Separate but Lethal: The Effects of Economic Segregation on Mortality in Metropolitan America

NORMAN J. WAITZMAN
and KEN R. SMITH

University of Utah

SOCIOECONOMIC GRADIENTS IN MORTALITY FOR several demographic groups have increased on both sides of the Atlantic during the past several decades (Townsend and Davidson 1982; Feldman et al. 1989; Whitehead 1992; Pappas et al. 1993; Elo and Preston 1995), a period that has witnessed a concomitant increase in socioeconomic inequality itself. After reaching a post–World War II low around 1968, for example, inequality of household income in the United States increased throughout most of the 1980s and peaked in the early 1990s (Karoly 1994; U.S. Bureau of the Census 1997). England experienced a progressive increase in income inequality during this period as well (Wilkinson 1996). A growing body of literature has tied the statistical distribution of income, as opposed to absolute levels of deprivation, to levels of mortality and morbidity. Cross-sectional research on several countries belonging to the Organization for Economic Cooperation and Development (OECD) revealed that country-specific income inequality was strongly related to overall life expectancy (Wilkinson 1992), while income inequality at the state level in the United States in 1990 was found to be directly correlated with mortality rates in two

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separate analyses (Kaplan et al. 1996; Kennedy, Kawachi, and Prothrow-Stith 1996).

The underlying pathways by which the statistical distribution of income affects health have received less formal analysis than has the test for the actual relation between these factors. This research often appeals to a broad theory of "social cohesion," which postulates that higher levels of income inequalities lead to a deterioration of community attachment and involvement, resulting in deleterious psychosocial and material consequences (Wilkinson 1996; Kawachi et al. 1997). Lower levels of community attachment may result in greater reluctance to invest in such health-promoting human capital as education and medical care (Kaplan et al. 1996). Kawachi et al. (1997) found that the level of disinvestment in "social capital," or community networks, as measured by subjective indices of social mistrust and absence of fairness, among others, appeared to mediate the relation between socioeconomic inequality and mortality.

This study both theoretically extends and empirically refines the burgeoning literature that links socioeconomic disparities to mortality. Its major theoretical extension rests with the formal consideration of the emerging areal configuration of socioeconomic inequalities and the potential relation of this pattern to mortality risk. Implicit in the concept of social cohesion, as it is anchored in the structure of social networks and investment, is a spatial characterization of community. We focus our analysis on the issues of the relevant unit of space for the analysis and how the socioeconomic configuration of residence within that unit relates to health. In terms of empirical refinements, a large and rich set of individual-level data containing area identifiers permitted an analysis of the location of area effects within the income distribution. The near universal absence of individual-level data in the research cited above precluded an investigation of the degree to which the higher rates of mortality associated with greater income inequality were borne unevenly within the income distribution. The extent to which there are uneven burdens may have important policy implications. Finally, the combination of individual- and area-level data afforded as well an exploration of the extent to which ecological effects merely act as proxies for individual-level characteristics. Each of these four extensions—the spatial dimension to inequality, the appropriate areal unit for analysis, the location of risk within the socioeconomic distribution, and level of analysis—is considered in turn.

Conceptual Issues

Spatial Dimension

A distinct spatial pattern of growing economic segregation has paralleled the recent trend in growing income inequality in the United States (Goldsmith and Blakely 1992; Jargowsky 1996; Danziger 1996). Industrial restructuring and the attendant changes in investment patterns from the early 1970s to the present provided the underlying catalyst for these trends. As the U.S. economy faced increasing international competition and became oriented more toward services and away from manufacturing, the relative rewards for high skills and formal education increased (Danziger and Gottschalk 1994) and the labor market increasingly bifurcated into high-paying jobs for professional, technical, and managerial workers, on the one hand, and low-paying service jobs with few fringe benefits and little opportunity for security and advancement, on the other (Harrison and Bluestone 1988; Goldsmith and Blakely 1992).

The primary setting in which this dynamic played out was the metropolitan area, where areal patterns of work and residence were reshaped by economic restructuring. Job location often shifted from core cities to the outer rings and suburbs of metropolitan areas (Goldsmith and Blakely 1992; Wilson 1996). Particularly among the "rust belt" cities in the Midwest and Northeast, the flow of capital out of the central city left in its wake growing concentrations of unemployed and poor inner-city residents (Wilson 1987, 1991). Growing urban segregation was marked by higher concentrations of both affluence and poverty (Coulton et al. 1996; Danziger 1996). One study that formally modeled urban economic segregation confirmed that structural economic transformation variables, including the lower proportion of jobs in manufacturing, the dispersion of jobs away from the urban core, and a growing proportion of jobs in managerial and professional occupations, were significantly associated with such segregation (Jargowsky 1996).

Several theorists have noted that this process of economic segregation was particularly devastating for inner-city black populations and contributed to the formation of a black "underclass" (Wilson 1987, 1996; Massey and Denton 1993). This racial dimension to economic segregation was due partly to the bleaker economic opportunities facing blacks, but also to migration out of the inner city by middle-class blacks (Wilson 1987). Although neighborhoods have traditionally been stratified more by race than by socioeconomic status (Farley 1991), economic segregation in metropolitan areas between 1970 and 1990 grew among blacks and whites. Indeed, the trend toward greater economic segregation within major U.S. metropolitan areas was more pronounced for blacks than for whites (Jargowsky 1996).

The process of growing economic segregation raises the question of the extent to which the breakdown in social cohesion and deterioration of "social capital" is attributable to spatial segregation along economic lines rather than strictly to rising statistical inequality. Higher concentrations of urban poverty, for example, have been cited in the underclass debate as leading to greater social isolation, higher levels of alcohol and drug abuse, and other deleterious behavioral patterns for those residing in such areas (Wilson 1987). Certainly, increases in income inequality do not necessarily express themselves spatially. Indeed, the historical trajectories in each urban area have been shaped by regional, state, and industry-specific forces and by inherent differences in the capacity of geographic entities to incorporate growth and sprawl (Jargowsky 1996). Invariably, therefore, investment and residential patterns resulting from structural changes in the economy differ by urban area. Thus, in examining the extent to which economic segregation affects mortality, our analysis, by implication, tests the degree to which the effects of income inequality on mortality may be mitigated through changes in policy, such as zoning laws, that regulate patterns of residential location and integration.

