

Measuring the Deconcentration of Housing Choice Voucher Program Recipients in Eight U.S. Metropolitan Areas Using Hot Spot Analysis

Xinhao Wang

David Varady

Yimei Wang

University of Cincinnati

Abstract

This article describes the use of hot spot analysis to measure changes in the clustering of U.S. Department of Housing and Urban Development (HUD) Housing Choice Voucher Program (HCVP) recipients. Hot spot analysis for HCVP recipients in eight metropolitan areas (New York, Baltimore, Chicago, Cincinnati, Miami, Houston, Los Angeles, and Phoenix) was performed using the tenant-based data system from HUD's Office of Public and Indian Housing. The 2000 and 2005 hot spots were overlaid with 2000 Census block group data. The hot spot results show that the tendency of HCVP households to cluster varies by metropolitan area; however, no evidence indicates that HCVP clustering is declining. Although HCVPs are becoming less concentrated in hot spots in Chicago and Phoenix, the opposite is true in other metropolitan areas, especially in New York, Cincinnati, and Baltimore. This type of HCVP concentration is likely to continue as long as affordable rental housing is confined largely to central cities and older inner suburbs.

Introduction

Since 1980, the thrust of U.S. low-income housing policy has shifted from supply-side to demand-side subsidies. The main focus of the U.S. Department of Housing and Urban Development's (HUD's) Housing Choice Voucher Program (HCVP)—a demand-side subsidy—is to enable low-income households to afford safe and decent housing. HUD is also using the HCVP to improve access to low-poverty neighborhoods, and, in turn, to deconcentrate poverty.¹

This study builds on previous HUD national research on the spatial distribution of HCVP recipients (HUD, 2003, 1998) as well as our own 2005 *Housing Studies* article (Wang and Varady, 2005) that provides a snapshot view of the spatial distribution of HCVP recipients in Hamilton County, Ohio (the core county in the Cincinnati Consolidated Metropolitan Statistical Area [CMSA]). In this article, we aim to answer the following four research questions:

1. To what extent has the HCVP shifted to the suburbs between 2000 and 2005? That is, to what extent has the distribution of HCVP clients changed between the central city and the remainder of the metropolitan area?
2. To what extent has the HCVP helped to deconcentrate poverty? Specifically, to what degree has the HCVP shifted from high- to low-poverty census block groups?
3. To what extent has the administration of the HCVP led to a decreased propensity for recipients to cluster spatially? That is, how prevalent is the tendency for HCVP recipients to live in high HCVP density clusters (that is, HCVP hot spots)? Is the tendency to cluster most apparent in hot housing markets in which HCVP recipients have the fewest opportunities to find affordable rental housing?
4. To what extent have these hot spots changed between 2000 and 2005? For particular metropolitan areas, **where have the 2000 hot spots disappeared and where have new hot spots emerged by 2005?**

This article helps to clarify whether HUD's current focus on vouchers without restrictions on geographical destination and without intensive counseling is leading to a shift of households to low-poverty neighborhoods where the density of HCVP households is low.²

The U.S. Census Bureau divides the country into four regions—Northeast, Midwest, South, and West. When we started this research project, our goal was to select two metropolitan areas from each region based on three criteria: (1) that each metropolitan area should contain at least two million people, (2) that each should contain a large proportion of African Americans and

¹ HUD's emphasis on poverty deconcentration is reflected in HUD's Section Eight Management Assessment System. HUD provides five points to housing agencies that can demonstrate that an increasing proportion of Housing Choice Voucher Program households with children are moving to low-poverty census tracts. (See HUD, 2001.)

² Here we are distinguishing between the regular operation of the Housing Choice Voucher Program and two major HUD demonstration programs, the Gautreaux Assisted Housing Mobility Program in Chicago and the Moving to Opportunity for Fair Housing Demonstration.

Hispanics, and (3) that the two selected for each region should include a so-called “hot” housing market (that is, where it is necessary to have a relatively high income to afford an apartment) and a so-called “cool” one. Exhibit 1 shows the eight metropolitan areas that we ultimately selected with respect to total population size and demographic and housing characteristics. Exhibit 2 shows how the eight metropolitan areas differ in the three criteria. For example, both New York and Baltimore have similarly high proportions of African Americans, but New York’s housing market is much hotter than Baltimore’s as shown by the higher income required to afford a two-bedroom apartment at or below the Fair Market Rent (FMR) standard.³

Exhibit 1

Study Areas



Sources: Regional boundary data were derived from 2004 ESRI data set; metropolitan boundary data were provided by HUD in 2006

³ We originally chose Philadelphia as the comparison metropolitan area for New York. Philadelphia is a Moving to Work site. For several years, the Philadelphia Housing Authority has been permitted to skip reporting its Housing Choice Voucher Program data to HUD. We replaced Philadelphia with Baltimore. Although technically Baltimore is a southern city, in actuality it resembles Philadelphia and other northeastern cities for spatial structure (that is, like Philadelphia, Baltimore has a historically important downtown core), a declining manufacturing base, and a large African-American population.

Exhibit 2

Socioeconomic and Housing Characteristics of the Eight Metropolitan Areas

Metropolitan Area	Region	2000 Population (in millions, U.S. Census)	Ethnic Minorities ^a	FMR for Two-Bedroom Apartment ^b (\$)	Income Required To Afford Two-Bedroom Apartment at or Below FMR Standard ^b (\$)	Median Household Income in 1999 (in \$, U.S. Census)	African-American Residents (%)	Hispanic Residents (%)	Households Below Poverty (%)
New York	Northeast	12.1	High African-American/ high Hispanic	1,189	45,320	50,795	20.78	21.74	15.49
Baltimore	Northeast	2.6	High African-American/ high Hispanic	941	37,640	49,938	27.21	2.02	9.72
Miami	South	2.3	High African-American/ high Hispanic	1,018	40,720	38,632	20.07	57.32	18.08
Houston	South	4.2	High African-American/ high Hispanic	768	30,720	44,761	17.45	29.90	12.34
Chicago	Midwest	8.3	High African-American/ high Hispanic	935	37,400	51,046	18.75	17.12	9.67
Cincinnati	Midwest	1.6	High African-American/ high Hispanic	668	26,720	44,914	12.97	1.08	10.06
Los Angeles	West	9.5	High African-American/ high Hispanic	1,269	50,760	45,903	9.63	44.58	15.13
Phoenix	West	3.3	High Hispanic	782	31,280	44,752	3.58	25.13	9.88

FMR = Fair Market Rent.

^a See Frey (2006).

^b See NLHC (2005).

Source: 2000 Census and Housing Choice Voucher Program data provided by HUD in 2006

Methods

We conducted our spatial analysis in three steps. First, we developed a database for the selected metropolitan areas using ArcGIS, a commercial Geographic Information System (GIS) software package. Exhibit 3 summarizes the data layers included in the databases. Second, we produced maps describing the distribution of HCVP recipients for the metropolitan areas. Third, we identified hot spots in each metropolitan area in 2000 and 2005 and summarized census block group data by hot spots.

Exhibit 3

Sources for Data Layers Used

Data Layer	Data Source
2000 and 2005 individual HCVP recipient points	HUD HCVP recipient data
Census block group polygons	ESRI compiled from TIGER file
Metropolitan polygons	ESRI compiled counties from TIGER file
County polygons	ESRI compiled from TIGER file
Central city boundary polygons	HUD
Major highway polylines	ESRI compiled from TIGER file
ZIP boundary polygons	ESRI compiled from TIGER file
Major surface water polylines	ESRI compiled from TIGER file
Census block group level attribute data: % African Americans, % Hispanics, % households below poverty, median household income, number of rental units	HUD

HCVP = Housing Choice Voucher Program.

We used the longitude/latitude location of HCVP recipients to create an ArcGIS point feature layer for 2000 and 2005 HCVP recipients. For HCVP recipient records without longitude/latitude data, we geocoded them using ZIP Code location; that is, we placed them on the center of the corresponding ZIP Code. We included these records only in the analysis of the distribution of HCVP recipients with respect to central city versus suburbs and not in the hot spot analyses. The HCVP recipient records that lacked longitude/latitude and ZIP Code data were excluded from all analyses. Exhibit 4 summarizes the data for each metropolitan area.⁴ After overlaying the census data with the 2000 and 2005 HCVP recipient data, we produced a series of dot maps to describe the distribution of HCVP recipients in each metropolitan area. For space reasons, we do not include or discuss these maps in this article.

