47.84	4	0.0000
Race	24.50	4	0.0001
Sex	108.11	4	0.0000
Neighborhood SES	11.00	4	0.0265
Likelihood Ratio	215.37	300	0.9999
Pseudo-R^2	0.2391		
Baseline + Neighborhood SES and Police Patrol			
Intercept	40.81	4	0.0000
Race	26.49	4	0.0000
Sex	101.51	4	0.0000
Neighborhood SES	10.56	4	0.0335
Police Patrol	13.36	4	0.0097
Likelihood Ratio	447.74	848	1.0000[a]
Pseudo-R^2	0.4335		

[a]Probabilities of exactly 1.0000 are the result of rounding up by SAS, the statistical program used to estimate the models. The actual probabilities are greater than 0.9999 but less than 1.0000.

The decreased likelihood that females are chronic offenders is not surprising in light of Hypothesis 3, which stated that there would be no chronic offenders among the females in the sample (hence all female offenders would fall in the adolescent-peaked category). However, Hypothesis 3 is not fully supported: while females are less likely than males to be chronic offenders, there is still a chronic offender class present among the females in the sample.

The next step in the analytical plan was to add variables to the model one-by-one or in clusters based on specific social contexts or domains (e.g., neighborhood, family, or peers). Each one of the variable clusters was added to test the hypotheses established in Chapter 2. By adding the variables in sequence, the extent to which each of the variables mediated and/or strengthened the effects of the core demographic variables (race and sex) on the latent classes was tested, as well as the independent effects of the social contexts themselves. In addition to testing for the effects of the social context variables and whether they suppress and/or strengthen the relationship of race and sex to the latent classes, the addition of the social context variables could actually change the nature of the relationship (e.g., from positive

to negative, or vice-versa) between the demographic variables and latent class membership.

The Baseline Model Plus Total Serious Contacts

To begin the model-building process, the measure of total serious contacts with the police was added to the baseline model containing race and sex. However, a modification had to be made when using this measure. When the omitted or comparison category was the nonoffender category, using "serious contacts" was problematic because none of the nonoffenders had any serious contacts. This skewed the results of the multinomial logit analyses. To correct for this, when using the measure of total serious contacts, the comparison category was the low-chronic offender class. This was the largest class other than the nonoffenders (n=518 nonoffenders, n=204 low-chronic offenders) and they did have a range of scores on the seriousness scale, unlike the nonoffenders who all scored zero on the scale.

Table 5.1a: Odds Ratios and Probabilities for the Baseline and Neighborhood Context Models

Latent Class	Adol.-Peaked		Low-Chronic		Medium-Chronic		High-Chronic	
Model	**Odds**	**Prob**	**Odds**	**Prob**	**Odds**	**Prob**	**Odds**	**Prob**
Baseline								
Intercept	30.5	0.000	59.2	0.000	2.6	0.061	2.8	0.048
Race	2.6	0.007	4.6	0.000	2.7	0.016	0.4	0.495
Sex	(0.3)[a]	0.526	(0.7)	0.038	0.1	0.865	0.7	0.409
Baseline + Contacts[b]								
Intercept	**	0.016	**	0.183	**	0.051	**	0.145
Race	0.3	0.953	3.3	0.746	1.6	0.831	8.2	0.625
Sex	(0.5)	0.871	0.2	0.962	(0.3)	0.929	(0.3)	0.948
Contacts	(0.6)	0.000	(0.1)	0.149	(0.2)	0.001	(0.1)	0.071
Baseline + SES								
Intercept	1.9	0.256	3.1	0.135	(0.6)	0.321	(0.6)	0.401
Race	0.6	0.379	1.2	0.118	0.7	0.363	(0.4)	0.422
Sex	(0.2)	0.669	(1.9)	0.064	0.3	0.724	1.0	0.324
SES	0.8	0.636	0.8	0.050	0.7	0.071	0.7	0.075
Baseline + SES/Police								
Intercept	69.4	0.038	108	0.022	3.4	0.485	17.1	0.170
Race	0.1	0.875	0.6	0.430	0.3	0.650	(0.6)	0.136
Sex	0.6	0.497	(0.3)	0.586	1.3	0.233	3.5	0.047
SES	0.7	0.100	0.7	0.081	0.7	0.108	0.6	0.122
Police	(0.8)	0.034	(0.8)	0.026	(0.9)	0.134	(0.9)	0.009

[a]Odds ratios in parentheses are (1 - exponentiated coefficient) and represent the "% less than." All other odds ratios are (exponentiated coefficient - 1) and represent the "% greater than."
[b]In the model with total serious contacts, the omitted or comparison group is the low-chronic as opposed to the nonoffenders. Because of this, results for the nonoffenders for this model are presented in the columns labeled "low-chronic."
**Indicates that the odds ratio was > 10,000.

Adding the measure of total serious contacts the individual had with police to the model (with the modified comparison category) improves the fit of the overall baseline model greatly. The likelihood ratio chi-square of the model is 225.47 with 500 degrees of freedom,

relative to the likelihood ratio chi-square of 7.64 with 4 degrees of freedom in the baseline (demographic variables only) model. The pseudo-R^2 of the model improves in fit from 0.0096 with the baseline model to 0.2488 with the addition of serious police contacts. Subsequent examinations of the correlation between the dependent and explanatory variables revealed that this was most likely due to the high-level correlation between latent class and the seriousness score (0.81). Adding the seriousness score to the model renders sex insignificant in the overall model, while race remains marginally significant ($p<0.04$) and the seriousness scale is highly significant ($p<0.00001$). These results are presented in Table 5.1.

The seriousness score is significant in predicting membership in two of the individual latent classes. A one-unit increase in the seriousness score[2] makes an individual 63 percent more likely to be an adolescent-peaked offender (relative to a low-chronic offender) and 23 percent more likely to be a medium-chronic offender. Because of the extremely high correlation between the dependent and explanatory variables as well as the problem

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[2] The seriousness scale ranged from 0-245, with a mean of 9.373 and a standard deviation of 21.063.

with using the nonoffenders as the comparison category, serious total contacts were left out of subsequent models.

The Baseline Model Plus Neighborhood Social Disorganization

In building upon the baseline model containing race and sex, the neighborhood social disorganization score was the next variable added, with results presented in Table 5.1. Based upon the chi-square for the individual model (215.37 with 300 degrees of freedom), it is a good fit, with race and sex both highly significant ($p<0.0001$ and $p<0.00001$), and neighborhood moderately significant ($p<0.03$). The pseudo-R^2 of the model (0.2391) is a large improvement over the pseudo-R^2 of the baseline model (0.0096), but is less than the pseudo-R^2 of the model with police contacts included (0.2488).

In this model, the neighborhood score is significant in predicting membership only in the low-chronic category of offenders ($p<0.05$). However, the relationship is in the direction counter to the one hypothesized. Each one-unit increase or improvement in the socioeconomic status of the neighborhood makes an individual 80 percent more likely to be a low-chronic offender. While neighborhood is not significant in predicting membership in any of the

other latent classes at the $p<0.05$ level, the relationships are all in the same direction, running counter to the hypothesized relationship (Hypothesis 4a).

Sex was not significant in predicting membership into any of the latent classes at the $p<0.05$ level, though it approached significance for the low-chronic offenders ($p<0.06$). Females are 190 percent less likely to be low-chronic offenders. This also offers indirect support to Hypotheses 3. Because it was hypothesized that all female offenders would be adolescent-peaked rather than chronic, it would also be expected that males would be much more likely to be chronic offenders than females. Of particular interest is that race is not significant in predicting any group membership when neighborhood is added to the model. The effect of race is rendered insignificant when neighborhood social disorganization is included, despite the unexpected direction of the relationship between using neighborhood and the latent classes.

The Baseline Model Plus Neighborhood Social Disorganization and Police Patrol

The full neighborhood model was completed with the addition of the formal measure of social control: level of

police patrol of the neighborhood. The measure of police patrol of the neighborhood is a proxy for the aggressiveness of the patrolling in any given area, yet its meaning is open for interpretation in different ways. For example, a high score on police patrol may reflect that: (a) the area is known as a high-crime area, so it is given more attention by the police, or (b) the individual's *perception* of police patrol is high, whether or not it is true in reality. It is logical that the latter would be more likely to be true for someone who is a frequent offender and, therefore, more aware of police behavior. Increased patrolling of an area which results in increased police contacts for individuals may not be a reflection of actual individual behavior (relative to an individual living in an area of lower-levels of police patrol), but only of policing activities.