Appropriate Ecological Unit

Studies on the impact of ecological characteristics on health require a group or area over which ecological effects are measured. The underlying theory for choosing an appropriate ecological unit, however, has often remained unaddressed or implicit in the analysis. Wilkinson (1996) appropriately addresses the differences in social safety nets, labor market policies, and national culture between countries in his discussion of statistical income inequalities and mortality at the national level. He also notes, however, that certain towns and other political subunits within countries produce notably stronger community networks than do others, which likely result in intranational differences in health outcomes. Researchers who have chosen to investigate inequalities at the state level (Kaplan et al. 1996; Kennedy, Kawachi, and D. Prothrow-Stith 1996) have generally not provided a formal theoretical rationale for selecting states as the appropriate unit for study. Kaplan et al. (1996) noted the correlation between income inequality and the level of certain types of human capital investments at the state level, but they employed measures of human capital investment that often conflated public and private sources and failed to distinguish state-level funding from that of other political units. Receipt of public assistance was treated as an adverse outcome, whereas it could be considered instead as a human capital investment. Another study used the primary sampling unit (PSU) from a national survey to measure inequality (Fiscella and Franks 1997), but it did so on the basis of data constraints.

The social cohesion argument addresses the strength of community bonds, and community is admittedly a complex concept with economic, political, cultural, historical, and demographic dimensions that are shaped at neighborhood, city, state, regional, national, and even multinational area levels. We chose the metropolitan statistical area (MSA) for our analysis because of our focus on the impact of spatial socioeconomic distribution on mortality. The MSA is widely recognized as the areal unit within which the market dynamic has primarily played itself out in terms of the spatial restructuring of job opportunities and residential neighborhoods. It is also a geographic unit constructed by the federal government based on strong social and economic ties within its boundaries.

Other ecological units, both larger and smaller, could be important with respect to the relation between spatial socioeconomic distribution and mortality. Regional flows of capital, for example, tended to favor the South and West over the Northeast and Midwest during much of the 1980s in the United States. Some have argued as well that a hierarchy has developed among MSAs, depending on the degree to which cities have developed critical industrial niches in, for example, investment and banking services and information technologies within the emerging global market (Goldsmith and Blakely 1992). Those MSAs in the uppermost tiers of the hierarchy may have relative resource advantages that benefit health, even though increases in economic segregation might be most pronounced in those areas. Our analysis did not attempt to assess the impact of these regional and hierarchical factors on mortality, although such an investigation would be valuable.

Location of Effects within the Distribution

We began by noting that socioeconomic disparities in health have been increasing during a period of concomitant increases in socioeconomic inequalities. The literature uncovering associations between income *disparities* and life expectancy or mortality *levels* (Kaplan et al. 1996; Kennedy, Kawachi, and Prothrow-Stith 1996) does not necessarily, on its face, speak to widening socioeconomic disparities in mortality. Additional information on the relative impact of socioeconomic inequalities on health within the population is required. Only if the relative burdens (benefits) on health of widening income inequalities were experienced disproportionately by those occupying the bottom (top) end of the distribution would larger health disparities by socioeconomic status result. If the health burden of rising income inequalities was felt equally throughout the income distribution, or if these relative burdens were reversed, then increasing socioeconomic disparities in health would be attributable entirely to causes other than rising socioeconomic inequalities. Hardly any research has been directed toward isolating the relative impact of income disparities on health within the socioeconomic distribution. Drawing on international data, Kunst and Mackenbach (1994) found a close association among nine OECD countries in their rank order by inequality of mortality rates and by income inequality, providing indirect support for the thesis that growing health inequalities may be due in part to rising socioeconomic inequalities. Other research showed, according to Wilkinson (1996), that the percentage of income held by the bottom 50 percent or more of the population in England and Wales had a higher correlation with mortality than the percentage held by lower proportions of the population, indirectly supporting the theory that income inequality has a broad impact on mortality right across the socioeconomic spectrum. Wilkinson also notes, however, that such measures of inequality might serve as a proxy for a country's entire income distribution, which renders unconvincing any conclusions about the breadth of impact along the socioeconomic distribution. As our data permitted an examination of the effects of spatial inequalities on mortality within the income distribution, our analysis sheds direct insight on this question.

Whether or not growing income inequality contributed to the dynamic producing greater socioeconomic disparities in health, the assessment of areal effects within the socioeconomic distribution merits closer scrutiny. Are the effects on mortality of economic segregation concentrated among the most socioeconomically disadvantaged, or are they experienced more broadly? Are there any compensating improvements in health among those best situated? The answers to these questions could provide insights into the as yet poorly understood mechanisms by which the distribution of income translates into higher levels of mortality, and they potentially provide direction for policy.

Level of Effects

Controversy has arisen over whether the effects on mortality uncovered in the ecological literature are truly independent effects or simply proxies for the effects of individual-level socioeconomic characteristics. It is a debate that has surrounded both the recent research associating income distribution with mortality and the more traditional ecological studies examining the relation between area-level socioeconomic status as measured, say, by median income and mortality. The issue is not strictly academic. Public policy directed toward mitigating ecological effects, anchored in deteriorating "social capital," for example, would likely be quite different from steps taken to improve individual socioeconomic status.

Data that combine area-level with individual-level characteristics permit the examination of these competing hypotheses. One recent study, based on the initial National Health and Nutrition Examination Survey (NHANES I), found that once controls were introduced for individual income, the distribution measure was no longer significantly related to mortality (Fiscella and Franks 1997). The areal unit for this analysis was the PSU. Small PSU-specific sample sizes on the NHANES I made the internally generated inequality measures, as well as the mortality experience, somewhat suspect in this analysis. Nonetheless, it is noteworthy that higher inequality by those measures was significantly associated with mortality in the expected direction when individual and household socioeconomic controls were left out of the analysis. We will critically evaluate the methods and findings in the NHANES I in more detail after we have described our own findings.

The issue of individual versus ecological socioeconomic measures has also been raised in closely related research on overall levels of socioeconomic status of areas and health outcomes. Studies on residence in clusters of socioeconomically disadvantaged census tracts, or federally designated poverty areas, in Oakland, California (Haan, Kaplan, and Camacho 1987), and in the United States in general (Waitzman and Smith 1998), uncovered significant associations between such residence and mortality, even after controlling for individual and household socioeconomic and demographic characteristics. In contrast, a study of ward deprivation scores and mortality in England found that measures of areawide deprivation lost statistical significance with the introduction of individual-level socioeconomic variables (Sloggett and Joshi 1994). One might note that the absence of a direct ecological-level effect on mortality, however, does not definitively prove the absence of an area effect. Characteristics of an area may influence health outcomes indirectly by exerting a potential effect on the socioeconomic attainment of its individual residents (Brooks-Gunn, Duncan, and Aber 1997) or by modifying the effect of individual socioeconomic characteristics on health.

