# FINAL TECHNICAL REPORT

# DETERMINANTS OF CHICAGO NEIGHBORHOOD HOMICIDE TRENDS: 1980-2000
# (2008-IJ-CX-0019)

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Submitted to:
National Institute of Justice
Data Resources Program 2008
Funding for the Analysis of Existing Data

# ABSTRACT

One of the most important social changes in the United States during the 1980s and 1990s was the dramatic increase and subsequent decrease in crime, and particularly violent crime, in large cities. For example, the homicide rate in Chicago nearly tripled between 1965 and 1992, after which point it declined by more than 50% through 2005. Surely this is a remarkable pattern of change, but is this trend representative of all areas in the city? The general purpose of the proposed project is to examine homicide trends in Chicago neighborhoods from 1980-2000 using three data sources available from ICPSR and the National Archive of Criminal Justice Data (NACJD). Drawing on the social disorganization and concentrated disadvantage literature, this study will use growth-curve modeling and semi-parametric group-based trajectory modeling to: 1) assess neighborhood variation in homicide trends; 2) identify the particular types of homicide trajectory that Chicago neighborhoods follow; 3) assess whether structural characteristics of neighborhoods influence homicide trends and trajectories; and 4) determine the extent to which the influence of structural characteristics is mediated by neighborhood levels of collective efficacy. This project extends prior research by not only describing the homicide trends and trajectories of Chicago neighborhoods, but also identifying the neighborhood characteristics that directly and indirectly influence those trends. Results show that considerable variation exists in homicide trends across Chicago neighborhoods. In the group-based trajectory analysis, homicide trajectories are consistently associated with initial levels of concentrated disadvantage as well as change over time. Change in family disruption is also predictive of trajectory group assignment, but only among neighborhoods with very high initial levels of

homicide. In the growth curve analysis, concentrated disadvantage is associated with initial levels of homicide, but not change over time. In contrast, social disorganization and immigrant concentration emerge as significant predictors of variability in homicide trends. Additional models incorporating data from the Project on Human Development in Chicago Neighborhoods (PHDCN) show that neighborhood ties and perceived social disorder mediate a substantial portion of the effects of concentrated disadvantage and social disorganization on homicide rates.

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## INTRODUCTION

One of the most important social changes in the United States during the 1980s and 1990s was the dramatic increase and subsequent decrease in crime, and particularly violent crime. Indeed, the homicide rate in Chicago nearly tripled between 1965 and 1992, after which it declined by more than 50% through 2005. This is a remarkable pattern of change, but is this overall trend characteristic of all areas within the city? If not, what other patterns in homicide can be identified among Chicago neighborhoods, and what might explain the variation in homicide trends across neighborhoods?

Much of the prior research on neighborhoods and crime has drawn on the social disorganization perspective which argues that neighborhoods characterized by high levels of poverty, residential turnover, and heterogeneity find it difficult to realize common values and solve collective problems, which may in turn lead to higher rates of crime (Shaw and McKay, 1942) . Others have expanded the perspective by specifying the intervening mechanisms through which structural characteristics of neighborhoods may influence crime rates, such as through social ties, mutual trust, or a shared willingness to engage in informal control (Bellair, 1997; Bursik, 1988; Sampson and Groves, 1989; Sampson, Raudenbush, and Earls, 1997). Though these theoretical approaches are firmly grounded in an ecological approach that emphasizes temporal concepts such as instability, population turnover, deterioration, and cyclical change, surprisingly few studies have employed longitudinal designs to explicitly capture such processes (Bursik, 1986; Fagan and Davies, 2004). Thus, while a great deal of prior criminological research has examined variation across neighborhoods in levels of crime, much less work has

been dedicated to describing crime trends within neighborhoods, and even less research has attempted to the identify characteristics associated with variation across neighborhoods in crime trends and trajectories.

Another possible reason for the predominance of cross-sectional research in the study of communities and crime is the strong emphasis by Shaw and McKay (1942) on the stability of crime-generating processes in neighborhoods (Bursik, 1984, 1986). This led to their influential conclusion that neighborhood rates of juvenile delinquency remained relatively stable over time despite sometimes rapid changes in racial and ethnic composition within neighborhoods. However, a handful of studies in the 1980s and 1990s questioned this stability hypothesis, instead arguing that change in neighborhoods can occur through multiple processes, and even the same dynamic processes can lead to different outcomes across neighborhoods depending on their initial ecological characteristics and their current stage in the developmental process (Bursik and Grasmick, 1992; Schuerman and Kobrin, 1986; Taylor and Covington, 1988). This approach suggests that communities progress through developmental pathways that can yield variation across communities in not just crime rates at a single point in time, but also in their trajectories of crime over a span of time.

This notion of community careers in crime parallels the concept of 'criminal careers' from the individual-level developmental and life-course literature where researchers often attempt to identify classes of individual offenders, such as abstainers, adolescent-limited delinquents, and life-course persistent offenders (Laub and Sampson, 2003; Moffitt, 1993; Piquero, Farrington, and Blumstein, 2003). If we were to think of crime patterns in terms of a neighborhood 'life-course', what types of trajectories might be evident? Do neighborhoods essentially mirror the

city-level crime trend, with differences only in scale, or does the pattern of change over time vary across neighborhoods? Recent macro-level research has begun to directly address these questions, with a general finding that neighborhoods do, indeed, seem to exhibit a variety of crime trajectories that are sometimes considerably different from the trend of the broader city (Chavez and Griffiths, 2009; Griffiths and Chavez, 2004; Weisburd, Bushway, Lum, and Yang, 2004).

The purpose of this project is to analyze homicide trends in Chicago neighborhoods from 1980-2000. The first objective is to determine whether trends in homicide varied across Chicago neighborhoods from 1980-2000. A great deal of research has examined variation across neighborhoods in *levels* of crime, but much less work has been dedicated to describing crime trends within neighborhoods. A second, related objective will be to determine whether these neighborhood homicide trends can be categorized into a discrete set of trajectory groups, similar to the offending trajectory groups that have been identified by developmental criminologists.

The third objective expands upon the descriptive analysis by identifying determinants of neighborhood homicide trends. Prior research has documented various crime trajectories across neighborhoods, but the next logical question is what gives rise to these various trajectories and, given similar levels of homicide at the beginning of the time period, what factors are associated with a neighborhood being categorized into one trajectory grouping over another? Drawing on the social disorganization and concentrated disadvantage literature, the focus of this objective will be to assess the degree to which structural characteristics of neighborhoods influence homicide trends, including factors such as poverty, unemployment, single-headed households, immigration, divorce, racial composition, density, and population mobility.

The fourth objective is to introduce community characteristics that are thought to mediate the influence of the previously mentioned factors on neighborhood homicide trends. Scholars have elaborated on the classic social disorganization model, arguing that concentrated disadvantage, population instability, and heterogeneity can reduce a community's ability to control its residents by reducing levels of social interaction and neighboring, mutual trust, the recognition of common goals and values, and legal cynicism. This study tests the expectation that more proximate neighborhood characteristics mediate the influence of the broader structural variables on homicide trends.

## RESEARCH DESIGN AND METHODS

Data for this project was compiled from a variety of sources. To generate the homicide rate (per 100,000), homicide incident counts were obtained from the Chicago Homicide Data Set available from the National Criminal Justice Archive at ICPSR (Block, Block, and ICJI, 1998). This data set includes tract identifiers that allow for merging with other tract characteristics. Data for neighborhood structural characteristics are drawn from the 1980, 1990, and 2000 Census of Population and Housing. The 1980 data come from Summary Tape File 4A (STF 4A), the 1990 data come from Summary Tape File 3A (STF 3A), and the 2000 come from Summary File 3 (SF 3). Variables for this portion of the analysis include population size, median household income, poverty rate, unemployment rate, divorce rate, percentage of female-headed households, residential mobility, homeownership rate, racial and Hispanic composition, immigrant composition, percentage of households speaking English, and population density. In order to avoid the problems associated with high levels of multicollinearity among the

regressors, several standardized mean indexes were created to represent key concepts identified in previous empirical and theoretical work (Land, McCall, and Cohen, 1990). All predictors are incorporated as both static levels at the beginning of the time period, and as change scores for the period 1980 to 2000 (Rosenfeld et al. 2007; Kubrin and Herting 2003).

The *concentrated disadvantage* index is comprised of median household income, the percentage of persons with a high school diploma, the percentage of persons with a bachelor's degree, percentage of persons who are African American, and the percentage of persons unemployed. It is expected that areas with high levels of disadvantage in 1980 will have trajectories with higher starting points, and that increases in concentrated disadvantage will be associated with increasing homicide trajectories. *Family disruption* is an index comprised of the percentage of persons age 15 and over who are divorced and the percentage of children who live with a single parent. As with concentrated disadvantage, high levels and increases in family disruption are expected to yield high and increasing trajectories of homicide. *Social disorganization* is measured with an index comprised of the percentage of persons who lived in a different house five years earlier, the percentage of homes that are renter-occupied, the percentage of housing units that are vacant, and population density. It is expected that areas with high levels of social disorganization in 1980 will have high starting points to their homicide trajectories, and that neighborhoods with increasing disorganization will be more likely to have increasing homicide trajectories. *Immigrant concentration* is measured using an index comprised of the percentage foreign-born and the percentage Hispanic. Though popular opinion among the American public is often that immigration and crime are strongly, positively related, much of the empirical research shows that immigrants are less likely to engage in crime than

native-born Americans after controlling for other characteristics (Hagan and Palloni, 1999; Mears, 2010). It is expected that neighborhoods with higher concentrations of immigrants may have higher initial homicide rates at the start of the time period, but controlling for levels of disorganization and disadvantage, areas with increasing concentrations of immigrants will be associated with a declining homicide trajectory.

As an initial attempt at determining whether the effect of these structural characteristics on neighborhood crime trends are mediated by emergent properties of neighborhoods such as social cohesion, collective efficacy, and disorder, this study also incorporates data from the 1994-1995 Community Survey of the Project on Human Development in Chicago Neighborhoods, which is also accessible from the National Archive of Criminal Justice Data. The community survey was conducted in 1994-1995, so the timing is not ideal for incorporation into a study of homicide trends from 1980-2000. Therefore, this portion of the analysis is restricted to just the years 1990-2000, and it is viewed as an initial effort to identify theoretically relevant mediating effects, and will hopefully stimulate future research. Because many of the community-level measures included in the PHDCN are highly collinear, two variables were selected as possible intervening mechanisms - *neighborhood ties* and *perceived social and physical disorder*.

## ANALYTIC PLAN

Because temporal and spatial analysis of neighborhood crime is a complex and relatively new endeavor, a comprehensive approach is taken. This involves a variety of analytical methods including hierarchical growth-curve modeling, semi-parametric group-based trajectory modeling,

and the analysis of spatial dependence. The first objective of this study is to determine whether the overall homicide trend in Chicago from 1980-2000 is representative of all neighborhood trends, with differences only in levels or scale, or if there is significant spatial variation in homicide trends at the neighborhood level. This question can be addressed using growth-curve modeling which involves the estimation of parameters that describe the average initial level of homicide for all tracts as well as coefficients that describe the average pattern of change over time. By nesting time-periods within neighborhoods, within-unit change in the homicide rate can be modeled as a linear or nonlinear function of time with a resulting model for each tract that includes an intercept representing the initial level of homicide at the beginning of the time period, and regression coefficients representing the effects of time on the homicide rate. A linear model would produce a single trend coefficient, whereas a nonlinear specification would require the addition of higher order terms resulting in additional coefficients. Key to this objective, variance components from these models provide an indication of whether there is significant variation in the homicide trend parameter estimates across neighborhoods (Kubrin and Herting 2003; Phillips and Greenberg 2008).

If the analysis under the first objective determines that homicide trends vary across neighborhoods, the second objective is to evaluate the number of different trajectories that can be used to characterize change over time in homicide rates in Chicago neighborhoods, and to describe those trajectories. This will be accomplished using semi-parametric group-based trajectory modeling via the SAS module PROC TRAJ (Nagin 2005; Nagin and Land 1993; Jones, Nagin, and Roeder 2001). This approach uses mixture models to identify a finite set of neighborhood crime rate trajectories within which each individual neighborhood can be

categorized.

The third objective goes beyond descriptive analyses by evaluating whether any observed variation in homicide trends across neighborhoods is associated with theoretically relevant variables identified in the existing macro-level literature on communities and crime. Again, a comprehensive approach will be taken. The first approach takes advantage of a key output of group-based trajectory modeling. The PROC TRAJ procedure produces a set of posterior probabilities of group assignment which allow for the categorization of each neighborhood into one of the estimated trajectories. These trajectory group assignments can them be used as the dependent variable in a set of logistic regression models that evaluate whether other neighborhood characteristics are predictive of the trajectory that a particular neighborhood follows. This extends prior research by not only identifying a set of homicide trajectories within which neighborhoods can be categorized, but also assessing the extent to which other neighborhood characteristics can predict homicide trajectory assignments.

Next, the hierarchical growth curve modeling described earlier will be expanded to evaluate whether the parameters from the growth curve models estimated under the first objective are significantly related to the census-based structural characteristics of neighborhoods. That is, assuming there is variability in the trend parameters across neighborhoods, additional multi-level growth curve models can assess whether that variability is associated with characteristics of neighborhoods such as concentrated disadvantage, social disorganization, family disruption, and immigrant concentration.