⁴ Note that in 2000, more than 4,000 Housing Choice Voucher Program records for Chicago were missing location data, a much larger number than for any other metropolitan area.

Exhibit 4

HCVP Information for the Eight Metropolitan Areas

Metropolitan Area	Counties	Year	Total HCVP Records	HCVP Records Geocoded With x, y Coordinates	HCVP Records Geocoded With ZIP Code	HCVP Records Not Geocoded Because of Missing Information
New York	NY: Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Rockland, Suffolk, Westchester	2000 2005	66,865 132,427	59,645 126,355	6,416 6,014	804 58
Baltimore	MD: Anne Arundel, Baltimore, Carroll, Harford, Howard, Queen Anne's	2000 2005	10,290 21,175	9,915 20,979	309 170	66 26
Miami	FL: Miami-Dade	2000 2005	13,005 21,130	12,547 20,758	437 370	21 2
Houston	TX: Chambers, Fort Bend, Harris, Liberty, Montgomery, Waller	2000 2005	9,803 16,198	9,341 15,785	428 403	34 10
Chicago	IL: Cook, DeKalb, DuPage, Grundy, Kane, Kendall, Lake, McHenry, Will	2000 2005	46,462 57,190	39,775 54,083	2,586 3,099	4,101 8
Cincinnati	KY: Boone, Campbell, Gallatin, Grant, Kenton, Pendleton; OH: Brown, Clermont, Hamilton, Warren; IN: Dearborn, Ohio	2000 2005	9,125 15,330	8,639 14,892	463 431	23 7
Los Angeles	CA: Los Angeles	2000 2005	51,736 76,134	51,277 75,648	429 485	30 1
Phoenix	AZ: Maricopa, Pinal	2000 2005	8,708 11,811	8,602 11,628	92 140	14 43

HCVP = Housing Choice Voucher Program.
Source: 2000 Census and HCVP data provided by HUD in 2006

We used hot spot analysis to identify areas with a high density of voucher recipients. For each metropolitan area, we created an HCVP-recipient density raster grid using the floating grid technique described in our 2005 *Housing Studies* article (Wang and Varady, 2005).⁵ From the 2000 HCVP density, we calculated the highest density in a metropolitan area. Hot spot areas include any area with a density greater than half of this highest density. Then we defined 2005 hot spot areas using the same density threshold value.⁶ Exhibit 5 summarizes the raster cell size, the search radius,⁷ and the hot spot threshold values for each metropolitan area. Note that we identified the hot spot areas by analyzing the density distribution for each metropolitan area independently. This approach enabled us to look at HCVP density in tandem with the population density for that particular metropolitan area. In other words, it would be expected that the HCVP density would be highest in New York, Chicago, and Los Angeles, where the population density is highest. Because this study focuses on variations in HCVP concentration among these different metropolitan areas and the changes in HCVP density between 2000 and 2005, we have not examined the link between HCVP density and the density of below-FMR units, the density of project-based assistance, or population density as a whole. Future research should be directed at these statistical relationships.

Exhibit 5

Hot Spot Parameters

Metropolitan Area	Cell Size (feet)	Search Radius (miles)	Maximum Density		Hot Spot Threshold
			2000	2005	
New York	500	0.50	3,275	6,778	1,637
Baltimore	500	0.50	1,149	1,766	575
Miami	500	0.30	1,558	2,264	779
Houston	500	0.75	296	532	148
Chicago	500	0.50	2,177	2,050	1,088
Cincinnati	500	0.50	579	979	290
Los Angeles	500	0.50	2,720	3,566	1,360
Phoenix	500	1.00	192	191	96

⁵ Previously, hot spot analysis has been used in criminological and epidemiological research (Harries, 1999).

⁶ The literature on spatial analysis provides no operational definition of the term “hot spots.” In fact, Harries (1999) argues that no single, absolute definition may be possible. Choosing a threshold level for identifying hot spots is as much an art as a science. For our 2005 *Housing Studies* article (Wang and Varady, 2005), we experimented with different threshold values. The 50-percent figure proved best for estimating and describing spatial patterns. Atkinson and Unwin (2002) provide support for our approach, stating that subjective judgment based on a range of density surfaces is a method that is as good as any.

⁷ The search radius is the distance used to define a circle for calculating each cell's Housing Choice Voucher Program recipient density.

After overlaying the 2000 and 2005 hot spots, we divided the census block groups for each metropolitan area into four categories:

1. Ongoing hot spot areas: census block groups that included or touched hot spots in both 2000 and 2005.
2. Disappearing hot spot areas: census block groups that included or touched hot spots in 2000 only.
3. Emerging hot spot areas: census block groups that included or touched hot spots in 2005 only.
4. Non-hot spot areas: census block groups that did not include or touch a hot spot in either 2000 or 2005.

We compared these four categories of census block groups for the proportion of poverty households, African-American households, and Hispanic households.

Census Block Group Analysis

In this section, we first compare the eight metropolitan areas with respect to changes in HCVP recipient densities. We then compare the eight with respect to the distribution of HCVP recipients between the central city and the rest of a metropolitan area. Finally, we examine the extent to which the administration of the HCVP is linked to poverty and minority deconcentration.

Changes in Overall Voucher Density

In all eight metropolitan areas, the number of voucher recipients increased substantially between 2000 and 2005. The greatest increase in absolute terms was in New York (an increase of 66,308 households), but the largest percentage increase was in Baltimore (106.9 percent). The Cincinnati metropolitan area experienced a 68.3-percent increase. The smallest increase in absolute numbers was in Phoenix; however, because of the small number of HCVP households in Phoenix in 2000, the percentage increase, 35 percent, was similar to the change in Chicago.

The wide variation in overall voucher densities among the metropolitan areas, in general, is consistent with differences in overall household density. In 2000, the highest voucher density, at about 27 households per square mile, was in New York; the second highest density, at 13 households per square mile, was in Los Angeles; and the lowest voucher density, at less than 1 household per square mile, was in Phoenix.

The New York metropolitan area, with the largest increase in HCVP recipients, also had the greatest increase in density between 2000 and 2005, doubling from 27 households per square mile to 55 households per square mile. In Baltimore, the HCVP density also doubled during this period, from 3.9 to 8.0 households per square mile, but the density level in 2005 was much lower than in New York. With the exception of Phoenix, all the other metropolitan areas experienced fairly large percentage increases in overall voucher density. In Phoenix, the overall level of voucher density remained at less than 1 household per square mile.

Houston stood out as the highest of the eight metropolitan areas with respect to the proportion of HCVP households, with 5.4 percent in 2000 and 9.0 percent in 2005. Phoenix had the lowest proportion, at less than 1 percent, while the other six cities varied between 1 and 3 percent.

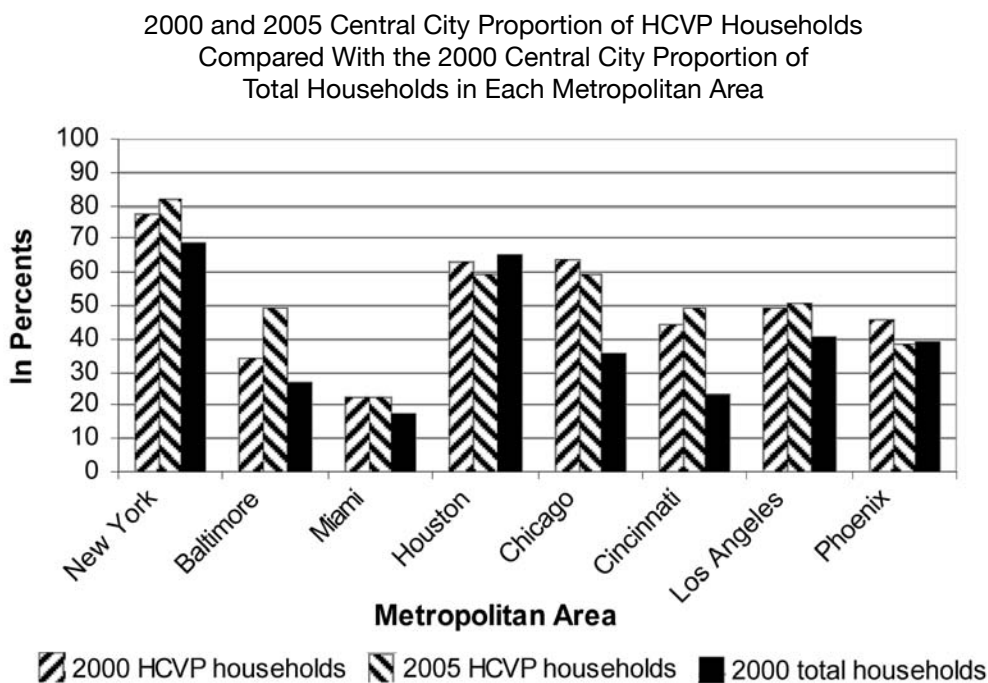
Changes in the Distribution of HCVP Households Between the Central City and Its Suburbs

The eight metropolitan areas vary considerably in the distribution of HCVP households between the central city and the rest of the metropolitan area (exhibit 6). In 2000, slightly less than 80 percent of HCVP recipients in the New York metropolitan area lived in New York City. In sharp contrast, only about 20 percent of HCVP recipients in the Miami region lived in the city of Miami. Between 2000 and 2005, almost no change occurred in the city/suburban distribution of HCVP recipients in Miami and Los Angeles. The biggest change took place in Baltimore, where the proportion of HCVP households living in the city of Baltimore rose from 34 to 49 percent. In contrast, the proportion of HCVP households living in the central city decreased slightly in Phoenix, Chicago, and Houston but increased slightly in Cincinnati and New York.