Whether the ecological effect on mortality, to the extent it exists, is more associated with socioeconomic level than with socioeconomic distribution has itself become a matter of debate (Kaplan et al. 1996). Greater support is garnered by the social cohesion argument, proponents tend to argue, if income distribution rather than overall levels of area economic development are found to be more strongly associated with mortality. The two effects, however, actually may not be entirely independent of each other. Resource *distribution*, it has been argued, may be more critical to health outcomes within relatively large areal units, whereas the *level* of resource development ultimately becomes critical within more confined areas (Wilkinson 1997). Lower levels of income inequality among residents within very poor tracts, in other words, may contribute less to health improvement than would increases in the median level of income in those tracts. At the MSA level, however, the opposite might be true. Consider that the more highly skewed is the spatial *distribution* of income in an MSA, everything else being equal, the lower is the overall economic *level* of its poorest tracts.

A very large sample with both area-level and individual-level characteristics provided a unique opportunity to revisit the issue of ecological versus individual-level effects on mortality. As noted earlier, we introduced a spatial socioeconomic distribution variable into the analysis in order to test the extent to which the effects of income distribution on mortality might be mediated by spatial configuration of areas. We also incorporated into our empirical models measures of overall economic status of the MSA, specifically median income and the poverty level, so as to test the relative importance of economic distribution versus overall economic level on risk of mortality within the selected areal unit.

Methods

Data

The combined samples of the National Health Interview Surveys (NHIS), conducted from 1986 through 1994, matched to death certificates taken from the National Death Index (NDI) for the years 1986 through 1995, served as the basis for the analysis. The NHIS is an annual, nationally representative sample of the noninstitutionalized civilian population in the United States. The merged file contained 711,093 respondents, of whom 37,706 died by 1995. Identifiers for 33 of the largest MSAs in the United States were specially appended to the file by the National Center for Health Statistics. Residents of these metropolitan areas of any age made up nearly 40 percent of the total U.S. population in 1994. It would have been desirable to have identifiers on additional areas, but such identification was restricted because of concerns about confidentiality of the data. MSAs are defined by the U.S. Bureau of the Census as urban areas with strong economic or social ties that often encompass several counties but that, at minimum, include single counties containing a city of at least 50,000 residents or an urbanized area with 50,000 population and a total metropolitan population of 100,000. For our analysis, we used an NHIS subsample comprising respondents aged 30 years and older who resided at the time of the interview in one of the 30 largest metropolitan areas for which we had areal measures of interest (table 1). This subsample contained 156,276 respondents; of these, 9,422 died by 1995.

Six measures of spatial concentration, three for poverty and three for affluence, on each urban area were taken from Coulton et al. (1996), based on 1990 census data: the C index, or the proportion of area poor (affluent) families residing in extreme poverty (affluence) tracts; the D index, or the proportion of poor (affluent) families that would have to move in order to achieve an even socioeconomic distribution throughout the area; and the p index, which is a measure of socioeconomic isolation defined formally below. Each of these measures has a different empha-

TABLE 1
Metropolitan Statistical Areas

City	Label
Anaheim, CA	ANH
Atlanta, GA	ATL
Baltimore, MD	BT
Boston, MA	BO
Chicago, IL	CH
Cleveland, OH	CLV
Columbus, OH	CMB
Denver, CO	DNV
Detroit, MI	DET
Fort Lauderdale, FL	FtL
Houston, TX	HT
Indianapolis, IN	IND
Kansas City, MO	KC
Los Angeles, CA	LA
Miami, FL	MI
Minn/St Paul, MN	StP
Newark, NJ	NWK
New Orleans, LA	NOL
New York, NY	NY
Norfolk, VA	NFK
Philadelphia, PA	PH
Phoenix, AZ	PHX
Pittsburgh, PA	PTB
Riverside, CA	RV
Sacramento, CA	SAC
San Antonio, TX	SA
San Diego, CA	SD
San Jose, CA	SJ
Seattle, WA	STL
Washington, DC	WA

sis in its construction, but all have been commonly used in the literature on spatial concentrations of poverty in urban areas (Coulton et al. 1996). We report results based on the "p index," or "isolation index," as results across all three indices were generally similar, albeit with a few exceptions that we will note in our discussion.

The p index measures the probability of asymmetric group contact, formally calculated as the average across all census tracts within an MSA of the probability of within-tract encounters between residents below and above a low-income (high-income) threshold in the case of the index for poverty (affluence). The income threshold for the p index for poverty was the federally defined poverty level, whereas a family income of $75,000 in 1989 was established as the threshold for the p index for affluence. This upper threshold, incorporating approximately the top 12 percent of the family income distribution, was highly correlated with lower thresholds adopted in other analyses (Coulton et al. 1996). Reported results are based on one minus the p index, so that higher values of the index, whether poverty or affluence, indicate higher levels of economic segregation.

Jargowsky (1996) correctly notes that residential concentration measures, like the p index, establish groups on the basis of what are essentially arbitrary income cutoffs, and are therefore not independent of the mean and variance of income within areas. An increase in the mean income across an area, for example, keeping constant the configuration of the resident population and the variance of income, would still change the probability of "asymmetric contacts" because a certain portion of families would be pushed across the established threshold. Actual economic segregation in the area would not change, in other words, but the p index that measured it would. Indeed, the p index is particularly sensitive to average rates of poverty and affluence in tracts where the poverty population resides (Coulton et al. 1996). Jargowsky constructs an economic segregation index, the ratio of within-tract income variance to metropolitan area–level income variance, that is truly independent of the level and variance of income in an area. We incorporated Jargowsky's measure into our analysis for the ten large metropolitan areas for which the measure was available, and the results were on a track that was close to those reported below for the p index for poverty.

Measures of median family income and the percentage of persons in poverty in metropolitan areas were constructed from the 1995 Area Resource File (ARF). The ARF is compiled by the Bureau of Health Professions in the U.S. Department of Health and Human Services, and it contains summary county-level data on residential and health characteristics from the U.S. Census and several other sources for all counties in the United States going back several decades. County-level data from the ARF were aggregated to match the geographic boundaries of the MSAs provided on the NHIS.

Models

Cox proportional hazards models were estimated on the mortality experience of sample individuals, controlling for age, sex, and areal characteristics of interest. The dependent variable is the hazard rate for all-cause mortality, where time is measured from the point of the subjects' NHIS interview. Separate models were run for those under age 65 and for those aged 65 and older, given the research suggesting that the impact of certain areal characteristics on mortality is concentrated among the nonelderly (Waitzman and Smith 1998). Models were also run with and without controls for individual household income and for race (white, black, Hispanic) so as to assess the extent to which areal effects on mortality were confounded by these background characteristics. Finally, in the interest of determining the extent to which the effects of areal characteristics on mortality were felt unevenly across the income distribution, we ran separate models for those in three different household income categories. The household income cutoffs for this analysis were: under \$15,000; \$15,000 to \$50,000; and \$50,000 and above.