Finally, the fourth objective is to test whether any observed effects of neighborhood structural characteristics on homicide levels and trends are mediated by characteristics such as

neighborhood ties and perceived disorder. This will be assessed by expanding the growth-curve models from the third objective, adding collective efficacy and social disorder as explanatory variables. The expectation is that any observed effects of the structural characteristics in the previous models will be attenuated after introducing neighborhood ties and perceived disorder, thus suggesting a process through which neighborhood characteristics such as disadvantage and instability influence homicide trends largely through their effect on these intervening characteristics.

## RESULTS

The following results are obtained with regard to the project objectives:

- The homicide trajectory of the average Chicago neighborhood from 1980-2000 closely mirrors the overall trajectory for the City of Chicago. The homicide rate gradually declines from 1980 to 1985, followed by an increase into the early 90s, and a subsequent decline through 2000.
- The variance components from an unconditional hierarchical growth curve model indicate that there is, indeed, variability in homicide trends as expected. Moreover, results from the semi-parametric group-based trajectory analysis revealed eight distinctive trajectories starting at low, moderate, and high levels of homicide in 1980, with some of them remaining stable over time, some increasing, and some declining. These results clearly show that homicide trends vary considerably across Chicago neighborhoods from 1980-2000.
- Descriptive analyses show that homicide trajectories appear to be associated with

initial levels and changes over time in concentrated disadvantage, social disorganization, family disruption, and immigrant concentration.

- Overall, the group-based trajectory analysis shows that higher and increasing levels of concentrated disadvantage are predictive of being in trajectory groups with higher and increasing homicide rates regardless of whether initial rates of homicide are low, moderate, or high in 1980. Whereas social disorganization is not predictive of homicide trajectory group assignment in any of the group comparisons, family disruption and immigrant concentration provide additional explanatory strength, but only for neighborhoods with very high initial levels of homicide.
- Results from the hierarchical growth-curve analysis show that concentrated disadvantage is predictive of starting points of homicide in 1980, yet it does not appear as a significant predictor of change over time. This is also true for family disruption. On the other hand, social disorganization and immigrant concentration were predictive of both initial levels of homicide and variability in change over time. These findings again underscore the point that certain structural characteristics of neighborhoods are predictive of neighborhood homicide trends.
- The analysis of intervening mechanisms finds that the effects of concentrated disadvantage and social disorganization on initial levels of homicide are significantly and substantially reduced after controlling for social ties and perceived disorder.

## CONCLUSIONS

These results clearly show that homicide trends vary considerably across neighborhoods over this time period. This is an important finding given that so much attention has been paid to the crime decline observed in the United States over the past two decades, and the relative uniformity in crime trends in US cities over this period, with variations mostly in the timing and amplitude of their trajectories. Far less attention has been directed at variability in crime trends across subareas within cities. The results from the first and second objectives of this study indicate that this is an important oversight, and that the variability in homicide trends across neighborhoods merits further analysis.

Despite the fact that the majority of research on communities and crime has been cross-sectional, the theoretical and empirical literature clearly emphasizes the importance of change over time in neighborhood structure and social processes for understanding change over time in rates of crime. As researchers continue to gather longitudinal data at the neighborhood level, and as the statistical methods for analyzing change continue to advance, it is important to consider whether we must revise or reorient our theoretical approach to the study of variation in crime trends across local areas. A large body of empirical literature has developed regarding the predictors of homicide across communities, and that research has shown a large degree of consistency in the relevance of particular structural characteristics across different time periods and across different levels of aggregation (Land et al., 1990; McCall, Land, and Parker, 2010). Thus, the expectations are fairly clear regarding between-neighborhood variation in crime rates, and from these it is easy to extrapolate expectations about within-community change over time.

The current analysis of between-neighborhood variability in within-unit homicide trends may appear, at first glance, to be simply a combination of the traditional cross-sectional and longitudinal approaches seen in prior work. However, the preceding analysis and discussion suggests that current theoretical frameworks may not be sufficiently developed to offer clear expectations with regard to the between-unit variability in neighborhood trajectories of homicide.

This line of research could yield important policy recommendations. If we can consistently identify characteristics associated with certain crime trajectories, and assuming these characteristics are responsive to social policies and programs, policy makers could apply interventions that are specifically targeted at neighborhoods at a particular stage of development. For example, the finding from the trajectory analysis that changes in concentrated disadvantage are associated with homicide trends for neighborhoods at low, moderate, or high levels of homicide suggests that neighborhood-based policies aimed at reducing poverty and unemployment, or improving high school and college graduation rates, will yield reductions in homicide regardless of the neighborhood's current level of homicide.

Of course, it is difficult for localities to develop policies and programs for reducing neighborhood characteristics such as poverty and unemployment. However, the analysis of intervening processes identified two characteristics that appear to mediate some of the effect of characteristics such as disadvantage and social disorganization on homicide rates. This suggests that policies aimed at increasing levels of interaction among neighborhood residents, or that reduce perceived levels of physical and social disorder, may be effective at reducing homicide levels even where disadvantage and disorganization persist. For example, efforts such as cleaning and repairing streets, removing graffiti, and eradicating drug sales and prostitution may

reduce residents' perceptions of physical and social disorder, which may in turn lead to reductions in homicide. Likewise, crime may be reduced through efforts to increase levels of social interaction among neighborhood residents such as funding block parties and festivals, forming a neighborhood watch, or by organizing neighborhood cleanups.

Another important finding from a policy perspective is that certain neighborhood characteristics are associated with high, persistent levels of homicide, even while other neighborhoods and the city as a whole are experiencing rapid declines in homicide. Specifically, social disorganization was found to yield high initial levels of homicide, and areas with high levels of disorganization tend to have homicide trends that do not fluctuate over time. Again, it is difficult for localities to design and implement policies that reduce concentrations of renter-occupied housing or prevent residential mobility. However, the mediation analysis suggests that policies targeting intervening mechanisms such as neighborhood ties and disorder may reduce levels of homicide even in areas with persisting social disorganization.

# INTRODUCTION

## STATEMENT OF THE PROBLEM

One of the most important social changes in the United States during the 1980s and 1990s was the dramatic increase and subsequent decrease in crime, and particularly violent crime. Perhaps nowhere was this more controversial and publicized than New York City, but the changes in Chicago were similarly dramatic. Indeed, the homicide rate in Chicago nearly tripled between 1965 and 1992, after which it declined by more than 50% through 2005. This is a remarkable pattern of change, but is this overall trend characteristic of all areas within the city? If not, what other patterns in homicide can be identified among Chicago neighborhoods, and what might explain the variation in homicide trends across neighborhoods?

Much of the prior research on neighborhoods and crime has drawn on the social disorganization perspective which argues that neighborhoods characterized by high levels of poverty, residential turnover, and heterogeneity find it difficult to realize common values and solve collective problems, which may in turn lead to higher rates of crime (Shaw and McKay, 1942) . Others have expanded the perspective by specifying the intervening mechanisms through which structural characteristics of neighborhoods may influence crime rates, such as through social ties, mutual trust, or a shared willingness to engage in informal control (Bellair, 1997; Bursik, 1988; Sampson and Groves, 1989; Sampson, Raudenbush, and Earls, 1997). Though these theoretical approaches are firmly grounded in an ecological approach that emphasizes temporal concepts such as instability, population turnover, deterioration, and cyclical change, surprisingly few studies have employed longitudinal designs to explicitly capture such processes (Bursik, 1986; Fagan and Davies, 2004). This is likely due in part to data limitations, as it can be

costly and time consuming to collect the necessary measures at multiple points in time. Moreover, at least in the early stages of the development of this perspective, statistical methods for effectively modeling change over time were not available. Thus, while a great deal of prior criminological research has examined variation across neighborhoods in levels of crime, much less work has been dedicated to describing crime trends within neighborhoods, and even less research has attempted to the identify characteristics associated with variation across neighborhoods in crime trends and trajectories.

Another possible reason for the predominance of cross-sectional research in the study of communities and crime is the strong emphasis by Shaw and McKay (1942) on the stability of crime-generating processes in neighborhoods (Bursik, 1984, 1986). That is, although rapid residential change was a large part of the social disorganization framework in the early Chicago School, there was an assumption that the processes that generated high crime in neighborhoods were, themselves, fairly stable over time. This led to their influential conclusion that neighborhood rates of juvenile delinquency remained relatively stable over time despite sometimes rapid changes in racial and ethnic composition within neighborhoods. However, a handful of studies in the 1980s and 1990s questioned this stability hypothesis, instead arguing that change in neighborhoods can occur through multiple processes, and even the same dynamic processes can lead to different outcomes across neighborhoods depending on their initial ecological characteristics and their current stage in the developmental process (Bursik and Grasmick, 1992; Schuerman and Kobrin, 1986; Taylor and Covington, 1988). This approach suggests that communities progress through developmental pathways that can yield variation across communities in not just crime rates at a single point in time, but also in their trajectories

of crime over a span of time.

This notion of community careers in crime parallels the concept of 'criminal careers' from the individual-level developmental and life-course literature where researchers often attempt to identify classes of individual offenders, such as abstainers, adolescent-limited delinquents, and life-course persistent offenders (Laub and Sampson, 2003; Moffitt, 1993; Piquero, Farrington, and Blumstein, 2003). If we were to think of crime patterns in terms of a neighborhood 'life-course', what types of trajectories might be evident? Do neighborhoods essentially mirror the city-level crime trend, with differences only in scale, or does the pattern of change over time vary across neighborhoods? Recent macro-level research has begun to directly address these questions, with a general finding that neighborhoods do, indeed, seem to exhibit a variety of crime trajectories that are sometimes considerably different from the trend of the broader city (Chavez and Griffiths, 2009; Griffiths and Chavez, 2004; Weisburd, Bushway, Lum, and Yang, 2004).

The purpose of this project is to analyze homicide trends in Chicago neighborhoods from 1980-2000. The first objective is to determine whether trends in homicide varied across Chicago neighborhoods from 1980-2000. A great deal of research has examined variation across neighborhoods in *levels* of crime, but much less work has been dedicated to describing crime trends within neighborhoods. A second, related objective will be to determine whether these neighborhood homicide trends can be categorized into a discrete set of trajectory groups, similar to the offending trajectory groups that have been identified by developmental criminologists.

The third objective expands upon the descriptive analysis by identifying determinants of neighborhood homicide trends. Prior research has documented various crime trajectories across

neighborhoods, but the next logical question is what gives rise to these various trajectories and, given similar levels of homicide at the beginning of the time period, what factors are associated with a neighborhood being categorized into one trajectory grouping over another? Drawing on the social disorganization and concentrated disadvantage literature, the focus of this objective will be to assess the degree to which structural characteristics of neighborhoods influence homicide trends, including factors such as poverty, unemployment, single-headed households, immigration, divorce, racial composition, density, and population mobility.

The fourth objective is to introduce community characteristics that are thought to mediate the influence of the previously mentioned factors on neighborhood homicide trends. Scholars have elaborated on the classic social disorganization model, arguing that concentrated disadvantage, population instability, and heterogeneity can reduce a community's ability to control its residents by reducing levels of social interaction and neighboring, mutual trust, the recognition of common goals and values, and legal cynicism. This study tests the expectation that more proximate neighborhood characteristics mediate the influence of the broader structural variables on homicide trends.

## LITERATURE REVIEW

### *Social Disorganization and Between-Community Variation in Crime*

Criminologists have long been interested in the extent to which crime and violence varies across neighborhoods. A large body of empirical research has identified substantial spatial variation in crime rates, and several major criminological theories have attempted to explain such between-unit differences. One of the earliest and most influential approaches to the study of

communities and crime in the United States was the analysis of community areas in Chicago by Shaw and McKay (1942). They followed an ecological framework arguing that natural processes of growth, competition, and decay in the city create areas with consistently high levels of poverty, ethnic heterogeneity, and population turnover. It was argued that these factors tend to reduce levels of interpersonal interaction and value consensus among residents which impedes the community's ability to achieve common goals and control its residents. Using analytic methods that were sophisticated and ambitious for the time, Shaw and McKay were able to show that areas near the central business district of Chicago were consistently and considerably higher in rates of juvenile delinquency than neighborhoods further from the city core.

A large body of empirical work has since studied variation in crime across communities from the social disorganization perspective. Early studies found effects of socioeconomic characteristics, racial heterogeneity, home-ownership, and transiency on juvenile delinquency (Lander 1954; Bordua 1958; Chilton 1964; Gordon 1967), though these studies failed to recognize the importance that Shaw and McKay placed on the tendency for these community characteristics to increase social disorganization and reduce informal social control. More recent research has expanded on Shaw and McKay's original framework by attempting to explicate the intervening mechanisms through which macro-social structural characteristics influence levels of informal social control and subsequently crime and delinquency (Sampson and Groves 1989; Simcha-Fagan and Schwartz 1986; Smith and Jarjoura 1988; Patterson 1991). This research attempted to further develop social disorganization theory into a systemic model of social control (Kasarda and Janowitz 1974; Brusik 1988; Bursik and Grasmick 1993). For example, Sampson and Groves (1989) used data from the British Crime Survey to provide a more direct test of the

social disorganization perspective by examining the mediating effects of local friendship networks, organizational participation, and the neighborhood capacity to supervise teens. They found that these indicators of social disorganization mediated much of the influence of neighborhood structural characteristics on crime and victimization. Likewise, Bellair (1997) found that getting together at least once a year with neighbors significantly reduced several forms of criminal victimization and mediated a large portion of the effects of ecological characteristics such as socioeconomic status and racial heterogeneity.

