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Differences in Lung Cancer Death Rates by Rural vs. Urban Status in Comparison to All-Cancer Death Rates — United States, 1999–2020

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Abstract

Background: Differences in all-cancer mortality by rural vs. urban status exist; limited information exists regarding how lung cancer contributes to these differences. We describe the contribution of lung cancer to rural-urban differences in all-cancer death rates.

Methods: We used National Vital Statistics System data to calculate age-adjusted lung cancer death rates by rural vs. urban status, overall and by multiple subgroups. We calculated the average annual percent change in cancer death rates by rural vs. urban status between 1999–2020, and percentage contribution of lung cancer to excess all-cancer mortality in rural counties in 2020.

Results: In 2020, lung cancer death rates were higher in rural counties among females (33.5 vs. 25.7) and males (49.0 vs. 35.9). Between 1999–2020, larger declines in lung cancer death rates were generally observed in urban counties. In 2020, lung cancer contributed 44.4% to the excess all-cancer mortality in rural counties.

Conclusions: Lung cancer death rates were generally higher in rural counties, and differences in death rates increased over time. In 2020, lung cancer contributed a large percentage to excess all-cancer mortality in rural counties. Implementation of interventions to improve lung cancer prevention, screening, and treatment might reduce rural-urban differences in cancer deaths.

Keywords

lung neoplasms; mortality; death rate; rural health; health status disparities

1. Introduction

Cancer death rates are higher in rural (non-metropolitan) vs. urban (metropolitan) areas [1]. For lung cancer, reported death rates are over 20% higher in rural areas [2, 3]. United States Cancer Statistics (USCS) data show differences in lung cancer death rates by demographic

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The authors have no competing interests to declare.

characteristics such as sex and race and ethnicity [4]. Cancer-related differences exist by these characteristics within rural populations [3, 5].

There is limited information on the contribution of lung cancer to rural-urban differences in cancer mortality. Thus, the primary aim of our study was to describe the contribution of lung cancer to rural-urban differences in all-cancer death rates. As a secondary aim, we also examined differences and trends in lung cancer death rates by rural vs. urban status and age, sex, and race and ethnicity.

We focused our examination of differences on 2020, the most recent year for which bridged-race group mortality data was available (for information on race bridging, see Ingram et al. [6]). Understanding more recent differences can inform current efforts to address risk factors associated with lung cancer deaths.

2. Materials and Methods

2.1. Data and Sample

We conducted a cross-sectional study using National Vital Statistics System (NVSS) data via CDC WONDER (<https://wonder.cdc.gov>). Our study population included persons whose underlying cause of death was from cancer between 1999–2020 (*International Classification of Diseases, 10th Revision* [ICD-10] codes C00–C97; lung cancer defined by C34). To minimize changes in classification of cause of death, we selected 1999 as the first year of our analysis, when ICD-10 was first implemented. Institutional Review Board approval was exempted under the Common Rule (45 CFR §46) because we used de-identified and publicly available data.

2.2. Measures

Our primary outcome was age-adjusted [7] lung cancer death rates per 100,000 persons. We also examined death rates for all cancers except for lung cancer and all cancers combined. We defined rural vs. urban status according to the urbanization variable in CDC WONDER, which is based on the 2013 National Center for Health Statistics (NCHS) Urban-Rural Classification Scheme for Counties [8]. We grouped together metropolitan counties (large central metropolitan, large fringe metropolitan, medium metropolitan, and small metropolitan) and non-metropolitan counties (micropolitan and noncore) for our analysis. We examined cancer death rates by age group, sex, and race and ethnicity (see Table 1 for a detailed breakdown of categories).

2.3. Statistical Analysis

We calculated age-adjusted cancer death rates per 100,000 persons for each cancer category (lung cancer, all cancers except for lung cancer, all cancers combined) for years 1999–2020. We stratified our analyses by sex and examined differences in cancer death rates overall and by rural vs. urban status. We calculated 95% CIs to compare rates.

We conducted joinpoint regression using the National Cancer Institute's Joinpoint trend analysis software version 4.9.1.0 to calculate average annual percent change (AAPC) in death rates between 1999–2020 for each cancer category by rural vs. urban status. We

conducted pairwise comparisons using the parallelism test to examine whether the AAPCs between rural vs. urban counties were similar in magnitude and direction.

We calculated the percentage difference in rural vs. urban all-cancer death rates contributed by lung cancer for 2020. Using similar methodology to a previous study [9], we divided the absolute rural-urban difference in lung cancer death rates over the absolute rural-urban difference in all-cancer death rates. This allowed us to determine how much lung cancer contributed to excess all-cancer mortality in rural counties.