Results presented below are for models in which the indices for area concentration of both poverty and affluence were entered into the same equation. Conceptually, we were interested in the influence of each measure of concentration on mortality, net of the other. From a statistical standpoint, the results on the concentration measures tracked closely to models in which those indices were entered separately, but overall model fit was statistically superior for the equations in which the indices were incorporated together. There was also a rationale to incorporate interaction terms of concentrated poverty and affluence, as the trends in poverty and affluence concentration have been found to be associated with each other (Coulton et al. 1996). Such an interaction term, however, did not prove to be statistically significant in any of the models, and so we report results absent such a term.

Results

Table 2 provides summary data for the NHIS sample by MSA, ordered from lowest to highest according to the poverty concentration index (1 − p index). Of the 30 urban areas, San José, California, was the most economically integrated according to the index, whereas New Orleans, Louisiana, was the most segregated along economic lines. In terms of concentrations of affluence, on the other hand, Washington, D.C., had the highest concentration, whereas Norfolk, Virginia, had the lowest. Table 2 also provides summary data on other area characteristics as well as the age-, sex-, and race-adjusted risk ratio; the New York MSA is used as the referent.

In table 3, age-specific, zero-order correlations are shown for the four area measures. The correlations are in the expected directions, but the relatively weak associations between concentrated poverty and concentrated affluence (−0.27 and −0.22 for the younger and older age groups, respectively) dispelled concern about the presence of harmful multicollinearity resulting from the joint inclusion of the two concentration indices in one model. The moderate correlations between the proportion of poor individuals and the p index for poverty (0.50) and between median income and the p index for affluence (0.53) presaged the attenuated effects of the p indices when the proportion of poor or median-income individuals is also included in the model. The association between the proportion of individuals who are poor and median income is about −0.80 for both age groups. These two areal measures were not jointly included in the same model.

The age-, sex-, and race-adjusted mortality rate ratios for each urban area are plotted against the poverty concentration index of the area for persons aged 30 to 64, and for those aged 65 and older in figure 1. The mortality rate ratios were generated from proportional hazards models on sample individuals, and each urban area of residence was entered as a dummy variable, except for the New York metropolitan area, which was used as the referent. The fitted line in both parts of the figure supports a strong linear relation between economic concentration and mortality risk, anticipating the results, cited below, from the detailed models that incorporate the concentration index itself as an independent variable. The slope of the fitted line in figure 1A suggests, for example, about a 50 percent higher mortality rate ratio in San Antonio than in San José, which is attributable to the difference in poverty concentration between those two urban areas. Although the association between economic segregation and mortality risk might appear in these figures to be stronger among the younger cohort (fig. 1A) than among the older cohort (fig. 1B), this was not borne out in the detailed analysis, which we will discuss below.

TABLE 2

Descriptive Statistics for 30 Large PMSA/MSAs Sorted by the P Index for Poverty

MSA	P index for poverty	P index for affluence	Proportion of individuals living below poverty line	Median family income ($1,000)	1990 population size	sample size (all ages)	Number deceased (all ages)	Age-, sex-, race-adjusted relative risk of mortality[a]	
								Ages 30–64	Ages 65+
San José	0.10	0.39	0.071	32.4	1,497,577	2575	47	0.684	0.853
Anaheim	0.11	0.38	0.073	31.4	2,410,556	3755	63	0.595	1.067
Washington	0.13	0.41	0.084	31.9	3,923,574	6988	196	0.834	0.909
Seattle	0.13	0.35	0.077	29.9	1,972,961	3793	78	0.830	0.934
Riverside	0.15	0.19	0.112	23.6	2,588,793	3583	88	0.829	1.063
Boston	0.15	0.35	0.092	26.9	2,870,699	7141	190	0.844	0.961
Ft. Lauderdale	0.15	0.21	0.091	23.8	1,255,488	2103	57	0.989	0.783
Sacramento	0.16	0.21	0.107	25.4	1,481,102	2479	65	0.974	1.224
San Diego	0.17	0.29	0.113	24.6	2,498,016	4042	77	0.724	0.902
Kansas City	0.17	0.25	0.090	27.1	1,566,280	2726	69	0.894	1.096
Indianapolis	0.17	0.23	0.094	26.3	1,249,822	2055	44	0.739	1.141
Minn./St. Paul	0.18	0.25	0.069	29.6	2,464,124	4525	81	0.699	0.964

Denver	0.18	0.27	0.082	28.4	1,622,980	3581	64	0.643	1.241
Phoenix	0.19	0.25	0.110	24.6	2,122,101	4240	124	0.873	1.045
Newark	0.20	0.40	0.110	28.5	1,824,321	3265	93	0.823	1.149
Pittsburgh	0.20	0.23	0.090	25.6	2,056,705	4240	124	0.888	1.109
Los Angeles	0.21	0.35	0.134	25.6	8,863,164	14951	388	0.878	0.922
Houston	0.22	0.30	0.103	29.5	3,301,937	6265	174	0.919	0.842
Atlanta	0.22	0.30	0.125	25.1	2,833,511	5145	140	0.891	1.154
Columbus	0.22	0.25	0.111	25.3	1,377,419	2496	74	0.858	1.173
New York	0.23	0.29	0.181	22.2	8,546,846	14345	500	1.000	1.000
Miami	0.23	0.26	0.150	22.7	1,937,094	3141	95	0.966	1.110
Baltimore	0.23	0.29	0.119	26.1	2,382,172	3929	122	0.840	1.039
Norfolk	0.23	0.18	0.139	23.4	1,396,107	2031	51	0.798	1.225
Philadelphia	0.24	0.30	0.120	25.6	4,856,881	8235	272	0.967	1.092
San Antonio	0.27	0.22	0.181	20.9	1,302,099	2251	75	1.028	1.163
Detroit	0.28	0.30	0.102	29.6	4,382,299	7472	188	0.691	0.976
Cleveland	0.29	0.26	0.097	27.3	1,831,122	3523	114	0.892	1.156
Chicago	0.30	0.30	0.113	29.5	6,069,974	11997	333	0.906	1.098
New Orleans	0.34	0.21	0.174	22.9	1,238,816	1795	73	1.331	1.319

[a]The New York PMSA is used as the referent for relative risk.
Abbreviations: PMSA, primary metropolitan statistical area; MSA, metropolitan statistical area.

TABLE 3
Age-Specific, Zero-Order Correlations among Area Measures

	P index for poverty	P index for affluence	Proportion poor individuals	Median income
	Ages 30–64 (N = 128,042)			
P index for poverty	1.00			
P index for affluence	−0.27	1.00		
Proportion poor	0.50	−0.22	1.00	
Median income	−0.25	0.55	−0.80	1.00
	Ages 65+ (N = 29,171)			
P index for poverty	1.00			
P index for affluence	−0.22	1.00		
Proportion poor	0.47	−0.20	1.00	
Median income	−0.19	0.53	−0.79	1.00

Note: $P < .0001$ for all correlations.

