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ORIGINAL PAPER

The Effects of Multiple Dimensions of Residential Segregation on Black and Hispanic Homicide Victimization

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Abstract Past research examining the association between residential segregation and homicide victimization has often considered only one dimension of segregation, and the literature that does use a multidimensional approach has not presented a uniform set of findings. The majority of the studies have focused on the experiences of Blacks, while overlooking the possibility that the differences between the structure of Black and Hispanic communities may alter the conclusions for Hispanics. In this study, we argue that in order to understand the mechanisms underlying the effects of segregation on homicide, we need to understand the multidimensional structure of Black and Hispanic segregation, and examine whether the relationship between segregation and homicide differs for Blacks and Hispanics. Using 2000 census data and homicide data from the National Vital Statistics System (1999–2001) for U.S. metropolitan areas, we identify two empirically distinct superdimensions of segregation (group separateness and centralized concentration), both of which have a substantial positive and statistically significant impact on homicide victimization for both Blacks and Hispanics.

Keywords Black · African American · Hispanic · Homicide · Racial segregation · Victimization

Introduction

Despite continuing efforts to bring about housing integration, racial and ethnic residential segregation remains a prominent feature of American life. In the 2000 census, Blacks continued to be the group most segregated from Whites, although their levels of segregation have shown a continued decline in the last three decades (Lewis Mumford Center 2001). Hispanics and Asians, in contrast, have experienced rising segregation because of

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their expanding populations as a result of continuous immigration (Logan et al. 2004; Wilkes and Iceland 2004).

Previous research has debated the consequences of segregation for segregated groups and the broader society (Cutler and Glaeser 1997; Massey and Denton 1993). The present study focuses on the consequences of segregation for homicide victimization. Prior to the 1990s, only a few studies explored how segregation may contribute to the high rates of victimization among minorities (see, e.g., Cohen et al. 1981; Messner and South 1986). Over the last two decades, however, researchers have begun to focus more on the mechanisms of victimization that operate in spatial terms, which has resulted in more research on the impact of segregation on the incidence of victimization (see, e.g., Collins and Williams 1999; Lee and Ousey 2007; Peterson and Krivo 1993; Phillips 2002).

In spite of this progress, much remains to be learned about the relationship between segregation and homicide victimization. Two issues are at the center of discussion in this paper. First, existing research has paid inadequate attention to the fact that segregation has different geographic forms (Massey and Denton 1988), each of which may contribute differently to victimization. Shihadeh and Flynn (1996) and Shihadeh and Maume (1997) were among the first to report that the estimated effect of segregation on homicide can vary depending on which indicator is used to describe the nature of segregation. Research in this area, however, is still dominated by the use of the index of dissimilarity, even though this index (or any other single indicator of segregation) may misrepresent the level of segregation in certain areas. The practice of considering only one dimension of segregation hampers theoretical progress in understanding the mechanisms that link segregation and homicide victimization. Without clear guidance from theory, the choice of segregation measures becomes somewhat arbitrary, and the interpretation of the effects of segregation becomes difficult.

Second, previous research on how segregation affects homicide has focused almost exclusively on the experiences of Blacks. Although the focus is understandable given that Black segregation is most severe among all groups, it nevertheless means that our knowledge of victimization in other populations is still very limited. As census data show, Hispanics are the fastest-growing population in the United States. With an estimated number of 45.5 million people in 2007, they now account for 15% of the total population and exceed Blacks by 4.8 million (U.S. Census Bureau 2008). Evaluating the effects of segregation for this population is thus central to understanding the exposure of minorities to homicide victimization.

The analysis of Hispanic segregation is important for theoretical reasons as well. Blacks and Hispanics share important structural similarities as they both experience high levels of poverty and poverty-related problems such as inadequate housing and crowded living conditions (Dalaker 2001). Despite these similarities, significant differences between the two groups make it important to examine the impact of segregation on each population. Research suggests that the residential segregation of Hispanics is different both in degree and in kind from that of Blacks: Not only do Hispanics experience lower levels of segregation, but their segregation may occur for reasons different from those that contribute to Black segregation. Migrant social networks, for example, tend to direct Hispanic immigrants to ethnic communities where their friends or relatives live (Kasinitz 1992; Massey 1986). The formation of such ethnic enclaves may, thus, reflect voluntary housing choices rather than discrimination that characterizes the formation of black communities (Allen and Turner 2009; Charles 2003). The critical question is, given the potential group differences, whether the consequences of segregation on the risk of homicide are less severe, or perhaps even beneficial, for Hispanics than for Blacks.

In this study, we argue that in order to understand the mechanisms underlying the effects of segregation on homicide, we need to understand the multidimensional structure of Black and Hispanic segregation, and examine whether the relationship between segregation and homicide differs for Blacks and Hispanics. We addressed these issues using 2000 census data for U.S. metropolitan areas and homicide data from the National Vital Statistics System (1999–2001).

How Might Segregation Affect Homicide Victimization?

Perhaps the easiest way to think about segregation is that segregation exists when a minority group is distributed unevenly—some neighborhoods have a large share of minorities, while others do not. Intuitive and straightforward, this understanding of segregation has led many researchers to use the index of dissimilarity (D) to examine, or control for, the effect of segregation on violence (e.g., Krivo and Peterson 2000; Lee 2000; Parker 2001; Parker and Pruitt 2000; Peterson and Krivo 1999; Stretesky et al. 2004). While the research is informative, a problem with this approach is that the index of dissimilarity (or any other single measure) does not capture the full extent of segregation. As an example, Fig. 1 shows the distribution of Blacks in Metro St. Louis and Nassau-Suffolk, NY in 2000. Blacks were distributed equally unevenly across the two metropolitan areas ($D = .73$ in both cases). Blacks in St. Louis, however, were located near the urban center and were closely packed into contiguous Black neighborhoods, whereas in Nassau-Suffolk, Blacks were more scattered in space and were therefore less segregated if assessed by measures of centralization and clustering. Had we only used the index of dissimilarity, such differences in the level of segregation would have been overlooked.

Taking a different approach, Johnston et al. (2007) found that the patterns of minority segregation in U.S. metropolitan areas can be described sufficiently well by two overarching concepts: "separation" (reflecting the degree to which members of a minority group are clustered together in relative isolation), and "location" (reflecting the degree to which minority members are located near the urban center where they are highly concentrated). In essence, these concepts encompass and replace the original five dimensions of segregation of Massey and Denton (1988). Because these concepts or "superdimensions" (Johnston et al. 2007: 479) are linked to different mechanisms through which segregation can affect homicide victimization, we use this framework to develop a model of the effects of segregation.

Group Separation and Homicide Victimization

In studies that use the index of dissimilarity, it is not always clear what accounts for the often-reported positive relationship between segregation and homicide. In much of the research, studies refer to segregation vaguely as a form of racial inequality that causes economic disadvantage among minority groups (Shihadeh and Flynn 1996, provide a useful review). As a consequence, segregation patterns are frequently treated as a small (and often insignificant) part of the large literature on class and violence. In fact, because segregation is so embedded in the thinking of economic disadvantage, it is not uncommon for studies to take the index of dissimilarity and other indicators of disadvantage, combine them into a composite measure, and report the overall effect of the disadvantage index on homicide, but not the independent effect of segregation (e.g., Messner and Golden 1992; Parker 2004; Wadsworth and Kubrin 2004).

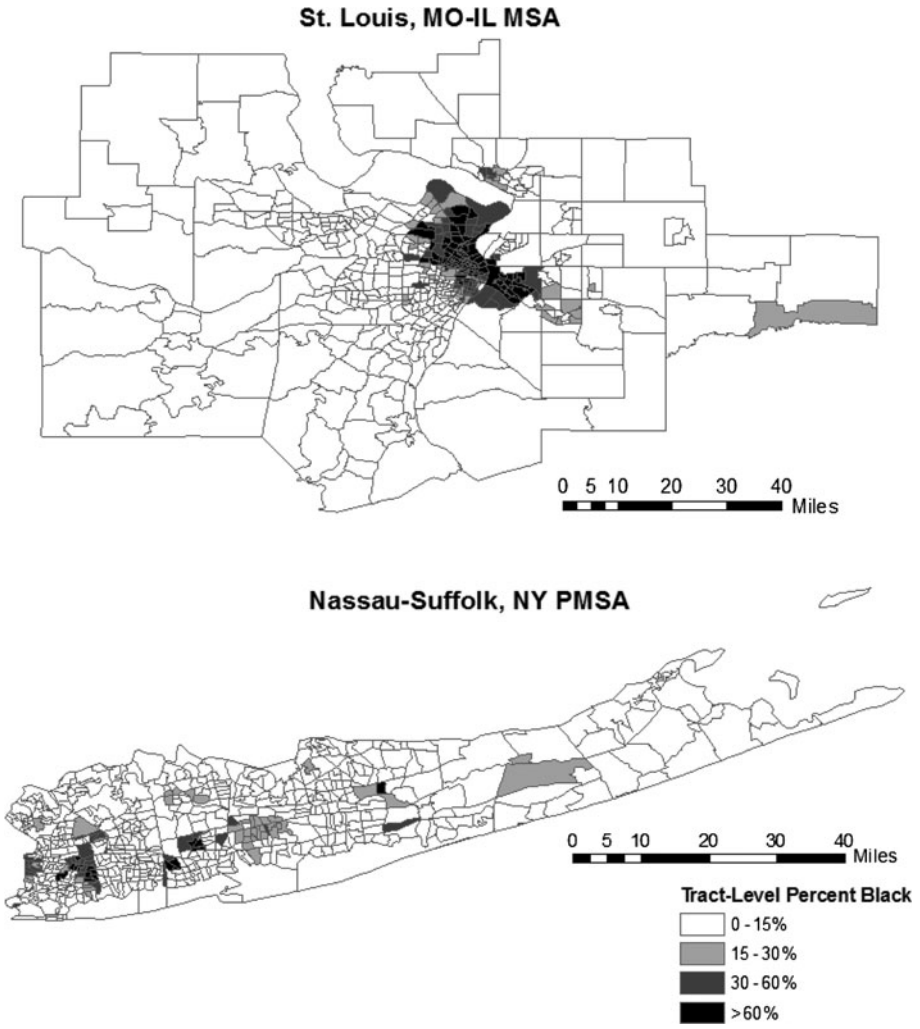

Fig. 1 Spatial distribution of the Black population in two Metropolitan areas with equal unevenness, 2000

To give segregation the full attention that it deserves, Shihadeh and Flynn (1996) pointed out, correctly, that the spatial forms of segregation that are not captured by the index of dissimilarity should be considered. They specifically focused on the concept of isolation, arguing that Black isolation is an alternative mechanism through which segregation generates violence. Based on criminological theories, they identified three processes—economic, cultural, and political—that link Black isolation to violence. Spatial isolation, they argued, is economically costly for Black neighborhoods. Isolation, for example, may create barriers for Blacks to enter the primary labor market (see Massey and Denton 1993). Poor labor force outcomes may contribute to economic decline in Black communities and increase Blacks' exposure to violence.

