Community Characteristics and Mortality: The Relative Strength of Association of Different Community Characteristics

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Objectives. We compared the strength of association between average 5-year county-level mortality rates and area-level measures, including air quality, sociodemographic characteristics, violence, and economic distress.

Methods. We obtained mortality data from the National Vital Statistics System and linked it to socioeconomic and demographic data from the Census Bureau, air quality data, violent crime statistics, and loan delinquency data. We modeled 5-year average mortality rates (1998–2002) for all-cause, cancer, heart disease, stroke, and respiratory diseases as a function of county-level characteristics using ordinary least squares regression models. We limited analyses to counties with population of 100 000 or greater (n = 458).

Results. Demographic and socioeconomic characteristics, particularly the percentage older than 65 years and near poor, were top predictors of all-cause and condition-specific mortality, as were a high concentration of construction and service workers. We found weaker associations for air quality, mortgage delinquencies, and violent crimes. Protective characteristics included the percentage of Hispanics, Asians, and married residents.

Conclusions. Multiple factors influence county-level mortality. Although county demographic and socioeconomic characteristics are important, there are independent, although weaker, associations of other environmental characteristics. Future studies should investigate these factors to better understand community mortality risk. (*Am J Public Health.* 2014;104:1751–1758. doi:10.2105/AJPH.2014.301944)

Community characteristics have been linked to mortality risks. Previous research has documented associations between area-level poverty, education, and racial residential segregation with all-cause and condition-specific mortality rates.[1–4] Although these studies highlight the relationship between social context and mortality, they typically focus on a limited set of indicators. Furthermore, these studies rarely examine social factors in conjunction with other area-level factors.

For example, a distinct line of research has emerged on the role of air quality in health and mortality. These studies have found significant associations between airborne carbon monoxide, ozone, and fine particulate matter (PM) with cardiovascular symptoms, cancer, and deaths. For instance, the probability of emergency department admissions for cardiovascular disease increases 0.96% for every 1 part-per-billion increase in peak daily carbon monoxide.[5] A 10 part-per-billion increase in ozone levels for 1 week increases cardiovascular and respiratory mortality by 0.64%.[6] Additionally, a 10-microgram increase in airborne fine PM has been shown to increase admissions for respiratory and cardiovascular conditions by similar magnitudes.[7] Finally, there are characteristics, such as financial distress, that have demonstrated associations with health outcomes at the individual level,[8–11] but their roles as independent community-level predictors of mortality have not been examined.

We address this gap in the literature by simultaneously modeling and examining the relative strength of association between average 5-year mortality rates and a diverse set of county-level characteristics, including air quality, sociodemographics, violence, and housing distress, that have emerged from different lines of research that typically do not intersect.

METHODS

We drew on national data from federal agencies, including the Environmental Protection Agency, the Federal Bureau of Investigation, and the Federal Reserve as well as the Census Bureau and the National Vital Statistics System.

Dependent Variables

The dependent variables were derived from 5 years of annual mortality data reported to the National Vital Statistics System from 1998 to 2002 for counties with populations of 100 000 or greater (n = 458). Using information on causes of death available from the National Vital Statistics System, we calculated average 5-year all-cause mortality rates as well as mortality rates for 4 leading causes of death (cancer, heart disease, stroke, and respiratory diseases).

As we examined county age distribution as a predictor in our models, we did not use age-adjusted mortality rates as the study outcome. More details are available from http://www.cdc.gov/nchs/deaths.htm.

Independent Variables

Sociodemographic characteristics. We obtained county-level information from Summary Files 1 and 3 released by the US Census Bureau for the 2000 Census on the sociodemographic and economic makeup of the 458 counties in our analysis. These included the proportion of residents of different age categories, race and ethnicity, educational attainment, poverty level, and occupation for each county. Educational attainment for residents aged 25 years and older included less than high school, high school graduate, some college, and college or more. We categorized poverty levels within the counties as poor (income-to-poverty ratio < 1.00), near poor (income-to-poverty ratio ≥ 1.00 and < 2.00), and nonpoor (income-to-poverty ratio ≥ 2.00). We calculated the poverty ratio using the federal poverty level standards specified by the Office of Management and Budget for 2000. We categorized occupations as management, business, financial, or other professional; sales, office, or administration; service; farming, fishing, or forestry; construction, extraction, maintenance and production, transportation, or material moving; and other. Details are available from http://www.census.gov/prod/2001pubs/mso-01icdp.pdf.

