RESEARCH REPORT

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Alcohol Outlets as Attractors of Violence and Disorder:

A Closer Look at the Neighborhood Environment

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URBAN INSTITUTE
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ALCOHOL OUTLETS AS ATTRACTORS OF VIOLENCE AND DISORDER

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Abstract

This report investigates the relationship between alcohol availability, type of alcohol establishment, distribution policies and violence and disorder at the block group level in the District of Columbia. We test whether density of alcohol outlets influences: (1) aggravated assault incidents, (2) calls for service for social “disorder” offenses, and (3) calls for service for a domestic incident, and examine variation in outcomes by time of day/day of week. Spatial econometric regression models are estimated using an information theoretic approach. The findings indicate that on-premise outlets, but not off-premise outlets are a significant predictor of aggravated assault. Concentrations of both on-premise and off-premise outlets are associated with high levels of disorderly conduct. With regard to domestic violence, off-premise outlets were associated with a significant increase in domestic violence, but on-premise outlets (specifically restaurants and nightclubs) were associated with a decrease in domestic violence. The report concludes with a discussion of implications for crime and community-level alcohol prevention efforts.

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EXECUTIVE SUMMARY

Since the early 1980s, a substantial literature has linked alcohol use and abuse to criminality. In 1998, the Bureau of Justice Statistics published a comprehensive analysis of victimization and incident data on alcohol and crime showing that that nearly 40 percent of violent victimizations and fatal motor vehicle accidents involve alcohol, and roughly 40 percent of detainees and persons incarcerated report using alcohol at the time they committed their offense (Greenfeld, 1998). These widely cited findings became the backdrop for closer policy attention to understanding and solving the variety of public safety problems associated with the consumption of alcohol (Travis, 1998, 1999).

Around the same time, researchers began testing theories examining whether variations in neighborhood context influence crime rates and the risk of victimization. Sociologists and criminologists reasoned that in addition to individual-level factors influencing alcohol use and criminal behavior, there could be neighborhood-level mechanisms, such as the physical features of the urban landscape, poverty levels, and social organizational features, that either affect the rate of alcohol use or the risk of victimization (Alaniz, Parker, Gallegos, Cartmill, 1998; Gorman, et al., 1998a, b; Scribner et al., 1999). Theories were soon developed that hypothesized a relationship between substance use and violence as stemming from properties of the illicit (or licit) distribution of those substances (see Parker, 1995, Alaniz et al., 1998). With regard to alcohol distribution, because data on levels of sales or consumption at the business or neighborhood level were (and remain) difficult to obtain, many of these studies used *the presence* of alcohol-selling establishments as a proxy for consumption. In addition, these studies often referenced earlier criminological studies finding evidence for hotspots of crime around liquor stores and bars (see for example, Block and Block, 1995; Roncek and Bell, 1981; Roncek and Maier, 1991; Sherman, Gartin and Buerger, 1989). For the most part, researchers found that the community impacts associated with alcohol outlet density include increased levels of homicide and other assaults, prostitution, liquor law violations, and traffic fatalities (LaScala, Gruenewald and Johnson, 2001; Lipton and Gruenewald, 2002; Speer, Gorman, Labouvie and Ontkush, 1998).

As evidence began to accumulate on the association between alcohol outlet density and violence, the availability and accessibility of geographic data began to increase, enabling researchers to conduct more rigorous and systematic assessments of the ecology of violence and crime around alcohol-selling establishments. Over the years, researchers had been calling for comprehensive, theory-based studies of the influence of alcohol outlets on violence and injury. As stated by Lipton and colleagues (2003:67): "[The public health studies on alcohol outlets] tend to be more descriptive in nature, and for the most part have not offered any explicit theoretical explanations as to why high alcohol outlet density and violence are associated with one another." Researchers also have stressed the importance of conducting place-based ecological studies that can shed light on the situational aspects of crime from the perspective of neighborhoods (Fagan and Davies 2000; Sampson 2001). Very recently, a number of studies have been published that seek to remedy the lack of theoretically-informed and methodologically sound research on the effects of high alcohol outlet densities.

This report describes an Urban Institute study that investigates the relationship between alcohol availability, type of alcohol establishment, distribution policies and violence and disorder at the block group level in the District of Columbia.

Research Questions

The study is designed to answer the following overarching questions:

Do increased availability and liberal distribution policies increase the incidence of aggravated assault, social disorder, and domestic violence?

Does the relationship between alcohol availability and violence and disorder vary by type of alcohol establishment?

Does the relationship between alcohol availability and violence and disorder vary by time of day?

Are there characteristics of the environment or situational factors that may be attracting crime around alcohol-selling establishments?

What types of situational factors act as *buffers* against crime and disorder in areas near alcohol-selling establishments?

The research questions are guided by the development of place-based theories of crime which focus on routine activities and criminogenic features of the environment (Brantingham and Brantingham, 1991, 1993, 1995; Clarke and Felson, 1993; Cohen and Felson, 1979; Felson, 1987; Roncek and Bell, 1981; Roncek and Faggiani, 1985; Roncek and LoBosco, 1983; Roncek and Maier, 1991; Roncek and Pravatiner, 1989) in an attempt to add to the scarce literature examining alcohol outlet density and overcome the limitations of that research—both theoretical and methodological. This study develops and tests a grounded comprehensive theoretical model of the relationship between alcohol availability and violence and disorder (described in the full report). The model captures a wide range of contextual variation in neighborhood places and processes.

Study Design

Research Site and Unit of Analysis

The research site is comprised of block groups in Washington, D.C., a high crime, urban area (68.3 square miles) consisting of roughly 581,500 residents (U.S. Census Bureau, 2007). The unit of analysis is the block group. Of the 433 block groups in the city, two were excluded from the analyses because valid crime numbers are not reported for them. Across the 431 block groups there are 1,473 alcohol-selling establishments. These outlets were coded by license type into the categories of restaurant (46.4 percent), store (32.6 percent), tavern (8.3 percent), nightclub (4.1 percent), hotel (4.9 percent) and multipurpose facilities (3.7 percent). Based on our local knowledge of the city businesses, we recoded a few multi-purpose facilities into nightclubs. Each of these outlets was then coded by where the alcohol is consumed (on-premise or off-premise).

Variable Measurement

This study examines our theoretical model of the influence of alcohol outlets on four outcomes: (1) aggravated assault incidents reported to the police, (2) calls for service (i.e., 911 calls to the police department) for disorderly conduct and (3) calls for services for social disorder

more broadly defined [termed "UI-defined disorder"] (shooting, sounds of gunshots, man down, woman down, indecent exposure, soliciting for prostitution, and destruction of property), and (4) calls for service for a domestic incident (either between intimate partners or guardians/parents and children).

Independent Variables

- On-premise and off-premise alcohol outlets-on-premise outlets (restaurants, taverns, and nightclubs and off-premise (i.e., liquor stores, mini markets, etc.) per square mile;
- Racial/ethnic heterogeneity-one minus the sum of squared proportions of each of four races/ethnicities: black, white, Asian, Hispanic;
- Concentrated disadvantage-sum of z-scores for five Census items: (a) percent of all households receiving public assistance, (b) percent of population with income below the federal poverty level in 1999, (c) percent black (non-Hispanic), (d) percent of civilian population age 16 or older in labor force who are unemployed, and (e) percent of households with children headed by a woman. Divided by number of items (5);
- Residential stability-sum of z-scores for two items: percent living in same house since 1995 and the percent of housing occupied by owners. The sum of these two items is then divided by the number of items (2);
  Population 18-29-proportion of population aged 18-29;
- Adult arrests-number of adult arrests during 2005 and 2006;
- Population per square mile-log of residential population per square mile;
- Prosocial places-sum of all schools, churches, libraries and recreation centers per square mile;
- Physical disorder-average of annual 727-1000 calls to Mayor's hotline in 2005 and 2006 including: abandoned vehicles, graffiti removal, illegal dumping, and streetlight repair (per square mile);
- Streetlight density-number of streetlights per square mile;
- Commercial/retail parcels-percent of parcels that are retail, commercial, or motel/ hotel/ inn;
- Vacant parcels-percent of parcels that are designated vacant;
- Bus stop density-number of bus stops per square mile;
- Metro stations-dummy variable for whether the block group has a metro station;
- Homeless services density-density of homeless services per square mile;
- Inverse distance to all alcohol selling establishments-total of inverse distance from block group centroid to each alcohol outlet;
- Temporal lag of aggravated assault -log of aggravated assaults in 2000-2001.

Statistical Methods

Spatial econometric regression models are estimated using an information theoretic approach (more specifically the Generalized Cross Entropy (GCE) approach) that readily handles both over- or under-dispersed count outcomes. The simultaneous nature of the GCE modeling strategy allows one to estimate the spatial autocorrelation coefficient without the need for ad-hoc and convenient transformations of the dependent variable. See Bhati (2008) for technical details. Appendix C contains the SAS programming for the GCE macro used in this study.

Critical Findings

The Density of Alcohol Outlets and Aggravated Assault

- The density of on-premise outlets is a significant predictor of aggravated assault.

- In contrast, high densities of off-premise outlets (liquor stores, mini-markets, etc.) do not influence assault. The coefficients for off-premise outlets were significant in the nested models until the physical environment variables were added.

- Almost all of physical environment variables have a significant association with assault, however, not all relationships are in the expected direction. The proportion of commercial or retail parcels, and physical disorder each has a significant influence on assault. In addition, the density of prosocial places also has a positive relationship with assault. Also in contrast to expectations, the proportion of vacant parcels and the presence of a metro station have negative relationships with assault, and the increased density of street lighting is associated with an increase in assault.

  In the District of Columbia areas with on-premise outlets and high assault levels often are popular retail and commercial corridors that have few vacant parcels and very good street lighting. With regard to metro stations appearing to act as buffers against assault, it may be that these block groups are more likely to have place managers—security guards, extra police and/or transit officers. In addition, almost all metro station platforms in the city are underground, away from bar exits and entrances, creating a flow of patrons away from high risk street areas. Bus stops, on the other hand, are places where pedestrians linger in the street and on sidewalks, often for long periods, awaiting the next bus. In the District in commercial and retail areas, there are often bus stops on every block.

- When our models for assault examined the different types of on-premise outlets—restaurants, taverns, and nightclubs—we find that the significant relationship between on-premise outlets and assault appears to be driven by taverns, as opposed to restaurants and nightclubs. Neither the coefficient for nightclubs nor the coefficient for restaurants is significant in the models examining assault.

- The findings from the time period models for assault do not elicit any surprises—high densities of on-premise alcohol outlets are associated with higher levels of aggravated assault both during the weekend and weekend late night periods. This finding is similar to the findings from the main assault model. High densities of on-premise outlets are not related to assault during the weeknight. These findings are consistent with a key premise of this study—that time of day is an important component to understanding the microenvironments of crime and place. As high densities of alcohol outlets are not significant attractors of assault all the time, crime prevention strategies should take into consideration “hot times” for assault around outlets.

- When single sales distribution policies are included in the models examining the influence of off-premise outlets on aggravated assault, the findings suggest

neighborhoods that have stores that ban single containers might be worse off with regard to assault than block groups that do not have stores that ban the sale of singles. Given that we found that off-premise outlets were not attractors of assault in our main models, it is a bit surprising that we found a higher incidence of assault in block groups with voluntary agreements against single sales. An explanation for this finding is that it is likely that neighborhoods where there are bans or voluntary agreements that prohibit single sales have already reached high levels of crime. And single sales policies are *a reaction* to high crime. Although we had hypothesized that neighborhoods that have stores that do not permit the sales of singles might exhibit greater social control, it appears that the contrary findings may indicate that the neighborhoods with stores that do not permit single sales had already reached a tipping point with regard to crime and disorder.

The Density of Alcohol Outlets and Social Disorder

- The analyses of social disorder confirm the long-hypothesized link between alcohol-selling establishments and disorder. Concentrations of both on-premise and off-premise outlets are associated with high levels of disorderly conduct. We found that levels of disorderly conduct are higher in block groups with concentrations of bars and off-premise outlets (liquor stores, mini-markets, etc.), but that levels of the more "fear-provoking" social disorder are not affected by alcohol outlets, on average across different days of week.

- However, when our analyses disaggregated calls for service for UI-defined disorder by time periods, we found that, during the weekend and weekend night periods, high concentrations of on-premise outlets are significantly related to disorder.

The Density of Alcohol Outlets and Domestic Violence

- Our analyses of models regressing calls for service for domestic violence incidents on alcohol outlets and a full suite of covariates found that the relationship between alcohol outlet density and domestic violence varies by type of outlet. More specifically, off-premise outlets have a positive relationship to domestic violence calls for service, and this relationship holds strong during the weekend and weekend night periods.

- In contrast, on-premise outlets have a significant negative relationship with domestic violence, and this relationship remained strong in the weekend models and weeknight models, but not during the weekend night models (however the coefficient approached significance). The negative relationship is driven by restaurants and nightclubs, but not bars.

- As with assault, time of day/week appears to matter for domestic violence. Although on-premise outlets have a consistent negative relationship with domestic violence calls for service over the different time periods, the relationship between off-premise outlets and domestic violence varies across the three time periods—the risk for domestic violence in areas of high densities of off-premise outlets is greatest during both the weekend and weekend nights time blocks, but not during the weeknight, suggesting

different routine activities for domestic violence offenders during the week.

- The prohibition of single sales did not mitigate any risk for domestic violence as evidenced by our findings indicating that block groups that have stores that prohibit singles actually have higher levels of domestic violence calls for services. Similar to our musings with regard to assault, we would interpret this finding as indicating that these neighborhoods have already reached the tipping point for crime and domestic violence—single sales policies simply do not go far enough or reach enough stores to buffer against violence.

Discussion and Implications

In some big cities, reducing alcohol use through limits on the physical availability of alcohol is an attractive policy option. In a quick review of city council legislation in large cities across the U.S., we found a number of bills or pending legislation designed to limit the number of bars and nightclubs, specify more restrictive distribution policies (such as limiting hours of operation), or even close establishments in high-crime neighborhoods. As policymakers understand, lowering the density of outlets in neighborhoods is not easy to accomplish and a reduction in density would not necessarily translate into lower crime rates for areas that were already experiencing high rates of crime and disorder.

Furthermore, global reductions in the number of outlets in a city may not be effective in reducing crime. Our study also examined whether *city-wide* density of outlets relative to a given block group influenced levels of violence or disorder in neighborhoods and found no association between the global measure and violence. In essence, it appears, at least in the District of Columbia, that high densities of outlets is a neighborhood-level problem—that there is something specific to the neighborhood (or within the neighborhood) that attracts or generates violence and disorder. In addition to changing zoning rules to impact density, policymakers can also choose to regulate the specific distribution policies and practices of alcohol outlets within neighborhoods. Given the findings of this study, some policymaker may want to suggest that limiting hours of operations or reducing the amount or types of alcohol sold could have some impact on crime and disorder. However, we did not conduct analyses by closing times, and thus, our findings cannot imply that changes in closing times would influence crime and violence. Future studies that incorporate analyses by examining outlet closing times could go a long way to inform more specific policies regarding limiting hours of operations.

In addition to targeting policies to reduce how much patrons drink, policies, laws, regulations and practices can be targeted to make alcohol-selling establishments and the neighborhoods that surround them safer, regardless of how much people drink. The research findings suggest that given the link between alcohol outlets and crime, law enforcement becomes a key agent in efforts to make high crime areas safer. To begin with, law enforcement officers must know the problem neighborhoods, problem bars and problem drinkers. They must have the ability to interact positively with neighborhood business and other community stakeholders so joint problem-solving can occur.

Crime prevention efforts would also benefit from having transportation policy analysts working in tandem with law enforcement or crime analysts when neighborhood changes were set to occur. For instance, in the District, transportation officials have discussed limiting the number of bus stops to increase the efficiency of bus service—these decisions should be made in concert

with area planners that are familiar with the landscape of crime and disorder. Essentially, effective problem solvers are those that are able to forge partnerships across disciplines or policy areas, and include community residents who often are the most familiar about the habits of residents and the local geography of problems.

In addition, the findings from this study suggest the need for utilization or *better* utilization of place managers for places that have managers. Place managers during vulnerable times and in vulnerable places could be critical to public safety. Strong place managers could reduce the opportunity for offending through direct supervision of crowds in popular businesses. As this study found that certain areas (areas with metro stations for instance) were not magnets for crime, but instead, these areas had lower levels of disorder and assault.

Understanding how time intersects with other variables has implications for policing and community problem solving. Furthermore, the differences in findings across the dependent variables suggest that opportunities for criminal behavior around outlets is very specific to settings. Indeed, understanding more about the nature of bars and the nature of people who patronize certain establishments would go far in providing important information for public safety interventions.

This study's findings also reiterate that generalizability in this area of research is very difficult. There may be neighborhood mechanisms so specific to the geographic area of study, resulting in very different contexts—contexts that differentially influence findings—across studies. For instance, research has shown that racial and cultural dynamics, such as racial heterogeneity and concentrated immigration, give rise to different sets of issues in different communities that can, in turn, influence bar culture, drinking patterns and crime opportunity (Nielson, Martinez and Lee, 2005).

Conclusion

The research set out to examine whether neighborhoods with high densities of alcohol selling establishments are more likely to exhibit high levels of aggravated assault, domestic violence and social disorder, and if so, in what types of neighborhoods these relationships are more likely to be found. In essence, bars act as attractors of violence. This study found strong evidence that high densities of both on-premise and off-premise outlets are associated with higher levels of violence and disorder. But that statement has be put in context—the relationships found are specific to the type of crime examined. High densities of on-premise outlets are associated with an increase in aggravated assault incidents, but at the same time, are also associated with a *decrease* in calls for service for domestic violence. Off-premise outlets do not significantly impact aggravated assault in any of the models examined, but off-premise outlets are significantly associated with an increase in calls for service for domestic violence. With regard to social disorder—and specifically calls for service for disorderly conduct, high densities of both on-premise and off-premise were associated with high levels of disorder.

Furthermore, the relationships varied across different time periods of the day and week, suggesting that if policymakers and communities want to implement cost effective alcohol-reduction strategies to combat crime and disorder, patterns of crime around outlets by time of day should be closely examined before thousands of dollars are allocated to new or continued programming. Bans on single containers might be feel-good measures that make the community feel safer, but should not be relied on to decrease neighborhood problems. In this age of instant crime data made available to the public, initial investments in research-based strategies, coupled

with community input, would have ample payoff in the long-run. We hope that the current study provides evidence of the need to continue to explore the multi-dimensional effects of alcohol availability on neighborhoods—and specifically violence and disorder. Problems associated with crime attractors are amenable to research-based problem solving. Coordinated dialog across policy areas (health and public health, crime, transportation, education, etc.) that yields targeted community-based strategies to reduce alcohol availability *and crime* will go far to help improve neighborhood quality of life.

Introduction

Since the early 1980s, a substantial literature has linked alcohol use and abuse to criminality. In 1998, the Bureau of Justice Statistics published a comprehensive analysis of victimization and incident data on alcohol and crime showing that that nearly 40 percent of violent victimizations and fatal motor vehicle accidents involve alcohol, and roughly 40 percent of detainees and persons incarcerated report using alcohol at the time they committed their offense (Greenfeld, 1998). These widely cited findings became the backdrop for closer policy attention to understanding and solving the variety of public safety problems associated with the consumption of alcohol (Travis, 1998, 1999).

Around the same time, researchers began testing theories examining whether variations in neighborhood context influence crime rates and the risk of victimization. Sociologists and criminologists reasoned that in addition to individual-level factors influencing alcohol use and criminal behavior, there could be neighborhood-level mechanisms, such as the physical features of the urban landscape, poverty levels, and social organizational features, that either affect the rate of alcohol use or the risk of victimization (Alaniz, Parker, Gallegos, Cartmill, 1998; Gorman, et al., 1998a,b; Scribner et al., 1999). Theories were soon developed that hypothesized a relationship between substance use and violence as stemming from properties of the illicit (or licit) distribution of those substances (see Parker, 1995, Alaniz et al., 1998). With regard to alcohol distribution, because data on levels of sales or consumption at the business or neighborhood level were (and remain) difficult to obtain, many of these studies used *the presence* of alcohol-selling establishments as a proxy for consumption. In addition, these studies often referenced earlier criminological studies finding evidence for hotspots of crime around liquor stores and bars (see for example, Block and Block, 1995; Roncek and Bell, 1981; Roncek and Maier, 1991; Sherman, Gartin and Buerger, 1989). For the most part, researchers found that the community impacts associated with alcohol outlet density include increased levels of homicide and other assaults, as well as traffic fatalities (LaScala, Gruenewald and Johnson, 2001; Lipton and Gruenewald, 2002; Speer, Gorman, Labouvie and Ontkush, 1998).

As evidence began to accumulate on the association between alcohol outlet density and violence, the availability and accessibility of geographic data began to

increase, enabling researchers to conduct more rigorous and systematic assessments of the ecology of violence and crime around alcohol-selling establishments. Over the years, researchers had been calling for comprehensive, theory-based studies of the influence of alcohol outlets on violence and injury. As stated by Lipton and colleagues (2003:67): "[The public health studies on alcohol outlets] tend to be more descriptive in nature, and for the most part have not offered any explicit theoretical explanations as to why high alcohol outlet density and violence are associated with one another." Researchers also have stressed the importance of conducting place-based ecological studies that can shed light on the situational aspects of crime from the perspective of neighborhoods (Fagan and Davies 2000; Sampson 2001). Very recently, a number of studies have been published that seek to remedy the lack of theoretically-informed and methodologically sound research on the effects of high alcohol outlet densities. Although these studies have strong implications for reducing crime and improving community well-being, they are somewhat limited in their generalizability. Most recent studies have used data from one geographic location in the United States (California) and have not examined neighborhoods smaller than the census tract.

This report describes an Urban Institute study that investigates the relationship between alcohol availability, type of alcohol establishment, distribution policies and violence and disorder at the block group level in the District of Columbia. This study develops and tests a grounded comprehensive theoretical model of the relationship between alcohol availability and violence and disorder. The model captures a wide range of contextual variation in neighborhood places and processes.

Research Questions

The study is designed to answer the following overarching questions:

(1) Do increased availability and liberal distribution policies increase the incidence of aggravated assault, social disorder, and domestic violence?

(2) Does the relationship between alcohol availability and violence and disorder vary by type of alcohol establishment?

(3) Does the relationship between alcohol availability and violence and disorder vary by time of day?

(4) Are there characteristics of the environment or situational factors that may be attracting crime around alcohol-selling establishments?
(5) What types of situational factors act as *buffers* against crime and disorder in areas near alcohol-selling establishments?

The research questions are guided by the development of place-based theories of crime which focus on routine activities and criminogenic features of the environment (Brantingham and Brantingham, 1991, 1993, 1995; Clarke and Felson, 1993; Cohen and Felson, 1979; Felson, 1987; Roncek and Bell, 1981; Roncek and Faggiani, 1985; Roncek and LoBosco, 1983; Roncek and Maier, 1991; Roncek and Pravatiner, 1989) in an attempt to add to the scarce literature examining alcohol outlet density and overcome the limitations of that research—both theoretical and methodological (Freisthler, 2004; Gorman et al., 1998a,b; Gorman et al., 2001; Gruenewald et al., 1996; Gruenewald, et al., 2006; Rabow and Watts, 1982; Scribner, MacKinnon and Dwyer, 1994; Scribner, et al., 1999; Watts and Rabow, 1983).

This study uses address-level data to create multiple variables measuring the physical, social, economic and cultural characteristics of a given area in addition to the density of alcohol-selling establishments by type and incidence of criminal activity. The availability of these data on the physical environment expands the range of factors hypothesized to influence the relationship between alcohol availability and adverse social outcomes, such as violence and disorder. The study also incorporates innovative spatial econometric modeling that takes into consideration both the unique distribution of crime across neighborhoods and the spatial nature of the data. These spatial econometric advances, coupled with the increasing availability of address-level data, provide a unique opportunity to continue ecological research of this nature.

The report is organized as follows: Chapter 1 provides the theoretical foundation for the study, reviewing the various “opportunity” theories and the current literature on the relationship between alcohol outlets and crime and disorder. Chapter 2 presents our theoretical model in detail, by discussing each of the main components of the model in relation to the extant literature. Chapter 3 lays out the research hypotheses, discusses the selection of the research site and the unit of analysis, and provides measurement

information for the dependent and independent variables examined in this study. Chapter 4 describes the analytical strategy, followed by a discussion of the results (Chapter 5). The last chapter (Chapter 6) summarizes the findings and discusses the implications of the study with regard to suggested community practices that can be developed to improve public safety.

Chapter 1. Background

Opportunity Theories

The theoretical backdrop that informs much of the current work on alcohol availability and crime—and this study—stems from research in the mid 1900s that developed ecological models to explain findings that crime and delinquency were related to areas (or places) that were witnessing decay and physical deterioration (Shaw and McKay, 1942; White, 1932). These and other studies (Burgess 1925; Thrasher 1927; Lander 1954; Bordua 1958; Schmid 1960; and Chilton 1964) provided the basis for understanding how crime is related to the environment—physical or social. Going beyond theories of social disorganization, this ecological research helped further the discussion that certain places have features that facilitate or hinder the *opportunity* for crime. Opportunity theories can be very generally categorized as theories that aim to explain variations in crime as due to: (1) the physical environment, (2) the predisposed structural dynamics of neighborhoods (social disorganization theory), and (3) victim lifestyles or the "routine activities" of people.

The physical environment includes internal and external features and layouts of buildings and institutions, boundary characteristics, and traffic patterns. The body of research relating to the location of targets and movement of offenders and victims in space and time includes research on event-based preventive approaches to crime, such as "defensible space" (Newman, 1972), "crime prevention through environmental design" (Jeffrey, 1971), and "situational prevention" (Clarke, 1980, 1992; Mayhew et al., 1976) and research on how an individual's "activity space" is influenced by the built environment or the "environmental backcloth" (Brantingham and Brantingham, 1981). The different activity spaces of individuals intersect with the varying neighborhood environments and create variations in crime and victimization.

Social disorganization theory focuses on the relationship between neighborhood structure, social control, and crime. Theoretical development and empirical research around disorganization theory has greatly focused on defining social organization by examining characteristics of neighborhood structure such as population change, social cohesion, and financial investment in neighborhoods. Because the constructs in social disorganization theory are contextual influences that increase the risk of crime, these

constructs—such as unsupervised peer groups, economic deprivation, single-parent families— have fallen under the rubric of opportunity.

Lifestyle theory focuses specifically on varying lifestyles of different social groups and how the different lifestyles are related to the differential exposure to dangerous places, times and other individuals. Lifestyle is "…routine daily activities, both vocational activities (work, school, keeping house, etc.) and leisure activities" (Hindelang, Gottfredson, and Garofalo 1978, 241). Variables examined in studies testing lifestyle theory usually include measures of the amount of time individuals spend outside of the home, such as at work, or out socializing.

Very similar to lifestyle theory is routine activities theory, which focuses on the context where potential victims and offenders come together in the absence of guardians. Routine activity focuses on the conduct of daily activities or "routine" activities not only for the victim, but for the offender and guardian, as well. In other words, the presence (or absence) of motivated offenders, potential targets, and guardians depends on the activities in which people are engaged and other characteristics of an area (Cohen and Felson, 1979). These theoretical developments naturally lead to the examination of *place* and *space*. Routine activities theory posits that different types of places exhibit different opportunity structures across space and time. Institutions and their characteristics, as well as other physical features of the environment, become important factors in understanding variations in crime. Historically, institutions have been viewed as places that can provide direct and indirect guardianship, counteracting opportunities for offending. Institutions that have been posited to offer strong guardianship include community-based organizations, schools, churches, recreation centers, and libraries.

Institutions as Crime Attractors and Generators

There are also institutions that may foster a *decrease* in social control or act as magnets for unsupervised groups of people who can become "motivated offenders" (Cohen and Felson, 1979). Hence, routine activities theory provides the foundation for hypothesizing that bars and liquor stores, as well as other alcohol-selling establishments, can be attractors or generators of crime (Brantingham and Brantingham, 1982, 1991, 1993, 1995; LaGrange, 1999; Roman, 2005) Roncek and Bell, 1981; Roncek and Faggiani, 1985; Roncek and LoBosco, 1983; Roncek and Maier 1991; Roncek and

Pravatiner 1989). Crime *generators* have been defined as those facilities or buildings that bring large numbers of diverse people together (Brantingham and Brantingham 1993; McCord, Ratcliffe, Garcia and Taylor, 2007). These types of facilities include schools, sports stadiums, and transportation hubs such as subway and bus stops, or exit ramps leading to highways. Crime *attractors* are distinct from generators in that attractors are more likely to bring together a higher fraction of potential offenders and victims (i.e., suitable targets) simply because of the nature of the facility. Studies that examine crime attractors often include alcohol outlets, halfway houses and homeless shelters, drug treatment facilities, pawn brokers and check cashing establishments. These facilities do not necessarily bring together the large numbers of people that generator land uses do.

The majority of the few studies examining local institutions at the neighborhood level found in the criminological literature were studies of institutions attracting crime, not inhibiting it. The studies examined institutions such as schools, shopping malls, bars and liquor stores (Brantingham and Brantingham, 1982; LaGrange, 1999; Roncek and Bell, 1981; Roncek and Faggiani, 1985; Roncek and LoBosco, 1983; Roncek and Maier 1991; Roncek and Pravatiner 1989). In general, these researchers argued that social control was reduced as a larger number of individuals congregated around establishments such as bars and liquor stores. The presence of more people increased the anonymity of an area and resulted in people ignoring or less effectively performing guardianship activities.

A limitation of many prior studies examining institutions is that they did not test theory, but rather compared the levels of crime around an institution in question with the crime levels in otherwise similar areas without the institution. Fagan and Davies (2000) lament the dearth of place-based ecological studies that can shed light on violence from the perspective of neighborhoods. Only recently, with advances in software and hardware, and an increasing interest in place-based research, have studies begun to assess the effects of the micro-location within the larger area. In the past, many theoretical studies to understand neighborhood crime did not adequately examine how places might influence crime within a neighborhood. Hence, those studies did not capture the characteristics or types of institutions that are present in a neighborhood that can act as buffers or attractors and generators of crime. Furthermore, because valid geographical

data on the physical environment were not readily available until recently in many jurisdictions, studies most often did not include a wide range of physical environment features, such as street lighting, heavily trafficked intersections, and locations of transportation hubs, which are hypothesized to influence the routine activities of criminal behavior. Findings of *community* differences may be erroneous in that a *location* or particular type of place could be causing the differences in neighborhoods, rather than the characteristics of inhabitants. *Place* can be a conceptually rich unit of analysis (Sherman, Gartin and Buerger, 1989). Place becomes important when studying variation in crime, because the unit of analysis at the micro-environmental level (e.g., blocks, block faces, block groups, etc.) can provide the level of detail needed to capture variation in the independent variables hypothesized to be related to crime. Large-scale surveys and aggregate studies fail to distinguish the characteristics and features of particular areas that are associated with greater risk (Gottfredson, 1981).

Alcohol Availability and Violence

The empirical literature examining alcohol outlets and violence within an ecological framework emerged in the mid 1990s. The studies at the time found that geographic factors can influence patterns of alcohol use and alcohol-related problems (Gorman, Speer, Gruenewald and Labouvie, 2001; Scribner, MacKinnon, and Dwyer, 1994). In one of the most-often cited ecological studies of the effects of alcohol availability (geographic density of outlets) on violence, Scribner, MacKinnon, and Dwyer (1995) found that in a typical city in LA county, one additional liquor outlet was associated with 3.4 additional assaults. Socio-demographic variables alone explained 70 percent of the variation in assaultive violence rates. When total outlet density was added to the model, 77 percent of the variation was explained. Similarly, a longitudinal study of 256 American cities between 1960 and 1980 found that the density of liquor stores was significantly related to the change in homicide rates (Parker and Rebhum, 1995). A study using block groups in three northern California cities found that areas with a higher density of alcohol outlets had significantly higher levels of crime among Mexican American youth (Alaniz and Parker, 1998).

A study of Australian counties found that overall alcohol sales were positively related to assaults, controlling for a number of geographic, socio-demographic and

economic characteristics (Stevenson, Bronwyn, and Weatherburn, 1999). However, the amount of variance explained by alcohol sales varied greatly by county. A study of Detroit census tracts found that alcohol availability is positively and significantly related to total crime, violent crime, property crime and homicide (Gyimah-Brempong, 2001).

Using state-level shipments of alcohol as a proxy for consumption, Benson, Rasmussen, and Zimmerman (2001) found that the consumption of some types of alcoholic beverages was an important determinant of participation in or victimization in some criminal activities. The authors found a significant relationship (though only marginally significant) between liquor consumption and the per-capita murder rate, between liquor consumption and rape, between beer consumption and assault, and between liquor and beer consumption and robbery. Their findings regarding the influence of the number of licensed alcohol outlets were mixed. They found that states with fewer licensed liquor outlets had lower per capita consumption of beer, but increased liquor consumption. The authors suggested the conflicting results may have been due to missing variables within their study.

Although the majority of studies are cross-sectional, a few researchers have examined how changes in alcohol outlet density impact crime over time. A study using country-level time-series data (1960-1995) from Norway to examine the relationship between changes in on-site outlet density and the rate of investigated crimes found that a 12 percent increase in on-premise outlet density led to an increase in reported violence of about 6 percent (Norstrom, 2000). A study examining longitudinal data from 581 California zip code areas (Gruenewald and Remer 2006) found that assault rates were related to changes in population and place characteristics, including changes in the number of bars and off-premise alcohol outlets. More specifically, lower median household income and greater percentages of minorities (African American, Hispanic, and Asian) were related to increased rates of violence. A ten percent increase in the number of off-premise outlets and bars was related to a 1.67 and 2.06 percent increase in violence rates across local and lagged spatial areas. Every six outlets accounted for one additional violent assault that resulted in at least one overnight stay at hospital. These effects increased with larger male populations, doubling with every three percent increase in males.

In recent years, studies on alcohol availability have focused more closely on the use of units of analysis smaller than the city. Studies that have used large units of analysis, such as the state, city or metropolitan area, have produced conflicting results (Gorman et al., 1998a, b; Scriber et al. 1995). Scribner and colleagues' (1995, discussed earlier) study examining violent crime in Los Angeles County found that alcohol outlet densities helped to explain the variability in violent crime. A study seeking to replicate the findings (Gorman et al., 1998b) using 223 of the largest municipalities in New Jersey found that alcohol outlet densities did not significantly contribute to violent crime rates. The same researchers also examined the relationship between alcohol availability and domestic violence but did not find a geographic association (Gorman et al., 1998a). The difference between the findings from these studies was attributed largely, and not unexpectedly, to different outcome variables across different units of analysis.

In a later study, Gorman and colleagues (2001), using the block group unit of analysis, found that there was a clear association between alcohol outlet densities and violent crimes. "In Camden, alcohol outlets appear to function as crime hotspots, in the sense that the crime they generate is evident only in the immediate area they occupy and not in adjacent areas" (Gorman et al., 2001, p. 634). The authors suggested that future research examine the nature of the relationship between alcohol outlets, social disorder, and violence. In addition, they stressed the testing of theories such as routine activities theory.

Scribner and colleagues (1999) attempted to overcome limits in past research by studying homicide at the census tract level and limiting the study to urban residential neighborhoods. They found that both off-site sale alcohol outlets per square mile and on-site sale outlets per person were significantly related to the homicide rates among urban residential areas. A higher *on-site* alcohol outlet density was not associated with higher rates of homicide. The authors stressed that alcohol outlets are dynamically linked to the social network that results from the routine activities in neighborhoods.

In a zip code-level study examining hospital admissions for violent assaults, Gruenewald and colleagues (2006) found that rates of assault were significantly associated with densities of off-premise alcohol retail establishments and on-premise establishments (bars). In addition, population and place characteristics both within zip

codes and between adjacent zip code areas (spatial interaction effects) influenced rates of assault. Assault rates were greatest in densely populated, low SES zones, zip code areas with greater residential instability, fewer foreign-born minorities, and greater income extremes. Characteristics of adjacent populations also affected assault rates. Their study used a theoretical foundation based in both routine activities theory and social disorganization theory.

Nielsen and Martinez (2003) examined the relationship between alcohol availability and non-lethal violence (robbery and aggravated assault) and all types of violence at the census-tract level in Miami, Florida. The authors found that alcohol availability had strong positive effects on rates of non-lethal violence. In addition, the author found that the percentage of recent immigrants also was also a significant positive predictor of violence. The authors did not disaggregate outlets by on-premise versus off-premise.

In more recent work, Nielsen and colleagues (2005) examined the impact of alcohol availability and other social disorganization measures (disadvantage, residential instability, recent immigration, and urban location) for Latino and black aggravated assault and robbery victimizations. Using data from Miami, the authors found that, although most predictors had similar effects on the outcomes for both groups, higher densities of alcohol outlets[1] were associated with greater numbers of Latino victims of assaults and robberies, but not black victims. To explain this finding, they related the criminogenic influence of alcohol to contextual features of Latino and black neighborhoods, and suggested that, for Latinos, alcohol availability may undermine a neighborhood's ability to exert social control. They also suggested that levels of disadvantage in black neighborhoods may be so high that alcohol plays no role in varying rates of black victimization.

The limited research that has used smaller units of analysis to study the influence of alcohol availability has consistently demonstrated a strong relationship between alcohol availability and crime problems—at the block group level (Alaniz and Parker, 1998; Costanza, Bankston, and Shihadeh, 2001; Gorman, Speer, Gruenewald and

[1] Again, the author did not disaggregate outlets by on-premise versus off-premise, stating that "there were no substantive differences from the results presented when each was separately included in the models" (2005, p. 486).

Labouvie, 2001) and the census tract level (Gyimah-Brempon, 2001; LaVeist and Wallace, 2000).

In addition to the studies discussed above, micro-level research examining hotspots of crime found an association between violence and alcohol establishments. Sherman, Gartin and Buerger (1989) examined the hottest spots for violence in Minneapolis in 1986 and found that on-site outlets were located in these areas. Block and Block (1995) found that dense concentrations of liquor license establishments in Chicago often coincided with dense concentration of criminal incidents. Hot spot areas of tavern/bar crimes tended to be associated with main streets. These streets were the most commercial and oldest in the city. Interestingly, there was a number of high crime taverns located in more remote or isolated areas of the city. The authors differentiated these establishments as "high-crime attractor" places as opposed to "high crime bright-lights" places.

Alcohol Outlets and Social Disorder

Although the connection between alcohol consumption, drunkenness and public disorder is a strong concern for many communities, few studies have examined alcohol outlets' influence on social disorder. An in-depth literature review on alcohol outlets and adverse social outcomes revealed only a few empirical studies examining whether outlets influence levels of neighborhood disorder. The few studies that we found came out of either Australia or Great Britain. A study conducted by Stevenson, Lind, and Weatherburn (1999), found that, in New South Wales, Australia, assault, malicious damage to property and offensive behavior were more common in postcodes that had higher alcohol sales volume. They also found that there was a significant positive correlation between off-premise alcohol sales and malicious damage to property and offensive behavior incidents. In an examination of police records, Briscoe and Donnelly (2001) found that malicious damage to property incidents on licensed premises occurred more often on Saturday and Sunday mornings between midnight and 3:00 a.m. and Friday and Saturday nights between 9:00 p.m. and midnight. They also found that offensive behavior incidents were most likely to occur on Friday and Saturday night between the hours of 9:00 p.m. and midnight. A study examining clusters of disorder in

Great Britain found afternoon clusters near alcohol outlets (Nelson, Bromley, and Thomas, 2001).