The effect of isolation, at the same time, reaches beyond the economic well-being of families and communities. Because of isolation, Blacks have reduced opportunities to

interact with individuals and institutions that represent mainstream society. This isolation, Shihadeh and Flynn argued, could be culturally and political damaging to Black neighborhoods: Isolation may contribute to the attenuation of conventional values, and such examples may include aggressive demeanor, weak attachment to social institutions, and tolerance for single parenthood (also see Anderson 1999; Wilson 1987); isolation may also weaken the political power of Blacks and contribute to the failure of pluralist politics, which in turn may drive up crime and leave communities vulnerable to further deterioration (see Massey and Denton 1993).

While Shihadeh and Flynn (1996) provided a compelling description of how isolation influences homicide, their measure, Lieberson's (1981) P^* index, does not capture the full degree of group isolation. The P^* index represents the probability that the next person a random Black will meet from his or her neighborhood (however defined) is also Black. Thus, the potential for Black isolation is higher in a neighborhood where Blacks account for 70% of population than it is in another neighborhood where Blacks account for 40% of population (since Blacks in that neighborhood have more neighbors who are not Black).

In contrast, the concept of group separation, as used by Johnston et al. (2007), provides a more complete perspective on how to measure the level of group isolation. Johnston et al. (2007) found that in metropolitan areas where minority members are very unevenly distributed, they also tend to experience high degrees of *isolation* and *clustering*, two basic dimensions of segregation identified by Massey and Denton (1988). To illustrate this, Fig. 2 shows two hypothetical metropolitan areas *A* and *B*, each containing the same numbers of Black and White neighborhoods, but there is a crucial difference: In area *A*, Black neighborhoods are scattered in a checkerboard pattern, whereas in area *B*, Black neighborhoods are clustered together. Because of this difference, the level of group isolation is different: In area *A*, Blacks can still meet and interact with Whites once they venture out of their own neighborhoods; in area *B*, however, Black neighborhoods are surrounded by other Black neighborhoods, and therefore, opportunities are further reduced for Blacks to interact with Whites. Thus, by combining isolation and clustering, the composite measure of group separation captures more accurately the degree to which a minority group is spatially isolated from Whites.

By using the P^* index, Shihadeh and Flynn (1996) implicitly focused on within-neighborhood isolation, while giving little consideration to between-neighborhood isolation. The work of Sampson, Morenoff, and colleagues, however, would suggest a different approach (Morenoff 2003; Morenoff et al. 2001; Sampson et al. 2002). According to these authors, the focal neighborhoods in which people reside are just one social context in

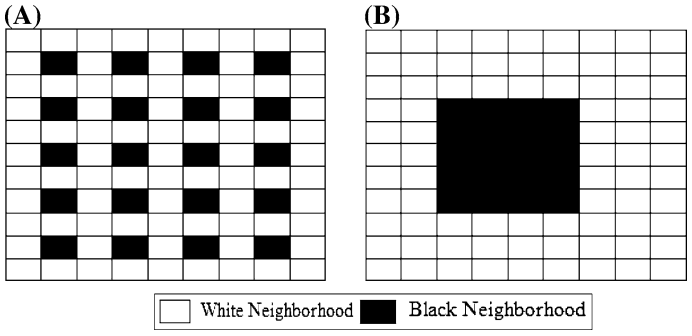

Fig. 2 Two hypothetical neighborhood distributions

which people live their lives. More often than not, social activities unfold in places outside of people's own neighborhoods. These might include activities people do when they go to work, attend school, pursue leisure, and visit family or friends. Based on these observations, Sampson et al. (2002: 472) argued that the expansion of community context to include extralocal conditions in nearby neighborhoods would enrich our understanding of the "spatial advantages or disadvantages" that a neighborhood may produce for residents in adjacent areas. Following the same logic, if one is examining segregation in order to consider the impact of group isolation on victimization patterns, then the P^* index by itself does not tell enough, and the more complete measure of group isolation, the superdimension of separation, would be more accurate.

In a recent study, Eitle (2009) examined whether the superdimensions of separation and location have independent effects on Black homicide victimization. Contrary to the theoretical expectation outlined above, he found that Black separation has no significant impact on the rates of homicide victimization measured at the metropolitan level. Eitle's study thus challenges the view that Black isolation has adverse consequences for the personal safety of Blacks. Before we hasten to modify the theory, we reanalyzed here the impact of separation on homicide, including a larger set of control variables to account for other possible sources of variation in the risk of homicide victimization.

Group Location and Homicide Victimization

Group separation, though important, says little about whether minority members live near the urban center or on the fringes of metropolitan areas, or how much land area is occupied by minority communities (relatively large or small). Johnston et al. (2007) found a close relationship between location and concentration in the distribution of minority members: In metropolitan areas where minority members live close to the urban center, they also tend to live at relatively high concentration. Massey and Denton's (1988) indices of centralization and concentration can, therefore, be combined to form a superdimension of "location" (or, as we term it, centralized concentration).

Evidence supporting a causal link between centralized concentration and homicide victimization is scattered in literature. Taken together, past research has suggested at least two mechanisms that are uniquely tied to the location and areal size of group settlement—job decentralization and crime opportunities—through which the centralized concentration of minorities may contribute to high rates of homicide victimization. First, in studying the impact of housing discrimination on Black employment, Kain (1968) argued that the central location of Black neighborhoods and the suburbanization of employment may create a spatial mismatch between residences and the location of jobs that may reduce the employment opportunities of Blacks.

Consistent with this hypothesis, research has shown that the disadvantages of inner-city life are evident at large urban cores where tax revenues are shrinking with the outflow of the wealthy to the suburbs, and where low-skilled jobs are dwindling with the decentralization of manufacturing and retailing (Kasarda 1989; Wilson 1987). If minority neighborhoods are located far from suburban areas where many jobs are located, then minorities may be less aware of such job opportunities, or be discouraged from seeking employment by the high costs of commuting. These effects may explain the often-reported relationship between job accessibility and the poor labor-market outcomes of minorities residing in central cities (for a review see Gobillon et al. 2007). Thus, job decentralization may be responsible, at least partly, for a variety of negative outcomes including the increase in crime and victimization (Ihlanfeldt 2002).

Second, the amount of land area occupied by minority communities is important as well. Particularly, the spatial concentration of minorities may increase their exposure to violence by changing the opportunity structures of crime. Suppose that minority members are all living in small, rather than large, neighborhoods. Then, their spatial concentration may produce crowded environments in which minorities have higher risks of victimization. Indeed, although spatial concentration and residential density are not the same concept, research has shown that high levels of concentration are related to measures of density that indicate high levels of crowding on a per room and per unit basis (Bond Huie and Frisbie 2000). Based on urbanism and crime opportunity theories, increased population density may induce distinctive patterns of social relationships, such as large variation in individual backgrounds and frequent close contact among strangers (Cohen and Felson 1979; Skogan 1977). Aggression, crime, and victimization might be expected under these circumstances to be prevalent in areas where minorities live under conditions of high spatial concentration. Empirically, this mechanism should produce a direct link between concentration and victimization that is independent of the effect of economic deprivation.

In short, like group separation, the extent to which minorities are concentrated in inner-city locations is likely to influence their rates of homicide victimization. Because the indicator of centralized concentration is largely independent of the indicator of separation, focusing on one but not the other may underestimate the effect of segregation in some urban areas. In previous research, the positive relationship between centralization and homicide was confirmed by Shihadeh and Maume (1997). Eitle (2009), using a composite measure that he called the "location index," found that the location index has a significant impact on homicide victimization. It remains a question, however, as to whether separation and location have independent effects on homicide as theories would suggest. Shihadeh and Maume (1997) did not include a measure of separation; Eitle (2009), on the other hand, found that only location (not separation) is important for homicide victimization. In the present study, we re-tested the effects of separation and location. We also extended the analysis to include the Hispanic population, who, as suggested below, might be affected differently by segregation than Blacks are.

Offsetting Effects of Segregation: Is the Effect on Homicide Racially Invariant?

Compared to Black segregation, less has been written about the segregation of Hispanics and how it affects homicide victimization. What makes the study of Hispanic segregation particularly important is the ongoing debate about the costs and benefits of ethnic enclaves. Unlike segregated Black neighborhoods, other ethnic enclaves may experience offsetting beneficial effects.[1] Ethnic enclaves, for example, are often perceived as buffer zones that allow the retention of ethnic languages and cultures (Varady 2005). Racial discrimination has played a smaller role in the creation of Hispanic enclaves than in the formation of Black segregation (Massey and Mullan 1984). Some scholars have accordingly argued that living in ethnic enclaves may have benefits for ethnic minority groups (e.g., Denner et al. 2001; Rodriguez 1993).