In general, the concentration of HCVP households in a central city reflects the city-suburban distribution of all households in that metropolitan area; however, our eight metropolitan areas

Exhibit 6

Proportions of Total and HCVP Households Living in the Central City



Source: 2000 Census and Housing Choice Voucher Program data provided by HUD in 2006

showed some variation in distribution patterns. In Chicago and Cincinnati, the proportion of HCVP households living in the central city was much higher than it was for all metropolitan area households. In Houston, which differed from the other seven metropolitan areas, the proportion of HCVP households living in the central city was lower than it was for all metropolitan households.

We also suspected that the concentration of HCVP households in the central city also reflected the concentration of rental units there. As predicted, for all of the eight metropolitan areas, the proportion of rental units in the central city was substantially higher than for the metropolitan area as a whole. For example, in the city of Cincinnati, the incidence of renting (54.3 percent) was 75 percent higher than it was for the metropolitan area as a whole (31.2 percent). In Miami and Chicago, the incidence of renting in the city was 50 percent higher than it was for the metropolitan area as a whole.

Poverty and Minority Deconcentration

The presumed linkage between HCVP household concentrations and poverty concentrations varied between cities. We defined “higher poverty” level census block groups as ones where 20 percent or more of the households were below the poverty line.⁸ In New York, in 2000, three-fifths of HCVP households lived in higher poverty census block groups; the comparable figure for Phoenix was less than one-third. No one pattern of change occurred between 2000 and 2005. In five metropolitan areas, the proportion of HCVP households living in higher poverty areas declined, with big drops occurring in Phoenix, Houston, and Chicago. The proportion increased slightly in New York and Los Angeles while it decreased a little in Miami and Cincinnati. The maps (not included here) show that, except for Phoenix, almost all the higher poverty areas contain some HCVP households.

Not surprisingly, there was a link between where HCVP recipients and African-American families are located. This scenario was most evident in Chicago, where two-thirds of HCVP households lived in census block groups where 30 percent or more of the residents were African American. Relatively little change occurred, however, between 2000 and 2005 in the extent to which HCVP households were concentrated in heavily African-American areas. The most significant increase was in Cincinnati, where the proportion rose from 45 to 50 percent.

The connection between HCVP concentrations and Hispanic populations was most apparent in Miami and Los Angeles, where in 2000 nearly three-fourths of HCVP households were located in census block groups where Hispanics made up 30 percent or more of the total population. Because Cincinnati had only a small Hispanic presence (no census block groups were 30 percent or more Hispanic), no meaningful correlation was found between HCVP recipients and Hispanic concentration. Between 2000 and 2005, a fairly large drop occurred in the extent to which Phoenix HCVP households lived in heavily Hispanic areas. Meaningful but less noticeable decreases were observed in Miami and Houston and even smaller changes were calculated in the other three metropolitan areas.

⁸ Most recent research has defined high-poverty areas as census tracts where 40 percent or more of the households live below the poverty line.

Hot Spot Analysis

Our hot spot analysis was carried out in three steps. First, we computed the cell-based HCVP recipient densities for the eight metropolitan areas for 2000 and 2005. Next, we compared the eight areas' hot spots with respect to the size of the hot spots, their spatial distribution, and changes between 2000 and 2005. Finally, we overlaid the hot spots on census block group data and maps, thereby enabling us to compare ongoing, disappearing, emerging, and non-hot spot areas.

Changes in Density

After dividing the nonzero HCVP density cells into four quartiles based on the 2000 densities, we calculated the mean density for each quartile and mapped the results. (Because of space limitations, these maps are not included in this article.) In general, fairly small differences occurred among the eight metropolitan areas with respect to mean HCVP density for the first three quartiles. Wide variation occurred, however, among the eight for the highest density quartile. Although the mean density for the New York metropolitan area in 2000 was 300 HCVP households per square mile in the highest density quartile, the mean density in the highest density quartile in Phoenix was only 48 households per square mile.

We used the 2000 density threshold values to group the 2005 density cells into four classes. A comparison of the 2000 and 2005 results showed virtually no change for the first three classes but large increases for the fourth density class. The biggest density increase, from 300 to 498 households per square mile, or 66 percent, occurred in New York. Baltimore experienced the second largest percentage increase, 46 percent, rising from 103 to 150 households per square mile. Cincinnati and Los Angeles also experienced meaningful increases, but Miami's and Chicago's increases in density were negligible. Houston and Phoenix experienced decreases in HCVP density of 17 and 6 percent, respectively.