Alcohol Outlets and Domestic Violence

In addition to the limited number of studies informing the relationship between alcohol outlets and social disorder, the literature is also limited with regard to alcohol outlets' influence on domestic violence. We found only one published ecological study that directly examined the relationship between alcohol outlets and domestic violence. Examining municipalities in New Jersey, Gorman, Labouvie, Speer and Subaiya (1998b) found that domestic violence, measured as complaints reported to the police, was not significantly related to alcohol outlet density. The authors did find that child care burden (number of children per 100 adults), social disadvantage, and population movement influenced rates of domestic violence. The limited literature on this topic is surprising given the wealth of literature showing that drinking alcohol is a risk factor for domestic violence. Furthermore, a review of published studies on drinking and domestic violence estimated that men were drinking in about 45 percent of the cases (estimates ranged from 6 to 57 percent) (Roizen, 1993).

In a study by Caetano, Schafer, and Cunradi (2001) that examined intimate partner violence across racial groups, the authors found that rates of intimate partner violence were much higher among men who reported drinking five or more drinks per occasion at least once a week than among those who abstained from alcohol consumption. They also found that rates of intimate partner violence were two to four times higher among men with alcohol problems than among men without alcohol problems. In a study of risk factors for intimate partner violence among urban women, Walton-Moss, Manganello, Fry and Campbell (2005) found that females identified male partner problematic alcohol use as a significant risk factor for abuse. In a another study, Stuart, Meehan, Moore, Morean, Hellmuth, and Follansbee (2006) looked at intimate partner violence arrestee characteristics and found that alcohol problems in perpetrators and partners were directly related to physical abuse.

Although alcohol outlets have not been included in ecological studies of the predictors of domestic violence, studies examining community context and domestic violence are not new. Using the 2000 National Household Survey on Drug Abuse,

Cunradi (2007), found that neighborhood disorder (fights, abandoned buildings and graffiti) was significantly correlated with domestic victimization (as noted by questions about intimate partner violence). Using the National Survey of Families and Households (NSFH), Fox and Benson (2006) examined social disorganization and intimate partner violence and found that violence against women is more prevalent and more severe in socio-economically disadvantaged neighborhoods. Another study using NSFH data (Van Wyk, Benson, Fox and DeMaris, 2003) found that population density, percent of single parents, percent non-white, racial heterogeneity, percent with low educational attainment, percent on public assistance, percent below the poverty line, and percent unemployed all had a significant positive relationship with domestic violence. Browning (2002), using the Chicago Health and Social Life Survey, found that female population and concentrated disadvantage were also significantly correlated with women's self-reporting of domestic violence. In a study on femicide and social disorganization, Frye and Wilt (2001) found that lower socioeconomic status and higher community social disorganization significantly predicted intimate partner homicides.

The empirical literature also demonstrates that alcohol-related violence is associated with more severe injuries and more chronic cases of violence (Reider et al. 1988; Brecklin, 2002; Graham, Plant and Plant, 2004; Leonard and Senchak, 1996; Martin and Bachman, 1997) and that alcohol use appears to be implicated more often in cases of intimate partner violence than in incidents that involve violence between strangers (Greenfeld and Henneberg, 2001). Furthermore, data from the National Crime Victimization Survey (NCVS) between 1993 and 1998 show that nearly one-half of the violent victimizations in which the victim reported alcohol use by the offender occurred in a residence, and more than 20 percent occurred in the victim's home (ibid). Given these findings, it is plausible that the rate of alcohol use by perpetrators in domestic violence cases is underreported. It is reasonable to hypothesize that in areas with easier access to alcohol, perpetrators may be more likely to consume alcohol more often and at higher rates than perpetrators living in areas with limited alcohol availability.

Alcohol Outlets and Public Safety: Other Outcomes Examined

Other studies examining the relationship between alcohol outlets and public safety have shown that the density of outlets is related to child maltreatment and traffic

accidents. Freisthler, Midanik, and Gruenewald (2004), applying routine activities theory to the study of child maltreatment, found that the number of off-premise outlets per population was positively associated with rates of child physical abuse and the number of bars per population was positively related to rates of child neglect. In a similar study, Freisthler (2004) used numerous measures of social disorganization to examine the relationship between alcohol access and neighborhood rates of child maltreatment. The study found that areas with higher percentages of poverty, female-headed households, Hispanic residents, population loss and greater densities of bars have higher rates of maltreatment. Freisthler, Needell and Gruenewald (2005) found that block groups with a higher concentration of bars and higher number of drug arrests had higher rates of child maltreatment.

A longitudinal study in Australia (Smith, 1992) found that a 10.5 percent relative increase in the alcohol outlet rate was associated with significant increases in driver and motorcyclist mortality. The authors found that the increases in traffic fatalities were due to the higher outlet rates for restaurants and stores rather than for hotels and taverns. A recent study of California zip codes (Treno, Johnson, Remer, Gruenewald, 2007) found that increases in the number of licensed alcohol retail establishments, especially bars and off-premise outlets, were positively associated with rates of car crashes and related injuries. Restaurants appeared to provide a protective effect against traffic-related injury. A study that combined telephone survey data on drinking patterns and administrative data on alcohol outlets found that alcohol-involved pedestrian collisions occurred more often in areas with greater bar densities and greater population, and where the local population reported drinking more alcohol per drinking occasion (LaScala, Johnson and Gruenewald, 2004). A study of motor vehicle crashes in Southeastern Michigan did not find an association between alcohol outlets and motor vehicle crashes (Melikera, Maio, Zimmerman, Kim, Smith and Wilson, 2004).

Limitations of Previous Research

A number of limitations have plagued the research on alcohol availability and crime. The majority of extant research has been conducted on large-scale geographical units, employed simple regression analysis, looked at alcohol-related problems in isolation, and failed to take into account the spatial structure of the data. Even when

studies use sound analytic techniques, the majority of recent work in this area has been limited to using data from one or two states/jurisdictions (e.g., California). Table 1 provides a list of studies that have examined the relationship between alcohol outlets and crime or other adverse neighborhood consequences. The table lists the studies by authors, provides the study unit of analysis and geographical areas, the dependent variable, the results, and the methodological issues/study limitations. As shown in the table, only a small handful of studies exist that examine placed-based variables at levels smaller than the census tract. The few studies that examine block group (or smaller) variations in crime utilize a very limited selection of situational risk factors. Similarly, these studies mostly examine violence or assault in isolation from other theoretically-related criminal events. Nor does the literature contain studies that examine alcohol establishments' influence on social disorder.

Column 5 in Table 1 also shows whether studies consider outlet types or distribution policies as key variables in their models. Historically, distribution practices and policies have been operationalized as alcohol outlets that sell alcohol that can be carried "off-premise" versus those that do not allow sales to be carried off the property. Basically, research studies are distinguishing among type of outlets; for the most part, restaurants, taverns and nightclubs do not allow off-premise sales, but the category for stores, such as mini-markets and liquor stores, do allow off-premise sales. As shown in the table, few studies distinguish between off-premise and on-premise. Furthermore, for the studies that do examine outlet types, the results are mixed, but for the most part show that off-premise outlets are significantly and positively related to assault.

Table 1. Summary of Literature on Alcohol Outlets and Crime							
	Study	**Place**	**Unit of Analysis**	**Crime***	**On/ Off Premise**	**Results**	**Methodological Issues/Limitations**
1	Roncek, D. and Pravatiner, M. (1989)	San Diego	City block (n=4,589)	Violent	N/A	Each additional bar associated with an increment of .4 violent crimes per block per year	Limited contextual variables
2	Sherman, L., Gartin, P. and Buerger, M. (1989)	Minneapolis	Address (n>115,000)	Predatory	N/A	10 of 42 locations with 10 plus predatory crimes over a 1-year period contained bars or liquor stores	Examined all types of places—no focus on alcohol-selling establishments
3	Roncek, D. and Maier, P. (1991)	Cleveland	City block (n=4,396)	Violent	N/A	Each additional bar associated with an increment of .9 violent crimes per block per year	Limited contextual variables
4	Scribner, R., MacKinnon, D., and Dwyer, J. (1995)	Los Angeles County	City (n=74)	Violent	Examines both on and off-premise outlets separately	Socio-demographics explained 70% of variance in violent crime; alcohol outlet density explained an additional 7%. Assaultive violence was significantly associated with density of both on and off premise alcohol outlets.	Descriptive in nature, research questions not based in theory
5	Gruenewald, P., Millar, A., and Roeper, P. (1996)	N/A	Various	Mostly violence and DWI	N/A	Outlines ways to curb alcohol related problems including drunk driving and violence	Meta-analysis of research on relationship between alcohol availability and alcohol-related problems
6	Alaniz, M. L., Cartmill, R., and Parker, R. (1998)	3 northern California cities	Block group (n=103)	Violent (youth)	Used off-premise outlets only	2 of 7 socio-demographic variables and off premise alcohol outlet density were predictive of youth violence	Limited base in theory; only examined subset of ecological variables. Did not examine physical environment variables or other situational risk factors.
7	Gorman, D., Speer, P., Labouvie, E., and Subaiya, A. (1998a)	New Jersey	Municipality (n=223)	Violent	Examines both on and off-premise outlets separately	Socio-demographics explained 70% of variance in violent crime; alcohol outlet density explained only an additional .3%. Different operationalizations of alcohol outlet	Large level of aggregation, hence no use of physical environment variables. No tests for spatial autocorrelation.

Table 1. Summary of Literature on Alcohol Outlets and Crime							
	Study	**Place**	**Unit of Analysis**	**Crime***	**On/ Off Premise**	**Results**	**Methodological Issues/Limitations**
8	Gorman, D., Speer, P., Labouvie, E., and Subaiya, A. (1998b)	New Jersey	Municipality (n=223)	Domestic Violence	Combines on and off-premise outlets into single variable	Socio-demographics explained 58% of variance in domestic violence; alcohol outlet density explained no additional variance	Large level of aggregation, hence no use of physical environment variables. No tests for spatial autocorrelation.
9	Speer, P., Gorman, D., Labouvie, E., and Ontkush, M. (1998)	Newark, NJ	Census tract (n=91) and block group (n=217)	Violent	Combines on and off-premise outlets into single variable	Socio-demographics explained 48% (tract) and 27% (block) of variance in violent crime; alcohol outlet density explained an additional 19% and 28% respectively	Limited operationalization of situational risk factors. Limited operationalization of violence and related behaviors.
10	Scribner, R., Cohen, D., Kaplan, S., and Allen, S. (1999)	New Orleans	Census tract (n=155)	Homicide	Examines both on and off-premise outlets separately	Socio-demographics explained 58% of variance in homicide; off-sale alcohol outlet density explained an additional 4%	Descriptive in nature, research questions related to routine activities, but very limited complement of variables studied; no tests for spatial autocorrelation
12	Treno, A., Alaniz, M., Gruenewald, P. (2000)	California and South Carolina	Telephone survey	Selection of drinking locations	Survey of routine drinking activities.	Drinking venues varied by different demographic characteristics, including a greater density of liquor stores in segregated ethnic communities	Limited operationalization of alcohol outlet. Limited community-level drinking and minority variables.
11	Gyimah-Brempong, K. (2001)	Detroit, MI	Census tracts	Total, property and violent crime	Combines on and off-premise outlets into single variable	Alcohol availability is positively and significantly related to total, property and violent crime rates and homicide	Limited operationalization of alcohol outlet. Limited community contextual variables.
13	Gorman, D., Speer, P., Gruenewald, P., and Labouvie, E. (2001)	Camden, NJ	Census block group (n=98)	Violent	Combines on and off-premise outlets into single variable	Model comprised of socio-demographics and alcohol outlet density explained 73% of the variance in violent crime; the model was replicated by spatial analysis	Limited operationalization of situational risk factors. Limited operationalization of violence and related behaviors.

Table 1. Summary of Literature on Alcohol Outlets and Crime							
	Study	**Place**	**Unit of Analysis**	**Crime***	**On/ Off Premise**	**Results**	**Methodological Issues/Limitations**
14	Lipton, R., and Gruenewald, P. (2002)	California	Zip codes	Assaults per roadway mile	Examines both on and off-premise outlets separately	Study found that alcohol outlets, in the presence of socioeconomic measures, moderate the occurrence of violence in urban areas. On-premise alcohol outlets were significantly associated with assault hospitalizations. Off-premise outlets were almost significant (.101).	Large level of aggregation. Proprietary spatial analysis software was used.
15	Freisthler, B., Midanik, L., and Gruenewald, P. (2004)	Three counties in California	Census tracts (n=940)	Child maltreatment	Examines both on and off-premise outlets separately	An additional bar per 1000 population was associated with a change of 2.2 more children with substantiated reports of maltreatment per 10,000 children	Only examines maltreatment (substantiated reports); No measure of community resources, institutions; proprietary spatial analysis software was used—(would be difficult to replicate)
16	Freisthler, B., Needell, B., Gruenewald, P. (2005)	California	Block groups	Rates of child abuse and neglect	Examines both on and off-premise outlets separately	Higher concentration of bars and higher number of incidents of drug possession were positively related to rates of child maltreatment. Bars and off premise outlets were related to violence	Only examines maltreatment (substantiated reports); No measure of community resources, institutions; proprietary spatial analysis software was used—(would be difficult to replicate)
17	Nielsen, A. L.; Martinez, Jr, R.; Lee, M. T. (2005)	Miami, FL	Census tract	Robbery and Assault victimizations	Combines on and off-premise outlets into single variable	Higher alcohol availability rates are associated with more Latino but not black assault and robbery victims	Limited contextual variables
18	Gruenewald, P., and Remer, L. (2006)	California	Zip codes	Violent assault	Examines on and off-premise outlets separately	The addition of spatial lagged variables of population and place characteristics, over and above local characteristics, contributed significantly to the models.	Only examines injury data to operationalize violent assaults; No measure of community resources, institutions. Did not examine variations in distribution policies.
19	Gruenewald, P., Freisthler,	California	Zip codes	Violent assault	Examines on	The addition of spatial lagged	Large level of aggregation and limited

Table 1. Summary of Literature on Alcohol Outlets and Crime							
	Study	**Place**	**Unit of Analysis**	**Crime***	**On/ Off Premise**	**Results**	**Methodological Issues/Limitations**
	B., Remer, L., LaScala, E. and Treno, A. (2006)			(hospital discharge data)	and off-premise outlets separately	variables of population and place characteristics, over and above local characteristics, contributed significantly to the models. Greater densities of off-premise outlets and bars were related to higher rates of violence.	operationalization of violence.
20	Waller, L., Zhu, Li; Gotway, C., Gorman, Dennis M. and Gruenewald, P. (2006)	Houston, TX	Census tracts	Violent crime (Part 1)	Combines on and off-premise outlets into single variable	The weighted regression provided a descriptive approach, while spatially varying coefficient models defined spatial correlations within a probability model to influence estimated associations	Methodology-focused and limited population and neighborhood variables.
21	Wood, D., and Gruenewald, P. (2006)	Alaska	132 Alaskan Native villages	Serious injury resulting from assault	Used prohibition standards	Villages that prohibited alcohol had lower age-adjusted rates of serious injury resulting from assault	Uses limited population for study (isolated Native Alaskan villages).
Original Source of Table Page 66 in Lipton, R., Gorman, D.M., Wieczorek, W.F., and Gruenewald, P. (2003) The Application of Spatial Analysis to the Public Health Understanding of Alcohol and Alcohol-Related Problems. Pp. 57-79 in Geographic Information Systems and Health Applications. Khan, O.A. and Skinner, R. (Eds.) Hershey, PA: Idea Group Publishing.							

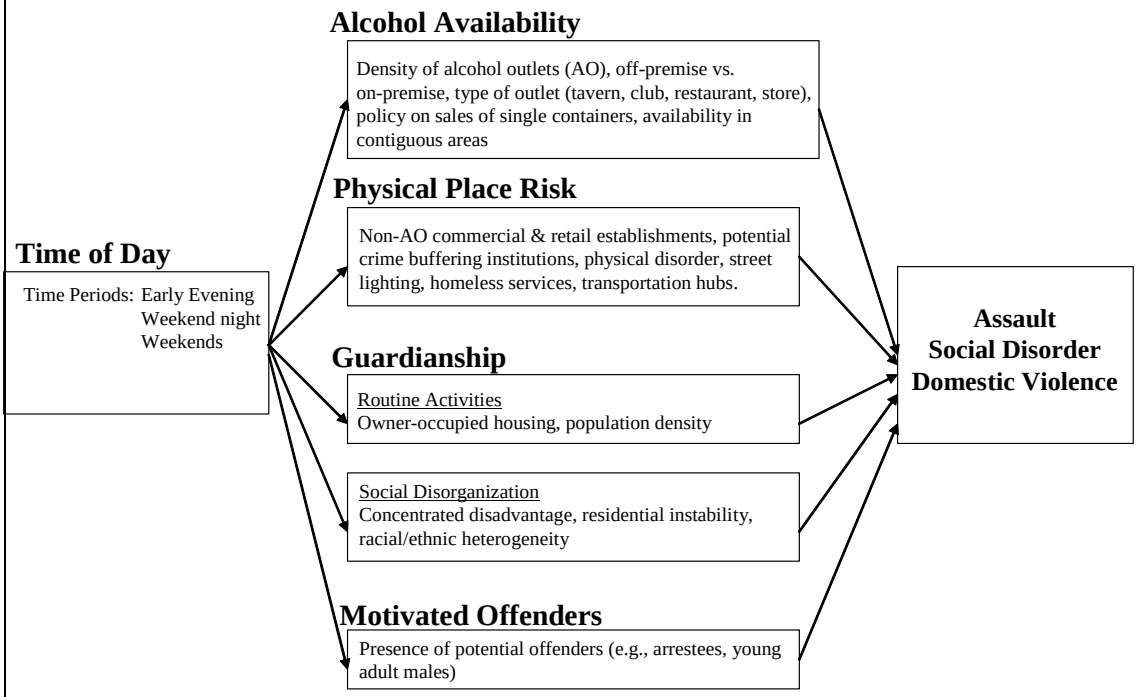
In addition to the inadequate range of measures of the physical environment and alcohol outlet distribution practices, spatial econometric methods to handle discrete events (i.e., counts) within a criminological framework have not been very accessible, which has contributed to the dearth of literature focused on the neighborhood ecology of crime. For the most part, sociologists and criminologists have resorted to a two-stage approach whereby the discretely-measured criterion variable is first converted into an approximately continuous measure and then traditional spatial analytic techniques are applied (Messner and Anselin, 2004; Morenoff, Sampson and Raudenbush, 2001, Roman, 2004). These techniques are acceptable; however, it is unclear whether these transformations always yield their desired corrections (Bhati, 2008). Researchers have shown that transformations of dependent variables (such as logarithmic, Freeman-Tukey type and Empirical Bayes transformations) are not always optimal when studies are interested in interpreting the marginal probability effects of predictor variables (Bailey and Gatrell, 1995). In recent years, a number of methodological advances have been made for modeling rare events in a spatial framework. In this study we utilize a new technique—a Generalized Cross Entropy approach—designed by one of the study authors, for handling count outcomes with over or under dispersion and spatial autocorrelation (see Bhati, 2008).

This study also examines multiple types of criminal behaviors, and a wide range of ecological and situational factors hypothesized to influence crime. Advancements in spatial statistical methods and availability of address-level data provide a unique opportunity to continue research in this difficult area. Below we present the components of our theoretical model of alcohol availability and crime, which will form the basis for analytical model development and testing.

Chapter 2. Theoretical Model of Alcohol Availability and Crime

Figure 1 presents the logic model that is used to guide our research questions. In addition to alcohol availability, we propose that there are four main independent components to the model that can be modeled within an opportunity framework: (1) physical place, (2) guardianship related to routine activities, (3) guardianship related to social disorganization, and (4) motivated offenders. These components all fall under the rubric of opportunity structures as discussed earlier.

Figure 1. Theoretical Model of Alcohol Outlets and Violence and Disorder



The model sets the stage for examining the ecological and environmental factors that could help shape the influence of alcohol-selling establishments on violence and disorder. Although some social disorganization-based variables have been incorporated in alcohol outlet studies in the past, few studies include measures that assess the physical/built environment. Similarly with the exception of a few studies that include estimates of the percentage of young adults, studies rarely include measures that

operationalize the motivated offenders construct. Overall, the environmental risk factors associated with violence in and around alcohol outlets have not been studied (Casteel et al., 2004; Freisthler and Gruenewald, 2007). The current theoretical model is designed ultimately to inform policies that can influence crime, disorder and violence. The following sections provide a summary of the components that comprise the model. (More detail on the operationalization of variables and the sources of data is provided later, in the "Methods" section.)

Components of the Model

Alcohol Availability

Studies examining alcohol availability most often quantify availability by measuring the number and density of alcohol selling establishments. Many studies also have examined the varying characteristics of alcohol-selling establishments that include type of establishment (bar, hotel, liquor store, etc.) or license type related to whether alcohol purchased can be carried off the premise ("off-premise" outlets). In a perfect world, rigorous neighborhood-level studies and place-based studies of alcohol availability would also include a host of variables that influence distribution or sales. Routine activities theory would lead one to focus on the specific context of the places selling alcohol. But in reality, neighborhood-level measures of sales and place-based characteristics of alcohol outlets either do not exist, or would be too burdensome to collect. For instance, we could not find any studies that examined hours of operation of bars in relationship to crime within a comprehensive model. However, community members and policymakers often advocate for limited retail and/or club hours, and risk factors related to workplace violence include hours of operation (U.S. Department of Labor, 1998; Loomis, et al., 2002). Longer hours of operation would be synonymous with increased availability. Furthermore, routine activities theory would suggest that those establishments that are open into late night/early morning would be associated with reduced guardianship, and result in the likelihood of increased crime. In addition, we could find no studies that examine variations in crime related to whether single bottles or cans of beer could be purchased, yet this has been of great concern to communities.

Single Sales

Liquor control boards and neighborhood advisory commissions repeatedly must deal with residential complaints about single container sales (Chan and Pierre, 2001; Shea, 2005).[2] In the District of Columbia and other cities across the country, law makers are attempting to limit public disorder and crime by banning the sales of single containers of alcohol. A single can be broadly defined as a container of an alcoholic beverage that is sold individually (not as part of a six-pack or any similar type of packaging), often with the implicit purpose of immediate consumption; size ranges from about 16 to 40 ounces. In general, the most common types of alcoholic beverages available as singles in alcohol selling establishments are beer, malt liquor, and ale, although singles of wine and other spirits are not difficult to find. Community members in the District of Columbia, San Diego, California, Normal and Bloomington, Illinois cite littering, loitering, public intoxication, and public urination as reasons why they want to ban single sales of alcohol (Weinstein, 2007; Masnjak, 2006; Miller, 2006). In 2004, Seattle, Washington assessed whether the city should expand alcohol sale limits into a broad area of the city. The ban in Seattle has liquor sellers in eight large neighborhoods restricting the sale of alcohol that can be taken off the business's premises between 6 and 9 a.m. and curbing the sale of certain types of low-cost, high-alcohol beers and wines (Murakami, 2004). These restrictions were aimed at curbing the number of people loitering outside the establishments early in the morning to buy alcohol and to limit the amount of public intoxication in local parks (ibid). In enacting these regulations, lawmakers cite successes such as the Mount Pleasant (District of Columbia) single sales ban that they say led to a 41 percent drop in all calls for police service and a 51 percent drop in disorderly conduct calls for service after the ban was put into place (Weinstein, 2007).

In the District of Columbia, a definition of a single can vary by license code and neighborhood-sponsored voluntary agreements, but there are a handful of commonly-used measurements. For beer, malt liquor, and ale, containers of less than or equal to 40

[2] Within a fifteen minute search on the Internet using the terms "purchase" "single containers" and "neighborhoods," we found at least ten sets of meeting minutes within the last three years from alcohol board meetings and planning commissions devoted to or discussing the issue. See for example: http://www.liq.wa.gov/minutes/reg021119.asp; and http://www.ci.salinas.ca.us/BoardCom/plancomm/planMts/Jun1604.html.

fl. oz. (~1250 mL) most often qualify explicitly as singles, although in some usages the noted threshold volume may be as small as 24 fl. oz. (~750 mL), or even as large as 70 fl. oz. (~2000mL). Though not cited quite as frequently, the threshold value for containers of wine is also usually given as 24 fl. oz. Singles of other spirits, such as the many varieties of hard liquor, are not explicitly defined in most relevant text, but a useful threshold value which is occasionally cited is 200 mL (~8 fl. oz.). In the District of Columbia there are two ways for a neighborhood to control the sale of single alcohol containers. The first is through a voluntary agreement between a third party (usually the advisory neighborhood commission (ANC)) and the store. The voluntary agreement is worked out with the Alcohol Beverage Regulation Administration, usually in lieu of a formal protest against a business who is applying for a new or renewal license. The restrictions placed in a voluntary agreement can vary by business but usually include restrictions on single sales and hours of operation. The other option for neighborhoods or areas that want to limit single sales, but cannot manage to do so through the use of voluntary agreements, is to get a moratorium passed. A moratorium is written into D.C. Official Code under Title 25. Once a moratorium goes into effect, all current and new license holders must comply with the regulations or be subject to enforcement sanctions. In the District of Columbia, several neighborhoods, including the H St Corridor, Ward 4, Mount Pleasant, Adams Morgan and Capitol Hill, have in place moratoriums on the selling of single sales.

Physical Place Risk

Physical place risk includes measures of the physical or "built" environment such as land uses, lighting, disorder, and traffic patterns—internal and external features of the physical environment that can be conducive to, or facilitate crime or the potential success for a criminal offender. For instance, certain types of land uses (or places) can provide the opportunity for people to congregate or particularly attractive places for potential offenders because of accessibility and the presence of people carrying money. Spaces can convey the likelihood of being observed (or not observed) and provide refuge for potential offenders. Neighborhoods with high densities of liquor stores are often blighted areas without desirable public and private services, such as parks, recreation centers, movie theaters, grocery stores, etc. (Alwitt and Donley, 1997; LaVeist and Wallace,

2000; Mohan, 2005). Concentrations of commercial properties can also bring about physical disorder—disorder that sends cues that guardianship is limited, hence, inviting crime and further disorder (Perkins, et al., 1993; Skogan, 1990). The overwhelming majority of alcohol outlet studies have not incorporated measures of the physical environment. A recent study (Gruenewald et al., 2005) included a measure of non-alcohol-selling retail establishments.

Guardianship: Routine Activities

Routine activities theory would suggest that the very nature of the alcohol outlet makes it conducive to crime and disorder. Bars, liquor stores and clubs attract people with money—who often are congregating in small spaces with limited capacity for guardianship. This component includes variables that represent surveillance or guardianship (or absence of guardianship) within the routine activity and defensible space framework: housing characteristics that represent ownership, number of residents who would likely be capable guardians, and the number of male adults. Areas where residents take pride in their neighborhoods and show that property is well-maintained are more likely to be areas where residents watch over their property and their neighbor's property. Areas with more crowding or males of drinking age may be less likely to have capable guardians. With the exception of two or three studies, the extant literature has not incorporated these types of variables in studies on alcohol outlets.

In addition, according to routine activities theory, time of day will influence the level of guardianship or surveillance. As the day progresses into the night, fewer capable guardians will be available. Estimating the number of guardians across different times of the day would be a complex task; data are not available at the neighborhood level. Hence, to capture this variation, we will utilize temporal dimensions of our dependent variables. Modeling an appropriate temporal framework is discussed further under the "Methods" section.

Social Disorganization

As stated earlier, neighborhood structural processes, such as residential instability, racial heterogeneity, and economic disadvantage, have been shown to influence neighborhood level crime. With regard to alcohol outlets and crime, areas high in social disorganization would be lacking the mechanisms to build social buffers against crime or

withstand the presence of motivated offenders. These areas also would be areas less likely to have residents who could effect change in retail store policies or zoning (Bursik and Grasmick, 1993). The extant research on alcohol availability and crime has done an adequate job incorporating a range of variables related to social disorganization (see Freisthler and Gruenewald, 2007; Gorman et al., 2001; Gruenewald et al., 2005, 2006).

Motivated Offenders

The presence of "motivated offenders" is one of the three requisites for crime under routine activity theory, yet few studies have incorporated measures, or proxy measures of this component. For studies examining alcohol outlets and crime, it seems critical to measure possible variation in potential offenders, given that offenders, compared to the general population, have been found to disproportionately use alcohol, and have demonstrated that they are willing to break the law.

Time of Day

The concept that crime varies by time of day is not new, and the empirical literature has provided some evidence of how opportunity structures can vary by the time of day (Garofalo, Siegel, and Laub 1987; Gouvis et al. 2001; Gouvis, Johnson, and Roth 1997; McManus 2001; Snyder 1999; Wiebe and Meeker 1998). These studies have associated youth activity patterns of attending school with victimization. Other studies examining nighttime activities and crime have shown a relationship between time of day and patterns of assault and residential burglaries (Massey, Krohn and Bonati, 1989; Messner and Blau, 1987; Roundtree and Land, 1996; Sampson and Wooldredge, 1987). Thus, understanding the factors associated with crime at different times of day is critical to informing crime prevention and intervention. These studies form a solid backdrop from which more detailed studies examining the interactions between different types of crime and location, time, population flow and other place and population characteristics can be developed.

In a recent block-level study, Roman (2004) developed a domain-specific model of opportunity factors to determine how the opportunity constructs affect violence across an entire county as youth flow to and from school, and found that a number of facilities were generators of crime—dependent on time of day—and further confirmed the importance of incorporating time into models of neighborhood violence. The results also

suggest that there is much to be learned from small area (i.e., block level) analyses of violence. The study utilized instrumental variables regression with spatial lag to examine how land use factors, neighborhood facilities and institutions, youth hangouts, and neighborhood contextual factors affected block-level violence, and whether and how the presence of schools changed any relationship found between violence and opportunity across neighborhoods. Schools were found to be generators of crime during the school day. During the after-school period, only blocks near schools characterized by resource deprivation experienced significantly higher rates of violent crime. During the morning commute, blocks near schools characterized as disorderly exhibited higher violent crime rates than blocks near orderly schools. In addition to schools, other places where youth patronize as part of their daily activities—places such as malls and movie theaters and recreation centers—were risky places after school and into the late night period on school nights. Although it is likely for youth to patronize these places during weekends, the study found that it is the times of day that are most likely to witness the greatest concentration of youth that experience the highest rates of violence.

Chapter 3. Research Method Overview, Site, and Data

Overview

The study develops a geographic information system (GIS) containing neighborhood crime, and demographic and physical environmental characteristics at the block group level for the District of Columbia. We calculate density measures of alcohol availability and distribution practices, and aggregate characteristics of neighborhoods to examine the relationships of those measures to crime and violence.

Research Hypotheses

The research hypotheses flow from our theoretical model. The central questions explored in this work focus on how the density of alcohol selling establishments, and distribution methods of alcohol at those establishments influence assault, disorder and domestic violence.

Detailed hypotheses include:

Higher densities of alcohol outlets will be associated with an increase in levels of aggravated assault. The association will be driven by alcohol outlets that permit alcohol to be carried *off premise*.

Higher densities of alcohol outlets will be associated with an increase in levels of disorderly conduct and other types of social disorder. The association will be driven by alcohol outlets that permit alcohol to be carried *off premise*.

Higher densities of alcohol outlets will be associated with an increase in levels of domestic violence. The association will be driven by alcohol outlets that permit alcohol to be carried *off premise*.

Levels of assault, social disorder, and domestic violence will vary across times of the day. The influence of alcohol outlets on assault, disorder and domestic violence will be greatest on weekend nights.

Levels of assault and social disorder will vary across the densities of different types of alcohol outlets (i.e., bar, nightclub, store, and restaurant). For instance, assault and

disorder will be lower in areas with high concentrations of restaurants, as compared to areas with high concentrations of bars, alcohol-selling stores, and nightclubs. We do not hypothesize a relationship between domestic violence and nightclubs, bars, and restaurants.

Aggravated assault and social disorder will be highest in those block groups with a high density of alcohol outlets where the outlets permit single container sales. High density of single sale outlets will not influence levels of domestic violence.

Disadvantaged/disorganized neighborhoods with alcohol outlets will have higher levels of assault, social disorder, and domestic violence than disadvantaged neighborhoods without these crime-attracting institutions.

Higher densities of pro-social institutions such as recreation and community centers and churches in neighborhoods with crime-attracting institutions will buffer against high levels of violence and disorder.

Other features of the physical environment that act as crime generators and attractors (transportation hubs, street lighting, vacant houses, physical disorder, commercial and retail land uses, and homeless services) will act as an independent influences on assault and disorder, but will have little influence on domestic violence.

Research Site

Washington, DC is a high crime, metropolitan area that has a total area of 68.3 square miles. In 2006, the population was estimated to be 581,530 (U.S. Census Bureau, 2007). During the violent crime wave of the early 1990s, Washington, D.C. was known as the "murder capital" of the United States. Homicides peaked in 1991 at 482, but the level of violence declined drastically in the 1990s (Metropolitan Police Department, 2007). In 2006, there were 169 murders in the city (ibid). According to the 2000 Census, the median income for a household in the city was $40,127, and the median income for a family was $46,283. Males had a median income of $40,513 versus $36,361 for females.

The per capita income for the city was $28,659 (ibid). In Washington, DC about 16.7 percent of families and 20.2 percent of the population were below the poverty line, including 31.1 percent of those under age 18 and 16.4 percent of those over age 65 (U.S. Census Bureau, 2000a). Washington, D.C. has an interesting dynamic that the daytime population is estimated at 982,853 while the residing population is estimated at approximately 582,000 (Bergman, 2005). The influx of over 410,000 workers into Washington on a normal business day comprises a 72 percent increase of the capital's normal population.

Unit of Analysis

The unit of analysis for this study is the census block group. The census block group is a subdivision of the census tract with most block groups being delineated by local participants as a part of the U.S. Census Bureau's Participant Statistical Areas Program (U.S. Census Bureau, 2000b). The block group is also the smallest unit for which the Census calculates and maintains data for. We believe that the appropriate unit of analysis to capture the effects of an alcohol-selling establishment is the block group. The block group level captures sufficient variation in the presence of alcohol-selling establishments and other independent variables hypothesized to be related to crime and disorder. Any larger level unit of analysis would mask important micro-level variation.

The District of Columbia is made up of 433 block groups as designated by the U.S. Census 2000. For this analysis we used 431 of the 433 block groups in the District. The two block groups that were excluded from the analysis consist of the National Mall (which is an open area national park) and Bolling Air Force Base. The National Mall was dropped from our analysis for two reasons. The first reason is that crimes committed on the National Mall are most often handled by the United States Park Police and not reported to the Metropolitan Police Department (MPD) and therefore fall outside of our sample. The second reason for dropping this block group is that the Census reports a population of 12 residents. Bolling Air Force Base was dropped from this analysis because their crime is also not reported to MPD and their alcohol-selling establishments are not registered with ABRA. For the remaining 431 block groups in the District of Columbia, there is an average of 573 households and 1,304 residents and 20 percent of the residents being under 18 years old (U.S. Census Bureau, 2000a). According to the

2000 Census, 60 percent of the residents are black, 31 percent are white and 8 percent are Hispanic (of any race) (ibid). The average block group size is 0.14 square miles; the smallest block group is 0.02 square miles and the largest block group is 1.87 square miles (ibid).

Measurement of Dependent Variable

This study examines our theoretical model of the influence of alcohol outlets on four outcomes, described in more detail below: (1) aggravated assault incidents, (2) calls for service (i.e., 911 calls to the police department) for disorderly conduct and (3) calls for services for social disorder more broadly defined, and (4) calls for service for a domestic incident (either between intimate partners or guardians/parents and children). Both police incident data on assault and calls for service data were provided by the District of Columbia Metropolitan Police Department (MPD). All incidents were mapped using ArcMap 9.0 using a street centerline file provided by the District of Columbia's Office of Chief Technology Officer (OCTO). All maps were projected using Maryland State Plane using a North American Datum (NAD) 83.

All dependent variables are examined using the average of the aggregate sum of the incidents or calls for service across a two-year time span. Descriptive Statistics for all dependent variables can be found in Table 2. The table also includes the descriptive statistics on the crime variables disaggregated by time of day for times corresponding to peek crime (assault, disorder and domestic violence) times.

Assault

The assault measure is the number of incidents reported to the police for assault with a deadly weapon (ADW) (i.e., aggravated assault) from January 1, 2005 through December 31, 2006. All aggravated assault incidents are person-level with each victim accounted for separately. For stability purposes, the victimization data are aggregated using the two-year time period (January 1, 2005- December 31, 2005, January 1, 2006- December 31, 2006) and then averaged. The practice of aggregating and averaging is standard practice in studies examining aggregate crime across neighborhoods (Roncek and Maier, 1991; Smith, Franzee, and Davidson, 2000). MPD provided the data with x and y coordinates associated with the locations of assaults. There were a total of 7,559 assaults reported to MPD from January 1, 2005 through December 31, 2006. Of these, we

used 6,468 (85.6 percent) ADWs and dropped 1,030 (13.6 percent) simple assaults (and threats). Simple assaults and threats were dropped because of inconsistent reporting practices *across* police precincts in the District. MPD does not mandate the consistent collection of simple assaults for research purposes. Another 51 incidents (0.8 percent) were dropped for missing incident start times and six incidents (< 0.01 percent) were dropped because they were missing x, y coordinates and address. There was a yearly average of 7.48 assaults per block group (see Table 2).

In addition to examining total crime spanning all days and times, to account for varying crime risk by time of day this study divides the number of incidents and calls into three different time periods. The three time periods examined are: (1) weekend nights, (2) the weekend, and (3) weeknights after work. Table 3 provides a description of the hours used to create the time periods. Incidents that were recorded as occurring over a period of time (as opposed to having a specific time reported) were coded to their start times and days.

Table 2. Descriptive Statistics for Independent Variables

	Mean	S.D.	Max	Min	Med	Skew	Nmiss	N
Dependent Variables								
Aggravated Assault	7.48	7.92	45.00	0.00	5.00	1.70	0	431
UI Defined Social Disorder	70.17	60.92	404.00	0.00	52.00	1.76	0	431
MPD Defined Social Disorder	188.60	205.89	2608.00	0.00	130.00	4.76[a]	0	431
Domestic Violence	24.60	27.25	180.00	0.00	16.00	2.28	0	431
Disaggregated by Time Periods								
Aggravated Assault- Weekend	1.95	2.25	12.50	0.00	1.00	1.72	0	431
Aggravated Assault- Weekend Night	1.23	1.56	9.00	0.00	0.5	1.98	0	431
Aggravated Assault- Weeknight	1.71	1.99	11.0	0.00	1.0	1.76	0	431
MPD Defined Social Disorder- Weekend	100.16	101.95	1121.00	0.00	71.00	3.58	0	431
MPD Defined Social Disorder- Weekend Night	60.82	62.10	606.00	0.00	42.00	3.10	0	431
MPD Defined Social Disorder- Weeknight	84.58	93.51	1066.00	0.00	58.00	3.84	0	431
UI Defined Social Disorder- Weekend	32.21	30.02	198.00	0.00	22.00	1.81	0	431
UI Defined Social Disorder- Weekend Night	17.37	17.59	112.00	0.00	12.00	1.83	0	431
UI Defined Social Disorder- Weeknight	28.33	25.59	194.00	0.00	21.00	1.92	0	431
Domestic Violence- Weekend	5.90	6.85	44.00	0.00	4.00	2.22	0	431
Domestic Violence- Weekend Night	3.18	3.98	24.00	0.00	2.00	2.21	0	431
Domestic Violence- Weeknight	4.71	5.11	38.00	0.00	4.00	2.14	0	431

[a] The skewed nature of this variable is mostly the result of one block (Chinatown area) that had 2,395 calls for disorderly conduct in 2005 2,822 calls for disorder in 2006. We do not view these numbers as outliers. There are 78 restaurants, 7 stores, 7 nightclubs, and 12 taverns in the block group (block group is 0.35 square miles).

