International Journal of Criminal Justice Sciences
Vol 1 Issue.2 July 2006

Property Crimes and Violence in United States: An Analysis of the influence of Population density

Keith Harries[1]
University of Maryland
Baltimore County, USA

Abstract

The role of population density in the generation or suppression of crime has been the subject of debate for decades. The classic argument is that high density offers opportunities for property crimes, given that it is a surrogate for the distribution of private property, much of which offers attractive targets to thieves. On the other hand, densely populated areas offer natural surveillance that has the effect of inhibiting violent crimes in so far as witnesses are more abundant and events are more likely to be reported to police. In this analysis, property and violent crimes were selected from a database of over 100,000 crimes reported in Baltimore County, Maryland, U.S.A., in the year 2000. Densities of population and of property and violent crimes were calculated for city blocks. Blocks with population densities above the mean of all blocks were then retained for further consideration. Analysis demonstrated that both property and violent crimes were moderately correlated with population density, and these crimes largely affected the same blocks. It was concluded that at the block level of geography, no evidence of a differential between property and violent crimes based on population density could be detected.

Keywords: Population density; property crime; violent crime; crime density; GIS.

Introduction

The role of population density as a generator or inhibitor of crime has been the subject of research and debate for decades. Unfortunately, the debate has been confounded by variations in definitions of density, as well as variations in the types of crimes related to it. Nominally, density refers to the number of persons per unit area, whether kilometers^2 or hectares. However, various modifications can be made in the hope of producing more refined measures. A common metric is persons per room in dwellings, presumed to be a reasonable measure of crowding, which in turn may lead to assumptions

[1] Professor, Department of Geography and Environmental Systems, University of Maryland Baltimore County,1000 Hilltop Circle, Baltimore, MD 21250, U.S.A. Email: harries@umbc.edu

relating to levels of poverty and the likelihood of criminal activity. Other possibilities include the calculation of density based only on residential land use, on the assumption that population density in industrial areas in American cities is likely to be low owing to the separation of land uses produced by the so-called zoning process. Zoning is intended to segregate various types of land uses, and particularly to ensure that residences are unlikely to be located amongst noxious industrial activities.

The role of population density is further complicated by apparently conflicting research findings, with some studies asserting that crime is promoted by high densities, and others suggesting that there is a significant surveillance effect inhibiting crime. An additional layer of complexity is introduced by the presence of many crime categories, each with its own set of situational dynamics. In the 1970s and '80s, a fashionable and now discredited view, largely based on the rat experiments of Calhoun (1962), was that high density, expressed in the form of residential crowding, increases aggression and hence violent crime. Other work has tended to see density as a more general agent of criminogenesis, while another perspective regards socioeconomic status (SES) as the prime factor, more or less regardless of density (Smith, 1986; Sampson, 1983; Harries, 1995, 2006; Li and Rainwater, 2000; Morenoff, et al., 2001). For additional discussion on the density and crowding theme, see: Freedman, 1975; Booth, 1976; De Waal, et al., 2000). The research reported here evaluates hypotheses concerning the relationship between specific types of crime and population density in an effort to determine whether compelling evidence can be detected for the presence of differential effects, whether criminogenic or crime-inhibiting.

Hypothesis

It is hypothesized that there will be a significant difference between the densities of (a) property crimes and (b) violent crimes in terms of their relationship to population density, all measured at a fine (large) scale of geography, specifically the city block as defined in the U.S. Census of Population. Property crimes will demonstrate a positive association with population density, owing to the higher level of opportunity offered by higher densities. Crimes of violence will be inversely related to density owing to a posited surveillance effect.

Data and Context

The raw data for this analysis consisted of the 103,041 crimes reported to police in Baltimore County, Maryland, U.S.A., in the year 2000. In addition, population data and the geography of blocks in the form of boundary files compatible with geographic information systems (GIS) software were extracted from the U.S. Census of Population and Housing, also for the year 2000 (U.S. Bureau of the Census, 1994; 2004).