Concerning the role of segregation in victimization, two benefits of ethnic enclaves are perhaps important to our understanding of whether and why segregation may have a

[1] Some researchers also argued that the segregation of Blacks may have positive impact on the social outcomes of Blacks (see a discussion in Cutler and Glaeser 1997). In general, however, studies tend to agree that residential segregation has a strong adverse effect on the social outcomes of Blacks (for a review see Charles 2003).

different effect for Hispanics. First, from an economic perspective, Portes and his colleagues proposed an enclave-economy hypothesis (Portes and Manning 1986; Wilson and Portes 1980). Based on their study of the labor-market experiences of Cuban refugees in South Florida, they argued that the establishment of enclaves may enable ethnic businesses to use ethnic networks to develop informal sources of capital, and that enclave workers might receive better returns to human capital than those employed in White-owned, secondary labor market. This argument, if correct, would suggest that some of the negative consequences of segregation might be offset by the formation of enclave economies.

Second, from a social organization perspective, some studies suggest that there might be important differences between Blacks and Hispanics in their family structures and the effectiveness of local institutions. Studies have reported a strong influence of familism in the Hispanic culture (Sabogal et al. 1987; Shaull and Gramann 1998). Consistent with this view, some case studies, including the work of Moore and Vigil (1993) and Vélez-Ibáñez (1993), reported that Hispanics rely in large degree on extended family and kin networks for child care, recreation, and other social functions. These observations stand in contrast to the study of Wilson (1987) who reported the disruption of families in poor Black neighborhoods through female-headed households, welfare dependency, and out-of-wedlock births. The favorable characteristics of Hispanic social organization may thus protect them from the adverse effects of residential segregation. As a result, Hispanic segregation might have a less pronounced net effect on homicide victimization than Black segregation does.

So far, empirical evidence to support the hypothesized beneficial effects of enclaves is mixed at best. In a study of Latino homicide in five different cities (El Paso, San Diego, Houston, Chicago, and Miami), Martinez (2002) found that the levels of homicide in many Latino communities were indeed low relative to those expected given extreme deprivation. The evidence was not all uniform, however. Some communities, such as downtown and border barrios in San Diego, were shown to have higher rates of violence than expected.

Other studies that compared Black and Hispanic homicides also produced mixed findings. Using 1990 data for U.S. metropolitan areas, Phillips (2002) reported that the relationship between segregation (measured by the index of dissimilarity) and homicide was small and statistically insignificant for both Hispanics and Blacks. Because Phillips used only the index of dissimilarity, it is not clear whether the results would have been different if other measures of segregation had been used. Burton (2004), in another study of Latino homicide, also reported that the index of dissimilarity is not related to the rates of homicide victimization. Burton, however, did find that higher levels of Latino isolation may induce higher rates of Latino homicide. Still, in another study, using 2000 arrest data for California and New York census places, Feldmeyer (2007) reported that the effect of isolation on homicide is racially invariant for Blacks and Hispanics, and that the effect of isolation on robbery and violent index rates is even larger (not smaller) for Hispanics than for Blacks. Given the large difference in samples and methodologies across the studies, it is not at all clear whether the effects of segregation vary for different minority groups. Obviously, whether or not there are gains from the segregation of Hispanics that are not experienced by Blacks is a question that deserves further investigation.

Summary

Prior research has generated a mixed set of findings in their attempts to decide what aspect of segregation influences homicide victimization. The majority of the studies have focused on the experiences of Blacks, while overlooking the possibility that the differences between ethnic enclaves and Black neighborhoods may change the conclusions for

Hispanics. The objectives of our analysis were therefore twofold: (1) to clarify the multidimensional nature of the relationship between segregation and homicide, and (2) to examine whether the relationship between segregation and homicide is racially invariant between Blacks and Hispanics. Our study extended the work of Johnston et al. (2007) who identified two superdimensions of segregation, but considered only metropolitan areas with a minimum minority population of 25,000. Here we used more inclusive samples to see how the superdimensions of segregation are relevant for our understanding of Black and Hispanic homicide in metropolitan areas.

Data and Methods

The Superdimensions of Segregation

To identify the superdimensions of segregation, we followed Massey et al. (1996) by factor analyzing 19 indices of segregation supplied by the Census Bureau for all 331 U.S. metropolitan areas (Iceland et al. 2002).[2] Our goal is different, however: Because the 19 indices are not distinct predictors of crime, we analyzed them in order to identify the superdimensions of segregation and their effects on homicide victimization. The 19 indices were calculated using population data from 2000 Census Summary File 1 (see "Appendix A"). All indices were built separately for Blacks and Hispanics, using census tracts as proxies for neighborhoods, and non-Hispanic Whites as the reference group.[3] Appendix A provides brief descriptions of these indices. Detailed formulas and explanations are readily available from other sources (e.g., Iceland et al. 2002; Massey and Denton 1988).

Metropolitan areas were used as the unit of analysis because they provide reasonable approximations of urban housing markets (see Wilkes and Iceland 2004). A city-level analysis, for instance, would exclude city dwellers who may move from central cities to suburbs in order to avoid racially-mixed neighborhoods. Also, the analysis conducted at the metropolitan level allowed us to include minority populations living outside of central cities for the examination of the effect of geographic location on homicide (also see Phillips 2002). Although aggregation by metropolitan area may obscure within-urban-area variation, the analysis is important for assessing the full impact of residential segregation on homicide.

For both Blacks and Hispanics, principal axis factoring was used to extract factors that represent the superdimensions of segregation. Segregation scales based on variables identified in the factor analysis were then entered into multivariate regression models to estimate their independent effects on homicide victimization.

[2] The data are available at http://www.census.gov/hhes/www/housing/housing_patterns/housing_patterns.html. The data do not include the percentage of minority populations living in central cities, an index originally included in Massey and Denton's (1988) analysis. As Massey and Denton noted, although this index is easy to calculate, it has only a weak relationship with other indices of centralization and is a poor measure of segregation. Therefore, we analyzed 19 indices of segregation instead of 20 (also see Johnston et al. 2007).

[3] Throughout this study, Blacks refer to non-Hispanic Blacks. Traditionally, indices of centralization are calculated using central business districts (CBD). As the functions of CBD continue to decentralize, the complex patterns of population distribution limit the use of CBD-based indices, especially when the metropolitan areas are multicentered (Hughes 1993). For these reasons, the Census Bureau provided alternative measures based on population centroids (Iceland et al. 2002). These indices are not without drawbacks, but their value in predicting crime has been demonstrated by Shihadeh and Maume (1997). Separate unreported analyses using monocentered metropolitan areas yielded similar results.

Modeling Homicide Victimization

Sample and Data

The sample used in the regression analysis was limited to metropolitan areas that had at least 5,000 Black (or Hispanic) residents in 2000. This sample restriction had been used in previous research (e.g., Martinez 1996; Peterson and Krivo 1993) to enhance the reliability of race-specific measures of homicide and explanatory variables.[4]

Information on Homicide victimization was obtained from the 1999–2001 mortality data compiled by the National Center for Health Statistics (NCHS) as part of the National Vital Statistics System (NVSS). For the purposes of our study, NVSS data have two important advantages over police data such as the Supplementary Homicide Reports (SHR). First, the ethnicity of victims, a key interest of our study, was missing on many SHR records (Fox 2004: 252). In contrast, Hispanic mortality statistics were published by the NCHS for all 50 states and the District of Columbia starting in 1997, with very low or zero rates of missing information (NCHS 2004).[5] Second, NVSS data have better coverage than SHR data (Riedel 1999). For example, from 1999 to 2001, more than a third of states did not submit (or only partially submitted) monthly SHR forms (Fox 2004: 217–218). Though our focus is on victimization, it is worth noting that previous studies suggest that because the majority of homicide is intraracial, research based on victimization data often leads to the same conclusions as research based on offender data (see Martinez 2002; Ousey 1999).

After removal of metropolitan areas because of missing data, geographic boundary incomparability, and outliers, our final sample contained 231 metropolitan areas for the model of Black victimization and 207 for the model of Hispanic victimization.[6]

Measures of Variables

The dependent variables, *Black* and *Hispanic homicide victimization*, were the total number of homicide victims of each group who were residents of each metropolitan area during the 3-year period from 1999 through 2001.[7] The multiple years of data were pooled to reduce the influence of random year-to-year fluctuations in homicide.

[4] We repeated the factor analysis of segregation for this sample of metropolitan areas with a minimum of 5,000 Black (or Hispanic) residents. Factor solutions (not reported) were similar to those based on all metropolitan areas.

[5] Sorlie et al. (1992) showed that the overall quality of race and ethnicity classification in death certificates is high. By matching death certificates to corresponding census records from previous population surveys, the study found an agreement rate of 98.2% for the classification of Black and 98.7% for the classification of Hispanic origin.

[6] The exclusion rules are as follows. First, in order to preserve confidentiality, metro-area identifiers were removed by the NCHS if the victims resided in areas with fewer than 100,000 people in 1990. As a result, 27 metropolitan areas were excluded from the Black sample, and 24 from the Hispanic sample. Second, several New England metropolitan areas (Boston, MA; Springfield, MA; Hartford, CT; Providence, RI; New London, CT; New Haven, CT) were excluded because of incomparability in geographic boundaries. For these areas, the Census Bureau used city- and town-based metropolitan definitions to calculate the segregation indices, whereas the NCHS used county-based definitions for compiling homicide data. Third, the study excluded four metropolitan areas in Texas (Brownsville-Harlingen-San Benito, El Paso, Laredo, and McAllen-Edinburg-Mission) that are outliers because Hispanics constituted a much larger proportion of their 2000 populations (ranging from 78 to 94%).

