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PREDICTING VIOLENT CRIME USING URBAN AND SUBURBAN DENSITIES

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ABSTRACT: Violent crime is often studied with individual level variables, using population characteristics as predictors. This study attempts to predict an additional amount of the variability in violent crime using an environmental variable—population density—in a single U.S. city. Data aggregated to the census block group level are used to test a model that compares the urban center of the city with the entire county and the non-urban parts of the county. Drawing on Jane Jacobs' (1961) theories of urbanism and the occurrence of crime, it was hypothesized that population density at the census block level would negatively predict violent crime in the urban areas. Based on evidence of a non-linear relationship between crime and density (Regoeczi, 2002), it was conversely hypothesized that density would have a positive predictive effect on violent crime in the suburban areas, due to differences in urban and suburban/rural crime. The analyses support the hypotheses for the urban areas, but fail to support the hypotheses for the suburban areas, providing insight into an elusive relationship—and the effects of environments on behavior patterns.
KEYWORDS: urban theory, geographic information systems, violent crime, population density

Understanding where crime happens can be a key to understanding why it happens (Roncek, 1993). Models that predict the occurrence of violent crime by geographical area often use data on the characteristics of the inhabitants (e.g. income, race, home ownership, family structure) of that area (Jencks, 1992). Additionally, there have been studies of psychological (e.g. ,territoriality) and physical-environmental predictors (e.g., block size, landscape) of crime (Kuo & Sullivan, 2001; Perkins, Wandersman, Rich & Taylor, 1993).

Population density has also received considerable attention as it relates to crime. Jane Jacobs (1961) contradicted the popular wisdom of city planners with her claim that crowded city streets and sidewalks could be effective deterrents to criminal behavior. A number of national studies tested the relationships between density and crime, with differing results. Some studies, such as those by Schuessler (1962) or Galle, Gove, and McPherson (1972), found positively correlated relationships between crime and density. Meanwhile, Kvalseth (1977) and others found the opposite types of relationships. Still others (e.g., Freedman, 1975) found non-significant relationships between the two variables.

Complicating factors in understanding studies like these are the differing ways that density is defined or measured, the level of data aggregation, and the different ways that crime data are gathered and analyzed (see Regoeczi, 2003). For instance, Shichor, Deker, and O'Brien (1980) found positive relationships between property crimes with contact

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and density, but negative relationships between non-property assaultive crimes and density, measured across 26 cities. The article attributed the first finding to the fact that many crimes in high-density areas would involve contact by necessity (Repetto, 1974), and the second to the idea of circulation on streets at all times acting as a deterrent (Jacobs, 1961). Alternatively, Sampson (1983) hypothesized that structural density, the degree to which an area is crowded with buildings, would be positively related to crime due to its ability to impede those same social controls.

Studies that hypothesized positive correlations between density and crime largely cite three theories: the theory of overcrowding and anti-social behavior (e.g., Lorenz, 1967); the theory of association between density and poverty (e.g., Curtis, 1975), or the theory of increased opportunity for crimes (e.g., Harries, 1974) in densely populated areas. These ideas draw on both environmental and population characteristics in theorizing causal linkages. Studies that hypothesized a negative relationship between crime and density (e.g., Shichor, Decker, & O'Brien, 1980) typically did so based on the theory of Jane Jacobs (1961), which holds that crowded streets (especially those with multiple windows facing them) work to inhibit the occurrence of crime as a behavior. This environmental explanation holds that informal neighborhood surveillance prevents crimes from occurring.

The frustrating contradictions that arose in urban research involving "this relationship… [which] appears to have eluded researchers" (Regoeczi, 2002, pg 505) may have contributed to the shift in focus of environmental psychologists and criminologists. Increasingly, research has been applied to neighborhood design, development, and policing practices. Crime Prevention Through Environmental Design (CPTED) is an approach that has become popular among planners and police (Lersch, 2004). Crowe (2000) divides the strategies employed by CPTED into three types: territorial reinforcement, access control, and surveillance. The CPTED principles are often employed in new developments, whether the developments are urban or suburban; commercial or residential. Although design has proven important in crime prevention, it has received a large amount of attention in recent research (such as the large body of writing on CPTED), perhaps to the neglect of other social and spatial processes contributing to crime (Koskela & Pain, 2000).

Over the past few decades deindustrialization and increasing suburbanization have worked to generally reduce population density in US cities (Fulton et al., 2001). The decrease in population density associated with these social and economic changes has been implicated in a number of the less desirable occurrences, such as reduced physical activity and poor air quality (Frumkin, Frank & Jackson, 2004). An increasing number of planners, social scientists, journalists, and grassroots organizations, particularly those subscribing to New Urbanist principles, are calling for increased levels of population density to combat these ill effects of suburban sprawl (Duany, Plater-Zybeck, & Speck, 2000; Calthorpe & Fulton, 2001).

While most arguments for greater density are made based on aesthetic appeals, environmental preservation, and convenience of transportation (Benfield, Raimi, & Chen, 1999), there are underlying, often complex relationships between the variability in

population density, and socio-cultural phenomena (Christens, 2004), including violent crime. Both demographic (e.g. Lang, 2005) and ethnographic (e.g. Brooks, 2004) writing on suburbs increasingly portrays them as areas distinct from urban areas: culturally, economically, and socially.