Results from the final neighborhood context model, including police patrol, are presented in Table 5.1. The chi-square of the overall model, which includes race, sex, neighborhood SES, and police patrol, is 447.74 with 848 degrees of freedom. The pseudo-R^2 for the model is 0.4335, which is the largest of all models thus far. All four explanatory variables are significant, ranging from $p<0.00001$ for race and sex, to $p<0.01$ for level of patrol,

and $p<0.03$ for neighborhood social context. Interestingly, the level of police patrol is more significant than either race or sex in predicting membership in individual offender categories.

Race is not significant in predicting membership in any of the individual offending classes. Sex is significant in predicting membership only in the high-chronic class, but is completely opposite the hypothesized direction. Females are 350 percent more likely to be high-chronic offenders than males when race, neighborhood score, and patrol level are included in the model. However, it is only marginally significant ($p<0.05$) and the small sample of high-chronic offenders (n=5, with 1 female) offers a reasonable explanation for this unexpected finding. The extremely small sample size makes the estimates of regression analyses with the high-chronic class as the dependent variable highly unstable.

Neighborhood is not significant in predicting membership in any of the latent classes at the $p<0.05$ level. Nevertheless, it is interesting to note that neighborhood is related to latent class in the opposite direction than hypothesized for all four latent classes, relative to the nonoffenders. Patrol level is significant in predicting membership in three of the offender classes:

the low-chronic, adolescent-peaked, and high-chronic. A one unit increase in the level of police patrol of the neighborhood makes an individual 82 percent less likely to be a low-chronic offender (than a nonoffender), 80 percent less likely to be an adolescent-peaked offender, and 88 percent less likely to be a high-chronic offender than a nonoffender. These results offer support to Hypothesis 4b: living in an area with an increased level of police patrol (providing formal social control) makes an individual less likely to be a higher-rate or more chronic offender. Police patrol appears to act as a deterrent, making an individual more likely to be a nonoffender than an offender.

The Baseline Model Plus Family Support and Structure

After measuring the predictive abilities of the neighborhood context variables, the next models included the measures of family support and structure. The family model included the following explanatory variables: race, sex, family stability, number of children in the family, head of the household's employment status throughout the respondent's childhood, head of the household's occupational prestige, the presence of a supervising adult when the respondent came home from school, and mother's

employment status through the respondent's childhood and adolescence(ages 6-17).

Results from the family support and structure model are presented in Table 5.2 with odds ratios presented in Table 5.2a. As with the baseline and neighborhood models, the chi-square is highly significant at 684.22 with 1460 degrees of freedom. The pseudo-R^2 for the model is also an improvement over the best fitting of the previous models (which included race, sex, neighborhood SES, and level of police patrol). The pseudo-R^2 for the family support and structure model is 0.5803.

Race and sex are both significant predictors in the overall model ($p<0.00001$). The dichotomous measure of family stability is also highly significant ($p<0.0001$) as is the number of children in the family ($p<0.003$), offering support for Hypothesis 5a and Hypothesis 5b. The employment status of both the head of the household and the respondent's mother, as well the occupational prestige of the head of the household and the presence of an adult at home when the respondent came home from school are not

Table 5.2: Multinomial Logit Estimates for the Family Support and Structure Model

Model	χ^2	DF	Probability
Baseline + Family			
Intercept	61.07	4	0.0000
Race	26.75	4	0.0000
Sex	113.26	4	0.0000
Family Stability	23.74	4	0.0001
Number of Kids	16.01	4	0.0030
HOH's Emp. Status[a]	3.40	4	0.4933
HOH's Occup. Status	4.90	4	0.2981
Adult Home	5.62	4	0.2293
Mother's Employment	4.13	4	0.3886
Likelihood Ratio	684.22	1460	1.0000[b]
Pseudo-R^2	0.5803		

[a]HOH = Head of Household
[b]Probabilities of exactly 1.0000 are the result of rounding up by SAS, the statistical program used to estimate the models. The actual probabilities are greater than 0.9999 but less than 1.0000.

significant, counter to the relationships asserted in Hypotheses 5c-5f.

When looking at the individual latent classes, race is significant in predicting membership only in the medium-chronic category. African-Americans are 260 percent more likely to be medium-chronic offenders than they are to be nonoffenders, relative to non-blacks. Race approaches significance for the low-chronic offenders ($p<0.07$), with African-Americans being 180 percent more

likely to be low-chronic offenders. Sex is not a significant predictor of class membership for any of the latent classes.

Table 5.2a: Odds Ratios and Probabilities for the Family Support and Structure Model

Latent Class	Adol.-Peaked		Low-Chronic		Medium-Chronic		High-Chronic	
Variable	Odds	Prob	Odds	Prob	Odds	Prob	Odds	Prob
Intercept	14.3	0.144	35.9	0.052	(0.7)[a]	0.531	(0.9)	0.298
Race	1.1	0.190	1.8	0.070	2.6	0.053	(0.3)	0.629
Sex	(0.1)	0.801	(0.6)	0.089	0.5	0.556	1.5	0.202
Stability	(0.7)	0.059	(0.8)	0.020	(0.5)	0.304	(0.9)	0.003
# of Kids	0.5	0.153	0.4	0.237	0.7	0.071	0.8	0.045
HOH's Emp.	(0.6)	0.183	(0.5)	0.207	(0.7)	0.088	(0.7)	0.153
HOH's Occup.	(0.3)	0.239	(0.3)	0.231	(0.2)	0.537	(0.2)	0.514
Adult Home	1.3	0.239	1.4	0.203	2.5	0.086	2.6	0.095
Mother Emp.	0.1	0.916	0.2	0.797	(0.2)	0.705	0.2	0.844

[a]Odds ratios in parentheses are (1 - exponentiated coefficient) and represent the "% less than." All other odds ratios are (exponentiated coefficient - 1) and represent the "% greater than."

Family stability has the most influence in predicting membership in the latent offender classes; it is significant for the low-chronic and high-chronic offenders and approaches significance for the adolescent-peaked offenders ($p<0.06$). Individuals who came from stable families are 80 percent less likely to be low-chronic offenders than nonoffenders. A stable family also makes an individual 73 percent less likely to be an adolescent-

peaked offender (note the significance level) and 91 percent less likely to be a high-chronic offender, offering support for Hypothesis 5a.

The number of children in the family, including the respondent, also predicts membership in various classes. The number of children in the family has an impact only on the most serious of offenders. With each additional child in his/her family, an individual is 80 percent more likely to be a high-chronic offender, offering support for Hypothesis 5b. The number of children also approaches significance for the medium-chronic offenders ($p<0.07$), with each additional child in the family making an individual 70 percent more likely to be a medium-chronic offender. The employment status of the mother or stepmother, the employment status and occupational status of the head of the household, and the presence of an adult when the child arrived home from school are not significant in predicting membership in any of the latent categories.

The Baseline Model Plus Peers and School

The final social context model measured the impact of peers and school on membership in the latent classes of offenders. Variables included in this model were: race,

sex, feelings about high school, whether the individual was a high school dropout, a scale of friends' overall involvement with multiple facets of the police and/or juvenile justice system, and a dichotomous measure of whether any of the individual's 2-3 closest friends were involved with the police.

Multinomial logit estimates from the peers and school model are found in Table 5.3 and odds ratios in Table 5.3a. The pseudo-R^2 of the peer context model (0.4020) is an improvement over the baseline model, but is not as large as the pseudo-R^2 for the family support and structure model (0.5803). The likelihood ratio goodness-of-fit statistic of 405.16 with 572 degrees of freedom also indicates that the peer model has a good fit to the data.

In the total peer context model, each of the variables is significant, ranging from the most significant, race and sex ($p<0.00001$), to the least significant, scale of friend's delinquent involvement ($p<0.05$). Only race and the scale of friends' juvenile delinquent behavior (marginally) are significant in predicting membership in any of the latent classes, which means that there is no support for Hypotheses 6a, 6b, or 6d at the latent class level. African-Americans are 530

percent more likely to be low-chronic offenders than they are to be nonoffenders, relative to whites. They are also 290 percent more likely to be adolescent-peaked offenders and 280 percent more likely to be medium-chronic offenders.