Air quality. We obtained county-level data for 2000 on 6 common air pollutants—ground-level ozone; $PM_{2.5}$, representing particles with diameters less than or equal to 2.5 micrograms; PM_{10}, representing particles with diameters between 2.5 and 10 micrograms; carbon monoxide (CO); nitrogen dioxide (NO_2); and sulfur dioxide (SO_2)—from the US Environmental Protection Agency.[12] We decided not to include the Air Quality Index because the reported Air Quality Index score for each county can reflect different combinations of the 6 criterion pollutants. We also excluded 4 individual pollutants, CO, NO_2, PM_{10}, and SO_2, with more than 25% missing because of concerns regarding the validity of the imputed value when levels of missing values reached 50% to 60%.

Violent crime. We obtained data on violent crime activity per county from the Federal Bureau of Investigation's Uniform Crime Reporting system, which the Inter-University Consortium for Political and Social Research maintains and cleans.[13] Violent crimes consisted of murder, rape, robbery, aggravated assault, burglary, larceny, and motor vehicle theft. We divided the count of violent crimes in each county by its population in 2000 to compute the violent crime rate per 1000 residents.

We imputed values for counties with information for only part of the year by annualizing the available months of data when at least 3 months of data were available. For cases in which less than 3 months of crime data were reported for a county, we imputed missing values using data from neighboring counties. Less than 6 months of data were available for 14% of the counties in our sample.

Economic distress. We obtained county-level data on mortgage, credit card, and automobile loan delinquencies from the Federal Reserve Bank of New York.[14] This data set included the percentage of a county's population with loans more than 90 days in arrears on the basis of a 5% sample of individuals who had credit reports with EquiFax, one of the major national credit bureaus.

Delinquency data were reported only for counties with at least 10 000 consumers with credit reports as of December 2000. We used the average of delinquency data for each category of loans in our models.

Analysis

We performed all analyses in our study at the county level. We limited the analysis to counties with a population of 100 000 or greater because the reliability of mortality rates for these counties is more robust. To identify potentially important contextual factors, we examined the bivariate association of each independent variable with mortality rates for death from all causes and the top 4 causes of death (cancer, heart disease, respiratory conditions, and stroke). If we observed multiple measures for a particular domain (air quality and economic distress) to be significantly associated with mortality outcomes, we modeled county mortality rates as a function of significant variables using multiple linear regression to determine whether independent relationships existed and if not to identify the best representative indicator.

Finally, we combined significant measures from these bivariate and domain-specific regression models into a final set of models to compare the relative influence of different county-level sociodemographic, economic, and environmental characteristics. We have presented the difference in the number of deaths for counties at the 75th percentile of each characteristic compared with counties at the 25th percentile to facilitate comparison between characteristics with different scales. The final set of models examined education, occupation, and poverty in separate models because of the strong collinear relationship of these socioeconomic variables. To correct for heteroskedacity in errors, we weighted observations by the square root of a county's population, after finding that SEs were approximately inversely proportional to population size. We performed all analyses on Stata 11.0 (StataCorp LP, College Station, TX). We used a $P < .05$ level to indicate statistical significance and provided 95% confidence intervals (CIs) for estimates.