3. Results

Our analysis included 12,644,869 persons whose underlying cause of death was from cancer between 1999–2020 (47.7% female; 52.3% male), including 3,380,830 from lung cancer. In 2020, the age-adjusted lung cancer death rate was 26.9 (95% CI: 26.7–27.1) for females and 38.1 (95% CI: 37.8–38.3) for males (Table 1). For females, the lung cancer death rate in rural counties was 33.5 (95% CI: 32.9–34.2) vs. 25.7 (95% CI: 25.5–26.0) in urban counties. For males, the lung cancer death rate in rural counties was 49.0 (95% CI: 48.3–49.8) vs. 35.9 (95% CI: 35.6–36.2) in urban counties.

By sex and age group, lung cancer death rates were highest among males aged ≥ 85 years in rural counties (387.1; 95% CI: 367.7–406.4). By sex and race and ethnicity, death rates were highest among Black males in rural counties (60.2; 95% CI: 56.6–63.9). Between 1999–2020, death rates decreased over time in all three cancer categories by rural vs. urban status; smaller declines were generally observed in rural counties (Table A.1. and Figure A.1). The parallelism tests conducted for all three cancer categories indicated statistically different trends between rural vs. urban counties ($p < 0.001$).

In 2020, lung cancer contributed 44.4% to the excess all-cancer mortality in rural counties (Table 2). By sex, this contribution was 46.4% for females and 44.2% for males. By sex and age group, among females aged < 85 years, lung cancer contributed 13.3% to 56.7% to the excess all-cancer mortality in rural counties. In contrast, for females aged ≥ 85 years, lung cancer contributed 186.5% to excess all-cancer mortality in urban counties (i.e., death rates for lung cancer and all cancers combined were higher in urban counties, while rates for all cancers except lung cancer were higher in rural counties). For males, lung cancer contributed 16.5% to 49.9% to the excess all-cancer mortality in rural counties by age group. In most cases, lung cancer positively contributed to excess all-cancer mortality in rural vs. urban counties by race and ethnicity.

4. Discussion

This cross-sectional study provides new information on the contribution of lung cancer to rural-urban differences in all-cancer death rates. Rural counties generally had higher lung cancer death rates and experienced a slower decline in rates between 1999–2020 than urban counties. In 2020, lung cancer contributed nearly 50% to excess all-cancer mortality in rural counties. Higher cigarette smoking prevalence [10] and lower access to healthcare, including for lung cancer screening [11] and treatment [12], may have contributed to slower declines in death rates in rural counties.

Lung cancer incidence is also higher in rural counties [13] and accounted for the largest percentage of cancer deaths compared to other cancer types in 2020 (23%)—likely reasons for its large contribution to rural-urban differences in all-cancer death rates. Other potential reasons for this large contribution include higher smoking prevalence and environmental and occupational exposures in rural areas. In 2020, the prevalence of smoking among adults aged ≥ 18 years was 19% in rural counties vs. 11% in urban counties [10].

While lung cancer death rates were generally higher in rural counties, some groups had higher death rates in urban counties. For example, lung cancer death rates were 6–10% higher among White, Asian and Pacific Islander, and American Indian/Alaska Native females in rural vs. urban counties. These patterns were not observed among Black and Hispanic females, and might also be explained by lower smoking prevalence. While current cigarette smoking is similar among Black females in urban vs. rural areas, a greater percentage of White females in rural vs. urban areas currently smoke [14]. Additionally, cigarette smoking among Hispanic adults is historically lower than other subgroups [15]. Continued efforts to monitor and track differences by rural vs. urban status, taking into consideration the intersection of multiple demographic characteristics, could inform tailored intervention efforts to reduce lung cancer deaths.

Death rates for lung cancer, all cancers except for lung cancer, and all cancers combined declined between 1999–2020. Several factors might explain this decline, including improvements in cancer screening and early detection (e.g., use of low-dose computed tomography for lung cancer screening), the advent of new cancer treatments (e.g., immunotherapies), and reductions in smoking [10]. Improving implementation of these efforts, particularly within rural communities, might reduce differences in lung cancer deaths. Wheeler et al. [16] describe several opportunities for advancing cancer control in rural areas, including prioritizing evidence-based intervention evaluation, adaptation, and dissemination in rural areas and using participatory implementation science to ensure equitable and context-appropriate implementation.