More recently, Sampson and colleagues have extended the social disorganization framework by emphasizing not just neighborhood ties, but also shared trust among neighborhood residents and a willingness to actively engage in social control (Sampson, et al. 1997; Morenoff, Sampson, and Raudenbush 2001). Neighborhoods with high levels of collective efficacy are characterized by mutual trust and shared expectations with regard to informal control, and are better able to effectively mobilize to control criminal behavior among residents. Several empirical studies, mostly utilizing data from the Project on Human Development in Chicago Neighborhoods (PHDCN), have found supportive results for the notion of collective efficacy. For example, Sampson, at al. (1997), found that commonly-used indicators of social disorganization – concentrated disadvantage, immigrant concentration, and residential instability – were inversely related to collective efficacy, and that the latter, in turn, was inversely associated with violent crime in Chicago neighborhoods. Likewise, Morenoff, et al. (2001) found that friend and kinship networks only reduce levels of neighborhood violence to the extent that they increase collective efficacy. Other research has found that collective efficacy significantly reduced neighborhood levels of homicide and non-lethal violence among intimates

(Browning 2002), and that communities with lower levels of mutual trust and civic engagement tend to have higher levels of homicide (Rosenfeld, Messner, and Baumer 2001).

*Social Disorganization and Within-Community Variation in Crime*

The studies cited above have contributed a great deal to our knowledge and understanding of variation in community levels of crime, yet they all examine neighborhood crime cross-sectionally. This is despite the fact that Shaw and McKay themselves utilized several decades of data to draw their conclusions, and central to their argument was the notion that urban growth and change are the fundamental precursors to social disorganization and crime. Though one of Shaw and McKay's most influential findings was that neighborhood crime rates were actually quite stable over time regardless of the invasion and succession characteristic of Chicago neighborhoods in the early part of the twentieth century, others warned that city ecology can change over time (Rosen and Turner 1967; Chilton and Dussich 1974; Schuerman and Kobrin 1986), and Bursik (1984: p.395) strongly states that "community processes related to delinquency can only be placed within larger urban dynamics and given a full meaning through longitudinal data".

Starting in the 1980's, research on neighborhood crime began to directly examine the influence of neighborhood characteristics on change over time (Bursik and Webb 1982; Bursik 1984; Bursik 1986; Heitgard and Bursik 1987; Taylor and Covington 1988). Bursik and Webb (1982) re-analyzed Shaw and McKay's claim that the distribution of delinquency across Chicago neighborhoods was relatively stable over time. Examining data from 1940-1970, they generally confirmed the stability hypothesis for the earliest decade, but found that compositional changes

in the subsequent decades were significantly related to changes in delinquency. Likewise, examining Baltimore neighborhoods from 1970-1980, Taylor and Covington (1988) found that increasing neighborhood instability was associated with increased levels of violence regardless of whether the neighborhood was undergoing decline or gentrification.

Subsequent research has expanded on these longitudinal approaches by simultaneously examining both within-neighborhood changes in crime and variation in crime trends across neighborhoods. In the first such study, Bursik and Grasmick (1992) found that neighborhoods characterized by increasing stability from 1930-1970 tended to experience significant declines in delinquency. They also showed that inferences about temporal processes gleaned from cross-sectional approaches could vary considerably from the conclusions drawn from research where time is directly incorporated. More recently, and using similar methods, Kubrin and Herting (2003) found significant variation in homicide trends across St. Louis neighborhoods from 1980-1994. They found that for some types of homicide, neighborhood disadvantage and instability helped explain both initial levels and changes over time.

*Community Careers in Crime*

An alternative approach to the study of neighborhood crime trends draws upon research in the developmental psychological literature that categorizes individuals into a discrete number of groups based on their pattern of delinquent, criminal, or deviant behavior over some period of time (Nagin 2005; Nagin and Land 1993). In the context of neighborhood crime, the objective is to identify a set of crime trajectories that are representative of the patterns found in neighborhoods across the city. Regression analysis can then be applied to identify the

characteristics associated with following a certain trajectory. Though the application of this approach to the macro-analysis of crime is very new, this sort of developmental perspective certainly follows the lead of urban ecology with its emphasis on the stages that communities pass through on their developmental trajectories.

Perhaps the first explicit application of the developmental perspective to the study of communities and crime was the study of crime trends in Los Angeles communities from 1950-1970 by Schuerman and Kobrin (1986). They introduced the notion of community careers in crime by categorizing neighborhood crime trends as either emerging, transitional, or enduring. They followed with an analysis of the determinants and consequences of each stage, finding that rising crime tended to be preceded by neighborhood deterioration characterized by factors such as increasing multiple-family dwellings and residential mobility. Subsequently, several studies have utilized contemporary methods of trajectory analysis to analyze neighborhood crime trends (Chavez and Griffiths 2009; Griffiths and Chavez 2004; Fagan 2008; Weisburd, et al. 2004). For example, using 14 years of crime data for Seattle street segments, Weisburd, et al. (2004) were able to classify 30,000 micro-areas into 18 unique crime trajectories. They found that the city's overall crime trend was primarily determined by a small proportion of cases in the steeply declining trajectories. Griffiths and Chavez (2004) identified three unique homicide trajectories for Chicago neighborhoods from 1980-1995, and found a diffusion effect of gun-related violence from clusters of neighborhoods with persistently high homicide rates to areas where homicide was moderate and slowly increasing. While these are important first steps in the application of the developmental perspective to neighborhood crime, none of these contemporary studies take the next step of identifying the theoretically relevant neighborhood characteristics that are

predictive of specific crime trajectories. As mentioned previously, this is a primary objective of the proposed study.

## RESEARCH DESIGN AND METHODS

### DATA SOURCES AND VARIABLES

Data for this project was compiled from a variety of sources. To generate the homicide rate (per 100,000), homicide incident counts were obtained from the Chicago Homicide Data Set available from the National Criminal Justice Archive at ICPSR (Block, Block, and ICJI, 1998). This data set includes tract identifiers that allow for merging with other tract characteristics. The population sizes used in the denominator of the homicide rate were obtained from the decennial U.S. Census files for each decade from 1980-2000, and cubic spline interpolation was used to generate intercensal estimates. Census tracts were excluded from the analysis if they had a population of less than 100 persons in any given year because such small denominators result in considerable instability in homicide rates. An additional two tracts (1701 and 3204) were omitted because they have no households. A large portion of the first tract is occupied by the Chicago-Read Mental Health Center, and the second tract is located in The Loop, and encompasses the Art Institute of Chicago, Grant Park, and several other green spaces. After removing these census tracts, the sample size was 827 tracts. The homicide rate is calculated per 100,000 population. Due to a high degree of skewness in the homicide rate, the following analysis uses the natural log of the homicide rate.[1]

As mentioned earlier, one objective was to examine the relationships between homicide

1 A small constant (1) was added to the homicide rate before logging in order to avoid undefined values caused by taking the natural log of zero.

trends and various characteristics of neighborhood structure identified as relevant by the social disorganization perspective. These variables are drawn from the 1980, 1990, and 2000 Census of Population and Housing. The 1980 data come from Summary Tape File 4A (STF 4A), the 1990 data come from Summary Tape File 3A (STF 3A), and the 2000 come from Summary File 3 (SF 3). Variables for this portion of the analysis include population size, median household income, poverty rate, unemployment rate, divorce rate, percentage of female-headed households, residential mobility, homeownership rate, racial and Hispanic composition, immigrant composition, percentage of households speaking English, and population density. In order to avoid the problems associated with high levels of multicollinearity among the regressors, several standardized mean indexes were created to represent key concepts identified in previous empirical and theoretical work (Land, McCall, and Cohen, 1990). All predictors are incorporated as both static levels at the beginning of the time period, and as change scores for the period 1980 to 2000 (Rosenfeld et al. 2007; Kubrin and Herting 2003).

The *concentrated disadvantage* index is comprised of median household income, the percentage of persons with a high school diploma, the percentage of persons with a bachelor's degree, percentage of persons who are African American, and the percentage of persons unemployed. The strong correlations between these component variables indicate that very high degrees of resource deprivation are differentially experienced by African Americans due to economic dislocation and high levels of racial residential segregation in Chicago (Land et al., 1990; Logan, Stults, and Farley, 2004; Massey and Denton, 1993; Morenoff et al., 2001; Wilson, 1987). It is expected that areas with high levels of disadvantage in 1980 will have trajectories with higher starting points, and that increases in concentrated disadvantage will be associated

with increasing homicide trajectories. This index had a reliability score of at least 0.88 in all years.

*Family disruption* is an index comprised of the percentage of persons age 15 and over who are divorced and the percentage of children who live with a single parent. Some have argued that neighborhoods with high rates of family disruption have a diminished capacity for formal and informal social control which may lead to higher rates of homicide (Cohen and Felson, 1979; Sampson, 1986, 1987). As with concentrated disadvantage, high levels and increases in family disruption are expected to yield high and increasing trajectories of homicide. This index had a reliability coefficient ranging from 0.51 in 1990 to 0.56 in 2000.

*Social disorganization* is measured with an index comprised of the percentage of persons who lived in a different house five years earlier, the percentage of homes that are renter-occupied, the percentage of housing units that are vacant, and population density. High levels of population turnover and density are likely to inhibit the ability of residents to recognize each other and develop friendship networks (Kasarda and Janowitz, 1974; Kornhauser, 1978; Wirth, 1938), and residents in such areas may be less willing to exercise informal social control and guardianship behavior (Morenoff et al., 2001; Sampson et al, 1997). Thus, it is expected that areas with high levels of social disorganization in 1980 will have high starting points to their homicide trajectories, and that neighborhoods with increasing disorganization will be more likely to have increasing homicide trajectories. This index also exhibited a high level of reliability, with alpha coefficients of 0.60 in all years.

*Immigrant concentration* is measured using an index comprised of the percentage foreign-born and the percentage Hispanic. Though popular opinion among the American public

is often that immigration and crime are strongly, positively related, much of the empirical research shows that immigrants are less likely to engage in crime than native-born Americans after controlling for other characteristics (Hagan and Palloni, 1999; Mears, 2010). Moreover, macro-level research typically finds either a null or negative relationship between immigrant concentration and crime rates (Chavez and Griffiths, 2009; Lee, Martinez, and Rosenfeld, 2001). Perhaps part of the reason for the presumed positive relationship between immigration and crime is the fact that immigrants are more likely to live in disadvantaged neighborhoods than their native-born counterparts (Alba, Logan, and Bellair, 1994; Alba, Logan, and Stults, 2000). Thus, it is expected that neighborhoods with higher concentrations of immigrants may have higher initial homicide rates at the start of the time period, but controlling for levels of disorganization and disadvantage, areas with increasing concentrations of immigrants will be associated with a declining homicide trajectory. This index had a reliability coefficient of at least 0.8 in all years.

As an initial attempt at determining whether the effect of these structural characteristics on neighborhood crime trends are mediated by emergent properties of neighborhoods such as social cohesion, collective efficacy, and disorder, this study also incorporates data from the 1994-1995 Community Survey of the Project on Human Development in Chicago Neighborhoods, which is also accessible from the National Archive of Criminal Justice Data. This survey contains responses from interviews conducted with 8,782 Chicago residents comprising a representative sample for each of the 343 neighborhood clusters of Chicago. The resulting data set includes measures such as willingness to engage in informal social control, social cohesion and trust, and social and physical disorder. The community survey was conducted in 1994-1995, so the timing is not ideal for incorporation into a study of homicide

trends from 1980-2000. Therefore, this portion of the analysis is restricted to just the years 1990-2000, and it is viewed as an initial effort to identify theoretically relevant mediating effects, and will hopefully stimulate future research. Because many of the community-level measures included in the PHDCN are highly collinear, two variables were selected as possible intervening mechanisms. The measure of *neighborhood ties* is an mean index derived from 5 survey items asking how often people in the neighborhood do favors for one another, how often neighbors watch over each other's property, how often neighbors as for advice, how often people in the neighborhood get together, and how often people in the neighborhood visit in each other's homes. Response categories for the constituent items ranged from a value of 1 for "never" to a value of 4 for "often". The *disorder* index is comprised of items measuring perceived levels of both social and physical disorder, including questions asking how much of a problem is posed by litter, graffiti, vacant buildings, drinking in public, using or selling drugs in public, and groups of teenagers or adults hanging out and causing trouble. Additional detail about the survey items that make up each of these indexes is provided in Appendix A.