Urban and suburban violent crimes tend to be different in nature and frequency. Violent crime victimization rates tend to be higher in urban areas than in suburban or rural areas (48, 37, and 28 per 1,000 persons, respectively), and urban violent crimes are more likely to be committed by strangers (Bureau of Justice Statistics, 2000). Rapes and sexual assaults are approximately equally distributed across the three geographic typologies. The difference in overall violent crime rates in urban areas is due to robberies and assaults. Although there is a real difference in rates, there is evidence that media coverage overemphasizes the danger of violent crime in cities in order to cater to the market for news (Yanich, 2001, 2004).

While suburbs experience less violent crime, much of the difference relative to urban areas appears to be due to security measures that are available to people with economic wherewithal. Gated communities are proliferating, and often combine restricted access and private policing (LaFree, Bursik, Short, & Taylor, 2000). These wealthy suburban communities have lower levels of crime, and tend to have low population densities. However, it is frequently the case that studies look at violent crime with data aggregated to the metropolitan area—potentially erasing important differences between cities and suburbs. In order for planners and designers to address the social issue of violent crime, more research needs to be done that uses disaggregated geographic data, but does not focus primarily on a single development or building.

In the suburbs, there is a negative association between socio-economic status and both population density (typically directly expressed in the size of houses and yards), and rate of criminal victimization (LaFree, Bursik, Short, & Taylor, 2000). Suburban geographies have characteristics (such as the association between low density and wealth) that may work to negate the preventive effects that density can have in urban areas (e.g., Alford, 1996) per Jane Jacobs' urban theory. In fact, it has been recently suggested that the relationship between crime and density is nonlinear (Regoeczi, 2002). Where behavioral outcomes are concerned, it has long been suspected there may be optimum ranges of density (e.g., Altman, 1975).

This article examines the relationship between violent crime and population density in a single United States city and in the suburbs that surround it. The hypotheses for the regression models are based on the suggestion that the nonlinearity of the relationship between violent crime and density may have to do with intrinsic differences between urban and suburban areas.

STUDY AREA

The city used for this analysis is Nashville, the state capitol of Tennessee. Nashville has a violent crime record that is close to the average for United States cities with over 100,000 residents. It reported an average of 0.1719 homicides per 1000 residents per year

compared to national average of 0.1836 between 1985 and 1997 (Bureau of Justice Statistics, 1999). During those years, the difference between Nashville's rate and the national average was never more than .063. Nashville is centered in Davidson County, which is the second most populous county in the state.

Like many southern U.S. cities, the city is growing in population—when measured as a metropolitan area. The Nashville metropolitan area's population grew 19 percent between 1990 and 1999, reaching 1,171,755 people by July 1, 1999 (U.S. Census Bureau, 2000). These growth statistics are cited more often than an important and lesser known fact—the fact that in this 2000 census, there were only approximately 3200 households in the city's downtown (U.S. Census Bureau, 2000).

This anomaly is due to the fact that the population within the metropolitan area is highly dispersed. This low density was highlighted in 2001 when *USA Today* designed a study of sprawl in the 271 U.S. metropolitan areas with more than 1 million people. In the study, the areas were ranked according to an overly simplistic measure of sprawl. The measure had two components, both of which were comparative: ranking of population density in 2000, and change in population density ranking since 1990 (El Nasser & Overberg, 2001). By this measure, Nashville was *the most sprawling* metropolitan region in the United States (index score of 478 compared to a median of 271 for the top 25 most sprawling metropolitan areas with over 1 million residents).

Despite the fact that there are problems with citing the *USA Today* study to say that Nashville is the most sprawling U.S. city—due to difficulties in achieving a consensus on the definition and measurement of sprawl (Galster et al, 2000; Kiefer, 2003)—Nashville's residents seem to have a growing awareness that they are facing problems with urban, especially downtown residential development. This has been evident in the creation of several new non-profit organizations (Cumberland Region Tomorrow, the Nashville Civic Design Center) dedicated to improving the city's development and design processes. These groups have advocated for, among other things, higher residential density in the city and preservation of rural and natural areas in the region.

According to the latest census estimations though, efforts to increase density have been ineffective. Between 2000 and 2003, the 6 counties (Cheatham, Robertson, Sumner, Wilson, Rutherford, & Williamson) that border Nashville's Davidson County added a combined 55,010 residents, growing 8.9% in 3 years (compared to the average of 2.7% in the state). In this same period of time, Nashville's Davidson County lost 49 residents (U.S. Census Bureau, 2004). Thus, there is no demographic indication that the advocacy for increasing population density and centralization in the region has been effective.

The stable or declining population of Davidson County is counteracted by the expansion of the region as a political and economic entity, and the corresponding transportation infrastructure. The Metropolitan Statistical Area was increased on June 6, 2003 so that it now includes 10 counties, or 5687 square miles (nearly twice as large as Rhode Island and Delaware combined, approximately 3014 sq. miles). The vast majority of urbanized land in the region is in the old city of Nashville, at the center of Davidson County. Figure 1 shows the population density in Davidson County's census block groups.