[7] During the study period, most homicides (94%) occurred within the victims' metropolitan area of residence. Victims of the 9/11 terrorist attacks were not included in the analyses.

In addition to the key independent variables (the superdimensions of Black and Hispanic segregation), several control variables were included in the analysis, all derived from the 2000 census data. Based on prior research, these variables were used to control for differences across metropolitan areas in socioeconomic status, demographic composition, family structure, residential stability, immigration, and region.

As described in "Appendix B", the socioeconomic status of Blacks (or Hispanics) was measured in absolute and relative terms. The absolute-status indicators were median income, high school graduation rate, family poverty rate, and unemployment rate. The relative-status indicators were adopted from Peterson and Krivo (1993): The income ratio compares the median income of Blacks (or Hispanics) with that of non-Hispanic Whites, whereas the Gini index captures income inequality within the Black (or Hispanic) population.

Demographic compositions were measured by both general and group-specific variables, including natural logarithms of population size and population density, relevant minority percentage (Black or Hispanic), and percentage of individuals aged 15–29 years (Black or Hispanic). The family structure variables were all based on group-specific characteristics. Male divorce rate and percentage of single-parent children were controlled for because previous studies have indicated that marital disruption and single parenthood are important structural causes of violence in minority neighborhoods (Sampson 1987). Residential stability was measured by the percentage of Blacks (or Hispanics) who had lived in the same residence for the past 5 years, and the immigration status of Blacks (or Hispanics) was measured by the percentage of the metropolitan Black (or Hispanic) population that is foreign-born.

To account for regional effects, we included two dummy variables: one for metropolitan areas in the census South and one for metropolitan areas in the five Southwestern states (Arizona, California, Colorado, New Mexico, and Texas). The Hispanic populations in the Southwestern states are primarily of Mexican descent, and they could differ significantly from Hispanics in other states who originate from Puerto Rico or Cuba (Martinez 1996).

Preliminary analyses showed high multicollinearity among the initial control variables. Therefore, principal components analyses were carried out to reduce multicollinearity in the regression analyses (see Land et al. 1990). Details for index construction are described below and summarized in "Appendix C". For Blacks, the analysis showed three clusters of variables: All of the six socioeconomic-status variables and one family-structure variable (percentage of single-parent children) loaded highly on one component; the second component had high loadings for the two general demographic composition variables (log population size and log population density); and the third component had high loadings for percent of Black aged 15–29 years and percent of Blacks who had lived in the same residence for the past 5 years. The standard scores of these variables were then averaged to produce three composite scales. Higher scores on the *socioeconomic disadvantage* scale are associated with more pronounced Black deprivation and wider income gaps, both within Blacks and between Blacks and Whites ($\alpha = .90$). The scale of *general population structure* has higher scores for metropolitan areas with greater population size and higher density ($\alpha = .78$). The scale of *population stability* has higher scores for metropolitan areas with a smaller proportion of young Black adults and a larger proportion of long-term residents ($\alpha = .71$).[8] In order to control for differences in the scales, all scales were converted to Z scores.

[8] In unreported analyses, we also reestimated the models by keeping the two variables (percent of Black aged 15–29 years and percent of Blacks who had lived in the same residence for the past 5 years) as separate control variables. The estimated effects of segregation on homicide did not change.

For Hispanics, the analysis yielded similar results. One minor difference was that the education variable had a low loading on the *socioeconomic disadvantage* component, possibly because the educational attainment of Hispanics does not fully capture the effect of language (e.g., English proficiency) on their socioeconomic achievement (Tienda and Neidert 1984). Therefore, the education variable was not used for the calculation of the disadvantage scale for Hispanics (which has a final $\alpha = .82$), but kept as a separate control variable. For both Blacks and Hispanics, the rest of the variables (minority percentage, male divorce rate, immigration, and region) were retained in their original forms (see "Appendix C").

Regression Models

The regression analyses used negative binomial models in order to account for the count nature of the dependent variables. Because we were interested in incidence rates of victimization, the natural logarithm of the population at risk was included as an offset with a fixed coefficient of 1, so that the models estimated victimization rates rather than counts (Osgood 2000). The at-risk populations for the two models were approximated by the year 2000 Black and Hispanic populations in each metropolitan area, respectively.

Results

The Superdimensions of Black and Hispanic Segregation

Table 1 provides the means and standard deviations for the 19 segregation indices.[9] A comparison of the means of the two groups shows that in 2000, Blacks were more segregated than Hispanics across all measures of segregation.

In order to understand the effect of segregation on homicide victimization, it is neither necessary nor desirable to use all of the 19 indices. Instead, an analysis of their interrelationships is important for the identification of empirically distinct forms of segregation. The correlation matrices for the segregation indices are reported in Tables 2 (for Blacks) and 3 (for Hispanics). Ideally, the correlations between indices within each dimension (correlations that are underlined) should have high absolute values because the indices are designed to measure the same aspect of segregation; intercorrelations between dimensions (correlations that are not underlined) should have low absolute values so that the dimensions are independent of one another.

An inspection of Table 2 shows that measures of Black segregation are indeed well correlated within dimensions (with correlations mostly above .7).[10] The lowest correlations are associated with the relative clustering index (RCL). As noted by Massey and Denton (1988), RCL is at best weakly associated with other measures of clustering. In addition to the high intra-dimension correlations, however, the data also exhibit high inter-dimension

[9] In unreported analyses, the summary statistics were also calculated with weights that were equal to the minority proportion in each metropolitan area so as to reduce the effect of random noise in the distribution of populations (see Massey and Denton 1988). Not surprisingly, the weighted means were higher than the unweighted means because segregation tends to increase in places where minorities constitute a larger proportion of the population. The introduction of weights, however, did not change findings about the factor structure of segregation. All results reported in the study, therefore, were based on unweighted data.

[10] Two pairs of indices—*xPy* and *xPx*, and *DPxy* and *DPxx*—are perfectly correlated because the calculations only consider two groups: the relevant minority group and the reference group, non-Hispanic Whites.

Table 1 The dimensions of segregation and 19 indices in 331 metropolitan areas

Dimension	Name of index	Black Mean (SD)	Hispanic Mean (SD)
Unevenness			
D	Index of dissimilarity	.50 (.14)	.37 (.12)
G	Gini index	.64 (.15)	.50 (.14)
H	Entropy or information index	.25 (.15)	.14 (.10)
A1	Atkinson index (shape parameter = 0.1)	.09 (.05)	.05 (.03)
A5	Atkinson index (shape parameter = 0.5)	.38 (.18)	.22 (.13)
A9	Atkinson index (shape parameter = 0.9)	.57 (.22)	.37 (.19)
Exposure			
xPy	Interaction index	.68 (.22)	.79 (.20)
xPx	Isolation index	.32 (.22)	.21 (.20)
V	Correlation ratio	.23 (.18)	.12 (.12)
Concentration			
DEL	Duncan's delta index	.79 (.10)	.71 (.10)
ACO	Absolute concentration index	.89 (.10)	.85 (.13)
RCO	Relative concentration index	.57 (.31)	.39 (.29)
Centralization			
ACE	Absolute centralization index	.69 (.19)	.62 (.21)
RCE	Relative centralization index	.25 (.19)	.15 (.17)
Clustering			
ACL	Absolute clustering index	.14 (.14)	.08 (.13)
SP	Spatial proximity index	1.15 (.15)	1.08 (.10)
RCL	Relative clustering index	.70 (1.7)	.37 (.92)
DPxy	Distance-decay interaction index	.75 (.19)	.82 (.19)
DPxx	Distance-decay isolation index	.25 (.19)	.18 (.19)

Notes: Summary statistics are based on unweighted data (see footnote 9); for the descriptions of indices see "Appendix A"; for all but two indices (*xPy* and *DPxy*), the larger the value, the higher the level of segregation; for *xPy* and *DPxy*, the smaller the value, the higher the level of segregation

correlations. For example, the correlations between the indices of unevenness and exposure are large (all between .77 and .97). The unevenness indices are also strongly correlated with all clustering indices except for RCL (mostly in the range between .7 and .9). Two exposure indices (*xPx* and *xPy*) are near-perfectly correlated (.98) with two clustering indices (*DPxy* and *DPxx*). These findings, therefore, suggest that these dimensions of segregation overlap to a considerable degree and are not empirically distinct.

In comparison to Blacks, Table 3 shows that in all but one dimension of segregation (unevenness), the intra-dimension correlations are slightly lower for Hispanics, which suggests that the choice of indices matters more for Hispanics than for Blacks. This result reflects the two groups' difference in the level of segregation (i.e., because Hispanics are less segregated than Blacks, the estimation of segregation is more sensitive to variation in the technical definitions of segregation). Similar to Blacks, high intercorrelations across dimensions are found for Hispanics, although the magnitude of inter-dimension correlations is somewhat lower.

To describe the underlying structure of segregation, Table 4 presents the results of factor analyses conducted for Blacks and Hispanics using principal axis factoring.[11] Beginning with Kaiser's (1960) rule of keeping those factors with eigenvalues greater than 1, two factors were extracted for each minority group, followed by orthogonal varimax rotation.[12] For both Blacks and Hispanics, the factor structure is clear, with the two identified factors explaining 78 and 71% of the common variance among the items, respectively. The unevenness, exposure, and clustering indices have uniformly high loadings on the first factor (all $\geq$.76) and low cross-loadings (all $\leq$.33). In other words, although these indices are conceptually distinct, they are not empirically distinct. In 2000, metropolitan areas with high (or low) levels of uneven distribution of Blacks (or Hispanics) also showed a high (or low) tendency for them to live in a few clusters and have little contact with Whites. This finding is thus consistent with that of Johnston et al. (2007). Using their terminology, this factor is labeled *group separateness*. For each group, a composite scale was constructed as the mean of the standard scores of items with high loadings ($\alpha = .98$ for Blacks and .94 for Hispanics), and then converted to Z scores.