## ANALYTIC PLAN

Because temporal and spatial analysis of neighborhood crime is a complex and relatively new endeavor, a comprehensive approach is taken. This involves a variety of analytical methods including hierarchical growth-curve modeling, semi-parametric group-based trajectory modeling, and the analysis of spatial dependence. The first objective of this study is to determine whether the overall homicide trend in Chicago from 1980-2000 is representative of all neighborhood trends, with differences only in levels or scale, or if there is significant spatial variation in

homicide trends at the neighborhood level. This question can be addressed using growth-curve modeling which involves the estimation of parameters that describe the average initial level of homicide for all tracts as well as coefficients that describe the average pattern of change over time. By nesting time-periods within neighborhoods, within-unit change in the homicide rate can be modeled as a linear or nonlinear function of time with a resulting model for each tract that includes an intercept representing the initial level of homicide at the beginning of the time period, and regression coefficients representing the effects of time on the homicide rate. A linear model would produce a single trend coefficient, whereas a nonlinear specification would require the addition of higher order terms resulting in additional coefficients. Key to this objective, variance components from these models provide an indication of whether there is significant variation in the homicide trend parameter estimates across neighborhoods (Kubrin and Herting 2003; Phillips and Greenberg 2008).

If the analysis under the first objective determines that homicide trends vary across neighborhoods, the second objective is to evaluate the number of different trajectories that can be used to characterize change over time in homicide rates in Chicago neighborhoods, and to describe those trajectories. This will be accomplished using semi-parametric group-based trajectory modeling via the SAS module PROC TRAJ (Nagin 2005; Nagin and Land 1993; Jones, Nagin, and Roeder 2001). This approach uses mixture models to identify a finite set of neighborhood crime rate trajectories within which each individual neighborhood can be categorized. The Bayesian Information Criterion (BIC) statistic is used to determine whether modeling additional trajectories leads to an increase in model fit, and whether fit is maximized by modeling each trajectory as linear, quadratic, or cubic. This iterative process will yield a set

of parameter estimates that describe each trajectory group, and it will provide a graphical display of the optimal number of homicide rate trajectories.

The third objective goes beyond descriptive analyses by evaluating whether any observed variation in homicide trends across neighborhoods is associated with theoretically relevant variables identified in the existing macro-level literature on communities and crime. Again, a comprehensive approach will be taken. The first approach takes advantage of a key output of group-based trajectory modeling. The PROC TRAJ procedure produces a set of posterior probabilities of group assignment which allow for the categorization of each neighborhood into one of the estimated trajectories. These trajectory group assignments can them be used as the dependent variable in a set of logistic regression models that evaluate whether other neighborhood characteristics are predictive of the trajectory that a particular neighborhood follows. This extends prior research by not only identifying a set of homicide trajectories within which neighborhoods can be categorized, but also assessing the extent to which other neighborhood characteristics can predict homicide trajectory assignments.

Next, the hierarchical growth curve modeling described earlier will be expanded to evaluate whether the parameters from the growth curve models estimated under the first objective are significantly related to the census-based structural characteristics of neighborhoods. That is, assuming there is variability in the trend parameters across neighborhoods, additional multi-level growth curve models can assess whether that variability is associated with characteristics of neighborhoods such as concentrated disadvantage, social disorganization, family disruption, and immigrant concentration.

Finally, the fourth objective is to test whether any observed effects of neighborhood

structural characteristics on homicide levels and trends are mediated by characteristics such as neighborhood ties and perceived disorder. This will be assessed by expanding the growth-curve models from the third objective, adding collective efficacy and social disorder as explanatory variables. The expectation is that any observed effects of the structural characteristics in the previous models will be attenuated after introducing neighborhood ties and perceived disorder, thus suggesting a process through which neighborhood characteristics such as disadvantage and instability influence homicide trends largely through their effect on these intervening characteristics.

# RESULTS

## NEIGHBORHOOD VARIATION IN HOMICIDE TRENDS

The first question to be addressed is whether there is significant variation in homicide trends across Chicago neighborhoods. Figure 1 shows the trend in the homicide rate from 1980-2000 for the city of Chicago overall, as well as for the average neighborhood within Chicago. Both trends show a gradual decline from 1980 to 1985, followed by an increase into the early 90's, and a subsequent decline through 2000. Certainly, it can be expected that some neighborhoods will have levels of homicide that are higher than these average levels, and others will have lower levels. However, it is possible that the primary source of deviation from the overall trend will be only in levels of homicide at each time point, such that neighborhoods predominantly follow the same general trend, just at higher or lower levels. On the other hand, it is also possible that neighborhoods vary not just in levels of homicide, but also in the trajectory that homicide rates follow over time.

Figure 2 again shows the observed trajectory of the average Chicago neighborhood, but it also includes observed trajectories for six different Chicago census tracts superimposed over it. These tracts were chosen purposively to illustrate the wide variety of trends exhibited across neighborhoods. Though not necessarily a representative sample of tracts, this selection clearly shows a variety of different patterns of homicide over time, with variability in levels of homicide in 1980, different general levels of homicide over time, and varying directions of change. Indeed, a visual examination of the trajectories for all Chicago census tracts over this period reveals a multitude of different trends, with varying trajectories at all levels of homicide.

While these visual inspections suggest considerable variability in homicide trajectories across neighborhoods, it is still possible that the particular selection of census tracts shown in Figure 1 overestimate the degree of variability, and that a more systematic analysis of all neighborhoods could reveal that neighborhoods tend to follow the same general trend, perhaps with differences only in degree. For additional evidence, we turn to the two statistical methods for evaluating trends and trajectories – semi-parametric group-based trajectory modeling, and hierarchical growth curve modeling.

## GROUP-BASED TRAJECTORY ANALYSIS

The group-based trajectory modeling (GTM) of homicide trajectories follows a two-stage process (Nagin, 2005). The initial stage entails first estimating a one group model with a quadratic functional form, then a two group model, a three group model, and so on, until the inclusion of an additional group no longer improves model fit according to the BIC statistic. Though the maximum likelihood always increases with each additional groups, the BIC statistic

includes a penalty for each additional parameter, thus rewarding parsimony. The BIC statistics presented in Table 1 show whether allowing for additional groups led to an increase in model fit, and the log Bayes factors presented in the last column provide a measure of the degree of evidence favoring each more complex model over the previous simpler model. A log Bayes factor of greater than 10 is typically considered to be very strong evidence that a given model is favorable to the previous one (Jones et al., 2001). These results show that each additional group provides an improvement to model fit up to an eight-group model, with each successive model producing a log Bayes factor of well over 10. The estimation of a nine-group model resulted in false convergence, so the eight-group model emerges as the clear choice. Specifying alternative functional forms (e.g. linear or cubic) either failed to reach convergence or did not yield an improvement to model fit, so all trajectories were estimated as quadratic. The average posterior probability of group assignment for all tracts was 0.935, further suggesting that the selected model fits the data well.

[ Table 1 about here ]

The predicted trajectories based on the eight-group quadratic model are illustrated in Figure 3. Overall, we see that these eight trajectories are visibly distinct from one other and represent very different patterns of change in homicide. The first two trajectory groups start at very low levels of homicide in 1980, but diverge in their trajectories from that point. Group 1, comprising about 15% of all census tracts, is characterized by persistently low levels of homicide throughout the full time period. Group 2 gradually increases from initially low levels to among the highest levels by 2000. Groups 3 and 4 start from similarly moderate levels in 1980, with group 5 just a little higher, but these three groups exhibit divergent trends over time with one

increasing, one declining, and one remaining mostly stable. Finally, groups 6, 7, and 8, start at considerably higher levels in 1980. Group 8 remains consistently high over the two decades, while group 6 declines markedly, and group 7 also declines but at a slower pace.

[ Figure 4 about here ]

*Structural Characteristics of Homicide Trajectory Groups*

It is clear from the GTM analysis and the visual illustration in Figure 3 that census tracts exhibit a variety of different trajectories of homicide over this time period. Tracts within a particular group are similar in their homicide trajectory, but do they have other common characteristics, and might these other characteristics be used to differentiate among the various groups in theoretically meaningful ways? Figures 4 and 5 present structural characteristics of the average tract in each trajectory grouping. Figure 4 provides mean values in 1980 – the starting point of the series – while Figure 5 provides average levels of change between 1980 and 2000. The mean values used to generate each figure are presented in tabular form in Appendices A and B.

While evaluating the mean initial values shown in Figure 4, it is helpful to recognize that the trajectory groups are numbered according to their starting points for homicide in 1980, such that group 1 has the lowest average homicide rate in 1980 and group 8 has the highest average rate. Considering this ordering, a fairly consistent pattern emerges from Figure 4; census tracts in trajectory groups with low homicide rates in 1980 also have the lowest average starting levels of disadvantage, social disorganization, and family disruption, and tracts in trajectory groups with high starting levels of homicide have the highest average starting points for these

characteristics. The pattern is less clear for immigrant concentration. For most of the groups, starting levels of homicide appear to be positively related to starting levels of immigrant concentration. For example, groups 1 and 2 have the lowest starting levels of homicide in 1980, and they also have among the lowest starting levels of immigrant concentration. Likewise, groups 6 and 7 have among the highest starting levels of homicide as well as the highest levels of immigrant concentration. However, two trajectory groups run contrary to this pattern. Tracts in group 3 have relatively low starting levels of homicide, but they have the second-highest average immigrant concentration of all groups, and tracts in group 8 have among the highest average starting levels of homicide in 1980, but they have the lowest average starting level of immigrant concentration of all groups. Finally, it is interesting to note that tracts in group 5 had moderate average starting levels of homicide in 1980, but they have considerably low average levels of disadvantage. Nearly all of these mean differences across groups are statistically significant (see Appendix A).

[ Figure 5 about here ]

Figure 5 displays mean levels of change in each variable from 1980-2000 for each trajectory group. This provides an initial indication of whether census tracts in trajectory groups experiencing increases in homicide over the period also experienced increases in other theoretically relevant characteristics. Recall from Figure 3 that trajectory groups 5, 6, and 7 are characterized by declining homicide rates, though from different starting points. Figure 5 shows that these three groups were also the only ones that experienced decreases in all of the structural characteristics. Likewise, groups 2 and 4 exhibited sharp increases in homicide over the period, and Figure 5 shows that these also experienced increases in all four of these structural

characteristics.

Figure 5 also shows that the relationship between changes in structural characteristics and changes in homicide is not always clear across trajectories. For example, tracts in groups 5, 6, and 7 experienced average declines in both homicide and immigrant concentration, while group 8 also experienced a decline in immigrant concentration, but it had persistently high and slightly increasing homicide rates. This suggests that declines in immigrant concentration are generally associated with declines in the homicide rate, except in neighborhoods with persistently high levels of homicide.

*Predictors of Trajectory Group Assignment*

The final stage of the group-based trajectory analysis involves the use of logistic regression to identify characteristics of neighborhoods that are significantly associated with membership in a given trajectory group over others while controlling for other characteristics. One approach would be to include all eight trajectory groups in a single multinomial logistic regression. However, the number and diversity of comparisons that this would produce would yield a highly complex set of findings that would likely defy interpretation. Instead, the following analysis will be conducted on subsets of the full set of trajectories, using sets of trajectory groups that provide particularly interesting and substantive comparisons.

The first homicide trajectory groups to be analyzed are groups 1 and 2, with results of the logistic regression reported in Table 2. Both of these trajectories start with very low levels of homicide in 1980, but they change over time in different ways. Group 1, with persistently low levels of homicide, serves as the reference group in contrast to group 2 which experienced an

increase over this time period to moderate levels of homicide. Thus, the purpose of this model is to address the question "among census tracts with low levels of homicide in 1980, what characteristics are predictive of following an increasing trajectory versus a persistently low trajectory?".

[ Table 2 about here ]

The results in Table 2 show that the only characteristics that significantly differentiate between these two trajectory groupings are initial levels and changes in concentrated disadvantage. Specifically, census tracts with higher initial levels of disadvantage, and increasing levels over time, are more likely to be assigned to the trajectory group with increasing levels of homicide. This is particularly interesting given that these two groups have very similar initial levels of homicide, indicating that this effect is not simply capturing cross-sectional differences in initial homicide levels. Based on the average levels of change shown in Figure 5, we might have expected that increases in family disruption and immigrant concentration would also be predictive of membership in group 2. The effects of these variables were positive in the logistic regression model, but not quite statistically significant.

[ Table 3 about here ]

Table 3 presents the results from a multinomial logistic regression model that evaluates the predictors of being assigned to trajectory group 4 or 5 compared with being assigned to group 3. These three groups all start at moderate levels of homicide in 1980, but group 5 declines over time while group 3 remains at moderate levels and group 5 increases. The reference category for these models is trajectory group 5, so the model is predicting assignment to a persistent or increasing trajectory group as opposed to a declining trajectory group. Here again, we see that

concentrated disadvantage is the only statistically significant predictor, and both initial levels and change in concentrated disadvantage appear to be predictive of being in groups 3 or 4 compared with group 5.

[ Table 4 about here ]

Table 4 provides the results from a multinomial logistic regression model comparing groups 7 and 8 with group 6. All of these groups started with the highest average homicide levels in 1980. Group 6 declined sharply over the period, while group 7 decline less markedly, and group 8 remained persistently high. Once again, we see that concentrated disadvantage significantly predicts group assignment, though the effect of change in disadvantage does not significantly differentiate between assignment in group 7 versus group 6. Contrary to the previous regressions, however, additional structural characteristics appear as significant predictors in these models. The comparison of group 7 with group 6 shows that tracts with high and increasing levels of family disruption and immigrant concentration are more likely to be assigned to the group with less of a decline in homicide. Likewise, tracts with increasing levels of family disruption are more likely to be assigned to the persistently high trajectory group (group 8) as opposed to the sharply declining group (group 6).