Except for the 4 air pollutants, missing data at the county level were not common for variables included in our analyses. We imputed values for 87 counties with missing data on fine PM ($PM_{2.5}$) and 11 counties that did not report any violent crime statistics for 2000. Our imputation technique treated air quality as correlated with observed county-level sociodemographic variables. We used the empirical correlation between these variables for counties with complete air quality to specify a multivariate normal distribution and simulated draws from this distribution to impute missing air quality data. We compared this imputation method to an alternative approach that calculated missing observations as a spatially weighted average of nearby counties' pollution data. Because average associations were broadly similar in both imputation techniques, we have presented our results using multiple imputation,[15] because this approach conservatively adjusts SEs upward to account for imputation uncertainty.[16]

RESULTS

Table 1 presents descriptive statistics of mortality, sociodemographic, economic, and environmental characteristics for the 458 counties, with each county weighted equally. The average all-cause mortality rate was 843 per 100 000 persons. Deaths from heart conditions, cancer, respiratory conditions, and stroke were 242, 197, 83, and 45, respectively, per 100 000 residents. On average, 12.4% of county residents were aged 65 years or older, with 12.0% Black, 9.5% Hispanic, and 3.3% Asian residents. More than a quarter of residents were in or near poverty level. An average of 27.0% of residents were employed in sales or administrative occupations, with another 23.5% employed in construction-related work. Fifty-two percent of county residents were married. The average level of fine PM ($PM_{2.5}$) was 41 (representing good air quality), and the average number of violent crimes per 1000 residents was 44. Across all counties, 1.1% of mortgages were more than 90 days delinquent in 2000.

TABLE 1—Sociodemographic, Economic, and Environmental Characteristics of Included Counties (n = 458): US Counties With Population ≥ 100 000, 2000

Characteristic	Mean (95% CI)	Min	Max
Causes of death/100 000[a]			
All causes	842.8 (823.8, 861.8)	371.0	1587.9
Heart disease	241.5 (234.6, 248.5)	85.8	518.7
Cancer	197.0 (192.5, 201.5)	76.1	412.1
Respiratory conditions	82.9 (80.8, 85.0)	25.6	169.7
Stroke	45.4 (44.1, 46.6)	16.3	99.2
Age, y, %			
0–17	25.4 (25.2, 25.7)	14.5	36.2
18–24	10.0 (9.7, 10.3)	4.5	32.0
25–44	30.1 (29.8, 30.3)	18.8	43.5
45–64	22.1 (21.9, 22.3)	12.7	29.7
65–79	9.2 (8.9, 9.4)	3.8	26.2
≥ 80	3.2 (3.1, 3.3)	0.9	8.9
Race/ethnicity, %			
White	73.8 (72.1, 75.5)	4.9	97.4
Black	12.0 (10.8, 13.2)	0.2	67.3
Asian	3.3 (2.8, 3.7)	0.3	58.2
Hispanic	9.5 (8.3, 10.7)	0.4	94.3
Native American or other	1.5 (1.2, 1.7)	0.2	38.6
Married resident, %	52.1 (51.5, 52.8)	22.8	70.8
Education, %			
< high school	17.4 (16.8, 18.0)	5.1	49.5
Completed high school	29.0 (28.4, 29.6)	11.7	49.9
Some college	28.3 (27.9, 28.7)	15.8	40.3
Poverty status,[b] %			
In poverty	11.3 (10.8, 11.7)	2.6	35.9
Near poverty	16.2 (15.7, 16.6)	5.8	29.8
Employment, %			
Management or professional occupations	33.7 (33.1, 34.3)	20.3	61.3
Sales or administration	27.0 (26.8, 27.2)	18.1	32.4
Construction	23.5 (23.0, 24.0)	8.3	43.9
Service occupations	15.1 (14.9, 15.4)	8.7	30.3
Farming or agriculture	0.7 (0.5, 0.8)	0.1	13.2
Average fine particulate matter[b]	41.2 (40.2, 42.1)	4.2	73.5
Percentage of mortgages > 90-d delinquent	1.1 (1.0, 1.1)	0.1	3.9
No. of violent crimes/1000 persons	43.7 (41.9, 45.4)	10.4	145.5

Note. CI = confidence interval.
[a]5-year average (1998–2002).
[b]We calculated the poverty ratio using the federal poverty level standards specified by the Office of Management and Budget for 2000.
[c]Particles with diameters ≤ 2.5 μg. On the basis of 370 counties with data on particulate matter.