Table 5.3: Multinomial Logit Estimates for the Peers and School Model

Model	χ^2	DF	Probability
Baseline + Peer/School			
Intercept	57.96	4	0.0000
Race	40.23	4	0.0000
Sex	68.92	4	0.0000
Feelings about HS	14.89	4	0.0049
High School Dropout	13.10	4	0.0108
Peers' Del. (scale)	9.84	4	0.0432
Peers' Del. (dich.)	19.48	4	0.0006
Likelihood Ratio	405.16	572	1.0000[a]
Pseudo-R^2	0.4020		

[a]Probabilities of exactly 1.0000 are the result of rounding up by SAS, the statistical program used to estimate the models. The actual probabilities are greater than 0.9999 but less than 1.0000.

The scale of peers' involvement with the police and/or the juvenile justice system is only slightly significant ($p<0.06$) in predicting category membership. Contrary to Hypothesis 6c, a one-unit increase in friends' involvement with the police or juvenile justice system

makes an individual 10 percent *less* likely to be a low-chronic offender. Sex, school dropout, and the dichotomous measure of peers' contacts with the police are not significant in predicting membership into any of the latent classes.

Table 5.3a: Odds Ratios and Probabilities for the Peers and School Model

Latent Class	Adol.-Peaked		Low-Chronic		Medium-Chronic		High-Chronic	
Variable	Odds	Prob	Odds	Prob	Odds	Prob	Odds	Prob
Intercept	211	0.000	374	0.000	10.0	0.115	30.0	0.022
Race	2.9	0.009	5.3	0.001	2.8	0.022	0.4	0.541
Sex	(0.2)[a]	0.739	(0.6)	0.147	0.1	0.939	1.0	0.335
HS Feelings	(0.1)	0.270	(0.4)	0.094	(0.1)	0.600	(0.3)	0.247
Dropout	0.1	0.893	0.9	0.323	1.0	0.979	(0.1)	0.850
Peers' Del. (scale)	(0.1)	0.101	(0.1)	0.055	0.0	0.423	(0.1)	0.137
Peers' Del. (dich.)	0.1	0.890	0.6	0.584	(0.3)	0.679	(0.3)	0.680

[a]Odds ratios in parentheses are (1 - exponentiated coefficient) and represent the "% less than." All other odds ratios are (exponentiated coefficient - 1) and represent the "% greater than."

In order to test the simultaneous effects of the demographic variables (race and sex) and the three social contexts (neighborhood, family, and peers) on latent offending classes, cumulative or comprehensive models were estimated. The results of these analyses provided highly

unstable estimates, most likely due to the collinearity between the explanatory variables as well as the small sample sizes of the higher-rate offender classes (e.g., the medium- and high-chronic offenders). Estimates generated from cumulative models which included the most significant predictors from each of the individual social context models (tested both with and without the measure of police patrol) provided very contradictory findings and, hence, are not discussed in this chapter. Results from these models can be found in Appendix A, with results from pair-wise logistic regression found in Appendix B.

Chapter 6 will provide an overview of the findings in Chapter 4 and Chapter 5 and discuss their significance relative to the hypotheses outlined in Chapter 2. In addition, suggestions will be made for future research in the area of criminal careers, social disorganization, and social control.

CHAPTER 6

CONCLUSION

The over-arching purpose of this project is to bring together the study of offending at the micro- and the macro-levels. The study examined the influence of neighborhood social conditions, family support and structure, and peer and school associations on longitudinal trajectories of delinquent/criminal offending. Specifically, behavioral trajectories were established for multiple latent classes of offenders based upon the similarity of individuals' offending rates over time. Then analyses testing the predictive power of social context in determining membership in the multiple latent classes were conducted. Baseline models containing only demographic variables (race and sex) as covariates were built upon with the addition of clusters of social context variables. This methodological strategy was chosen for two reasons: 1) to test how social context mediates the relationship between race, sex, and category membership, and 2) to test for the direct effects of social context on category membership.

To conduct these analyses, a sample was drawn from two birth cohorts from the city of Racine, Wisconsin in the years 1942 and 1949. A total of 788 individuals, split evenly between males and females, were included in the sample. Each sample member had lived in the city of Racine, Wisconsin at least through his or her eighteenth birthday and was considered to be in "continuous residence" within the city limits. Longitudinal offending data were in the form of contacts with a member/members of the Racine Police Department. Contacts were measured for ages 6 to 25. These data were paired with detailed interview information for each of the sample members taken from in-person interviews conducted in 1976. In addition, each sample member was located in a neighborhood--or in multiple neighborhoods if he or she moved within the city of Racine before his or her eighteenth birthday--and the socioeconomic characteristics of the neighborhood were measured. The researchers who collected the original data (Shannon 1988; 1991) defined neighborhoods as collections of city blocks and used information from the US Census of Housing to create indexes measuring neighborhood context.

The analytical methods utilized for the two steps of the project included semiparametric mixed Poisson regression models, also known as Poisson latent class

analyses, and multinomial logit regression models. The first allowed for the sorting of individuals into latent classes based on the similarity of their offending trajectories. In addition, it allowed for these trajectories to be graphically represented and descriptive characteristics for each of the latent classes to be generated. Multinomial logit models were utilized to test the predictive power of the social context variables and the relationship between the demographic variables and the latent offender classes.

The primary contribution of this project is that it brings together levels of study on offending which are often conducted independently: individual-level characteristics, families and peer groups, and communities. In addition, longitudinal data were used, whereas much of the previous research on contextual effects and offending has used cross-sectional data. The data set used consisted of males as well as females, which is relatively rare for longitudinal data with the depth of individual-level information that is included in the 1942 and 1949 Racine Birth Cohort Studies. This research offers support to much of the previous research on the impact of social context on offending behavior, but also produces some contradictory results. These findings will

be discussed in relation to the hypotheses outlined in Chapter 2.

REVIEW OF THE FINDINGS

The Presence of Latent Offender Classes

Previous research on latent classes of offenders in various sample populations suggests the existence of at least three types of offenders: nonoffenders, or those with no detected offenses, chronic offenders, and adolescence-peaked (or adolescence-limited) offenders. Research by Nagin and Land (1993) and D'Unger et al. (1998) suggest that between four and five latent classes best capture longitudinal offending patterns among many different male samples. Further research by D'Unger et al. (forthcoming) suggests that there is less heterogeneity among female offenders and that three classes best capture their offending behavior.

In looking at the breakdown of the offender classes, the findings of five total categories (total sample n=788), five male categories (male sample n=391), and three female categories (female sample n=397) are

consistent with previous analyses. However, there is mixed support for Hypotheses 7, 8, and 9. Across the total sample and male- and female-only samples, nonoffenders are the most prevalent of all of the offender types. This offers full support for Hypothesis 7. It is interesting to note, however, that the class of "nonoffenders" are not always that: in the total sample, members of the nonoffender class (n=518) have an average of 0.6 offenses across the 20 years of data collection. For the male-only sample, this doubles to 1.2 offenses across all the years. While these mean numbers are very small, nonoffenders nonetheless have 334, or 10.6 percent, of the total police contacts for the cohort. These numbers may be a reflection of the heightened level of police patrol in the close-knit town of Racine--even those who are not considered to be "trouble-makers" do have some contacts with the police.

Contrary to Hypothesis 8, the adolescent-peaked offenders are not the most prevalent of the offender groups in the overall sample. There are 32 adolescent-peaked offenders in the total sample as compared to 204 low-chronic offenders and 34 medium- or high-chronic offenders. The adolescent-peaked offenders also account for close to 16 percent of the total police contacts,

relative to 38.8 percent for the low-chronic class and 34.8 percent for the medium- and high-chronic classes combined. The higher prevalence of the low-chronic class as compared to the adolescent-peaked class runs counter to the findings of West and Farrington (1973; 1977) and Wolfgang, Figlio, and Sellin (1972).

Rather than the existence of a very small class of high-chronic offenders who commit the majority of crimes, there exists two problematic groups in the 1942 and 1949 Racine Birth Cohorts. While the medium- and high-chronic offenders have a very high mean number of contacts across the years of data collection (25.2 and 71.8, respectively), there are only 34 of them in the total sample. It is the sheer number of low-chronic offenders (n=204) which makes them a "burden" to police despite their relatively low mean number of police contacts (6.0). The low-chronic offenders account for almost 40 percent of all the police contacts for the sample, which is similar to the percentage of offenses attributed to the highest-rate offenders by previous researchers (West and Farrington 1973; 1977; Wolfgang, Figlio, and Sellin 1972).