Results from proportional hazards models on the relative risk of mortality associated with area poverty and affluence concentration are provided in table 4: A (ages 30 to 64) and B (ages 65+). Results are presented in two sets of six models for each age cohort. The first set (upper panel) presents age- and sex-adjusted results, whereas the second set (lower panel) adjusts as well for race. Within each set, the first three models (columns 1–3) are distinguished by the inclusion of different area measures. The first model controls for the area concentration indices only (column 1). The second model introduces an additional control for the household median income level in the urban area (column 2), and the third model replaces median income with the percentage of individuals in the urban area living below the federally designated poverty line (column 3). The subsequent three models (columns 4–6) repeat the pattern of the first three but incorporate an additional control for sample individuals' household income.

The rate ratios in the table on each concentration index indicate the relative risks of mortality associated with an increase in the value of the index from 0 (complete economic integration) to 1 (extreme economic segregation). The rate ratio of 5.283 ($P < .01$) associated with the poverty concentration index in column 1 of table 4A, for example,

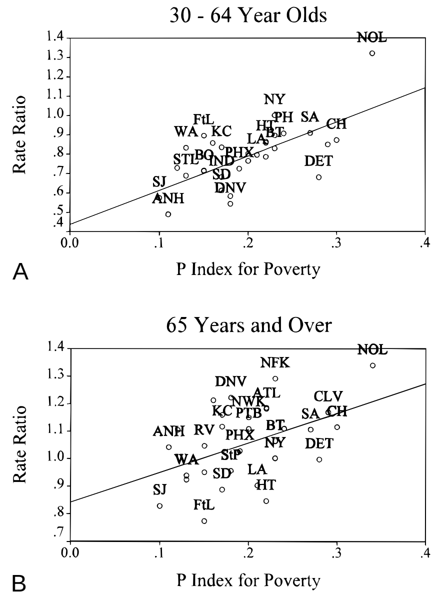

FIG. 1. Association between mortality risk (*RR*) and p index for poverty from 1986 to 1995. **A.** Among 30- to 64-year-olds. Ten MSA labels are masked for heuristic reasons. $R^2 = 0.4344$. **B.** Among persons 65+ years. Eight MSA labels are masked for heuristic reasons. $R^2 = 0.2111$.

indicates that the age- and sex-adjusted risk of mortality for an individual between the ages of 30 and 64 living in a metropolitan area with the highest possible poverty concentration was more than five times that of a counterpart living in an area with no poverty concentration. Of course, such extremes on that index are only hypothetical. Given a more realistic range represented, say, by the difference in the p index for poverty between Seattle and Chicago (table 2), this same rate ratio translates into a mortality risk in Chicago 1.33 times that in Seattle based on different levels of economic segregation in the two cities:

$$e^{[\ln(RR) \times (p1 - p2)]} = e^{[1.66 \times (.30 - .13)]} = 1.33$$

where RR is the rate ratio reported in the table, and p1 and p2 are the respective economic concentration indices for the two cities.

Age- and sex-adjusted results from models for both age groups revealed a large and significant relative risk of mortality associated with residence in urban areas characterized by higher levels of economic seg-

TABLE 4
All-Cause-Mortality Proportional Hazards Models for Poverty and Affluence Concentration (P Index) from the National Health Interview Survey (1986–94)[a]

	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
A. AGES 30 TO 64						
Age- and sex-adjusted						
Household income	—	—	—	0.940***	0.940***	0.940***
P index for poverty	5.283***	5.276***	2.414**	2.804***	2.819***	1.824
P index for affluence	0.924	2.446**	1.119	1.648	2.693***	1.827*
Median income	—	0.997***	—	—	0.998**	—
Proportion poor in MSA	—	—	24.755***	—	—	5.903***
Age-, sex-, and race-adjusted						
Household income	—	—	—	0.943***	0.943***	0.943***
P index for poverty	2.271***	2.337**	1.298	1.849*	1.862*	1.101
P index for affluence	0.658	1.592	0.795	1.364	2.661**	1.564
Median income	—	0.997***	—	—	0.998***	—
Proportion poor in MSA	—	—	12.517***	—	—	9.215***

B. AGES 65+						
Age- and sex-adjusted						
Household income	—	—	—	0.981***	0.981***	0.981***
P index for poverty	1.942***	2.080***	2.422***	1.608**	1.726**	2.076***
P index for affluence	0.472***	0.442***	0.494***	0.512***	0.424***	0.532**
Median income	—	1.001	—	—	1.001	—
Proportion poor in MSA	—	—	0.555	—	—	0.493
Age-, sex-, and race-adjusted						
Household income	—	—	—	0.981***	0.981***	0.981***
P index for poverty	1.724**	1.829**	1.982**	1.591*	1.680**	1.811**
P index for affluence	0.449***	0.442***	0.471***	0.505***	0.471***	0.525***
Median income	—	1.000	—	—	1.000	—
Proportion poor in MSA	—	—	0.728	—	—	0.748

[a]Entries are rate ratios.
*$P < .10$; **$P < .05$; *** $P < .01$.

regation, especially as measured by the p index for poverty. These risks remained significant even after controlling for the area level of median income (table 4A, B: column 2) or for the area poverty level (tables 4A, B: column 3), each of which was also significantly associated with mortality among the younger, but not the older, group. Among the younger group, the size of the effect on mortality of poverty concentration was particularly sensitive to the introduction of the poverty-level measure. The relative risk of mortality associated with the concentration index was more than halved when the area poverty measure was entered into the equation (column 3). Indeed, once a control for individual household income was added into this equation, the relation between area poverty concentration and mortality risk among the younger group no longer achieved statistical significance (table 4A, column 6). On the other hand, the effect of poverty concentration on mortality remained robust with the control for individual household income in each of the other equations among the younger group (table 4A: columns 4–5) and for all equations among the older group (table 4A: columns 4–6).

The introduction of an adjustment for individual-level race into the models (lower panel in table 4A, B) further attenuated the effect on mortality of area concentration of poverty among the younger groups. When household income was incorporated into the race-adjusted equations for this younger group, the area poverty concentration measure achieved only marginal significance (column 4). The introduction of a control for area poverty level, either alone (column 3) or in conjunction with household income (column 6), also had the effect of eliminating the significant relation between area poverty concentration and mortality for the group aged 30 to 64.