## HIERARCHICAL GROWTH-CURVE ANALYSIS

Group-based trajectory analysis has many advantages, and as seen above, it can be used effectively to illustrate the nature of neighborhood crime trajectories over time, and to identify potential predictors of particular trajectory groupings. However, as is the case with most statistical methods, group-based trajectory analysis has its own set of shortcomings and

detractors. Perhaps the most commonly voiced concern about GTM is that its emphasis on the identification of discrete trajectory groups tends to reify groups that do not actually exist in a concrete sense (Raudenbush 2005; Sampson and Laub 2005). Rather, the group trajectories are statistical generalizations of the trends for the individual units within the group. Even the original authors of the GTM method have warned of the risk of reification (Nagin and Tremblay 2005), explaining that the groups should be used only as approximations of trajectories, and that the underlying distribution of individual trajectories may actually be continuous.

Hierarchical growth curve modeling (HGCM) provides an alternative and widely-used method for modeling this heterogeneity among trajectories. Rather than assigning each unit to a single trajectory group, HGCM models between-unit variation from the average trajectory by estimating random coefficients for the intercept and the slope coefficients for the time variables. Specifically, a multi-level model is estimated where the level-one model consists of the homicide rate regressed on a cubic function of time, producing coefficients for the intercept, year, year squared, and year-cubed. The level-two model essentially regresses these coefficients on a vector of characteristics of tracts that are believed to predict variation in homicide trends across census tracts. In the models presented below, both the linear and quadratic trend parameters are allowed to vary randomly across tracts. The year variable is centered on 1980 – the first year in the series – and all covariates are grand-mean centered. Thus, the model intercept indicates the predicted homicide rate in 1980 for a census tract with average levels of all the predictor variables. The independent variables used in these models include the same characteristics that were used to predict trajectory group membership – concentrated disadvantage, social disorganization, family disruption, and immigrant concentration. A control for spatial

autocorrelation is also included in the form of a variable representing the average homicide rate in surrounding census tracts based on queen contiguity.

*Unconditional Model*

The top panel of Table 5 provides results from an unconditional hierarchical growth-curve model predicting the logged neighborhood homicide rate, with only year, year squared, and year cubed as the predictors. Looking first at the fixed effects, the intercept indicates that the average census tract had a logged homicide rate in 1980 of 2.567, which corresponds with an unlogged homicide rate of 12.03 per 100,000. [2] The significant coefficients for all three trend parameter estimates suggests a cubic functional form for the average homicide trajectory over time, where the average homicide rate declines initially, then increases, and eventually declines again. This follows the overall observed trends for the city of Chicago and the average Chicago neighborhood shown earlier in Figure 1. The variance components for the intercept and the trend parameters are all statistically significant, indicating that there is significant variation across census tracts in homicide trajectories.

*Conditional Model*

The second panel of Table 5 provides the coefficient estimates from a conditional model where the time-varying covariates are added to the model as predictor variables. Since the covariates have all been grand-mean centered, the coefficients for the intercept and the year

[2] Recall that a small constant (1) was added to each homicide rate in order to avoid undefined values when the homicide rate is zero. Therefore, the predicted unlogged homicide rate is equal to the exponentiation of the predicted logged homicide rate minus one.

variables describe the predicted trend for a census tract with average values for all the covariates. The coefficients for each of the covariates indicate the effect of the given characteristic on starting levels of homicide, and its effect on each of the trend parameters. For example, the effect for concentrated disadvantage in the first column of coefficients shows the effect that disadvantage has on the starting point for the homicide rate growth curve. The positive coefficient (b=0.794) indicates that tracts with higher levels of disadvantage tend to have higher starting homicide rates in 1980. The non-significant coefficients for concentrated disadvantage in the subsequent columns indicate that disadvantage does not have a significant effect on any of the trend parameter estimates. Family disruption also has a significant, positive effect on initial levels of homicide (b = 0.354), and similar to concentrated disadvantage it does not affect the trend in homicide over time.

In contrast, both social disorganization and immigrant concentration significantly influence all three trend parameter estimates (e.g. year, year-squared, and year-cubed), though the direction of the effects varies. First, higher levels of social disorganization are associated with higher levels of homicide in 1980, as indicated by the significant positive effect of disorganization on the intercept (b=0.354). Moreover, disorganization significantly influences the trend over time in homicide rates. The declining linear trend that was evident in the main effect for year (b=-0.055) is less steep and perhaps even positive in areas with increasing disorganization (b=0.101). Likewise, the subsequent increase in homicide indicated by the main effect of year-squared (b=0.007) is also weaker where social disorganization is higher (b=-0.016). Finally, the tendency for homicide rates to decline again toward the end of the period as evidenced in the effect of year-cubed (b=-0.0003) is less pronounced in more disorganized areas

(b=0.0005), with the trend actually becoming positive at certain levels of disorganization. Thus, it appears that areas with high levels of disorganization tend to have homicide rates that are higher in 1980, and that exhibit less fluctuation over time.

Immigrant concentration also significantly influences all three trend parameter estimates, but in a manner that differs from the effects just described for social disorganization. The direction of the effects of immigrant concentration on year, year-squared, and year-cubed are opposite of the effects for social disorganization, which suggests that areas with higher levels of immigrant concentration tend to have homicide rates that change with greater volatility. That is, the linear trend declines at a greater rate, the subsequent increase indicated by the quadratic coefficient is heightened, and the eventual decline suggested by the cubic coefficient is also accentuated.

Table 5 provides additional information about any remaining variability in homicide trends. First, the quadratic and cubic trend estimates remain statistically significant even after controlling for these four structural characteristics as well as homicide rates in surrounding census tracts. This indicates that the overall temporal pattern indicated in the unconditional model has not been fully explained by changes over time in these tract characteristics, though the estimate for the linear trend is no longer significant. Second, the significance of the variance components for the intercept and the linear and quadratic temporal trends indicates that variability in homicide trends across census tracts persists even after controlling for these characteristics.

*Modeling Intervening Mechanisms*

The final stage of analysis involves the estimation of similar growth curve models predicting homicide trends, but including intervening variables that may mediate the effects of the structural characteristics of neighborhoods. As described earlier, this analysis will use measures of neighborhood ties and perceived disorder from the 1994-1995 Community Survey of the Project on Human Development in Chicago Neighborhoods. Since this source provides only cross-sectional measures of neighborhood characteristics measured in the period 1994-1995, this is seen as a preliminary attempt to identify intervening processes with the hope that longitudinal measures will become available in the future. Since the measures are only available in the mid 1990s, the following models are estimated for a shorter period of time – 1990 to 2000.

The first panel of Table 6 provides results of a hierarchical growth-curve model that is similar to the model presented in Table 5, but that differs in several important ways. First, as noted, this model is for the period 1990-2000. During this time period homicide initially increases through the early 90s, and then declines steadily through 2000. Therefore, the model presented in Table 6 includes only a linear and quadratic term for the year variable. Also, because the PHDCN variables are measured for neighborhood clusters, this is a 3-level model with years nested within census tracts, nested within neighborhood clusters. The first panel of Table 6 provides coefficient estimates for a model that does not include the intervening variables, and the second panel provides estimates from a model that does include these characteristics.

The coefficients for the year variable in the first panel of Table 6 show a significant trend in the homicide rate where homicide initially increased, on average, and then declined ($b = 0.074$ and $-0.012$). Despite the fact that this model only covers the period 1990-2000, we see effects of

the structural characteristics that are very similar to the effects seen in Table 5 for the full period. Specifically, concentrated disadvantage and family disruption only affect starting levels of homicide, while social disorganization and immigrant concentration also influence the trend over time. Also similar to the previous model, increasing disorganization is associated with a more persistently high homicide level, while immigrant concentration tends to accentuate the overall trend by enhancing the initial increase and subsequent decrease.

The results in the second panel of Table 6 show the effects from a model that includes the intervening variables – neighborhood ties and perceived disorder. Several notable findings emerge. First, the significant effects of neighborhood ties and disorder on the intercept indicate that these two characteristics are associated with initial levels of homicide. Specifically, tracts with more extensive neighborhood ties in 1994-95 tend to have a homicide trajectory over the 1990-2000 period that started at lower levels in 1990 ($b = -0.662$). Likewise, tracts with greater perceived disorder tend to have trajectories that started at higher levels ($b = 1.460$). However, neither of these characteristics is associated with the linear or quadratic trend. This is not surprising given that the trend parameters reflect change over time, while neighborhood ties and disorder have been measured at only a single point in time.

The primary motivation for including neighborhood ties and perceived disorder was to evaluate whether these factors mediate the effect of the structural characteristics on homicide trends. Again, since the intervening variables are measured cross-sectionally, any observed mediation is most likely to occur for the effects of the structural characteristics on the intercept rather than on the linear and quadratic trends. Indeed, the results in the second panel of Table 6 show that social disorganization and immigrant concentration continue to exhibit significant

effects on year and year-squared, and they are largely unchanged from the model that did not include the intervening variables. However, the effects of all of the structural characteristics on the intercept change substantially after controlling for neighborhood ties and perceived disorder. The effect of concentrated disadvantage declines the most (51%) from an effect of 0.991 to 0.489, and the effect of social disorganization declined nearly as much (48%). Both changes are statistically significant. The effect of family disruption declines by about 18%, and the negative effect of immigrant concentrations becomes even more negative, but neither of these differences are statistically significant.

# CONCLUSIONS

## DISCUSSION OF FINDINGS

The first objective was to determine whether the overall homicide rate trend for Chicago from 1980-2000 is representative of all neighborhoods, with most differences occurring only in levels of homicide, or whether there is significant variation in homicide trends across neighborhoods. The variance components from the unconditional growth curve model indicated that there was, indeed, variability in homicide trends as expected. Moreover, satisfying the second objective, results from the semi-parametric group-based trajectory analysis revealed eight distinctive trajectories starting at low, moderate, and high levels of homicide in 1980, with some of them remaining stable over time, some increasing, and some declining. These results clearly show that homicide trends vary considerably across neighborhoods over this time period. This is an important finding given that so much attention has been paid to the crime decline observed in the United States over the past two decades, and the relative uniformity in crime trends in US

cities over this period, with variations mostly in the timing and amplitude of their trajectories. Far less attention has been directed at variability in crime trends across subareas within cities. The results from the first and second objectives of this study indicate that this is an important oversight, and that the variability in homicide trends across neighborhoods merits further analysis.

The third objective went beyond this descriptive analysis by evaluating whether the observed variation in homicide trends across neighborhoods is associated with theoretically relevant variables. The expectation was that initial levels of homicide in 1980, as well as the nature and rate of change over time, would be influenced by neighborhood levels of concentrated disadvantage, social disorganization, family disruption, and immigrant concentration. This was first tested by regressing trajectory group assignments on these neighborhood characteristics using binary and multinomial logistic regression. The most consistent predictor of trajectory group assignment was concentrated disadvantage. The initial level of disadvantage in 1980, as well as increases in disadvantage from 1980-2000, were predictive of being assigned to homicide trajectory groups with higher starting levels and with trajectories that increased over time. In fact, concentrated disadvantage was the only distinguishing characteristic between trajectory groups with low or moderate starting levels of homicide.

When distinguishing among trajectory groups with high starting levels of homicide, family disruption and immigrant concentration appeared as significant predictors in addition to concentrated disadvantage. Specifically, neighborhoods with declining family disruption were more likely to be assigned to the sharply declining trajectory group versus the persistently high trajectory, and neighborhoods with higher initial levels of immigrant concentration were more

likely to be assigned to the moderately declining versus the persistently high trajectory group.

Overall, these findings show that higher and increasing levels of concentrated disadvantage are predictive of being in trajectory groups with higher and increasing homicide rates regardless of whether initial rates of homicide are low, moderate, or high in 1980. Whereas social disorganization is not predictive of homicide trajectory group assignment in any of the group comparisons, family disruption and immigrant concentration provide additional explanatory strength, but only for neighborhoods with very high initial levels of homicide.

An alternative approach to identifying characteristics associated with neighborhood homicide trends involved the use of hierarchical growth-curve modeling for the same time period. Similar to the trajectory analysis, these results showed that concentrated disadvantage was predictive of starting points of homicide in 1980, yet it did not appear as a significant predictor of change over time. This was also true for family disruption. On the other hand, social disorganization and immigrant concentration were predictive of both initial levels of homicide and variability in change over time. These findings again underscore the point that certain structural characteristics of neighborhoods are predictive of neighborhood homicide trends.

The final objective was to test whether the observed effects of characteristics such as disadvantage and immigrant concentration on homicide trends are mediated by intervening mechanisms such as neighborhood social ties and disorder. This analysis used a truncated time series from 1990-2000 and cross-sectional measures of social ties and disorder from the Project on Human Development in Chicago Neighborhoods. Results showed that the effects of concentrated disadvantage and social disorganization on initial levels of homicide were

significantly and substantially reduced after controlling for social ties and disorder.