For males only, the pattern is largely the same. A large group of low-chronic offenders (n=128) with an average of 7.2 police contacts and a small group (n=31) of

medium- and high-chronic offenders with 25.3 and 70.3 mean police contacts, respectively, account for 74.7 percent of the total police contacts. For the females, the pattern is more in-line with findings from previous research. While there are only 78 chronic offenders in the female subsample, they account for almost 70 percent of all the female contacts with a mean of 5.5 contacts across all ages. The female adolescent-peaked offenders account for the rest of the contacts. The hypothesized prevalence of adolescent-peaked and chronic offenders is, therefore, supported for the females, but not for the males.

Sex and Race as Predictors of Class Membership

While the hypothesized higher level of heterogeneity among the males does exist, in support of Hypothesis 1, the findings run counter to previous research on female offenders which suggests the absence of a chronic-patterned latent class. D'Unger et al. detect three classes of offenders among their sample of Second Philadelphia Cohort (born in 1958) females (1998), two of which are adolescent-peaked classes (bifurcated into higher- and lower-rate groups) and a class of nonoffenders. In the current research, there is detected a class of nonoffenders, adolescent-peaked offenders, and

chronic offenders among the females, running counter to Hypothesis 3. It must be noted, however, that the shape of the chronic offender trajectory among the females approaches zero at the end of data collection at age 25, though it looks quite distinct from the earlier-peaking adolescent-peaked category. Only with additional years of data collection could the actually "chronicity" of the females in the sample be established.

Support for Hypothesis 2 is found among the total sample as well as the sex-specific subsamples. Across all ages, the males offend at higher rates than the females. The highest-rate male offenders have contacts with the police at a rate approximately ten times that of the female offenders. Even the lowest-rate male offenders (the low-chronics) offend at a peak rate higher than any of the females. While the finding of multiple classes of offenders clearly contradicts Gottfredson and Hirschi's (1990) assertion that there is a singular age-crime curve, it does support their theory that men are, "always and everywhere more likely than women to commit criminal acts" (Gottfredson and Hirschi 1990 p. 145). This is at least the case among this sample of individuals.

There is also support for the race component of Hypothesis 2. While African-Americans make up 6.4 percent

of the nonoffenders, they make up 41.4 percent of the medium-chronic offenders and 60 percent of the high-chronic offenders. Among the male- and female-only subsamples, the same pattern is exhibited. African-Americans make up 4.8 percent of the nonoffenders among the males and 7.0 percent of the nonoffenders among the females, while comprising 75 percent of the high-chronic offenders among the males and 18 percent of the chronic offenders among the females.

When looking at the results from the multinomial logit analyses, sex and race are clearly important in determining latent class membership, offering further support for Hypothesis 2. In the baseline model, being African-American is a significant predictor of membership into three of the latent offender classes relative to the comparison category of the nonoffenders. The result is strongest for the low-chronic offenders: African-Americans are 460 percent more likely than whites to be low-chronic offenders. Conversely, females are 70 percent less likely than males to be low-chronic offenders. When neighborhood SES and serious police contacts are added to the baseline multinomial logit models, race and sex become almost

statistically insignificant in determining latent class membership.[1] The significance level of sex is greatly reduced in the family and peer models, while the significance of race is reduced in the family context model but stays stronger or higher in the peer context model. While females are 60 percent less likely to be low-chronic offenders in the family support and structure model ($p<0.09$), sex is not a significant predictor of membership in any of the classes in the peers and school model. African-Americans are 180 percent more likely to be low-chronic offenders in the family model and 530 percent more likely to be low-chronic offenders in the peers and school model. They are also 260 percent and 280 percent more likely to be medium-chronic offenders in the two models, respectively. In addition, they are 290 percent more likely to be adolescent-peaked offenders as compared to nonoffenders, relative to the non-blacks, in the peers and school model.

These results suggest that, while the direct effects of race and sex are quite strong in predicting membership in latent offending classes, these effects are mediated by

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[1] Race is insignificant in all of the models, while sex is marginally significant ($p<0.06$) in predicting membership in the low-chronic

the addition of various social contexts to the models. In particular, the sex of the individual becomes a less important predictor when factors such as family stability and peers' delinquency are included in the models. Interestingly, race is low in statistical significance in predicting class membership in the family model, but remains a very significant predictor in the peers and school model. This would suggest that a large part of the effect of race can be attributed to factors such as family stability and the number of children in the family, as opposed to a direct race effect. However, race and peers' delinquency are independent of each other, with race being the more significant predictor of latent class membership.

The Effect of Neighborhoods and Police Patrol

The significance of neighborhood SES/social disorganization is seen in looking at the results from the latent class analyses and subsequent sorting of individuals in each of the offender classes. For the sample as a whole, the mean neighborhood score (on a 1-26 scale, with 1 being the area of lowest SES) is 11.9. For the nonoffenders in the sample, the mean score is slightly

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class in the model including SES and in the low-chronic class in the

higher: 12.6. All of the offender classes have scores both below that of the nonoffenders and that of the sample as a whole. Adolescent-peaked offenders have a mean neighborhood score of 10.6, only slightly below average, while low-chronic offenders have a mean neighborhood score of 11.0. The decrease in neighborhood scores is most pronounced with the medium- and high-chronics. The medium-chronic class has a mean neighborhood score of 8.4, while the high-chronic class has a mean neighborhood score of only 2.2, indicating that they are being drawn from some of the very worst of Racine's neighborhoods. The pattern is very similar for the male-only sample, with nonoffenders having the highest SES score (12.3) and high-chronic offenders having the lowest score (2.3). Interestingly, the neighborhood effect does not seem to be present among the females. While the nonoffenders have a mean neighborhood score of 13, slightly higher than their male counterparts, the chronic offenders have a mean score of 10.5. This is a significantly higher score than the medium- or high-chronic offenders, and only slightly less than the score of the low-chronic offenders. It appears that the effect of neighborhood context is stronger among

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model including SES and police patrol ($p<0.08$).

the males (and hence, in the overall sample where the male patterns are dominant) than it is among the females. It could be hypothesized that this reflects the gendered nature of children's play, particularly in the 1950s and 1960s. While boys often spent more time outside (in the neighborhood) engaged in play activity, girls' play was more frequently inside, hence their offending behavior was less influenced by neighborhood context.

The significance of neighborhood social context appears different in the results from the multinomial logit models. While neighborhood is marginally significant in predicting membership in three of the latent classes in the baseline plus neighborhood SES model, the effect is in the opposite direction to that hypothesized in Hypothesis 4a. Odds ratios suggest that living in an area of higher SES makes an individual more likely to be a low-, medium-, or high-chronic offender. One possible explanation for this could be the association with the level of police patrol in such neighborhoods. It could be that the adults residing in more well-off neighborhoods have a positive working relationship with the police who, in turn, keep a close watch over such neighborhoods. To test this theory, the correlation between neighborhood SES and police patrol was measured,

but there was no evidence for such a relationship. In fact, there exists a very weak negative relationship between SES and police patrol, suggesting that patrol-level is not strongly related to the SES of a given neighborhood and that neighborhoods of higher SES have lower levels of patrol. Another possibility is the opportunity for offending which exists in areas with a higher level of SES. Neighborhoods of low SES present little opportunity for the commission of property crimes because of a lack of desirable goods to steal. In a higher-SES neighborhood, the presence of more desirable property (e.g., automobiles) may increase rates of property offending.

Another possible explanation for the relationship between neighborhood SES and offender class is the quality of the neighborhood SES construct. The Census data available for 1950 and 1960 are very limited and the measure may provide only a weak proxy for neighborhood social disorganization. The differences between concentric zones in the city, as outlined in Chapter 2, may be less pronounced than in a larger, more urbanized city, hence the neighborhood effect would be weaker.

Results from the multinomial logit models suggest that the level of police patrol in a neighborhood acts as

a deterrent to offending, with an increased level of patrol making an individual less likely to be an adolescent-peaked, low-chronic, or high-chronic offender. This offers support for Hypothesis 4b that formal social control is important in predicting category membership. However, contrary to Hypothesis 4b, the effect is not markedly stronger for the chronic offenders than for the adolescent-peaked offenders. The level of police patrol acts as a deterrent to all offenders. This is a plausible explanation given that the level of police patrol is measured through the respondent's *perceptions* of police patrol, which is more likely to make patrol level act as a deterrent to the individual's behavior.