The second factor of Black and Hispanic segregation is also easy to interpret. With high loadings for indices of concentration and centralization (all $\geq$.55), this factor suggests that in metropolitan areas where the two minority groups are located near the population center, they also tend to concentrate in a small share of the urban environment. As the distance from the population center increases, minority groups tend to live in less compact areas. Thus factor 2 is labeled *centralized concentration*. It supports Johnston et al. (2007) assertion that the location of minority settlement is a major component of segregation that is distinct from the dimension of group separateness. A scale of *centralized concentration* was formed for each group using the mean of the standard scores of items with high loadings ($\alpha = .87$ for Blacks and .79 for Hispanics). The scale was also converted to Z scores for ease of interpretation.

In addition to the conceptual advantages noted above, the evidence suggests that the superdimensions of segregation have practical advantages over the single indicators of segregation used in prior research. First, the indices representing the superdimensions are more successful in accounting for variance in homicide rates than are single indicators. This is what one would expect because the superdimensions are measured with multiple indicators and should therefore be more reliable that single indicators. We verified the higher explanatory power of the superdimensions by conducting an auxiliary analysis which compared the coefficient of variation (R^2) for a series of models that systematically compared single indicators with the superdimensions. We found that for both Blacks and Hispanics, the model that included the two superdimensions of segregation had a higher R^2 value than other models that included only a single indicator of segregation. The finding suggests that the multidimensional approach is more successful in accounting for variance in homicide rates than the typical approach of considering only one dimension of segregation. (The details of this analysis are presented in "Appendix D").

[11] On the basis of bivariate correlations, nine segregation indices were removed from the matrices before they were factor analyzed. Five unevenness indices were removed because of their near-perfect correlations with the dissimilarity index (D). Two interaction indices (xPy and $DPxy$) were also removed because they are redundant with the measures of isolation (xPx and $DPxx$) (see footnote 10). The $DPxx$ index was removed because it is near-perfectly correlated with the xPx index for both Blacks and Hispanics. Finally, the RCL index was removed because it is a weak measure of segregation, as discussed in the text.

[12] In unreported analyses, oblique rotations produced similar results with low inter-factor correlations ($r = .09$ for Black segregation and .18 for Hispanic segregation). These findings are evidence that the factors are distinct.

Table 2 Correlation matrices for indices of Black segregation in 331 Metropolitan areas

	D	*G*	*H*	A1	A5	A9	*xPy*	*xPx*	*V*	DEL	ACO	RCO	ACE	RCE	ACL	SP	RCL	*DPxy*	*DPxx*
Unevenness																			
D	1.0																		
G	.99	1.0																	
H	.96	.95	1.0																
A1	.96	.95	.96	1.0															
A5	.99	.98	.98	.98	1.0														
A9	.97	.98	.96	.93	.98	1.0													
Exposure																			
xPy	−.77	−.78	−.88	−.77	−.81	−.82	1.0												
xPx	.77	.78	.88	.77	.81	.82	−1.0	1.0											
V	.88	.88	.97	.89	.92	.91	−.96	.96	1.0										
Concentration																			
DEL	.22	.21	.18	.28	.24	.17	.10	−.10	.07	1.0									
ACO	.09	.07	.02	.13	.09	.02	.31	−.31	−.09	.77	1.0								
RCO	.36	.35	.32	.38	.36	.31	−.14	.14	.26	.59	.71	1.0							
Centralization																			
ACE	.06	.05	.06	.10	.07	.04	.04	−.04	.03	.62	.46	.44	1.0						
RCE	.42	.40	.37	.42	.40	.36	−.22	.22	.30	.32	.35	.52	.54	1.0					
Clustering																			
ACL	.77	.75	.87	.81	.81	.77	−.85	.85	.89	.04	−.15	.09	.01	.22	1.0				
SP	.77	.75	.88	.81	.81	.78	−.87	.87	.91	.05	−.13	.14	.04	.25	.95	1.0			
RCL	.35	.33	.32	.32	.35	.35	−.12	.12	.22	.08	−.02	−.25	−.02	.03	.38	.40	1.0		
DPxy	−.69	−.69	−.81	−.69	−.72	−.74	.98	−.98	−.90	.17	.41	−.05	.07	−.16	−.84	−.86	−.09	1.0	
DPxx	.69	.69	.81	.69	.72	.74	−.98	.98	.90	−.17	−.41	.05	−.07	.16	.84	.86	.09	−1.0	1.0

Table 3 Correlation matrices for indices of Hispanic segregation in 331 Metropolitan areas

	D	*G*	*H*	A1	A5	A9	*xPy*	*xPx*	*V*	DEL	ACO	RCO	ACE	RCE	ACL	SP	RCL	*DPxy*	*DPxx*
Unevenness																			
D	1.0																		
G	.99	1.0																	
H	.96	.95	1.0																
A1	.97	.96	.98	1.0															
A5	.98	.98	.98	.99	1.0														
A9	.98	.98	.97	.96	.99	1.0													
Exposure																			
xPy	−.64	−.65	−.73	−.65	−.65	−.64	1.0												
xPx	.64	.65	.73	.65	.65	.64	−1.0	1.0											
V	.86	.86	.96	.89	.89	.88	−.84	.84	1.0										
Concentration																			
DEL	.37	.36	.37	.37	.36	.33	−.33	.33	.37	1.0									
ACO	.01	−.01	−.03	.02	.02	.01	.38	−.38	−.14	.33	1.0								
RCO	.40	.38	.37	.41	.40	.38	−.11	.11	.29	.53	.55	1.0							
Centralization																			
ACE	.08	.07	.09	.09	.09	.08	−.06	.06	.08	.61	.30	.36	1.0						
RCE	.37	.35	.33	.39	.38	.35	−.02	.02	.21	.27	.32	.57	.51	1.0					
Clustering																			
ACL	.53	.53	.61	.57	.55	.52	−.76	.76	.66	.13	−.26	−.02	−.01	.06	1.0				
SP	.73	.73	.85	.78	.77	.74	−.82	.82	.92	.31	−.23	.13	.05	.08	.71	1.0			
RCL	.49	.48	.51	.52	.54	.53	−.15	.15	.40	.01	.06	−.06	−.04	.17	.32	.45	1.0		
DPxy	−.54	−.56	−.64	−.55	−.54	−.53	.99	−.99	−.76	−.30	.45	−.04	−.04	.05	−.76	−.78	−.08	1.0	
DPxx	.54	.56	.64	.55	.54	.53	−.99	.99	.76	.30	−.45	.04	.04	−.05	.76	.78	.08	−1.0	1.0

Table 4 Factor patterns for Black and Hispanic segregation in 331 Metropolitan areas

	Black segregation		Hispanic segregation	
	Factor *1*	Factor *2*	Factor *1*	Factor *2*
Unevenness				
D	**.84**	.26	**.76**	.33
Exposure				
xPx	**.95**	−.09	**.92**	−.03
V	**.99**	.09	**.96**	.20
Concentration				
DEL	−.00	**.82**	.28	**.63**
ACO	−.19	**.86**	−.30	**.63**
RCO	.16	**.78**	.12	**.81**
Centralization				
ACE	.00	**.65**	.02	**.61**
RCE	.27	**.55**	.09	**.63**
Clustering				
ACL	**.93**	−.00	**.76**	−.09
SP	**.94**	.03	**.93**	.05
Eigenvalue	4.69	3.12	4.36	2.68
Proportion of variance explained	.47	.31	.44	.27

Notes: loadings ≥.4 are in bold; factors were orthogonally rotated with varimax rotation

A second, and more important, advantage of using the composite measures is that if we were to include multiple individual segregation indices into a same model without considering the large bivariate correlations between these indices, then the model would suffer from multicollinearity (for details see "Appendix D"). Consequently, some indices of segregation would be shown to have no significant impact on homicide not because they are not related to homicide, but because they covary with other segregation indices, and it is difficult to evaluate their independent contribution to homicide. We next present the results showing the independent effects of the superdimensions of segregation on homicide victimization.

The Impact of the Superdimensions of Segregation on Homicide Victimization

From 1999 to 2001, the NVSS data recorded 20,559 Black and 7,749 Hispanic victims of homicide in the sampled metropolitan areas. The distributions of victimization rates were skewed to the right, with the highest annual victimization rate being 65.6 per 100,000 for Blacks (median = 16.2) and 29.3 for Hispanics (median = 6.1).

Table 5 present the results of the negative binomial models for Blacks and Hispanics. In both models, the variance of the dependent variable exceeds the mean ($\alpha > 0$; $p < .001$), which indicates that the data were more consistent with negative binomial models than with Poisson models.[13] By adding all explanatory variables, the models explained Black

[13] Our models allowed for (but did not explain) unobserved heterogeneity in the data. Future research may consider latent class models that model unobserved heterogeneity across metropolitan areas (Nagin 2005).

homicide better than they explained Hispanic homicide ($R^2 = .60$ for Blacks and .23 for Hispanics).[14,15]

Net of the effects of control variables, both *group separateness* and *centralized concentration* had a substantial and statistically significant positive effect on homicides. Among Blacks, for example, a one-standard-deviation increase in *group separateness*, holding all other variables constant, would increase the victimization rate by 13% (= 100*{exp(.122) − 1}). The estimated effect size of *centralized concentration* was comparable to that of *group separateness*. Notably, these results disagree with those of Eitle (2009: 33) who found that "when considered together, only the superdimension of location (concentration and centralization), rather than separation (unevenness, exposure, and clustering), is a significant predictor of Black homicides." Our models included more extensive controls (see "Appendix B"). Furthermore, to see whether the difference was attributable to a difference in study period, we reestimated the same models from Table 5 using the 2000–2002 Vital Statistics data (rather than 1999–2001) and found the same results (results not shown).