TABLE 2—Pearson Correlation of County Characteristics in 2000 and Average 5-Year All-Cause Mortality (1998–2002): US Counties With Population ≥ 100 000

Characteristics	R (95% CI)
Age, y	
0–17	−0.5146*** (−0.6062, −0.4230)
18–24	−0.2932*** (−0.3848, −0.2016)
25–44	−0.6303*** (−0.7219, −0.5387)
45–64	0.4563*** (0.3647, 0.5479)
65–79	0.8478*** (0.7562, 0.9394)
≥ 80	0.8584*** (0.7668, 0.9500)
Race/ethnicity	
White	0.2173*** (0.1257, 0.3089)
Black	0.1368*** (0.0452, 0.2284)
Asian	−0.2909*** (−0.3825, −0.1993)
Hispanic	−0.3112*** (−0.4028, −0.2196)
Native American or other	−0.0888 (−0.1804, 0.0028)
Education	
< high school	0.2403*** (0.1487, 0.3319)
High school graduate	0.5863*** (0.4947, 0.6779)
Some college	−0.2644*** (−0.3560, −0.1728)
Employment	
Service	0.3944*** (0.3028, 0.4860)
Sales or administration	0.0130 (−0.0786, 0.1046)
Farming	−0.0838 (−0.1754, 0.0078)
Construction	0.3226*** (0.2310, 0.4142)
Poverty status	
Poverty	0.1612*** (0.0696, 0.2528)
Near poverty	0.3067*** (0.2151, 0.3983)
Married resident	−0.2913*** (−0.3829, −0.1997)
$PM_{2.5}$	0.1291* (0.0273, 0.2309)
Mortgage delinquency	0.3580*** (0.2664, 0.4496)
Violent crime	0.1300** (0.0373, 0.2227)

Note. CI = confidence interval; $PM_{2.5}$ = particulate matter with diameters ≤ 2.5 μg. We calculated the poverty ratio using the federal poverty level standards specified by the Office of Management and Budget for 2000.
**P* < .05; ***P* < .01; ****P* < .001.

Community Characteristics and All-Cause Mortality

Table 2 presents the bivariate correlation between county characteristics and all-cause mortality. As expected, counties with older populations or higher percentages of residents with lower educational attainment or lower household income had higher mortality rates. Counties with higher percentages of married residents or Hispanic or Asian residents tended to have lower mortality rates.