Given the nature of the city of Racine and its small-town police department, the level of police patrol may be acting less as an agent of formal social control and more as an agent of informal social control. Considering the size of the city and the aggressiveness with which the Racine police patrolled, it can be hypothesized that the police and offenders knew each other well and possibly interacted in multiple social domains, other than just in the roles of police officer/suspected criminal. This could make the nature of the relationship more familial and less authoritarian than the relationship between the

police and the residents of a city such as New York, NY or Washington, DC. Perceptions of police patrol may also be a factor in this relationship. The perception of getting caught and/or punished is a large part of the effectiveness of deterrence strategies. Those individuals who perceive higher-levels of police patrol in their neighborhoods, whether real or not, may be more likely to refrain from offending. For them, deterrence may be more successful than for those who perceive the risk of getting caught/punished to be minimal.

Families and Peers as Predictors of Class Membership

There is mixed support for the influence that families, peers, and school have on trajectories of offending over time. Family stability--living in a two-parent family from ages 6 through 17--is the strongest predictor of latent class membership in either the family or peer model. An individual living in a stable family is 73 percent less likely to be an adolescent-peaked offender, 80 percent less likely to be a low-chronic offender, and 91 percent less likely to be a high-chronic offender. While family stability is not significant for the medium-chronic offenders, the relationship is in the same direction as for the other three classes. These

findings offer support for Hypothesis 5a: living in a stable family makes an individual less likely to be a chronic offender. Contrary to Hypothesis 5a, however, family stability also acts as a buffer against adolescent-peaked offending.

The number of children in a family is also predictive of latent class membership, but only for the most chronic of offenders. For each additional child in an individual's family, he or she is approximately 70 percent more likely to be a medium-chronic offender and approximately 80 percent more likely to be a high-chronic offender. While this variable can only act as a proxy for the level of supervision and guardianship that parents are able to provide for their children, it does suggest that the presence of more children makes it "easier" for an individual to be a higher-rate offender. For the adolescent-peaked and the low-chronic offenders, the number of children in the family is insignificant.

The results do not offer any support for Hypotheses 5c - 5f. Consistent employment of the head of the household in the individual's childhood home is not a predictor of membership in any of the latent classes, though it approaches significance ($p<0.09$) in the expected direction for the medium-chronic offenders (those living

in a family where the head of the household was consistently employed are less likely to be offenders). The scale of the head of the household's occupational prestige also is not significant in predicting membership in any of the latent classes. This could be a by-product of the sample, given that 80 percent of the head of households were blue-collar workers. The presence of an adult home after school is only marginally related to membership in two of the latent offender classes, but in an unexpected direction. The presence of an adult home after school makes an individual 250 percent more likely to be a medium-chronic offender and 260 percent more likely to be a high-chronic offender, though the probabilities of these are $p<0.09$ and $p<0.1$, respectively. Given the small number of medium- and high-chronic offenders, this anomalous finding may be an artifact of sample size. There is another possible explanation for this finding. Having an adult present in the home, such as a mother, grandmother, or older sibling, might be an impetus for a child to play outside in the neighborhood rather than at home under the watchful eye of an elder. In doing so, one is more at risk of coming into contact with a police officer than if play were confined to the home. This was suggested earlier with regards to gendered

differences in offending, and may apply to the presence of an adult in the home after school as well. Finally, mother's employment is not predictive of membership in any of the latent classes.

In the model estimating the effects of peers and school on latent class membership, race is the most significant predictor, as discussed in the above section. However, the scale of peers' delinquent involvement is also a significant predictor of membership in the low-chronic class, which is the largest of the offender classes, though it is in the opposite direction from that hypothesized in Hypothesis 6c. Individuals who reported having peers with higher levels of involvement with the police and juvenile justice system are less likely to be low-chronic offenders themselves. While this is contrary to the social learning perspective, it would support the deterrence effects found for the level of police patrol--seeing one's friends get in trouble with the law acts as a deterrent to the individual. In addition, parents might act as a deterrent. If parents are aware that their children are associating with delinquent peers, then the parents may prohibit their children from further associations with these peers. There is no evidence to support Hypothesis 6a, 6b, or 6d. Feelings of

(un)attachment to high school as well actually dropping out of school do not predict membership in any of the latent classes, which suggests that school attachments do not factor into the decision to offend.

Overall, these analyses point to the importance of some social contexts on offending behavior. Though not strongly significant themselves, neighborhoods, families, and peers mediate the relationship between race and sex and membership in the various latent classes. While race and sex have a small direct effect, it appears that what is most significant in these analyses is the buffering effect of family stability. Not only does living in a stable family act to prohibit chronic offending patterns, it also works to prevent adolescent-peaked offending. This is interesting in light of Moffitt's (1993) hypothesis on the origin of adolescent-peaked offending. Moffitt suggests that such behavior is merely a social mimicry of the behavior of true chronic offenders, perhaps less tied to the influence of social factors and more to the gap between social and biological maturity. However, this research suggests that families/parents do have an influence over their children's behavior, whether through "true" offending or mere social mimicry.

Another of the findings to consider is the proportion of individuals falling in the low-chronic offender class. This group of individuals is the largest of the offender groups. As a group, they maintain a fairly consistent, though very low rate, of offending over time. Race (being African-American), sex (being female), and lower levels of neighborhood police patrol all are risk factors for membership in this group. Given the size of the low-chronic class, they present a difficulty to the police in their ability to exercise formal social control over low-chronic offenders. Unlike previous research, which targets one small class of offenders as being the most problematic and, hence, a focus of crime-prevention policy, the current analyses suggest the existence of two classes of offenders who increase the burden placed upon the police: low-chronic offenders because of their sheer numbers, and high-chronic offenders because of their very high mean rates of offending.

FUTURE RESEARCH AND POLICY CONSIDERATIONS

These findings provide a fertile ground for future research. In particular, the work needs to be replicated on more data sets, preferably drawn from more recent cohorts and with more detailed measures of neighborhood social organization. While the neighborhood social context measures for the 1942 and 1949 Racine Birth Cohorts are socioeconomic indicators drawn from Census data and acting as proxies for disorganization, more detailed measures are necessary to establish the link between neighborhoods and individual behavior. In particular, measures of neighbor friendship networks, participation in neighborhood organizations, and neighborhood "incivilities" such as graffiti, public drinking, and loitering would provide more accurate measures of social disorganization.

Replication of these analyses on other samples of females would also be beneficial. Given the relative infrequency of female offending, particularly with older cohorts, a larger sample could improve the analyses. The nature of female delinquency/crime has also changed

greatly over the past several decades, so a more recent cohort may yield a more complete picture of female offending over time.

The influence of police patrol, and exactly what this construct measures, also merits further research. In particular, the nature of the deterrent effect found in the current analyses needs to be determined. Is police patrol acting as an agent of formal social control, or is it the unique character and more personal nature of small-town policing which acts as more of an agent of informal social control? If the latter is the case, support would be offered for community-based policing strategies, particularly in "problematic" neighborhoods, rather than the simple addition of more police officers to the streets.

While this research points to the importance of families as agents of social control, it does not address the state of the family in the late twentieth century United States. While two-parent families were normative in 1950s and 1960s Racine, Wisconsin, they no longer are in late twentieth century society. Suggesting that only two-parent families can act as a buffer to children's involvement in delinquent/criminal careers is an impractical solution. Instead, public policy should be

directed to increase the ability of single parents to provide adequate supervision and monitoring of their children: low-cost daycare and after-school programs are two social programs which could be implemented to increase levels of guardianship.

The role of peers and school in affecting criminal trajectories is ambiguous in this research. While the measures in these analyses contained individuals' self-reports of their peers' delinquency, official reports of delinquency may provide a better measure. The problems of recall error and the possibility of an individual's skewed perception of his or her friends would be avoided with the use of official statistics. Conversely, a different measure of offending behavior, such as self-reported offending, would provide a contrast to the current research. Preliminary research by D'Unger et al. (1996) suggests that despite the difference in overall levels of offending between official (police or FBI) and self-report data, the latent classes of self-reported and official trajectories are the same. Data with both self-report and official offending behavior would be necessary for such a test.