## IMPLICATIONS FOR POLICY AND PRACTICE

Despite the fact that the majority of research on communities and crime has been cross-sectional, the theoretical and empirical literature clearly emphasizes the importance of change over time in neighborhood structure and social processes for understanding change over time in rates of crime. As researchers continue to gather longitudinal data at the neighborhood level, and as the statistical methods for analyzing change continue to advance, it is important to consider whether we must revise or reorient our theoretical approach to the study of variation in crime trends across local areas. A large body of empirical literature has developed regarding the predictors of homicide across communities, and that research has shown a large degree of consistency in the relevance of particular structural characteristics across different time periods and across different levels of aggregation (Land et al., 1990; McCall, Land, and Parker, 2010). Thus, the expectations are fairly clear regarding between-neighborhood variation in crime rates, and from these it is easy to extrapolate expectations about within-community change over time. The current analysis of between-neighborhood variability in within-unit homicide trends may appear, at first glance, to be simply a combination of the traditional cross-sectional and longitudinal approaches seen in prior work. However, the preceding analysis and discussion suggests that current theoretical frameworks may not be sufficiently developed to offer clear expectations with regard to the between-unit variability in neighborhood trajectories of homicide.

This line of research could yield important policy recommendations. If we can consistently identify characteristics associated with certain crime trajectories, and assuming these

characteristics are responsive to social policies and programs, policy makers could apply interventions that are specifically targeted at neighborhoods at a particular stage of development. For example, the finding from the trajectory analysis that changes in concentrated disadvantage are associated with homicide trends for neighborhoods at low, moderate, or high levels of homicide suggests that neighborhood-based policies aimed at reducing poverty and unemployment, or improving high school and college graduation rates, will yield reductions in homicide regardless of the neighborhood's current level of homicide.

These findings are encouraging in light of prior research showing that even disadvantaged communities can effectively mobilize in response to common needs and goals ((Perkins, et al. 1990; Swaroop and Morenoff 2006). For example, Swaroop and Morenoff (2006) found that there was little association between neighborhood disadvantage and community participation, though the results varied somewhat depending on whether the motivation for participation was expressive or instrumental. While expressive participation is motivated by a sense of identity and includes actions designed to promote a sense of community among residents, instrumental participation is motivated by a desire to protect community interests and solve specific community problems. Their analysis of a survey of individuals in Chicago neighborhoods found that residents of disadvantage communities are actually more likely to engage in expressive community participation than those in affluent communities. They found a similar effect for instrumental participation, but only to a point. After a certain level of community disadvantage is reached, further increases in disadvantage yield declines in instrumental participation. This finding underscores one of the conclusions drawn in the current study – that approaches to crime reduction must be custom-tailored to the developing

characteristics of the community.

Of course, it is difficult for localities to develop policies and programs for reducing neighborhood characteristics such as poverty and unemployment. However, the analysis of intervening processes identified two characteristics that appear to mediate some of the effect of characteristics such as disadvantage and social disorganization on homicide rates. This suggests that policies aimed at increasing levels of interaction among neighborhood residents, or that reduce perceived levels of physical and social disorder, may be effective at reducing homicide levels even where disadvantage and disorganization persist. For example, efforts such as cleaning and repairing streets, removing graffiti, and eradicating drug sales and prostitution may reduce residents' perceptions of physical and social disorder, which may in turn lead to reductions in homicide. Indeed, prior research has found that improvements to the physical environment of the community are associated with increased cohesion and neighborhood participation (Markowitz, et al 2001; Perkins, et al. 1990; Skogan 1990), though the causal relationship between physical disorder and crime has been debated (Sampson and Raudenbush, 1999; Taylor 1996). Research also suggests that these increased levels of social interaction may lead to reduced crime through increases in collective efficacy and informal social control (Bellair 1997; Morenoff, Sampson, and Raudenbush 2001; Sampson, Raudenbush and Earls 1997).

These results point to clear policy recommendations such as funding block parties and festivals, forming a neighborhood watch, or organizing neighborhood cleanups, and results from existing programs suggest that these efforts can be successful. For example, the Kansas City Building Blocks program was an effort to generate neighborhood commitment and help develop and maintain relationships among residents (Ohmer and Beck 2006). Community organizers

were hired to work with residents to develop a "collaborative plan for their block, and developing projects to make that vision a reality, including forming crime watch groups, shutting down crack houses, developing community gardens, and rehabilitating dilapidated housing" (Ohmer and Beck 2006:195-196). Likewise, several studies have found that community gardening programs lead to increased social ties and collective efficacy among not just the program participants, but also among the broader community (Alaimo, Reischl, and Allen 2010; Teig, et al. 2009).

Another important finding from a policy perspective is that certain neighborhood characteristics are associated with high, persistent levels of homicide, even while other neighborhoods and the city as a whole are experiencing rapid declines in homicide. Specifically, social disorganization was found to yield high initial levels of homicide, and areas with high levels of disorganization tend to have homicide trends that do not fluctuate over time. Again, it is difficult for localities to design and implement policies that reduce concentrations of renter-occupied housing or prevent residential mobility. However, the mediation analysis suggests that policies targeting intervening mechanisms such as neighborhood ties and disorder may reduce levels of homicide even in areas with persisting social disorganization.

## DIRECTIONS FOR FUTURE RESEARCH

The analysis presented in this article expands on prior research in important ways, but several limitations and suggestions for future research should be discussed. First, most of the analysis relied on census data for measuring the theoretically relevant independent variables. Though the final models incorporated survey-based measures of neighborhood ties and perceived

disorder, these were measured at only a single point in time. Because of this, it is not surprising that these characteristics only appeared to mediate the influence of structural characteristics on initial levels of homicide, and not on trends over time. It is possible that if we were to measure these social process and perception variables over time, we would find that they also mediate the effects of disadvantage and disorganization on homicide trends. Thus an important avenue for future funding and research is to generate longitudinal neighborhood-level measures of characteristics such as social ties, disorder, and informal social control.

Another shortcoming of the current analysis is the method used to account for spatial autocorrelation. Though including a control for average levels of homicide in surrounding neighborhoods provides a better guard against biased results than failing to account for spatial dependence altogether, it is still not an ideal approach, and the resulting regression coefficients may still have some bias and inefficiency. Methods for incorporating spatial analysis into longitudinal models continue to advance, but applying these methods to a multilevel growth-curve model are not currently fully developed. As these methods continue to mature, researchers should replicate prior studies in a way that fully accounts for spatial dependence in order to provide a more robust assessment of previous findings.

Rather than settle on a single method for evaluating homicide trajectories, the current study took a comprehensive approach that applied both semi-parametric group-based trajectory modeling and hierarchical growth curve analysis. This two-pronged approach yielded some consistent findings across methods, but there were also some inconsistencies. For example, though concentrated disadvantage was a significant predictor of initial levels of homicide under both analytic methods, it was not predictive of change over time in the growth-curve models.

One criticism of using growth-curve modeling to evaluate crime trends is that it may not have the flexibility necessary to account for growth patterns that deviate considerably from the overall average neighborhood trend (Raudenbush 2001). Therefore, any differences across the modeling strategies may be due to the different assumptions that they each make about the underlying distribution of trajectories.

However, another possible explanation of these different findings is that the regression models uses to explain group membership under the group-based trajectory method were estimated as logistic regression models contrasting groups that started *at a specific level of homicide*, while the hierarchical growth curve models were estimated for all neighborhoods in a pooled model. A primary reason for the modeling strategy used for predicting trajectory group membership was that it allowed for an evaluation of whether the predictors of homicide trends varied depending on the starting point of homicide. This is valuable from a policy perspective because it has the potential to identify characteristics of neighborhoods that predict diverging trends among neighborhoods that were originally at the same level. That is, they address the question "If two neighborhoods had similar levels of homicide in 1980, what characteristics are predictive of a decline over time versus persistent levels?" One possible avenue for future research would be to estimate hierarchical growth curve models that attempt to address the same question. For example, hierarchical models could be estimated that include, for each neighborhood, a measure of its starting point of homicide, and that model this as a cross-level interaction with the covariates at level-one. By generating cross-level interactions with a variable such as concentrated disadvantage, it would be possible to determine whether the effect of changing levels of disadvantage on homicide was conditional upon starting levels of

homicide.

Future research should also investigate alternative methods for evaluating change over time in the predictor variables when utilizing the group-based trajectory method. The trajectory analysis in the current study took advantage of a data source with more than 20 time points, but changes in the independent variables in the GTM analysis were measured simply as the change from 1980 to 2000. It is possible that this crude measure of change fails to capture additional temporal variability that occurred between those two time points. This may also explain some of the differences between the GTM and HGCM results. One possible approach is to also use GTM to identify trajectories in the *predictor variables*. These trajectories can then be cross-classified with the homicide trajectories groups, or a dual-trajectory analysis could be conducted (Nagin, 2005). Though these models can be highly complex and often fail to converge, this and other strategies should be pursued to better understand how neighborhood dynamics influence homicide trajectories.

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# DISSEMINATION OF RESEARCH FINDINGS

## CONFERENCE PRESENTATIONS

Stults, Brian J. 2009. Determinants of Chicago Neighborhood Homicide Trends:1965-1995", 10th Crime Mapping Research Conference, New Orleans, LA.

Stults, Brian J. 2009. Hierarchical Growth-Curve Analysis of Chicago Neighborhood Homicide Trends: 1965-1995", Annual Meeting of the American Society of Criminology, Philadelphia, PA.

Stults, Brian J. 2008. Determinants of Chicago Neighborhood Homicide Trends:1965-1995", Annual Meeting of the American Society of Criminology, St. Louis, MO.

## PEER-REVIEWED JOURNAL ARTICLES

Stults, Brian J. 2009. "Determinants of Chicago Neighborhood Homicide Trends:1965-1995." *Homicide Studies* 14:244-267.

