

Geographic Patterns of Renal Cancer in the United States¹

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ABSTRACT—Mapping of the geographic distribution of renal cancer mortality for groupings of U.S. counties revealed clustering of elevated rates among white males and females in the upper north-central part of the country. Throughout the United States, mortality increased with urbanization for males only, whereas rates for both sexes showed positive correlations with socioeconomic status. The major correlate of the cancer rates was ethnicity. Mortality was elevated in counties with high percentages of residents of German, Scandinavian, and especially Russian descent. Ethnic susceptibility appears to account, at least partly, for the regional clustering of kidney cancer and may provide leads to environmental determinants.—JNCI 63: 363-366, 1979.

About 7,000 deaths in the United States are attributed each year to renal cancer, most of which are adenocarcinomas; yet little is known about the origins of this tumor (1-3). Clues were sought through an examination of the geographic distribution of this cancer across the country.

METHODS

Age-adjusted rates of mortality from cancer of the kidney (International Classification of Diseases, 7th revision: code 180) were calculated for the white population in the 506 SEA of the contiguous United States during the 20-year period 1950-69. The SEA are combinations of adjacent counties with similar demographic and economic composition (4). A direct standardization was employed, as used for the calculation of age-adjusted mortality rates for U.S. counties (1). The percentile distributions of the rates were then plotted in computer-generated SEA maps for the white male and female populations in the United States.

We next applied weighted multiple regression techniques, as described in detail elsewhere (5), to estimate and test for the influences of demographic, socioeconomic, ethnic, and industrial indices upon the SEA mortality rates. These included the following continuous variables: percent urban, percent rural farm, median education level, median income, percent of foreign birth or parentage for 11 ethnic groups, and percent employed in each of 18 major Standard Industrial Classification codes. Cross-tabulations are presented for selected variables judged to be significant by the regression analyses.

Employing only the 396 SEA with nonwhite populations of at least 2,000, we conducted similar analyses for kidney cancer mortality among nonwhites.

RESULTS

Mortality was elevated among white males in the upper north-central part of the United States and in the Northeast (text-fig. 1). Among white females clus-

tering of high rates was especially pronounced in the north-central region (text-fig. 2). The highest rates among females were in North Dakota, where the SEA ranked 1st, 3d, 5th, 16th, and 34th among all 506 SEA in the country. For whites of both sexes rates were relatively low in most parts of the South. In text-figure 3, the age curves for renal cancer illustrate the consistent North-South and male-female differentials.

Mortality rates were higher among males in urban than in rural SEA, but this trend was not seen in females (table 1). In both sexes the rates tended to increase with socioeconomic status (median income). The strongest indicator of mortality, however, was ethnicity. The rates varied in proportion to the percentage of residents of German, Scandinavian, and especially Russian descent (table 2). The regression analyses revealed that the ethnic associations accounted for about 40% of the excess mortality in the North Central States among males and about 70% among females.

No significant differences in mortality rates were seen according to the level of employment among the 18 major manufacturing industries.

Among nonwhites, mortality was lower in the South than in the North, and it increased with urbanization among males but not females (table 3). Few SEA in the upper north-central region had large enough numbers of nonwhites to evaluate risk in this part of the country. Only six renal cancer deaths were reported among nonwhites in North Dakota over the 20-year period, and only 22 in Minnesota. Nevertheless, the two statewide rates among nonwhites of both sexes were nearly double the national average.

Mortality from kidney cancer increased about 20-30% among males during 1950-69, but it remained essentially constant among females. The rate of increase among males was greater in rural than urban areas and among nonwhites than whites, but it did not differ substantially according to region of the country.