4.1. Limitations

NVSS does not collect information on behavioral risk factors like cigarette smoking that may influence differences in lung cancer death rates. We classified counties as rural vs. urban to understand broader differences by county classification, and to allow for comparison of our findings to previous studies. However, this binary categorization could mask differences in cancer death rates across the rural-urban continuum. We did not correct for or examine lung cancer incidence, which can impact trends in lung cancer death rates. Lastly, it is possible that our findings for 2020 may not be directly comparable to other years due to healthcare challenges experienced during the COVID-19 pandemic. However, we did not observe a decline in lung cancer deaths that was substantially larger in 2020 compared to 2019.

5. Conclusions

In this cross-sectional study using NVSS data, we found generally higher lung cancer death rates in rural vs. urban counties. Lung cancer death rates have decreased over time, but

larger declines in urban counties have led to increased differences. In 2020, lung cancer contributed almost 50% to the excess all-cancer mortality in rural counties. Future studies that identify and address underlying causes of these differences (e.g., marketing of tobacco products, differential healthcare access to screening and treatment) are important to reduce differences in lung cancer death rates.

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Appendix

Appendix

Table A.1.

Trends in Age-Adjusted Cancer Death Rates^a by Cancer Category and Rural vs. Urban Status^b, National Vital Statistics System, United States, 1999–2020

Variable	Lung Cancer		All Cancers Except Lung Cancer		All Cancers Combined	
	Rural n=685,505	Urban n=2,695,325	Rural n=1,681,744	Urban n=7,582,295	Rural n=2,367,249	Urban n=10,277,620
	AAPC (95% CI)					
Total	-1.7 (-2.0, -1.5) ^d	-2.8 (-3.0, -2.7) ^d	-0.9 (-0.9, -0.8) ^d	-1.3 (-1.4, -1.3) ^d	-1.1 (-1.2, -1.0) ^d	-1.7 (-1.8, -1.7) ^d
Females						
Overall	-0.7 (-0.9, -0.4) ^d	-2.2 (-2.4, -2.0) ^d	-0.9 (-1.0, -0.9) ^d	-1.4 (-1.4, -1.3) ^d	-0.9 (-1.0, -0.8) ^d	-1.5 (-1.6, -1.4) ^d
Age group (years) ^e						
<45	-4.3 (-5.5, -3.1) ^d	-5.6 (-6.5, -4.7) ^d	-1.0 (-1.2, -0.8) ^d	-1.2 (-1.6, -0.9) ^d	-1.4 (-1.6, -1.2) ^d	-1.5 (-1.8, -1.3) ^d
45–54	-1.2 (-2.1, -0.3) ^d	-3.9 (-4.3, -3.6) ^d	-0.7 (-1.4, 0.0)	-1.3 (-1.5, -1.2) ^d	-0.8 (-1.2, -0.5) ^d	-1.8 (-2.0, -1.6) ^d
55–64	-0.9 (-1.6, -0.3) ^d	-2.8 (-3.2, -2.4) ^d	-0.8 (-1.0, -0.6) ^d	-1.4 (-1.5, -1.3) ^d	-0.9 (-1.0, -0.7) ^d	-1.8 (-1.9, -1.7) ^d
65–74	-1.4 (-1.8, -1.0) ^d	-3.1 (-3.3, -2.8) ^d	-1.1 (-1.3, -0.9) ^d	-1.7 (-1.8, -1.5) ^d	-1.2 (-1.3, -1.0) ^d	-2.1 (-2.1, -2.0) ^d
75–84	0.2 (-0.2, 0.7)	-1.2 (-1.5, -0.9) ^d	-1.0 (-1.1, -0.9) ^d	-1.3 (-1.3, -1.3) ^d	-0.7 (-0.8, -0.5) ^d	-1.3 (-1.4, -1.2) ^d
≥85	0.9 (0.3, 1.6) ^d	0.2 (-0.2, 0.6)	-1.0 (-1.1, -0.9) ^d	-0.9 (-1.1, -0.8) ^d	-0.7 (-0.8, -0.6) ^d	-0.8 (-0.8, -0.7) ^d
Race and ethnicity ^f						
NH American Indian or	-0.6 (-1.5, 0.2)	-0.9 (-2.1, 0.4)	-0.4 (-1.3, 0.6)	-0.9 (-1.2, -0.6) ^d	-0.6 (-1.2, -0.1) ^d	-1.0 (-1.6, -0.4) ^d