Finally, the key determinant of low-chronic versus high-chronic offending behavior needs to be determined.

It could be that low-chronic offenders engage in more property crimes and fewer violent crimes than the high-chronic offenders. Or both the low- and high-chronic offenders may be "generalists" in their offending, with the only distinction being the overall lambda of the two groups. Such a distinction would be key for the development of effective crime-prevention strategies which act proactively as opposed to reactively to the problem of crime in the United States.

APPENDIX A

THE COMPREHENSIVE SOCIAL CONTEXT MODELS

The major goal of this project was to test various models of social context which included the demographic variables as well as the statistically strongest variables representing each of the social domains (neighborhood, family, and peers). However, problems of multicollinearity among the social context variables caused the cumulative models that included all of the neighborhood, family, and peer variables to be unstable.

This produced uninterpretable and contradictory results, which are reported here.

Below are presented the results from comprehensive social context models both with and without the level of police patrol included in the model. In addition, comparable models were estimated with the medium- and high-chronic offender classes collapsed into a single class to adjust for the problem of small sample size with those two classes.

THE COMPREHENSIVE SOCIAL CONTEXT MODELS

In order to test the predictive strength of the various social contexts against one another, two final cumulative models were estimated. The two final models included the variables which were the strongest overall predictors in each of the respective individual social context models. The first of the multinomial logit models included: race, sex, neighborhood SES, family stability, and the dichotomous variable measuring friends' involvement with the police. Each was highly significant

in their respective individual social context model (neighborhood, family, or peers/school). The second model included all of the above variables as well as the measure of formal social control in the neighborhood--police patrol. The overall fit of both models was good based upon both the likelihood ratio goodness-of-fit statistic as well as the pseudo-R^2. The model without police patrol has a likelihood ratio of 414.34 with 56 degrees of freedom and a pseudo-R^2 of 0.4089, while the model with police patrol has a likelihood ratio of 681.08 with 1468 degrees of freedom and a pseudo-R^2 of 0.5787. The latter model has the highest pseudo-R^2 of all models estimated, with the exception of the family model which has a pseudo-R^2 of 0.5803.

In the overall model without police patrol, all the explanatory variables are significant with the exception of neighborhood, with levels ranging from $p<0.00001$ for race, sex, and friends' delinquency to $p<0.0001$ for family stability. The significance level of neighborhood SES is marginal with $p<0.08$. This is a reduction in significance for neighborhood SES from the original baseline models, in which it is significant at the $p<0.05$ level. Table A.1

Table A.1: Multinomial Logit Estimates for the Final Models, With and Without Police Patrol

Model	χ^2	DF	Probability
Final without Police Patrol			
Intercept	40.08	4	0.0000
Race	30.59	4	0.0000
Sex	75.46	4	0.0000
Neighborhood SES	8.34	4	0.0800
Family Stability	23.01	4	0.0001
Peers' Del. (dich.)	40.46	4	0.0000
Likelihood Ratio	414.34	756	1.0000[a]
Pseudo-R^2	0.4089		
Final with Police Patrol			
Intercept	30.77	4	0.0000
Race	32.06	4	0.0000
Sex	72.62	4	0.0000
Neighborhood SES	8.44	4	0.0766
Police Patrol	8.28	4	0.0818
Family Stability	20.86	4	0.0003
Peers' Del. (dich.)	38.52	4	0.0000
Likelihood Ratio	681.08	1468	1.0000[a]
Pseudo-R^2	0.5787		

[a]Probabilities of exactly 1.0000 are the result of rounding up by SAS, the statistical program used to estimate the models. The actual probabilities are greater than 0.9999 but less than 1.0000.

presents the results from the comprehensive social context multinomial logit models and Table A.1a presents the odds ratios for the models.

In the first model family stability and peers' delinquency predict membership in various offender categories. Race is not significant at the $p<0.05$ level,

but it is interesting to note that the direction of the relationship is counter to the relationship in most of the other models. African-Americans are 70 percent less likely to be high-chronic offenders. Given the relatively small percentage of African-Americans in the sample and the very small sample size (n=5) of high-chronic offenders, this finding is not unexpected. Family stability is predictive of membership in both the low-chronic and high-chronic latent offender classes and, marginally, of membership in the adolescent-peaked class. Individuals from stable families are 70 percent less likely to be low-chronic offenders and 90 percent less likely to be high-chronic offenders. They are also 70 percent less likely to be adolescent-peaked offenders. Peers' involvement in juvenile delinquency is predictive only for the low-chronic offenders ($p<0.04$). Individuals' whose 2-3 closest friends were involved with the police are 260 percent more likely to be low-chronic offenders than nonoffenders. Neighborhood SES shows only a

Table A.1a: Odds Ratios and Probabilities for Final Models, With and Without Police Patrol

Latent Class	Adol.-Peaked		Low-Chronic		Medium-Chronic		High-Chronic	
Model	Odds	Prob	Odds	Prob	Odds	Prob	Odds	Prob
W/O Police								
Intercept	2.2	0.323	2.4	0.290	(0.6)[a]	0.450	(0.8)	0.250
Race	0.2	0.705	0.7	0.339	0.5	0.493	(0.7)	0.075
Sex	(0.1)	0.850	(0.6)	0.168	0.2	0.763	1.1	0.291
SES	1.0	0.102	1.0	0.088	0.9	0.107	0.9	0.111
Stability	(0.7)	0.082	(0.7)	0.035	(0.4)	0.446	(0.9)	0.004
Del. (dich.)	1.4	0.153	2.6	0.041	0.2	0.765	0.5	0.544
With Police								
Intercept	149	0.046	170	0.041	11.9	0.318	19.9	0.241
Race	(0.5)	0.360	(0.3)	0.611	(0.3)	0.613	(0.9)	0.016
Sex	1.4	0.280	0.2	0.839	2.1	0.194	5.5	0.039
SES	1.0	0.115	1.0	0.099	0.9	0.121	0.9	0.128
Police	(0.9)	0.049	(0.9)	0.044	(0.8)	0.095	(0.9)	0.020
Stability	(0.8)	0.058	(0.8)	0.029	(0.6)	0.239	(0.9)	0.008
Del. (dich.)	0.8	0.363	1.7	0.134	(0.1)	0.922	0.1	0.937

[a]Odds ratios in parentheses are (1 - exponentiated coefficient) and represent the "% less than." All other odds ratios are (exponentiated coefficient - 1) and represent the "% greater than."

marginally significant association with membership in the low-chronic class.

When level of police patrol was added to the model, the multinomial logit results change slightly. Like the model without patrol level, several of the results are quite different from those in the baseline and individual social context models. Race, sex, and peers' delinquency remain significant at the $p<0.00001$ level, while neighborhood SES remains significant only at the $p<0.08$ level. Family stability remains at approximately the same

level of significance, while police patrol is rendered insignificant at the $p<0.05$ level. This is quite different from the results presented in Table 5.1, in which police patrol is significant at the $p<0.01$ level. Results for the current model are also presented in Table A.1, with odds ratios in Table A.1a.

Race and family stability remain significant in predicting membership in the individual latent classes, in addition to police patrol. However, sex becomes significant with the addition of police patrol, while peers' delinquency becomes insignificant for predicting the individual latent classes. African-Americans are 87 percent less likely to be high-chronic offenders than whites, and females are 550 percent more likely to be high-chronic offenders. These findings contradict both the hypotheses and the findings of the individual social context models, in which African-Americans are more likely to be high-chronic offenders than whites, while females are less likely to be high-chronic offenders than males.

Level of police patrol is significant in predicting membership in three of the latent offender categories. A one unit increase in neighborhood police patrol makes an individual 87 percent less likely to be a low-chronic offender, 87 percent less likely to be an adolescent-

peaked offender, and 91 percent less likely to be a high-chronic offender. This supports the results found in the individual social context models. Family stability is also quite significant in predicting membership for three out of the four classes.[1] Individuals from stable families are 83 percent less likely to be low-chronic offenders, 79 percent less likely to be adolescent-peaked offenders (only at the $p<0.06$ level of significance), and 91 percent less likely to be high-chronic offenders.

The final models offer support for some of the hypotheses outlined in Chapter 2, as well as some contradictions; in particular, race and sex, which predict membership in the high-chronic category in the opposite direction than expected. The final models, both with and without police patrol, have high predictive power (based on the pseudo-R^2 and the likelihood ratio chi-square) relative to the baseline model, which indicates that at least some social contexts are important predictors of latent offender class membership.