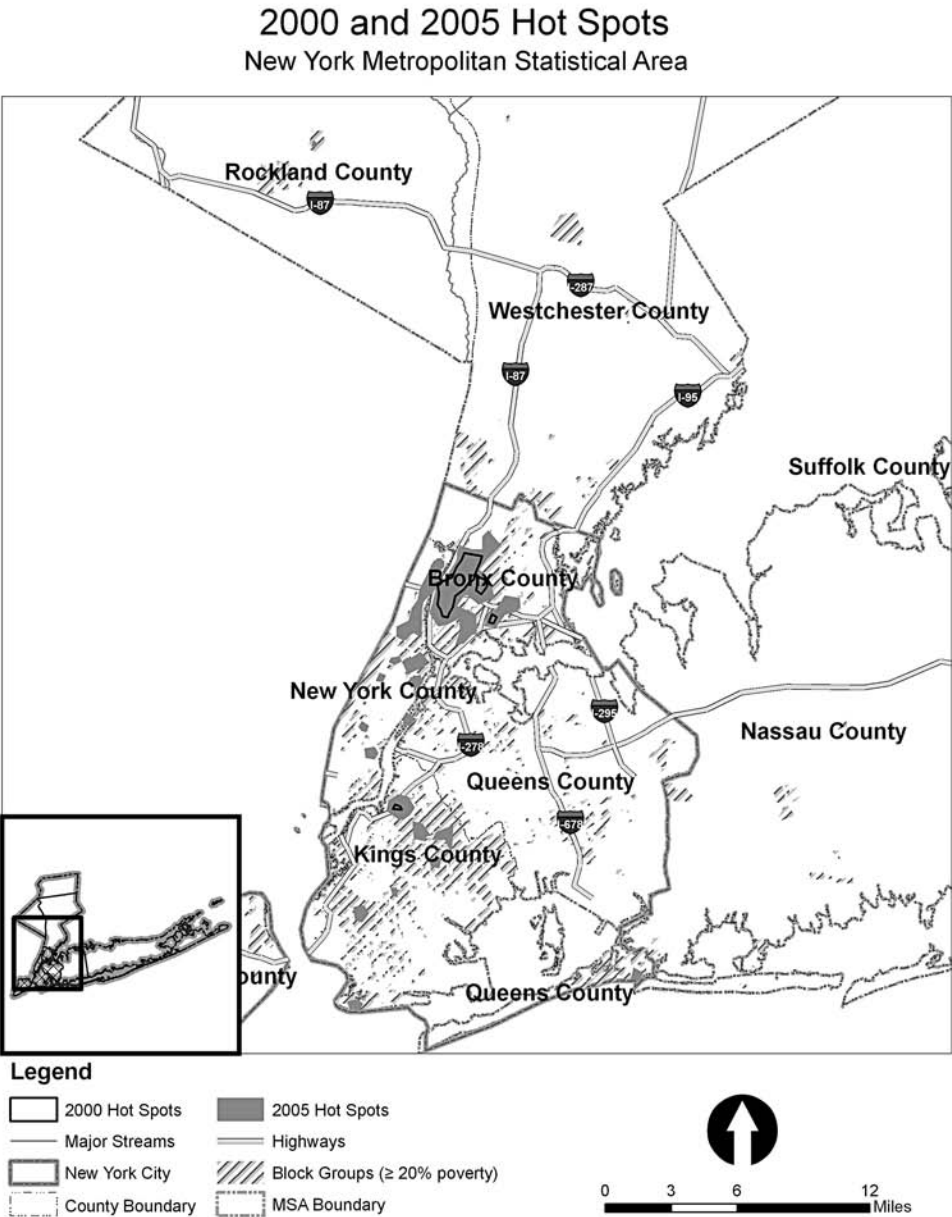
Overall Description of Hot Spots

Exhibits 7 through 14 show the location of hot spots for the eight metropolitan areas in 2000 and 2005. Exhibit 15 compares the metropolitan areas for changes in the proportion of HCVP households residing in hot spots. In the New York metropolitan area, most hot spots are in New York City. The large increase in HCVP households in New York between 2000 and 2005 was accompanied by a five-fold increase in the size of the area encompassed by hot spots (from 2.9 to 15.7 square miles).⁹ Furthermore, the growth in the size of hot spots in New York was accompanied by an increase in the mean density of HCVP households in those hot spots (increasing 25 percent from 2,193 households per square mile to 2,743 households per square mile). As a result, New York stands out from the other metropolitan areas based on the high proportion of HCVP households living in hot spots (41 percent). New York's hot spots were entirely concentrated in New York City in both 2000 and 2005. In 2000, the city hot spots were in northern Manhattan, southern Bronx, and northern Brooklyn. Between 2000 and 2005, hot spots spread over more of these three boroughs.

⁹ Comparisons across metropolitan areas based on hot spot results must be made cautiously; see the concluding section of this article.

Exhibit 7

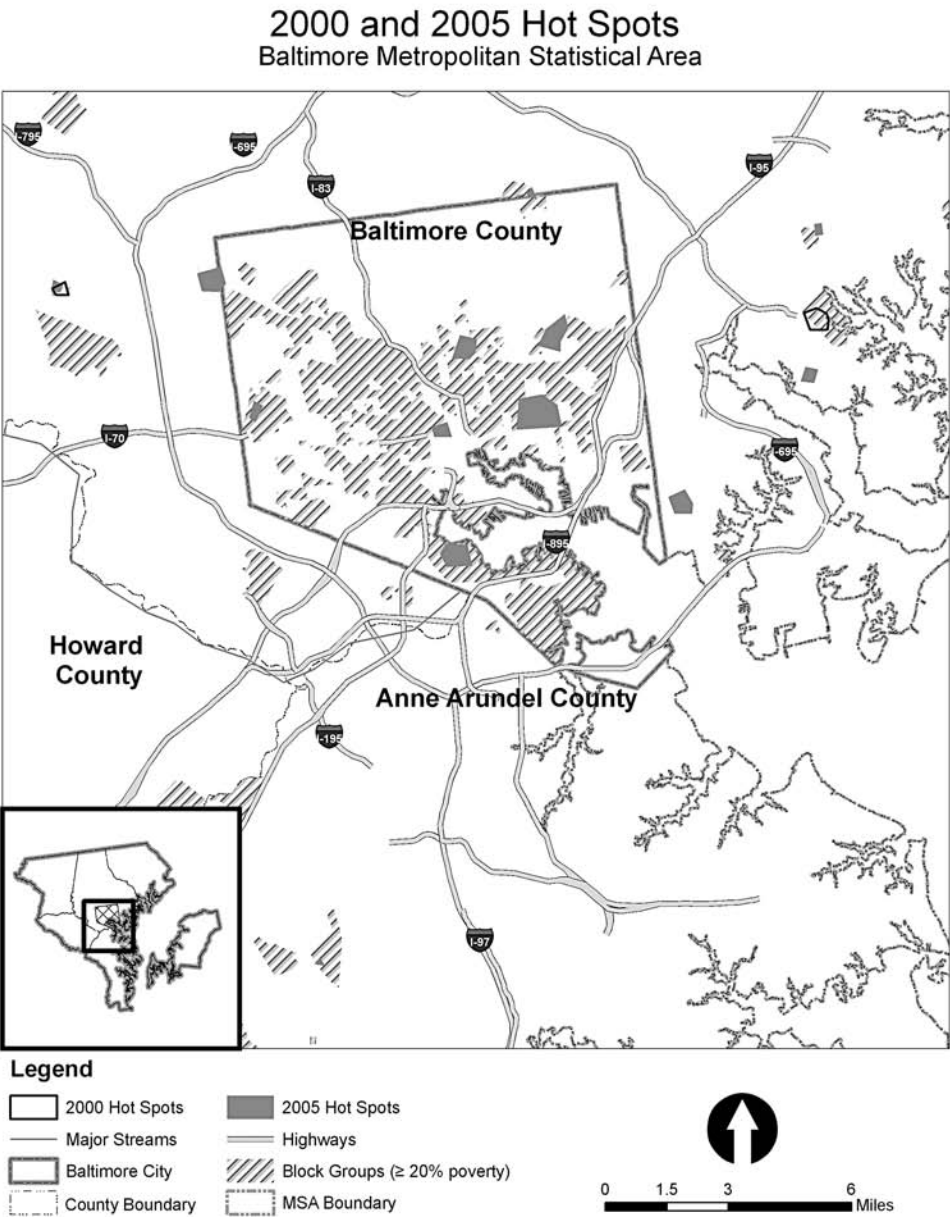
Hot Spots in New York



Sources: Metropolitan and city boundary data provided by HUD in 2006; census block, highway, and stream data obtained from the 2004 ESRI data set

Exhibit 8

Hot Spots in Baltimore



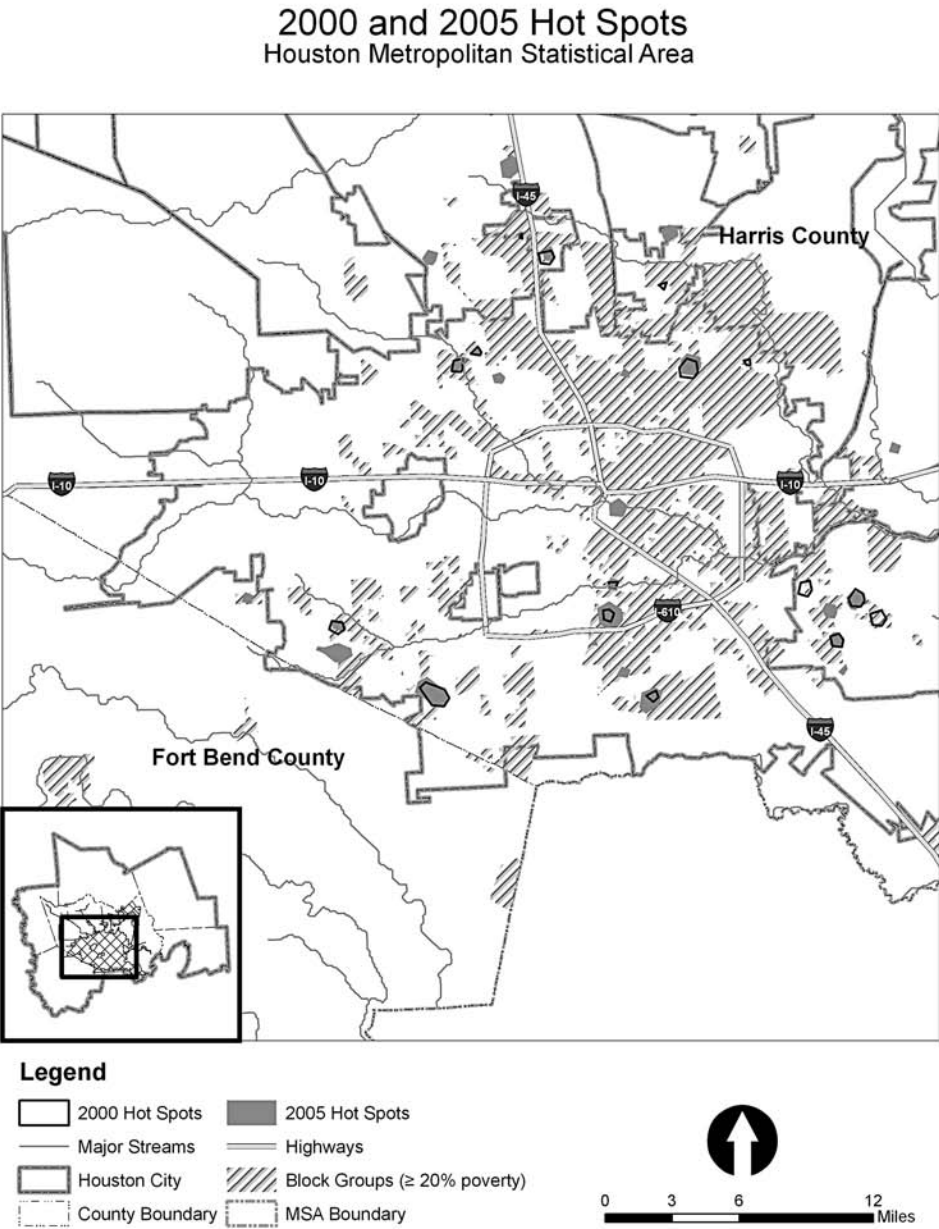
Sources: Metropolitan and city boundary data provided by HUD in 2006; census block, highway, and stream data obtained from the 2004 ESRI data set