Variable	Lung Cancer		All Cancers Except Lung Cancer		All Cancers Combined	
	Rural n=685,505	Urban n=2,695,325	Rural n=1,681,744	Urban n=7,582,295	Rural n=2,367,249	Urban n=10,277,620
AAPC (95% CI)						
Alaska Native						
NH Asian or Pacific Islander	-0.0 (-1.0, 1.0)	-1.3 (-1.7, -0.9) ^d	-1.6 (-2.2, -1.1) ^d	-1.0 (-1.2, -0.9) ^d	-1.3 (-1.8, -0.8) ^d	-1.1 (-1.2, -1.0) ^d
NH Black or African American	-1.2 (-1.8, -0.5) ^d	-2.3 (-2.6, -2.0) ^d	-1.3 (-1.4, -1.1) ^d	-1.4 (-1.6, -1.3) ^d	-1.2 (-1.4, -1.1) ^d	-1.6 (-1.7, -1.5) ^d
NH White	-0.5 (-0.8, -0.2) ^d	-1.9 (-2.1, -1.7) ^d	-0.9 (-0.9, -0.8) ^d	-1.3 (-1.3, -1.2) ^d	-0.8 (-0.9, -0.7) ^d	-1.4 (-1.5, -1.4) ^d
Hispanic or Latino	-1.8 (-2.5, -1.2) ^d	-1.7 (-2.1, -1.3) ^d	-1.4 (-1.9, -1.0) ^d	-0.9 (-1.1, -0.7) ^d	-1.3 (-1.5, -1.1) ^d	-0.9 (-1.0, -0.9) ^d
Males						
Overall	-2.6 (-2.9, -2.2) ^d	-3.5 (-3.6, -3.4) ^d	-1.0 (-1.1, -0.9) ^d	-1.4 (-1.5, -1.3) ^d	-1.4 (-1.5, -1.4) ^d	-2.0 (-2.0, -1.9) ^d
Age group (years) ^e						
<45	-5.4 (-6.5, -4.2) ^d	-5.7 (-6.6, -4.7) ^d	-1.2 (-1.4, -1.0) ^d	-1.4 (-1.5, -1.3) ^d	-1.8 (-2.0, -1.6) ^d	-1.9 (-2.0, -1.7) ^d
45–54	-3.7 (-4.2, -3.2) ^d	-5.3 (-5.7, -5.0) ^d	-0.6 (-1.0, -0.3) ^d	-1.5 (-1.9, -1.2) ^d	-1.3 (-1.6, -1.1) ^d	-2.5 (-2.6, -2.3) ^d
55–64	-2.7 (-3.1, -2.2) ^d	-4.1 (-4.2, -3.9) ^d	-0.2 (-0.5, 0.0)	-1.1 (-1.3, -1.0) ^d	-1.1 (-1.3, -0.8) ^d	-2.0 (-2.1, -1.9) ^d
65–74	-3.1 (-3.4, -2.9) ^d	-4.1 (-4.4, -3.7) ^d	-1.0 (-1.2, -0.8) ^d	-1.6 (-1.7, -1.4) ^d	-1.7 (-1.9, -1.5) ^d	-2.4 (-2.5, -2.3) ^d
75–84	-2.3 (-2.7, -1.9) ^d	-2.8 (-3.0, -2.6) ^d	-1.2 (-1.4, -1.0) ^d	-1.5 (-1.5, -1.5) ^d	-1.5 (-1.6, -1.4) ^d	-1.9 (-1.9, -1.8) ^d
≥85	-1.7 (-2.1, -1.3) ^d	-2.1 (-2.6, -1.7) ^d	-1.2 (-1.4, -0.9) ^d	-1.2 (-1.3, -1.0) ^d	-1.3 (-1.4, -1.2) ^d	-1.3 (-1.4, -1.3) ^d
Race and ethnicity ^f						
NH American Indian or Alaska Native	-2.3 (-3.0, -1.5) ^d	-2.1 (-3.2, -0.9) ^d	-1.0 (-1.4, -0.7) ^d	-0.4 (-0.9, 0.2)	-1.4 (-1.8, -1.0) ^d	-0.8 (-1.3, -0.2) ^d
NH Asian or Pacific Islander	-3.0 (-4.1, -1.8) ^d	-2.6 (-2.9, -2.3) ^d	-2.8 (-3.5, -2.1) ^d	-1.4 (-1.5, -1.3) ^d	-2.8 (-3.5, -2.1) ^d	-1.6 (-1.8, -1.5) ^d
NH Black or African American	-3.0 (-3.5, -2.6) ^d	-4.0 (-4.2, -3.8) ^d	-2.0 (-2.1, -1.9) ^d	-2.1 (-2.2, -2.0) ^d	-2.3 (-2.4, -2.2) ^d	-2.6 (-2.7, -2.6) ^d
NH White	-2.4 (-2.7, -2.1) ^d	-3.3 (-3.5, -3.0) ^d	-0.8 (-0.9, -0.8) ^d	-1.2 (-1.3, -1.2) ^d	-1.3 (-1.3, -1.2) ^d	-1.8 (-1.8, -1.7) ^d
Hispanic or Latino	-4.5 (-5.0, -3.9) ^d	-3.4 (-3.7, -3.2) ^d	-1.6 (-2.0, -1.2) ^d	-1.1 (-1.2, -1.0) ^d	-2.7 (-3.9, -1.5) ^d	-1.6 (-1.7, -1.5) ^d

Abbreviations: AAPC, average annual percent change; CI, confidence interval; NH, non-Hispanic.