In terms of concentrated affluence, significant protective effects surfaced among the cohort over age 65 (table 3B), regardless of the nature of individual-level and other area-level controls. Generally weaker and less consistent effects of concentrated affluence surfaced among the younger group. When adjustments were incorporated for both area median income and individual household income, however, concentrated affluence surfaced alongside concentrated poverty as a significant risk factor for mortality among the younger group, even after controlling for race (table 4A: upper and lower panel in column 5).

In each equation, there were significant area effects, even if they were not exclusively attached to the poverty or affluence concentration measures. Metropolitan-area poverty level, in particular, had a robust, statistically significant association with relative risk of mortality in the younger group, regardless of other controls in the model. Among the older cohort, however, area poverty concentration was the exclusive area measure significantly associated with mortality (table 4B, lower panel). Moreover, the area poverty concentration effect on mortality risk was robust across race-adjusted, as well as race- and household income–adjusted, models among the older group.

Were the effects on mortality associated with economic segregation felt evenly across socioeconomic status? We explored this question with respect to the younger group only, as income distribution during the retirement years tends to be less reflective of relative current socioeconomic position than is the case during years of labor market participation. Models run separately by income group showed a monotonic relation between area concentration of poverty and mortality risk. In age- and sex-adjusted models (table 5A), a higher relative risk of mortality associated with higher levels of area poverty concentration was most pronounced among those with incomes below $15,000 (RR = 8.6, $P < .01$), less pronounced but still statistically significant among the group with incomes from $15,000 to $50,000 (RR = 2.447, $P < .05$), while no significant relation surfaced among the group earning over $50,000. Concentrated affluence was associated with a marginally significant increase in mortality risk among the low-income group, and with a significant increase in such risk among the middle-income group when an additional control was entered for area median income. The results on the concentration indices among the low-income group were robust with the introduction of either area median income or poverty level into the model, whereas these other area measures, particularly area poverty level, drew significance away from the area concentration indices for the middle-income group.

With the additional adjustment for race (table 5B), the monotonic relation between area poverty concentration and mortality across income groups was sustained, but the effect of such concentration on mortality reached statistical significance at the 95 percent confidence interval among the low-income group only, and only in the models that did not control as well for area poverty level. The poverty-level measure, on the other hand, maintained a significant association with mortality risk for both the low- and middle-income groups in the age-, sex-, and race-adjusted model. Concentrated affluence surfaced as a statistically significant risk factor in that model, however, only when an additional

TABLE 5
All-Cause Mortality Proportional Hazards Models for Poverty and Affluence Concentration (P Index) from the National Health Interview Survey (1986–94), Ages 30 to 64[a]

	Categories of household income		
	<$15,000	$15,000–$49,999	>$50,000
A. Age- sex-adjusted			
P index for poverty	8.592***	2.447**	1.168
P index for affluence	3.214*	1.394	1.487
P index for poverty	8.272**	2.412*	1.134
P index for affluence	3.529*	3.041**	2.600
MSA median income	0.999	0.997*	0.998
P index for poverty	6.278***	1.228	0.822
P index for affluence	3.231*	1.607	1.686
Proportion poor in MSA	3.187	15.443***	4.489
B. Age- sex- race-adjusted			
P index for poverty	3.864**	1.635	0.950
P index for affluence	2.719	1.128	1.257
P index for poverty	3.909**	1.631	0.929
P index for affluence	4.927**	2.545*	2.218
MSA median income	0.998*	0.997***	0.998
P index for poverty	2.053	0.875	0.698
P index for affluence	2.977	1.328	1.430
Proportion poor in MSA	14.254***	13.768***	3.998

[a]Entries are rate ratios.
*$P < .10$; **$P < .05$; ***$P < .01$.

control was entered for area median income. Even there, concentrated affluence had a strong association with mortality only among the low-income group.

Discussion

Ours is the first analysis, to our knowledge, that has examined the relation between economic segregation in urban areas, specifically the spatial concentrations of poverty and affluence, and mortality. The findings suggest that concentrations of poverty were significantly associated with elevated risk of mortality for both elderly and nonelderly residents of large urban areas in the United States during the late 1980s and early 1990s. Urban concentration of affluence, on the other hand, was found to be only sporadically associated with elevated risk of mortality among the nonelderly, but was consistently and significantly associated with risk of mortality among the elderly, for whom the effect was protective.

These results were robust in the face of controls for individual-level income, lending support to the theory that community characteristics exert effects on risk of mortality that transcend individual and household characteristics. Our results extend previous research relating statistical inequalities to mortality at the ecological level (Kaplan et al. 1996; Kennedy, Kawachi, and Prothrow-Stith 1996), but stand in contrast to one study (Fiscella and Franks 1997) that failed to find significant effects of statistical inequality of income on mortality once adjustment was made for individual household income. That study was based on a sample of much smaller size, with far fewer deaths, than was used for this analysis. It also adopted a different geographic unit, the PSU, encompassing nonurban as well as urban areas, within which broader, systemic economic ties are not likely to be as strong as within the MSA, which is constructed on the basis of such ties. The ecological variable used in the Fiscella and Franks study was a measure of the statistical distribution of income, as was the case in earlier work (Kaplan et al. 1996; Kennedy, Kawachi, and Prothrow-Stith 1996), whereas the measure used in our analysis was based on the spatial distribution of socioeconomic status. The disparate results between the two studies might indicate that the spatial socioeconomic configuration of an area is more distinct from individual socioeconomic status in its impact on mortality than is the statistical distribution of income in an area. This issue could be directly explored in our data with measures of statistical inequality of income at the MSA level, measures that were not available for this study.

Consider as well that the analysis of Fiscella and Franks (1997) was driven primarily by the mortality experience of the elderly. Among the elderly, our analysis uncovered heightened risk of mortality from concentrated poverty, but also revealed a significantly reduced mortality risk associated with concentrated affluence. In urban areas characterized both by concentrated poverty and concentrated affluence, the two effects would cancel each other out somewhat. Higher levels of statistical income inequality over the course of the past several decades, however, have increasingly been expressed in urban areas with precisely that configuration of concentrated poverty and affluence (Coulton et al. 1996; Danziger 1996). The statistical measure of inequality may therefore tend to conflate the two areal effects and result in weaker ecological associations with mortality, particularly in studies dominated by the experience of the elderly. Indeed, the simple correlation of state-level statistical inequality with mortality in earlier research was largest for those aged 25 to 64 and twice that of the elderly (Kaplan et al. 1996).