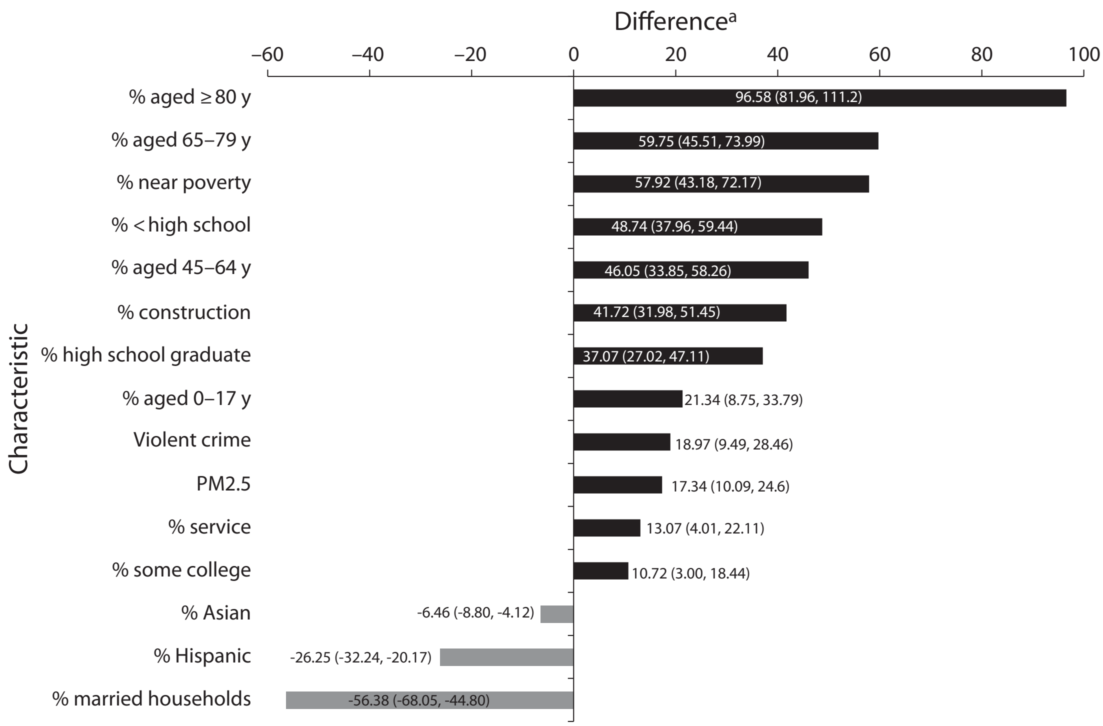
Counties with higher percentages of residents who were White or Black or employed in service occupations and construction had higher mortality rates. Counties with more economic distress, as measured by higher mortgage delinquencies, also had higher mortality rates. In terms of air pollutants and crime, higher levels of fine PM and violent crime were associated with higher all-cause mortality. Based on the multiple linear regression model, Figure 1 presents the difference in number of deaths from all causes per 100 000 persons between counties at the 25th percentile and counties at the 75th percentile of each county characteristic. Overall, counties with higher proportions of elderly residents, particularly those aged 65 years and older, had the largest difference in mortality. Although weaker than those for age, county socioeconomic characteristics also had strong, independent associations with mortality. Counties with high percentages of residents with low educational attainment or near poverty also had substantially higher numbers of deaths.

Interestingly, the percentage of residents in poverty in a county was not significantly associated with mortality. The association of occupation with mortality was generally comparable to those observed for education. The difference in mortality from the 25th to 75th percentile counties ranged between 13.1 (percentage service workers) and 41.7 (percentage construction workers) for occupation and between 10.7 (percentage some college) and 48.7 (percentage < high school) for education. Of the significant relationships we found, the difference in the number of deaths between 25th and 75th percentile counties associated with rates of violent crime and level of fine PM was smallest but remained substantial at 19.0 and 17.3, respectively.

Three characteristics, the percentage of Hispanics, Asians, and married residents in a county were associated with reductions in all-cause mortality. The reduction ranged between 56.4 (percentage married) and 6.5 (percentage Asian) for counties at the 25th and 75th percentile of these sociodemographic characteristics.

Community Characteristics and Higher Cause-Specific Mortality

Table 3 presents the county characteristics ranked by the difference in the number of condition-specific deaths per 100 000 persons between counties at the 25th and 75th percentile of each characteristic. As with all-cause mortality, county age and socioeconomic characteristics—particularly the percentage of elderly residents and residents of low income and low educational attainment—were robust predictors of cause-specific mortality. Of the occupation categories we examined, the percentage of construction workers in a county was consistently associated with greater mortality for all 4 causes, although the ranking of its influence varied by condition, being strongest for heart disease and weakest for respiratory



Note. PM2.5 = particulate matter with diameters ≤ 2.5 μg. We calculated the poverty ratio using the federal poverty level standards specified by the Office of Management and Budget for 2000.
[a]Number of deaths from all causes per 100 000 persons between counties at the 25th percentile and counties at the 75th percentile of each characteristic. All associations were statistically significant at $p < 0.01$. Reference categories for regression models: Percent Bachelors Plus; management, business, financial operations, and professional occupations; 25-44 years of age; Percent White; Poverty ≥ 200%. Values in parentheses indicate 95% confidence intervals.

FIGURE 1—Magnitude of significant county characteristics association with all-cause mortality: US counties with population ≥ 100 000: 1998–2002.