Table 3. Time Periods Used for Analysis[a]		
Period	**Hours of the Day**	**Total Number of Hours in Period**
Weekend	Friday 10:00 p.m.-Sunday 4:59 a.m.	31
Weekend "Late" Nights	Friday 10:00 p.m.-11:59pm, Saturday 12:00-4:59 a.m., 10:00 p.m.-11:59 p.m., Sunday 12:00 a.m.-4:59 a.m.	14
Weekday Nights	Mon., Tues., Wed., Thurs. 3:00 p.m.- 9:59 p.m.	28

[a]Time periods were not meant to be comparable. See below for detailed description of time and why time periods were chosen.

We created these time periods based on: (1) data collected by the study authors on hours of alcohol outlet operation, and (2) an exploratory examination of the peak times for assault across hours and days of the week. Figures 2-4 show the distribution of aggravated assaults by various time periods. Figure 2 shows incidence of aggravated assault across a 24 hour period; Figure 3 shows the incidence of aggravated assault throughout the day, but disaggregates days by *day of week* (Monday, Tuesday, Wednesday, Thursday are averaged together for ease of viewing), and Figure 4 shows the number of assault incidents across six four-hour periods for each day of the week. Because there was not much variation in numbers of assaults for the hours of the day between 6:00 a.m. and 2:00 pm (see Figure 3 and 4) across the days of the week, we decided that it was prudent to limit the number of time periods examined in the analysis. Hence, we created three time periods for consideration in our modeling, as described in Table 3. Figures 5-8 map aggravated assault levels across block groups in the District of Columbia. The method "natural breaks" was used to create the levels of assaults on the thematic map. Figure 5 maps all aggravated assaults, Figures 6 through 8 provide a picture of aggravated assaults across the three time periods. There was a yearly average of 1.95 assaults per block group on weekends; 1.23 on weekend nights and 1.71 on weeknights (see Table 2).

Social Disorder

The two measures of social disorder are (1) calls for service for disorderly conduct (as classified by 911 call takers prior to resolution) and (2) calls for service for a more broadly-defined class of social disorder, but not including disorderly conduct: shooting, sounds of gunshots, man down, woman down, indecent exposure, soliciting for prostitution, and destruction of property (these also are classifications made by the 911 call-takers). For these two variables, calls were averaged across 2005 and 2006. Across these two years there was an average of 188.62 calls per block group for disorderly conduct, and 70.2 calls for service for the UI-defined category of social disorder. MPD provided these data with a date/time field, location of call for service, block ID, priority level, case number (if one was filed), and x, y coordinates.

As with aggravated assault, social disorder calls (disorderly conduct and UI-defined disorder) also were disaggregated into three different time periods of the day/week. The same time periods were used (see Table 3). Figures 9-11 provides a descriptive picture of the distribution of disorderly conduct by various time periods used to determine which final time categories should be used in the analyses. Figure 9 shows the incidence of disorderly conduct across a 24 hour period; Figure 10 shows the incidence of disorderly conduct throughout the day, but disaggregates days by *day of week*, and Figure 11 shows the number of disorderly conduct calls across six four-hour periods for each day of the week. As result of the distribution and what we know about the time of day that alcohol outlets are open, we only examined the three time periods described in Table 3 (in addition to modeling disorderly conduct calls at all times of the day). Figures 12-15 map disorderly conduct levels across block groups in the District of Columbia. The "natural breaks" method was used to create the thematic maps of disorder conduct. Figure 12 maps all disorderly conduct calls. Figures 13 through 15 provide a picture of disorderly conduct across the three time periods. There was a yearly average of 100.16 calls for disorderly conduct per block group on weekends; 60.82 on weekend nights and 84.58 on weeknights (see Table 2).

Figures 16-18 provides a descriptive picture of the distribution of UI-defined social disorder by various time periods used to determine which final time categories

should be used in the analyses. Figure 16 shows the incidence of UI-defined disorder across a 24 hour period; Figure 17 shows the incidence of UI-defined disorder throughout the day, but disaggregates days by *day of week*, and Figure 18 shows the number of UI-defined social disorder across six four-hour periods for each day of the week. As result of the distribution and what we know about the time of day that alcohol outlets are open, we only examined the three time periods described in Table 3 (in addition to modeling disorder at all times of the day). Figures 19-22 map disorderly conduct levels across block groups in the District of Columbia. The "natural breaks" method was used to create the thematic maps of UI-defined disorder. Figure 19 maps all UI-defined disorder calls across block groups. Figures 20 through 22 provide a picture of disorderly conduct across the three time periods. For UI-defined social disorder, there was a yearly average of 32.21 calls per block group on weekends; 17.37 on weekend nights and 28.33 on weeknights.

Domestic Violence

Domestic violence data were obtained from the Metropolitan Police Department and consist of 911 calls that were received for domestic violence-related incidents from January 1, 2005- December 31, 2006. The call codes are "domestic violence," "domestic violence assault" and "domestic violence incidents." There were 21,349 domestic violence calls for service that came into MPD over two years and an average of 24.60 per block group. These data included a date/time field, location of call for service, block of call for service, priority level, case number (if one was filed), and x, y coordinates. Time of day and day of week variables were tabulated in SAS from the date/time variable provided by MPD. In addition to assessing all domestic violence calls across all time periods, we assess domestic violence calls across three different time periods, the same periods for which we consider assault and disorder: (1) weekend (2) weekend nights, and (3) weeknights (Monday through Thursday) (see Table 3).

Figures 23-25 show the distribution of domestic violence calls by time of day and across four-hour time periods. As mentioned above, these figure are shown to provide a glimpse at the underlying data used to determine which time period should be used in the analyses. Figure 23 shows the incidence of domestic violence calls across a 24 hour

period; Figure 24 shows the incidence of domestic violence calls throughout the day, but disaggregates days by *day of week*, and Figure 25 shows the number of domestic violence calls across six four-hour periods for each day of the week. Similar to assault and disorder, for all analyses going forward we chose the three time periods described in Table 3 (in addition to modeling disorder calls at all times of the day). Figures 26-29 map disorder levels across block groups in the District of Columbia. The "natural breaks" method was used to create the thematic maps of disorder. Figure 26 maps all domestic violence calls by block group. Figures 27 through 29 provide a picture of domestic violence across the three time periods (weekend, weekend nights, and weeknights). There was a yearly average of 5.90 calls for domestic violence related offenses on weekends, 3.18 on weekend nights and 4.71 on weeknights.

Measurement of Independent Variables

This section describes the operationalization of the independent variables. The measures representing the constructs have been developed from a number of data sources as described in Table 4. All descriptive statistics for the independent variables can be found in Table 5.

Table 4. Variable Descriptions and Sources

Variable	Variable Name	Operationalization/Coding at Block Group Level	Year(s)	Data Source
On-Premise Alcohol Outlets	On_sqmi	Number of on-premise outlets per square mile	Licensed through 2006	Office of the Chief Technology Officer (OCTO)
Off-Premise Alcohol Outlets	Off_sqmi	Number of off-premise outlets per square mile	Licensed through 2006	OCTO
Restaurant	Rest_sqmi	Number of Restaurants per square mile	Licensed through 2006	OCTO
Tavern	Tavern_sqmi	Number of Taverns per square mile	Licensed through 2006	OCTO
Nightclub	night_sqmi	Number of Nightclubs per square mile	Licensed through 2006	OCTO
Store	store_sqmi	Number of stores per square mile	Licensed through 2006	OCTO
Social Disorganization				
Racial/Ethnic Heterogeneity	racehet	One minus the sum of squared proportions of each of four races: black, white, Asian, Hispanic	2000	2000 Census
Concentrated Disadvantage	concdis	Sum of z-scores for five Census items: (a) percent of all households receiving public assistance, (b) percent of population with income below the federal poverty level in 1999, (c) percent black (non-Hispanic), (d) percent of civilian population age 16 or older in labor force who are unemployed, and (e) percent of households with children headed by a woman. Divided by number of items (5).	2000	2000 Census

Table 4. Variable Descriptions and Sources

Variable	Variable Name	Operationalization/Coding at Block Group Level	Year(s)	Data Source
Residential Stability	resstab	Sum of z-scores for two items: percent living in same house since 1995 and the percent of housing occupied by owners. The sum of these two items is then divided by two (the number of items).	2000	2000 Census
Motivated Offenders				
Population 18-29	rate18_29	Proportion of population aged 18-29	2000	2000 Census
Adult Arrests 05/06	arr_0506	Number of adult arrests	1/1/05 - 12/31/06	MPD
Routine Activities				
Population	loqpopsqmi	Log of residential population per square mile	2000	US Census
Physical Environment				
Prosocial places	proso_sqmi	Aggregation of all schools, churches, libraries and recreation centers per square mile	2006	OCTO
Physical Disorder	phydis56mi	Average of annual 727-1000 calls including: abandoned vehicles, graffiti removal, illegal dumping, and streetlight repair per square mile	1/1/2005-12/31/2006	OCTO
Streetlight Density	stlight_sqmi	Density of streetlights per square mile	2006	OCTO
Pct of Parcels- Commercial/ Retail	commretailpercent	Percent of parcels that are retail, commercial, or motel/ hotel/ inn	2006	OCTO
Pct of Parcels- Vacant	vacantpercent	Percent of parcels that are designated vacant	2006	OCTO
Bus Stop Density	busstop_sqmi	Density of bus stops per square mile	2006	OCTO

Table 4. Variable Descriptions and Sources

Variable	Variable Name	Operationalization/Coding at Block Group Level	Year(s)	Data Source
Metro Stations	metro_dum	Dummy variable for whether the block group has a metro station	2006	OCTO
Homeless Services Density	homless_sqmi	Density of homeless services per square mile	2006	OCTO
Inverse Distance to ASEs	invmiledist	Total of inverse distance from block group centroid to each alcohol outlet	2006	Created internally at UI
No Single Sales	notallows_sqmi	Density of stores that do not allow single sales per square mile	2006	Data collected by UI
Allows Single Sales	allows_sqmi	Density of stores that do allow single sales per square mile	2006	Data collected by UI
Controls				
Aggravated Assault 2000-2001	lasslt0001	Log of aggravated assaults 2000-2001	1/1/200-12/31/2001	MPD

Table 5. Descriptive Statistics for Independent Variables

Independent Variables	Mean	S.D.	Max	Min	Med	Skew	N-miss	N
Alcohol Outlets								
On-Premise Alcohol Outlets	2.30	7.60	112.00	0.00	0.00	8.59	0	431
Off-Premise Alcohol Outlets	1.12	1.37	9.00	0.00	1.00	1.65	0	431
Restaurant	17.08	52.24	550.00	0.00	0.00	5.28	0	431
Tavern	3.30	11.81	100.00	0.00	0.00	4.81	0	431
Nightclub	1.04	4.66	45.45	0.00	0.00	5.83	0	431
Store	14.89	23.08	200.00	0.00	5.88	2.87	0	431
Inverse Distance to all Outlets	1220.78	2623	28,400	36.814	476.045	6.436	0	431
Social Disorganization								
Concentrated Disadvantage	-0.004	0.795	3.030	-1.150	-0.060	0.797	0	431
Residential Stability	0.007	0.855	1.930	-2.320	-0.020	-0.106	0	431
Racial Heterogeneity	0.267	0.188	0.760	0.000	0.250	0.499	0	431
Motivated Offenders								
Proportion of Population 18-29	0.195	0.134	0.974	0.000	0.159	3.04	0	431
Adult Arrests 2005-2006	213.27	281.88	3302.00	1.00	128.00	4.82	0	431
Population Density 2000 (log)	9.32	1.06	11.40	0.52	9.51	-3.17	0	431
Physical Environment								
Prosocial Places Density	34.89	36.33	200.00	0.00	25.00	1.50	0	431
Physical Disorder Density	1328.07	1075.75	6533.33	3.70	1011.11	1.56	0	431
Streetlight Density	1452.57	620.58	3233.33	0.00	1490.91	-0.16	0	431
Proportion of Parcels-Commercial/Retail	0.038	0.076	0.734	0.000	0.017	5.52	0	431
Proportion of Parcels-Vacant	0.076	0.105	0.762	0.000	0.039	2.94	0	431
Bus Stop Density	76.16	53.13	466.67	0.00	66.67	1.79	0	431
Metro Stop (dummy)	0.081	0.273	1	0	0	3.077	0	431
Homeless Services Density	5.99	13.60	100.00	0.00	0.00	3.52	0	431
Inverse Distance to ASEs	1220.78	2623.20	28400.16	36.81	476.04	6.44	0	431
Stores-No Single Sales Density	1.43	9.33	166.67	0.00	0.00	14.05	0	431
Stores-Allows Single Sales (Density)	13.46	20.62	133.33	0.00	4.62	2.31	0	431
Controls								
Aggravated Assaults 2000-2001	1.80	1.04	4.32	0.00	1.79	-0.12	0	431

Alcohol Outlets

Alcohol outlet data are based on license information for all establishments registered with the Alcoholic Beverage Regulation Administration (ABRA) for 2006. These data were obtained from the District of Columbia Office of the Chief Technology Officer (OCTO). Data included information on business type, street address, name of company that applied for the license, business/outlet name, license type, and license number. All address data were for premise address (not owner address). In 2006, there were a total of 1,501 licenses for businesses to sell alcohol in DC. The data were provided in a shape-file as part of a geodatabase. Each license location was geocoded to the business location using ArcMap. All addresses were validated and 100 percent were geocoded. Of the addresses, companies licensed as caterers (8) and wholesalers (17) were dropped from this analysis. Three additional businesses were dropped when the two block groups (the National Mall and Bolling Air Force Base) were deleted from the sample, leaving 1,473 alcohol-selling establishments. These outlets were then coded by license type into the categories of restaurant (46.4 percent), store (32.6 percent), tavern (8.3 percent), nightclub (4.1 percent), hotel (4.9 percent) and multipurpose facilities (3.7 percent). Based on our local knowledge of the city businesses, we recoded a few multi-purpose facilities into nightclubs. Each of these outlets was then coded by where the alcohol is consumed (on-premise or off-premise). License types and descriptions for the main categories of outlets used in this study are listed in Table 6.

For each of the alcohol-selling establishments that require off-premise consumption of the alcohol, phone numbers were collected from an internet search. Once phone numbers were collected, businesses were contacted either by phone or in person to collect data on hours of operation, single sales and whether the alcohol outlet made a voluntary agreement to not sell singles. (Agreements are voluntary and made with the local neighborhood association or advisory neighborhood commission (ANC)).[3] The survey response rate was 75 percent.

[3] In the District, the ANCs are the body of government with the closest official ties to the people in a neighborhood. Residents are elected to be part of the ANC board.

After examining the data collected by the survey on hours of operation for alcohol outlets, we determined that most relevant time periods to examine were those described in Table 2. Taverns and nightclubs were surveyed by phone and the majority reported closing times between 2:00 a.m. (Monday through Thursday and Sunday) and 3:00 a.m. (Friday and Saturday), although hours of operation varied widely.

Table 6. License Classifications

License Type	Liquor Types	Premise Type	Hours of Operation Permitted/Alcohol Sales Hours
Restaurant	Spirits, Wine, Beer	On	Any time except: M-F 2:00 am-8:00 am Sat 3:00 am- 8:00 am Sun 3:00 am- 10:00 am
Tavern	Spirits, Wine, Beer	On	Any time except: M-F 2:00 am-8:00 am Sat 3:00 am- 8:00 am Sun 3:00 am- 10:00 am
Nightclub	Spirits, Wine, Beer	On	Any time except: M-F 2:00 am-8:00 am Sat 3:00 am- 8:00 am Sun 3:00 am- 10:00 am
Store A	Spirits, Wine, Beer	Off	M-Sat 9:00am-10:00 pm[a]
Store B	Wine and Beer	Off	M-Sat 9:00 am-10:00 pm[a] Sun 9:00 am-10:00 pm[a]

[a]Stores are allowed to remain open past the time they can sell alcohol in order to continue to sell other goods

As we will describe in more detail in later sections, with regard to the alcohol outlet data, we utilize three sets of alcohol outlet variables: density of *on-premise* versus *off-premise* outlets; density of *outlets by four types* (store, restaurant, tavern, nightclub); and density of *outlets that permit single sales versus those that do not permit single sales*. The size of the block group in square miles is used create the density measures for all alcohol outlet variables.

In addition to these density variables, we also examined a measure that represents the presence of all alcohol outlets in the city and their proximity to or influence on block groups. We expected that alcohol outlets that were close by, but in other block groups, could easily influence levels of violence and disorder. We calculated this measure using the distance from the centroid of each block group to all alcohol outlets across the city.

The distances (in miles) were summed and the inverse was taken. The higher the number, the more clustered the alcohol outlets are around the centroid of the block group.

Social Disorganization: Guardianship

The three variables used to measure social disorganization are derived from Census 2000 block group data. *Racial/ethnic heterogeneity* is calculated by one minus the sum of squared proportions of each of the four races: black, white, Asian and Hispanic. This calculation follows neighborhood-level sociological research in communities made up of more than two racial or ethnic groups (Bellair, 1997; Velez, 2001; Warner and Roundtree, 1997). Values range from zero to one, where low scores indicate blocks that are racially and ethnically homogenous and high scores represent blocks that are more heterogeneous. *Concentrated disadvantage* is operationalized as an index of five Census items: (a) percent of all households receiving public assistance, (b) percent of population with income below the federal poverty level in 1999, (c) percent black (non-Hispanic), (d) percent of civilian population age 16 or older in labor force who are unemployed, and (e) percent of households with children headed by a woman. The concentrated disadvantage index is calculated as the sum of z-scores for these items divided by five (the number of items). *Residential stability*[4] is the sum of z-scores for responses to two Census items: percent living in same house since 1995 and the percent of housing occupied by owners. The sum of these two items is then divided by two (the number of items).

Routine Activities: Guardianship

Because there is some overlap between the guardianship constructs in social disorganization and routine activities, we chose to incorporate variables having to do with home ownership within the social disorganization component (residential stability) as is common in the literature. For guardianship related to routine activities we included one variable: *population density*. Increased population density can be viewed as either improving guardianship (i.e., more eyes on the street), or after a certain tipping point, reducing guardianship in the sense that overcrowding increases anonymity and allows

[4] Note that the residential stability variable is measuring stability (not instability).

potential offenders cover. This variable is calculated as the number of residents in the block group per square mile. The variable is logged to smooth its uneven distribution.

Motivated Offenders

We used two variables to represent motivated offenders: *adult arrests* and *young adult population*. Adult arrests is the number of all arrests of adults 18 and over aggregated for the calendar years 2005 and 2006. It is reasonable to assume that adults arrested (the majority of arrests are for minor crimes, mostly drug offenses) are not incarcerated for any long periods of time and hence, the variable is likely to represent the potential to offend again rather than representing a deterrent effect. Arrest data were provided by Metropolitan Police Department with designations for adult or juvenile arrest, arrestee information, location of arrest and x, y coordinates of the arrest location. For 2005 and 2006, there were 99,914 arrests reported by MPD. These data were checked to be sure arrest location did not geocode in high proportions to the police department or the courthouse. As we did with the dependent variables, data across years were aggregated to achieve stability but unlike the dependent variables, arrests were not averaged. Young adult population represents the *proportion of the population that is between the ages of 18 and 29* within each block group. This age range was chosen because it constitutes a high-risk for offending age group and because alcohol use may be common among this age group. This variable was calculated using Census 2000 data.

Physical Place Risk

Block group level physical place risk includes built environment variables that are derived from routine activities principles. All data used to develop these variables described below were provided by OCTO. *Physical disorder* is operationalized using calls received by the District of Columbia Citywide Call Center (202-727-1000). The call center was designed by city administrators to be a centralized point of contact for neighborhood quality of life issues that do not need to involve the police. The calls used for this variable are calls for abandoned vehicles, graffiti removal, illegal dumping and streetlight repair for 2005-2006. The calls were averaged over the two-year period. *Commercial/retail parcels* is the percent of parcels in 2006 within a block group that are designated retail, commercial or motel/hotel/inn. This variable represents businesses

where people might congregate in groups and put themselves at risk for victimization. *Vacant parcels* is the percent of parcels in 2006 that are categorized as vacant and abandoned. *Metro station* is a dummy variable to denote whether the block group has metro stop. Points (x, y coordinates) represent metro platform centroids identified from visual observation of orthophotography. There are 40 metro stations in the District of Columbia and 35 block groups have at least one metro station. *Bus stop density* is a variable representing the number the bus stops per square mile in each block group. *Homeless services density* is the number of shelters and organizations that provide services to homeless clients per square mile. The last two variables in this category represent constructs that might be seen as buffering against crime (as apposed to attracting or generating it). *Streetlight density* represents the number of street lamps (not traffic lights) per square mile. *Prosocial places is* an aggregation of all schools, churches, libraries and recreation centers. This variable is also standardized by the size of the block group in square miles.

Block Group-Level Control Variables

The study controls for the size of each block group in square miles, because according to routine activity theory, larger block groups are hypothesized to provide more opportunity for offending. The size of the block group (in square miles) is used as an offset variable. Basically, by using the offset we are modeling the effects of the predictors on the count of violence and disorder (or any outcome) per square mile. This neutralizes the potential impact of the different scales and the differences in the populations at risk of victimization. Data on block group size were obtained from the 2000 U.S. Census. This study also examined two other measures to standardize opportunities for offending: the length of roadways in each block group and the population size. Roadway miles was calculated using the street centerline file provided by DC OCTO and the census block group shape-file in ArcMap. Using roadway miles rather than the size of the block group has been used in several studies on the effects of alcohol outlets on violence and drunk driving (see Gruenewald, Johnson, and Treno, 2002; Lipton and Gruenewald, 2001). Another method that appears in the alcohol outlet literature is standardizing by the size of the population of a block group (Gorman, et al.,

2001). We easily determined that standardizing by population size would not be appropriate in the District of Columbia because it has a very small residential population in the central business district where hot spots of assault and disorder occur. And given our focus on routine activity spaces, we thought square miles or street segments would be more appropriate. Analyses conducted using street segments yielded a significant number of outliers for a number of independent variables, created problems with collinearity, and led to regression results that were difficult to interpret. After conducting diagnostics and analyses using the three methods of standardization, we decided to use square miles as the method of standardization in all models described henceforth.

The study also controls for prior levels of crime by using a measure of aggravated assault incidents for January 1, 2000 through December 31, 2001. Temporal lags of crime were introduced into the models as a means of capturing unobserved heterogeneity. Given that our primary analysis unit is the block group, we are relying on what amounts to a cross-sectional design. There could exist unobservable predictors of crime that may contaminate inferences on our predictors of interest (density of alcohol outlets). Fortunately, since crime is a fairly stable outcome and low (high) crime-rankings among block groups remains fairly stable from year to year, introducing the temporal lag of crime into the model is a simple way to account for the effects of any other predictors of crime that may be relatively stable over time. This approach is commonly used in most recent ecological studies of crime utilizing a cross-section design (Markowitz et al., 2001; Morenoff et al., 2001). We follow that literature and use the temporal lag of crime to account for unobserved block group-specific heterogeneity.

Data for 2000 and 2001 were not available for social disorder and domestic violence, so we relied on assault incidents as the temporal control for all models (i.e., across all dependent variables). The number of assaults per block for those years was transformed using the natural log transformation.

Spatial Autocorrelation

Using the framework of routine activities, we would expect to see people buying and consuming alcohol along the paths that coincide with their routine activities. People will buy beer at the corner store or go to the local bar or restaurant after work, and crime

should occur among these frequently used blocks groups and streets. For this study, we examined the potential for crime in one block to be correlated to the crime in a block group nearby as an independent variable, because applications of routine activity theory support its effects (Morenoff and Sampson, 1997; Roncek and Montgomery, 1995; Smith Franzee and Davison, 2000). According to Anselin and Bera (1998) spatial autocorrelation reflects the relationship between two different units of observation that is dependent on their geographic location. The presence of spatial autocorrelation can affect the properties of the OLS estimators and lead to models being misspecified. This study tests for the presence of spatial autocorrelation using two different methods that coincide with the two types of modeling techniques used in this study: (1) testing for the presence of spatial autocorrelation and then upon finding it, adding a spatial lag variable as a control in our negative binomial models (i.e., a conditional spatial autocorrelation model), and (2) estimating a fully simultaneous spatial autocorrelation model to account for joint nature of crime generation in neighboring block groups.

First, using the GeoDa software (Anselin, 2003) the Moran global spatial autocorrelation test was conducted for the four dependent variables. In GeoDa, we tested for spatial autocorrelation using a block-group level shape file of the District of Columbia which excludes the two block groups that were dropped from the analysis (The Mall and Bolling Air Force Base). We obtained significant and positive Moran statistics for all four measures: 0.375 ($p < .001$) for assault, 0.251 ($p < .001$) for MPD defined disorder, 0.381 ($p < .001$) for the UI-defined disorder and 0.394 ($p < .001$) for domestic violence. These results demonstrate that there is spatial dependence in the data—violence and disorder in a block group has an influence on violence and disorder in other block groups. In order to account for the presence of spatial autocorrelation a spatial lag variable was created in GeoDa using the queen criterion. The queen weight is defined as a location's neighbors as those with either a shared border or vertex (in contrast to a rook weights matrix, which only includes shared borders).

Second, spatial autocorrelation is tested for and incorporated directly within the modeling itself. As will be described in more detail in the “Analytic Strategy,” section, the Generalized Cross Entropy approach (Bhati, forthcoming 2008) allows one to

estimate a flexible count outcome models (with over or under-dispersion) and that allows for substantive spatial autocorrelation. The final model resolves the simultaneity between the observed count in one block group and its surrounding units by deriving a reduced form specification. As in the standard linear model case, the GCE reduced form captures the spatial autocorrelation in a coefficient ρ (rho) that can be subject to standard statistical testing.

Data Limitations

One limitation to this study is the use of official police data (incidents records) to measure aggravated assault. The amount of bias present from using only official police data is unknown. Generally, research has shown that results produced using official records are roughly consistent with results using victimization data (Bastian 1993; Blumstein, Cohen, and Rosenfeld 1991). Similarly, we use calls for service data to operationalize domestic violence and disorder. We acknowledge that using calls for service may be fraught with bias because not all calls will result in substantiated allegations of violence. However, our decade-long relationship with the MPD and with their data leads us to believe that these measures are consistently reported across block groups over time.

Second, as stated earlier, we were unable to obtain data on calls for service for domestic violence incidents and disorder incidents that occurred in years prior to 2005 and 2006, and thus, could not include a direct temporal control. As a proxy, we included aggravated assault incident reports for these earlier years (2000, 2001).

Third, the study does not include any variables that measure police presence or any other component of guardianship that is not residential in nature (e.g., based on households and/or residents). Numerous attempts were made to collect police expenditure data, but the Metropolitan Police Department does not make this information public. Calls for service data (911 emergency calls for service) were examined as a possibility, but the data file only included calls made, not calls cleared by an officer at the scene. Incorporating a strong measure of police presence would strengthen the study by providing a more thorough measurement of the guardianship construct in routine activity theory.

Fourth, our measure of physical disorder consists of calls to the District's hotline regarding community nuisances. It is certainly possible that the level of calls by neighborhood differs simply because of characteristics of residents who live there. A large number of calls may signify high levels of community commitment and not necessarily the amount of disorder. However, we believe our measure has some validity given disorder's solid correlation with aggravated assault (0.40; $p < .001$), as the social disorganization literature would generally dictate.

Fifth, data were not available to accurately estimate the flow of potential targets across block groups. Like routine activities theory posits, as the number of potential targets increase (holding constant the presence of motivated offenders and absence of capable guardians), the opportunity for victimization increases. Hence, as the flow of the population changes, so too may the incidence of crime. But block-group level population approximations at any given time of day routinely do not exist, and even if they did, would be beyond the scope of this study. Because residents are engaging in their routine activities—going to work, school, leisure activities—throughout the day, the number of targets does not always equal the number of residents living in a block, census tract, neighborhood, etc. It would be ideal to have a direct measure of the extent of potential targets at different times of the day—particularly since in the District of Columbia, most alcohol outlets are situated in non-residential areas.

Sixth, the use of cross sectional data may be problematic in that reverse causation may be operating. In cases of reverse causation, or simultaneous equation bias, the regression estimates will suffer from bias (either upward or downward). This study tests whether characteristics of the neighborhood environment influence aggravated assault and other crimes, but does not specify a model reflecting potential effects of crime on the siting of alcohol outlets.

Chapter 4. Statistical Methods

The study tests an opportunity framework developed to examine whether alcohol outlets act as attractors of crime. The study employs ecological data and incident-based crime data to model neighborhood patterns of violence and disorder around alcohol outlets. The models tested are designed to capture other features of the environment that create the opportunity for violence (e.g., vacant housing, commercial land uses, homeless shelters and homeless services locations, etc.) or buffer against it (e.g., streetlight density and prosocial places). Furthermore, incorporating time of day into the models provides an understanding of the potentially different patterns of crime around crime attractors. The study examines different time periods that coincide with prime times for socialization and patronage of alcohol outlets and drinking establishments.

The study views neighborhoods as micro-environments which vary along a host of situational and environmental dimensions that are important to modeling the risk of violence and disorder. This study follows the analytical strategy of recent research (Morenoff, Sampson, and Raudenbush, 2001; Sampson and Raudenbush, 1999; Smith, Frazee, and Davidson, 2000) seeking to understand how places fare in terms of guardianship and risk of crime and violence—without focusing on the production of offenders, but instead focusing on the context or place.

Model Diagnostics

Before any analyses were conducted we examined whether the independent variables were highly collinear and whether the distribution of the dependent variables were normal. With regard to assessing multi-collinearity, we calculated a condition number[5] (Belsley, Kuh, and Welsch, 1980) in SAS. Values of the condition number larger than 30 are considered problematic. For this study, all sets of independent variables examined had condition numbers between 12 and 20. We also used SAS to calculate the

[5] The condition number is a measure of how close a matrix is to being singular. If the matrix of regressors is nearly singular, the data are nearly collinear and regression coefficients will have large standard errors.

variable inflation factors (VIF)[6] for each of the variables. All variables had VIF scores under 5, suggesting that multicollinearity should not be issue in our analyses.

Next we examined the distribution of the dependent variables. With regard to the assault, the majority of block groups in the study site have zero assaults, and the variance is greater than the mean, exhibiting overdispersion. The social disorder variables exhibit underdispersion, as does domestic violence, indicating that the variance is less than the mean. Any truncation of the distribution of the dependent variable renders OLS estimates biased and inconsistent (Cameron and Trivedi 1998; Liao 1994; Long 1997; Tobin, 1958). Negative binomial regression models can account for the large number of zeros, particularly when overdispersion is exhibited. However, negative binomial models do not perform well when in models with underdispersed dependent variables. Given this issue, as well as the weaknesses associated with using a negative binomial framework with spatially autocorrelated data, we determined that it would be more appropriate to use an innovative spatial econometric technique that falls under the *information theoretic* umbrella. The Generalized Cross Entropy (GCE) approach is described in more detail below and context is provided for the use of these methods. In this study, models are estimated using both standard negative binomial regression and the GCE technique. We utilize both types of models as a way to compare the very new information theoretic models to the generally better-known, but not as appropriate, negative binomial models.

Information Theoretic Modeling

All GCE models are estimated using the SAS software (SAS Macro is provided in Appendix C). The GCE approach that we utilize in this report falls under the general class of estimation methods termed information theoretic methods. Information theory is an interdisciplinary field of study that uses entropy and entropy related measures to quantify uncertainty. The procedure may be summarized as follows. The sample at hand provides us evidence in the form of moment constraint that should be satisfied by the model. Therefore, once we convert all the unknowns in the model into proper probabilities, then we can impose moment constraint that these probabilities must

[6] Variance inflation factors are a scaled version of the multiple correlation coefficient between a variable and the rest of the independent variables. The VIF shows how much the variance of the coefficient estimate is being inflated by multi-collinearity.

satisfy—at least in this sample. Unfortunately, there are an infinite number of probability distributions that may be consistent with the data at hand. How do we choose among them? This sort of a problem is termed an ill-posed inversion problem—more unknowns than equations linking them.

Likelihood based approaches resolve this ill-posed inversion problem by assuming a particular parametric form for the probabilities. If this assumption is correct, then it seems reasonable to maximize the likelihood that this sample was generated from the assumed distribution. The optimization problem, under a set of regularity conditions, work well if the assumptions are correct.

Information theoretic approaches solve the ill-posed problem another way. Faced with a similar ill-posed problem in statistical mechanics, Ed Jaynes (1957a,b) proposed to recover the unknown probabilities by maximizing the uncertainty implied by the probabilities. That way, the recovered models will the most conservative or least informative about the process under study. Jaynes (1957a,b) proposed to use Shannon's information entropy (Shannon, 1948) as the criterion to maximize subject to all data constraint to solve the problem. This results in a constrained optimization problem that can be solved in most standard software. Moreover, if the research has prior knowledge about the probabilities of interest, then the Kullback-Leibler directed divergence measure (Kullback, 1959) can be used as the criterion. Now information is measured as the divergence between the prior and the posteriors. This is also termed the Cross Entropy (CE). The modeling strategy employed in this report uses a generalized version of the CE approach (hence the term GCE). Golan, Judge, and Miller (1996) provide several applications of the GCE approach. A large number of parametric models (including, for example, the Poisson) can be derived by making assumptions about the priors and the support space. Bhati (2008) derives, demonstrates with simulations, and applies this approach to study the spatial structure in the homicide counts (a count outcome) in Chicago.

As demonstrated by Bhati (2008), the GCE model provides the same inference as the Poisson model if we make some restrictive assumptions (usually untestable). The GCE approach readily handles both over- or under-dispersed count outcomes. Unlike

more traditional approaches for handling extra-Poisson variation (including, for example, the negative binomial model), under the GCE approach no assumptions are made about the parametric form of the mixing distribution, about the functional form of the mean-variance dependence, or about the randomness stemming from a finite mixture of distributions. Rather, the restrictive dependence implied by the Poisson model is recognized and relaxed semi-parametrically. The strategy can recover both over- or under-dispersed random variables very accurately. Simulated evidence provided by Bhati (2008) shows that the modeling strategy is fairly robust to various types of heteroskedasticity. Moreover, given the simultaneous nature of the GCE modeling strategy, it allows one to estimate the spatial autocorrelation coefficient without the need for ad-hoc and convenient transformations of the dependent variable. See Bhati (2008) for technical details. Comparison of the GCE models (subsequent chapter) to the negative binomial regression models (Appendix A) demonstrates the superiority of the GCE approach.

Context for use of the GCE Approach

Unlike time-series analysis, which has a fairly long history in econometric theory and practice, the incorporation of a spatial dimension in applied work is fairly recent (Anselin, 1988). Despite that, the last three decades have seen an explosion in research activity surrounding spatial econometrics. Tremendous progress has been made in developing methods for studying the spatial and spatio-temporal dynamics involving continuous unbounded outcomes modeled using the standard linear model and its extensions. See Anselin, Florax, and Rey, (2004) for a recent review of this literature. Development of similar methods to study spatial structures involving binary and multinomial choice outcomes has been slower. However, development of methods for analyzing spatially correlated counts has been minimal. For example, the edited volume Advances in Spatial Econometrics: Methodology, Tools and Applications (Anselin, Florax, and Rey, eds., 2004) contains no contributions on the analysis of count outcomes.

Epidemiologists and statisticians have, to be sure, developed a set of methods for mapping and modeling disease rates/counts that extend the basic Poisson regression model to incorporate spatial correlation. For example, to analyze disease and mortality

data, statisticians often rely on Bayes, Empirical Bayes, or Maximum-Likelihood estimates of the so-called Poisson or Binomial "auto-models" (Besag, 1974; Clayton and Kaldor, 1987; Cressie and Read, 1989). Unfortunately, these models are conditional autoregressive models (CAR) which, although very useful for prediction and smoothing purposes, are undesirable for investigating and studying the underlying data generating mechanisms (Anselin, 2002). For the latter purpose, typically of more interest to social scientists, simultaneous autoregressive models (SAR) are more pertinent.

Under a CAR specification, the expected outcome is modeled conditional on the outcomes realized in surrounding locations. Under SAR specifications, on the other hand, the realizations of a variable of interest (be it manifest or latent) are simultaneously determined by the exogenous predictors in some or all surrounding locations. Resolving this simultaneity results in a non-linear-in-parameters reduced form that is typically intractable. In practice, researchers commonly resort to a two-stage approach whereby the discretely measured criterion variable is first converted into an approximately continuous measure and then traditional linear model spatial analytical techniques are applied to it (Messner and Anselin, 2004; Morenoff, Sampson, and Raudenbush, 2001). Though usually feasible, it is unclear whether these transformations always yield their desired corrections. When analyzing rare crimes, for example, logarithmic, Freeman-Tukey type, or Empirical Bayes transformations may not always yield the desired criterion measures (Bailey and Gartell, 1995:277). Moreover, when analyzing rare events it is typically desirable to retain and model the discrete nature of the variable, as analysts may be interested in interpreting the marginal probability effects of the exogenous predictors at several points on the support.

Model Estimation

For this study, four sets of models are tested for each of the four dependent variables. The main model tested is as follows:

AGGRAVATED ASSAULT=alcohol outlets(off_premise, on_premise, inverse distance to all outlets), SD/guardianship(racehet, concentrated disadvantage, residential stability), motivated offenders(18-29 year olds, arrests), RA guardianship(population density), physical place risk(physical disorder, prosocial places, metro stations, street light density, bus stops, homeless services), temporal control for assault

The same model is tested for social disorder operationalized in two ways (as described earlier): MPD-defined disorderly conduct, and UI-defined social disorder.

MPD DISORDER=alcohol outlets(off_premise, on_premise,inverse distance to all outlets), SD/guardianship(racehet, concentrated disadvantage, residential stability), motivated offenders(18-29 year olds, arrests), RA guardianship(population density), physical place risk(physical disorder, prosocial places, metro stations, street light density, bus stops, homeless services), temporal control for assault*

UI DISORDER=alcohol outlets(off_premise, on_premise, inverse distance to all outlets), SD/guardianship(racehet, concentrated disadvantage, residential stability), motivated offenders(18-29 year olds, arrests), RA guardianship(population density), physical place risk(physical disorder, prosocial places, metro stations, street light density, bus stops, homeless services), temporal control for assault*

We also estimated a main model for domestic violence, which is similar to the models above with the exception that the variable representing the density of homeless services was dropped because it is not hypothesized to influence levels of domestic violence:

DOMESTIC VIOLENCE=alcohol outlets(off_premise, on_premise, inverse distance to all outlets), SD/guardianship(racehet, concentrated disadvantage, residential stability), motivated offenders(18-29 year olds, arrests), RA guardianship(population density), physical place risk(physical disorder, prosocial places, metro stations, street light density, bus stops), temporal control for assault*

*As described earlier, data were not available from the Metropolitan Police Department in earlier years for disorder or domestic violence. Instead we used the aggravated assault in 2000-2001 as a temporal control.