The results of this analysis also address the similar controversy regarding the ecological effects of overall area socioeconomic level, as opposed to distributional, characteristics. Among the younger group, the poverty level of metropolitan areas, in particular, was associated with a large, increased risk of mortality that proved to be robust across models in which individual-level controls were entered into the analysis. Indeed, when the poverty-level measure was entered alongside the poverty concentration measure among this group, the concentration index lost its significance in the age-, sex-, race-adjusted model and in the age-, sex-adjusted model when an additional control for household income was introduced. Rather than a definitive indication that poverty level is a superior predictor of mortality than is poverty concentration, it is possible that the poverty concentration effect was confounded by poverty level, as evidenced by the moderate correlation of 0.50 between the two (table 3). On the other hand, the relative risk associated with poverty level was significant across all models, actually increasing in magnitude with the introduction of a control for race when the model was also adjusted for household income (table 4A: column 6). Such a pattern suggests that there is a racial element to both poverty level and poverty concentration. Neither poverty level nor median income of the MSA was significantly associated with mortality among the elderly in any model.

In an earlier study, we found that poverty-area residence in the United States was significantly associated with elevated mortality among the nonelderly, but not among the elderly, after controlling for individual socioeconomic characteristics (Waitzman and Smith 1998). The disparate findings regarding area-level effects on the mortality risk of the elderly between this analysis and our earlier research may be attributable to several factors. On the one hand, there might be cohort effects. The elderly group from the previous study was, for the most part, an earlier cohort, in which the youngest was born nearly two decades before the youngest elderly respondent in the current analysis. Elderly respondents in the previous study were therefore less exposed to rising spatial inequalities and concentrated poverty during the latter portion of their working lives and early retirement than was the elderly group on the NHIS. Such differences in exposure may have been important in terms of their effects on mortality. On the other hand, the NHIS included a broader age range of the elderly, with a larger proportion of very old respondents than in the earlier study. The very old elderly may be more vulnerable than their younger counterparts to the risks posed by concentrated poverty, perhaps due to the cumulating effects of adverse exposures associated with living in such areas.

Perhaps most pertinent to the disparate results among the elderly between this and our earlier analysis, however, were the differences in the areal measure used and in the geographic unit over which the analysis was performed. The measure in the earlier study, poverty-area residence, was a census tract–specific measure that would be likely to contribute positively to the p index for poverty concentration in urban areas used in the current analysis. However, the p index is an MSA average built up from similar, although not identical, individual tract-specific data. The earlier analysis focused on the mortality risks of living in poor tracts, whereas the current analysis focused, in some sense, on the mortality risks of residing in metropolitan areas where there were relatively more such tracts. The presence of areal effects on mortality risk among the elderly in the current analysis, then, may be attributable to threshold or spillover effects. Elderly residents of nonpoor neighborhoods in urban areas characterized by high concentrations of poverty, in other words, may experience an elevated risk of mortality that is attributable, for example, to limited access to high-quality health care services. The absence of a mortality effect associated with residing in poor tracts among the elderly, on the other hand, may be due to some "crossover," where the most vulnerable individuals died prior to reaching old age, as postulated in our earlier analysis (Waitzman and Smith 1998).

The extent to which the elevated mortality risk associated with higher concentrations of poverty was confined to tracts of concentrated poverty or spilled over more generally across the metropolitan area, as we suggested above was the case for the elderly, could not be ascertained. Nor could we assess the extent to which the significant reduction in mortality risk among the elderly associated with concentrated affluence was confined to those elderly respondents residing in affluent tracts. The absence of neighborhood- or tract-level identifiers on the NHIS prevented us from more specifically identifying the residence of sample respondents. Furthermore, measures of concentrated poverty and affluence taken from Coulton et al. (1996), while constructed from tract-level data, were metropolitan area–wide averages, as noted above. It is therefore possible that some metropolitan areas, despite having relatively low averages for economic segregation, contained tracts and neighborhoods that suffered from more severe poverty and disadvantage than any tract in metropolitan areas with higher averages of concentrated poverty as measured by the p index. Elevated mortality risk from such intense poverty and dislocation in these areas, as suggested by our earlier work on risk of poverty-area residence (Waitzman and Smith 1998), would tend to weaken the statistical association between poverty concentration and risk of mortality, as measured by the p index.

Indeed, Wilson's hypothesis regarding urban dislocation (1987) focused, in particular, on the growth of the number of extreme poverty tracts (those in which more than 40 percent of the population is below the poverty line) within metropolitan areas and the detrimental impact of that environment on the economic and social prospects of its residents. The "C" index of poverty concentration, based on the percentage of the metropolitan poverty population residing in such extreme poverty areas, is calibrated more to the depth of poverty in an area than is the p index. The incorporation of the C index into our analysis, however, generated nearly identical results to those associated with the p index. On the other hand, the "D" index of poverty concentration, the concentration measure least sensitive to the depth of poverty in neighborhoods, also showed the weakest associations with mortality risk. These results provided corroboration that risk of mortality is particularly sensitive to more intensive concentrations of poverty.

What of the effects of concentrated affluence? Although the protective effect of concentrated affluence was robust across specification among the elderly, an elevated mortality risk associated with concentrated affluence among the younger group was either more marginal in significance or particularly sensitive to model specification. We remain skeptical of the elevated mortality risk associated with concentrated affluence because median income in the metropolitan area had a moderate correlation (.53) with that index, and it was almost exclusively in the models that incorporated median income that the p index for affluence surfaced as a significant risk to mortality among the younger group.

Of course, the rising concentration of affluence was part and parcel of the growing economic segregation in urban areas of the country in the past few decades (Coulton et al. 1996; Danziger 1996). We therefore were interested in exploring the interactive effects on mortality of concentrated poverty and affluence. The integration of an interval-level interaction term between concentrated poverty and affluence, however, proved to be insignificant in all model specifications. In a cluster analysis, Coulton et al. (1996) identified five distinct types of metropolitan areas in terms of a poverty–affluence concentration profile. We also performed separate analyses based on these urban types. That categorization produced very lopsided numbers of MSAs across types, with some cells containing very few observations, particularly in our data. Furthermore, the results from the analyses incorporating these area variables were very inconsistent and yielded no compelling patterns.

Our analysis of the effects of urban poverty concentration on mortality risk within the income distribution demonstrated that such risk, although largest among the poor, was not confined to them (table 5A). Those in low- to middle-income households, with annual earnings above $15,000 but under $50,000, also experienced significantly elevated risk associated with areal characteristics, whereas those with higher earnings were not significantly affected. First, this uneven pattern of risk across the income distribution lends support to the thesis that increasing economic segregation within urban areas may be partly responsible for increases in socioeconomic inequalities in mortality over the past several decades. Second, the very high mortality risks associated with concentrated poverty among those with very low incomes (table 5A)—which, however, were greatly attenuated with the control for race (table 5B)—lends support to the Wilson hypothesis that concentrated urban poverty has been most detrimental to blacks, particularly nonelderly blacks. Indeed, a similar sensitivity of the poverty concentration index surfaced with the control for race and household income in the full model (table 4A, column 4).