TABLE 3—The Estimated Increase in Death per 100 000 Persons (5-Year Average, 1998–2002) for Selected Leading Causes of Death for Difference From 25th to 75th percentile of County Characteristics in 2000: US Counties With Population ≥ 100 000

	Heart Disease		Cancer		Respiratory Condition		Stroke	
Rank[a]	Characteristic	Estimate, % (95% CI)	Characteristic	Estimate, % (95% CI)	Characteristic	Estimate, % (95% CI)	Characteristic	Estimate, % (95% CI)
1	Aged ≥ 80 y	44.36*** (35.88, 52.84)	Aged 65–79 y	22.94*** (19.40, 26.44)	Near poverty	10.05*** (7.16, 12.95)	Aged ≥ 80 y	9.55*** (7.47, 11.62)
2	High school graduate	19.92*** (14.12, 25.80)	Aged ≥ 80 y	13.64*** (10.10, 17.33)	Aged 65–79 y	9.20*** (6.10, 12.31)	Near poverty	7.22*** (5.37, 9.07)
3	Employed in construction	16.07*** (10.77, 21.45)	Aged 45–64 y	9.27*** (6.24, 12.29)	< high school	7.23*** (4.87, 9.52)	Aged 45–64 y	5.10*** (3.38, 6.82)
4	Near poverty	14.50** (5.92, 23.07)	High school graduate	7.35*** (4.82, 9.80)	Aged 45–64 y	6.30*** (3.66, 8.93)	< high school	4.94*** (3.41, 6.47)
5	< high school	14.32*** (8.13, 20.51)	< high school	6.88*** (4.17, 9.52)	Aged ≥ 80 y	5.38** (2.19, 8.58)	Employed in construction	3.72*** (2.53, 4.99)
6	Aged 65–79 y	12.61** (4.35, 20.88)	Employed in construction	5.07*** (2.69, 7.36)	Aged 0–17 y	4.80** (2.03, 7.53)	Violent crime	3.16*** (1.84, 4.48)
7	Aged 45–64 y	12.01** (4.99, 19.00)	Near poverty	3.95* (0.31, 7.59)	Employed in construction	3.64*** (1.66, 5.54)	Some college	2.28*** (1.17, 3.39)
8	Employed in service	10.73*** (5.77, 15.68)	Aged 0–17 y	3.64* (0.51, 6.76)	Some college	2.83** (1.11, 4.50)	Aged 18–24 y	2.18*** (1.10, 3.25)
9	Mortgage delinquency	9.27*** (4.56, 13.94)	Employed in service	2.97** (0.82, 5.15)	$PM_{2.5}$	2.21** (0.62, 3.69)	$PM_{2.5}$	1.97*** (0.98, 3.08)
10	$PM_{2.5}$	9.23*** (5.17, 13.28)	$PM_{2.5}$	2.58** (0.62, 4.43)	Employed in service	1.86* (0.03, 3.68)	Employed in farming	0.34** (0.11, 0.57)
11	Employed in sales or administration	5.36* (0.78, 9.93)						

Note. CI = confidence interval; $PM_{2.5}$ = particulate matter with diameters ≤ 2.5 μg. Only statistically significant effects are shown. Ranking is on the basis of number of additional deaths. Lower ranking indicates a more detrimental effect (greater number of additional deaths). Reference categories for multivariate models: percentage bachelor's degree or higher; management, business, financial operations, and professional occupations; aged 25–44 years; percentage White; poverty ≥ 200%. We calculated the poverty ratio using the federal poverty level standards specified by the Office of Management and Budget for 2000.
[a]Listed from largest to smallest significant magnitude.
*$P < .05$; **$P < .01$; ***$P < .001$.

conditions. We also observed significant associations of service, sales, and farming, mining, or fishing occupations with greater mortality, but we did not consistently observe these associations across conditions.

It is worth noting the variation in factors that appear influential on cause-specific deaths compared with factors that were associated with all-cause mortality. For example, mortgage delinquency and employment in sales and farming were significant predictors of cause-specific mortality but not of all-cause mortality. Also notable was the significant independent influence of the less traditionally examined community predictors such as air quality, mortgage delinquency, and violent crime. Although the difference in deaths was more modest than was that for county age and socioeconomic characteristics, fine PM was associated with each of the 4 cause-specific deaths we examined. Counties at the 75th percentile for mortgage delinquencies and violent crime were associated with more deaths owing to heart disease and stroke, respectively. However, these 2 indicators did not significantly contribute to deaths for the other causes.