Baltimore County is a rapidly urbanizing county that is adjacent to, and effectively surrounds, Baltimore City. The County has an area of 1,550km², compared to areas of 172km² for the Chennai municipality, for example, and some 1,172km² for the Chennai metropolitan area (Yoagentharan and Jayakumar, 2006). Thus it may be said that Baltimore County has an area somewhat larger than Chennai metro, but with only about ten percent of the latter's population. As of 2000, the county's population exceeded that of Baltimore City by approximately 100,000 (754,292 compared to 651,154), a reversal of the historic pattern.

The county consists of two principal types of landscapes, one that is sparsely populated and rural and another that is relatively densely populated and urban. The urban part is adjacent to Baltimore city, while the rural part, principally in the north, consists of farms and pastures for cattle and horses. The size of a block (U.S. Bureau of the Census, 1994), basically the smallest area bounded by streets, varies according to whether the context is urban or rural. In Baltimore County, with a total of 8,031 blocks, the overall mean area of blocks is quite large, at 19.53 hectare. However, when the blocks were separated into those included in this analysis (predominantly urban) and those excluded (rural), the mean area dropped to only 3.82 ha. Blocks, like other census units, vary in size depending on population density. Historically, census tracts and blocks were smallest toward the centre of urbanized areas. This was due to the necessity of including a specific population for census purposes – about 4,000 for tracts, and about 100 for blocks – hence the smaller size for the mainly urbanized area.

Method

Given that a substantial part of the county is rural *(Figure 1)* with low population densities, analysis was initially confined to blocks with populations greater than zero (N = 6,673). Population densities were calculated for these blocks, and further selection was made on the basis of an arbitrary distinction between those blocks with densities above the mean for populated blocks (35.53 per ha, N = 921) and those below. Blocks above the mean were selected in order to better detect the effects of higher densities, the essential focus of the research. However, it should be noted that the "above the mean" density criterion merely ensured the exclusion of blocks with a more rural character, while still including a wide variety of urbanized blocks, ranging along the continuum from detached single family homes to densely developed apartment complexes.