Hot Spots in Miami

Sources: Metropolitan and city boundary data provided by HUD in 2006; census block, highway, and stream data obtained from the 2004 ESRI data set

Exhibit 10

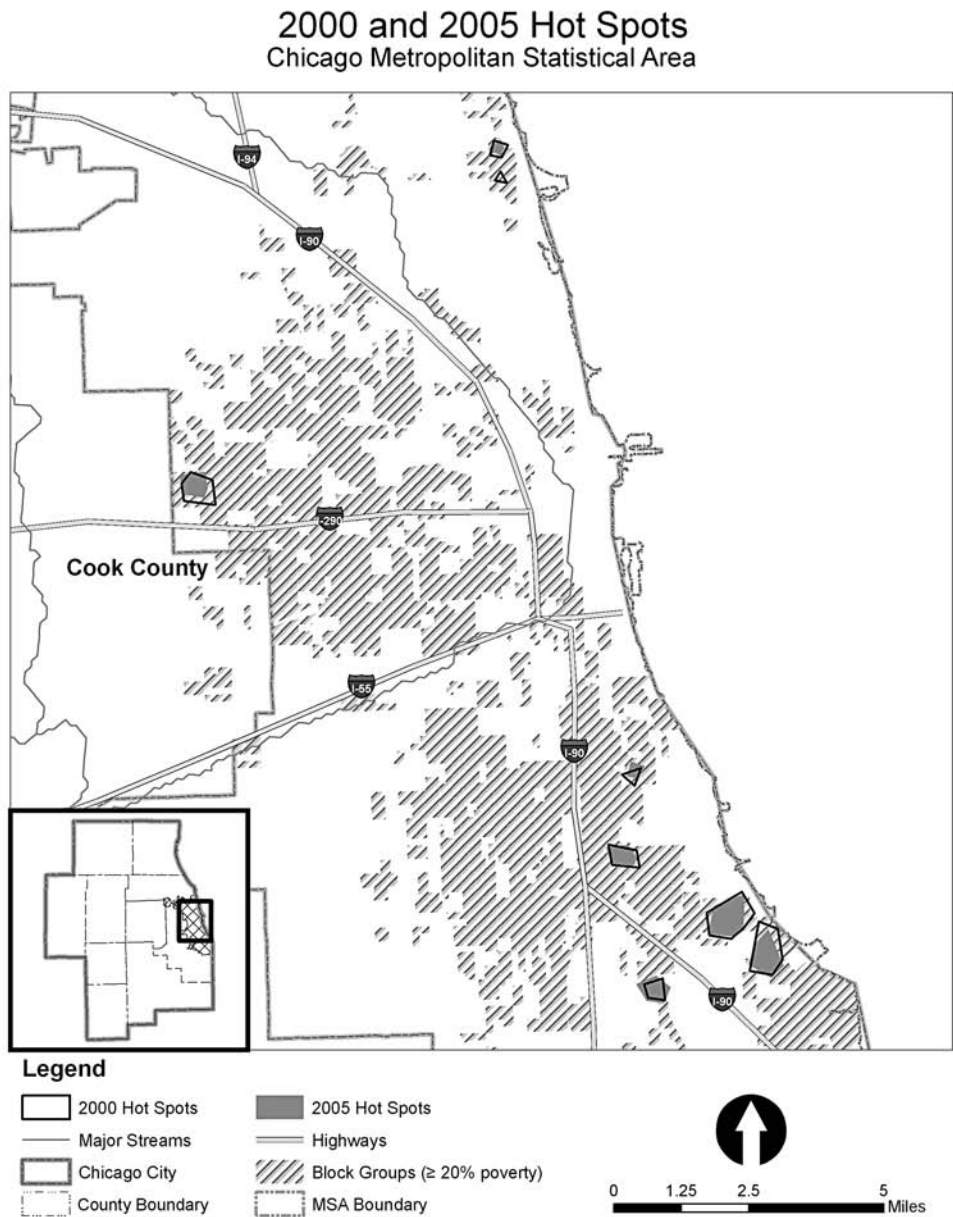
Hot Spots in Houston



Sources: Metropolitan and city boundary data provided by HUD in 2006; census block, highway, and stream data obtained from the 2004 ESRI data set

Exhibit 11

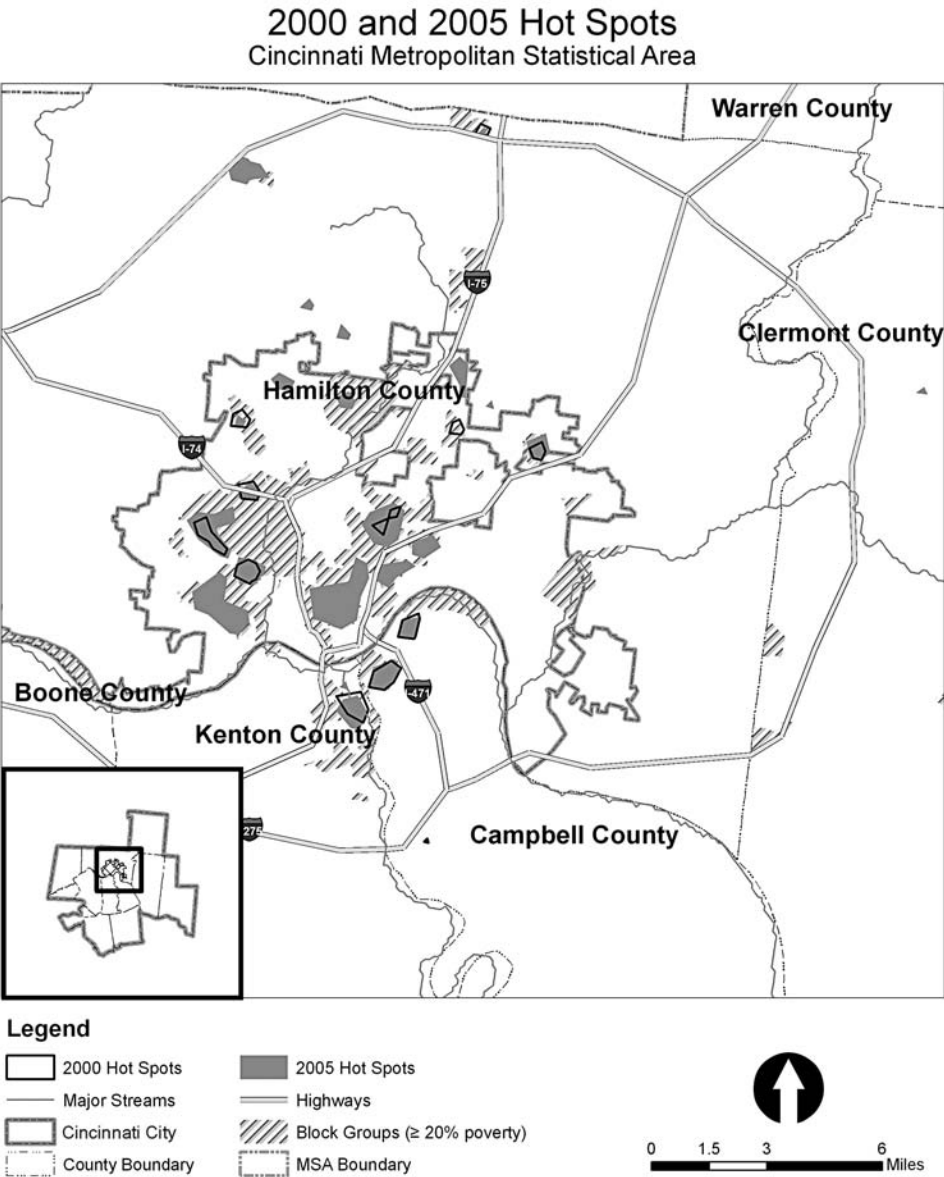
Hot Spots in Chicago



Sources: Metropolitan and city boundary data provided by HUD in 2006; census block, highway, and stream data obtained from the 2004 ESRI data set