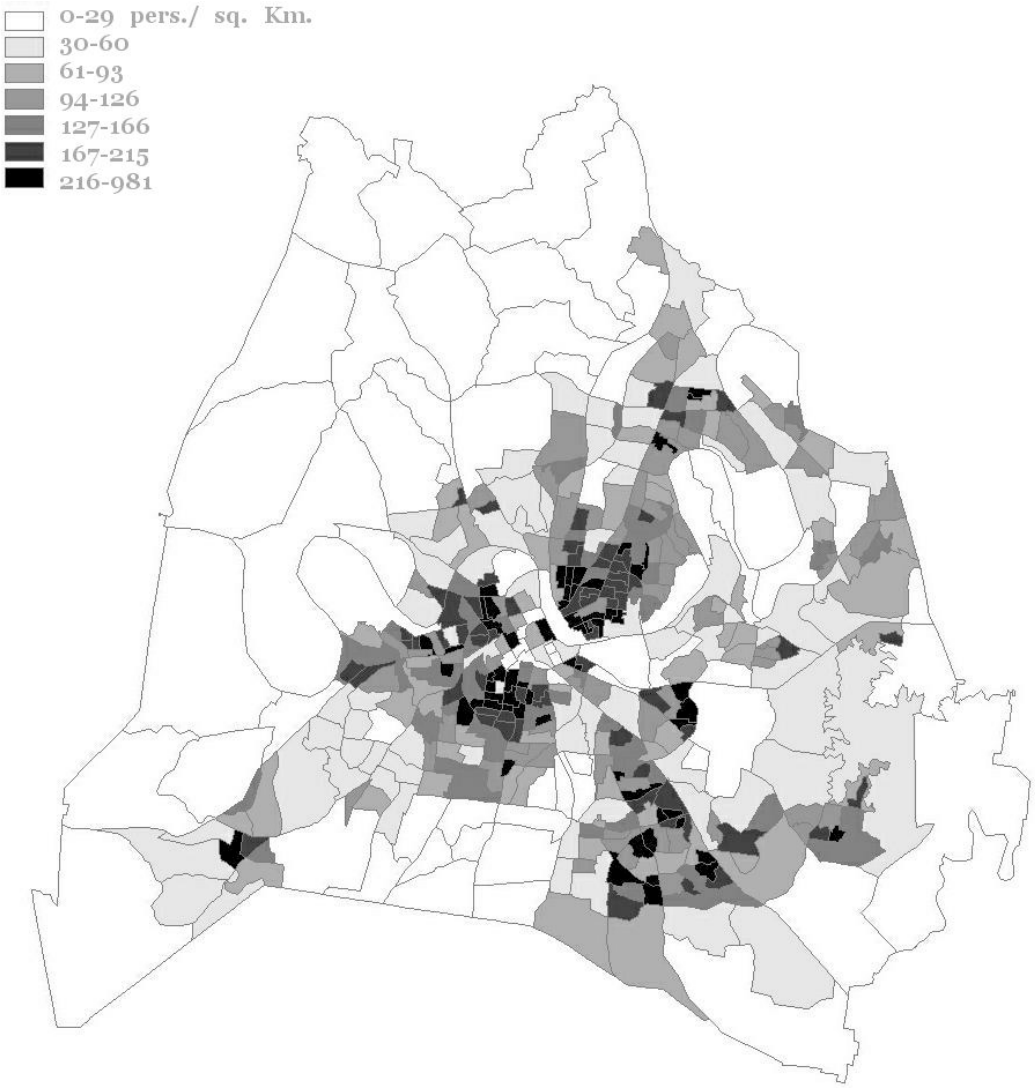

Figure 1. Population density in Davidson County's census block groups.

In the midst of theoretical and political debates on population density and its desirability, the present research is useful for its potential to influence the housing and development debate. It does so by examining the relationships between violent crime and urban and suburban spaces in a model that takes more traditional population characteristics into account. There is some indication that crime, fear of crime, and individual decisions about living in urban and suburban areas are closely linked (Cullen

& Levitt, 1996), which reveals some of the dynamic interplay between perceptions of social issues and corresponding realities.

METHODS AND HYPOTHESES

Most studies of the relationships between population density and violent crime have been analyzed using data aggregated to the level of the city. Having the data disaggregated to the level of the census block group allows for a more nuanced analysis that is sensitive to the differences in urban and suburban areas (although there are spatial externalities not taken into account, e.g., proximity to a high crime area). Based on urban theorists who hold that the presence of other people can prevent crime (e.g., Jacobs, 1961), it was hypothesized that elevated population densities would predict reduced rates of violent crime in Nashville's urban areas. This first hypothesis was chosen because it was developed and has been tested in urban areas (Alford, 1996)

The second hypothesis relies on theory that distinguishes the city and the suburban parts of the county as geographical spaces. It was hypothesized that elevated population densities would predict greater rates of violent crime in suburban areas. This alternative hypothesis for suburban areas is based on an assertion that suburban behavior patterns are qualitatively different than urban behavior patterns. This hypothesis reflects a relative difference within a suburban context. Using data that are disaggregated to the census block group level allows analyses that take urban and suburban environmental differences into account. As Roger Barker stated, "when environments are relatively uniform and stable, *people* are an obvious source of behavior variance … But today *environments* are more varied and unstable than heretofore, and their contribution to the variance of behavior is enhanced" (1968, p. 3, italics in original). The study design is based, in part, on the need to test environmental variance for its relationship to violent behaviors.

Davidson County has 467 census block groups. Much of the variability in violent crime across Davidson County census block groups can be explained using data on sociodemographic characteristics; we use variables that have been shown in previous research to be correlates of assaultive violence (Scribner, MacKinnon, & Dwyer, 1995). These data are included in the analyses that follow, in order to isolate the unique predictive power of population density.