DISCUSSION

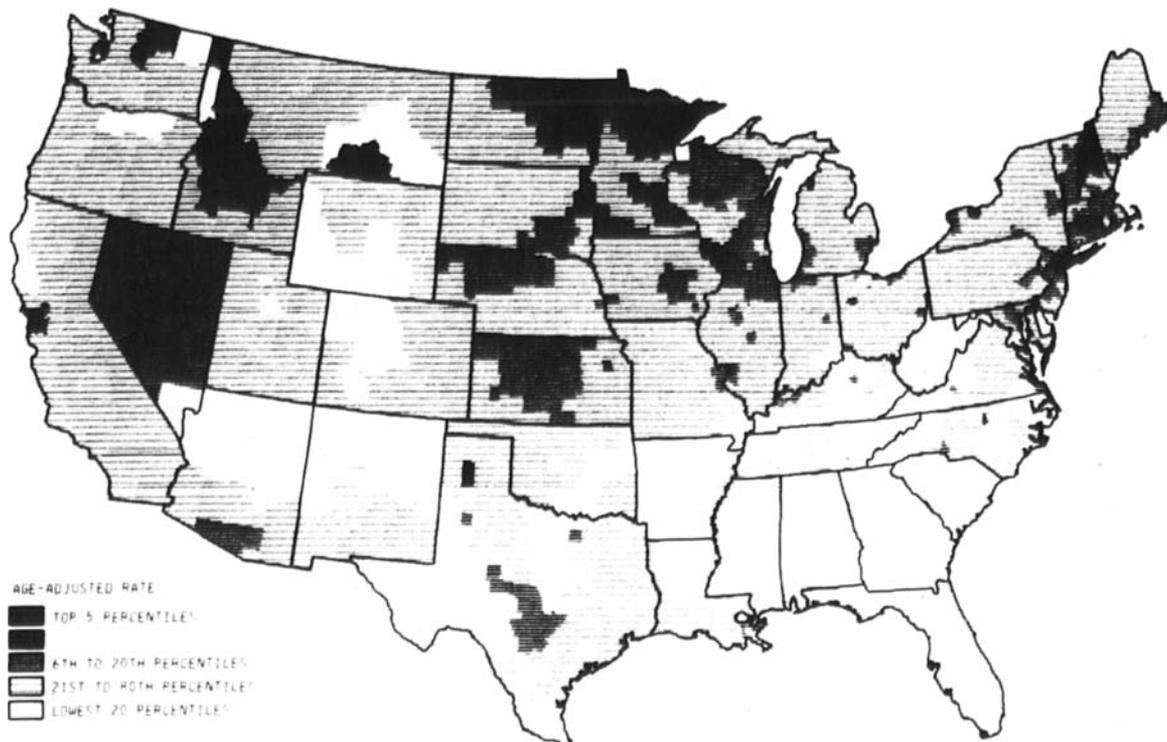
Our earlier mapping of mortality rates for kidney cancer across U.S. counties showed high rates scattered

ABBREVIATION USED: SEA = State economic area(s).