Growing economic segregation has been associated with, and mediated by, growing racial segregation and with higher percentages of minority, particularly black minority, populations (Massey and Eggers 1990). The extent to which the mortality effects that we uncovered in this analysis are attributable to growing racial segregation in urban areas, and are felt most intensely by minority—particularly black minority—populations, deserves separate treatment in a dedicated analysis. Data with larger numbers of black respondents than were available to us, and for health outcomes that have a higher incidence than mortality, would be helpful in performing such an analysis.

The fact that poverty concentration was significantly associated with mortality risk among the middle-income group, however, also suggests that the Wilson hypothesis does not constitute a full explanation. In the race-adjusted model, only poverty level and median income were significant predictors of mortality (table 5B). One study (McDonough et al. 1997) found that income instability was a significant predictor of mortality among middle-income earners, and higher levels of poverty or lower levels of median income in an area may indicate weaker labor market conditions that pose risks to stable income.

Urban areas that are experiencing rapid economic growth, in fact, are also most likely to be subject to the emerging patterns of economic segregation associated with that growth (Goldsmith and Blakely 1992). High levels of economic segregation, in other words, might act at this juncture as a proxy for rapid growth and relatively stable earnings prospects for those in the middle class, whereas high levels of urban poverty or low median income might be a proxy for depressed areas that have largely been left out of the emerging economic nexus and pose risks to economic security for those in the middle class. Those at the bottom of the economic ladder (i.e., the poor, minorities) and those outside the market nexus (i.e., the elderly) may be most immediately and adversely affected by rising spatial inequalities and the increased social isolation that it entails. As the relative economic advantage of these urban areas declines over time, their middle-income residents may also be subject to the heightened mortality risk associated with increased isolation.

In addition to the limitations we have reviewed elsewhere in the text, there are other notable strictures on our analysis. We referred to patterns of increasing economic segregation among urban areas in the country and to widening socioeconomic disparities in mortality, but our analysis was cross-sectional. We examined how variations in areal characteristics of urban areas across the country affect mortality risk, but our data did not permit a dynamic analysis. Furthermore, the measures of concentrated poverty and affluence used in our analysis were taken as of 1990, whereas the mortality experience that we examined transpired from

1986 to 1994. Added to the fact that some respondents died before the date on which area characteristics were measured is the potential impact of lag effects. Presumably, the full effects of exposure take time, and our results would no doubt be enhanced with additional years of exposure. A closely related matter concerns migration. We compiled residence characteristics at the time of the NHIS interview, but respondents could have recently migrated to, or subsequently moved away from, the area. A full accounting of residential history was impossible, given data constraints. In any case, such measurement error suggests that our results are conservative.

Our analyses also assumed that economic segregation causally precedes risk of death. It is plausible, although we do not think it likely, that high mortality rates may promote increases in the spatial concentration of affluence or poverty. This view holds that a health threat is interpreted by a portion of residents as tied to the specific locale and as sufficiently serious to prompt them to migrate to other, more healthful areas, thereby leaving their old residence with a greater concentration of poverty than before. The perception of localized causes by residents is probably more likely for external causes of death, such as homicide, than for elevated rates of, say, cardiovascular disease. Our earlier research on the elevated mortality risks associated with residence in federally designated poverty areas indicated that such risk was not tied specifically to external causes but, rather, prevailed across several causes (Waitzman and Smith 1998). Future research exploring the uncovered relations between economic segregation and mortality in the current analysis by cause could help in addressing the reverse causality argument.

Of course, for reverse causality to occur, the threat would also have to be so great that more would be gained by leaving than by working to reduce or eliminate the health threat. The literature on migration demonstrates that economic forces play a critical role in determining selective in- and outmigration from urban neighborhoods (Wilson 1987), forces that are a critical influence on economic segregation and, ultimately, on health risks. We are unaware of any study that addresses the alternative hypothesis, although it remains to be seen whether it can be dismissed entirely as a possible explanation for our findings. An important impediment to such an investigation is the lack of a large, longitudinal data set for both individuals and communities.

The emphasis of our investigation has been on spatial concentration of poverty and affluence. Introducing additional areal characteristics, like racial and ethnic compositions, as discussed above, and others that are not considered in our analysis, might shed light on our findings. Such an enhancement to our study must wait for an expansion of our modest sample of metropolitan areas. Given the appropriate confidentiality concerns of the NCHS, we are, at present, restricted to the analysis of 30 MSAs. One might also note that, although those areas constituted several of the largest MSAs, encompassing nearly 40 percent of the U.S. adult population, and although variation in concentrated poverty and affluence across these 30 MSAs was on a similar track across all metropolitan areas, the restricted number of observations probably was a factor in the conservatism of our results.

Our analysis suggests that the spatial configuration of urban areas along socioeconomic lines is significantly associated with risk of mortality, even after controlling for individual-level socioeconomic characteristics. The heightened risks associated with economic segregation were greatest among the poor, but were not confined to them. These results suggest that economic segregation in metropolitan areas might be a factor in the association uncovered in earlier research between statistical socioeconomic inequalities and mortality. The spatial articulation of income inequalities in metropolitan areas may therefore be critical to the deterioration of "social capital" that has been associated in earlier work with rising income inequalities (Kawachi et al. 1997).

One might be inclined to interpret our findings as lending more support to the "material resource reduction" argument than to the "social cohesion" thesis, as the mortality effects associated with the p index for poverty were stronger and more robust than those associated with concentrated affluence. Any increase in economic segregation, whether at the top or bottom of the distribution, would seem to matter for proponents of the theory that a reduction in social cohesion associated with inequality underlies increased mortality. We would argue, however, that what matters more in support of these arguments, which are probably not mutually exclusive in any case, is the locale where the effect is manifest. If the mortality effects associated with concentrated poverty are limited to areas of poverty, then indeed one would be inclined to point to resource reduction as a critical factor. On the other hand, the mortality effects may be more broadly felt across the urban area, in which case the social cohesion argument would be bolstered. The particular measure (affluence or poverty) of concentration matters less, in other words, than the locale of the effect. As noted above, we were not able to identify the locale of the mortality effects uncovered in our analysis, but to the extent that they extend beyond the low-income population (table 5A, B), we believe that the social cohesion argument receives some indirect support. In either case, policies directed toward reducing economic segregation in urban areas may be effective in reducing some of the lethal effects associated with increasing socioeconomic inequalities.

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Address correspondence to: Norman J. Waitzman, PhD, University of Utah, Department of Economics, 1645 East Central Campus Drive Front, Salt Lake City, UT 84112-9300.