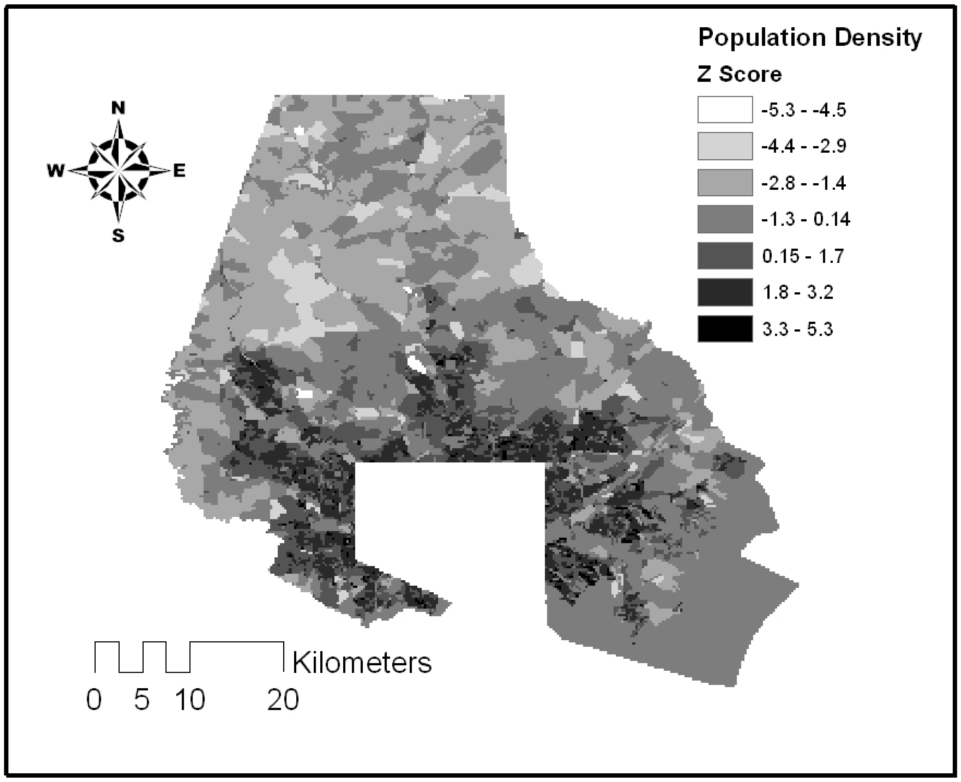

Figure 1. Baltimore County, Maryland: population density expressed as Z scores. The rural nature of the northern part of the county is apparent, as is the denser population toward the center. The empty central area is the territory of Baltimore City, a separate jurisdiction. Geographic units are rasters. Source: Author.

The crime data were filtered in two ways. First, those incidents that could not be geocoded, i.e. mapped in a GIS on the basis of the address of record, were dropped leaving a usable total of 97,880 events, including both more serious (so-called Federal Bureau of Investigation “Part 1” crimes; FBI, 2004), as well as other less serious events.[2] Analysis of crime categories led to a further process of selection based on both frequency of occurrence and reasonable probability of fitting within the rubric of being influenced positively or negatively by population density. Frequency of occurrence was relevant as it would determine whether the specific crime type was fairly common in the county and likely to be broadly distributed. For this reason

[2] The crimes included in this analysis were those reported to the police and regarded by the police department as “founded,” or likely to have actually taken place. Implicit in this condition is the underreporting of crimes which tends to be more pronounced in poverty areas where the benefits associated with reporting tend to be marginal. Reporting in such areas can be life-threatening in that witnesses are intimidated and sometimes killed to prevent them from testifying. In general, it can be assumed that numbers of crimes reported to the police are a substantial undercount of actual incidents. If adjustments were made for systematic underreporting, with over-weighting for poverty areas, the effect would be to amplify the conclusions reached here, i.e. high density, low SES areas would be even more strongly associated with crime.

homicide, for example, was excluded, as were several other categories accounting for substantial numbers of cases.[3] *Table 1* shows the crime categories included in this analysis.

Violent Crime Categories	**Number**
Assault, common	5,887
Assault, common, spouse	3,271
Assault, other weapon	1,268
Domestic incident	4,837
TOTAL	15,263
Property Crime Categories	**Number**
Breaking and entering, force, other	1,638
Breaking and entering, force, residence	1,884
Breaking and entering, no force, other	441
Breaking and entering, no force, residence	710
Theft from building	3,034
Destruction of property	9,468
TOTAL	17,175

Table 1. Violent and property crime categories included in the analysis. Source: Data from Baltimore County Police Department.

The violent crimes are biased in favour of assaults and domestic incidents. In his review of the effects of density, Felson (2002, 64) noted that "an assault backs the victim into a corner and can easily generate screams or shouts, which are likely to be heard in a high-density area." The other category, domestic incidents, would also be more likely, it could be argued, to attract attention in a high density environment given that sound effects would be likely, and also likely to be heard by others. The property crimes emphasize "breaking and entering," otherwise generally referred to as burglary, together with thefts from buildings (other than shoplifting), and "destruction of property" a designation that could cover a variety of property-related infractions. The population density-related case to be made with respect to these categories is that higher density offers more opportunity for crimes, particularly during daytime hours when many people are away at

[3] Excluded crime categories accounting for at least one percent of the total (approximately 1,000 cases) were as follows: Abandoned auto, Stolen auto, Drugs (marijuana possession), Fraud, Missing person, Property lost and found, Runaway children, Illegally stored autos, Sudden unexplained deaths, Suspicious condition or person, Theft of auto parts or accessories, Thefts from autos, Unauthorized use of vehicle, Other.

work. Thus a set of violent crimes was assembled that should be inhibited by high density. Property crimes were compiled that could be seen as being encouraged by the same condition.