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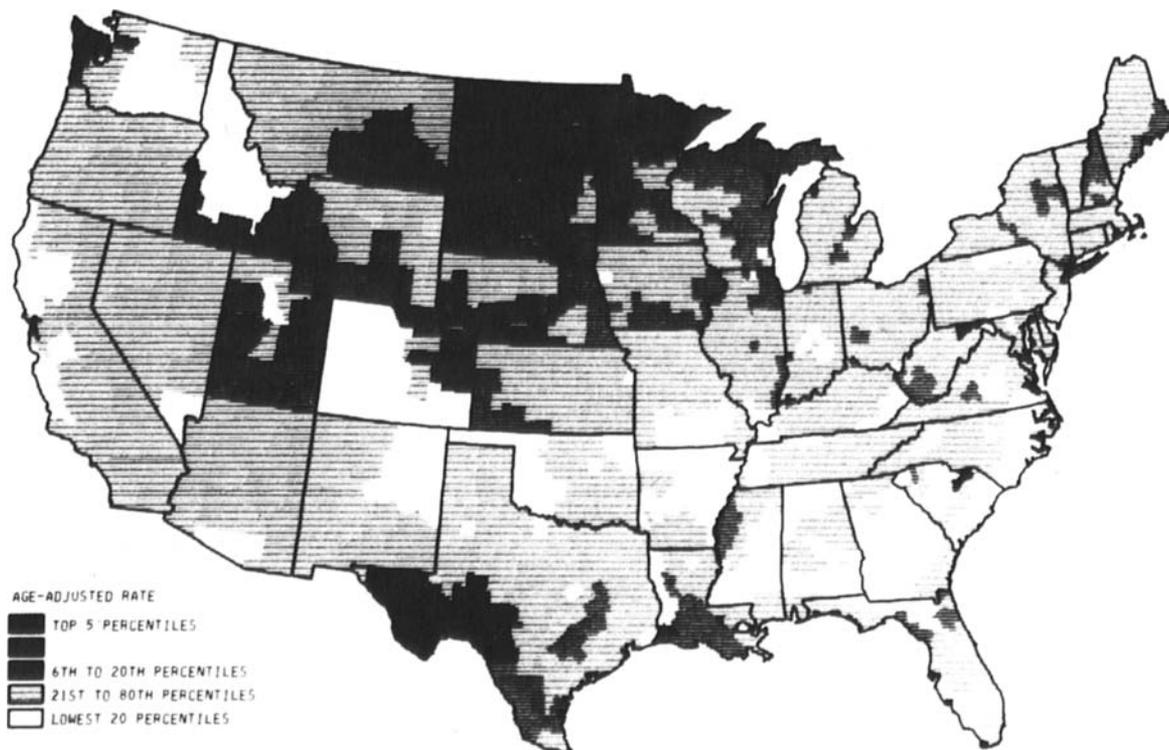
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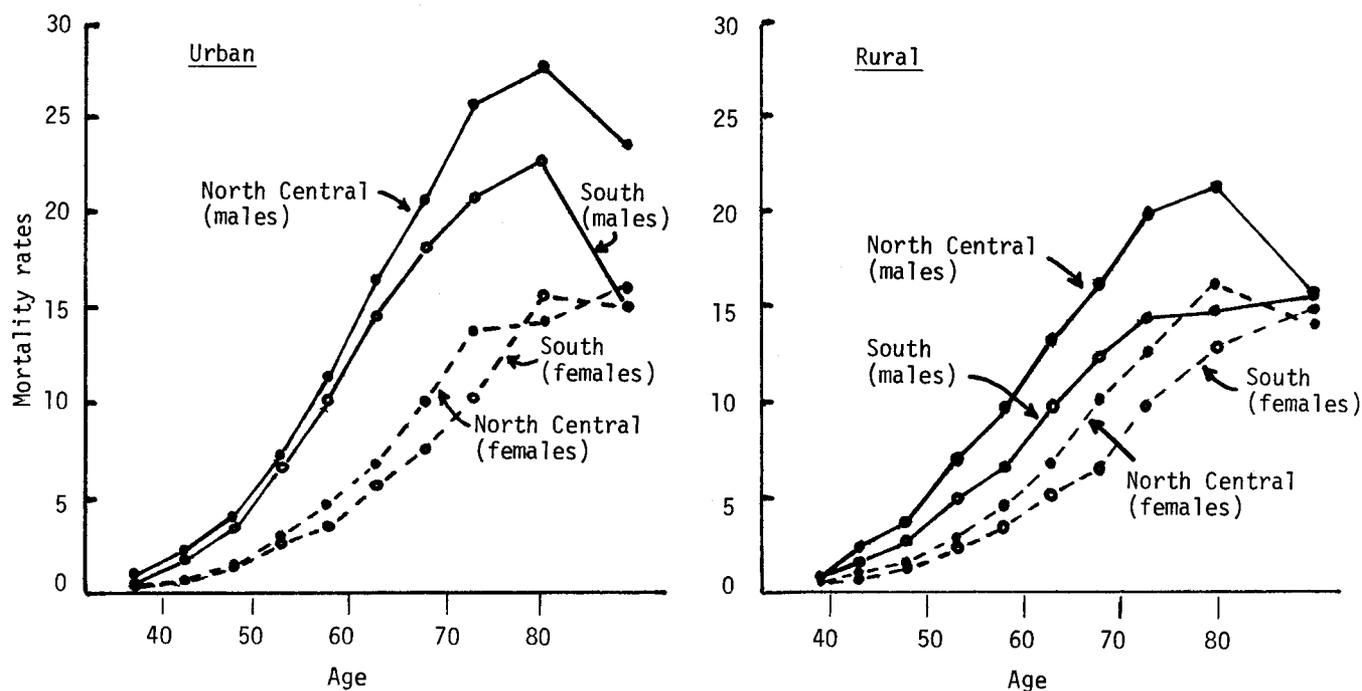
TEXT-FIGURE 1.—Kidney cancer mortality among white males, 1950-69.

through parts of the North (6), but the pattern was not clear-cut. For the relatively uncommon cancers (e.g., renal), the county populations may be too small to uncover distinct geographic patterns. When the rates for kidney cancer were plotted by SEA, which consolidates

smaller counties of similar demographic makeup, definite clustering of elevated mortality was observed for both sexes in the upper north-central region and for males alone in the Northeast. Geographic differences in reporting or survival experience may be partly



TEXT-FIGURE 2.—Kidney cancer mortality among white females, 1950-69.