The sociodemographic characteristic data covers age (ratio of males aged 15-24 to males aged 35-44 years), percent Hispanic (any race), female-headed households with children under 18 (population adjusted), employment (percent of workers over the age of 16 that are employed), percent African-American, median household income, percent of households receiving public assistance income, and percent of households that are owner occupied. While it is true that these traditional predictive variables account for a significant amount of variance in violent crime, they all provide information about the residents of an area without regard for the environmental characteristics that influence behavior. The addition of a spatial variable to this model is useful both for building

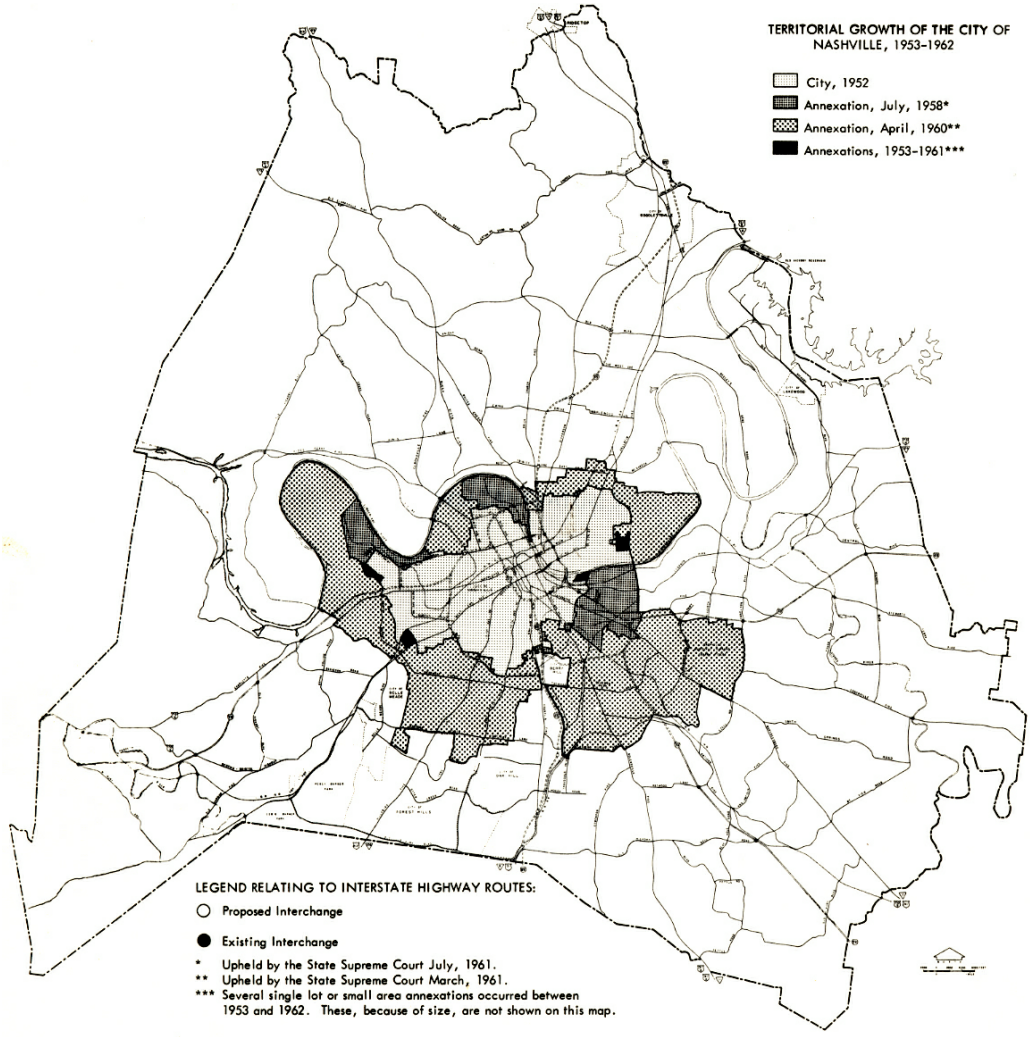

Figure 2. Early city boundary.

theory, and for taking analysis beyond the individual level, thereby providing support for an extra-individual focus in intervention efforts.

The data on violent crime (Metropolitan Nashville Police Department, 2002) include counts (aggregated to the census block group level) of homicide, rape, assault, and robbery. These data are based on police records and therefore exclude all crimes that were not documented by the police. The time period encompassed by this crime data is January 2002 to December 2002. The measure of violent crime that was used for the following analyses was population adjusted for each census block group. Population density was calculated by dividing the number of residents in each census block group by