# FIGURES

**Figure 1. Homicide Rate Trends for the City of Chicago and the Average Chicago Neighborhood, 1980-2000**

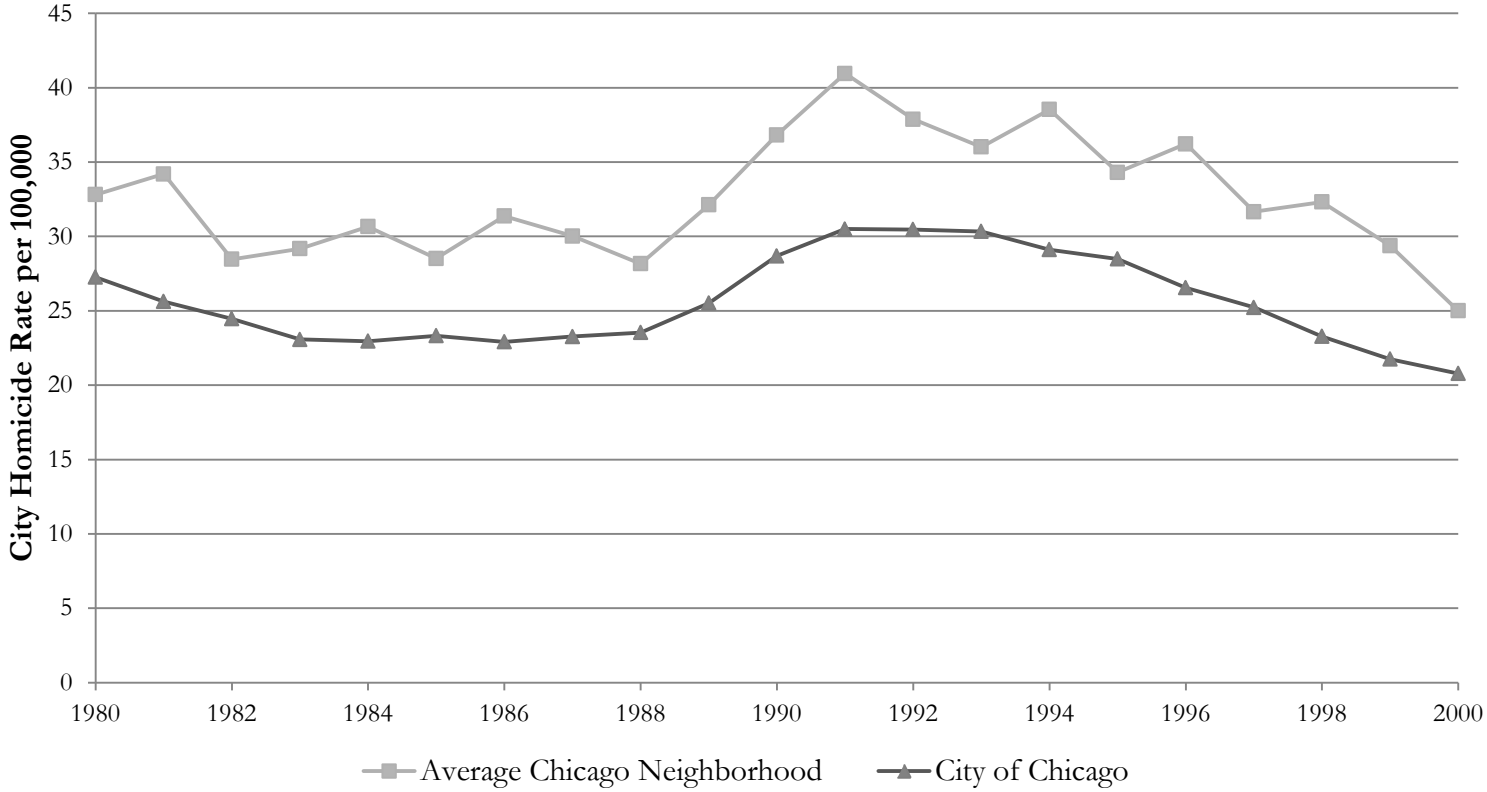


**Figure 2. Homicide Rate Trends for the Average Chicago Neighborhood and Six Selected Census Tracts, 1980-2000**

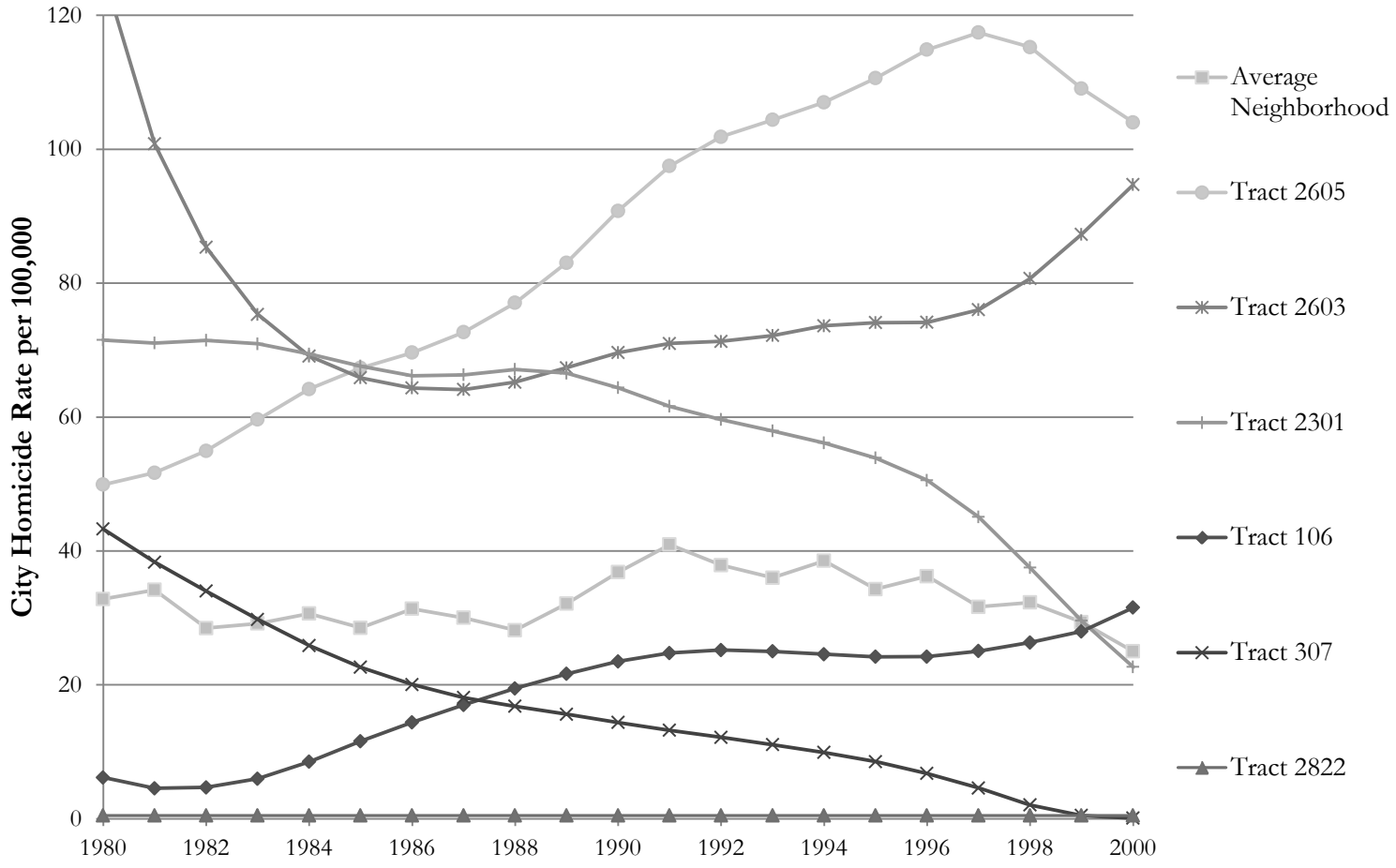


**Figure 3. Group-Based Homicide Trajectories in Chicago Neighborhoods, 1980-2000**

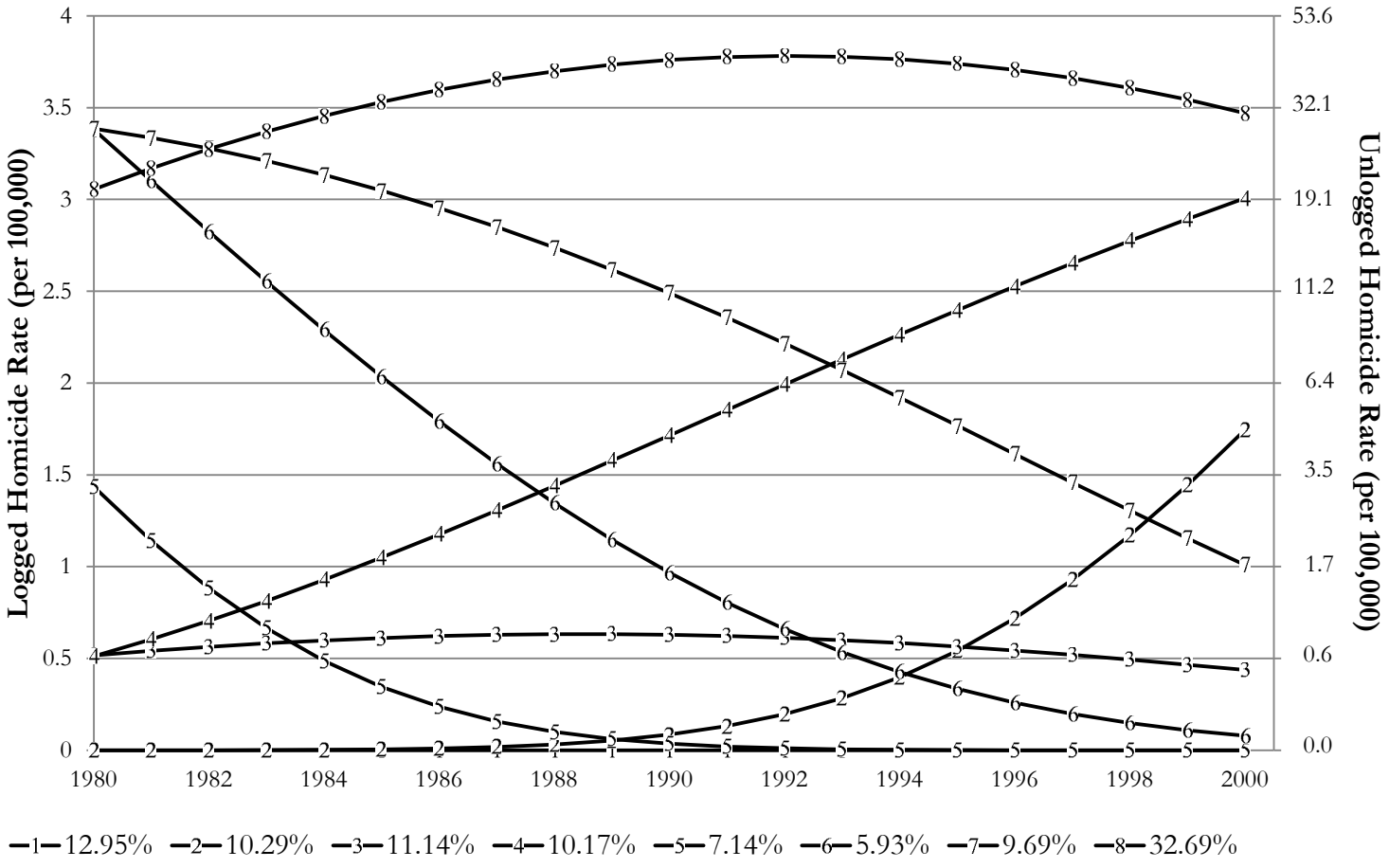


**Figure 4. Average Neighborhood Characteristics in 1980 by Homicide Trajectory Group**

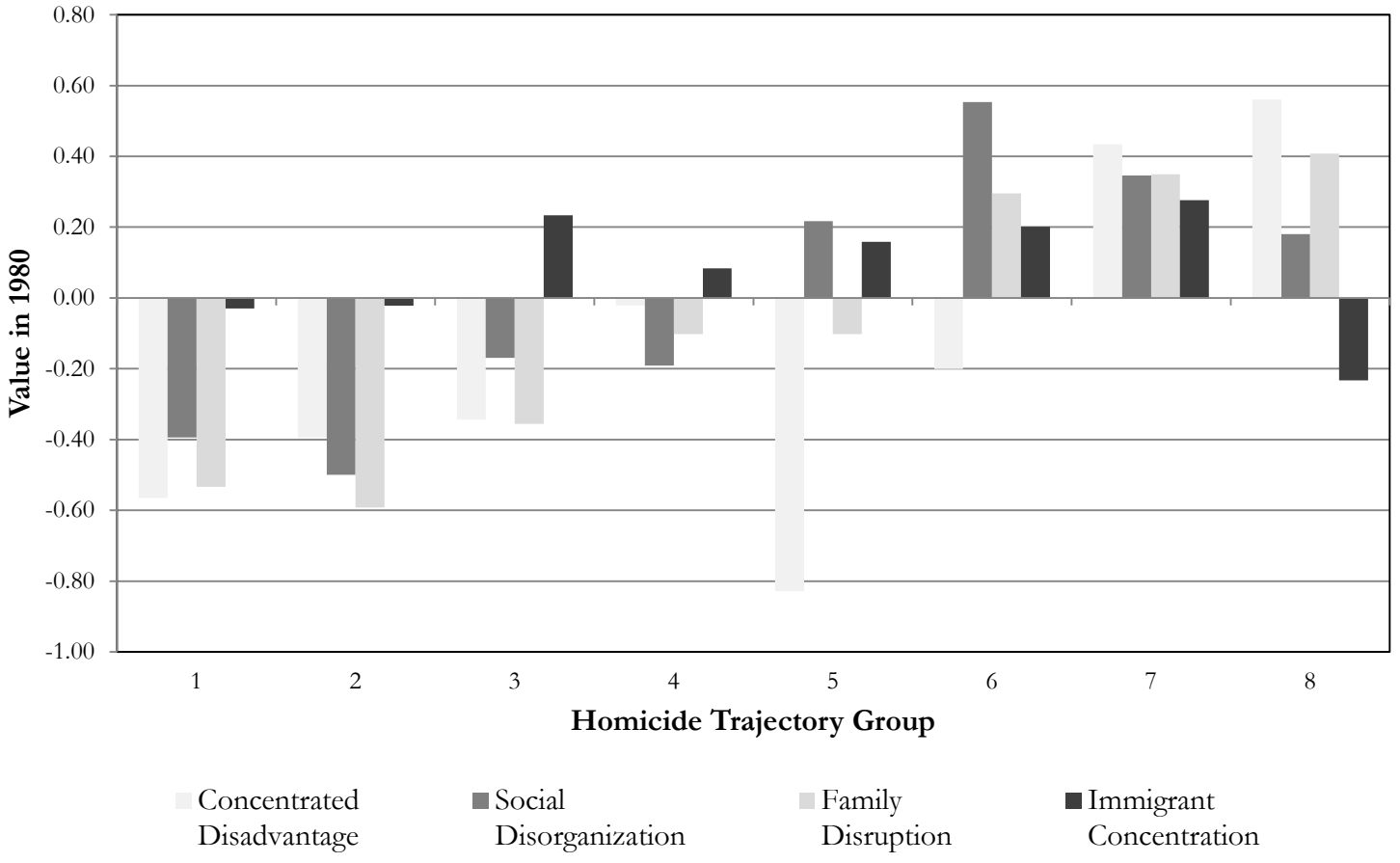
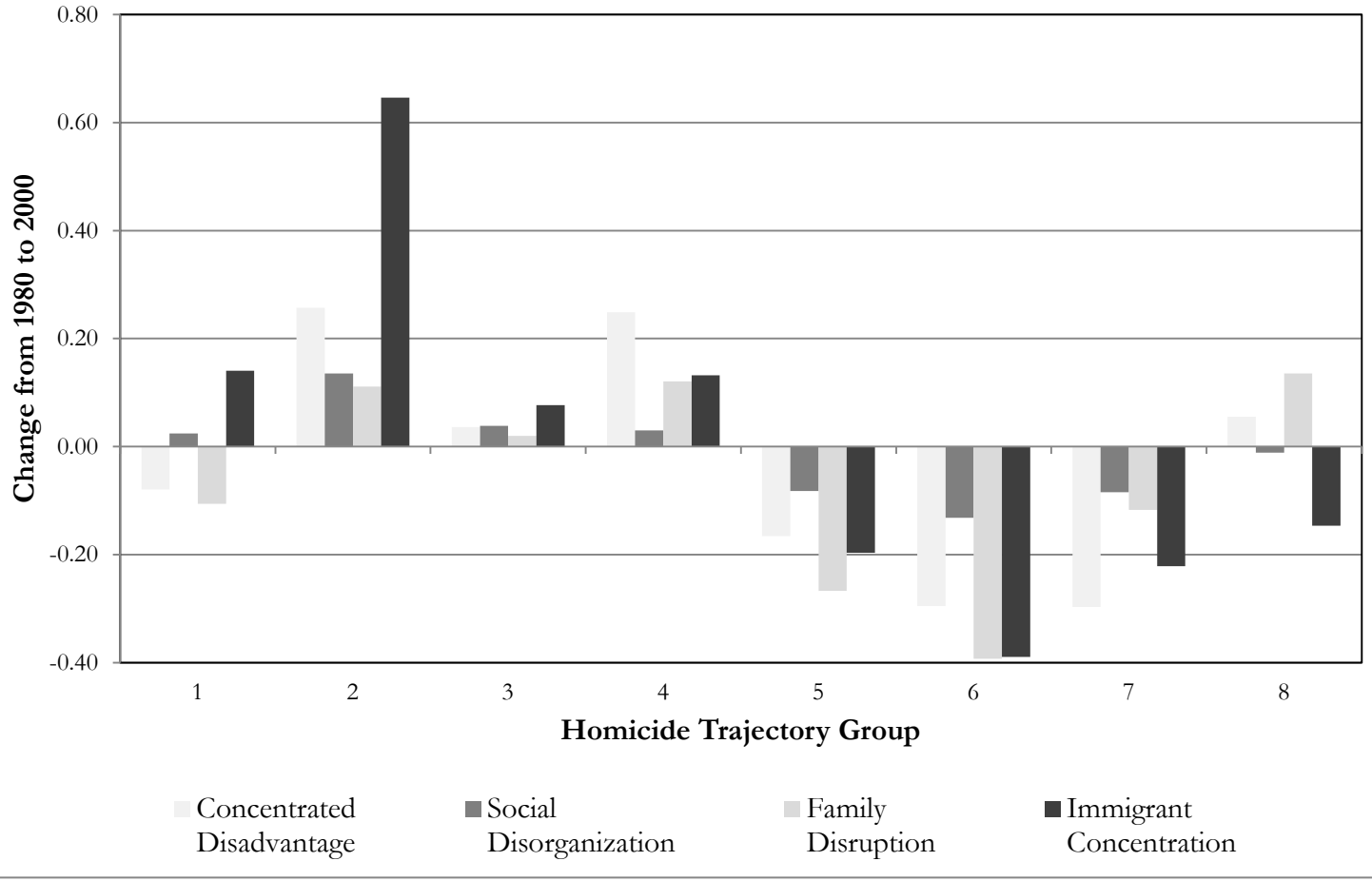