For each of these models, we add the variables representing the different constructs in blocks to show how the results change with each block of variables. For the information theoretic models, each of the four dependent variable full models has a nested set of 3 models: first the regression model is estimated with the alcohol outlet variables (on_premise and off_premise)[7] and the temporal control for assault; the second model adds the social disorganization variables (racehet, concentrated disadvantage and residential stability) and then the motivated offenders (18-29 year olds, arrests) and

[7] The variable *inverse distance to all alcohol outlets* was not a significant predictor in any preliminary models. As a result, we did not include the variable in any of the final models.

routine activities guardianship (population density) are added together as a block. Last, the physical place risk variables are added to form the "full" model.

The second set of models examines the full model (with all the blocks of variables), but the dependent variables are disaggregated by *time periods*. Models are run for each of three time periods discussed earlier: weekends, weekend nights, and weeknights (Monday through Thursday).

The third set of models examines the full model of alcohol outlets for each dependent variable but disaggregates on-premise and off-premise by *type of outlet*. In other words, instead of retaining the on-premise and off-premise variables in the model, we break the variables into the four types of alcohol outlets: stores, restaurants, taverns and night clubs. All stores are off-premise outlets, so we would expect that the off-premise measure will have the influence as the stores measure.

The fourth set of models examines the *singles sale policy*—more specifically the influence of the outlets that permit the sales of singles cans and bottles of beer, malt liquor or ale versus the influence of outlets that do not permit the sales of singles. These models are run for all four dependent variables. Although exploratory analyses comparing disorder and assault in a 500 meter buffer around single sale outlets versus non-single sale outlets, show that there is no significant difference in the *number* of assault incidents or disorder we believe it is an important relationship to test in a multivariate framework. To do so, we created two new variables: one measuring the density of stores that permit the sale of singles and one variable measuring the density of stores that do not permit the sale of singles. There are ten block groups consisting only of stores that ban or regulate singles, but for the most part, these block groups are small and have very few stores. Out of the 431 block groups, the overwhelming majority (396 or 91.9 percent) do not have any stores that ban or regulate the sale of singles. One block group has five stores that ban singles, three block groups each have two stores that ban singles and five block groups have one store that bans singles. In general, it is a mixed bag for block groups—35 block groups consist of both stores that ban/regulate single containers and stores that permit the sales of singles. Figure 30 depicts the landscape of stores in the District of Columbia that voluntary refrain from selling/ban singles.

Figure 2. Aggravated Assaults by Hour of Day, District of Columbia Block Groups

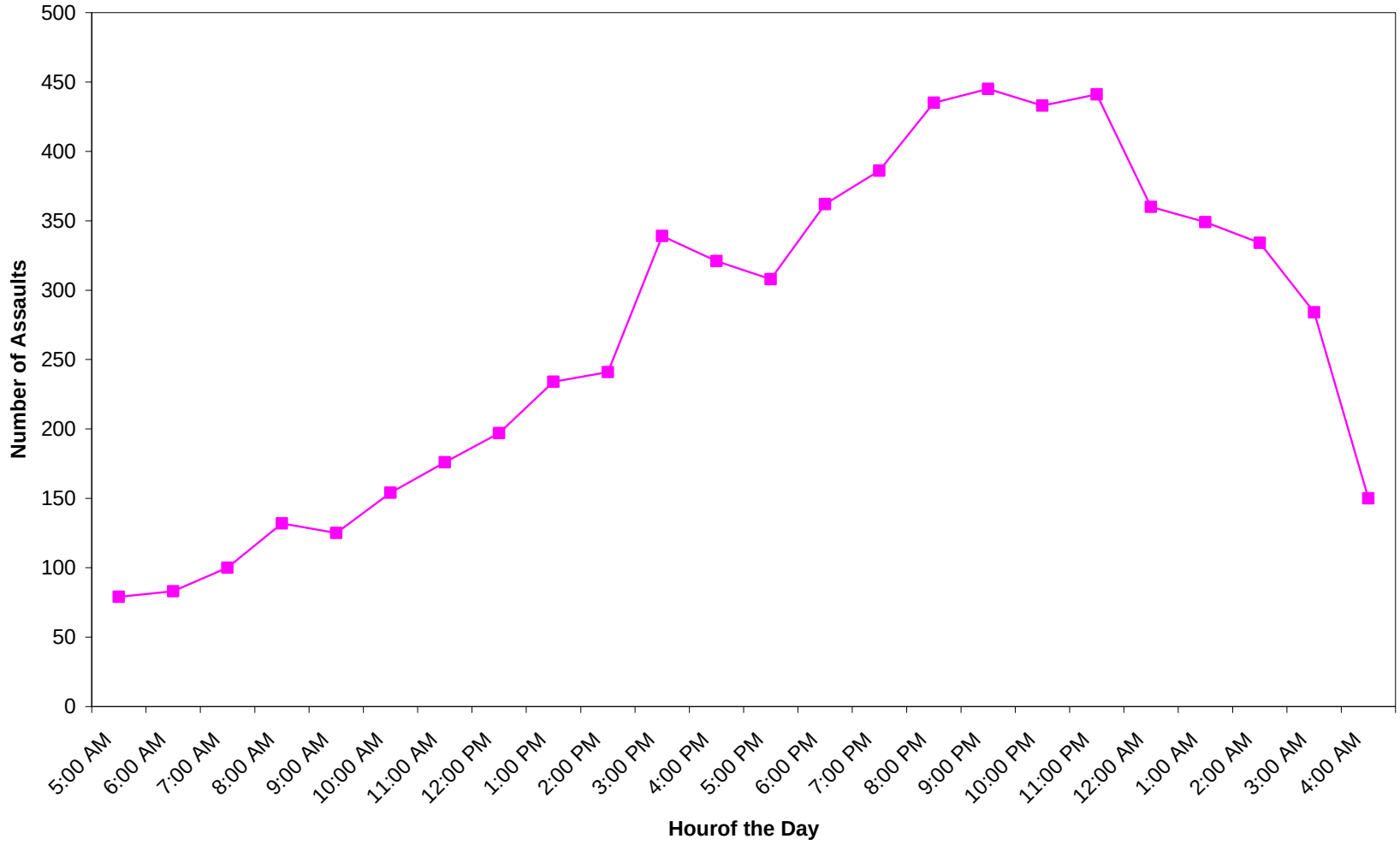


Figure 3. Aggravated Assaults by Hour of the Day and Day of Week, District of Columbia Block Groups

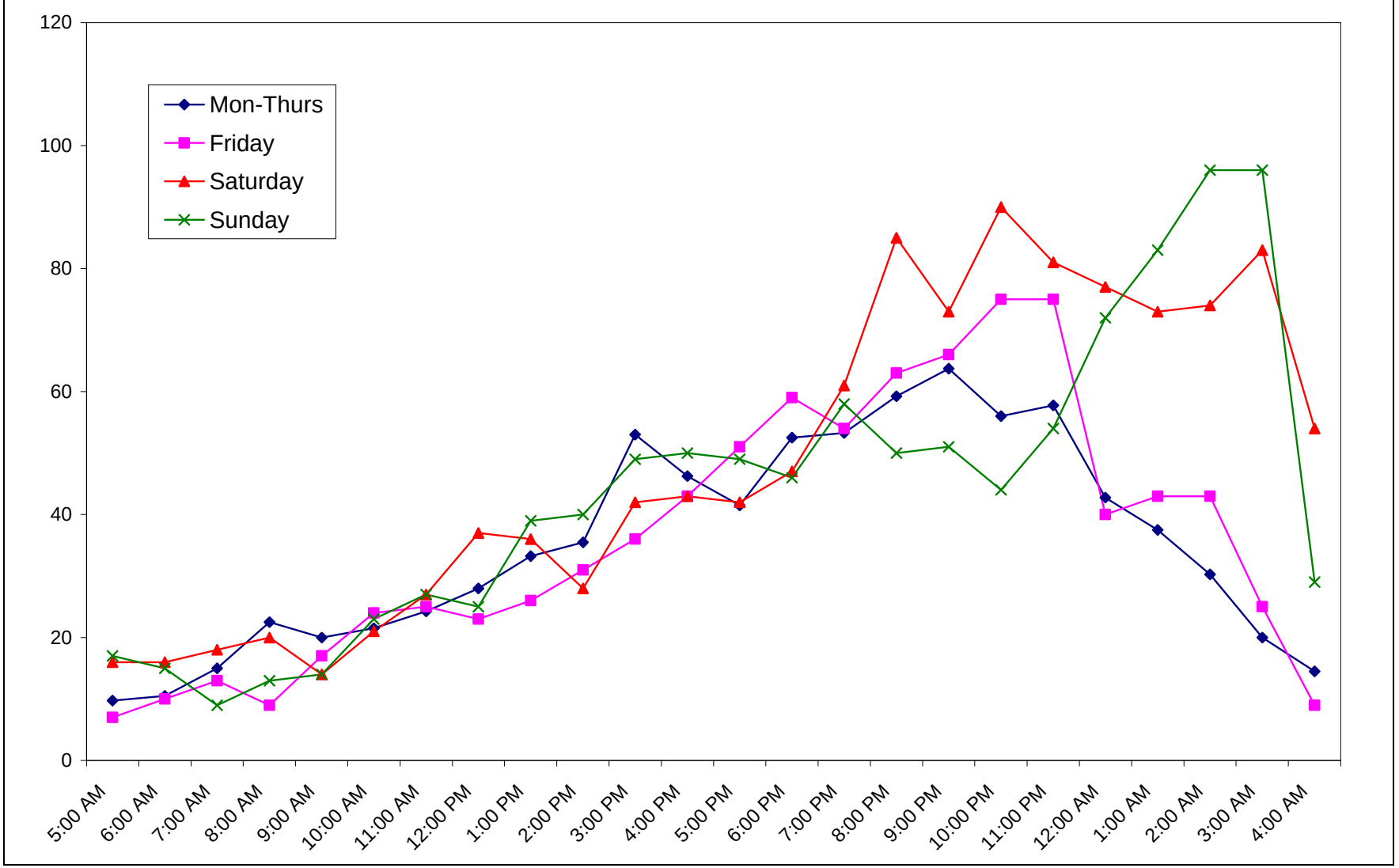


Figure 4. Aggravated Assaults by Time Periods and Day of Week, District of Columbia Block Groups

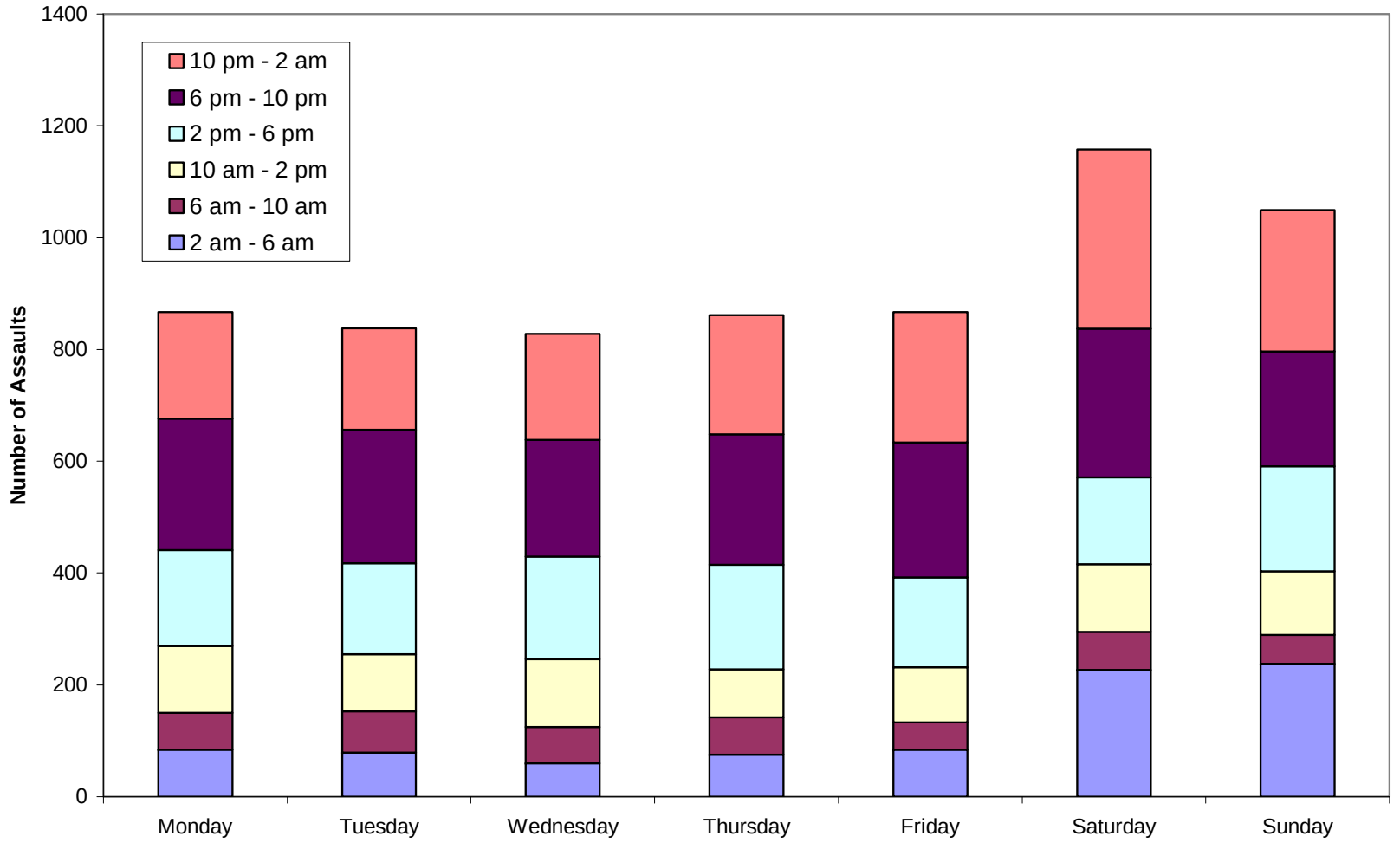


Figure 5. Map of Assaults, by Block Group, District of Columbia

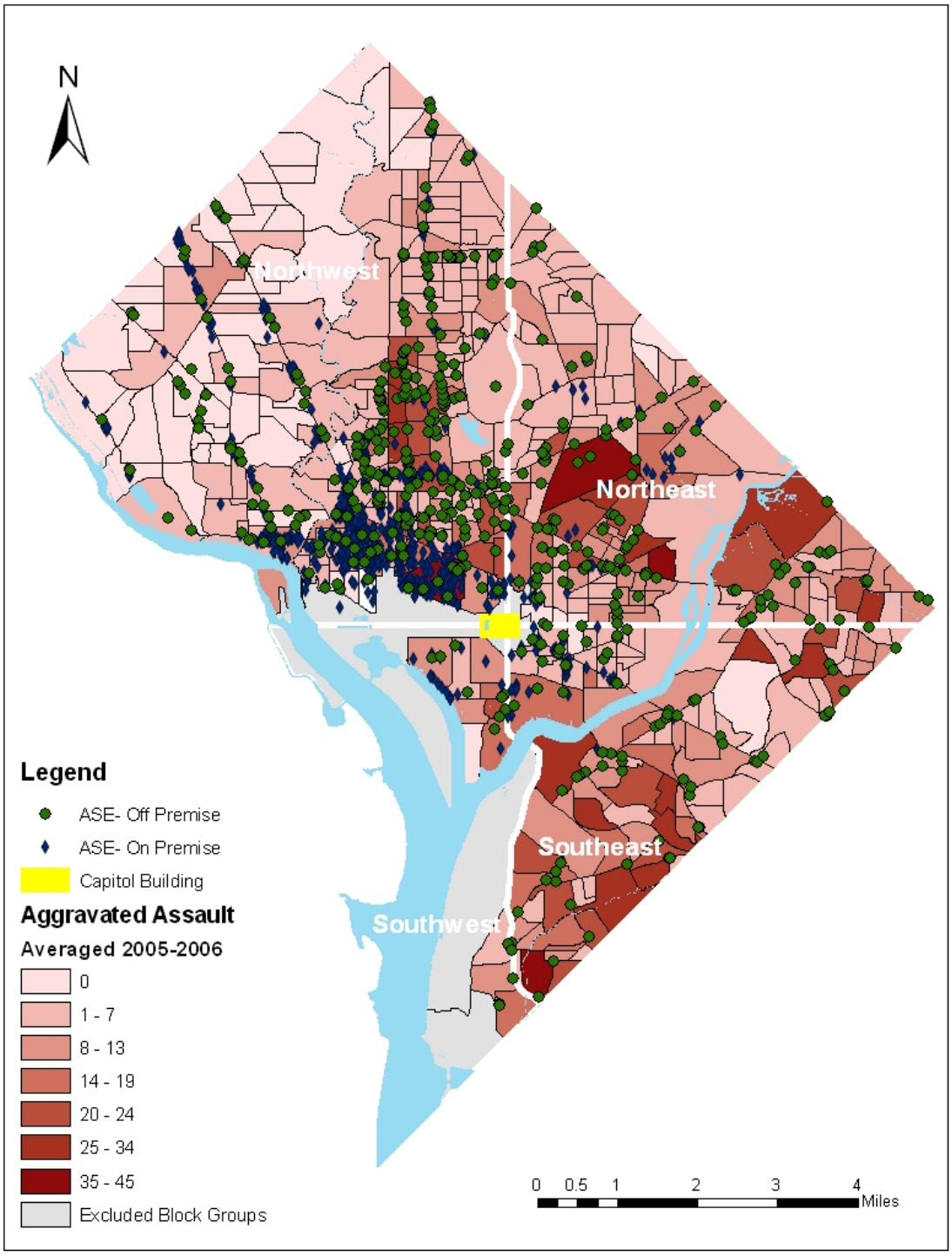


Figure 6. Map of Weekend Assaults, by Block Group, District of Columbia

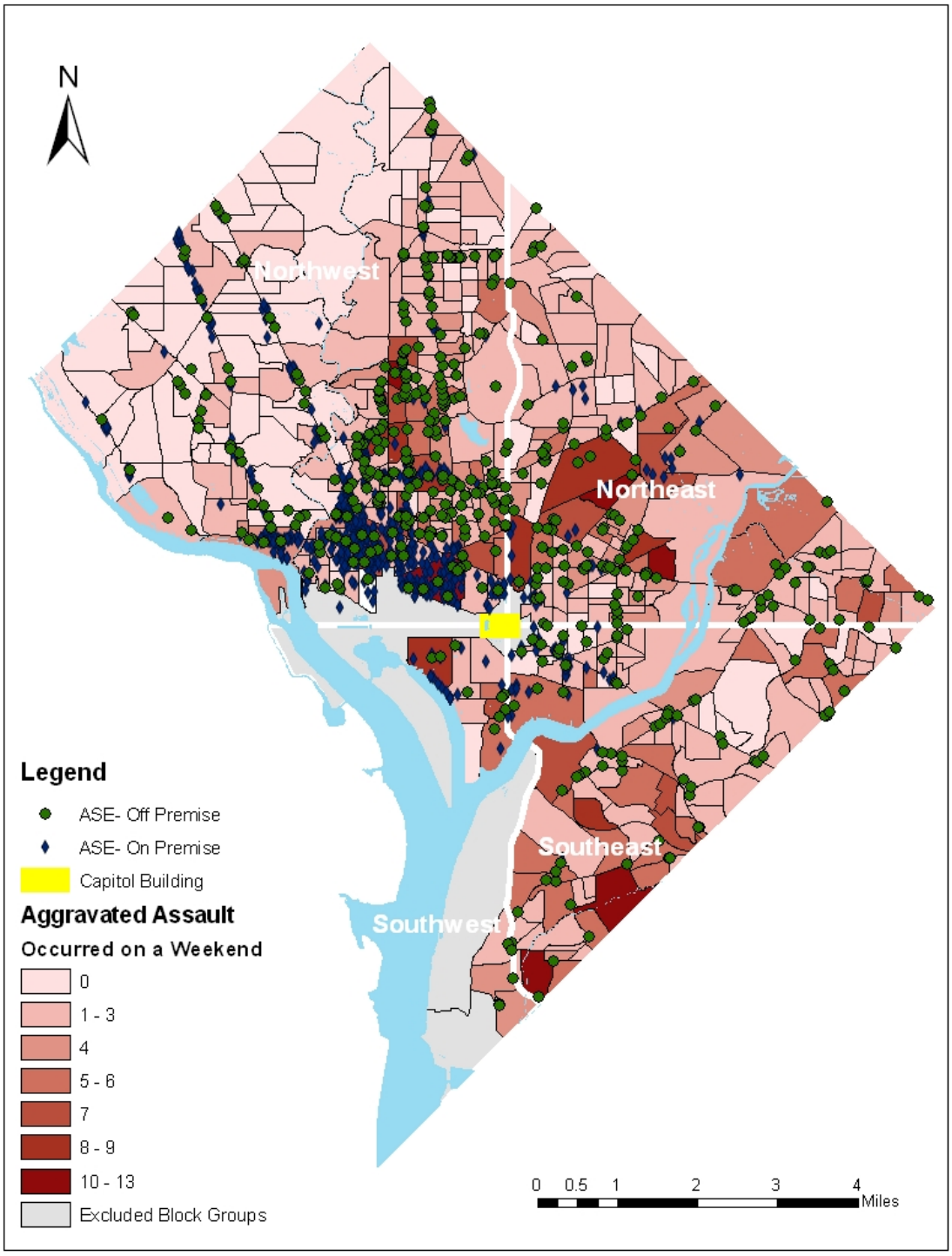


Figure 7. Map of Weekend Night Assaults, by Block Group, District of Columbia

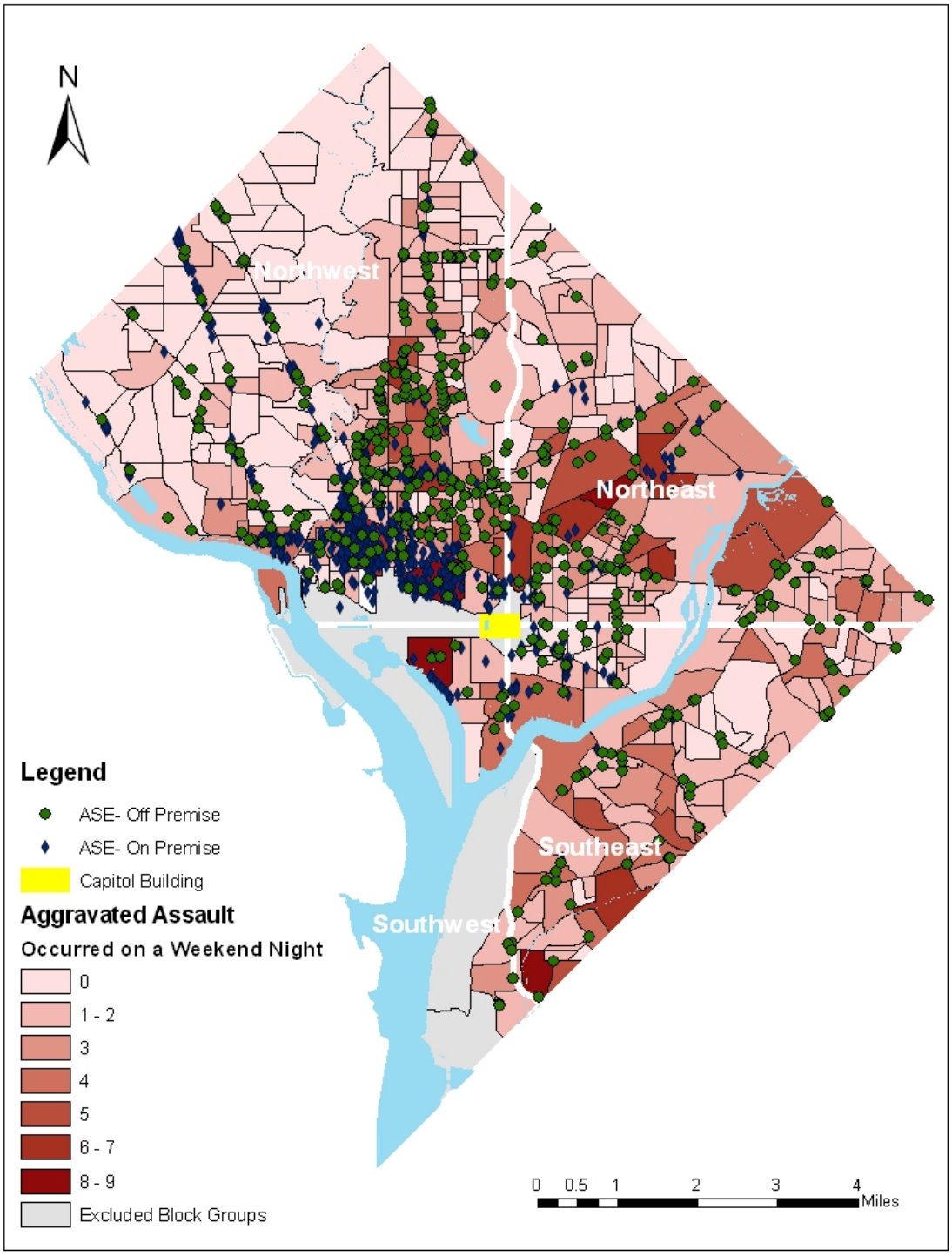


Figure 8. Map of Weeknight Assaults, by Block Group, District of Columbia

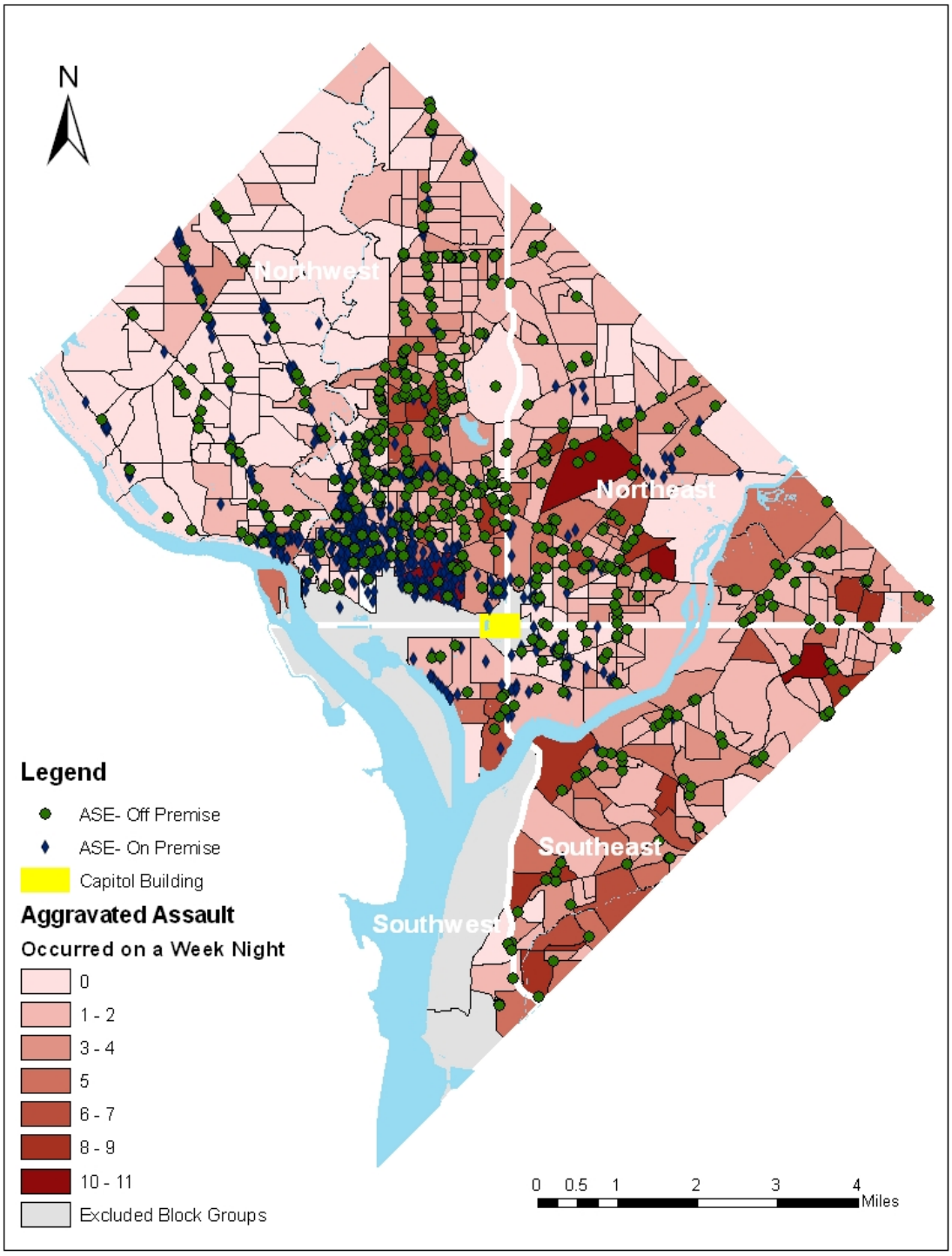


Figure 9. Disorderly Conduct Calls for Service by Hour of the Day, District of Columbia Block Groups

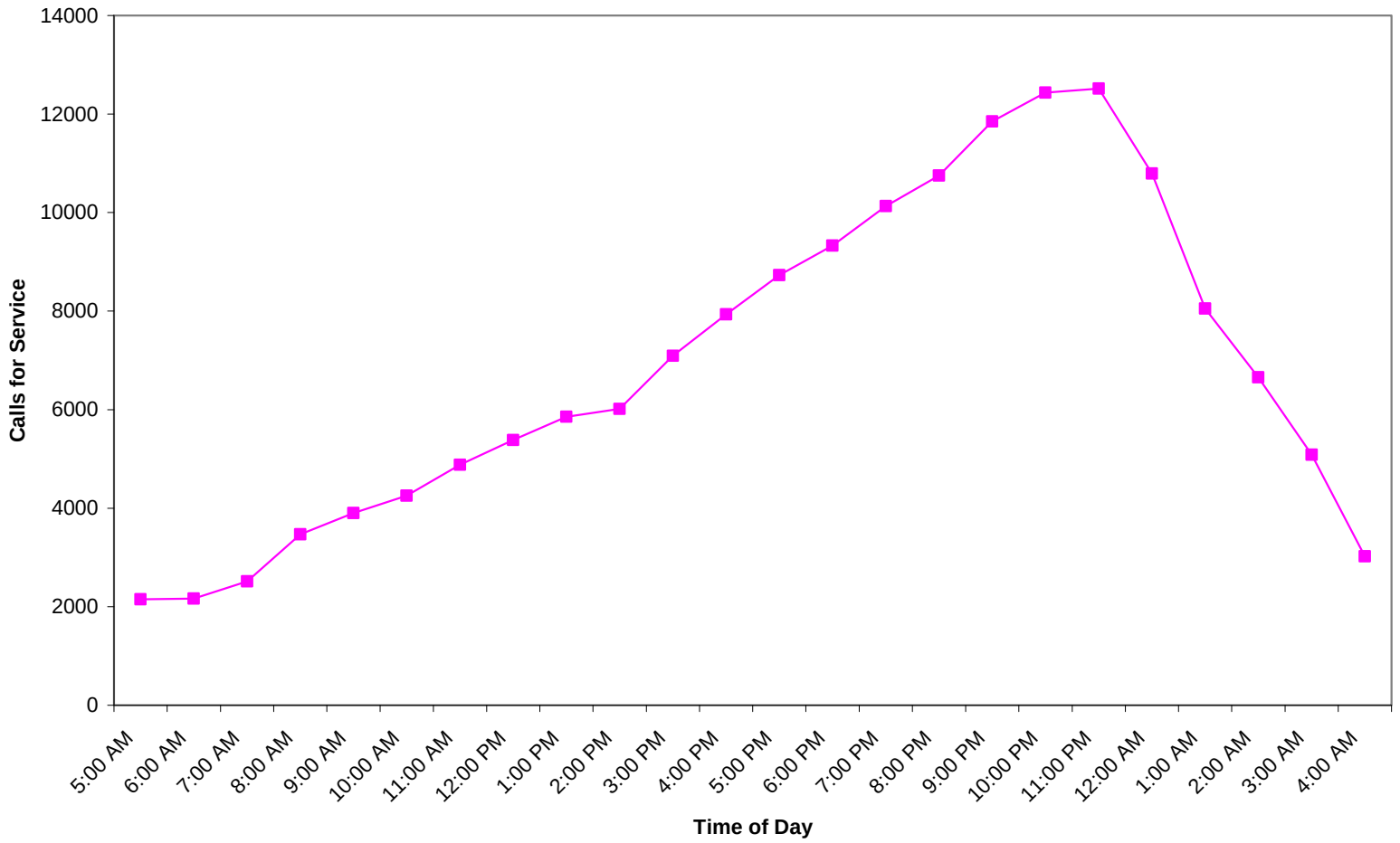


Figure 10. Disorderly Conduct Calls for Service by Hour of the Day and Day of Week, District of Columbia Block Groups

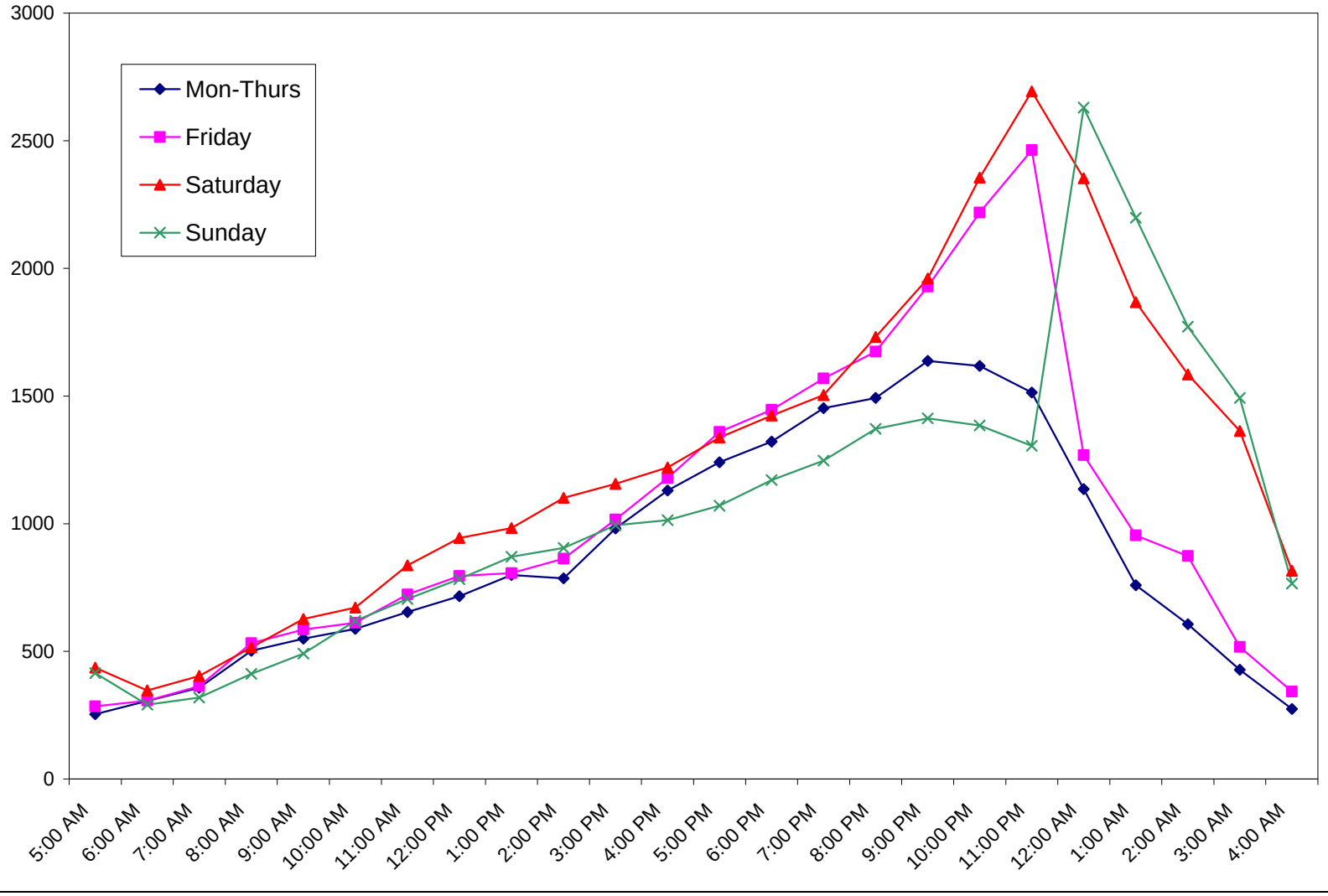


Figure 11. Disorderly Conduct Calls for Service by Time Periods and Day of Week, District of Columbia Block Groups

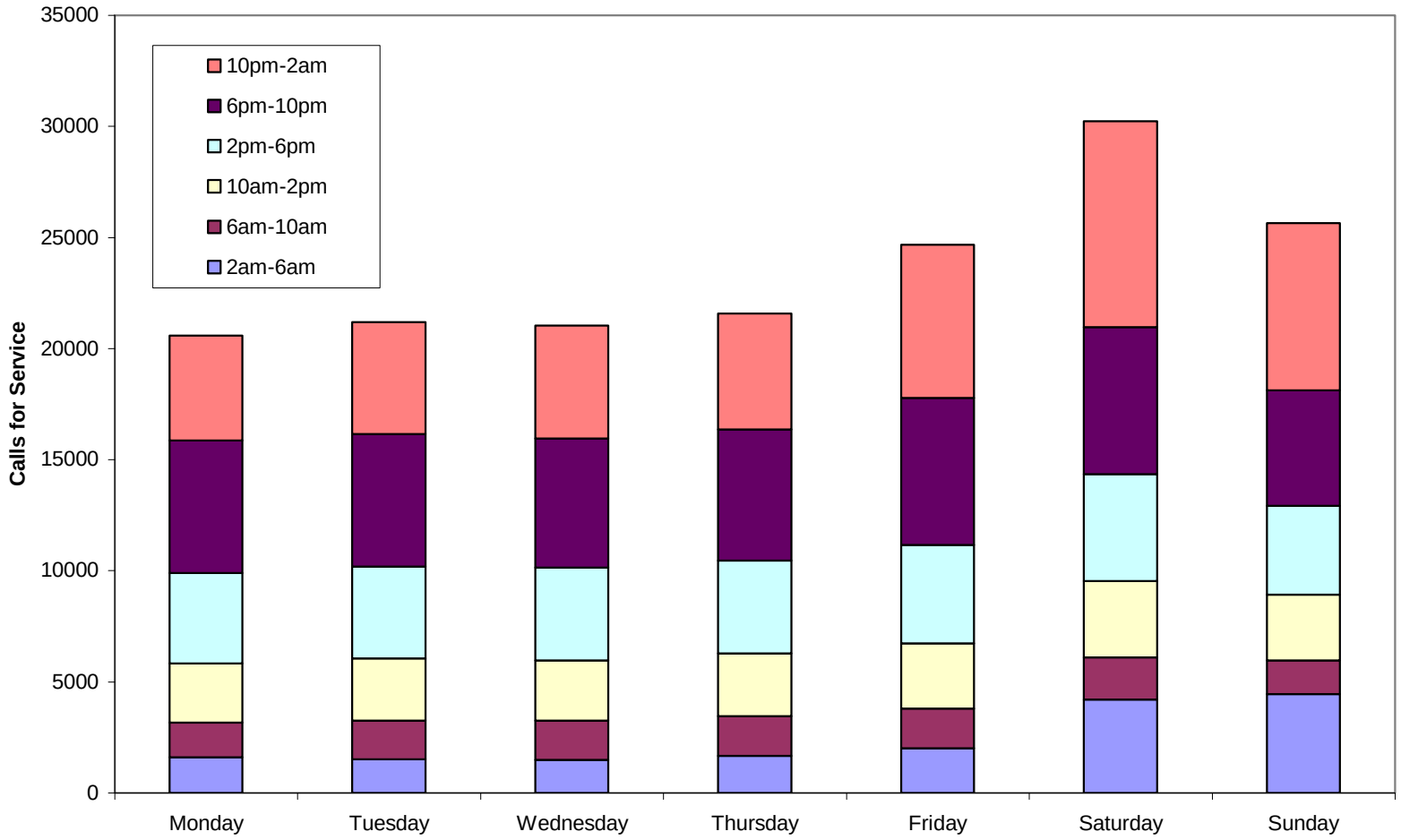


Figure 12. Map of All Calls for Disorderly Conduct, by Block Group, District of Columbia