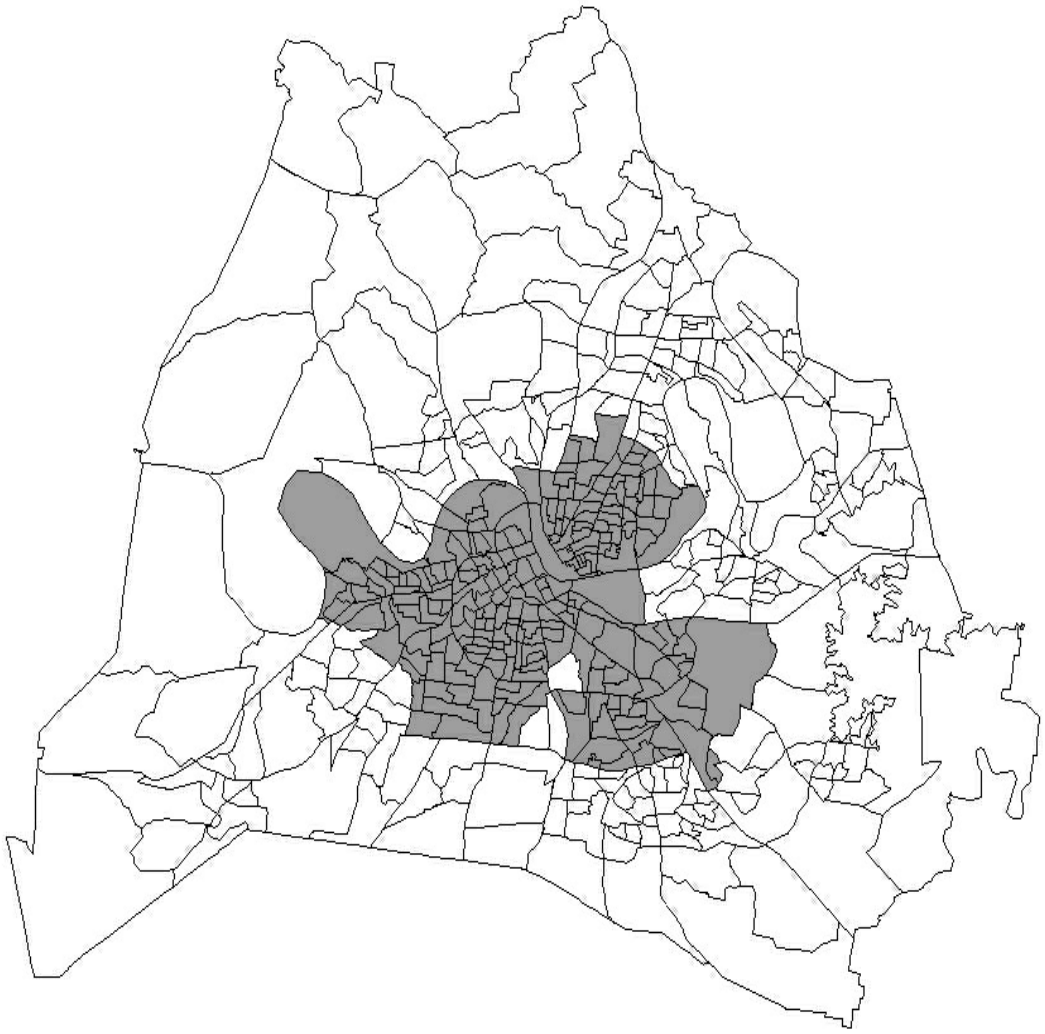

Figure 3. Census blocks selected for the study.

the land area of the block group (in feet, as designated in the files used for geographic analyses).

Finding a boundary to separate urban and suburban areas is challenging because Nashville was an early participant in the consolidation of city and county governments. Historical research provided a city boundary that was used before the consolidation of governments (see Figure 2). This map was used to select the census block groups that were at least partially contained within this boundary (see Figure 3). These block groups

(n=233) represent just under half of the total number of census block groups in the county (n=467), and just under half of the county's population (219,087 of 569,891 residents).

As with previous research, all variables were transformed to their base 10 logarithms to both assure normal distributions and to permit interpretation in terms of elasticities prior to testing correlations or regression models (Gorman, Speer, Gruenewald, & Labouvie, 2001; Scribner, MacKinnon, & Dwyer, 1995). Two regression models were run at each geographic extent (city, county). In each area, the first model included only sociodemographic independent variables and the second model added the environmental variable, population density.

RESULTS

Bivariate analyses show a non-significant negative correlation between population density and violent crime (Table 1) in the urban areas (refer to Figure 3 for selection boundaries), and a non-significant positive correlation between density and violent crime (Table 2) in the county. The classic socioeconomic/demographic variables are fundamentally similar across both geographic extents. When comparing the Nashville urban area to all of Davidson County, the correlations between other demographic variables and the violent crime rate differ only in magnitude and not directionality.

Multivariate analyses are conducted at several geographic extents for a robust understanding of the phenomena. The hierarchical two-block regression model enters all independent variables except population density in block one and then adds population density to the model in block two. Table 3 shows the coefficients for the regression models in the Nashville Urban area (n = 233; Block 1 Adjusted R Square = .345; Block 2 Adjusted R Square = .403). The standardized coefficients show that, for this geographic area, population density is among the most significant negative predictors of the occurrence of violent crime per capita (R Square change = .058).

This finding for the urban area of Nashville lends considerable support to the first hypothesis. The next hypothesis is tested in two regression models with the same hierarchical structure as the first. The first, shown at the level of the county (including the downtown areas) is shown in Table 4. The standardized coefficient for population density is somewhat less negative, but remains significantly so. This finding indicated that the inclusion of the suburbs does not necessarily reverse the relationship between violent crime and density that is shown in urban areas, and warrants further investigation. The model, partially due to a larger sample size (n=467), predicts a larger portion of the variability in violent crime (Block 1 Adjusted R Square = .418; Block 2 Adjusted R Square = .445), although density predicts less of the variance (R Square change = .027).

TABLE 1. CORRELATIONS BETWEEN NEIGHBORHOOD STRUCTURAL CHARACTERISTICS, VIOLENT CRIME RATES, AND POPULATION DENSITY IN NASHVILLE.