Like Blacks, Hispanics are also affected by the levels of segregation. For example, the rate of Hispanic homicide would increase by 18% for a one-standard-deviation increase in *separateness* and 14% for a one-standard-deviation increase in *centralized concentration*. Thus, in spite of some theoretical expectations for the protective benefits of ethnic enclaves, our data suggest that Hispanics have higher risks of homicide victimization when they have higher segregation scores. Both forms of segregation are important: Their risk is higher when they live away from Whites in a coherent block of urban territory; they may also increase their risk of victimization by living close to the urban center in relatively high concentration, though not necessarily in a small number of clusters.

To formally test the differences in the estimated coefficients across groups, we reestimated our models using seemingly unrelated regression methods because the models were fitted on overlapping metropolitan areas and the disturbance terms for the models may be correlated (the estimates were derived using "suest" command in Stata 10, see StataCorp. 2007:347–364). The analysis yielded the same finding as those reported in Table 5 (results not shown). A comparison of the regression coefficients between Blacks and Hispanics indicated that the difference in the segregation coefficients is not statistically significant ($p = .57$ for *group separateness* and .78 for *centralized concentration*). The finings suggest that the impact of segregation on homicide is racially invariant at the metropolitan level. Despite some differences in how Black neighborhoods and Hispanic enclaves are formed, residential segregation may still have negative consequences for Hispanics, and this is the case for the risk of homicide victimization.

[14] Before running regression analyses, we examined the extent of multicollinearity in the models. The highest bivariate correlation was found between *percent Black* and *South* ($r = .54$) for Blacks and between *percent Hispanic* and *Southwest* ($r = .69$) for Hispanics. The variance inflation factors (VIF) were all below 4. Thus, the scaling procedures were effective in alleviating multicollinearity problems that would otherwise be present, had the initial segregation indices and control variables been included in the models.

[15] After fitting the regression models, we followed Osgood (2000) and Ousey and Augustine (2001) by identifying potential outliers using standardized residuals. For each potential outlier, the probability of obtaining the observed value was calculated using the negative binomial distribution. Observations with a probability lower than what would be expected from sampling error in a sample of size 231 or 207 were excluded to see if they had undue influences on the regression results. Gary, IN, Kansas City, MO, Youngstown, OH, and Phoenix-Mesa, AZ had more Black victims than expected; Albuquerque, NM and Phoenix-Mesa, AZ had more Hispanic victims than expected. These analyses yielded similar results, indicating that the extreme observations were not influential.

Table 5 Negative binomial models of Black and Hispanic homicide victimization

Variable	Black *b* (SE)	Hispanic *b* (SE)
Superdimension of segregation		
Group separateness	.122 (.052)*	.166 (.072)*
Centralized concentration	.119 (.041)**	.134 (.045)**
Control variable		
Black/Hispanic socioeconomic disadvantage	.065 (.032)*	.030 (.051)
Hispanic education		−.017 (.006)*
General population structure	.070 (.045)	.017 (.057)
Black/Hispanic population stability	.092 (.039)*	−.144 (.069)*
Percent Black/Hispanic	.004 (.004)	−.000 (.005)
Black/Hispanic male divorce rate	.022 (.015)	.031 (.034)
Black/Hispanic immigration	−.019 (.005)**	−.007 (.005)
South	.052 (.070)	.234 (.089)**
Southwest	−.133 (.074)	−.114 (.128)
Overdispersion α	.102	.158
LR test of $\alpha = 0$	1,059.18***	556.54***
−2log-likelihood	1,715.47	1,216.74
Model χ^2	123.84***	59.68***
R^2 (see "Appendix D" for method of calculation)	.60	.23
N	231	207

Note: The models includes log Black/Hispanic population at risk (with a fixed coefficient of 1) and a constant

* $p < .05$; ** $p < .01$; *** $p < .001$

In addition to the effects of segregation, several effects of control variables are worth noting. While metropolitan areas with higher levels of Black socioeconomic disadvantage had the expected higher rates of Black homicide, the effect of socioeconomic disadvantage was not statistically significant for Hispanics. The educational attainment of Hispanics did have a significant negative relationship with homicide victimization, which suggests that education, not the increase of income, has the most salient impact on reducing homicide (also see Martinez 1996; Phillips 2002). In addition to this group difference, we also found that the presence of fewer Hispanic young adults and more long-term residents reduces homicide rates for Hispanics, while the same population structure seems to increase Black homicide. The latter finding was surprising but not unprecedented. Using data from the Uniform Crime Reports, Land et al. (1990) similarly found that a lower proportion of the younger population (15–29 years old) is related to a higher (not lower) city homicide rate. These results suggest the need for more research on how an area's age structure might affect homicide victimization. The coefficients for immigration were both negative, although the effect was only statistically significant among Blacks. We also found few regional effects in the risk of homicide victimization, except for that the rate of Hispanic homicide was higher in the South. Since research indicates that the Hispanic population has been growing rapidly in the South and their assimilation experiences tend to differ from the experiences of those who settled in other regions (Saenz et al. 2003), future research should investigate sources of this regional effect.

Discussion

The goal of this paper was to examine (1) how the superdimensions of segregation influence homicide victimization, and (2) whether the effects vary between Blacks and Hispanics. Prior research has most often considered only one dimension of segregation, even though a single dimension of segregation does not capture the full extent of segregation. Studies also disagree on whether the degree of group separation can have an independent effect on homicide victimization (see, e.g., Shihadeh and Flynn 1996 versus Eitle 2009). Still, to complicate matters further, the case of Hispanic segregation presents a largely overlooked question regarding the costs and benefits of segregation—that is, could the positive aspects of ethnic enclaves be strong enough to withstand crime-facilitating conditions? Our literature review shows that studies disagree on how segregation might affect Hispanic homicide victimization. Our investigation, therefore, adds significantly to this body of research.

Consistent with the work of Johnston et al. (2007), we identified two superdimensions of segregation that are important for our understanding of the high risks of homicide victimization among minority groups. One superdimension, *group separateness*, combines the concepts of unevenness, isolation, and clustering, and reflects variation in the degree to which minority members are clustered together in relative isolation. The other superdimension, *centralized concentration*, combines the concepts of concentration and centralization, and reflects variation in the size and location of the areas of minority settlement. For victimization studies, the focus on the superdimensions of segregation clarifies some of the issues in the relationship between segregation and homicide victimization. Some of the implications of our findings are as follows.

First, our study contradicts the finding of Eitle (2009) that *group separateness* does not have an independent effect on Black homicide over and above the areal size and location of group settlement. For both Blacks and Hispanics, we found that net of the effects of control variables, the rates of homicide victimization are higher in metropolitan areas with higher separateness scores. When minority neighborhoods are clustered together in a contiguous urban territory, the potential of social contact between minority members and the White population is significantly reduced. In this sense, the positive relationship between group separateness and homicide victimization found by our study supports the theoretical proposition laid out in our study that group separation has serious negative consequences for the safety of minority groups.

Using the superdimension of separateness, our study extends the concept of group isolation used in prior research, broadening it from a rather-narrow focus on within-neighborhood dynamics to a wider perspective. Shihadeh and Flynn (1996), as discussed, measured isolation by only the opportunities that Blacks have to interact with their own neighbors within the neighborhood boundaries. By this operationalization, each neighborhood is implicitly treated as an independent entity whose residential structure does not affect (nor will it be affected by) nearby neighborhoods. In contrast, by capturing both within- and between-neighborhood interaction, the superdimension of group separateness suggests that theories of victimization should explore the ways that extralocal conditions in nearby neighborhoods may serve to mitigate or exacerbate the effect of focal neighborhoods on victimization. As discussed above, Sampson et al. (2002) used the term "social advantages or disadvantages" to describe the interconnection between neighborhoods, and as they observed, this kind of research is still in its infancy. It is therefore important to reconsider how we should conceptualize group isolation in its different forms. Because measures of within- and between-neighborhood isolation overlap substantially at the

metropolitan level, we do not recommend our data for the efforts to sort out their separate effects. In fact, such attempts would have produced misleading results (see "Appendix D"). Rather, future research may want to pursue the "spatial interaction" approach suggested by Wong (2002), and use local (rather than global) segregation measures to evaluate how social interaction across neighborhoods may affect homicide victimization.

A second finding of our study is that the location of minority communities and the size of their land area are significant factors in influencing their risk of homicide victimization. This effect was observed not only for Blacks but also for Hispanics. Thus, for both groups, the rates of homicide victimization are higher in metropolitan areas where minority members live in relatively small areas near the urban center (irrespective of their degree of group separateness). Because metropolitan areas with high levels of group separateness still show a wide range in their levels of centralized concentration, research that overlooks the areal size and location of group distributions may underestimate the risk of homicide victimization in some metropolitan areas. Overall, these findings suggest that Kain's (1968) spatial mismatch hypothesis and crime-opportunity structures associated with concentrated living need to be explored more for a better understanding of how segregation might generate homicide victimization.