^a Per 100,000 persons and age-adjusted to the 2000 standard population for the United States.

^b Defined using the 2013 National Center for Health Statistics Urban-Rural Classification Scheme for Counties.

^c AAPCs calculated using Joinpoint regression, which allowed different slopes for 4 periods.

^d Denotes significant result ($p < 0.05$).

^e We used 10-year age groups to calculate age-specific death rates. Age-adjusted rates were calculated for <45 years because these years contained multiple age groups.

^f Race and ethnicity (Hispanic or Latino origin) were reported separately on the death certificate and combined for this analysis. Hispanic or Latino persons could be of any race. Deaths of persons with Hispanic or Latino origin "Not Stated" were included in overall counts but were not included in specific racial and ethnic group counts.

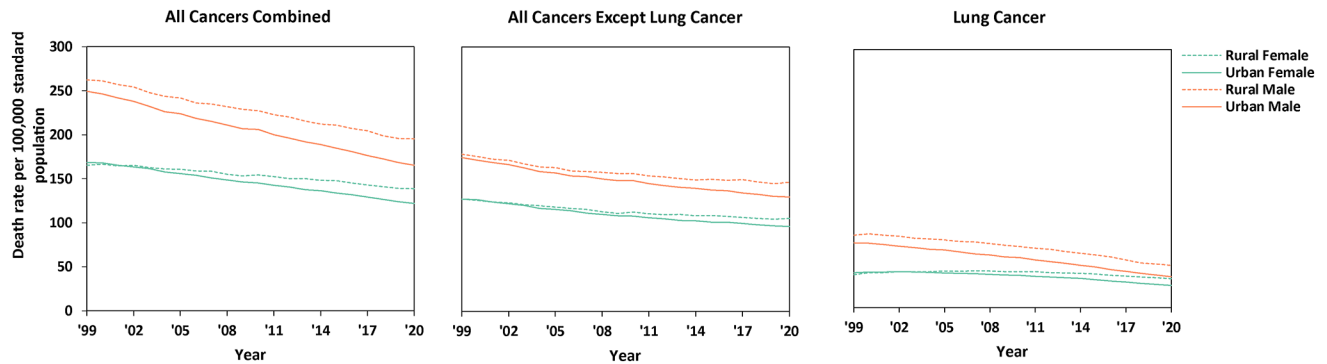


Figure A.1.

Age-Adjusted Cancer Death Rates^a by Cancer Category, Rural vs. Urban Status^b, and Sex, National Vital Statistics System, United States, 1999–2020

The three graphs show age-adjusted death rates between 1999–2020 in three respective categories: (1) all cancers combined, (2) all cancers except for lung cancer, and (3) lung cancer. Death rates are displayed by rural vs. urban status and sex (female vs. male). Death rates declined in all three categories and subgroups from 1999 to 2020. Death rates were higher for males vs. females, and for most years, in rural vs. urban counties. Death rates for urban counties declined at a faster rate than for rural counties. In 2020, lung cancer contributed to almost 50% of the excess all-cancer mortality in rural counties.

^a Per 100,000 persons and age-adjusted to the 2000 standard population for the United States.

^b Defined using the 2013 National Center for Health Statistics Urban-Rural Classification Scheme for Counties.