Analysis and Results

In order to remove the effect of the area of blocks (which varies a great deal), crimes were, like population, also expressed as densities. Thus two databases were produced, one relating to property crimes with block crime densities greater than zero (N = 921 blocks) and the other dealing with violent crimes also with block crime densities greater than zero (N = 875 blocks). Pearson correlation coefficients were then calculated between the log of population density (to dampen skewness in the density values) and each of the crime density measures (Table 2). The coefficients (0.41 for violent crime and 0.35 for property) are relatively weak, but remarkably similar. Spatially lagged analyses with (log) population density, as the independent variable, in each case, employing GeoDa (Anselin, 2003), resulted in little change in the coefficients, to 0.42 and 0.37 respectively. Both are positive, implying that higher population densities are actually associated with higher levels of both violent and property crimes.

Inspection of the distributions of the two crime density categories suggested considerable geographic correspondence between the patterns. Accordingly, the intersection of the two patterns was derived using GIS tools, showing that of the 921 property crime density blocks, 826 were also in the violent density class, producing a correlation coefficient of 0.56 *(Table 2)* between cases where both values were non-missing.

RELATIONSHIP	N	r	SIG.
(Log) Population Density and Violent Crime Density	875	0.41	0.01
(Log) Population Density and Property Crime Density	921	0.35	0.01
Violent Crime Density and Property Crime Density	708*	0.56	0.01

Table 2. Bivariate correlations between (log) population density and densities of violent and property crimes, and between the crime density measures. Units of observation are blocks. Source: Author.
*Only matching cases (blocks) retained (i.e. both cases non-missing).

This level of correspondence between the distributions is noteworthy in that both databases were originally derived completely independently.

Histograms of the two crime density distributions provide some insights relating to the nature of the spatial distribution *(Figure 2)*. Both distributions are strongly leptokurtic, with property crime density exhibiting kurtosis = 25.9 (with a value of zero approximating normal), as well as highly significant skewness (3.72).

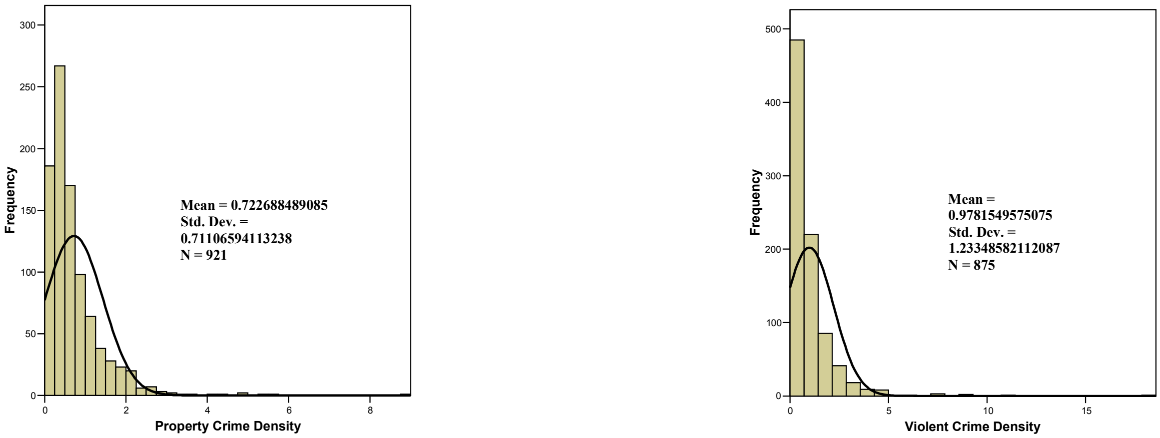

Figure 2. Histograms of block-level property crime density (left) and violent crime density (right). Distributions are leptokurtic and right skewed, implying many blocks with low densities and a few with very high densities. Source: Author.

The violence distribution is similar. Thus many blocks have very low densities of both property and violent incidents, while a few register high densities for both categories. The positive correlation coefficient reported above further confirms this tendency toward spatial coincidence.