Overall, neighborhood SES is not predictive of the latent classes, while patrol level is much more significant. Family stability is also predictive in the

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[1] Note that the fifth class of offenders was the nonoffenders, which

expected direction, while peers' involvement with the police is moderately significant in the final cumulative model, but only for the low-chronic offenders and only when patrol-level is not included in the model.

In comparing the baseline, family, peer, and comprehensive models, the full model of family support and structure explains the most variance, according to the pseudo-R^2 (0.5803). This is followed by the comprehensive model with police patrol (0.5787), the baseline model plus neighborhood context and police patrol (0.4335), the final model without police patrol (0.4089), the peer and school context model (0.4020), the baseline plus serious contacts model (0.2488), the baseline plus neighborhood context model (0.2391), and the baseline model (0.0096). The most substantial finding is the change in the effect of race and sex from the baseline to the final models. In the model which includes only race and sex as independent variables, both are predictive of membership in the latent classes (race is predictive for the adolescent-peaked and low- and medium-chronic while sex is predictive for the low-chronic). In the final models, however, race and sex are only marginally significant. In the model without

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was the omitted or comparison category.

police patrol, African-Americans are 87 percent less likely to be high-chronic offenders, though the level of significance is only $p<0.08$. In the model with police patrol, females are 550 percent more likely to be high-chronic offenders, though the level of significance is only $p<0.04$. The direction of these relationships are both highly suspect, however, given the extremely small sample size of the high-chronic class (n=5). Family stability and police patrol are far more significant than either race or sex.

The Problem of Sample Size and the High-Chronic Offenders

One problem with the multinomial logit analyses conducted utilizing all five latent offender classes is the extremely small sample size of the high-chronic offenders (n=5). Because of this problem, the models predicting membership into this class are unstable, as evidenced by the results found in the final comprehensive models for race and sex which run counter to the results from the previous models and counter to the expected direction of the relationship.

One way to deal with this issue is to collapse the five latent classes of offenders into four classes in order to achieve a larger sample size for the highest-rate

offenders. When the five classes of offenders are collapsed into four, the sample sizes become: 518 nonoffenders, 204 low-chronic offenders, 32 adolescent-peaked offenders, and 34 medium- and high-chronic offenders.

To test the validity of the final comprehensive social context models discussed above, multinomial logit regression analyses were estimated using four categories for the dependent offending variable: nonoffenders (as the omitted comparison category), adolescent-peaked offenders, low-chronic offenders, and medium- and high-chronic offenders collapsed into one class. Variables in the model included race, sex, neighborhood social disorganization, family stability, and peers' delinquency. In addition, the model was estimated with and without level of police patrol, as were the comprehensive social context models utilizing all five latent offender classes. Multinomial logit estimates for these models are presented in Table A.2 and odds ratios in Table A.2a.

The overall fit of the two models is very good. The model without police patrol has a likelihood ratio chi-square of 414.81 with 567 degrees of freedom. The pseudo-R^2 for the model without police patrol is 0.4093, which is

approximately the same as the pseudo-R^2 for the model using all five latent classes of offenders (0.4089). The

Table A.2: Multinomial Logit Estimates for the Final Models, With and Without Police Patrol, Medium- and High-Chronic Classes Combined

Model	χ^2	DF	Probability
Final without Police Patrol			
Intercept	35.20	3	0.0000
Race	28.80	3	0.0000
Sex	75.90	3	0.0000
Neighborhood SES	7.13	3	0.0679
Family Stability	15.95	3	0.0012
Peers' Del. (dich.)	40.50	3	0.0000
Likelihood Ratio	414.81	567	1.0000[a]
Pseudo-R^2	0.4093		
Final with Police Patrol			
Intercept	25.23	3	0.0000
Race	29.86	3	0.0000
Sex	72.39	3	0.0000
Neighborhood SES	7.37	3	0.0609
Police Patrol	2.41	3	0.4924
Family Stability	14.32	3	0.0025
Peers' Del. (dich.)	39.44	3	0.0000
Likelihood Ratio	687.10	1101	1.0000[a]
Pseudo-R^2	0.5819		

[a]Probabilities of exactly 1.0000 are the result of rounding up by SAS, the statistical program used to estimate the models. The actual probabilities are greater than 0.9999 but less than 1.0000.

model with police patrol has a likelihood ratio chi-square of 687.10 with 1101 degrees of freedom. The pseudo-R^2 for

the model is 0.5819, which is slightly higher than the comparable model with five latent classes (0.5787).

In the full model without police patrol, all of the explanatory variables are significant, though neighborhood context is only marginally so ($p<0.07$). Race, sex, and peers' delinquent activity are all significant at the $p<0.00001$ level, while family stability is significant at the $p<0.001$ level.

Turning to the power of the various social contexts to predict membership in the latent offender classes, several of the explanatory variables are significant when police patrol is not included in the model. Race is predictive of membership in all three of the latent classes: the low-chronic, the adolescent-peaked, and the combined medium- and high-chronic (the comparison or omitted category is the nonoffenders). African-Americans are 330 percent more likely to be low-chronic offenders, 210 percent more likely to be adolescent-peaked offenders, and 280 percent more likely to be either medium- or high-chronic offenders. These results run counter to the final models with the medium- and high-chronic offenders disaggregated, but are supportive of the hypotheses as well as the results from the other baseline and social context models.

In the final comprehensive social context model without police patrol using all five offender classes, race is significant in predicting membership only in the high-chronic offender class, but only marginally so ($p<0.08$). In addition, it is counter to the results found in all of the other models; while most models predict that African-Americans are more likely to be in one of the offender classes, the final comprehensive model predicts that African-Americans are less likely to be high-chronic offenders. By collapsing the medium- and high-chronic offenders into one category, race becomes significant in the expected direction for all three of the latent classes.

Sex is significant in predicting membership in two of the three latent offender classes. Females are 80 percent less likely to be low-chronic offenders and 50 percent less likely to be adolescent-peaked offenders. Sex is not significant for the combined medium- and high-chronic class. The results for the females are in the hypothesized direction and are supported by results from the other baseline and social context models. In the comprehensive social context model without police patrol using all five latent classes of offenders, sex is not

significant in predicting membership into any of the latent classes.

Neighborhood social context is significant in predicting membership only in one class of offenders: the low-chronics ($p<0.05$). A one-unit increase in the socioeconomic status of the neighborhood makes an individual 7 percent (rounded from 0.07 to 0.1, or 10%, in

Table A.2a: Odds Ratios and Probabilities for Final Models, With and Without Police Patrol, Medium- and High-Chronic Classes Combined

Latent Class	Adol.-Peaked		Low-Chronic		Medium- and High-Chronic	
Model	Odds	Prob	Odds	Prob	Odds	Prob
W/O Police						
Intercept	4.7	0.000	5.2	0.000	(0.3)	0.574
Race	2.1	0.000	3.3	0.000	2.8	0.002
Sex	(0.5)[a]	0.036	(0.8)	0.000	(0.3)	0.373
SES	0.0	0.270	0.1	0.049	0.0	0.463
Stability	0.6	0.132	0.2	0.501	1.8	0.003
Del. (dich.)	0.7	0.015	1.5	0.000	(0.1)	0.635
With Police						
Intercept	3.2	0.010	3.8	0.005	(0.6)	0.182
Race	2.2	0.000	3.4	0.000	3.3	0.001
Sex	(0.5)	0.025	(0.8)	0.000	(0.4)	0.225
SES	0.0	0.240	0.1	0.043	0.0	0.463
Police	0.2	0.381	0.2	0.482	0.6	0.137
Stability	0.5	0.199	0.2	0.644	1.6	0.006
Del. (dich.)	0.8	0.012	1.6	0.000	(0.1)	0.780

[a]Odds ratios in parentheses are (1 - exponentiated coefficient) and represent the "% less than." All other odds ratios are (exponentiated coefficient - 1) and represent the "% greater than."

Table A.2a) more likely to be a low-chronic offender. Though this effect is very small, it is still counter to the hypothesized direction of the relationship.