Community Characteristics and Lower Cause-Specific Mortality

Most of the statistically significant associations with cause-specific mortality were detrimental, but several sociodemographic characteristics were associated with lower mortality rates (Table 4). A higher percentage of Hispanic residents was associated with fewer deaths for all conditions, except heart disease.

Counties with higher percentages of married residents and Asian residents had fewer deaths from cancer and respiratory conditions, whereas counties with higher percentages of Black residents had fewer deaths owing to respiratory conditions. One unexpected finding was the association of greater mortgage delinquency rates with reduced stroke mortality, although the statistical significance of this effect ($P = .04$) was not as strong as were the other predictors.

DISCUSSION

We have described the relative strength of the independent associations of a diverse set

TABLE 4—The Estimated Reduction in Death per 100 000 Persons (5-Year Average, 1998–2002) for Selected Leading Causes of Death for Difference From 25th to 75th Percentile of County Characteristics in 2000: US Counties With Population ≥ 100 000

	Cancer		Respiratory Conditions		Stroke	
Rank[a]	Characteristic	Estimate, % (95% CI)	Characteristic	Estimate, % (95% CI)	Characteristic	Estimate, % (95% CI)
1	Married	−12.60*** (−15.47, −9.64)	Married	−11.24*** (−13.78, −8.71)	Hispanic	−2.62*** (−3.46, −1.77)
2	Hispanic	−6.24*** (−7.76, −4.73)	Black	−8.16*** (−10.27, −5.91)	Mortgage delinquency	−1.24* (−2.40, −0.08)
3	Asian	−1.17*** (−1.76, −0.59)	Hispanic	−4.73*** (−5.99, −3.38)		
4			Asian	−0.98*** (−1.49, −0.46)		

Note. CI = confidence interval. Only statistically significant effects are shown. Ranking is on the basis of the number of fewer deaths. Lower ranking indicates more protective effect (more deaths averted). No significant factor is found for heart disease. Reference categories for regression models are percentage bachelor's degree or higher; management, business, financial operations, and professional occupations; younger than 65 years; percentage White; poverty ≥ 200%.
[a]Listed from largest to smallest significant magnitude.
*$P < .05$; **$P < .01$; ***$P < .001$.

of county-level characteristics with mortality. We observed the expected strong links of mortality rates with county demographic and socioeconomic characteristics. The percentages of elderly residents older than 65 years and of the near poor were the top predictors of all-cause mortality. The proportion of residents with less than a high school education, aged 45 to 64 years, or employed in construction also demonstrated a substantial, but more modest, association with all-cause mortality. The associations between air quality, mortgage delinquencies, and violent crimes were significant but among the weakest of the county characteristics we examined. We observed similar results with condition-specific mortality, with strong associations of older age and lower socioeconomic status and weaker, but significant, associations for air quality, mortgage delinquencies, and violent crime. Higher percentages of Hispanics, Asians, and married residents were generally protective, with significant associations with reduced mortality observed for both all-cause and cause-specific mortality.

After age, county socioeconomic characteristics exhibited the strongest association with mortality. Education demonstrated the expected relationship with mortality, with lower educational attainment associated with greater numbers of deaths. Selected occupations are also linked with higher mortality. Counties with higher percentages of construction workers had consistently greater all-cause and condition-specific mortality. Employment in service, sales, or farming also had a significant association with mortality, although these associations were weaker and less consistent than was the association with employment in construction. Previous research suggests that the link between occupation and mortality derives from the risks and exposures associated with specific occupations.