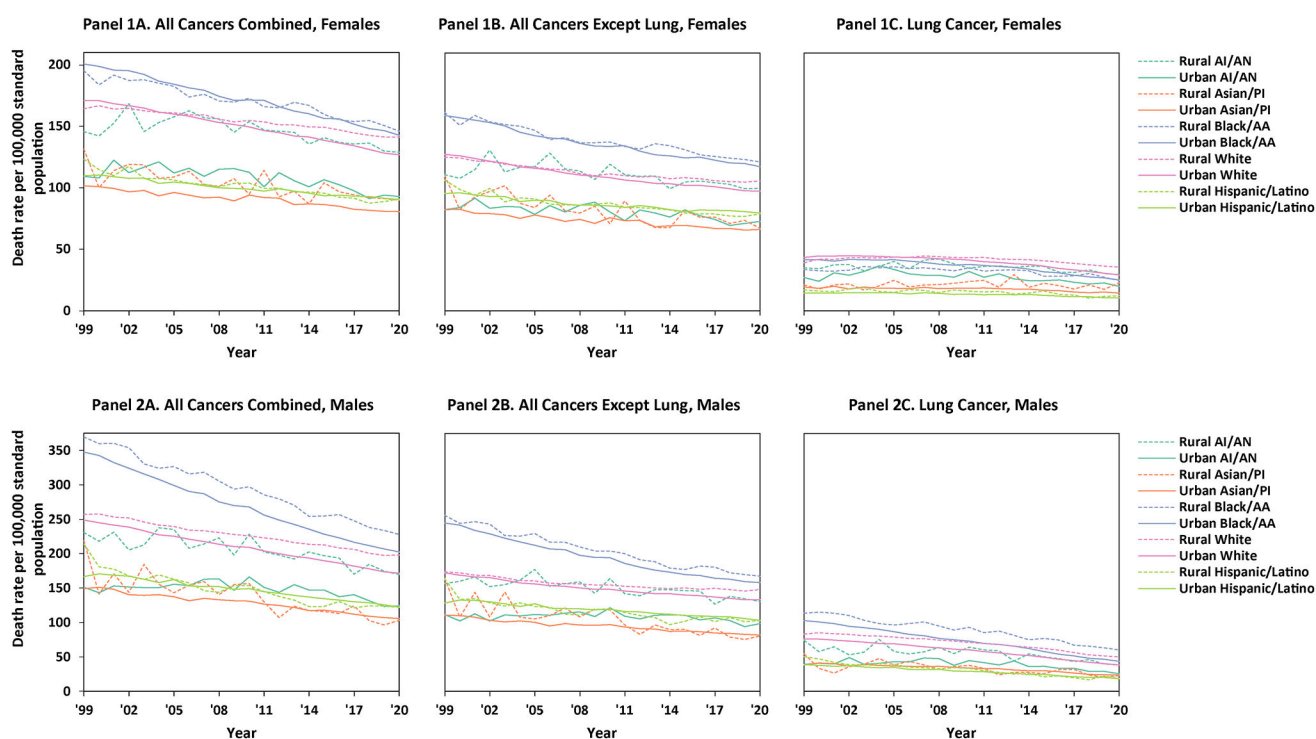


Figure A.2.

Age-Adjusted Cancer Death Rates^a by Cancer Category, Rural vs. Urban Status^b, Sex, and Race and Ethnicity^c, National Vital Statistics System, United States, 1999–2020

The six graphs show age-adjusted death rates between 1999–2020 in three respective categories: (1) all cancers combined, (2) all cancers except for lung cancer, and (3) lung cancer. Graphs display death rates by rural vs. urban status and race and ethnicity (AI/AN; Asian/Pacific Islander; Black/African American; White; Hispanic/Latino). The top three graphs display death rates for females, and the bottom three graphs display death rates for males. Death rates declined from 1999 to 2020. Death rates were higher for males vs. females and generally highest among persons who were Black/African American. Death rates by rural vs. urban status varied across years and racial and ethnic groups.

Abbreviations: AI/AN, American Indian or Alaska Native; Asian/Pacific Islander; Black/African American.

^aPer 100,000 persons and age-adjusted to the 2000 standard population for the United States.

^bDefined using the 2013 National Center for Health Statistics Urban-Rural Classification Scheme for Counties.

^cRace and ethnicity (Hispanic or Latino origin) were reported separately on the death certificate and combined for this analysis. All racial groups are non-Hispanic or Latino. Hispanic or Latino persons could be of any race. Deaths of persons with Hispanic or Latino origin “Not Stated” were included in overall counts but were not included in specific racial and ethnic group counts.