**Figure 5. Average Change in Neighborhood Characteristics from 1980 to 2000 by Homicide Trajectory Group**



# TABLES

**Table 1. Bayesian Information Criterion (BIC) and Log Bayes Factors [$2log_e(B_{10})$] for competing models**

| Number of groups | Null Model | BIC | $2log_e(B_{10})$ |
|---|---|---|---|
| 1 | | -33,349 | |
| 2 | 1 | -25,640 | 15,419 |
| 3 | 2 | -24,969 | 1,342 |
| 4 | 3 | -24,589 | 759 |
| 5 | 4 | -24,450 | 279 |
| 6 | 5 | -24,238 | 424 |
| 7 | 6 | -24,152 | 172 |
| 8 | 7 | -24,070 | 164 |
| 9 | 8 | -24,086 | 130 |

**Table 2. Logistic Regression Predicting Homicide Trajectory Group Assignment**

| | Group 2 vs. 1 | | |
|---|---|---|---|
| | Logit | | Standard Error |
| Concentrated Disadvantage | | | |
| Initial Level | 1.097 | * | 0.491 |
| Change | 1.927 | ** | 0.614 |
| Social Disorganization | | | |
| Initial Level | 0.305 | | 0.377 |
| Change | -0.042 | | 0.688 |
| Family Disruption | | | |
| Initial Level | 0.436 | | 0.422 |
| Change | 0.670 | | 0.360 |
| Immigrant Concentration | | | |
| Initial Level | 0.236 | | 0.448 |
| Change | 0.599 | | 0.334 |
| Intercept | 0.289 | | 0.345 |
| *N* of Cases | Group 1 = 107<br>Group 2 = 85 | | |
| Likelihood Ratio | 45.67 ** | | |
| Pseudo $R^2$ | 0.173 | | |

** p <= .01 ; * p <= .05

**Table 3. Logistic Regression Predicting Homicide Trajectory Group Assignment**

| | Group 3 vs. 5 | | | Group 4 vs. 5 | | |
|---|---|---|---|---|---|---|
| | Logit | | Standard Error | Logit | | Standard Error |
| Concentrated Disadvantage | | | | | | |
| Initial Level | 1.468 | ** | 0.471 | 2.986 | ** | 0.541 |
| Change | 1.145 | * | 0.555 | 3.320 | ** | 0.682 |
| Social Disorganization | | | | | | |
| Initial Level | -0.317 | | 0.425 | -0.407 | | 0.482 |
| Change | 0.625 | | 0.697 | 0.480 | | 0.776 |
| Family Disruption | | | | | | |
| Initial Level | -0.341 | | 0.453 | 0.470 | | 0.513 |
| Change | -0.384 | | 0.410 | 0.011 | | 0.461 |
| Immigrant Concentration | | | | | | |
| Initial Level | -0.054 | | 0.401 | -0.006 | | 0.422 |
| Change | -0.176 | | 0.415 | -0.079 | | 0.442 |
| Intercept | 1.238 | ** | 0.352 | -1.329 | ** | 0.361 |
| *N* of Cases | Group 3 = 92; Group 4 = 84; Group 5 = 59 | | | | | |
| Likelihood Ratio | 112.74 ** | | | | | |
| Pseudo $R^2$ | 0.222 | | | | | |

** p <= .01 ; * p <= .05

**Table 4. Logistic Regression Predicting Homicide Trajectory Group Assignment**

| | Group 7 vs. 6 | | | Group 8 vs. 6 | | |
|---|---|---|---|---|---|---|
| | Logit | | Standard Error | Logit | | Standard Error |
| Concentrated Disadvantage | | | | | | |
| Initial Level | 0.922 | ** | 0.316 | 1.987 | ** | 0.319 |
| Change | -0.301 | | 0.414 | 1.304 | ** | 0.408 |
| Social Disorganization | | | | | | |
| Initial Level | -0.603 | | 0.406 | -0.459 | | 0.364 |
| Change | -0.405 | | 0.563 | -0.421 | | 0.527 |
| Family Disruption | | | | | | |
| Initial Level | 0.977 | * | 0.494 | 0.490 | | 0.460 |
| Change | 0.945 | * | 0.392 | 1.017 | ** | 0.363 |
| Immigrant Concentration | | | | | | |
| Initial Level | 1.015 | ** | 0.350 | 0.460 | | 0.323 |
| Change | 1.379 | * | 0.543 | 0.800 | | 0.502 |
| Intercept | 0.569 | * | 0.290 | 1.415 | ** | 0.270 |
| *N* of Cases | Group 6 = 49; Group 7 = 80; Group 8 = 270 | | | | | |
| Likelihood Ratio | 134.88 ** | | | | | |
| Pseudo $R^2$ | 0.200 | | | | | |

** p <= .01 ; * p <= .05

**Table 5. Multilevel Growth Curve Estimates of Neighborhood-Level Homicide Trends in Chicago, 1980-2000**

| | Intercept | | Linear Trend | | Quadratic Trend | | Cubic Trend | |
|---|---|---|---|---|---|---|---|---|
| | Coeff | S.E. | Coeff | S.E. | Coeff | S.E. | Coeff | S.E. |
| **Unconditional Model** | | | | | | | | |
| Intercept | 2.567 ** | 0.058 | -0.113 ** | 0.014 | 0.017 ** | 0.001 | -0.001 ** | 0.00005 |
| Random Effects | | | | | | | | |
| Variance | 2.159 ** | 0.126 | 0.049 ** | 0.003 | 0.0001 ** | 0.00001 | | |
| Residual Variance | 1.117 ** | 0.013 | | | | | | |
| Log Likelihood | -34,599 | | | | | | | |
| **Conditional Model** | | | | | | | | |
| Intercept | 2.407 ** | 0.085 | -0.055 | 0.031 | 0.007 * | 0.003 | -0.0003 ** | 0.0001 |
| Concentrated Disadvantage | 0.794 ** | 0.069 | 0.009 | 0.023 | 0.001 | 0.002 | -0.00004 | 0.00008 |
| Social Disorganization | 0.354 ** | 0.083 | 0.101 ** | 0.025 | -0.016 ** | 0.003 | 0.0005 ** | 0.00008 |
| Family Disruption | 0.325 ** | 0.080 | -0.021 | 0.026 | 0.002 | 0.003 | -0.00007 | 0.00009 |
| Immigrant Concentration | 0.049 | 0.065 | -0.066 ** | 0.020 | 0.006 ** | 0.002 | -0.0002 * | 0.00007 |
| Spatial Dependence | 0.083 * | 0.038 | -0.027 | 0.015 | 0.004 * | 0.002 | -0.0001 ** | 0.00005 |
| Random Effects | | | | | | | | |
| Variance | 0.729 ** | 0.056 | 0.040 ** | 0.003 | 0.0001 ** | 0.000008 | | |
| Residual Variance | 1.111 ** | 0.013 | | | | | | |
| Log Likelihood | -27,466 | | | | | | | |

** p <= .01 ; * p <= .05

**Table 6. Multilevel Growth Curve Estimates of Neighborhood-Level Homicide Trends in Chicago, 1990-2000**

| | Intercept | | | Linear Trend | | | Quadratic Trend | | |
|---|---|---|---|---|---|---|---|---|---|
| | Coeff | | SE | Coeff | | SE | Coeff | | SE |
| **Model without Neighborhood Cluster Variables** | | | | | | | | | |
| Intercept | 2.483 | ** | 0.053 | 0.074 | ** | 0.020 | -0.012 | ** | 0.002 |
| Concentrated Disadvantage | 0.991 | ** | 0.082 | 0.005 | | 0.031 | 0.001 | | 0.003 |
| Social Disorganization | 0.506 | ** | 0.081 | -0.156 | ** | 0.030 | 0.013 | ** | 0.003 |
| Family Disruption | 0.276 | ** | 0.088 | -0.022 | | 0.033 | 0.001 | | 0.003 |
| Immigrant Concentration | -0.337 | ** | 0.067 | 0.065 | * | 0.026 | -0.004 | | 0.002 |
| Spatial Dependence | 0.060 | | 0.036 | 0.005 | | 0.016 | 0.000 | | 0.002 |
| Variance Components | | | | | | | | | |
| Tract | 1.426 | ** | 0.098 | 0.2290 | ** | 0.016 | 0.002 | ** | 0.000 |
| Neighborhood Cluster | 0.000 | | 0.000 | 0.000 | | 0.000 | 0.152 | ** | 0.034 |
| Residual Variance | 0.775 | ** | 0.014 | | | | | | |
| Log Likelihood | -13904 | | | | | | | | |
| **Model with Neighborhood Cluster Variables** | | | | | | | | | |
| Intercept | 2.479 | ** | 0.051 | 0.074 | ** | 0.020 | -0.012 | ** | 0.002 |
| Concentrated Disadvantage | 0.489 | ** | 0.108 | 0.015 | | 0.041 | 0.002 | | 0.004 |
| Social Disorganization | 0.262 | ** | 0.086 | -0.161 | ** | 0.034 | 0.014 | ** | 0.003 |
| Family Disruption | 0.228 | ** | 0.086 | -0.022 | | 0.033 | 0.001 | | 0.003 |
| Immigrant Concentration | -0.440 | ** | 0.067 | 0.071 | ** | 0.026 | -0.004 | | 0.003 |
| Spatial Dependence | 0.030 | | 0.036 | 0.011 | | 0.016 | -0.001 | | 0.002 |
| Neighborhood Cluster Variables | | | | | | | | | |
| Neighborhood Ties | -0.662 | ** | 0.217 | 0.037 | | 0.085 | -0.0001 | | 0.008 |
| Disorder | 1.460 | ** | 0.236 | -0.011 | | 0.090 | -0.006 | | 0.009 |
| Variance Components | | | | | | | | | |
| Tract | 1.336 | ** | 0.093 | 0.229 | ** | 0.016 | 0.0022 | ** | 0.00015 |
| Neighborhood Cluster | 0.128 | | 0.029 | 0.000 | | 0.000 | 0.00000 | | 0.00000 |
| Residual Variance | 0.774 | | 0.013 | | | | | | |
| Log Likelihood | -13859 | | | | | | | | |

** p <= .01 ; * p <= .05