Conclusions and Caveats

In an analysis of this sort, geographic scale is critical, and framing the research design at different scales will generate variations in results. For example, if a landscape is viewed at the regional level – say the state of Tamil Nadu – any city, town, or village will be a location where both property and violent crimes tend to cluster. Yet, if we zoom in to larger geographic scale (smaller area) substantial variation will be apparent at the local level. Even finer resolution will reveal variations by house types or kinds of settlement, such as older more central slums or peripheral slums that research in Chennai has suggested were newer and more criminogenic (Bunch, 1994; see also Jaishankar et. al., 2004). Similarly, in Baltimore County communities vary widely in their built characteristics and demographic composition.

Criminals' awareness spaces and action spaces differ greatly, as does the distribution of opportunities for both property and violent crimes. The scale of the present analysis may be regarded as relatively large in the sense that the units of observation (blocks) are relatively small. A yet finer scale would be possible if blocks were broken down into their extremely detailed physical and human environments, such as situations in which part of the block is in commercial land use. This would increase the probability of certain types of crimes that would be less likely in the purely residential part of the block, e.g. the theft of vehicles, theft from vehicles, and perhaps robbery.

Another example of local “distortion” in crime patterns can be created by the presence of a street corner market for illegal drugs. The market may generate local crimes that would not otherwise occur, as addicts desperately try to come up with cash to enable them to “score a hit.” This may manifest as local street robberies, burglaries, or larcenies. Rengert (1996), for example, has documented the spatial bias of burglaries toward drug markets in the case of drug-dependent burglars. A drug market, then, may act like a magnet to draw crime to the neighbourhood, thus increasing block-level crime density. In the broader scheme of things, blocks containing drug markets may appear to be anomalies.

At the scale employed here, the hypotheses outlined initially are not confirmed, at least not when considered together. The hypothesis to the effect that property crimes and density would be positively related is borne out, but the inverse relationship proposed for violence is not. In general, the block-level reality in Baltimore County is that all ten categories of crimes considered here, whether against property or the person, tend occur (or not occur) together. If there is a surveillance effect associated with higher population densities resulting in damping levels of violent crime, it is not apparent here.

The routine activity theory of crime (Cohen and Felson, 1979) posits that for a crime to occur, it is necessary to have a motivated offender, a suitable target, and the absence of a capable guardian. Under conditions of high population density, various contexts will exist in which the offender and target are present, but in spite of higher densities, capable guardians are either not present, or if present cannot be effectively deployed. Time of day, for example, may be critical. The population densities reported here apply, as they do in any national census, to the resident population that is actually present in the census-recorded locations at night, while for the most part away at work during daylight hours. Thus domestic assaults and even street crimes may occur virtually undetected in daytime in a neighbourhood with a nominally high population density but with a large proportion of the population at work during the day.

Micro-level demographics may also play a role in determining whether the posited surveillance or guardianship effect plays a critical role. For example, an area with a high level of elderly persons who are usually at home may provide a stronger level of (daytime) guardianship compared to a “working” neighbourhood. On the other hand, the elderly may be less willing than younger persons with children in their care to report crimes for fear of witness intimidation, a major problem in some U.S. cities. As noted previously, other research suggests that high crime densities are also associated with low SES. Thus, we have a basis for assuming that the relationship between population density and crime density is not independent, but is actually conditioned by SES, with the expectation that high population density in association with high SES will yield crime productivity that differs markedly from contexts in which high population density occurs in conjunction with low SES.

Since no systematic cross-sectional analysis of the crime-density relationship has occurred across a continuum of urban scales, the extant research tends to consist of snapshots of single places at one scale at one time, much like this presentation. The likely explanation is lack of resources – mounting a systematic cross-sectional analysis across a set of geographic scales would be a major undertaking. A fully-fledged research effort would call for detailed land use maps for a large (e.g. metropolitan) area, similarly detailed crime data, and a supporting database of up-to-date demographic and socioeconomic data. The fact that the required areal data would probably cross several jurisdictional boundaries (at least in the U.S. context) would constitute a severe limitation and helps to explain why research has not occurred across the scale continuum to date.