Exhibit 12

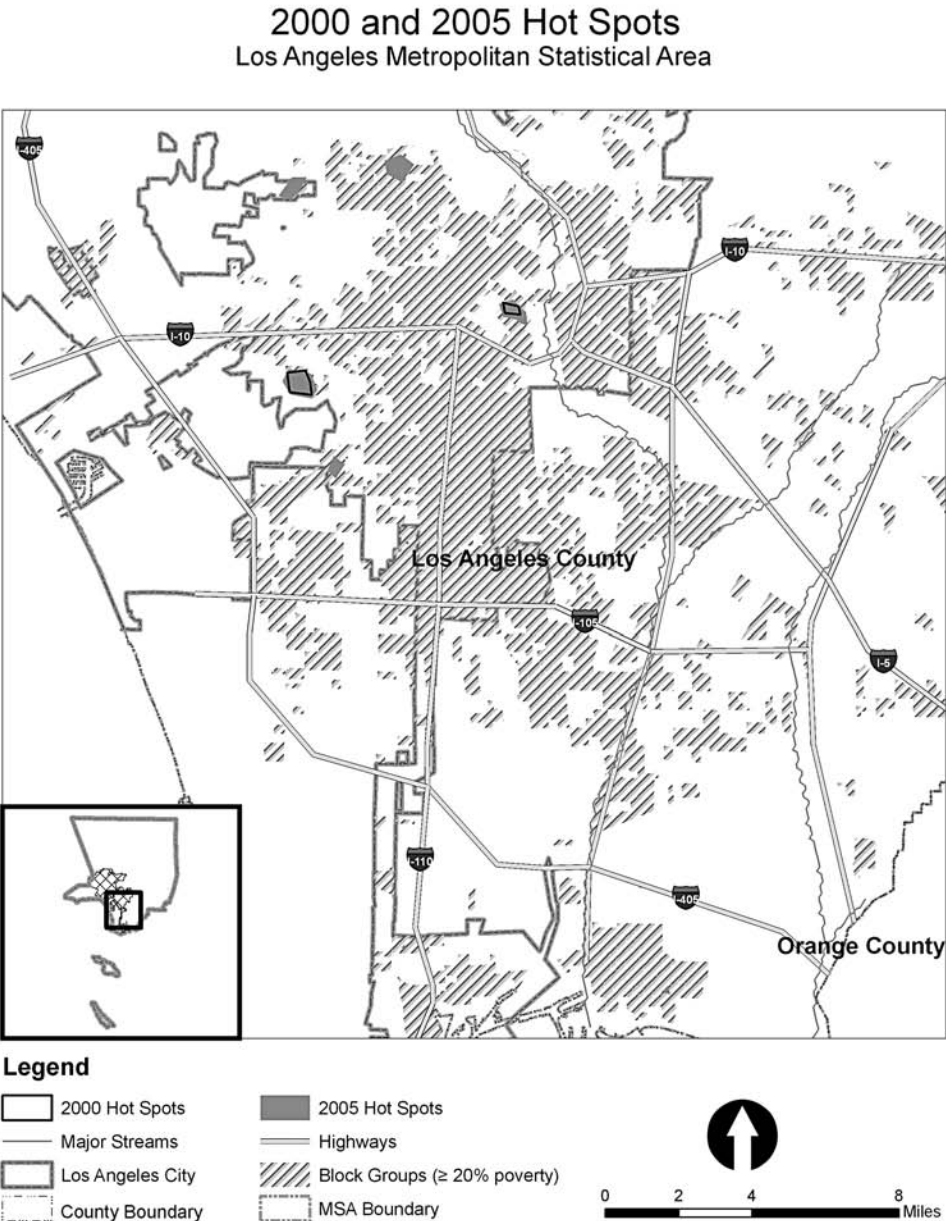
Hot Spots in Cincinnati



Sources: Metropolitan and city boundary data provided by HUD in 2006; census block, highway, and stream data obtained from the 2004 ESRI data set

Exhibit 13

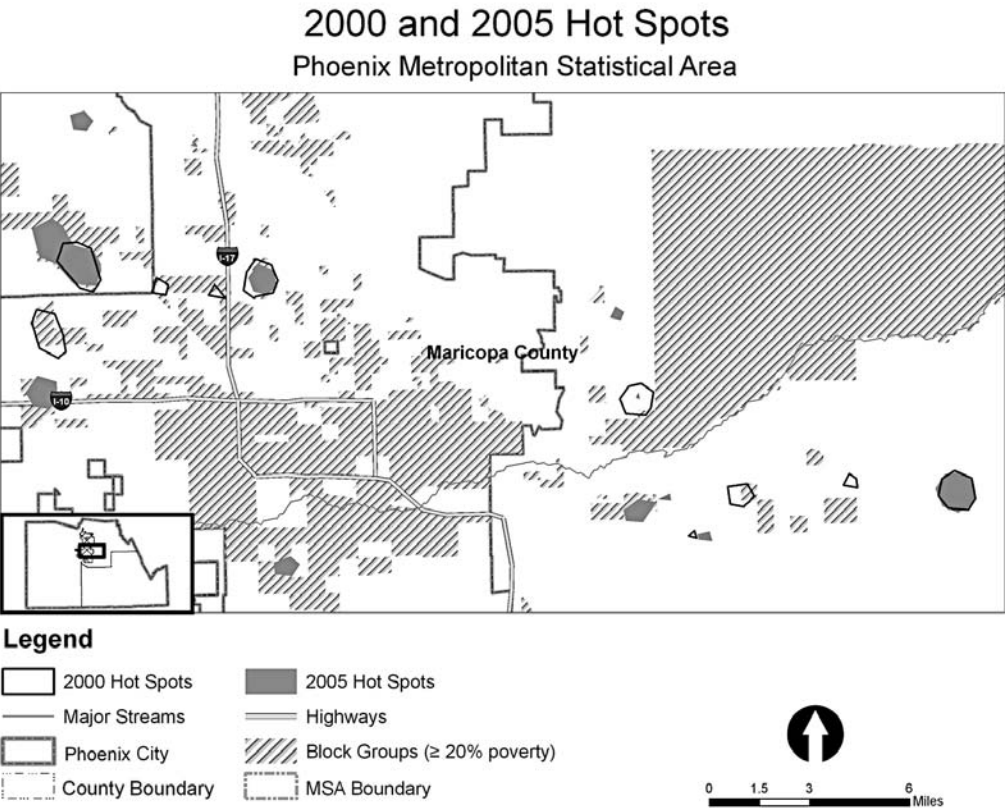
Hot Spots in Los Angeles



Sources: Metropolitan and city boundary data provided by HUD in 2006; census block, highway, and stream data obtained from the 2004 ESRI data set

Exhibit 14

Hot Spots in Phoenix



Sources: Metropolitan and city boundary data provided by HUD in 2006; census block, highway, and stream data obtained from the 2004 ESRI data set

Baltimore also experienced large increases in the number of hot spots and the area covered by them. In 2000, the Baltimore metropolitan area contained only two small hot spots, both outside the city of Baltimore in Baltimore County, one to the west and one to the east of the city. Between 2000 and 2005, the size of hot spots in Baltimore rose from 0.3 to 2.7 square miles. Most new hot spots were in the city of Baltimore, particularly in sections of east, west, and southwest Baltimore. By 2005, the city had eight hot spots and the county had five. Baltimore's hot spots are in neighborhoods populated heavily by African Americans and low-income households.