The numerous dangers directly associated with construction work, including falls, are well documented in the literature.[17–19] Furthermore, construction workers are often exposed to hazardous materials and chemicals, which pose longer-term risks to mortality from cancer[20] and respiratory diseases.[21] The greater mortality associated with a greater concentration of service and sales or office workers may be linked to hazards associated with subcategories of these occupations. For example, protective services, which include firefighting and law enforcement, are inherently dangerous occupations.[22] Wholesale and retail workers are often at a higher risk of death from traffic accidents and assaults and violent acts, with highest fatality rates at gasoline stations, convenience stores, and used car dealerships.[23] Aside from occupation-related exposures, sales or office and service workers, respectively, had 24 and 43 higher adjusted odds of being current smokers than did professional and management occupations,[24] which may contribute to their association with condition-specific mortality.

It is surprising that the percentage of the near poor (100%–200% federal poverty level) but not the percentage of the poor (< 100% federal poverty level) was associated with greater mortality. However, this finding may reflect the fragility of the health and social services safety net for the working poor. Programs such as food stamps, housing subsidies, and Medicaid increase health care access[25] and provide needed support for the poorest and most vulnerable.[26] However, the near poor have not been as well supported.[27] Many low-wage and part-time workers lack employer-based health insurance and other benefits[28] but do not qualify for such programs as Medicaid and state-supported child care.[29]

The burden of cost sharing and the lack of affordable coverage options for these workers have contributed to reduced utilization of preventive services and poorer medication adherence even among the insured.[30–32] Furthermore, the lack of affordable housing and the instability of low-wage employment[33,34] likely create chronic stress among the near poor that interacts with unhealthy behaviors to increase mortality risk.[35] The Medicaid expansion under the Affordable Care Act should improve health access for the near poor in participating states, which can in turn improve health outcomes and reduce mortality risks. However, more comprehensive measures, such as "living wage" legislation,[36] are needed to address the higher mortality risk observed in counties with large proportions of the near poor.

Few studies have simultaneously modeled community-level air quality, public safety, and financial distress after controlling for a robust set of demographic and socioeconomic characteristics. Our findings indicate that the associations of these characteristics with mortality are independent but weaker than are those for county demographic and socioeconomic characteristics. Our results are broadly consistent with the literature. Numerous studies have already linked fine PM to greater all-cause mortality and cardiovascular and respiratory outcomes.[37–40] Rettenmaier and Wang used the County Health Ranking data set to examine county-level associations of 24 behavioral, clinical care, socioeconomic, and environmental factors with mortality.[41] The authors also identified significant effects of violent crime with premature mortality. However, their study, which used a different definition of air quality (i.e., number of unhealthy days) and included numerous county-level behavioral factors, did not find, as we did, a relationship between fine PM and premature mortality.

The relationship between community-level financial distress and mortality has not been well studied. The few existing studies, grounded on individual-level analyses, have reported poorer health, including nonadherence to treatment, greater odds of no insurance, and higher prevalence of hypertension, heart disease, and depression and lower self-rated health among individuals experiencing debt-related strain.[8–11] Our study suggests mortgage-related distress is also associated with deaths owing to heart disease at the county level.

Although the ecological associational design of our study precludes causal inference, we were able to describe the relative strength of the associations for a diverse set of county-level characteristics on all-cause and condition-specific mortality. Our study confirms the expected importance of county demographic and socioeconomic characteristics. However, we also highlighted the independent association of fine PM, community violence, and mortgage distress with important mortality outcomes. These variables are rarely examined jointly with community demographic and socioeconomic characteristics. Our results highlight the need for studies that investigate factors from separate lines of research to better understand the key drivers of community mortality risk. ■

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K. S. Chan and D. J. Gaskin conceptualized the study and developed the analytic plan. K. S. Chan wrote the initial draft of the article, with contributions from E. Roberts, R. McCleary, C. Buttorff, and D. J. Gaskin. E. Roberts and R. McCleary acquired the data and conducted the data analyses. E. Roberts, R. McCleary, and C. Buttorff participated in the development of the analytic plan and interpretation of results. All authors reviewed, refined, and approved the final draft.

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Human Participant Protection

The Johns Hopkins Bloomberg School of Public Health institutional review board reviewed and approved the study protocol.

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