By and large, the available evidence increasingly tends to suggest that most types of crime tend to increase in levels of occurrence with increasing population density. This relationship, however, is moderated by SES. A cluster of affluent high-rise apartments in Mumbai or New York may have high density, but will also have a high level of guardianship, thus inhibiting crime. On the other hand, a high density poverty area will incorporate in its lifestyle incentives for predatory behaviours and disincentives for guardianship, given the hazards associated with confronting criminals (on their turf) or witnessing criminal acts.

An operating rule when considering the crime-density relationship might be as follows: The smaller the geographic scale, the more sweeping the generalization can be; at larger scales, local variations in SES and its correlates (such as the status of housing) are more likely to upset generalizations that are valid for larger areas.

Acknowledgement

The author wishes to thank Philip Canter, Chief Statistician, Baltimore County Police Department, for providing access to the data used in this analysis. The author also thanks the anonymous peer reviewers for their wise comments. The views expressed herein are those of the author and are not associated in any way with the Baltimore County Police Department.

References

Bunch, M.J. (1994). *The Physical Ecology of Slums in Madras, India, 1986*. M.A. Thesis, Department of Geography, University of Waterloo, Waterloo, Canada.

Anselin, L., (2003). *GeoDa 0.9 User's Guide*. Urbana, IL: Spatial Analysis Laboratory, Department of Agricultural and Consumer Economics, University of Illinois, Urbana-Champaign.

Booth, A., (1976). *Urban Crowding and its Consequences*. Praeger, New York.

Calhoun, J.B., (1962). Population density and social pathology. *Scientific American* 206,
139-148.

Cohen, L.E. and Felson, M. (1979). Social change and crime rate trends: A routine activity approach. *American Sociological Review* 44, 588-608.

De Waal, F.D.M., Aureli, F., Judge, P.G., (2000). Coping with crowding. *Scientific American* 282, 76-81.

FBI [Federal Bureau of Investigation], (2004). *Uniform Crime Reporting Handbook*. U.S. Department of Justice, Washington, D.C..

Freedman, J., (1975). *Crowding and Behavior*. W.H. Freeman, San Francisco.

Harries, K., (1995). The ecology of homicide and assault: Baltimore City and County, 1989-91. *Studies in Crime and Crime Prevention* 4, 44-60.

Harries, K. (2006). Extreme spatial variations in crime density in Baltimore County, MD. *Geoforum*. In press.

Jaishankar K., Shanmugapriya S., and V. Balamurugan (2004). Crime Mapping in India: A GIS implementation in Chennai City Policing, *Geographic Information Sciences*, Vol.10, No1, June 2004.

Li, J. and Rainwater, J. (2000). The real picture of land-use, density, and crime: A GIS application. Available from: http://gis.esri.com/library/userconf/proc00/professional/papers/PAP508/p508.htm.

Morenoff, J.D., Sampson, R.J., Raudenbush, S.W., (2001). Neighborhood inequality, collective efficacy, and the spatial dynamics of urban violence. *Criminology*, 39, 517-59.

Rengert, G.F. (1996). *The Geography of Illegal Drugs*. Boulder, CO: Westview Press.

Sampson, R.J., (1983). Structural density and criminal victimization. *Criminology* 21, 276-293.

Smith, S.J., (1986). *Crime, Space, and Society*. Cambridge, Cambridge University Press.

U.S. Bureau of the Census, (1994). *Geographic Areas Reference Manual*. Washington D.C.

U.S. Bureau of the Census, (2004). American Fact Finder, retrieved from http://factfinder.census.gov on October 1, 2004.

Yoagentharan, S. and M.R.Jayakumar (2006). GIS database for Chennai city roads and strategies for improvement. Accessed at: http://www.gisdevelopment.net/application/Utility/transport/utilitytr0001.htm, March 12, 2006.