Topography appears to play a role in accounting for variations in the number of hot spots in the two midwestern metropolitan areas. Cincinnati is a hilly city, which results in relatively well-defined communities and that, in turn, leads to spatially concentrated HCVP populations and many hot spots (44 in the metropolitan area in 2005, up from 15 in 2000). The Cincinnati metropolitan area's hot spots are mostly in the northern sector of Hamilton County, and most of those are within the city limits. Three older Kentucky cities across the Ohio River from Cincinnati (Covington,

Exhibit 15**HCVP Households in Hot Spots**

Metropolitan Area	Year	Total HCVP Households	HCVP Households (Number)	Within Hot Spots (Percent)
New York	2000	59,645	5,475	9
	2005	126,355	51,297	41
Baltimore	2000	9,915	470	5
	2005	20,979	3,300	16
Miami	2000	12,547	1,686	13
	2005	20,758	3,660	18
Houston	2000	9,341	1,632	17
	2005	15,785	3,715	24
Chicago	2000	39,770	3,304	8
	2005	54,078	2,639	5
Cincinnati	2000	8,639	1,623	19
	2005	14,892	5,517	37
Los Angeles	2000	51,276	1,483	3
	2005	75,648	4,429	6
Phoenix	2000	8,602	1,132	13
	2005	11,628	1,132	10

HCVP = Housing Choice Voucher Program.

Sources: 2000 Census block boundary data from 2004 ESRI data set; 2000 Census and HCVP data provided by HUD in 2006

Newport, and Dayton) have hot spots. Three-fourths of the growth of Cincinnati's hot spots over the 5 years took place in the city of Cincinnati, with the biggest change being the emergence of new hot spots to the northeast and northwest of downtown. The area northeast of downtown is located in Cincinnati's African-American ghetto; the one that is northwest of downtown and on the western side of the industrial Mill Creek Valley is in a racially changing area containing garden apartments built in the 1950s, 1960s, and 1970s.

In contrast, Chicago has few hot spots, and the hot spot distribution remained relatively stable between 2000 and 2005. The small number of hot spots may reflect the fact that HCVP density is uniformly high in large swaths of the West Side and South Side, where many HCVP recipients live. This uniformity would depress the number of hot spots. In 2005, five of the seven Chicago hot spots were located on the South Side, one on the western edge of the city, and another to the north of downtown. Chicago's hot spots are in more heavily African-American and higher poverty areas.

In both southern metropolitan areas—Miami and Houston—the size of the hot spots increased between 2000 and 2005; however, the total area encompassed by the hot spots was far larger in Houston than in Miami. In 2000, a major Miami hot spot was located to the west of Interstate 95 (I-95), but many small hot spots also were dispersed throughout Dade County. Although many areas identified as hot spots in 2000 remained as hot spots in 2005, several new hot spots emerged

to the west of the city along U.S. Highway 27. Almost all hot spots were in areas with high proportions of Hispanic and low-income households.

Houston's hot spots were spread throughout the city, but a few were located in the suburbs as well. In general, the hot spots were concentrated in heavily African-American and high-poverty areas. Between 2000 and 2005, a new hot spot developed near downtown Houston, and the hot spot in the south loop expanded. Although more than two-thirds (69 percent) of Houston's hot spots were located outside the central city, only about two-fifths (44 percent) of Miami's were.

In 2000, Los Angeles' hot spots were concentrated in south and central Los Angeles. A few more hot spots appeared over the next 5 years, but, with one exception, all were located inside these same two districts. In general, the hot spots in Los Angeles were located in areas with high proportions of African-American and low-income households. The one new hot spot that emerged between 2000 and 2005 was located south of I-405 in a heavily Hispanic area.

In 2005, nearly nine-tenths (86 percent) of the hot spots in the Los Angeles metropolitan area were concentrated in the city of Los Angeles, while only about one-fourth (27 percent) of the hot spots in Phoenix were inside the central city. Other hot spots in the Phoenix metropolitan area were in the eastern suburban cities (Tempe, Scottsdale, and Mesa) and to the west of Phoenix.

Changing Hot Spots

For each metropolitan area, we classified census block groups into one of four categories: (1) ongoing hot spot areas—that is, contiguous census block groups that fully or partially enclosed a hot spot in both 2000 and 2005; (2) disappearing hot spot areas—that is, contiguous census block groups that fully or partially enclosed a hot spot in 2000 but not in 2005; (3) emerging hot spot areas—that is, contiguous census block groups that fully or partially enclosed a hot spot in 2005 only; and (4) non-hot spot areas—that is, the collection of census block groups that did not fully or partially include a hot spot in either 2000 or 2005. For purposes of simplicity, we use the term “ongoing hot spots” rather than “ongoing hot spot census block groups” (and so forth).

Exhibit 16 shows by metropolitan area the breakdown of census block groups between hot spot and non-hot spot areas. In Los Angeles and Chicago, only about 1 percent of the census block groups enclosed hot spots. In contrast, in New York and Cincinnati, more than 10 percent of the census block groups contained or touched hot spots. In the other four metropolitan areas, between 6 and 8 percent of the census block groups contained or touched hot spots.

Exhibit 17 shows the breakdown of the hot spots by category. As shown, no consistent pattern among the metropolitan areas is evident. Baltimore differed from the other metropolitan areas because virtually all (93 percent) of the hot spots were emerging ones. New York, Cincinnati, and Los Angeles had a high, but not overwhelming, proportion of emerging hot spots, but those locations also had a meaningful proportion (about one-quarter) of ongoing hot spots. In Miami and Houston, the number of hot spots was split equally between emerging and ongoing hot spots. In Phoenix, the hot spots were roughly evenly distributed among all three categories (ongoing, disappearing, and emerging). In Chicago, most (73 percent) hot spots were ongoing ones.

Exhibit 16

Proportion of Hot Spot Census Block Groups

Metropolitan Area	Census Block Groups				
	Total	Non-Hot Spots		Hot Spots	
	(number)	(number)	(percent)	(number)	(percent)
New York	9,103	8,036	88.3	1,067	11.7
Baltimore	1,893	1,775	93.8	118	6.2
Miami	1,221	1,117	91.5	104	8.5
Houston	2,331	2,192	94.0	139	6.0
Chicago	5,970	5,893	98.7	77	1.3
Cincinnati	1,291	1,093	84.7	198	15.3
Los Angeles	6,395	6,336	99.1	59	0.9
Phoenix	2,229	2,099	94.2	130	5.8

Sources: 2000 Census block boundary data from 2004 ESRI data set; 2000 Census and Housing Choice Voucher Program data provided by HUD in 2006

Exhibit 17

Three Categories of Hot Spot Census Block Groups

Metropolitan Area	Hot Spot Census Block Groups					
	Ongoing		Disappearing		Emerging	
	(number)	(percent)	(number)	(percent)	(number)	(percent)
New York	232	22	0	0	835	78
Baltimore	3	3	5	4	110	93
Miami	53	51	8	8	43	41
Houston	55	40	15	11	69	50
Chicago	56	73	14	18	7	9
Cincinnati	54	27	10	5	134	68
Los Angeles	14	24	0	0	45	76
Phoenix	40	31	40	31	50	38

Sources: 2000 Census block boundary data from 2004 ESRI data set; 2000 Census and Housing Choice Voucher Program data provided by HUD in 2006

If the HCVP successfully promoted poverty and minority deconcentration,¹⁰ we would expect to see two results: (1) compared to ongoing hot spots, disappearing hot spots would tend to be in high-poverty and high-minority areas; and (2) compared to ongoing hot spots, emerging hot spots would tend to be in low-poverty and low-minority areas.

Exhibit 18 shows the socioeconomic indicators for the metropolitan areas' hot spots and non-hot spots. In Miami, the proportion of low-income households in disappearing hot spots meets expectations—they are far higher than in ongoing ones (33 and 24 percent, respectively). The results in

¹⁰ We emphasize again that poverty deconcentration is not the main goal of the Housing Choice Voucher Program.

Exhibit 18

Socioeconomic Indicators for the Non-Hot Spot and Three Categories of Hot Spot Census Block Groups

Metropolitan Area	Ongoing Hot Spots (%)	Disappearing Hot Spots (%)	Emerging Hot Spots (%)	Non-Hot Spots (%)
Percentage of Households in Poverty ^a				
New York	39	NA	31	12
Baltimore	19	22	20	8
Miami	24	33	23	14
Houston	33	27	38	1
Chicago	65	32	14	10
Cincinnati	25	14	23	7
Los Angeles	34	NA	28	15
Phoenix	16	18	15	9
Percentage of African Americans				
New York	33	NA	36	19
Baltimore	71	42	61	25
Miami	12	30	9	21
Houston	50	25	44	16
Chicago	87	70	77	18
Cincinnati	48	27	44	8
Los Angeles	62	NA	18	10
Phoenix	6	6	5	4
Percentage of Hispanics				
New York	59	NA	45	17
Baltimore	2	3	3	2
Miami	76	60	79	55
Houston	32	56	28	30
Chicago	3	8	4	17
Cincinnati	1	2	2	1
Los Angeles	24	NA	32	45
Phoenix	32	40	37	24

NA = not available.