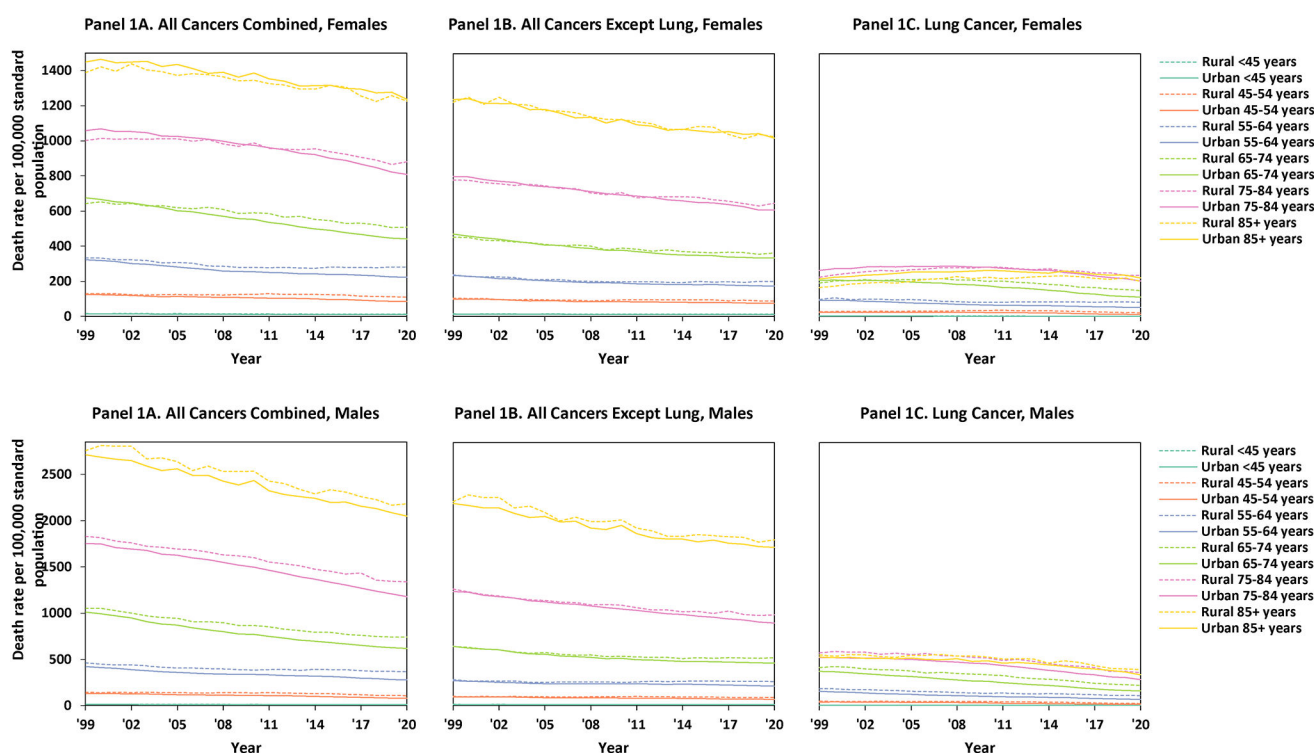


Figure A.3.

Age-Adjusted Cancer Death Rates^a by Cancer Category, Rural vs. Urban Status^b, Sex, and Age Group^c, National Vital Statistics System, United States, 1999–2020

The six graphs show age-adjusted death rates between 1999–2020 in three respective categories: (1) all cancers combined, (2) all cancers except for lung cancer, and (3) lung cancer. Graphs display death rates by rural vs. urban status and age group (<45 years; 45–54; 55–64; 65–74; 75–84; ≥85 years). The top three graphs display death rates for females, and the bottom three graphs display death rates for males. Death rates declined from 1999 to 2020. Death rates were higher for males vs. females and generally highest among persons who were ≥85 years. Death rates by rural vs. urban status varied across years and age groups.

^aPer 100,000 persons and age-adjusted to the 2000 standard population for the United States.

^bDefined using the 2013 National Center for Health Statistics Urban-Rural Classification Scheme for Counties.

^cWe used 10-year age groups to calculate age-specific death rates. Age-adjusted rates were calculated for <45 years because these years contained multiple age groups.

Abbreviations

AAPC	average annual percent change
CDC	Centers for Disease Control and Prevention
ICD-10	International Classification of Diseases, 10th Revision
NCHS	National Center for Health Statistics

NH	non-Hispanic
NVSS	National Vital Statistics System
USCS	United States Cancer Statistics

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Highlights

- Lung cancer death rates were higher in rural vs. urban counties.
- Between 1999–2020, urban counties had larger declines in lung cancer death rates.
- Lung cancer contributed 44% to excess cancer mortality in rural counties.

Lung Cancer Deaths^a by Rural vs. Urban Status^b, National Vital Statistics System, United States, 2020

Table 1.