Census Block Groups	1	2	3	4	5	6	7	8	9	10
1. Population Density	1.00									
2. Violent Crime Rate	-.12	1.00								
3. Age Ratio (15-24 / 35-44)	.32	.13	1.00							
4. % Hispanic (Any Race)	.07	.02	.20	1.00						
5. Fem Headed HHs	.38	.25	.36	-.06	1.00					
6. % Employed	-.29	-.16	-.16	.17	-.53	1.00				
7. % Black	.22	.35	.18	-.18	.68	-.60	1.00			
8. Median HH Income	.04	-.38	-.17	.03	-.61	.54	-.38	1.00		
9. % Public Assistance $	.39	.29	.23	-.08	.67	-.60	.58	-.58	1.00	
10. % Owner Occupied	-.34	-.45	-.45	-.14	-.33	.17	-.24	.60	-.33	1.00

Note: All variables entered as base 10 logarithms.

TABLE 2. CORRELATIONS BETWEEN NEIGHBORHOOD STRUCTURAL CHARACTERISTICS, VIOLENT CRIME RATES, AND POPULATION DENSITY IN DAVIDSON COUNTY.

Census Block Groups	1	2	3	4	5	6	7	8	9	10
1. Population Density	1.00									
2. Violent Crime Rate	.09	1.00								
3. Age Ratio (15-24 / 35-44)	.36	.28	1.00							
4. % Hispanic (Any Race)	.19	.10	.28	1.00						
5. Fem Headed HHs	.42	.44	.38	.02	1.00					
6. % Employed	-.25	-.20	-.15	.15	-.46	1.00				
7. % Black	.29	.41	.29	-.08	.69	-.50	1.00			
8. Median HH Income	-.11	-.48	-.31	-.06	-.66	.48	-.45	1.00		
9. % Public Assistance $	.42	.38	.31	-.02	.68	-.53	.57	-.59	1.00	
10. % Owner Occupied	-.45	-.51	-.57	-.26	-.45	.16	-.32	.68	-.39	1.00

Note: All variables entered as base 10 logarithms.

Table 3. Regression Models for Census Block Groups in Nashville Urban Area[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.216	.613		3.616	.000
	AGE RATIO (15-24 / 35-44)	-4.791E-02	.094	-.033	-.511	.610
	% HISPANIC (ANY RACE)	.883	.591	.088	1.494	.137
	% FEM HEADED HHS	-1.203	.449	-.261	-2.681	.008
	% EMPLOYED	.368	.618	.051	.596	.552
	% BLACK	1.011	.259	.345	3.900	.000
	MEDIAN HH INCOME	-.392	.142	-.300	-2.753	.006
	% PUBLIC ASSISTANCE $	1.265	.758	.142	1.669	.097
	% OWNER OCCUPIED	-.978	.352	-.229	-2.779	.006
	POPULATION DENSITY					
2	(Constant)	2.260	.585		3.861	.000
	AGE RATIO (15-24 / 35-44)	7.129E-03	.090	.005	.079	.937
	% HISPANIC (ANY RACE)	.996	.565	.099	1.762	.080
	% FEM HEADED HHS	-.735	.441	-.159	-1.669	.097
	% EMPLOYED	.423	.590	.059	.717	.474
	% BLACK	.902	.249	.308	3.627	.000
	MEDIAN HH INCOME	-.387	.136	-.297	-2.844	.005
	% PUBLIC ASSISTANCE $	1.826	.734	.205	2.486	.014
	% OWNER OCCUPIED	-1.114	.337	-.261	-3.303	.001
	POPULATION DENSITY	-164.672	36.028	-.286	-4.571	.000

a. Dependent Variable: VIOLENT CRIME Note: All variables entered as base 10 logarithms

The reduction in the predictive power of population density on violent crime with the inclusion of suburban geographic units is clarified in the third regression model, which is similarly hierarchically structured. The goal of the third regression is to test the same models only in the census block groups of Davidson County that were not selected for the Nashville Urban Area. As Table 5 shows, even in a suburban geographic area, population density is a significant negative predictor of violent crime. However, the model has less predictive power in the suburbs (Block 1 Adjusted R Square = .288; Block 2 Adjusted R Square = .308; R Square change = .02).

DISCUSSION OF FINDINGS

The hypotheses that drove this study were based on a review of the literature, which showed differing or conflicting relationships between density and crime. At least one

Table 4. Regression Models for Census Block Groups in Davidson County[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.983	.355		5.579	.000
	AGE RATIO (15-24 / 35-44)	-2.005E-02	.069	-.013	-.289	.773
	% HISPANIC (ANY RACE)	.744	.383	.076	1.944	.053
	% FEM HEADED HHS	-.834	.308	-.174	-2.706	.007
	% EMPLOYED	.144	.349	.020	.412	.681
	% BLACK	.768	.154	.272	4.984	.000
	MEDIAN HH INCOME	-.349	.081	-.296	-4.330	.000
	% PUBLIC ASSISTANCE $	1.602	.549	.160	2.916	.004
	% OWNER OCCUPIED	-.820	.201	-.235	-4.072	.000
	POPULATION DENSITY					
2	(Constant)	2.160	.349		6.192	.000
	AGE RATIO (15-24 / 35-44)	-2.050E-04	.068	.000	-.003	.998
	% HISPANIC (ANY RACE)	1.001	.378	.103	2.651	.008
	% FEM HEADED HHS	-.607	.305	-.126	-1.991	.047
	% EMPLOYED	.199	.341	.027	.584	.560
	% BLACK	.733	.151	.259	4.869	.000
	MEDIAN HH INCOME	-.378	.079	-.321	-4.802	.000
	% PUBLIC ASSISTANCE $	1.997	.542	.199	3.682	.000
	% OWNER OCCUPIED	-.914	.197	-.262	-4.628	.000
	POPULATION DENSITY	-115.609	24.110	-.207	-4.795	.000

a. Dependent Variable: VIOLENT CRIME Note: All variables entered as base 10 logarithms.

study has suggested that this relationship is non-linear (Regoeczi, 2002). Since most of the studies reviewed used data that were aggregated to a larger geographic area, it was suspected that the precision inherent in more disaggregated data would allow differences in urban and suburban areas to be teased out. Thus, the Jacobs (1961) hypothesis was adopted for the urban area and the converse hypothesis was put forward for the suburban area.