Thus, in regard to the theoretical question of whether Hispanics are less susceptible to segregation-related homicide victimization, our results provide little evidence that the effects of residential segregation vary for different minority groups. Our results contradict some earlier studies that found no association between residential segregation and Hispanic homicide (Burton 2004; Phillips 2002). Our results strongly suggest that both group separateness and centralized concentration have a significant role in increasing the killings of Hispanics. Even though the average level of segregation is lower among Hispanics, the effect size for both types of segregation is large and statistically indistinguishable from that among Blacks. Together, these results suggest that one must use caution when accepting ethnic enclaves as good on the basis that the segregation of Hispanics is often created by self-choice. As judged by the estimated effect of segregation on homicide, residential segregation is still an important structural impediment to Hispanics.

In discussing structural similarities and differences between Hispanics and Blacks, we have discussed economic and social organization perspectives on how the formation of Hispanic enclaves may facilitate the social adaptation of enclave residents. While it is important to recognize the positive aspects of ethnic concentration, our study has painted a less rosy picture. One way to interpret the results is that other mechanisms may tamper the hypothesized protective effects of ethnic enclaves. Challenging the enclave-economy hypothesis, for example, Sanders and Nee (1987) argued that although enclave labor market may benefit ethnic employers, the spatial concentration of enclave workers can have negative effects on the workers' socioeconomic achievement. By reassessing the experience of Cubans, they found that the patron-client economic relationships embedded in the ethnic networks may trap enclave workers to low-wage jobs that reduce their socioeconomic mobility. Consistent with this view, other studies have discussed how enclave economies may be used for exploiting vulnerable ethnic workers including newly-arrived immigrants (Hondagneu-Sotelo 1994) and women (Hagan 1998). This literature, at minimum, suggests that ethnic jobs do not always create human capital advantages as predicted by the enclave-economy hypothesis (for a review see Zhou 2007).

Another negative aspect of ethnic enclaves is suggested by Portes and Jensen (1987: 769) who found that even in places where the ethnic economy is quite strong, ethnic enclaves often hold little sustained interest for ethnic businessmen, professionals, and well-paid employees; and overtime, these communities tend to be abandoned by people with

more financial resources who prefer to live in more affluent suburban areas. Given that the lack of material resources in local communities can reduce the effectiveness of ethnic networks (Menjivar 1994), the exodus of better-off members can reduce the protective effects of Hispanic social networks. Hispanic communities, due to the lack of resources, could face similar problems as those affecting Black neighborhoods. These observations, while speculative, could explain our finding that Hispanics are not immune to the crime problems created by their residential segregation.

Before we can draw a final conclusion, however, it is important to point out a possibility that may merit future research. We have found that the residential segregation of Hispanics, on average, serves to increase their rates of homicide victimization. This finding, however, does not preclude the existence of a different relationship between segregation and homicide in some neighborhoods, particularly if there is wide variation in social and economic characteristics across ethnic communities. In a study of Miami and San Diego neighborhoods, Martinez et al. (2004) found that in San Diego, the ethnic compositions of neighborhoods were positively related to the likelihood of drug-related homicide, whereas the same set of variables did not affect homicide in Miami. These findings, indirectly, suggest that the effect of ethnic segregation may depend on the characteristics of specific neighborhoods. Future investigation, therefore, should examine the relationship between segregation and homicide across differential social context. At the same time, future research may also wish to explore the differences among Hispanic subgroups (Mexican-Americans or Chicanos, Puerto Ricans, Cubans, and other Latin Americans). Cultural differences among these groups could be potentially important as well.

Several limitations of the study should be recognized. Most importantly, our analysis has focused on segregation patterns measured at the scale of census tract for U.S. metropolitan areas. Prior research, including that of Massey and Hajnal (1995) and Reardon et al. (2009), suggests that the patterns of segregation may vary across units of analysis, so that the results may change, for example, if we use census block or block group to measure segregation for a sample of U.S. cities. Our study, therefore, should be extended in future research to examine segregation patterns at other geographic levels and their impact on homicide victimization.

A second issue that may have important implications for our research is that the segregation indices reported here measure spatial patterns of a single minority group relative to non-Hispanic Whites. As society becomes more racially and ethnically diverse, additional summary statistics are needed to take into account the presence of multiple groups (see Iceland 2004; Reardon and Firebaugh 2002). Research should continue to investigate patterns of segregation in a multiracial and multiethnic context and to determine whether or not diversity may facilitate or inhibit violence and victimization.

A third limitation is that this study provides no information about the race and ethnicity of offenders. Several authors have illustrated how such data may be used to develop models for intergroup associations (e.g., Messner and South 1986; South and Felson 1990). It may well be that segregation has opposite effects on different types of victimization: It may increase victimization by members of one's own group, but decrease victimization by members of another group. Even though violent crime is predominantly intraracial (Hagan and Peterson 1995), the distinction between types of victimization may be useful for advancing our understanding of how segregation is linked to the rates of victimization.

Notwithstanding these cautions, our study places segregation at the center of victimization research. It does not treat segregation as one of many control variables, nor does it assume that the experiences of Blacks should represent those of other racial and ethnic groups. Instead, with this study, it is the hope of the author to stimulate discussion on how

best to measure segregation and to refine theories of victimization to accommodate a multiracial and multiethnic social context.

Appendix A

See Table 6.

Table 6 Descriptions of 19 segregation indices used in the study

Dimension/ index	Description of index	Range
Unevenness		
D	The maximum vertical line between the Lorenz curve and the diagonal line of evenness; interpreted as the percentage of a group's population that would have to move in order to achieve an even distribution	0 to 1
G	The twice the area between the Lorenz curve and the diagonal line of evenness; unlike D, it is sensitive to population movements between any pairs of areal units (census tracts in this study), not just transfers between areas of over- and under-representation	0 to 1
H	The weighted average of each areal unit's deviation from the racial or ethnic entropy of the whole metropolitan area, which is largest when each group is equally represented in the metropolitan area	0 to 1
A1	Similar to the Gini index, but let researchers decide how to weight areal units where minority members are under- or over-represented; when the shape parameter is 0.1, areas of under-representation contribute more to the index	0 to 1
A5	Areas of under-representation and over-representation contribute equally to the index	0 to 1
A9	Areas of over-representation contribute more to the index	0 to 1
Exposure		
xPy	The minority-weighted average of the majority proportion in each areal unit; interpreted as the probability that a minority person shares an area with a majority person	0 to 1
xPx	The minority-weighted average of the minority proportion in each areal unit; interpreted as the probability that a minority person shares an area with another minority person	0 to 1
V	An adjustment of the isolation index to remove its asymmetry (i.e., the minority exposure to majority is equal to the majority exposure to minority only when the two groups consist of the same proportion)	0 to 1
Concentration		
DEL	The proportion of group members residing in areal units with above-average density; interpreted as the proportion of a group's population that would have to move to achieve a uniform density	0 to 1
ACO	The total area inhabited by a group compared with the minimum and maximum possible areas that could be inhabited by that group	0 to 1
RCO	The share of space occupied by a minority group compared with the majority group	−1 to 1
Centralization		
ACE	A group's spatial distribution compared to the distribution of land area around the population center	−1 to 1

Table 6 continued

Dimension/ index	Description of index	Range
RCE	The extent of one group's centralization compared to another group's centralization	−1 to 1
Clustering		
ACL	The average number of members of one group in nearby areal units expressed as a proportion of the total population in nearby areal units	0 to 1
SP	The weighted average of intragroup proximities for the minority and majority populations (weights equal to the proportion of each group in the population)	0 to $+\infty$
RCL	The average proximity between minority members compared to the average proximity between majority members	$-\infty$ to $+\infty$
DPxy	Probability that the next person a minority member meets anywhere in the metropolitan area is a majority member	0 to 1
DPxx	Probability that the next person a minority member meets anywhere in the metropolitan area is another member from the same group	0 to 1

Note: The grouping of indices follows Massey and Denton (1988)

Appendix B

See Table 7.

Table 7 Definitions and summary statistics for the initial control variables

Variable	Definition	Mean	SD
Model 1: Black homicide victimization ($N = 231$)			
Socioeconomic status			
Black median income	Median family income among Blacks	32,522.96	7,733.93
Black education	Percentage of Black population 25 years old and over that graduated high school	73.33	7.77
Black poverty	Percentage of Black families living below the official poverty line	22.44	6.53
Black unemployment	Percentage of Blacks in the civilian labor force that are unemployed	11.79	3.06
White-Black income ratio	Ratio of non-Hispanic White to Black median family income	1.73	0.27
Black income inequality	Gini index of family income inequality among Blacks	44.94	3.52
Demographic composition			
Population size (Log)	Number of total population (log)	13.08	1.03
Population density (Log)	Population per square mile (log)	5.71	0.83
Percent Black	Percentage of population that is Black	13.86	10.56
Black aged 15–29 years	Percentage of Black population 15–29 years of age	24.48	3.05

Table 7 continued

Variable	Definition	Mean	SD
Family structure			
Black male divorce rate	Percentage of Black males 15 years old and over who are divorced	10.06	2.23
Black single-parent children	Percentage of Black children under 18 years of age living with single parents	60.58	8.77
Residential Stability	Percentage of Black residents living in the same residence for last 5 years	45.63	8.17
Immigration	Percentage of Black population that is foreign-born	4.22	6.07
Region			
South	1 = South, 0 = non-South	0.48	–
Southwest	1 = Southwest, 0 = non-Southwest	0.20	–
Model 2: Hispanic homicide victimization ($N = 207$)			
Socioeconomic status			
Hispanic median income	Median family income among Hispanics	35,415.45	6,181.12
Hispanic education	Percentage of Hispanic population 25 years old and over who graduated high school	58.50	12.80
Hispanic poverty	Percentage of Hispanic families living below the official poverty line	18.37	5.73
Hispanic unemployment	Percentage of Hispanics in the civilian labor force who are unemployed	9.13	3.11
White-Hispanic income ratio	Ratio of non-Hispanic White to Hispanic median family income	1.61	0.24
Hispanic income inequality	Gini index of family income inequality among Hispanics	42.35	3.38
Demographic composition			
Population size (Log)	Number of total population (log)	13.22	0.98
Population density (Log)	Population per square mile (log)	5.72	0.92
Percent Hispanic	Percentage of population that is Hispanic	12.14	13.06
Hispanic aged 15–29 years	Percentage of Hispanic population 15–29 years of age	31.08	5.20
Family structure			
Hispanic male divorce rate	Percentage of Hispanic males 15 years old and over who are divorced	6.65	1.95
Hispanic single-parent children	Percentage of Hispanic children under 18 years of age living with single parents	32.69	7.88
Residential Stability	Percentage of Hispanic residents living in the same residence for last 5 years	36.34	9.35
Immigration	Percentage of Hispanic population that is foreign-born	34.39	14.93
Region			
South	1 = South, 0 = non-South	0.40	–
Southwest	1 = Southwest, 0 = non-Southwest	0.27	–

Appendix C

See Table 8.