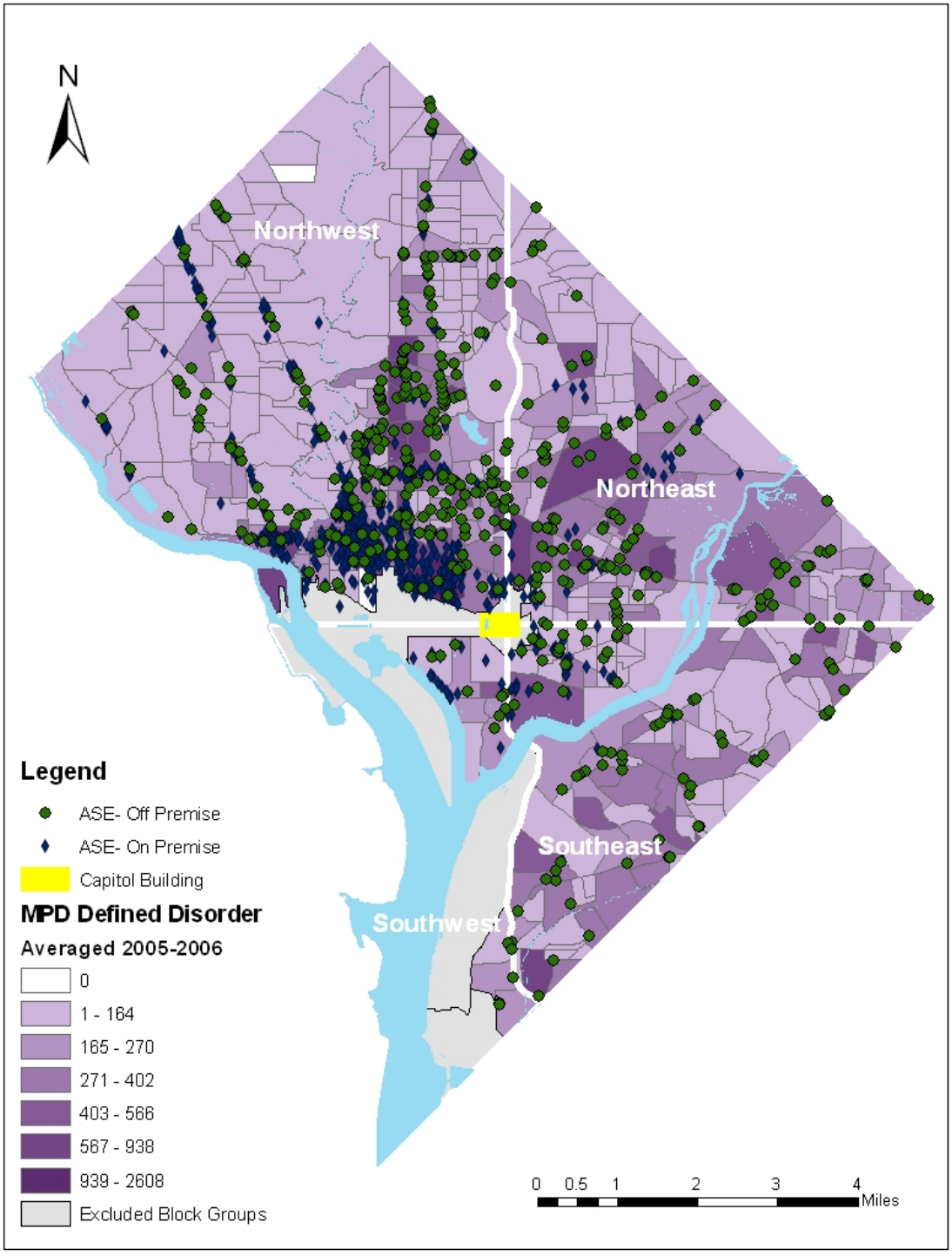


Figure 13. Map of Weekend Calls for Disorderly Conduct, by Block Group, District of Columbia

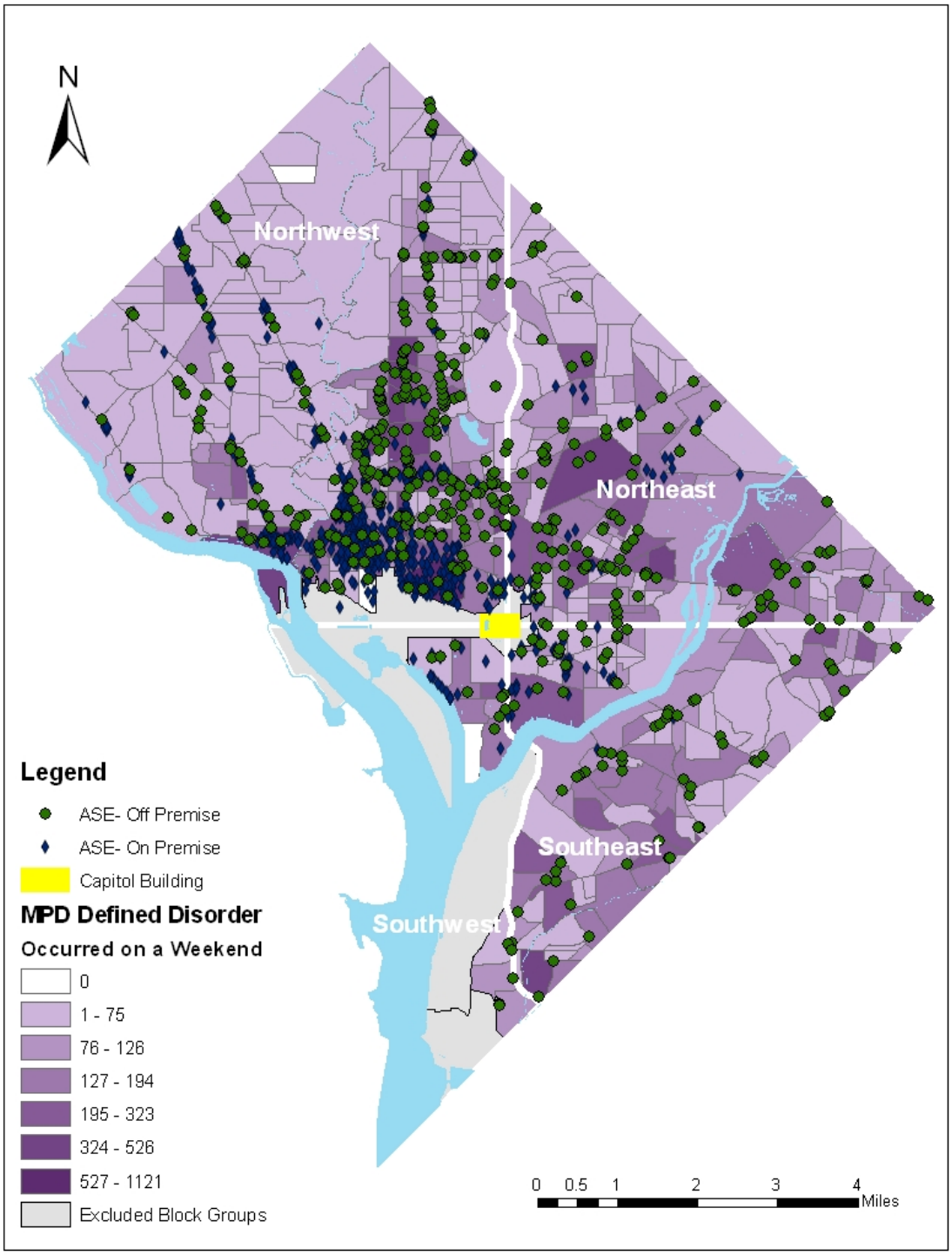


Figure 14. Map of Weekend Night Calls for Disorderly Conduct, by Block Group, District of Columbia

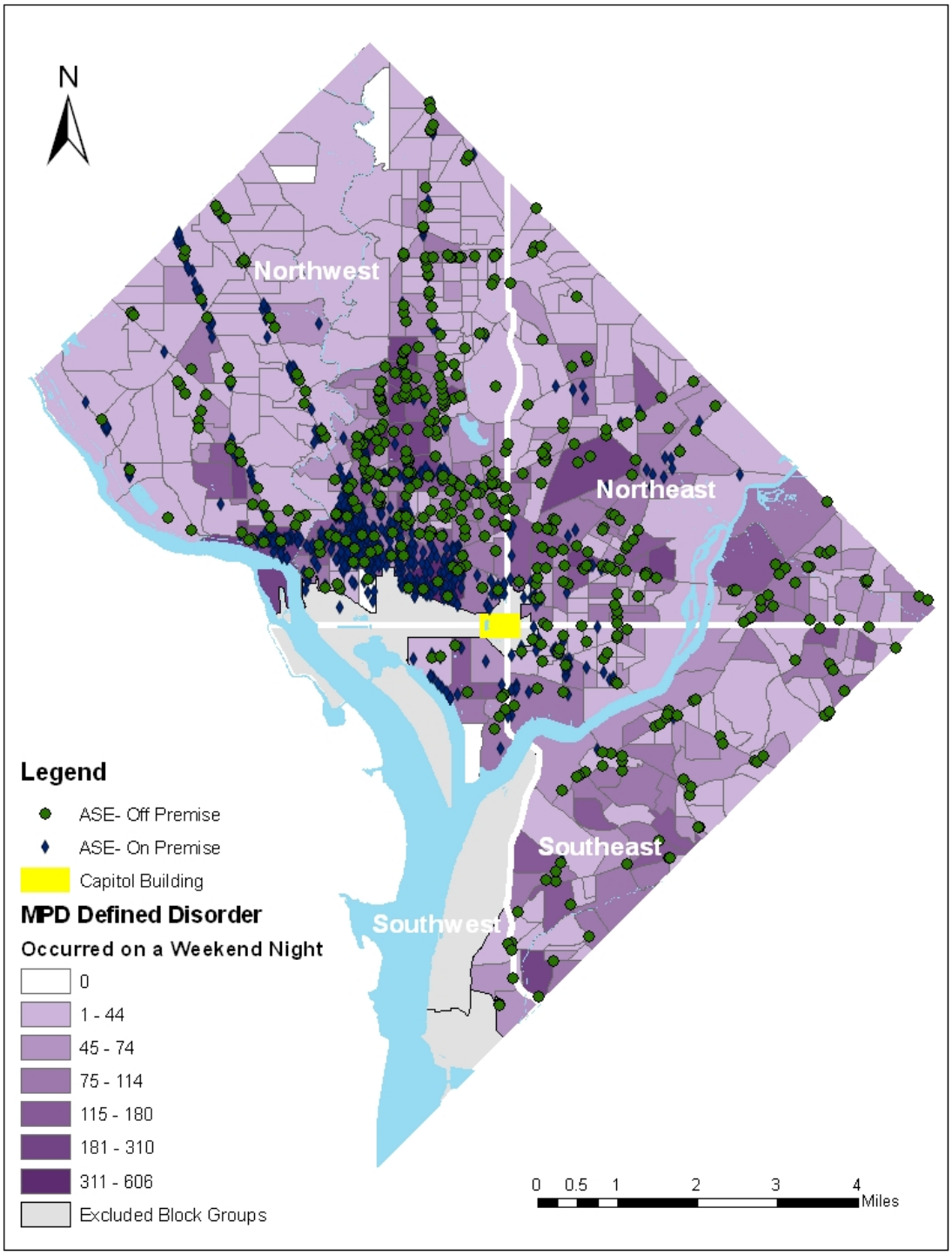


Figure 15. Map of Weeknight Calls for Disorderly Conduct, by Block Group, District of Columbia

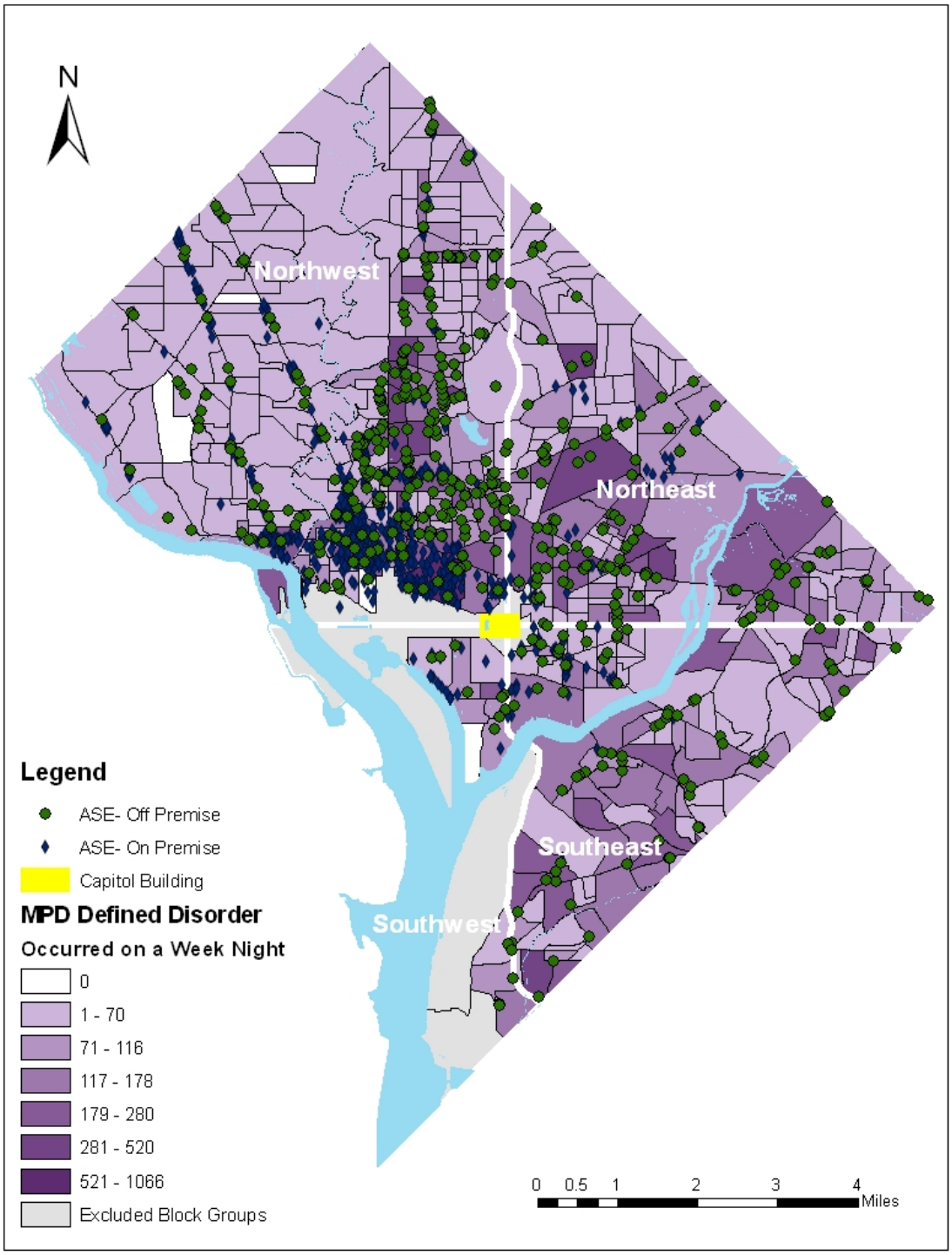


Figure 16. UI-Defined Disorder Calls for Service by Hour of the Day, District of Columbia Block Groups

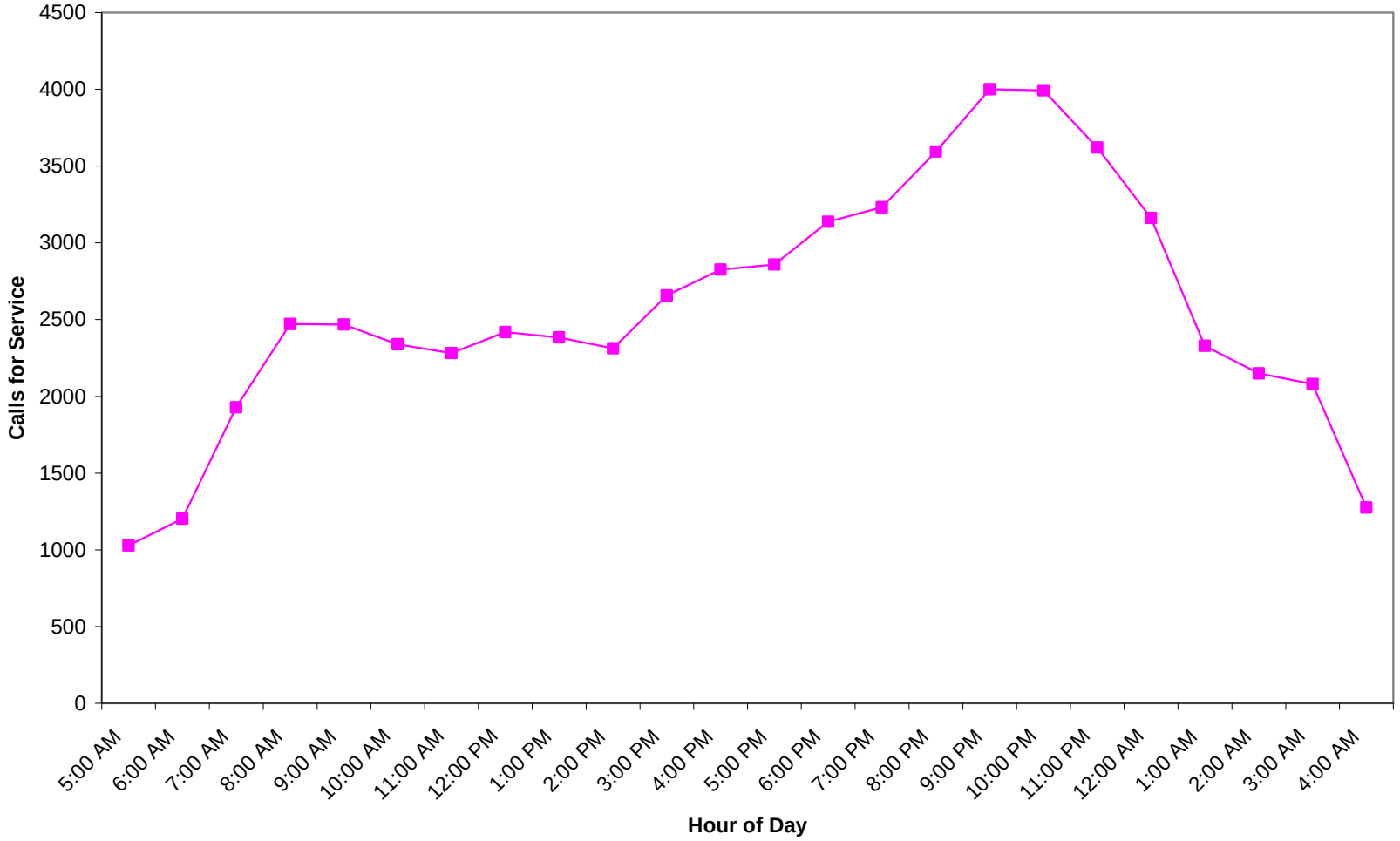


Figure 17. UI-Defined Disorder Calls for Service by Hour of the Day and Day of the Week, District of Columbia Block Groups

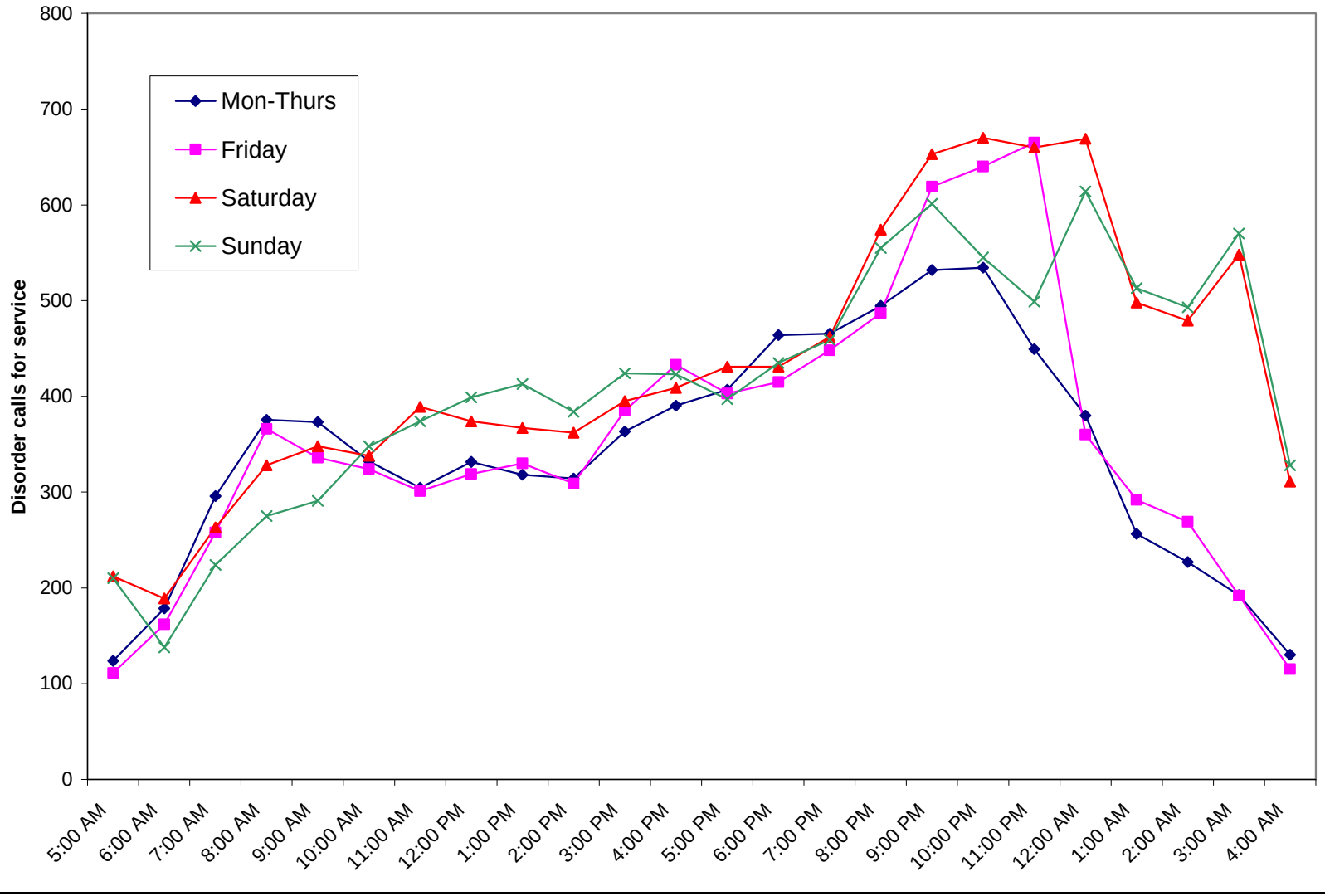


Figure 18. UI-Defined Disorder Calls for Service by Time Periods and Day of Week, District of Columbia Block Groups

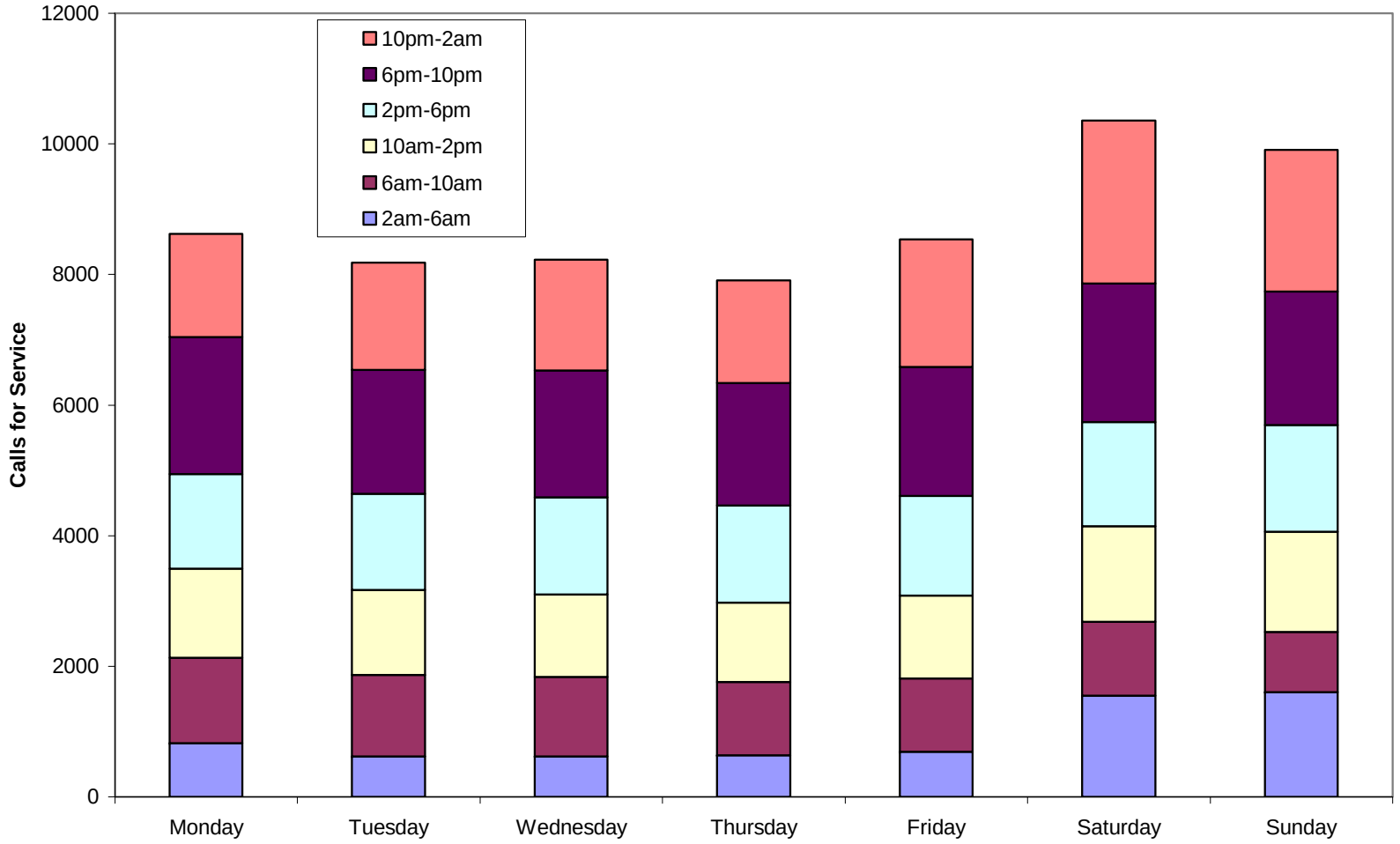


Figure 19. Map of UI-Defined Social Disorder, by Block Group, District of Columbia

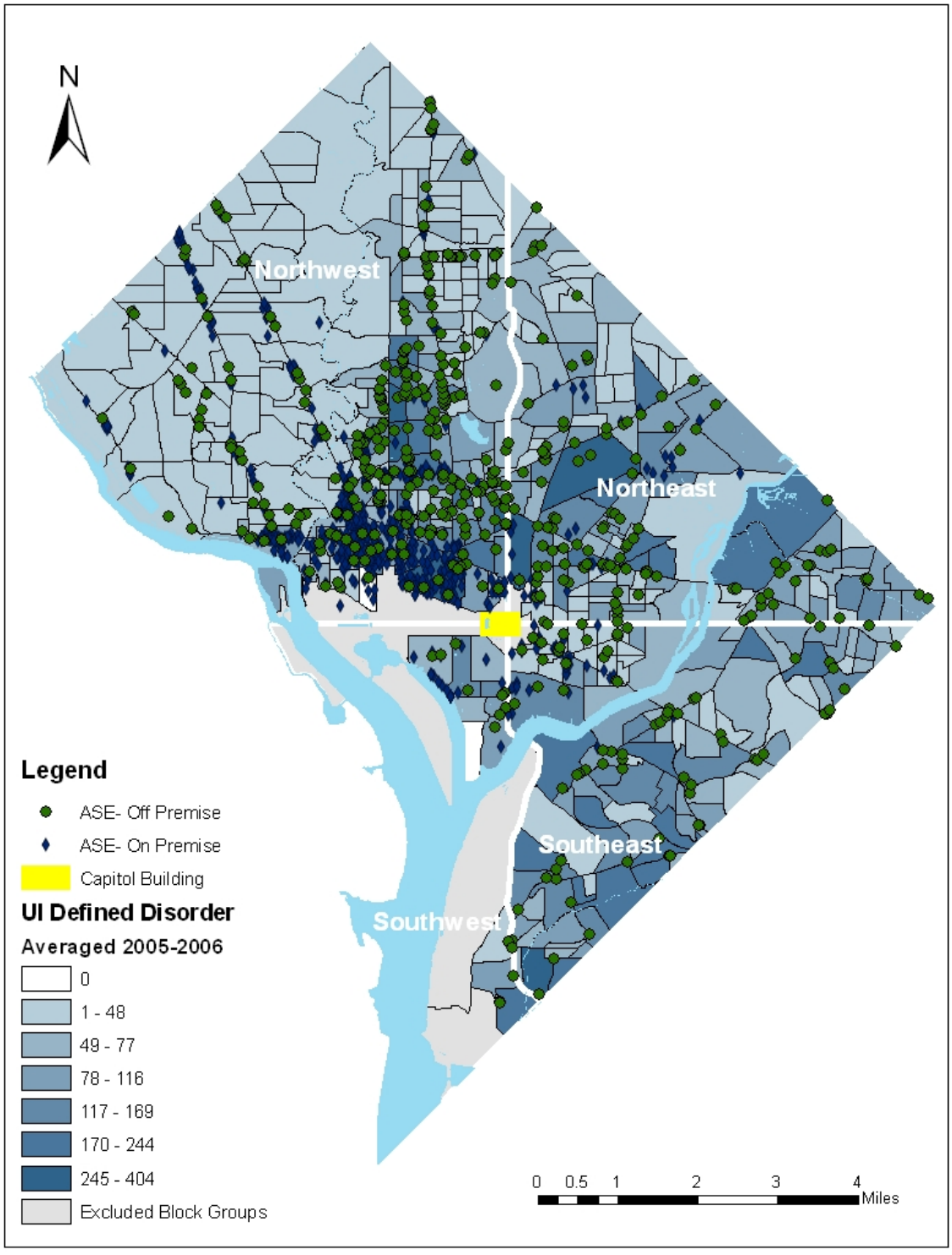


Figure 20. Map of Weekend UI-Defined Social Disorder, by Block Group, District of Columbia

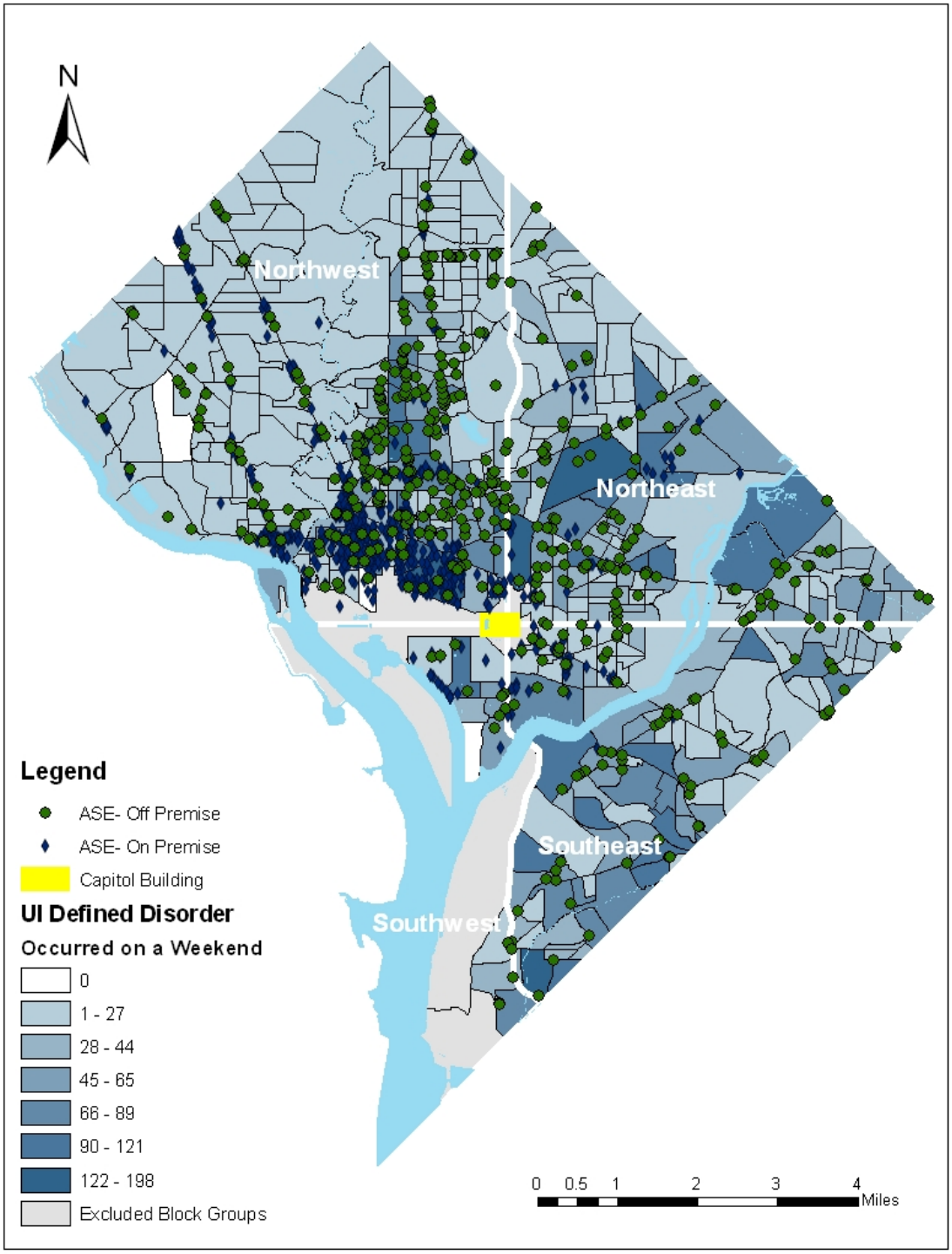


Figure 21. Map of Weekend Night UI-Defined Social Disorder, by Block Group, District of Columbia

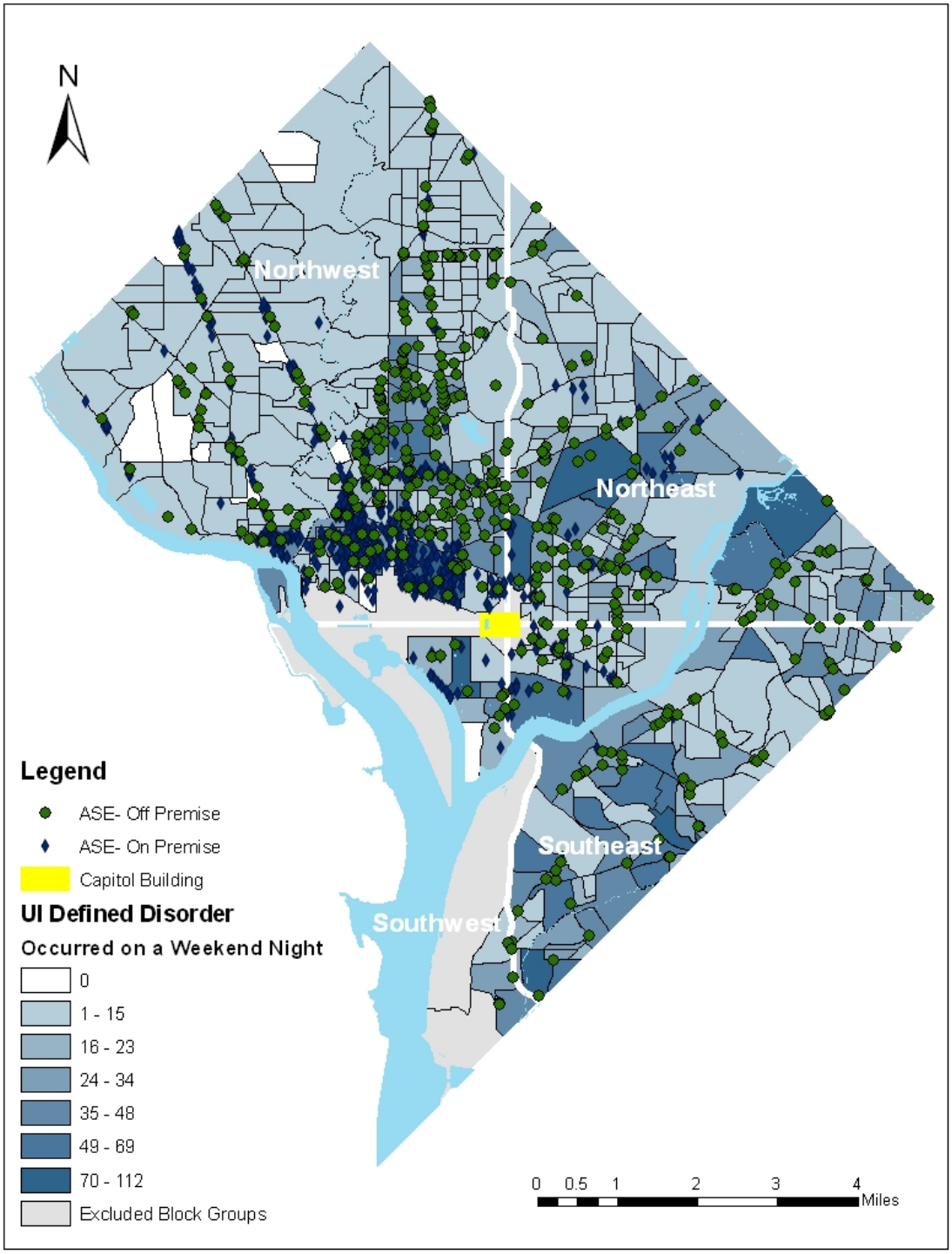


Figure 22. Map of Weeknight UI-Defined Social Disorder, by Block Group, District of Columbia