TEXT-FIGURE 3.—Renal cancer mortality rates, deaths/yr/100,000, among whites in urban (all counties with populations $\geq 250,000$) and rural (all counties with populations $< 25,000$) areas of the North Central States and South by age and sex, 1950-69.

TABLE 1.—Average kidney cancer mortality rates (deaths/year/100,000) among whites according to sex, region, and urbanization, 1950-69

Sex	Region	Average mortality rates for counties of:		
		0-39% urban	40-79% urban	$\geq 80\%$ urban
Male	Northeast	3.8	3.9	4.3
	South	2.8	3.1	3.7
	North-central	3.7	4.0	4.2
	West	3.2	3.4	3.7
Female	Northeast	1.8	2.1	2.0
	South	1.6	1.8	1.8
	North-central	2.2	2.1	2.1
	West	1.9	1.9	1.7

TABLE 2.—Average kidney cancer mortality rates (deaths/year/100,000) among whites according to sex, region, and Russian ethnicity, 1950-69

Sex	Region	Average mortality rates for counties of: ^a			
		$< 0.1\%$ Russian	0.1-0.9% Russian	1.0-2.9% Russian	$\geq 3.0\%$ Russian
Male	Northeast	—	3.8	4.2	4.2
	South	2.9	3.5	3.9	—
	North-central	3.6	4.0	4.2	4.1
	West	2.7	3.5	3.5	—
Female	Northeast	—	2.0	2.1	2.1
	South	1.7	1.8	1.9	—
	North-central	1.9	2.2	2.3	3.0
	West	1.6	1.8	2.0	—

^a Dashes indicate < 5 SEA in this category.

responsible, but the considerably higher incidence rates for renal cancer in both males and females in Minneapolis-St. Paul than in any other region reported in the Third National Cancer Survey 1960-71 (7) suggest that the regional excess in mortality is real and reflects incidence patterns. Furthermore, the highest reported incidence of kidney cancer in Canada is in the Provinces of Manitoba and Saskatchewan, which border the region of highest risk in the United States (8).

The regression analyses suggested that the geographic variation was related, particularly in females, to ethnic susceptibility. The high-rate areas tended to have higher concentrations of residents of Russian, German, and Scandinavian descent. The reported incidence statistics for renal cancer are relatively high in Scandinavian countries (Sweden, Norway, and Iceland) but not in Germany (8). Comparable data for the Soviet Union are not available; however, the republics with the highest rates for cancer of the urinary tract (Estonia, Latvia, and other republics of the northwest

TABLE 3.—Average kidney cancer mortality rates (deaths/year/100,000) among nonwhites according to sex, region, and urbanization, 1950-69

Sex	Region	Average mortality rates for counties of:		
		0-39% urban	40-79% urban	$\geq 80\%$ urban
Males	South	2.1	2.4	3.0
	Non-South	3.5	3.6	3.9
Females	South	1.4	1.2	1.3
	Non-South	1.9	1.2	1.9

sector) are those from which most Russian-Americans emigrated (9). In addition, an elevated kidney cancer risk has been reported among Jews, many of whom are of Russian ancestry (2, 10, 11). It seems likely that nutritional (2) and other environmental factors play a role in the ethnic patterns of renal cancer, in view of the shifting risk among migrant populations and the sparse evidence for genetic determinants, except in children with Wilms' tumor (nephroblastoma) (2, 12, 13).

An urban gradient in kidney cancer has been previously reported (8, 14). Our data indicate that this effect may be limited to males, perhaps related to the greater percentage of cigarette smokers reported among city dwellers (15). Smoking has been implicated, but a causal relationship seems firmly established only for tumors arising from the renal pelvis (2, 16, 17), which account for a small proportion of renal cancers. The mortality patterns suggest that occupational factors are not involved in the urban excess among males, though kidney cancer, including adenocarcinomas, have been reported in some occupational groups, notably coke oven workers (18, 19). Elevated rates were not seen in areas with primary metal manufacturing plants, where industrial exposures to metals and coke oven emissions would mainly occur.

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