Instead, the results show that when layered onto more traditional predictive (sociodemographic) variables, population density at the census block group level is a significant negative predictor of violent crime in both types of development, as well as in the county as a whole. Therefore, the Jacobs hypothesis, which was developed in distinctly dense urban areas of the Northeastern U.S., is supported in very diverse settings. Importantly, this environmental characteristic – population density – predicted more of the variance in violent crime than the majority of the other population

Table 5. Regression Models for Census Block Groups in Davidson County (Excluding Nashville Urban Area)[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.071	.356		3.006	.003
	AGE RATIO (15-24 / 35-44)	8.231E-02	.114	.062	.721	.472
	% HISPANIC (ANY RACE)	1.115	.440	.164	2.535	.012
	% FEM HEADED HHS	3.337E-02	.405	.007	.082	.934
	% EMPLOYED	.345	.349	.058	.990	.323
	% BLACK	.285	.163	.129	1.748	.082
	MEDIAN HH INCOME	-.207	.078	-.218	-2.653	.009
	% PUBLIC ASSISTANCE $	2.169	.955	.162	2.270	.024
	% OWNER OCCUPIED	-.141	.220	-.058	-.640	.523
2	(Constant)	1.267	.358		3.535	.000
	AGE RATIO (15-24 / 35-44)	4.207E-02	.114	.032	.370	.711
	% HISPANIC (ANY RACE)	1.573	.465	.231	3.384	.001
	% FEM HEADED HHS	9.500E-02	.400	.021	.237	.813
	% EMPLOYED	.430	.345	.072	1.244	.215
	% BLACK	.310	.161	.140	1.922	.056
	MEDIAN HH INCOME	-.243	.078	-.256	-3.113	.002
	% PUBLIC ASSISTANCE $	2.152	.942	.161	2.285	.023
	% OWNER OCCUPIED	-.205	.218	-.084	-.940	.348
	POPULATION DENSITY	-84.593	30.940	-.178	-2.734	.007

a. Dependent Variable: VIOLENT CRIME Note: All variables entered as base 10 logarithms

characteristics in the model. The magnitude of this environmental characteristic represents an important theoretical contribution to the violent crime literature—namely that at extra-individual scales, environments are more powerful determinants of violent crime than the population characteristics that are traditionally examined.

Several limitations of this study should be considered, as well. The measure of violent crime used for the dependent variable counts only incidents documented by the police force, which has inherent biases. Additionally, the data do not account for spatial externalities, such as proximity to areas with higher rates of violent crime. The geographic divisions (census block groups) are arbitrarily set and each one contains several different types of development. The units that were chosen to be included in the "urban" category are not inherently different in every case from some of the units in the "suburban" category. Also, the study uses data from an individual year rather than longitudinal data collected over time.

Despite these limitations, the findings are informative given the complexity of the relationships between density, crime, and population variables. The findings in the

suburban parts of Davidson County are particularly interesting and warrant attempts at replication in other distinctly suburban areas. Although there were differences in magnitude, the negatively predictive relationship held statistical significance in suburban areas. Additional research in urban and suburban areas might consider similar relationships between controllable environmental-level characteristics, such as density, and crime, as well as other perceptual and behavioral characteristics and processes.

REFERENCES

Alford, V. (1996). Crime and space in the inner city. *Urban Design Studies, 2*, 45-76.

Altman, I. (1975). *The environment and social behavior*. Pacific Grove, CA: Brooks/Cole.

Barker, R. (1968). *Ecological psychology: Concepts and methods for studying the environment of human behavior*. Stanford, CA: Stanford University Press.

Benfield, F. K., Raimi, M., & Chen, D. (1999). *Once there were greenfields: How urban sprawl is undermining America's environment, economy, and social fabric.* Washington, DC: Natural Resources Defense Council.

Brooks, D. (2004). *On paradise drive: How we live now (and always have) in the future tense*. New York: Simon & Schuster.

Bureau of Justice Statistics (2000). Urban, suburban, and rural victimization, 1993-1998. Retrieved from the web on 7/13/05 from: http://www.ojp.usdoj.gov/bjs/pub/pdf/usrv98.pdf

Bureau of Justice Statistics (1999). Number of homicides and population for cities with estimated population 100,000 or more, from 1985-1997. Retrieved from the web on 7/12/05 from: http://www.ojp.usdoj.gov/bjs/data/lgcithom.wk1

Calthorpe, P. & Fulton, W. (2001). *The regional city: Planning for the end of sprawl.* Washington, DC: Island Press.

Christens, B. (2004). *Regional sprawl in the Northern Colorado Front Range.* M.S. Thesis: Vanderbilt University.

Crowe, T. (2000). *Crime prevention through environmental design: Applications of architectural design and space management concepts (2nd Ed.)*. Boston: Butterworth-Heinemann.