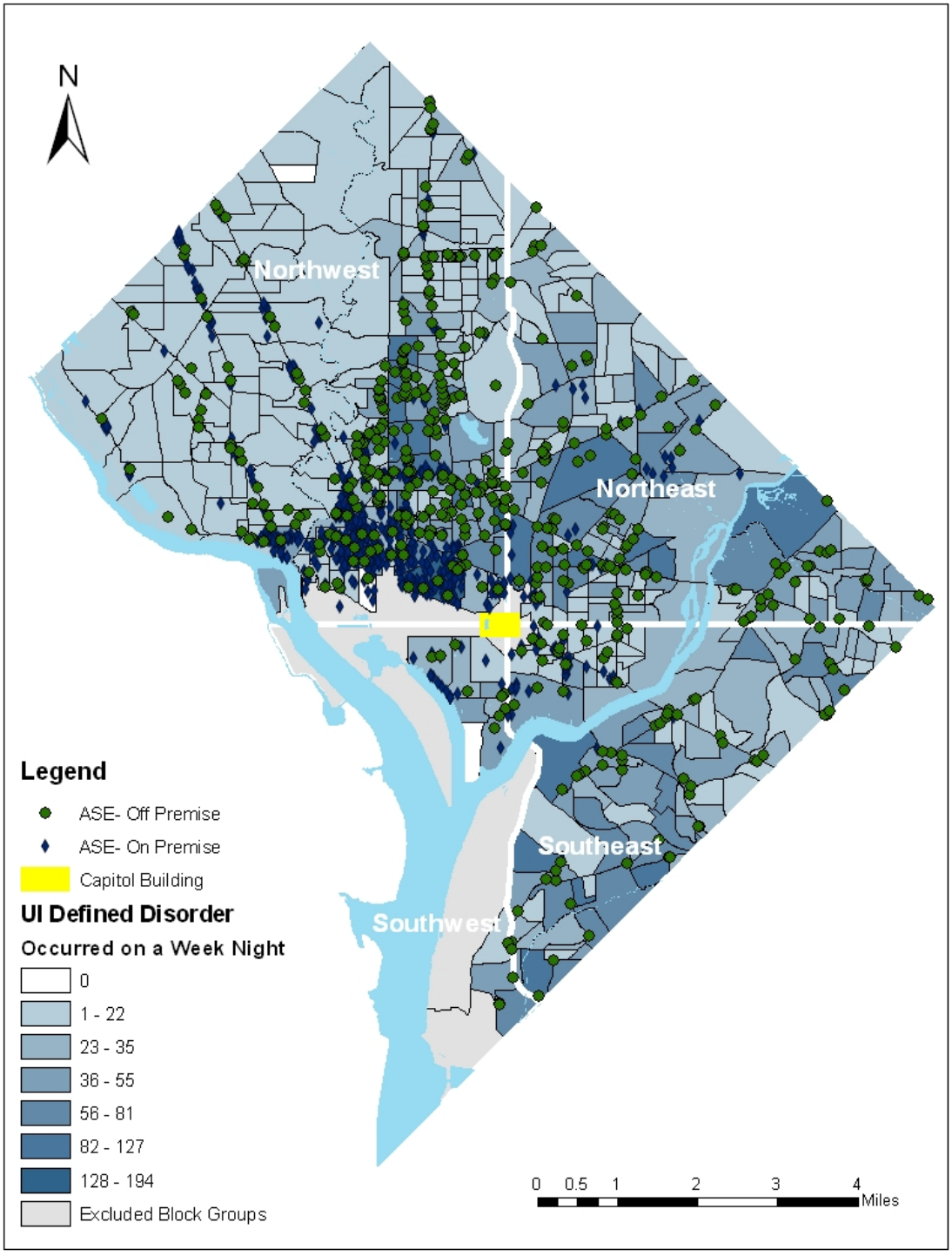


Figure 23. Domestic Violence Calls for Service by Hour of the Day, District of Columbia Block Groups

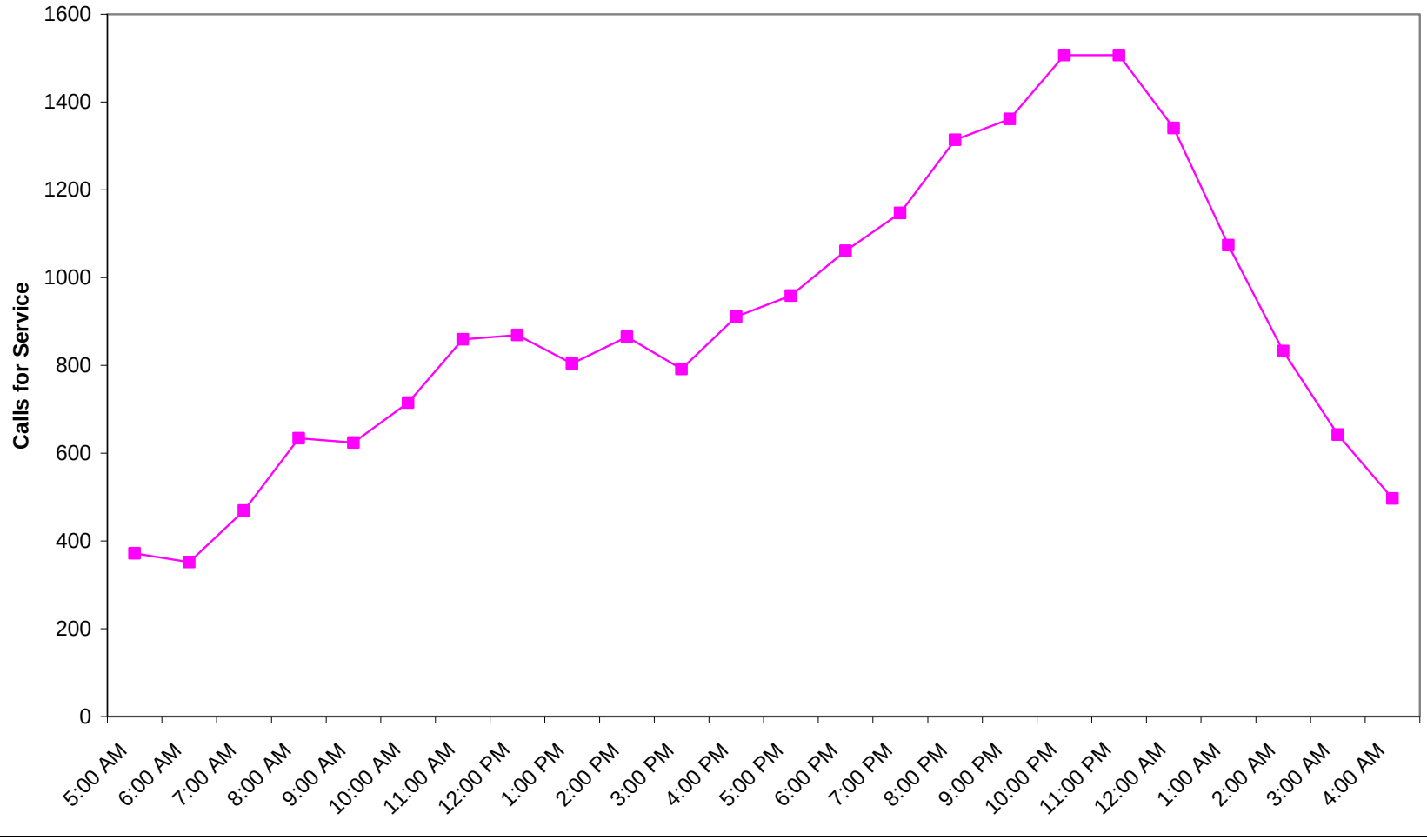


Figure 24. Domestic Violence Calls for Service by Hour of the Day and Day of the Week, District of Columbia Block Groups

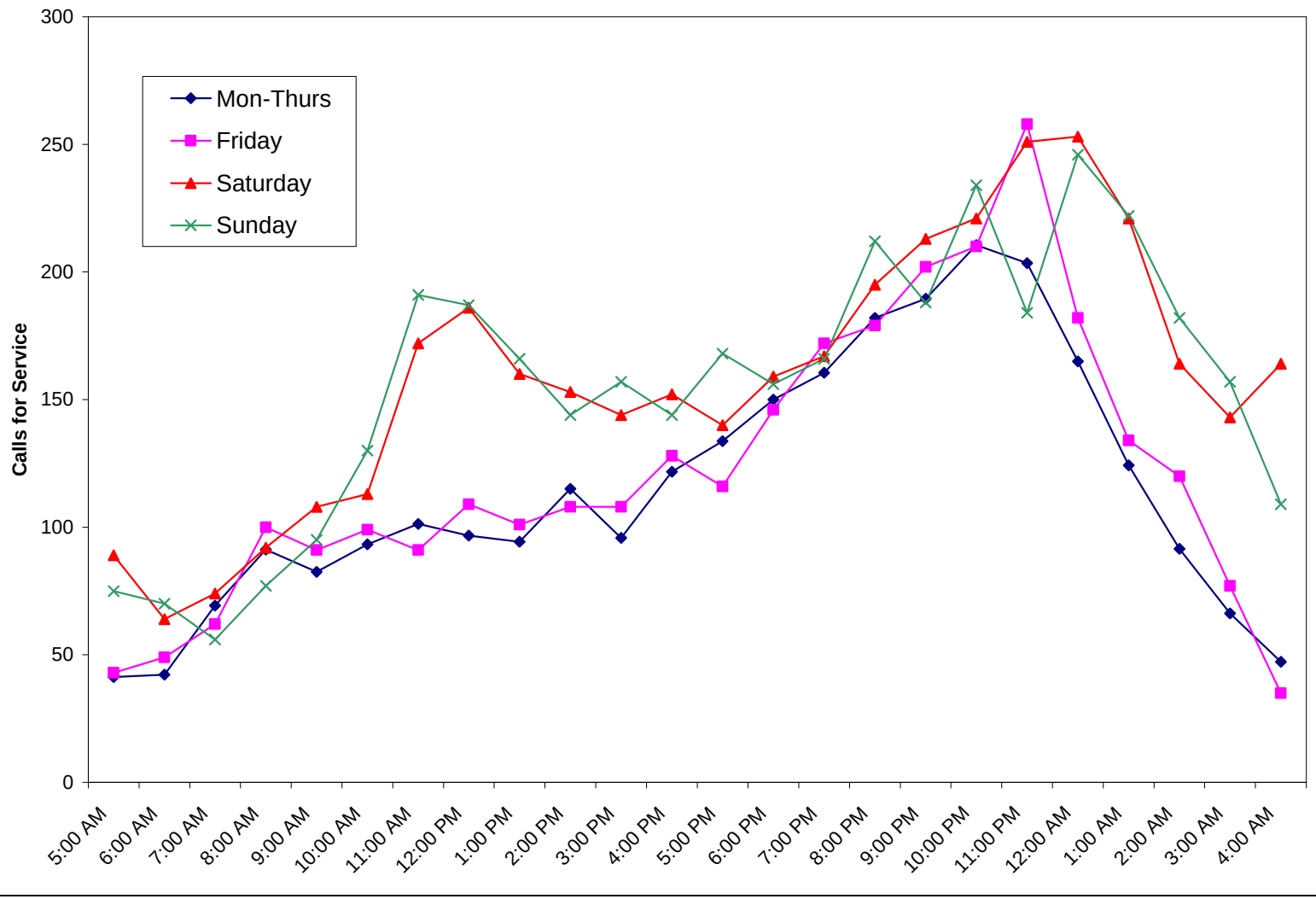


Figure 25. Domestic Violence Calls for Service by Time Periods and Day of the Week, District of Columbia Block Groups

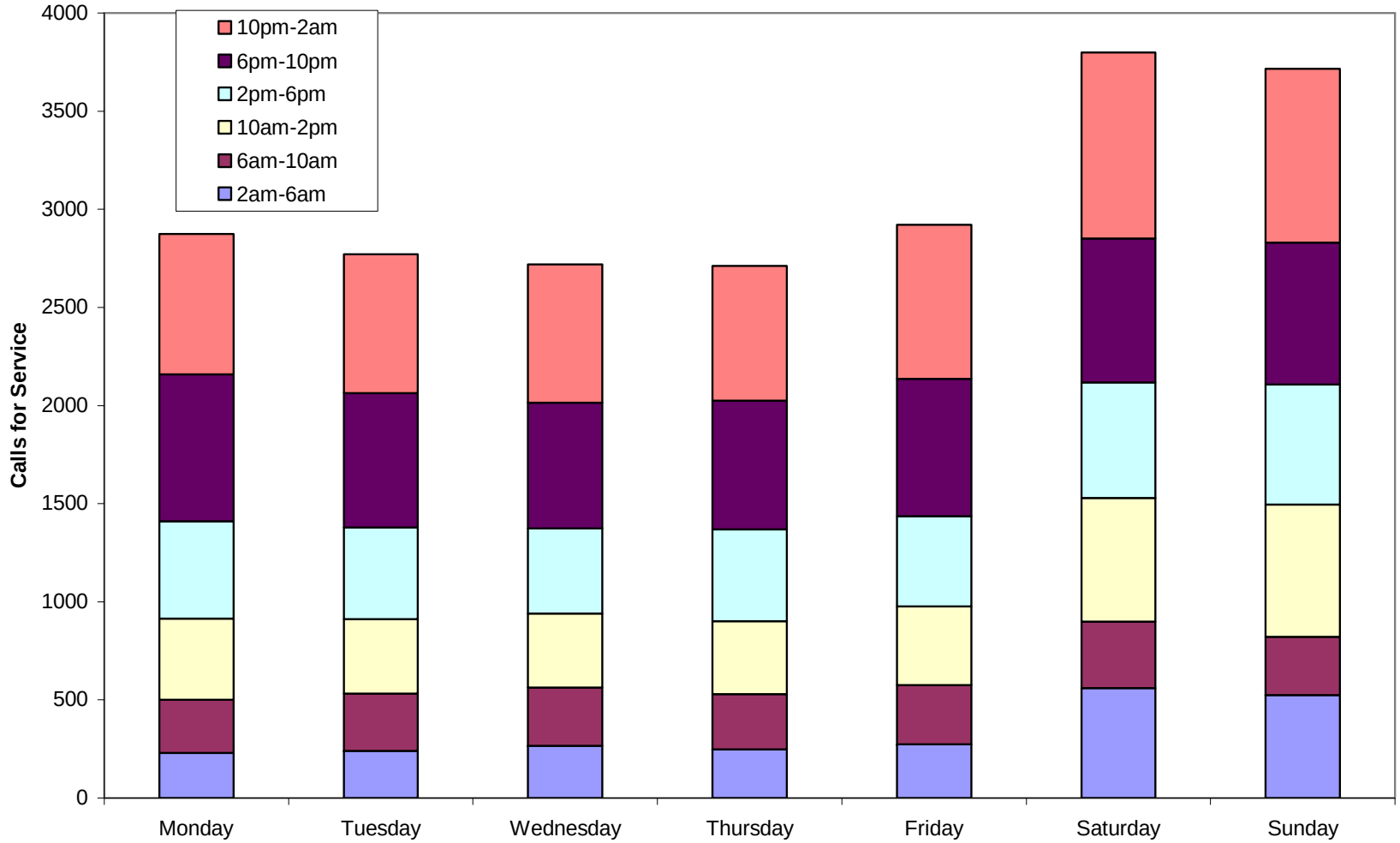


Figure 26. Map of Domestic Violence Calls for Service, by Block Group, District of Columbia

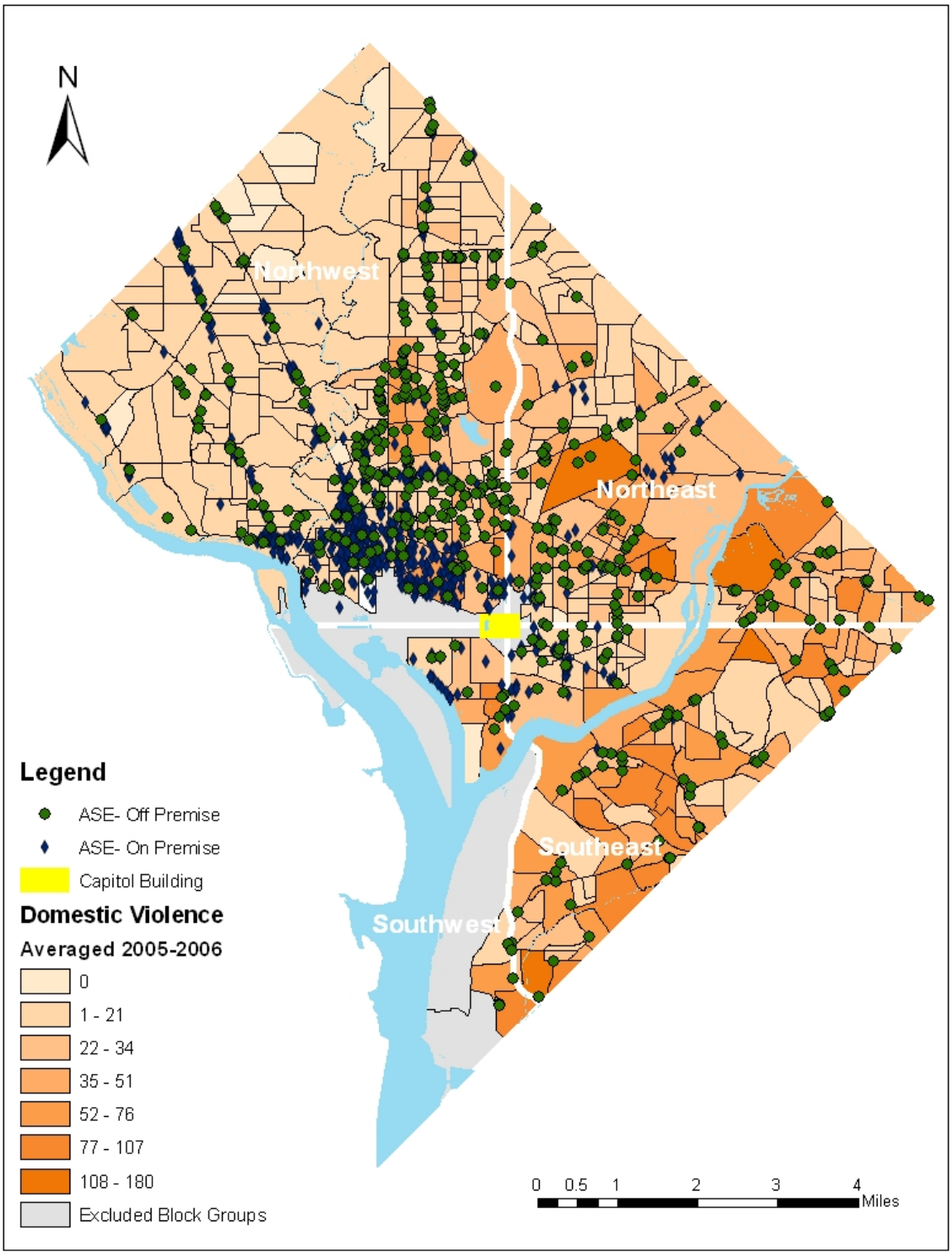


Figure 27. Map of Weekend Domestic Violence Calls for Service, by Block Group, District of Columbia

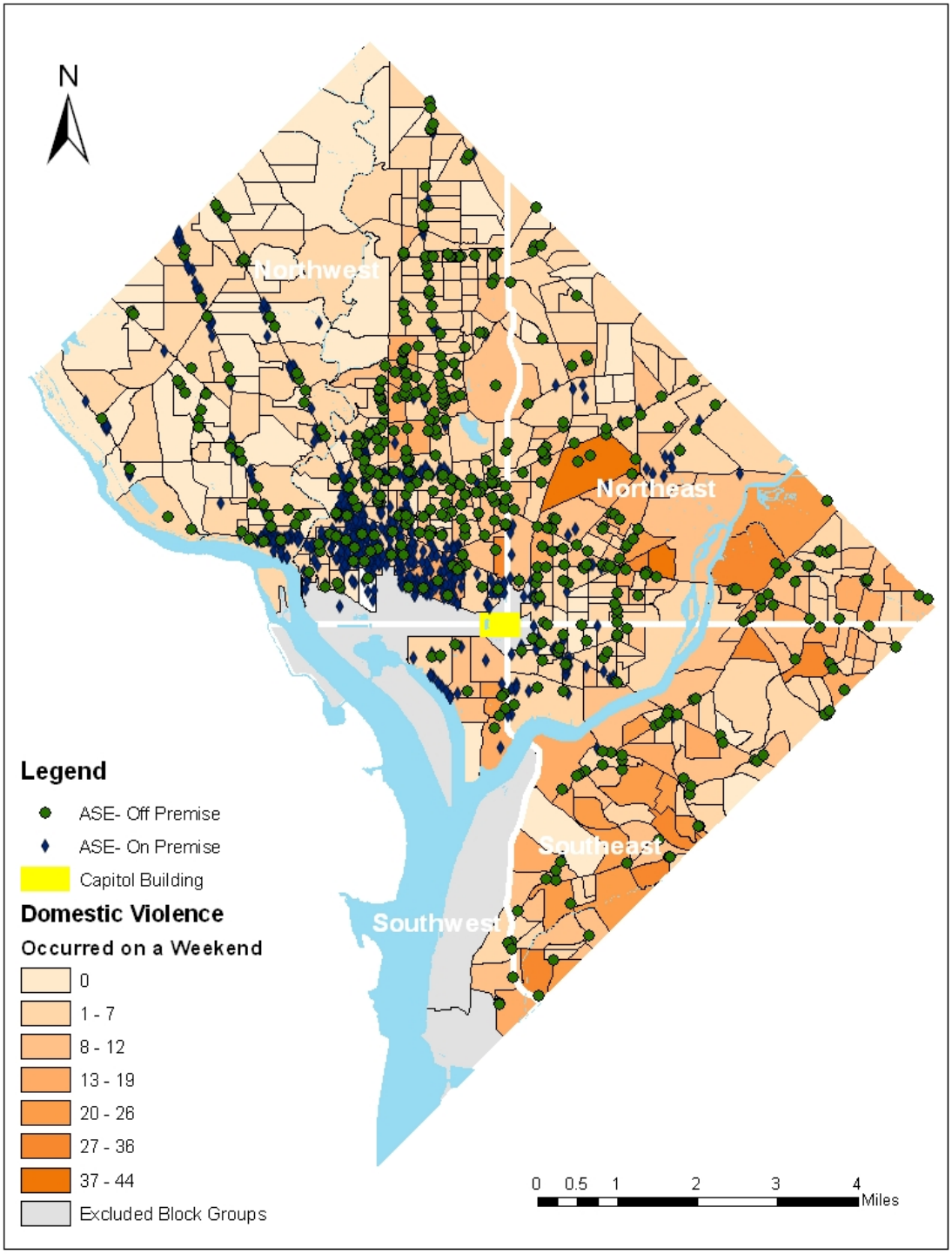


Figure 28. Map of Weekend Night Domestic Violence Calls for Service, by Block Group, District of Columbia

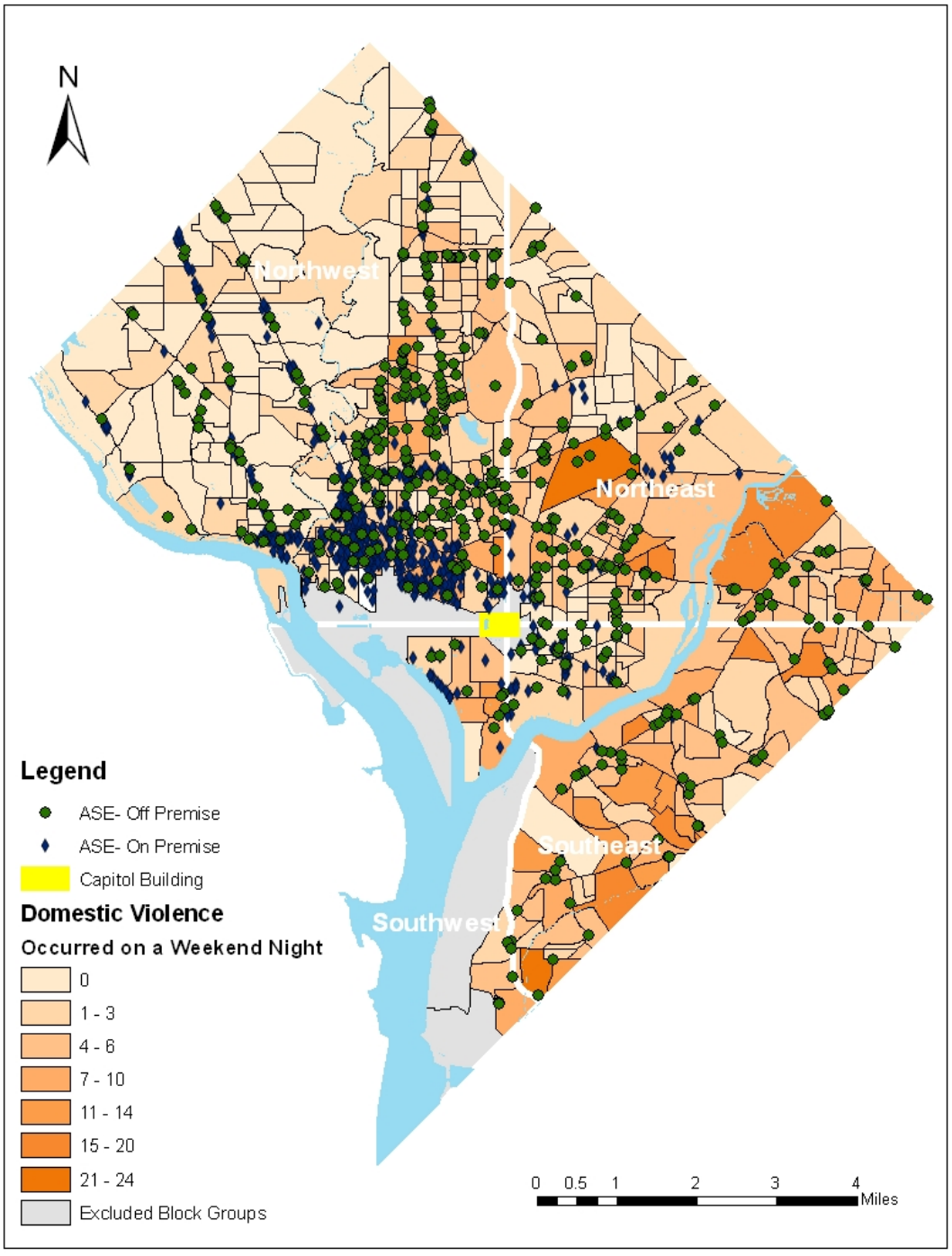


Figure 29. Map of Weekend Night Domestic Violence Calls for Service, by Block Group, District of Columbia

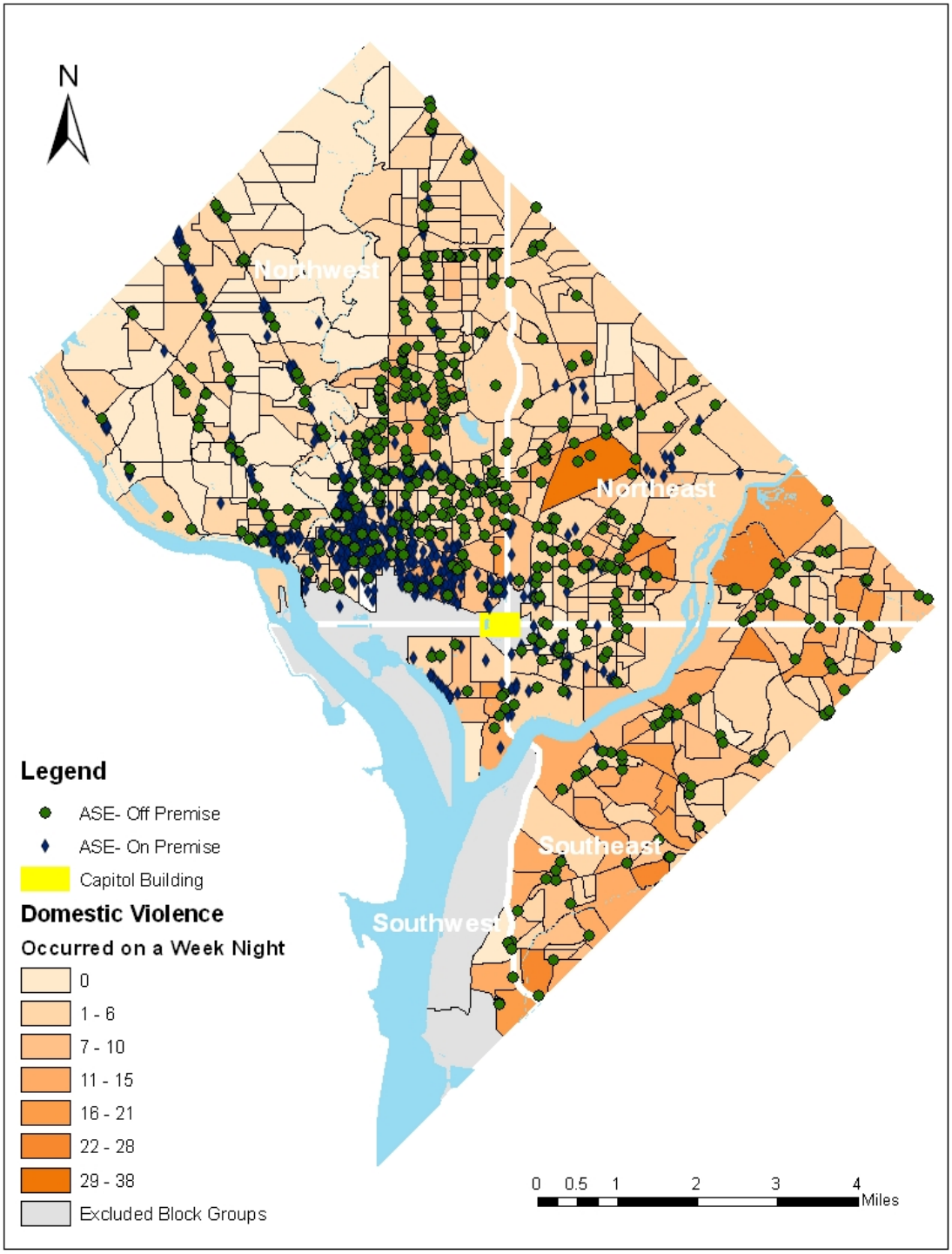
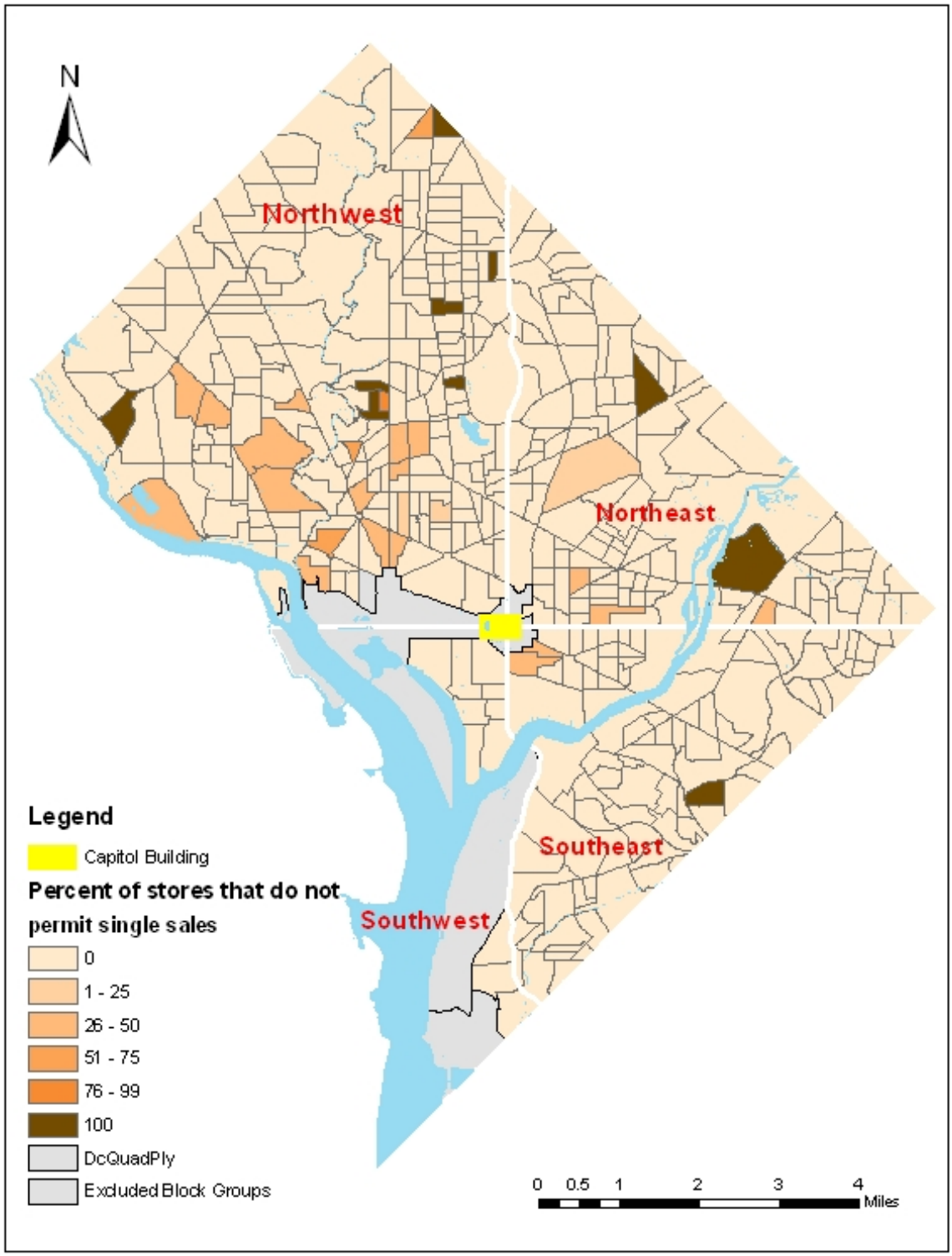


Figure 30. Map of Block Groups with Stores that Regulate the Sale of Single Containers, District of Columbia, 2006



Chapter 5. Results

Correlations

Variable correlations are shown in Appendix B. A few correlations are worth noting. On-premise and off-premise outlets are moderately correlated (.36 $p < .001$). When looking at the relationships between the independent variables and the dependent variables, not surprisingly, the strongest bivariate relationship occurs between the aggravated assault and the temporal lag of aggravated assault (2000-2001) (.81; $p < .001$). Aggravated assault also is highly correlated with adult arrests (.64; $p < .001$). Similarly, the other dependent variables (both types of disorder and domestic violence) also correlate highly with adult arrests. Looking at the social disorganization variables, concentrated disadvantage is highly correlated with aggravated assault (0.61; $p < .001$), domestic violence (0.65; $p < .001$) and UI-defined disorder (0.50; $p < .001$). However, the bivariate relationship between disorderly conduct ("MPD disorder") and concentrated disadvantage, although significant, is not nearly as strong (.26; $p < .001$). This is somewhat surprising in light of the research literature, and particularly, social disorganization theory, which has linked social disorder directly with disorganization. Somewhat unexpectedly, racial heterogeneity is negatively correlated with assault (-0.19; $p < .001$), UI-defined disorder (-0.10; $p < .05$), and domestic violence (-.39; $p < .001$), and is not significantly correlated with disorderly conduct (0.09; $p = .08$). A few other bivariate correlations stand out—prosocial places has a positive correlation with assault and disorder, as opposed to a negative relationship as we hypothesized, suggesting that prosocial institutions are not necessarily acting as buffers against crime. Our physical disorder measure (calls to the neighborhood services hotline) is not significantly correlated with many of the variables; however, it does have a moderate positive correlation with off-premise outlets (.42; $p < .001$).

Generalized Cross Entropy (GCE) Regression Results

As stated in the previous chapter, analysis of the relationship between alcohol outlets, physical place risk, social disorganization, and motivated offenders is estimated using a Generalized Cross Entropy approach. In all of the GCE models we provide a pseudo R-squared measure as a rough proxy for the predictive power of the model. These are computed in the standard method used in OLS (proportion of observed variance explained by the model). Unfortunately, this is not an accurate measure for the dependent variable for two reasons. First, the measure is a count and therefore the OLS R-squared measure is only a rough approximation. Second, with spatial

autocorrelation included in the models the traditional R-squared measure can behave unpredictably. For example, typically, adding more variables to the model should either increase the R-squared or leave it unchanged. If adding more variables in the model changes the spatial autocorrelation coefficient sufficiently, then, in the GCE models, the R-squared can even decrease. Hence, we caution the reader to view the R-squared measures in these models as rough guides to the predictive powers of the models and not to compare models (whether nested or not).

In addition, in the GCE models, interpretation of the size of the coefficients is not straight forward. Unlike linear models or some non-linear models, the size of the marginal effect depends on the amount of over- or under-dispersion. Despite this sensitivity, the signs of the coefficient are directly interpretable. Hence, in our discussion, we report and interpret only the direction of the effects of specific variables.

Table 7 presents the results of the main models regressing aggravated assault on alcohol outlets. The four models presented represent nested models where variables comprising the components of our theoretical model are added in blocks. All models include a control variable (the temporal lag of assault). In the final or "full" model (Model 4), the density of on-premise outlets has a significant positive relationship with aggravated assault. The density of off-premise outlets does not significantly influence aggravated assault in the full model, although it had reached significance in the nested models (Models 1 through 3). This finding is contrary to what we hypothesized (Hypothesis 1), as we expected that any positive association would be driven by off-premise outlets, not on-premise outlets. The addition of the physical environment variables appears to reduce the significant influence of off-premise outlets. In the full model, all variables are significant with the exception of adult arrests, the density of homeless services, and the density of bus stops. Interestingly (and similar to the bivariate correlations), prosocial places do not act as buffers of crime, but instead act as generators of crime—the influence of prosocial places on assault is positive. Also somewhat unexpected, the proportion of vacant parcels and the dummy variable for metro stations both have a negative relationship with aggravated assault. The full model has the highest R-squared (R^2= 0.73) of the four models.

Table 8 displays the findings that test Hypothesis 2 (off-premise alcohol outlets will influence social disorder). The results indicate that the density of both on-premise and off-premise outlets significantly influence disorderly conduct calls, although the coefficient for on-premise

outlets is very small. All independent variables are significant, but not all the significant relationships are in the expected direction (proportion of young adults, vacant parcels and block groups with metro stops have a negative influence on disorderly conduct).

Table 9 provides the results for the other type of social disorder examined—UI-defined disorder (sounds of gunshots, man/woman down, indecent exposure, soliciting for prostitution, and destruction of property). Both on-premise and off-premise outlets have a positive and significant influence on UI-defined disorder in Models 1 through 3, but when the block of physical environment variables are added to the model (Model 4) the influence of both on-premise and off-premise outlets is no longer significant. The full model has an R-squared of 0.60. All independent variables in the full model are significant except for the number of adult arrests. Similar to the results for the models examining disorderly conduct and assault, the variables vacant parcels, presence of metro station and the proportion of young adults have a significant negative relationship with social disorder.

Table 10 provides the results examining whether alcohol outlets have an influence on domestic violence (Hypothesis 3). The significance levels remain virtually unchanged as the various blocks of variables are added to the model. The density of on-premise outlets has a negative influence on domestic violence, meaning that as the density of restaurants, taverns, and nightclubs increases, the levels of domestic violence decrease. The effect is opposite (positive) for off-premise outlets—as the density of off-premise outlets increase, so too does the level of domestic violence, all other variables held constant. All variables are significant with the exception of proportion of vacant parcels and the density of bus stops.