Family stability is predictive of membership in one latent class of offenders, while peers' delinquency is predictive of membership in two latent classes. The relationship between family stability and class membership reverses when the medium- and high-chronic offender groups are collapsed. Individuals from stable families are 180 percent more likely to be higher-rate offenders than nonoffenders, which is counter to the hypothesized direction. Peers' delinquency is predictive of membership in the low-chronic and adolescent-peaked offender classes. Individuals who associate with delinquent peers are 150 percent more likely to be low-chronic offenders and 70 percent more likely to be adolescent-peaked offenders, supporting Hypothesis 6d.

When the level of police patrol is added to the final comprehensive model with a four-class dependent variable, three of the explanatory variables are significant at the $p<0.0001$ level (race, sex, and peers' delinquency), one is marginally significant at the $p<0.06$ level (neighborhood) and one is insignificant (police patrol). Race, sex, neighborhood social disorganization, family stability, and

peers' delinquency are all significant in predicting membership in various latent offender classes.

Race is highly significant in predicting membership in all of the latent classes (low-chronic, adolescent-peaked, and the medium- and high-chronic offenders combined) in the expected direction, which is counter to the results found with the comprehensive social context model with the disaggregated medium- and high-chronic offender classes. In the current model, African-Americans are 340 percent more likely to be low-chronic offenders, 220 percent more likely to be adolescent-peaked offenders, and 330 percent more likely to be medium- or high-chronic offenders. Sex is significant in predicting membership in two of the latent classes, also in the hypothesized direction and opposite to the findings in the comprehensive models with all five latent classes disaggregated in the dependent variable. Females are 80 percent less likely to be low-chronic offenders, 50 percent less likely to be adolescent-peaked offenders, and 40 percent less likely to be medium- or high-chronic offenders.

Neighborhood is again marginally significant ($p<0.04$) in predicting membership in one of the latent classes (low-chronic), but counter to the hypothesized direction.

A one unit increase in neighborhood socioeconomic status makes an individual 7 percent (rounded to 0.1, or 10% in Table A.2a) more likely to be a low-chronic offender. This percentage is unchanged from the model without police patrol. Family stability is significant in predicting membership in the combined medium- and high-chronic offender category, but opposite the hypothesized direction. Individuals from stable families are 160 percent more likely to be medium- or high-chronic offenders. Associating with delinquent peers increases the likelihood that an individual will be in two of the offender categories. Individuals with delinquent peers are 160 percent more likely to be low-chronic offenders and 77 percent more likely to be adolescent-peaked offenders. This offers some support to the hypotheses outlined in Chapter 2.

In the final comprehensive social context models using the collapsed medium- and high-chronic offender category, race and sex remain significant in predicting membership in several of the latent offender categories. In addition, the relationships between race and sex and the offender categories are in the expected direction, with males and African-Americans more likely to be offenders than females and non-blacks. While the

relationships are in the expected direction for the two demographic control variables, they are counter to the results using all five of the latent classes in the dependent variable, supporting the notion that it is problematic to use the high-chronic offender class as a stand-alone latent offender category.

While the cumulative models described in Appendix A produce some results of interest, too many are uninterpretable and/or contradictory for them to be given much credence. The small sample size of the adolescent-peaked, medium-chronic, and high-chronic offender classes make regression estimates highly unstable when membership in any of these three latent categories is used as the dependent variable. Nonetheless, it is important that they be presented for completeness, hence their inclusion here.

APPENDIX B

PREDICTING OFFENDER CATEGORIES: LOGISTIC REGRESSION MODELS

In Chapter 5 and Appendix A, results from the multinomial logit models--in which membership in the latent offender classes was treated as a single dependent variable taking one of five values (1-5)--were discussed. In addition to these models, individual logistic regression models, which treat membership in each latent class as a separate variable, were also tested. However, as mentioned in Chapter 3, there are problems of consistent interpretation of such models. While multinomial logit models compare each class of offenders against a single, omitted comparison category (in the previous analyses, the nonoffenders), logistic models compare membership in a single category to membership in *any* of the other four categories. For example, when the dependent variable is a dichotomous measure of membership in the adolescent-peaked class, a value of 1 indicates that an individual is an adolescent-peaked offender, while a value of 0 indicates that the individual is either a nonoffender, a low-chronic offender, a medium-chronic

offender, or a high-chronic offender. It cannot be discerned from the model to which class each individual scoring a 0 on the dependent variable belongs.

One way to deal with this problem of shifting reference groups in the logistic regression models is to limit the comparison group to *only* the nonoffenders. For example, if the dependent variable is a dichotomous measure of membership in the adolescent-peaked category, a score of 1 on the dependent variable would indicate that the individual is an adolescent-peaked offender, while a score of 0 would indicate that the individual is a nonoffender. In this case, in each regression model, all of those who were not in the latent offender class of interest or nonoffenders would be deleted from the model. This means that the sample size would change with each regression model.[1] For comparability to the multinomial logit models, highlights from single individual logistic models with the comparison group of nonoffenders will be discussed briefly.

The logistic regression models used for the purpose

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[1] For each model, sample size would equal 518 (the n for the nonoffender class), plus the n of the latent class of interest (e.g., for the high-chronic model, the sample size would be 518+5=523).

Table B.1: Logistic Regression Models Estimates

Dependent Variable: Latent Class	Parameter Estimate	DF	Standard Error	Probability	Odds Ratio
Adolescent-Peaked					
Intercept	-1.6468	1	0.4530	0.0003	.
Race	2.3177	1	0.5125	0.0001	10.152
Sex	-3.3633	1	0.7640	0.0001	0.035
Neighborhood SES	-0.0648	1	0.0354	0.0675	0.937
Low-Chronic					
Intercept	-1.3094	1	0.4248	0.0021	.
Race	0.3592	1	0.6902	0.6028	1.432
Sex	-2.5622	1	0.5440	0.0001	0.077
Neighborhood SES	-0.0510	1	0.0326	0.1174	0.950
Medium-Chronic					
Intercept	0.1225	1	0.2080	0.5557	.
Race	0.6637	1	0.3245	0.0408	1.942
Sex	-1.6330	1	0.1858	0.0001	0.195
Neighborhood SES	-0.0314	1	0.0144	0.0286	0.969
High-Chronic					
Intercept	-0.8347	1	1.2599	0.5076	.
Race	1.2122	1	1.0794	0.2614	3.361
Sex	-1.9577	1	1.1768	0.0962	0.141
Neighborhood SES	-0.6423	1	0.3208	0.0453	0.526

of comparison included the variables measuring race, sex, and neighborhood SES. Results from these models are presented in Table B.1.

With membership in the adolescent-peaked offender class as the dependent variable and the nonoffenders as

the comparison class, all three of the explanatory variables are significant. The model overall is significant with a chi-square of 83.6 with 3 degrees of freedom ($p<0.0001$). African-Americans are 915 percent more likely to be adolescent-peaked offenders than nonoffenders, while females are 97 percent less likely to be adolescent-peaked offenders than males. Neighborhood SES is only slightly significant, with a one unit increase in neighborhood SES making an individual 6 percent less likely to be an adolescent-peaked offender.

The model for the low-chronic offenders is a good fit with a chi-square of 37.7 with 3 degrees of freedom ($p<0.0001$). For the low-chronic offenders, only sex is statistically significant. Females are approximately 92 percent less likely to be low-chronic offenders than the males in the sample. While race is not significant in the model, the odds ratio is above 1.0. African-Americans are 43 percent more likely to be low-chronic offenders.

Medium-chronic offenders, on the other hand, follow a pattern similar to the adolescent-peaked offenders. The overall model fits well, with a chi-square of 94.8 with 3 degrees of freedom ($p<0.0001$). African-Americans are 94 percent more likely to be medium-chronic offenders, while females are 81 percent less likely to be medium-chronic

offenders. As with the adolescent-peaked offenders, neighborhood SES is only slightly significant. A one unit increase in neighborhood SES makes an individual 3 percent less likely to be a medium-chronic offender.

Neighborhood SES is a much stronger predictor for membership in the high-chronic offender class. The model for the high-chronic offenders is the least well-fit, though the chi-square is still 34.9 with 3 degrees of freedom ($p<0.0001$). A one unit increase in the social organization of the neighborhood makes an individual 47 percent less likely to be a high-chronic offender. While race is not significant, possibly because of sample size, the odds ratio is 3.4, meaning African-Americans are 240 percent more likely to be high-chronic offenders when compared to the nonoffender category. Females are also 86 percent less likely to be high-chronic offenders.

Results from the individual logistic models offer some support as well as some contradictions to the results from the multinomial logit models.

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