^a We used the 2000 Census definition that identified households below the poverty level.

Sources: 2000 Census block boundary data drawn from the 2004 ESRI data set; 2000 Census and Housing Choice Voucher Program data provided by HUD in 2006

Chicago are mixed. As expected, the proportion of HCVP households in poverty is lower in emerging than in ongoing hot spots (14 percent versus 65 percent). In contrast to expectations, however, the percentage of HCVP households in poverty areas is also lower in disappearing hot spot areas (32 percent) than in ongoing hot spots (65 percent). In Houston, emerging hot spots had higher proportions of households below the poverty level than did ongoing hot spots.

The results dealing with race and ethnicity were similarly inconclusive. As expected, Miami's disappearing hot spots had higher proportions of African Americans than ongoing or emerging hot spots

did. At the same time, Miami's disappearing hot spots had relatively low proportions of Hispanics. Houston exhibited the opposite pattern. There, disappearing hot spots had higher proportions of Hispanics, but low proportions of African Americans. In Los Angeles, the results are consistent with the deconcentration hypothesis; that is, the proportion of African Americans in emerging hot spot areas was much lower than in ongoing ones (18 percent versus 62 percent). The Los Angeles pattern was not evident in any of the other metropolitan areas.

Conclusions

Using hot spot analysis, this article has sought to expand the limited literature available on the spatial distribution of households participating in HUD's HCVP. To perform this hot spot analysis, we created two HCVP-recipient density raster grids for eight metropolitan areas, two in each region of the United States. We defined HCVP hot spots for each metropolitan area as the aggregation of grid cells with an HCVP density greater than half of the highest 2000 HCVP density in the metropolitan area.

In general, the results should dampen expectations concerning the potential effect of the HCVP on poverty deconcentration. First, minimal evidence suggested that HCVP was shifting to the suburbs. Although the proportions of HCVP recipients living in the central city decreased between 2000 and 2005 in Phoenix, Houston, and Chicago, they increased in the other five metropolitan areas.

Second, little indicated that the HCVP was promoting poverty or minority deconcentration. The proportion of HCVP households in high-poverty and high-minority (African-American or Hispanic) census block groups remained stable during the 2000-to-2005 period. Furthermore, there was no support for our hypothesis that disappearing hot spots would have relatively high-poverty and minority-population rates while rates in emerging hot spots would be relatively low.

Third, no evidence emerged to show a decline in HCVP clustering. Although HCVP recipients were becoming less concentrated in hot spots in Chicago and Phoenix, the opposite was true in the other metropolitan areas, especially in New York, Cincinnati, and Baltimore.

Fourth, the results also failed to show that the hotter the housing market, the greater the degree of concentration of HCVP households in hot spots. The concentration of HCVP recipient hot spots in the hottest housing market, New York, was comparable to the degree of concentration in the coolest housing market, Cincinnati. Both levels of concentration far exceeded that in Chicago, another hot-market area.

Finally, the results show that growth in the HCVP between 2000 and 2005 has affected clustering patterns in different metropolitan areas in different ways. In New York and Cincinnati, the growth of the HCVP population has led to a large increase in the number of hot spots, the density in these hot spots and the areas they encompass, and the characteristics of the population living in the hot spots. In contrast, Chicago and Los Angeles continue to have few hot spots that cover only relatively small areas.

The fact that many HCVP households live in central cities and that HCVP clustering continues should not be surprising. HCVP housing opportunities are limited to available affordable housing; that is, to properties renting below Fair Market Rent or at the somewhat higher payment standard. If

these units are concentrated in particular areas, housing agencies can do little to move households to other areas. Other factors, such as proximity to friends, churches, and public transportation, also contribute to the continued concentration of poverty and to the continued concentration of HCVP households. Unless the distribution of affordable housing opportunities changes, the clustering of HCVP clients and their concentration in high-poverty, high-minority areas will continue.

Implications for HCVP Hot Spot Research

We caution against comparing the number of hot spots in one metropolitan area with those in another metropolitan area. A metropolitan statistical area (MSA) with high HCVP densities may not have many hot spots if the HCVP households are evenly distributed within large districts such as Chicago's South Side and West Side. On the other hand, an MSA with much lower HCVP densities may contain a large number of hot spots if HCVP households are confined to relatively clearly defined communities based on topography or housing patterns (for example, Cincinnati). The most appropriate use of hot spot analysis is for examining changes in the location of hot spots for particular metropolitan areas over time. For example, are more of them emerging outside the central city?

Furthermore, hot spot results are sensitive to density distribution and, in particular, to extremely high densities. In Baltimore, Chicago, and Los Angeles, the highest densities were 25 to 32 times as high as the mean densities; the ratios in the other five metropolitan areas were between 12 and 20 times as high as the mean densities. Consequently, fewer hot spots were identified in the three high-density metropolitan areas.

The number of hot spots should not be confused with the number of HCVP households in the metropolitan area. The latter affects the density value for the whole metropolitan area, not the spatial distribution within the metropolitan area. For example, some hot spots may be so close to each other that they merge into a bigger hot spot. In other metropolitan areas, hot spots may be very distant from each other. The policy implications of these two patterns are quite different.

Hot spot results are very much affected by the threshold value chosen. In our study, we used the value that was half of the highest 2000 HCVP density for that particular metropolitan area. Other methods may be used to define the threshold value, such as using three standard deviations above the mean density. Density is calculated from the number of HCVP households in the area's vicinity. Clearly, hot spot analysis is as much an art as it is a science.

Our experience demonstrates that it is more important to use the hot spot method to focus attention on certain areas rather than highlight the actual hot spot boundaries. Some hot spots effectively identify the areas of HCVP household concentration. In other cases, however, the actual boundary may not appear reasonable because, for example, it may cut through an apartment complex rather than include the entire development. It is important to recognize that density is calculated for each cell and that the resulting density statistic is a function of the number of HCVP recipients in the vicinity of the cell. Take, for example, a high HCVP density apartment complex with a scattering of HCVP households in the vicinity of the complex. The dispersal pattern of HCVP households outside the apartment complex could affect the actual shape of the hot spot.

Hot spot analysis is most likely to be useful as a research and planning tool if it is combined with field observation. The latter could help in identifying different types of hot spots (for example, 1950s and 1960s garden apartment complexes, newer low-income housing tax credit developments, or single-family detached home neighborhoods containing houses for rent). Field observation is a necessary prerequisite for developing programs that address the unique clustering-related issues pertinent to these different types of neighborhoods.

Authors

Xinhao Wang is a professor of planning at the University of Cincinnati.

David Varady is a professor of planning at the University of Cincinnati.

Yimei Wang is a graduate student at the University of Cincinnati.

References

- Atkinson, P.J., and D.J. Unwin. 2002. "Density and Local Attribute Estimation of an Infectious Disease Using MapInfo," *Computers and Geosciences* 28: 1095–1105.
- Frey, William H. 2006. *Diversity Spreads Out: Metropolitan Shifts in Hispanic, Asian and Black Populations Since 2000*. The Living Cities Census Series (March). Washington, DC: The Brookings Institution. Available at http://www.brook.edu/metro/pubs/20060307_Frey.pdf.
- Harries, Keith. 1999. *Mapping Crime: Principle and Practice*. Washington, DC: U.S. Department of Justice.
- National Low Income Housing Coalition (NLIHC). 2005. *Out of Reach*. Washington, DC: National Low Income Housing Coalition. Available at <http://www.nlihc.org/oor/oor2006/data.cfm?getstate=on&getmsa=on&msa=401&state=AZ>.
- U.S. Department of Housing and Urban Development (HUD). 2003. *Housing Choice Voucher Location Patterns: Implications for Participant and Neighborhood Welfare*. Washington, DC: U.S. Department of Housing and Urban Development. Available at http://www.huduser.org/publications/pdf/Location_Paper.pdf.
- . 2001. *Housing Choice Voucher Handbook*. Washington, DC: U.S. Department of Housing and Urban Development.
- . 1998. *A Picture of Subsidized Households in 1998*. Washington, DC: U.S. Department of Housing and Urban Development. Available at <http://www.huduser.org/publications/pubasst/picture.html>.
- Wang, Xinhao, and David P. Varady. 2005. "Using Hot Spot Analysis to Study the Clustering of Section 8 Housing Voucher Families," *Housing Studies* 20 (1): 29–48.