Results of Models Incorporating Time of Day/Week

Tables 11 through 14 examine the full model for each of the dependent variables, but disaggregate the dependent variables by the three time periods described earlier in Table 2. The three models in Table 11 (aggravated assault models) each correspond to a time period. The results of three time-period based models show that the density of on-premise outlets is a significant predictor of assault, both during the weekend, and weekend night, but not during the weeknight (Monday through Thursday). The density of off-premise outlets does not significantly influence assault in any of the time periods (this finding is similar to the main model findings—Table 7). In addition, a few of the independent variables exhibit different relationships with assault across the

three models. For instance, during the weeknight, the number of adult arrests and concentrated disadvantage have a significant positive relationship with assault, but these relationships are not significant during the weekend or weekend night period. Block groups with metro stations have a negative effect on assault during the weekend and weekend night, but does not have a significant relationship with assault during the weeknight period.

Table 12 shows the results for disorderly conduct calls for service regressed on alcohol outlets and the full set of independent variables across three time periods. The findings across the time periods are similar to those found in the full model for disorderly conduct without disaggregating by time periods. The density of both on-premise and off-premise outlets influence disorderly conduct levels in the weekend model and the weekend night model. However, only *off*-premise outlets (as opposed to on-premise) has a significant influence on disorderly conduct during the weeknight. This appears reasonable to understand given people are generally less likely to go to restaurants, bars and nightclub on weeknights. For the most part, all other independent variables had an impact on disorderly conduct across the different time periods, with the exception of two variables during the weekend night—neither concentrated disadvantage nor density of homeless services exhibit an influence on disorderly conduct during the weekend night.

Table 13 presents the results for UI-defined disorder. Off-premise outlets have a significant influence during two time periods: the weekend and weekend night. This finding does not parallel the results from the main model (Table 9)—where off-premise outlets did *not* exhibit a significant influence on UI-defined disorder. The off-premise outlet variable does not reach significance during the weeknight. On-premise outlets are not significant in any model disaggregated by time of day. With the exception of adult arrests (which has a small effect on UI-defined disorder during the weekend) all other predictor variables exhibit similar influences across the different time period models.

Table 14 shows the results of the three time period models for domestic violence. The significance levels of the alcohol outlet variables vary across the three time periods. During the weekend and weekend night periods, off-premise alcohol outlets were positively and significantly related to domestic violence calls for service. The density of off-premise outlets does not significantly influence weeknight domestic violence. However weeknights appear to have a cooling effect on domestic violence where are there high densities of on-premise alcohol selling

establishments. During the weeknight and during the weekend, domestic violence is significantly and negatively related to the density of on-premise outlets. The negative relationship indicates that high densities of on-premise establishments (restaurants, bars and nightclubs) are associated with lower levels of domestic violence.

The social disorganization variables behaved similarly across all time periods, with the exception of concentrated disadvantage—the levels of concentrated disadvantage were significant predictors of domestic violence only during the weekend. For the motivated offender variables, and population density, the results are generally the same across models. The proportion of 18-29 year olds was negative and significant across all time periods, as was the density of the resident population (a significant positive relationship). However, adult arrests did not achieve significance in the weekend night model. The physical environment variables had a mix of positive and negative relationships and their significance varied across time periods.

Results of Models by Outlet Type

The next set of models regresses the four dependent variables on alcohol outlets where the on-premise outlet variable is disaggregated by type of business (Table 15). The models examine whether high densities of restaurants, bars and nightclubs independently influence aggravated assault, disorderly conduct, UI-defined disorder, and domestic violence. As described earlier, we hypothesized that the type of outlet would influence assault and disorder (restaurants, bars and nightclubs would be significant), but would not influence levels of domestic violence (Hypothesis 5). The aggravated assault model results indicate that it is the density of nightclubs, not taverns or restaurants, that is driving the association between on-premise outlets and aggravated assault that was found earlier (Table 7, Model 4). Looking at MPD-defined disorder (disorderly conduct), it appears that the positive association found between disorderly conduct and on-premise outlets in Table 8 (Model 4) is being driven by taverns. Disaggregating on-premise outlet types also reveals that nightclubs and restaurants have the opposite effect from taverns—a significant *negative* relationship with disorderly conduct.

The results of regressing the other social disorder variable (UI-defined disorder) on the suite of independent variables where outlet type is broken out are also interesting—similar to the disorderly conduct model discussed above, taverns have a significant positive association with UI-defined disorder, whereas nightclubs have a significant negative association. The earlier main

model for UI-defined disorder (Table 9, Model 4) did not find an association between the density of outlets (either type) and UI-defined disorder; when UI-defined disorder was broken into time periods (Table 13), however, total on-premise outlets had a positive influence on disorder that occurred during the weekend and weekend night periods.

Table 15 also shows that the results of the GCE models examining the influence of the various types of on-premise outlets on domestic violence do not vary much from the earlier model results. The negative association between on-premise outlets and domestic violence appears to be driven by nightclubs and restaurants. The findings signify that areas that have greater densities of nightclubs and restaurants have lower levels of domestic violence calls for service.

Results of Models Assessing the Influence of Outlets that Permit the Sale of Singles

Table 16 provides the results of models testing whether neighborhoods that had high densities of stores that do not permit the sale of singles fare better with regard to crime than neighborhoods with high densities of stores that permit the sale of singles (Hypothesis 6). The results for the four dependent variables are presented together in one table. The results indicate that even in areas with stores that do not permit the sale of singles, assault, disorderly conduct and domestic violence remain high (the relationship between the density of sales that do not permit singles and each dependent variables is significant and positive).

Chapter 6. Discussion and Conclusion

This study is designed to expand our understanding of the role of alcohol outlets in attracting crime—specifically, the crimes of aggravated assault, domestic violence and incidents of social disorder. The study examines the physical environment of block groups and controls for neighborhood structural characteristics, using opportunity theories to identify attributes of block groups and other crime generators and attractors found in neighborhoods that provide the opportunity for crime. The study examines the time of day and week to further refine the assessment of the effects of crime attractors and generators. Not surprisingly, the impact people have on their environment with regard to crime will vary over time as people move through the day and night socializing and patronizing alcohol establishments. This variability permits the assessment of the effects of attractors on crime more precisely than in previous work. Recent research in this area has called for an expanded focus on theory-based ecological assessments of the impact of alcohol distribution on neighborhoods and in a more diverse array of settings (Britt, Carlin, Toomey and Wagenaar, 2005).

This study is grounded in a theoretically-informed perspective and examines a diverse urban area with great variation in residential and commercial settings. The study hypothesizes that violence and disorder in neighborhoods with high alcohol outlet densities will be highest during time periods associated with the presence of large numbers of people populating alcohol selling establishments. We examine a wide range of physical environment characteristics hypothesized to influence levels of crime and disorder, as well as variations in distribution practices that go beyond contrasting on-premise and off-premise outlets. Below we discuss the findings for each of the types of crime examined—aggravated assault, social disorder, domestic violence. As this study examined very different dependent variables and employed many models—and found contrasting results across types of crimes and models—for organizational purposes, we discuss the findings separately by dependent variable.

The Density of Alcohol Outlets and Aggravated Assault

The results from the models examining aggravated assault reveal that the density of on-premise outlets is a significant predictor of aggravated assault. In contrast, high densities of off-premise outlets (liquor stores, mini-markets, etc.) do not influence assault. These findings stand in contrast to the majority of studies assessing the influence of off-premise outlets on assault. More

often, studies have found that off-premise outlets have a significant effect on assault (see for example, Alaniz et al., 1998; Gorman, et al., 1998a; Gruenewald et al., 2006; Scribner et al., 1995).[8]

We note that some of the aforementioned studies utilize different measures of assault and different denominators to calculate density, and for the most part, study the phenomena at different levels of aggregation—variation in measurement could certainly contribute to the differing findings. Regardless, the findings from this study indicate the importance of including measures of the physical environment. The coefficients for off-premise outlets were significant in the nested models until the physical environment variables were added. In addition, almost all of physical environment variables have a significant association with assault, however, not all relationships are in the expected direction. The proportion of commercial or retail parcels, and physical disorder each has a significant influence on assault. In addition, the density of prosocial places also has a positive relationship with assault. Although this relationship is not in the hypothesized direction, it is not totally unexpected given that some research has found that institutions, such as schools and churches, that have historically been viewed as places that buoy social control, in a modern, urban society no longer provide buffers against crime (Felson, 1994).

Also in contrast to expectations, the proportion of vacant parcels and the presence of a metro station have negative relationships with assault, and the increased density of street lighting is associated with an increase in assault. In the District of Columbia areas with on-premise outlets and high assault levels often are popular retail and commercial corridors that have few vacant parcels and very good street lighting. This is certainly true for the recently revitalized Chinatown/Central downtown area of the District. The Chinatown block group comprises 78 restaurants and 12 taverns and has almost no vacant parcels. In general in the District, areas with high percentages of vacant parcels are not commercial and retail areas (bivariate correlation between vacant parcels and proportion commercial/retail is not significant—see Appendix B). With regard to metro stations appearing to act as buffers against assault, it may be that these block groups are more likely to have place managers—security guards, extra police and/or transit officers. In addition, almost all metro station platforms in the city are underground, away from bar exits and entrances, creating a flow of patrons away from high risk street areas. Bus stops, on the other hand, are places where pedestrians

[8] Although Lipton and Gruenewald (2002) did not find a significant relationship between off-premise outlets and assaults, the coefficient was close to significant (.101).

linger in the street and on sidewalks, often for long periods, awaiting the next bus. In the District in commercial and retail areas, there are often bus stops on every block.

When our models for assault examined the different types of on-premise outlets—restaurants, taverns, and nightclubs—we find that the significant relationship between on-premise outlets and assault appears to be driven by taverns, as opposed to restaurants and nightclubs. Neither the coefficient for nightclubs nor the coefficient for restaurants is significant in the models examining assault. The finding of no effect for nightclubs when there have been many highly-publicized reports of violent incidents around clubs in recent years may be due to the low number of clubs. There are only six block groups with nightclubs. In the District it is more likely that club-type bars will be categorized as bars (i.e. taverns), rather than nightclubs, for licensing purposes. Hence, although our findings indicate that the density of nightclubs is not significantly associated with violent assaults, we would caution readers to not overstate these findings.

The findings from the time period models for assault do not elicit any surprises—high densities of on-premise alcohol outlets are associated with higher levels of aggravated assault both during the weekend and weekend late night periods. This finding is similar to the findings from the main assault model. High densities of on-premise outlets are not related to assault during the weeknight. These findings are consistent with a key premise of this study—that time of day is an important component to understanding the microenvironments of crime and place. As high densities of alcohol outlets are not significant attractors of assault all the time, crime prevention strategies should take into consideration "hot times" for assault around outlets. Crime prevention strategies will be discussed in more detail in the "Implications" section of this report.

When single sales distribution policies are included in the models examining the influence of off-premise outlets on aggravated assault, the findings suggest neighborhoods that have stores that ban single containers might be worse off with regard to assault than block groups that do not have stores that ban the sale of singles. Given that we found that off-premise outlets were not attractors of assault in our main models, it is a bit surprising that we found a higher incidence of assault in block groups with voluntary agreements against single sales. An explanation for this finding is that it is likely that neighborhoods where there are bans or voluntary agreements that prohibit single sales have already reached high levels of crime. And that the policy is a *reaction against* high crime levels. Although we had hypothesized that neighborhoods that have stores that

do not permit the sales of singles might exhibit greater social control, it appears that the contrary findings may indicate that the neighborhoods with stores that do not permit single sales had already reached a tipping point with regard to crime and disorder. In other words, even with voluntary agreements banning single sales these areas would still have higher levels of violence and disorder in comparison to areas with stores that implemented bans or voluntary agreements simply because crime is too high or disadvantage too great in these areas for the ban of single sales to make a difference. Furthermore, stores that do not allow single sales are often found within the same block groups with stores that do permit single sales—mostly likely washing out any buffering potential of single sale policies.

Other notable findings from the aggravated assault models include the findings that racial heterogeneity has a negative relationship with assault, as does the proportion of 18-29 year olds in the population. These findings contrast with earlier studies (see, for instance, Britt et al., 2005 with regard to racial heterogeneity; and Zhu, Gorman and Horel, 2006 with regard to young adult population). In the District, racial heterogeneity could simply be a marker of gentrification and in essence, affluence, which most often buffers against violence. Similarly, households in the District that are more affluent tend to be households where older adults reside. With the exception of concentrated disadvantage, our models do not include a variable that solely measures affluence. Future research of this nature should consider including variables that measure affluence.

The Density of Alcohol Outlets and Social Disorder

The analyses of social disorder confirm the long-hypothesized link between alcohol-selling establishments and disorder. Concentrations of both on-premise and off-premise outlets are associated with high levels of disorderly conduct. An important contribution of the present research is that the study operationalizes social disorder in two ways—(1) the traditional "disorderly conduct" and (2) a group of calls that indicate more dangerous behaviors such as "shots fired," and "man/woman down." A common mental picture of crowded bars in seedy areas of town is that of people leaving bars in a disorderly manner, urinating on street sidewalks and neighbors homes or comporting themselves in a loud or obnoxious way. We found that levels of disorderly conduct are higher in block groups with concentrations of bars and off-premise outlets (liquor stores, mini markets, etc.), but that levels of the more "fear-provoking" social disorder are not affected by alcohol outlets, on average across different days of week. However, when our analyses

disaggregated calls for service for UI-defined disorder by time periods, we found that, during the weekend and weekend night periods, high concentrations of on-premise outlets are significantly related to disorder. Essentially, the findings begin to compare to the findings for aggravated assault. This suggests that we may be correct to view this category of social disorder as more fear provoking or troublesome—and actually more closely aligned to the conduct of violent behavior then to disorder. In addition, the results of the UI-defined disorder analyses disaggregating on-premise outlets by type of outlet (Table 15, column 3) show that any potential effect in the main models may have been masked by the opposing influence of nightclubs and taverns—taverns have a positive influence on the more fear-provoking category of social disorder, whereas nightclubs have a negative influence on social disorder.

The Density of Alcohol Outlets and Domestic Violence

Our analyses of models regressing calls for service for domestic violence incidents on alcohol outlets and a full suite of covariates found that the relationship between alcohol outlet density and domestic violence varies by type of outlet. More specifically, off-premise outlets have a positive relationship to domestic violence calls for service, and this relationship holds strong during the weekend and weekend night periods. In contrast, on-premise outlets have a significant negative relationship with domestic violence, and this relationship remained strong in the weekend models and weeknight models, but not during the weekend night models (however the coefficient approached significance). As noted in the "Results" section, the negative relationship is driven by restaurants and nightclubs, but not bars. It is possible that the neighborhoods that have a higher density of restaurants and nightclubs are neighborhoods where there are either few residents in those neighborhoods or nearby, or, for the most part, high densities of restaurants and clubs generate a lifestyle that contributes to people from those neighborhoods being out of their homes and, therefore, not in a situation where domestic violence is likely to occur. Similarly, in areas of greater densities of off-premise outlets, people may be more likely to purchase alcohol and return to their home nearby with their libations, increasing opportunity for drinking in the home, and in turn, interacting with family members and turning a potential offender into an offender.

As with assault, time of day/week appears to matter for domestic violence. Although on-premise outlets have a consistent negative relationship with domestic violence calls for service over the different time periods, the relationship between off-premise outlets and domestic violence varies

across the three time periods—the risk for domestic violence in areas of high densities of off-premise outlets is greatest during both the weekend and weekend nights time blocks, but not during the weeknight, suggesting different routine activities for domestic violence offenders during the week. This is an important finding in light of recent research that found that the most common time range for a domestic violence incident (across all days) was 6 p.m. to 8:59 p.m., with the second most common time range being from 9 p.m. to 10:59 p.m. (Tennessee Bureau of Investigations, 2006)—these same hours encompass our weeknight period. More research should be done to pinpoint high risk days and times for domestic violence and to determine whether and how neighborhoods influence risky times. Validation of findings that weekends are especially vulnerable periods could assist with the development of new or focused strategies that incorporate targeted risk management treatment principles for both victims and offenders.

The prohibition of single sales did not mitigate any risk for domestic violence as evidenced by our findings indicating that block groups that have stores that prohibit singles actually have higher levels of domestic violence calls for services. Similar to our musings with regard to assault, we would interpret this finding as indicating that these neighborhoods have already reached the tipping point for crime and domestic violence—single sales policies simply do not go far enough or reach enough stores to buffer against violence.

As this study is one of a few neighborhood-level studies to examine levels of domestic violence within the lens of crime attractors, we believe it will assist in building a foundation to further conceptualize how features of the neighborhood environment might contribute to a serious public health issue. Our findings imply that there is something inherent in neighborhoods—and in particular, high densities of off-premise outlets, that influences the number of calls to police for domestic violence incidents. Multi-level research, as well as longitudinal research should be conducted to uncover the geography of alcohol purchasing patterns, consumption, and domestic violence incidents.

Crime Prevention Around Crime Attractors: Implications of the Current Study

In some big cities, reducing alcohol use through limits on the physical availability of alcohol is an attractive policy option. In a quick review of city council legislation in large cities across the U.S., we found a number of bills or pending legislation designed to limit the number of bars and nightclubs, specify more restrictive distribution policies (such as limiting hours of operation), or

even close establishments in high-crime neighborhoods. As policymakers understand, lowering the density of outlets in neighborhoods is not easy to accomplish and a reduction in density would not necessarily translate into lower crime rates for areas that were already experiencing high rates of crime and disorder. Furthermore, global reductions in the number of outlets in a city may not be effective in reducing crime. Our study also examined whether *city-wide* density of outlets relative to a given block group influenced levels of violence or disorder in neighborhoods and found no association between the global measure and violence. In essence, it appears, at least in the District of Columbia, that high densities of outlets is a neighborhood-level problem—that there is something specific to the neighborhood (or within the neighborhood) that attracts or generates violence and disorder. In addition to changing zoning rules to impact density, policymakers can also choose to regulate the specific distribution policies and practices of alcohol outlets within neighborhoods. Given the findings of this study, some policymaker may want to suggest that limiting hours of operations or reducing the amount or types of alcohol sold could have some impact on crime and disorder. However, we did not conduct analyses by closing times, and thus, our findings cannot imply that changes in closing times would influence crime and violence. Future studies that incorporate analyses by examining outlet closing times could go a long way to inform more specific policies regarding limiting hours of operations.

In addition to targeting policies to reduce how much patrons drink, policies, laws, regulations and practices can be targeted to make alcohol-selling establishments and the neighborhoods that surround them safer, regardless of how much people drink. The research findings suggest that given the link between alcohol outlets and crime, law enforcement becomes a key agent in efforts to make high crime areas safer. To begin with, law enforcement officers must know the problem neighborhoods, problem bars and problem drinkers. They must have the ability to interact positively with neighborhood business and other community stakeholders so joint problem-solving can occur.

Looking beyond law enforcement, the physical and social environment could be manipulated in specific ways to reduce crime and disorder around trouble alcohol outlets or high concentrations of outlets. The reduction of physical disorder in neighborhoods should become part of a neighborhood's ammunition against violence. Although this study cannot produce findings indicating *causal* relationships, it is evident that physical disorder serves either as cues for violence,

or engenders some sort of criminal propensity in neighborhoods residents or residents who patronize bars. Indeed, a recent study found that certain bars have cultures that appear to tolerate drinking to intoxication (Graham et al., 2006). These bars were more likely to have violent incidents than bars where patrons did not drink to intoxication.

Importantly, community alcohol prevention efforts have had impacts on violence. Results of an evaluation of a five-year community alcohol prevention trial in California and South Carolina found that assault cases declined, rates of nighttime motor vehicle crashes decreased significantly, as well as rates of DUI crashes in experimental versus comparison communities. The prevention efforts were designed as a coordinated, comprehensive community-based intervention that attempted to (a) mobilize communities, (b) assist alcohol beverage servers and retailers with reducing intoxication and driving after drinking, (c) reduce underage access to alcohol by training retailers who sell alcohol for consumption away from the outlet, and increased enforcement of underage sales laws, (d) increase the actual and perceived risk being arrested for driving after drinking; and (e) assist communities in developing local restrictions on access through local zoning laws and other municipal controls on outlet density (Holder et al., 2000).

Crime prevention efforts would also benefit from having transportation policy analysts working in tandem with law enforcement or crime analysts when neighborhood changes were set to occur. For instance, in the District, transportation officials have discussed limiting the number of bus stops to increase the efficiency of bus service—these decisions should be made in concert with area planners that are familiar with the landscape of crime and disorder. Essentially, effective problem solvers are those that are able to forge partnerships across disciplines or policy areas, and include community residents who often are the most familiar about the habits of residents and the local geography of problems.

In addition, the findings from this study suggest the need for utilization or *better* utilization of place managers for places that have managers. Place managers during vulnerable times and in vulnerable places could be critical to public safety. Strong place managers could reduce the opportunity for offending through direct supervision of crowds in popular businesses. As this study found that certain areas (areas with metro stations for instance) were not magnets for crime, but instead, these areas had lower levels of disorder and assault. Although added security or additional

staff may appear at first too costly for business owners, the current study suggests that added staff would only be needed for a small number of hours a few days a week.

Understanding how time intersects with other variables has implications for policing and community problem solving. Furthermore, the differences in findings across the dependent variables suggest that opportunities for criminal behavior around outlets is very specific to settings. Indeed, understanding more about the nature of bars and the nature of people who patronize certain establishments would go far in providing important information for public safety interventions.

Future Research Considerations

More specifically, alcohol outlet characteristics must also be examined more closely to determine additional methods to diminish opportunities for offending. This study does not incorporate any measures that assess the crime attracting characteristics of outlets such as size of the outlet or bar area, amount of alcohol sold, type of clientele, crowding, or staff/patron ratio. Additional research to assess the influence of these characteristics could greatly increase our understanding of the micro-level factors that impact crime and disorder. Reducing crowding, or implementing lower staff/patron ratios, for instance, in concert with orderly closing time measures, could be simple and cost effective measures to improve the orderliness of taverns and restaurant bars, resulting in fewer opportunities for crime.

In addition, it is important to remember that ecological studies of alcohol outlet densities such as this one are not designed to provide insight into the social processes related to alcohol use. To date, sociological research conducted at the neighborhood level generally has contributed little to our understanding of person-environment interactions with regard to alcohol research. These interactions are difficult to study using extant data or field research methods. For instance, the current study cannot assess whether certain types of alcohol outlets might create drinkers out of non-drinkers or create problem drinkers out of non-problem drinkers, or whether one additional outlet increases the likelihood of people patronizes these places, and in turn, drinking to the point of producing a potential offender. Or whether certain bars segregate or concentrate drinkers in a way that increases problem behaviors. Can high levels of neighborhood cohesion buffer against problem bars? These types of questions can best be answered with studies that utilize controlled settings or with large-scale studies of individuals that model the interaction of people with certain fixed and variable environmental risks and protective elements. Small-scale field studies—and some do

exist—can contribute somewhat to generating hypotheses about person-place interactions, but generally are not of the size to ensure that findings are not specific to the social context under study. Research sponsored by the National Institute on Alcohol Abuse and Alcoholism (NIAAA) has recently begun to explore these questions and to conduct agent-based modeling and simulations to examine these dynamics (see for instance, Gorman, Mezic, Mezic and Gruenewald, 2006). Gorman and Gruenewald and colleagues continue to conceptualize and test a variety of hypotheses to provide insight into the behavioral ecology of drinking patterns using both simulated studies and field research based on the ongoing collection of person-, outlet-, and neighborhood-level data. As sociologists and community practitioners continue efforts to uncover methods to inform the development of neighborhood social control, multi-level research examining the micro-level conditions of neighborhoods that support and deter violence will be essential.

We also expect that future studies of neighborhood violence and disorder will begin to rely on an expanded repertoire of measures of physical attributes of the environment. Given the accessibility of address-based measures, it is our hope that a variety of physical attributes, such as street lighting, highly-trafficked intersections, and the walkability of neighborhoods, become standard within ecological studies of alcohol outlets and other neighborhood-level studies utilizing a routine activities or general opportunity framework. Furthermore, a fuller range of ecological measures will enable a more nuanced understanding of how crime opportunity is created by different land use characteristics *in conjunction with* neighborhood factors such as disadvantage, poverty, or racial heterogeneity. This could be done by examining interaction effects, or models that permit the easy mapping of the most at-risk neighborhoods and the specific risk or protective characteristics of those neighborhoods.

This study's findings also reiterate that generalizability in this area of research is very difficult. There may be neighborhood mechanisms so specific to the geographic area of study, resulting in very different contexts—contexts that differentially influence findings—across studies. This point has been echoed by other researchers (see Lipton and Gruenewald, 2002). For instance, definitions of the classes or categories of alcohol outlets will differ across jurisdictions, making it unprofitable for jurisdictions to act on conclusions related to particular types of alcohol-selling establishments drawn from research conducted in other settings. Similarly, research has shown that racial and cultural dynamics, such as racial heterogeneity and concentrated immigration, give rise to

different sets of issues in different communities that can, in turn, influence bar culture, drinking patterns, and crime opportunity (Nielson, Martinez and Lee, 2005).

Conclusion

The research set out to examine whether neighborhoods with high densities of alcohol selling establishments are more likely to exhibit high levels of aggravated assault, domestic violence and social disorder, and if so, in what types of neighborhoods these relationships are more likely to be found. The research conducted over the last few decades has suggested that drinking establishments, particularly bars, attract clientele more likely to include motivated or potential offenders. Bars and other alcohol outlets provide a substance that, when consumed in large amounts, is associated with aggression (Graham et al., 2006). In essence, regardless of the behavioral mechanism that "produces" violence, bars act as attractors of violence. Research examining cross-sectional relationships between high densities of bars/taverns and nightclubs has found support for the bars-as–crime attractors argument. In addition, alcohol outlet research has found that, historically, off-premise outlets were often concentrated in disadvantaged areas, further offering opportunities for violence and disorder. In general, this study found strong evidence that high densities of both on-premise and off-premise outlets are associated with higher levels of violence and disorder. But that statement has be put in context—the relationships found are specific to the type of crime examined. High densities of on-premise outlets are associated with an increase in aggravated assault incidents, but at the same time, are also associated with a *decrease* in calls for service for domestic violence. Off-premise outlets do not significantly impact aggravated assault in any of the models examined, but off-premise outlets are significantly associated with an increase in calls for service for domestic violence. With regard to social disorder—and specifically calls for service for disorderly conduct—high densities of both on-premise and off-premise were associated with high levels of disorder.

Furthermore, the relationships varied across different time periods of the day and week, suggesting that if policymakers and communities want to implement cost effective alcohol-reduction strategies to combat crime and disorder, patterns of crime around outlets by time of day should be closely examined before thousands of dollars are allocated to new or continued programming. Bans on single containers might be feel-good measures that make the community feel safer, but should not be relied on to decrease neighborhood problems. In this age of instant

crime data made available to the public, initial investments in research-based strategies, coupled with community input, would have ample payoff in the long-run.

The range of crime types examined in this study provides a foundation from which to continue to hypothesize about the dynamics between alcohol use, neighborhood socio-economic features, social organization, and the built environment. The majority of published studies examining the influence of alcohol outlets on crime has focused on how outlets influence assault, as opposed to domestic violence and nuisance crimes like social disorder. The literature's focus on violent assaults largely stems from hypotheses linking alcohol and aggression, as well as researcher interest in facilitating policy dialog about serious public safety problems. We reiterate this concern, but also hope that the current study provides evidence of the need to continue to explore the multi-dimensional effects of alcohol availability on neighborhoods—and specifically violence and disorder. Problems associated with crime attractors are amenable to research-based problem solving. Coordinated dialog across policy areas (health and public health, crime, transportation, education, etc.) that yields targeted community-based strategies to reduce alcohol availability and reduce crime will go far to help improve neighborhood quality of life.

Table 7. GCE Results for Aggravated Assault Incidents by Neighborhood Characteristics

	Model 1		Model 2		Model 3		Model 4	
Parameter	**b**	**SE**	**b**	**SE**	**b**	**SE**	**b**	**SE**
Constant	0.5692	0.0805***	0.5936	0.1034***	-3.4627	0.2507***	-1.9931	0.3180***
Alcohol Outlets								
ASE- On Premise	-0.0002	0.0002	0.0005	0.0003	0.0011	0.0003***	0.0007	0.0003*
ASE- Off Premise	0.0151	0.0008***	0.0142	0.0009***	0.0064	0.0009***	-0.0004	0.0010
Social Disorganization								
Concentrated Disadvantage	-	-	0.2466	0.0417***	0.0559	0.0404	0.1920	0.0430***
Residential Stability	-	-	0.1021	0.0330***	-0.0022	0.0377	-0.2121	0.0413***
Racial Heterogeneity	-	-	0.6112	0.1256***	-0.4672	0.1352***	-0.5935	0.1456***
Motivated Offenders								
18-29 year olds	-	-	-	-	-1.3285	0.2737***	-1.5072	0.2582***
Adult Arrests	-	-	-	-	0.0002	0.0001***	0.0001	0.0001
Population (log)	-	-	-	-	0.5531	0.0321***	0.3920	0.0375***
Physical Environment								
Prosocial Places	-	-	-	-	-	-	0.0019	0.0006***
Percent Vacant	-	-	-	-	-	-	-0.5454	0.2145**
Physical Disorder	-	-	-	-	-	-	0.0002	0.0000***
Presence of Metro Station	-	-	-	-	-	-	-0.3035	0.0738***
Density of Streetlights	-	-	-	-	-	-	0.0001	0.0000**
Percent Comm. or Retail Property	-	-	-	-	-	-	2.6001	0.3417***
Density of Homeless Services	-	-	-	-	-	-	0.0001	0.0014
Density of Bus Stops	-	-	-	-	-	-	-0.0003	0.0004
Controls								
Aggravated Assaults (log 2000-2001)	1.0952	0.0599***	0.9728	0.0635***	0.6667	0.0533***	0.5147	0.0511***
Pseudo R^2		0.58		0.55		0.68		0.73
Rho								0.31***
Overdispersion parameter								-0.12*

*p < .05; **p<.01; ***p <.001 (two-tailed tests).

b, estimate; SE, standard error

Table 8. GCE Results for Disorderly Conduct by Neighborhood Characteristics

	Model 1		Model 2		Model 3		Model 4	
Parameter	**b**	**SE**	**b**	**SE**	**b**	**SE**	**b**	**SE**
Constant	2.7406	0.0418***	2.8189	0.0470***	-0.6825	0.0416***	0.8865	0.0544***
Alcohol Outlets								
ASE- On Premise	0.0013	0.0000***	0.0009	0.0000***	0.0009	0.0000***	0.0003	0.0000***
ASE- Off Premise	0.0159	0.0001***	0.0143	0.0001***	0.0080	0.0001***	0.0017	0.0001***
Social Disorganization								
Concentrated Disadvantage	-	-	-00685	0.0073***	-0.1459	0.0067***	0.0483	0.0071***
Residential Stability	-	-	0.0633	0.0047***	0.0510	0.0054	-0.1981	0.0063***
Racial Heterogeneity	-	-	0.4919	0.0195***	-0.4646	0.0193***	-0.6189	0.0215***
Motivated Offenders								
18-29 year olds	-	-	-	-	-0.2290	0.0347***	-0.6711	0.0346***
Adult Arrests	-	-	-	-	0.0003	0.0000***	0.0001	0.0000***
Population (log)	-	-	-	-	0.3919	0.0049***	0.2555	0.0052***
Physical Environment								
Prosocial Places	-	-	-	-	-	-	0.0021	0.0001***
Percent Vacant	-	-	-	-	-	-	-0.7298	0.0359***
Physical Disorder	-	-	-	-	-	-	0.0001	0.0000***
Presence of Metro Station	-	-	-	-	-	-	-0.1693	0.0106***
Density of Streetlights	-	-	-	-	-	-	0.0004	0.0000***
Percent Commercial or Retail Property	-	-	-	-	-	-	1.8083	0.0444***
Density of Homeless Services	-	-	-	-	-	-	0.0023	0.0002***
Density of Bus Stops	-	-	-	-	-	-	0.0007	0.0001***
Controls								
Aggravated Assaults (log 2000-2001)	0.3993	0.0061***	0.5391	0.0088***	0.3096	0.0065***	0.1400	0.0062***
Pseudo R^2		0.39		0.48		0.56		0.66
Rho								0.29***
Overdispersion parameter								0.28***

*p < .05; **p<.01; ***p <.001 (two-tailed tests).

b, estimate; SE, standard error

Table 9. GCE Results for UI-Defined Disorder by Neighborhood Characteristics

	Model 1		Model 2		Model 3		Model 4	
Parameter	**b**	**SE**	**b**	**SE**	**b**	**SE**	**b**	**SE**
Constant	2.4678	0.0710***	2.1194	0.0736***	-0.9872	0.0656***	0.2578	0.0896***
Alcohol Outlets								
ASE- On Premise	0.0003	0.0001***	0.0007	0.0001***	0.0008	0.0001***	0.0001	0.0001
ASE- Off Premise	0.0128	0.0002***	0.0102	0.0003***	0.0047	0.0003***	-0.0002	0.0003
Social Disorganization								
Concentrated Disadvantage	-	-	0.1241	0.0117***	-0.0044	0.0112	0.1228	0.0120***
Residential Stability	-	-	0.1495	0.0077***	0.0928	0.0092***	-0.0920	0.0109***
Racial Heterogeneity	-	-	0.6292	0.0330***	-0.2162	0.0328***	-0.4717	0.0365***
Motivated Offenders								
18-29 year olds	-	-	-	-	-0.3910	0.0611***	-0.7175	0.0610***
Adult Arrests	-	-	-	-	0.0001	0.0000***	0.0000	0.0000
Population (log)	-	-	-	-	0.3718	0.0086***	0.2735	0.0096***
Physical Environment								
Prosocial Places	-	-	-	-	-	-	0.0019	0.0002***
Percent Vacant	-	-	-	-	-	-	-0.5456	0.0585***
Physical Disorder	-	-	-	-	-	-	0.0001	0.0000***
Presence of Metro Station	-	-	-	-	-	-	-0.1594	0.0191***
Density of Streetlights	-	-	-	-	-	-	0.0003	0.0000***
Percent Commercial or Retail Property	-	-	-	-	-	-	1.5893	0.0914***
Density of Homeless Services	-	-	-	-	-	-	0.0040	0.0004***
Density of Bus Stops	-	-	-	-	-	-	0.0008	0.0001***
Controls								
Aggravated Assaults (log 2000-2001)	0.5325	0.0135***	0.5089	0.0161***	0.3342	0.0116***	0.1948	0.0112***
Pseudo R^2		0.49		0.50		0.56		0.60
Rho								0.39***
Overdispersion parameter								0.11***

*p < .05; **p<.01; ***p < .001 (two-tailed tests).

b, estimate; SE, standard error

Table 10. GCE Results for Domestic Violence by Neighborhood Characteristics

	Model 1		Model 2		Model 3		Model 4	
Parameter	**b**	**SE**	**b**	**SE**	**b**	**SE**	**b**	**SE**
Constant	1.7683	0.0765***	2.2146	0.1098***	-2.7440	0.1206***	-1.2104	0.1574***
Alcohol Outlets								
ASE- On Premise	-0.0046	0.0002***	-0.0031	0.0003***	-0.0017	0.0002***	-0.0014	0.0002***
ASE- Off Premise	0.0121	0.0004***	0.0145	0.0005***	0.0060	0.0005***	0.0013	0.0005**
Social Disorganization								
Concentrated Disadvantage	-	-	0.1681	0.0205***	-0.0058	0.0198	0.1024	0.0197***
Residential Stability	-	-	0.0338	0.0160*	-0.0495	0.0172***	-0.2162	0.0183***
Racial Heterogeneity	-	-	-0.3565	0.0692***	-1.2858	0.0681***	-1.1485	0.0687***
Motivated Offenders								
18-29 year olds	-	-	-	-	-1.2363	0.1304***	-1.2934	0.1189***
Adult Arrests	-	-	-	-	0.0003	0.0000***	0.0002	0.0000***
Population (log)	-	-	-	-	0.6283	0.01777***	0.4240	0.0193***
Physical Environment								
Prosocial Places	-	-	-	-	-	-	0.0009	0.0003***
Percent Vacant	-	-	-	-	-	-	-0.1518	0.0909
Physical Disorder	-	-	-	-	-	-	0.0001	0.0000***
Presence of Metro Station	-	-	-	-	-	-	-0.2578	0.0334***
Density of Streetlights	-	-	-	-	-	-	0.0003	0.0000***
Percent Commercial or Retail Property	-	-	-	-	-	-	1.0954	0.2186***
Density of Bus Stops	-	-	-	-	-	-	-0.0002	0.0002
Controls								
Aggravated Assaults (log 2000-2001)	0.7339	0.0244***	0.6280	0.0268***	0.2700	0.0195***	0.1639	0.0189***
Pseudo R^2		0.39		0.38		0.58		0.57
Rho								0.31***
Overdispersion parameter								0.30***

*p < .05; **p<.01; ***p < .001 (two-tailed tests).

b, estimate; SE, standard error

Table 11. GCE Results for Aggravated Assault Incidents by Neighborhood Characteristics, Time Period Models

	Weekend		Weekend Night		Weeknight	
Parameter	**b**	**SE**	**b**	**SE**	**b**	**SE**
Constant	-3.3731	0.6856***	-3.2544	0.8397***	-5.7619	0.9159***
Alcohol Outlets						
ASE- On Premise	0.0017	0.0007**	0.0030	0.0008***	-0.0014	0.0010
ASE- Off Premise	0.0023	0.0023	0.0042	0.0031	-0.0029	0.0026
Social Disorganization						
Concentrated Disadvantage	0.1505	0.1009	0.1310	0.1335	0.2205	0.1079*
Residential Stability	-0.2877	0.0968***	-0.2748	0.1269*	0.0214	0.1014
Racial Heterogeneity	-0.4864	0.3508	-0.0229	0.4513	-0.5437	0.3559
Motivated Offenders						
18-29 year olds	-0.9408	0.5370	-0.6570	0.6628	-1.4615	0.6431*
Adult Arrests	0.0001	0.0002	0.0002	0.0002	0.0005	0.0002***
Population (log)	0.3090	0.0753***	0.1882	0.0904*	0.62000	0.1032***
Physical Environment						
Prosocial Places	0.0002	0.0016	0.0002	0.0021	0.0030	0.0016
Percent Vacant	-0.3817	0.5148	-0.5405	0.6867	-0.9696	0.5549
Physical Disorder	0.0003	0.0001***	0.0003	0.0001***	0.0002	0.0001***
Presence of Metro Station	-0.4655	0.1731**	-0.7866	0.2368***	-0.2132	0.1850
Density of Streetlights	0.0001	0.0001	0.0000	0.0001	-0.0000	0.0001
Percent Commercial or Retail Property	3.2723	0.7320***	3.2670	0.9157***	3.3221	0.9840***
Density of Homeless Services	-0.0000	0.0034	-0.0022	0.0046	-0.0013	0.0036
Density of Bus Stops	-0.0001	0.0009	-0.0016	0.0013	0.0003	0.0010
Controls						
Aggravated Assaults (log 2000-2001)	0.9981	0.1211***	1.1788	0.1538***	0.8006	0.1108***
Pseudo R^2	0.65		0.58		0.59	
Rho	0.22***		0.27***		0.30***	
Overdispersion Parameter	-0.50***		-0.71***		-0.46***	

*p < .05; **p<.01; ***p < .001 (two-tailed tests).

b, estimate; SE, standard error

Table 12. GCE Results for Disorderly Conduct by Neighborhood Characteristics, Time Period Models