Table 8 Definitions and summary statistics for study variables used in regression analyses

Variable	Definition	Mean (SD)	Range
Model 1: Black homicide victimization ($N = 231$)			
Dependent variable			
Black homicide victimization	Number of Black homicide victims in each metropolitan area from 1999 to 2001	89.0 (208.1)	0 to 1,622
Superdimension of segregation			
Black separateness	Scale of separateness among Blacks, measured in *Z* scores. The original scale is the mean of the *Z* scores of 5 segregation indices: *D*, *xPx*, *V*, ACL, and SP ($\alpha = .98$)	.00 (1.0)	−1.68 to 3.29
Black centralized concentration	Scale of centralized concentration among Blacks, measured in *Z* scores. The original scale is the mean of the *Z* scores of 5 segregation indices: DEL, ACO, RCO, ACE, and RCE ($\alpha = .87$)	.00 (1.0)	−3.50 to 1.68
Control variable			
Black socioeconomic disadvantage	Scale of Black socioeconomic disadvantage, measured in *Z* scores. The original scale is the mean of the *Z* scores of 7 items: Black median income, Black education, Black poverty, Black unemployment, White-Black income inequality, Black income inequality, and Black single-parent children ($\alpha = .90$); the sign of two variables (median income and education) was reversed	.00 (1.0)	−2.90 to 2.26
General population structure	Scale of general population structure, measured in *Z* scores. The original scale is the mean of the *Z* scores of 2 items: logged population size and logged population density ($\alpha = .78$)	.00 (1.0)	−1.55 to 3.81
Black population stability	Scale of Black population stability, measured in *Z* scores. The original scale is the mean of the *Z* scores of 2 items: Black aged 15–29 years and residential stability ($\alpha = .71$); the sign of one variable (Black aged 15–29 years) was reversed	.00 (1.0)	−3.89 to 1.94
Percent Black	Percentage of population that is Black	13.9 (10.6)	1.33 to 51.1
Black male divorce rate	Percentage of Black males 15 years old and over who are divorced	10.1 (2.38)	2.79 to 24.8
Immigration	Percentage of Black population that is foreign-born	4.22 (6.07)	.07 to 39.6
South	1 = South, 0 = non-South	.48 (–)	0, 1
Southwest	1 = Southwest, 0 = non-Southwest	.20 (–)	0, 1
At-risk population (log)	Black population in 2000 (log)	10.8 (1.30)	8.53 to 14.7
Model 2: Hispanic homicide victimization ($N = 207$)			
Dependent variable			
Hispanic homicide victimization	Number of Hispanic homicide victims in each metropolitan area from 1999 to 2001	37.4 (126.4)	0 to 1,465

Table 8 continued

Variable	Definition	Mean (SD)	Range
Superdimension of segregation			
Hispanic separateness	Scale of separateness among Hispanics, measured in *Z* scores. The original scale is the mean of the *Z* scores of 5 segregation indices: *D*, *xPx*, *V*, ACL, and SP ($\alpha = .94$)	.00 (1.0)	−1.45 to 3.00
Hispanic centralized concentration	Scale of centralized concentration among Blacks, measured in *Z* scores. The original scale is the mean of the *Z* scores of 5 segregation indices: DEL, ACO, RCO, ACE, and RCE ($\alpha = .79$)	.00 (1.0)	−3.51 to 2.25
Control variable			
Hispanic socioeconomic disadvantage	Scale of Hispanic socioeconomic disadvantage, measured in *Z* scores. The original scale is the mean of the *Z* scores of 6 items: Hispanic median income, Hispanic poverty, Hispanic unemployment, White-Hispanic income inequality, Hispanic income inequality, and Hispanic single-parent children ($\alpha = .82$); the sign of one variable (median income) was reversed	.00 (1.0)	−1.67 to 3.39
General population structure	Scale of general population structure, measured in *Z* scores. The original scale is the mean of the *Z* scores of 2 items: logged population size and logged population density ($\alpha = .78$)	.00 (1.0)	−2.11 to 3.58
Hispanic population stability	Scale of Hispanic population stability, measured in *Z* scores. The original scale is the mean of the *Z* scores of 2 items: Hispanic aged 15–29 years and residential stability ($\alpha = .85$); the sign of one variable (Hispanic aged 15–29 years) was reversed	.00 (1.0)	−3.47 to 2.15
Hispanic education	Percentage of Hispanic population 25 years old and over that graduated high school	58.5 (12.8)	27.7 to 89.3
Percent Hispanic	Percentage of population that is Hispanic	12.1 (13.1)	.72 to 63.3
Hispanic male divorce rate	Percentage of Hispanic males 15 years old and over who are divorced	6.65 (1.95)	2.36 to 12.8
Immigration	Percentage of Hispanic population that is foreign-born	34.4 (14.9)	4.91 to 71.4
South	1 = South, 0 = non-South	.40 (−)	0, 1
Southwest	1 = Southwest, 0 = non-Southwest	.27 (−)	0, 1
At-risk population (log)	Hispanic population in 2000 (log)	10.6 (1.42)	8.53 to 15.3

Appendix D: Auxiliary Analysis Comparing Different Measures of Segregation

Table 9 compares the explanatory power of the two superdimensions with the index of dissimilarity and other individual indicators of segregation. Because studies vary widely in terms of the number of explanatory variables involved, we used a set of baseline models that included only the measures of segregation and two most important indicators of the metropolitan population structure: (1) percent Black (or Hispanic) and (2) the size of the Black (or Hispanic) population (used as offset). In addition to the index of dissimilarity, the following segregation indices were used for the comparison as they are often used as

Table 9 Baseline negative binomial models comparing different measures of segregation

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Black homicide victimization ($N = 231$)						
Superdimension of Segregation						
Group separateness	.187***					
Centralized concentration	.148***					
Individual segregation index						
D		2.00***				
xPx			1.91***			
RCO				.693***		
ACE					.830***	
SP						1.53***
Overdispersion α	.124	.140	.140	.163	.176	.150
−2log-likelihood	1,746.8	1,764.2	1,763.1	1,789.0	1,803.2	1,778.4
R^2 (see "Appendix D")	.35	.28	.26	.20	.13	.22
Hispanic homicide victimization ($N = 207$)						
Superdimension of segregation						
Group separateness	.204***					
Centralized concentration	.127**					
Individual segregation index						
D		2.65***				
xPx			2.08***			
RCO				.253*		
ACE					.766***	
SP						1.78***
Overdispersion α	.192	.200	.225	.243	.216	.228
−2log-likelihood	1,234.9	1,246.0	1,257.4	1,272.9	1,262.0	1,263.5
R^2 (see "Appendix D")	.17	.12	.09	.02	.05	.06

Note: Other variables in the models include percent Black (Hispanic) and log Black (Hispanic) population at risk (with a fixed coefficient of 1) and a constant

* $p < .05$; ** $p < .01$; *** $p < .001$

the preferred measures of segregation: *xPx* for exposure, RCO for concentration, ACE for centralization, and SP for clustering (see Massey and Denton 1988).

In order to see how well the models accounted for the rates of homicide victimization, we used the method recommended by Osgood (2000: 38) to calculate the R^2 values. Specifically, because negative binomial models do not provide an R^2, we calculated the R^2 as follows. First, we transformed the fitted homicide counts to rates, and calculated the sum of the squared differences between the predicted and observed values (error sum of squares). Second, we calculated the sum of squared differences between the observed values and the mean homicide rate (total sum of squares). Then, the R^2 is equal to one minus the ratio of the error sum of squares to the total sum of squares. As shown in Table 9, we found that for both Blacks and Hispanics, the model that included the two superdimensions of segregation had a higher R^2 value than other models that included only a single indicator of segregation. This finding suggests that the multidimensional approach is more successful in accounting for variance in homicide rates than the typical approach of considering only one dimension of segregation.

The use of the composite segregation measures has a more important advantage: If we were to include multiple individual segregation indices into a same model without considering the large bivariate correlations between these indices, then the model would suffer from multicollinearity. Consequently, some indices of segregation would be shown to have no significant impact on homicide not because they are not related to homicide, but because they covary with other segregation indices, and it is difficult to evaluate their independent contribution to homicide. For example, in the baseline model for Blacks, only two indices (*xPx* and ACE) remained statistically significant when all five indices were added simultaneously. For Hispanics, the significant coefficients were for *D* and ACE. In both models, the variance inflation factors for *D*, *xPx*, and SP exceeded 4 (the largest value was 24.0), suggesting that the models were not suitable for identifying the individual contribution of the segregation indices. Thus, using the composite measures of segregation is a better choice, if one is examining the full impact of segregation on homicide victimization.

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