Cullen, J. B. & Levitt, S. D. (1996). *Crime, urban flight, and the consequences for cities*. Cambridge, MA: National Bureau of Economic Research.

Curtis, L. A. (1975). *Violence, race, and culture*. Lexington, MA: D.C. Health.

Duany, A., Plater-Zyberk, E., & Speck, J. (2000). *Suburban nation: The rise of sprawl and the decline of the American dream.* New York: North Point Press.

El Nasser, H, & Overberg, P. (2001). What you don't know about sprawl. *USA Today 19*(112:1).

Frumkin, H., Frank, L., & Jackson, R. J. (2004). *Urban sprawl and public health*. Washington: Island Press.

Fulton, W., Pendall, R., Nguyen, M. & Harrison, A. (2001). *Who sprawls most? How growth patterns differ across the U.S.* Washington, D.C.: The Brookings Institution.

Galle, O. R., Gove, W. R., & McPherson, J. M. (1972). Population density and pathology: what are the relations for man? Science, 176(April), 23-30.

http://dx.doi.org/10.1126/science.176.4030.23

Galster, G., Hason, R., Wolman, H., Coleman, S., & Freihage, J. (2000). Wrestling sprawl to the *ground: Defining and measuring an elusive concept.* Washington DC: Fannie Mae Foundation.

Harries, K. D. (1974). *The geography of crime and justice*. New York: McGraw Hill.

Kiefer, M. J. (2003). Suburbia and its discontents: Notes from the sprawl debate. Harvard Design Magazine, 19, 1-5.

Kuo, F. E. & Sullivan, W. C. (2001). Environment and crime in the inner city: Does vegetation reduce crime? Environment & Behavior, 33, 343-367. http://dx.doi.org/10.1177/00139160121973025

Kvalseth, T. O. (1977). Note on effects of population density and unemployment on urban crime. Criminology, 15(May), 105-110. http://dx.doi.org/10.1111/j.1745-9125.1977.tb00051.x

Jacobs, J. (1961). The life and death of great American cities. New York: Random House.

Jencks, C. (1992). Rethinking social policy: Race, poverty, and the underclass. New York: Harper Perennial.

Koskela, H. & Pain, R. (2000). Revisiting fear and place: Women's fear of attack and the built environment. Geoforum, 31, 269-280. http://dx.doi.org/10.1016/S0016-7185(99)00033-0

LaFree, G., Bursik, R.J., Short, J. & Taylor, R.B. (2000). The nature of crime: Continuity and change. Criminal Justice 2000, 1, 261-308.

Lang, R. E. (2005). Valuing the suburbs: Why some "improvements" lower home prices. Opolis: An International Journal of Suburban and Metropolitan Studies, 1(1), 5-12.

Lersch, K. M. (2004). Space, time, and crime. Durham, NC: Carolina Academic Press.

Lorenz, K. (1967). On aggression. London: Methuen & Co.

Metropolitan Nashville Police Department (2002). Violent crime data. Nashville, TN: Metropolitan Nashville Police Department.

Perkins, D. D., Wandersman, A., Rich, R. C., & Taylor, R. B. (1993). The physical environment of street crime: Defensible space, territoriality and incivilities. Journal of Environmental Psychology, 13, 29-49. http://dx.doi.org/10.1016/S0272-4944(05)80213-0

Regoeczi, W. C. (2003). When context matters: A multilevel analysis of household and neighborhood crowding on aggression and withdrawal. Journal of Environmental Psychology, 23(4), 451-464. http://dx.doi.org/10.1016/S0272-4944(02)00106-8

Regoeczi, W. C. (2002). The impact of density: The importance of nonlinearity and selection on flight and fight responses. Social Forces, 81(2), 505-530. http://dx.doi.org/10.1353/sof.2003.0018

Repetto, T. A. (1974). Residential crime. Cambridge, MA: Ballinger.

Roncek, D. W. (1993). Mapping crime: An inescapable but valuable task for intracommunity analysis. In Block, C. R., and Block, R. L. (eds.), Questions and Answers in Lethal and Non- Lethal Violence. National Institute of Justice, Washington, DC, pp. 151-161.

Schuessler, K. (1962). Components of variation in city crime rates. Social Problems, 9(Spring), 314-323. http://dx.doi.org/10.2307/798545

Shichor, D., Decker, D. L., & O'Brien, R. M. (1980). The relationship of criminal victimization, police per capita and population density in twenty-six cities. Journal of Criminal Justice, 8, 309-316. http://dx.doi.org/10.1016/0047-2352(80)90042-2

Speer, P. W., Gorman, D. M., Labouvie, E. W., Ontkush, M. J. (1998). Violent crime and alcohol availability: Relationships in an urban community. Journal of Public Health Policy, 19, 303-318. http://dx.doi.org/10.2307/3343538

U.S. Census Bureau (2000). Metropolitan Area Population Estimates for July 1, 1999 and Population Change for April 1, 1990 to July 1, 1999 (includes April 1, 1990 Population Estimates Base). Washington, D.C.: U.S. Census Bureau.

Yanich, D. (2004). Crime creep: Urban and suburban crime on local TV news. Journal of Urban Affairs, 26(5), 535-563. http://dx.doi.org/10.1111/j.0735-2166.2004.00214.x

Yanich, D. (2001). Location, location, location: Urban and suburban crime on local TV news. Journal of Urban Affairs, 23(3/4), 221-241. http://dx.doi.org/10.1111/0735-2166.00086