	Weekend		Weekend Night		Weeknight	
Parameter	**b**	**SE**	**b**	**SE**	**b**	**SE**
Constant	0.0733	0.0729	-0.5034	0.0874***	0.3038	0.0726***
Alcohol Outlets						
ASE- On Premise	0.0004	0.0001***	0.0007	0.0001***	0.0000	0.0001
ASE- Off Premise	0.0018	0.0002***	0.0011	0.0002***	0.0015	0.0002***
Social Disorganization						
Concentrated Disadvantage	0.0195	0.0097*	0.0106	0.0119	0.0787	0.0101***
Residential Stability	-0.1991	0.0085***	-0.2167	0.0106***	-0.1754	0.0090***
Racial Heterogeneity	-0.6405	0.0287***	-0.6943	0.0352***	-0.5449	0.0307***
Motivated Offenders						
18-29 year olds	-0.4348	0.0436***	-0.3864	0.0514***	-0.9734	0.0547****
Adult Arrests	0.0002	0.0000***	0.0001	0.0000***	0.0000	0.0000***
Population (log)	0.3213	0.0076***	0.3550	0.0096***	0.2447	0.0077***
Physical Environment						
Prosocial Places	0.0021	0.0001***	0.0021	0.0002***	0.0024	0.0001***
Percent Vacant	-0.6541	0.0492***	-0.6702	0.0612***	-0.6458	0.0505***
Physical Disorder	0.0001	0.0000***	0.0001	0.0000***	0.0001	0.0000***
Presence of Metro Station	-0.2164	0.0145***	-0.2298	0.0180***	-0.1688	0.0153***
Density of Streetlights	0.0004	0.0000***	0.0003	0.0000***	0.0004	0.0000***
Percent Commercial or Retail Property	1.4537	0.0623***	1.3796	0.0755***	1.7334	0.0668***
Density of Homeless Services	0.0014	0.0003***	-0.0001	0.0003	0.0023	0.0003***
Density of Bus Stops	0.0005	0.0001***	0.0005	0.0001***	0.0008	0.0001***
Controls						
Aggravated Assaults (log 2000-2001)	0.0942	0.0079***	0.0485	0.0093***	0.1326	0.0088***
Pseudo R^2	0.60		0.48		0.58	
Rho	0.26***		0.26***		0.31***	
Overdispersion parameter	0.33***		0.39***		0.34***	

*p < .05; **p<.01; ***p < .001 (two-tailed tests).

b, estimate; SE, standard error

Table 13. GCE Results for UI-Defined Disorder by Neighborhood Characteristics, Time Period Models

	Weekend		Weekend Night		Weeknight	
Parameter	**b**	**SE**	**b**	**SE**	**b**	**SE**
Constant	-0.2048	0.1240	-0.4577	0.1549***	-0.3772	0.1338***
Alcohol Outlets						
ASE- On Premise	0.0004	0.0001***	0.0008	0.0002***	0.0000	0.0001
ASE- Off Premise	0.0002	0.0004	0.0001	0.0006	0.0004	0.0004
Social Disorganization						
Concentrated Disadvantage	0.0938	0.0173***	0.0949	0.0228***	0.1168	0.0187***
Residential Stability	-0.1314	0.0158***	-0.1494	0.0213***	-0.0400	0.0168*
Racial Heterogeneity	-0.7012	0.0535***	-0.7829	0.0729***	-0.4245	0.0566***
Motivated Offenders						
18-29 year olds	-0.7369	0.0893***	-0.8805	0.1223***	-0.4197	0.0942***
Adult Arrests	0.0001	0.0000**	0.0000	0.0000	0.0000	0.0000
Population (log)	0.2762	0.0140***	0.2482	0.0179***	0.2659	0.0154***
Physical Environment						
Prosocial Places	0.0023	0.0003***	0.0019	0.0004***	0.0025	0.0003***
Percent Vacant	-0.5506	0.0839***	-0.5099	0.1086***	-0.5234	0.0912***
Physical Disorder	0.0001	0.0000***	0.0001	0.0000***	0.0001	0.0000***
Presence of Metro Station	-0.1590	0.0273***	-0.2050	0.0370***	-0.1603	0.0296***
Density of Streetlights	0.0003	0.0000***	0.0003	0.0000***	0.0003	0.0000***
Percent Commercial or Retail Property	1.4304	0.1336***	1.5733	0.1730***	1.1573	0.1515***
Density of Homeless Services	0.0032	0.0005***	0.0030	0.0007***	0.0034	0.0006***
Density of Bus Stops	0.0006	0.0002***	0.0005	0.0002**	0.0008	0.0002***
Controls						
Aggravated Assaults (log 2000-2001)	0.1818	0.0159***	0.2095	0.0215***	0.2075	0.0173***
Pseudo R^2	0.56		0.516		0.566	
Rho	0.38***		0.41***		0.39***	
Overdispersion parameter	0.18***		0.20***		0.16***	

*p < .05; **p<.01; ***p < .001 (two-tailed tests).

b, estimate; SE, standard error

Table 14. GCE Results for Domestic Violence by Neighborhood Characteristics, Time Period Models

	Weekend		Weekend Night		Weeknight	
Parameter	**b**	**SE**	**b**	**SE**	**b**	**SE**
Constant	-1.8067	0.3294***	-1.9581	0.4264***	-3.0892	0.3945***
Alcohol Outlets						
ASE- On Premise	-0.0013	0.0005**	-0.0011	0.0006	-0.0024	0.0006***
ASE- Off Premise	0.0023	0.0010*	0.0031	0.0014*	0.0006	0.0013
Social Disorganization						
Concentrated Disadvantage	0.1019	0.0422*	0.0685	0.0582	0.0577	0.0510
Residential Stability	-0.2928	0.0399***	-0.3644	0.0546***	-0.1114	0.0454**
Racial Heterogeneity	-1.1466	0.1506***	-0.9437	0.1969***	-1.0743	0.1693***
Motivated Offenders						
18-29 year olds	-1.6850	0.2736***	-1.9988	0.3738***	-1.4733	0.3078***
Adult Arrests	0.0001	0.0001*	0.0001	0.0001	0.0003	0.0001***
Population (log)	0.3890	0.0403***	0.3210	0.0515***	0.4764	0.0493***
Physical Environment						
Prosocial Places	0.0013	0.0006*	0.0005	0.0009	0.0001	0.0008
Percent Vacant	-0.1665	0.1938	-0.1007	0.2579	0.0122	0.2197
Physical Disorder	0.0001	0.0000***	0.0002	0.0000***	0.0001	0.0000***
Presence of Metro Station	-0.2886	0.0716***	-0.3624	0.0975***	-0.1194	0.0842
Density of Streetlights	0.0003	0.0001***	0.0003	0.0001***	0.0002	0.0001***
Percent Commercial or Retail Property	0.7014	0.4765	0.9024	0.5834	1.6625	0.5412***
Density of Bus Stops	0.0002	0.0004	0.0002	0.0006	-0.0012	0.0005*
Controls						
Aggravated Assaults (log 2000-2001)	0.2362	0.0405***	0.3055	0.0542***	0.2869	0.0444***
Pseudo R^2	0.52		0.54		0.57	
Rho	0.29***		0.34***		0.45***	
Overdispersion parameter	0.23***		0.26***		0.067	

*p < .05; **p<.01; ***p < .001 (two-tailed tests).

b, estimate; SE, standard error

Table 15. GCE Results for Dependent Variables by Neighborhood Characteristics and Type of Alcohol Outlet

	Aggravated Assault		MPD Defined Disorder		UI Defined Disorder		Domestic Violence	
Parameter	**b**	**SE**	**b**	**SE**	**b**	**SE**	**b**	**SE**
Constant	-2.0946	0.3150***	0.7190	0.0529***	0.2197	0.0891*	-1.1698	0.1573***
Alcohol Outlets								
Density of Restaurants	-0.0006	0.0006	-0.0002	0.0001***	-0.0000	0.0002	-0.0013	0.0004***
Density of Taverns	0.0087	0.0028***	0.0043	0.0004***	0.0018	0.0008*	-0.0002	0.0017
Density of Nightclubs	-0.0029	0.0042	-0.0127	0.0006***	-0.0059	0.0012***	-0.0112	0.0027***
Density of Off-Premise Stores	-0.0002	0.0010	0.0015	0.0001***	-0.0003	0.0003	0.0011	0.0005*
Social Disorganization								
Concentrated Disadvantage	0.1738	0.0434***	0.0337	0.0070***	0.1192	0.0120***	0.1046	0.0197***
Residential Stability	-0.2156	0.0413***	-0.1955	0.0063***	-0.0911	0.0108***	-0.2109	0.0184***
Racial Heterogeneity	-0.5845	0.1469***	-0.5482	0.0213***	-0.4441	0.0368***	-1.1122	0.0695***
Motivated Offenders								
18-29 year olds	-1.5472	0.2602***	-0.6902	0.0345***	-0.7216	0.0609***	-1.2830	0.1201***
Adult Arrests	0.0001	0.0001	0.0001	0.0000****	0.0000	0.0000	0.0002	0.0000***
Population (log)	0.4008	0.0378***	0.2508	0.0051***	0.2701	0.0096***	0.4154	0.0194***
Physical Environment								
Prosocial Places	0.0018	0.0006*	0.0020	0.0001***	0.0019	0.0002***	0.0009	0.0003***
Percent Vacant	-0.5314	0.2128*	-0.6955	0.0350***	-0.5389	0.0579***	-0.1325	0.0907
Physical Disorder	0.0002	0.0000***	0.0001	0.0000***	0.0001	0.0000***	0.0001	0.0000***
Presence of Metro Station	-0.2921	0.0737***	-0.1561	0.0104***	-0.1546	0.0189***	-0.2555	0.0334***
Density of Streetlights	0.0001	0.0000*	0.0004	0.0000***	0.0003	0.0000***	0.0003	0.0000***
Percent Commercial or Retail Property	2.6170	0.3533***	2.1534	0.0467***	1.7443	0.0950***	1.1938	0.2237***
Density of Bus Stops	-0.0003	0.0004	0.0008	0.0001***	0.0008	0.0001***	-0.0001	0.0002
Density of Homeless Services	0.0000	0.0014	0.0013	0.0002***	0.0036	0.0004***	------	-----
Controls								
Aggravated Assaults (log 2000-2001)	0.5190	0.0510***	0.1559	0.0062***	0.1989	0.0112***	0.1715	0.0191***
Pseudo R^2		0.73		0.68		0.60		0.57
Rho		0.32***		0.31***		0.40***		0.30***
Overdispersion parameter		-0.12*		0.30***		0.12***		0.25***

*p < .05; **p<.01; ***p <.001 (two-tailed tests); b, estimate; SE, standard error

Table 16. GCE Results for Dependent Variables by Neighborhood Characteristics, Models Incorporating Single Sales Outlets

	Aggravated Assault		MPD Defined Disorder		UI Defined Disorder		Domestic Violence	
Parameter	**b**	**SE**	**b**	**SE**	**b**	**SE**	**b**	**SE**
Constant	-2.0847	0.3155***	0.7176	0.0529***	0.2200	0.0891*	-1.1585	0.1572***
Alcohol Outlets								
Density of Restaurants	-0.0007	0.0006	-0.0002	0.0001***	-0.0000	0.0002	-0.0014	0.0004***
Density of Taverns	0.0088	0.0028***	0.0043	0.0004***	0.0018	0.0008*	-0.0003	0.0017
Density of Nightclubs	-0.0025	0.0042	-0.0127	0.0006***	-0.0059	0.0012***	-0.0110	0.0027***
No Single Sales- Stores	0.0041	0.0017*	0.0012	0.0002***	-0.0002	0.0005	0.0035	0.0011***
Single Sales- Stores	-0.0015	0.0011	0.0016	0.0002***	-0.0003	0.0003	0.0008	0.0005
Social Disorganization								
Concentrated Dis.	0.1739	0.0435***	0.0339	0.0070***	0.1191	0.0120***	0.1034	0.0197***
Residential Stability	-0.2034	0.0417***	-0.1964	0.0063***	-0.0909	0.0108***	-0.2097	0.0184***
Racial Heterogeneity	-0.5916	0.1471***	-0.5470	0.0213***	-0.4444	0.0369***	-1.1156	0.0694***
Motivated Offenders								
18-29 year olds	-1.5058	0.2614***	-0.6951	0.0346***	-0.7208	0.0611***	-1.2768	0.1202***
Adult Arrests	0.0001	0.0001*	0.0001	0.0000***	0.0000	0.0000	0.0002	0.0000***
Population (log)	0.3953	0.0379***	0.2515	0.0051***	0.2700	0.0096***	0.4119	0.0194***
Physical Environment								
Prosocial Places	0.0015	0.0006*	0.0020	0.0001***	0.0019	0.0002***	0.0008	0.0003**
Percent Vacant	-0.5254	0.2133**	-0.6957	0.0350***	-0.5389	0.0579***	-0.1342	0.0907
Physical Disorder	0.0002	0.0000***	0.0001	0.0000***	0.0001	0.0000***	0.0001	0.0000***
Presence of Metro Station	-0.2939	0.0741***	-0.1562	0.0104***	-0.1547	0.0189***	-0.2564	0.0334***
Density of Streetlights	0.0001	0.0000*	0.0004	0.0000***	0.0003	0.0000***	0.0003	0.0000***
Percent Commercial/Retail	2.6636	0.3545***	2.1522	0.0467***	1.7445	0.0950***	1.2282	0.2236***
Density of Bus Stops	-0.0004	0.0004	0.0008	0.0001***	0.0008	0.0001***	-0.0002	0.0002
Density of Homeless Services	0.0006	0.0015	0.0012	0.0002***	0.0036	0.0004***	-----	------
Controls								
Aggravated Assaults (log 2000-2001)	0.5305	0.0516***	0.1553	0.0066***	0.1990	0.0112***	0.1742	0.0191***
Pseudo R^2		0.74		0.68		0.60		0.57
Rho		0.32***		0.31***		0.40***		0.30***
Overdispersion parameter		-0.13**		0.12***		0.12***		0.24***

*p < .05; **p<.01; ***p < 001 (two-tailed tests).

b, estimate; SE, standard error

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Appendix A

This appendix includes the negative binomial regression results for each of the four main models examining the influence of alcohol outlets on the four dependent variables (aggravated assault, disorderly conduct, UI-defined social disorder, and domestic violence). Similar to Tables 7 through 10 in the text, the tables show the nested models, but start with a constant (Model 1) and proceed to add blocks of variables. Essentially, Model 1 in each of the tables below is a null model examined in order to compute the log likelihood. As in demonstrated by comparing Tables A1 through A4 below with Tables 7 through 10, there are many important differences in the significance levels and direction of the effect for the key alcohol outlet predictor variables. In some cases, for instance, the variables are not significant in these models below, but exhibit significant relationships with their dependent variables when using the GCE approach.

Table A1. Negative Binomial Regression Models of Aggravated Assault by Neighborhood Characteristics

	Model 1		Model 2		Model 3		Model 4		Model 5	
Parameter	**b**	**SE**	**b**	**SE**	**b**	**SE**	**b**	**SE**	**b**	**SE**
Constant	4.4876	0.0608***	1.9784	0.1121***	2.0271	0.1681***	-1.8492	0.3987***	-1.6375	0.4379***
Alcohol Outlets										
ASE- On Premise	-	-	0.0009	0.0006	0.0028	0.0007***	0.0037	0.0006***	0.0015	0.0005**
ASE- Off Premise	-	-	0.0118	0.0020***	0.0120	0.0020***	0.0072	0.0016***	-0.0009	0.0014
Social Disorganization										
Concentrated Disadvantage	-	-	-	-	0.6922	0.1028***	0.4334	0.0819***	0.3450	0.0629***
Residential Instability	-	-	-	-	0.2353	0.0659***	0.0665	0.0646	-0.1436	0.0569*
Racial Heterogeneity	-	-	-	-	1.2137	0.3036***	0.2716	0.2618	-0.1813	0.2216
Motivated Offenders										
18-29 year olds	-	-	-	-	-	-	-1.5672	0.3836***	-1.1567	0.3229***
Adult Arrests	-	-	-	-	-	-	-0.0000	0.0001	0.0001	0.0001
Population	-	-	-	-	-	-	0.4937	0.0418***	0.4193	0.0486***
Physical Environment										
Prosocial Places	-	-	-	-	-	-	-	-	0.0028	0.0009**
Percent Vacant	-	-	-	-	-	-	-	-	-0.3444	0.3298
Physical Disorder	-	-	-	-	-	-	-	-	0.0003	0.0000***
Presence of Metro Station	-	-	-	-	-	-	-	-	-0.1395	0.1047
Density of Streetlights	-	-	-	-	-	-	-	-	0.0002	0.0001**
Percent Commercial or Retail Property	-	-	-	-	-	-	-	-	3.1308	0.5121***
Density of Bus Stops	-	-	-	-	-	-	-	-	0.0004	0.0006
Density of Homeless Services	-	-	-	-	-	-	-	-	-0.0010	0.0022
Controls										
Lag of Aggravated Assault	-	-	0.0118	0.0020***	0.0081	0.0035*	0.0079	0.0027**	0.0114	0.0021***
Log of Aggravated Assaults (2000-2001)	-	-	0.0118	0.0032***	0.6352	0.0721***	0.5500	0.0613***	0.3884	0.0495***

*p < .05; **p<.01; ***p < .001 (two-tailed tests).

b, estimate; SE, standard error

Table A2**.** Negative Binomial Regression Models of MPD Defined Disorder by Neighborhood Characteristics

	Model 1		Model 2		Model 3		Model 4		Model 5	
Parameter	**b**	**SE**	**b**	**SE**	**b**	**SE**	**b**	**SE**	**b**	**SE**
Constant	7.7552	0.0508***	6.0704	0.0886***	5.9350	0.1423***	3.2485	0.2731***	2.5481	0.4168***
Alcohol Outlets										
ASE- On Premise	-	-	0.0019	0.0007**	0.0018	0.0008*	0.0039	0.0007***	0.0007	0.0006
ASE- Off Premise	-	-	0.0152	0.0019***	0.0149	0.0019***	0.0121	0.0018***	0.0028	0.0016
Social Disorganization										
Concentrated Disadvantage	-	-	-	-	0.2326	0.0992*	0.1747	0.0898	0.0306	0.0703
Residential Instability	-	-	-	-	-0.0228	0.0560	-0.0483	0.0642	-0.2060	0.0557***
Racial Heterogeneity	-	-	-	-	1.0116	0.2746***	0.2838	0.2615	-0.1522	0.2170
Motivated Offenders										
18-29 year olds	-	-	-	-	-	-	-0.9450	0.3968*	-0.0609	0.3393
Adult Arrests	-	-	-	-	-	-	0.0000	0.0001	0.0002	0.0001
Population	-	-	-	-	-	-	0.3288	0.0279***	0.2787	0.0426***
Physical Environment										
Prosocial Places	-	-	-	-	-	-	-	-	0.0037	0.0010***
Percent Vacant	-	-	-	-	-	-	-	-	-0.1677	0.3959
Physical Disorder	-	-	-	-	-	-	-	-	0.0002	0.0001***
Presence of Metro Station	-	-	-	-	-	-	-	-	-0.1322	0.1143
Density of Streetlights	-	-	-	-	-	-	-	-	0.0004	0.0001***
Percent Commercial or Retail Property	-	-	-	-	-	-	-	-	2.8438	0.5800***
Density of Bus Stops	-	-	-	-	-	-	-	-	0.0013	0.0007*
Density of Homeless Services	-	-	-	-	-	-	-	-	0.0012	0.0025
Controls										
Lag of Aggravated Assault	-	-	0.0043	0.0031	0.0061	0.0034	0.0043	0.0029	0.0102	0.0023***
Log of Aggravated Assaults (2000-2001)	-	-	0.5626	0.0580***	0.4604	0.06860.0019	0.4457	0.0651***	0.3195	0.0520***

*p < .05; **p<.01; ***p < .001 (two-tailed tests).

b, estimate; SE, standard error

Table A3. Negative Binomial Regression Models of UI Defined Disorder by Neighborhood Characteristics

	Model 1		Model 2		Model 3		Model 4		Model 5	
Parameter	**b**	**SE**	**b**	**SE**	**b**	**SE**	**b**	**SE**	**b**	**SE**
Constant	6.7271	0.0461***	5.0883	0.0806***	4.9874	0.1287***	1.9321	0.2603***	1.5332	0.3562***
Alcohol Outlets										
ASE- On Premise	-	-	0.0010	0.0006	0.0017	0.0007*	0.0039	0.0006***	0.0010	0.0005
ASE- Off Premise	-	-	0.0102	0.0017***	0.0100	0.0017***	0.0062	0.0015***	-0.0004	0.0013
Social Disorganization										
Concentrated Disadvantage	-	-	-	-	0.3952	0.0863***	0.3328	0.0729***	0.2517	0.0587***
Residential Instability	-	-	-	-	0.0843	0.0506	0.0442	0.0539	-0.0529	0.0464
Racial Heterogeneity	-	-	-	-	1.2202	0.2454***	0.5816	0.2190**	0.1837	0.1870
Motivated Offenders										
18-29 year olds	-	-	-	-	-	-	-1.2590	0.3253***	-0.5789	0.2746*
Adult Arrests	-	-	-	-	-	-	-0.0001	0.0001	0.0000	0.0001
Population	-	-	-	-	-	-	0.3722	0.0262***	0.3248	0.0376***
Physical Environment										
Prosocial Places	-	-	-	-	-	-	-	-	0.0029	0.0008***
Percent Vacant	-	-	-	-	-	-	-	-	-0.0123	0.3224
Physical Disorder	-	-	-	-	-	-	-	-	0.0001	0.0000***
Presence of Metro Station	-	-	-	-	-	-	-	-	-0.0241	0.0978
Density of Streetlights	-	-	-	-	-	-	-	-	0.0004	0.0001***
Percent Commercial or Retail Property	-	-	-	-	-	-	-	-	2.2407	0.4842***
Density of Bus Stops	-	-	-	-	-	-	-	-	0.0014	0.0006**
Density of Homeless Services	-	-	-	-	-	-	-	-	0.0039	0.0021
Controls										
Lag of Aggravated Assault	-	-	0.0110	0.0028***	0.0114	0.0030***	0.0101	0.0024***	0.0138	0.0020***
Log of Aggravated Assaults (2000-2001)	-	-	0.5221	0.0511***	0.3740	0.0594***	0.3718	0.0529***	0.2453	0.0441***

*p < .05; **p<.01; ***p < .001 (two-tailed tests).

b, estimate; SE, standard error

Table A4. Negative Binomial Models of Domestic Violence by Neighborhood Characteristics

	Model 1		Model 2		Model 3		Model 4		Model 5	
Parameter	**b**	**SE**	**b**	**SE**	**b**	**SE**	**b**	**SE**	**b**	**SE**
Constant	5.6534	0.0556***	3.5185	0.0982***	3.8632	0.1528***	-0.0113	0.3303	0.2820	0.4110
Alcohol Outlets										
ASE- On Premise	-	-	-0.0032	0.0007***	-0.013	0.0008	0.0003	0.0007	-0.0014	0.0007
ASE- Off Premise	-	-	0.0098	0.0019***	0.0111	0.0019***	0.0066	0.0016***	0.0010	0.0015
Social Disorganization										
Concentrated Disadvantage	-	-	-	-	0.6238	0.1052***	0.4487	0.0847***	0.3855	0.0723
Residential Instability	-	-	-	-	0.1269	0.0595*	0.0631	0.0602	-0.1211	0.0558
Racial Heterogeneity	-	-	-	-	0.3865	0.2935	-0.3557	0.2531	-0.5036	0.2241
Motivated Offenders										
18-29 year olds	-	-	-	-	-	-	-0.9369	0.3690*	-0.7963	0.3194
Adult Arrests	-	-	-	-	-	-	-0.0000	0.0001	0.0001	0.0001
Population	-	-	-	-	-	-	0.4552	0.0314***	0.3449	0.0431
Physical Environment										
Prosocial Places	-	-	-	-	-	-	-	-	0.0010	0.0009
Percent Vacant	-	-	-	-	-	-	-	-	0.2008	0.3701
Physical Disorder	-	-	-	-	-	-	-	-	0.0002	0.0000
Presence of Metro Station	-	-	-	-	-	-	-	-	-0.0861	0.1156
Density of Streetlights	-	-	-	-	-	-	-	-	0.0004	0.0001
Percent Commercial or Retail Property	-	-	-	-	-	-	-	-	1.4224	0.5668
Density of Bus Stops	-	-	-	-	-	-	-	-	0.0004	0.0006
Controls										
Lag of Aggravated Assault	-	-	0.0188	0.0033***	0.0129	0.0035***	0.0158	0.0028***	0.0174	0.0024
Log of Aggravated Assaults (2000-2001)	-	-	0.6600	0.0604***	0.4424	0.0694***	0.3829	0.0588***	0.2994	0.0520

*p < .05; **p<.01; ***p < .001 (two-tailed tests).

b, estimate; SE, standard error

Appendix B. Table B1. Correlation Coefficients of Variables (N=431)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1																	
2	0.72***	1																
3	0.85***	0.84***	1															
4	0.84***	0.56***	0.78***	1														
5	0.91***	0.70***	0.78***	0.71***	1													
6	0.83***	0.64***	0.71***	0.62***	0.94***	1												
7	0.87***	0.61***	0.73***	0.75***	0.71***	0.63***	1											
8	0.81***	0.83***	0.96***	0.74***	0.74***	0.67***	0.72***	1										
9	0.84***	0.80***	0.97***	0.77***	0.79***	0.73***	0.71***	0.91***	1									
10	0.83***	0.74***	0.92***	0.78***	0.78***	0.74***	0.69***	0.84***	0.97***	1								
11	0.73***	0.97***	0.84***	0.59***	0.69***	0.62***	0.63***	0.85***	0.80***	0.73***	1							
12	0.71***	0.97***	0.80***	0.54***	0.70***	0.65***	0.59***	0.80***	0.79***	0.73***	0.92***	1						
13	0.65***	0.90***	0.73***	0.49***	0.66***	0.64***	0.52***	0.72***	0.74***	0.70***	0.82***	0.97***	1					
14	0.83***	0.55***	0.76***	0.97***	0.73***	0.64***	0.73***	0.71***	0.76***	0.77***	0.58***	0.54***	0.49***	1				
15	0.82***	0.56***	0.74***	0.93***	0.72***	0.65***	0.70***	0.70***	0.75***	0.77***	0.58***	0.55***	0.50***	0.96***	1			
16	0.81***	0.54***	0.76***	0.96***	0.67***	0.58***	0.76***	0.72***	0.75***	0.75***	0.58***	0.52***	0.47***	0.91***	0.87***	1		
17	0.09	0.30***	0.11*	-0.14**	0.23***	0.30***	-0.01	0.09	0.13**	0.14**	0.22***	0.33***	0.38***	-0.12*	-0.07	-0.14**	1	
18	0.13**	0.27***	0.14**	-0.00	0.18***	0.19***	0.08	0.16***	0.14**	0.11*	0.27***	0.29***	0.28***	0.02	0.05	-0.01	0.36**	1
19	0.81***	0.62***	0.75***	0.71***	0.74***	0.67***	0.72***	0.73***	0.74***	0.74***	0.65***	0.60***	0.54***	0.70***	0.68***	0.70***	0.12*	0.24***
20	0.61***	0.26***	0.50***	0.65***	0.48***	0.40***	0.58***	0.48***	0.48***	0.50***	0.32***	0.22***	0.17***	0.64***	0.59***	0.65***	-0.24**	-0.01
21	-0.29***	-0.27***	-0.26***	-0.21***	-0.30***	-0.29***	-0.20***	-0.22***	-0.26***	-0.25***	-0.22***	-0.31***	-0.33***	-0.23***	-0.24***	-0.17***	-0.31***	-0.14**
22	-0.19***	0.085	-0.10*	-0.39***	-0.10*	-0.05	-0.21***	-0.08	-0.11	-0.16***	0.03	0.13**	0.15**	-0.36***	-0.30***	-0.39***	0.34***	0.22***
23	-0.05	0.03	-0.02	-0.10	0.00	0.03	-0.07	-0.02	-0.03	-0.04	-0.02	0.09	0.14**	-0.10*	-0.08	-0.13**	0.29***	0.09
24	0.64***	0.65***	0.65***	0.49***	0.61***	0.57***	0.56***	0.61***	0.66***	0.63***	0.63***	0.62***	0.56***	0.49***	0.49***	0.50***	0.16**	0.13**
25	0.13**	0.08	0.08	0.09	0.09	0.05	0.15**	0.10	0.07	0.04	0.09	0.13**	0.15**	0.09	0.08	0.10*	0.06	0.32***
26	0.17***	0.24***	0.20***	0.03	0.14**	0.12	0.16***	0.23***	0.19***	0.15**	0.27***	0.22***	0.18***	0.05	0.05	0.047	0.07	0.42***
27	0.09	0.13**	0.05	0.02	0.09	0.08	0.09	0.08	0.06	0.04	0.18***	0.13**	0.11*	0.01	0.03	0.04	0.04	0.42***
28	0.12*	0.24***	0.21***	0.05	0.14**	0.12*	0.09	0.18***	0.22***	0.20***	0.21***	0.19***	0.17***	0.06	0.06	0.07	0.21***	-0.00
29	-0.10*	0.06	-0.07	-0.17***	-0.05	-0.05	-0.10*	-0.05	-0.07	-0.09	0.06	0.06	0.07	-0.17***	-0.14**	-0.14**	0.19***	0.31***
30	0.13**	0.29***	0.15**	-0.07	0.23***	0.26***	0.05	0.11*	0.15**	0.17***	0.24***	0.24***	0.24***	-0.06	-0.02	-0.07	0.55***	0.29***
31	0.22***	0.08	0.21***	0.28***	0.19***	0.16***	0.18***	0.19***	0.20***	0.22***	0.10*	0.04	0.01	0.27***	0.25***	0.27***	-0.14**	-0.16**
32	0.21***	0.26***	0.23***	0.09	0.24***	0.20***	0.20***	0.23***	0.21***	0.20***	0.27***	0.23***	0.21**	0.12*	0.13**	0.09	0.29***	0.37***
33	0.20***	0.32***	0.30***	0.06	0.20***	0.18***	0.15**	0.29***	0.26***	0.22***	0.33***	0.32***	0.27***	0.07	0.10*	0.06	0.20***	0.35***
34	0.12*	0.33***	0.13**	-0.07	0.22***	0.22***	0.03	0.13**	0.13**	0.10*	0.27***	0.34***	0.36***	-0.04	-0.00	-0.09	0.63***	0.57***

1. Agg Assault
2. MPD Disorder
3. UI Disorder
4. Domestic Violence
5. Asslt Weekend
6. Asslt Weekend Night
7. Asslt Weeknight
8. UI Disorder Weeknight
9. UI Disorder Weekend
10. UI Disorder Weekend
11. MPD Disorder Weeknight
12. MPD Disorder Weekend
13. MPD Disorder Weekend Night
14. DV Weekend
15. DV Weekend Night
16. DV Weeknight
17. On Premise
18. Off Premise
19. Assault 2000-2001
20. Concentrated Disadvantage
21. Residential Stability
22. Racial Heterogeneity
23. Rate 18-29
24. Adult Arrests
25. Population
26. Prosocial Places
27. Physical Disorder
28. Metro Flag
29. Streetlight Density
30. Commercial/Retail Parcels
31. Vacant Parcels
32. Bus stops
33. Homeless Services
34. Inverse Distance (miles)

Table B1 (continued). Correlation Coefficients of Variables (N=431)

	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
19	1															
20	0.71***	1														
21	-0.29***	-0.18***	1													
22	-0.26***	-0.52***	-0.26***	1												
23	-0.02	-0.06	-0.65***	0.34***	1											
24	0.56***	0.36***	-0.26***	-0.00	-0.02	1										
25	0.19***	0.12*	-0.18***	0.21***	0.15**	-0.03	1									
26	0.29***	0.14**	-0.02	0.17***	-0.04	0.12*	0.31***	1								
27	0.23***	0.11*	0.17***	0.06	-0.15**	0.01	0.46***	0.42***	1							
28	0.12*	-0.05	-0.13**	0.10*	0.02	0.30***	-0.19***	0.00	-0.15**	1						
29	0.03	-0.09	0.15**	0.11*	-0.07	-0.06	0.46***	0.31***	0.61***	-0.07	1					
30	0.18***	-0.07	-0.20***	0.17***	0.10*	0.24***	-0.27***	0.15**	0.02	0.24***	0.12**	1				
31	0.28***	0.45***	-0.20***	-0.35***	0.04	0.20***	-0.39***	-0.01	-0.25***	0.15**	-0.30***	0.01	1			
32	0.34***	0.16***	-0.13**	0.05	0.04	0.15**	0.27***	0.29***	0.27***	0.07	0.32***	0.25***	-0.06	1		
33	0.23***	0.06	-0.21***	0.28***	0.10*	0.20***	0.26***	0.42***	0.20***	0.10*	0.21***	0.16***	-0.07	0.34***	1	
34	0.14**	-0.16***	-0.30***	0.38***	0.23***	0.15***	0.21***	0.23***	0.17***	0.10*	0.23***	0.35***	-0.15**	0.29***	0.26***	1

1. Avg. ADW
2. Avg. MPD Disorder
3. Avg. UI Disorder
4. Avg. Domestic Violence
5. ADW Weekend
6. ADW Weekend Night
7. ADW Week Night
8. UI Disorder Week Night
9. UI Disorder Weekend
10. UI Disorder Weekend
11. MPD Disorder Week Night
12. MPD Disorder Weekend
13. MPD Disorder Weekend Night
14. DV Weekend
15. DV Weekend Night
16. DV Week Night
17. On Premise
18. Off Premise
19. Assault 2000-2001
20. Concentrated Disadvantage
21. Residential Stability
22. Racial Heterogeneity
23. Rate 18-29
24. Adult Arrests
25. Population
26. Prosocial
27. Physical Disorder
28. Metro Flag
29. Streetlights
30. Commercial/Retail Parcels
31. Vacant Parcels
32. Bus stops
33. Homeless Services
34. Inverse Mile Distance

Appendix C: Generalized Cross Entropy Macro for SAS

```
%MACRO GCE_SP(L,DAT,CON,ID,DEP,IND,OFS);

/*******************************************************/
/* USAGE NOTES:                */
/* L  = LOCATION               */
/* DAT = DATA FILE WITH NO MISSING OBSERVATIONS    */
/* CON = SPATIAL CONTIGUITY MATRIX (SAME SORT ORDER  */
/*    AS THE DATA FILE)        */
/* ID = AN ID VARIABLE         */
/* DEP = DEPENDENT VARIABLE (ONLY 1)       */
/* IND = LIST OF INDEPENDENT VARIABLES (NO INTERCEPT) */
/* OFS = OFSET VARIABLE (IF NONE, SET TO 0 VARIABLE) */
/*******************************************************/

TITLE "SPATIAL GCE COUNT OUTCOME MODELS OF &DEP. ";

LIBNAME SAF "&L.";
FILENAME OUTFILE "&L.\&DEP..LST";
FILENAME LGFILE "&L.\&DEP..LOG";

PROC PRINTTO PRINT=OUTFILE LOG=LGFILE NEW;
RUN;

DATA SPCONT(DROP=&ID.) SPIDENT(KEEP=&ID.); SET &CON.;
RUN;

PROC IML;
USE &DAT.;
READ ALL VAR{&DEP.} INTO Y;
READ ALL VAR{&IND.} INTO XX;
READ ALL VAR{&OFS.} INTO OFS;
CLOSE &DAT.;
USE SPCONT;
READ ALL INTO C;
CLOSE SPCONT;

N = NROW(Y);
NONES = J(N,1,1);
W = C/(C[,+]*NONES`);
X1 = NONES || XX;
X2 = NONES;
K1 = NCOL(X1);
K2 = NCOL(X2);
```

```
Z = (0:3*Y[<>])`;
M = NROW(Z);

LFACY = Y#LOG(Y+(Y=0))-Y;
LFACZ = Z#LOG(Z+(Z=0))-Z;

Y1=Y;
Y2=LFACY;
Z1=Z;
Z2=LFACZ;

P0 = J(M,1,1/M);

START SDUAL_OBJ(BB) GLOBAL(OFS,Y1,Y2,X1,X2,Z1,Z2,K1,K2,M,N,P0,W);
        B1=BB[1:K1];
        B2=BB[K1+1:K1+K2];
        R1=BB[K1+K2+1];
        A1=INV(I(N)-R1*W);
        NONES=J(N,1,1);
        MONES=J(M,1,1);
        OMEGA1 = OFS*Z1` + A1*X1*B1*Z1` + X2*B2*Z2` - NONES*Z2`;
        OMEGA2 = OMEGA1[,<>];
        OMEGA = EXP(OMEGA1 - OMEGA2*MONES`)*P0;
        DUAL = Y1`*(A1*X1)*B1 + Y2`*X2*B2 - NONES`*LOG(OMEGA) -
NONES`*OMEGA2 - Y2`*NONES;
        RETURN(DUAL);
FINISH SDUAL_OBJ;

START SDUAL_GRD(BB)
GLOBAL(OFS,Y1,Y2,X1,X2,Z1,Z2,K1,K2,M,N,P0,W,S1,S2,PHAT);
        B1=BB[1:K1];
        B2=BB[K1+1:K1+K2];
        R1=BB[K1+K2+1];
        A1=INV(I(N)-R1*W);
        NONES=J(N,1,1);
        MONES=J(M,1,1);
        OMEGA1 = OFS*Z1` + A1*X1*B1*Z1` + X2*B2*Z2` - NONES*Z2`;
        OMEGA2 = OMEGA1[,<>];
        OMEGA = EXP(OMEGA1 - OMEGA2*MONES`)*P0;
        PHAT = ((NONES*P0`)#EXP(OMEGA1 -
OMEGA2*MONES`))/(OMEGA*MONES`);
        S1 = PHAT*Z1;
        S2 = PHAT*Z2;
        CON1 = (A1*X1)`*(Y1-S1);
        CON2 = (X2)`*(Y2-S2);
        CON3 = (A1*W*A1*X1*B1)`*(Y1-S1);
```

Appendix C

```
        GRADNT = (CON1 // CON2 // CON3 )`;
        RETURN(GRADNT);
FINISH SDUAL_GRD;

OPTN={1 1};
TCR={10000 10000};

B0 = J(K1+K2+1,1,0);

CALL NLPNRA(RC,LMHAT,"SDUAL_OBJ",B0,OPTN,,,,,"SDUAL_GRD");
CALL NLPFDD(DUAL,GRAD,HESS,"SDUAL_OBJ",LMHAT,,"SDUAL_GRD");

RSQ = 1 - ((Y1-S1)`*(Y1-S1)) / ((Y1-Y1[:])`*(Y1-Y1[:]));

cov = inv(-HESS);
ase = sqrt(vecdiag(cov));
bhat = LMHAT`;
sighat = phat[:,]*(z##2)-(phat[:,]*z)##2;
marg = bhat*sighat;
BHAT_NULL = B0;
wald = ((bhat-BHAT_NULL)/ase)##2;
pval = 1-probchi(wald,1);

VNM = {INTERCEPT &IND.} || {OD_PARM} || {R1};

PRINT "SPATIAL GENERALIZED CROSS ENTROPY MODEL RESULTS";
print bhat[format=9.4 rowname=vnm colname="LAMBDA"]
ase[format=9.4 colname="ASE"]
wald[format=6.2 colname="WALD"]
pval[format=6.2 colname="PVAL"]
marg[format=6.2 colname="MARG"];
PRINT DUAL RSQ;

QUIT;

PROC PRINTTO;
RUN;

%MEND;
```