Variable	Total			Rural			Urban		
	No.	Rate (95% CI)		No.	Rate (95% CI)		No.	Rate (95% CI)	
Total	136,084	31.8 (31.7–32.0)		28,398	40.6 (40.1–41.1)		107,686	30.2 (30.0–30.4)	
Females									
Overall	63,135	26.9 (26.7–27.1)		12,442	33.5 (32.9–34.2)		50,693	25.7 (25.5–26.0)	
Age group (years) ^c									
<45	402	0.5 (0.4–0.5)		72	0.7 (0.5–0.8)		330	0.4 (0.4–0.5)	
45–54	2,437	11.9 (11.4–12.4)		537	20.1 (18.4–21.8)		1,900	10.7 (10.2–11.2)	
55–64	11,995	54.7 (53.8–55.7)		2,675	81.2 (78.1–84.3)		9,320	50.1 (49.0–51.1)	
65–74	19,977	115.0 (113.4–116.6)		4,141	146.8 (142.3–151.2)		15,836	108.9 (107.2–110.6)	
75–84	19,147	207.5 (204.5–210.4)		3,634	234.6 (227.0–242.2)		15,513	202.0 (198.8–205.2)	
≥85	9,177	216.2 (211.8–220.7)		1,383	200.5 (190.0–211.1)		7,794	219.3 (214.4–224.2)	
Race and ethnicity^d									
NH American Indian or Alaska Native	360	23.6 (21.1–26.1)		177	29.5 (25.1–34.0)		183	19.9 (16.9–22.8)	
NH Asian or Pacific Islander	1,791	14.7 (14.0–15.3)		87	22.6 (18.0–28.0)		1,704	14.4 (13.7–15.1)	
NH Black or African American	6,278	25.0 (24.4–25.7)		594	24.6 (22.6–26.6)		5,684	25.1 (24.4–25.8)	
NH White	52,193	30.3 (30.1–30.6)		11,409	35.5 (34.8–36.2)		40,784	29.2 (28.9–29.5)	
Hispanic or Latino	2,426	10.8 (10.4–11.2)		164	12.2 (10.3–14.1)		2,262	10.7 (10.3–11.2)	
Males									
Overall	72,949	38.1 (37.8–38.3)		15,956	49.0 (48.3–49.8)		56,993	35.9 (35.6–36.2)	
Age group (years) ^c									
<45	497	0.6 (0.5–0.6)		85	0.8 (0.6–0.9)		412	0.5 (0.5–0.6)	
45–54	2,614	13.1 (12.6–13.6)		585	21.4 (19.7–23.2)		2,029	11.8 (11.3–12.3)	
55–64	14,649	71.5 (70.3–72.7)		3,378	106.4 (102.8–110.0)		11,271	65.1 (63.9–66.3)	
65–74	25,573	168.4 (166.4–170.5)		5,755	218.3 (212.6–223.9)		19,818	158.0 (155.8–160.2)	
75–84	21,341	295.4 (291.5–299.4)		4,610	355.9 (345.6–366.2)		16,731	282.2 (278.0–286.5)	
≥85	8,275	342.7 (335.3–350.1)		1,543	387.1 (367.7–406.4)		6,732	333.9 (325.9–341.9)	
Race and ethnicity^d									
NH American Indian or Alaska Native	391	30.6 (27.4–33.7)		192	38.4 (32.8–44.1)		199	25.5 (21.8–29.2)	

Variable	Total			Rural			Urban		
	No.	Rate (95% CI)	No.	Rate (95% CI)	No.	Rate (95% CI)	No.	Rate (95% CI)	No.
NH Asian or Pacific Islander	2,222	23.6 (22.6–24.6)	66	22.8 (17.5–29.1)	2,156	23.6 (22.6–24.6)			
NH Black or African American	8,104	45.6 (44.5–46.6)	1,147	60.2 (56.6–63.9)	6,957	43.9 (42.8–45.0)			
NH White	58,847	40.7 (40.4–41.0)	14,294	50.2 (49.3–51.0)	44,553	38.4 (38.0–38.7)			
Hispanic or Latino	3,227	18.5 (17.8–19.2)	234	18.9 (16.4–21.4)	2,993	18.5 (17.8–19.2)			

Abbreviations: CI, confidence interval; NH, Non-Hispanic.

^aPer 100,000 persons and age-adjusted to the 2000 standard population for the United States.

^bDefined using the 2013 National Center for Health Statistics Urban-Rural Classification Scheme for Counties.

^cWe used 10-year age groups to calculate age-specific death rates. Age-adjusted rates were calculated for <45 years because these years contained multiple age groups.

^dRace and ethnicity (Hispanic or Latino origin) were reported separately on the death certificate and combined for this analysis. Hispanic or Latino persons could be of any race. Deaths of persons with Hispanic or Latino origin “Not Stated” were included in overall counts but were not included in specific racial and ethnic group counts.

Table 2.
Contribution of Lung Cancer to Rural vs. Urban^a Differences in All-Cancer Death Rates, National Vital Statistics System, United States, 2020

Age-Adjusted Cancer Death Rates ^b										
Variable	Lung Cancer			All Cancers Except Lung Cancer			All Cancers Combined			% Contribution of Lung Cancer ^d
	Rural Rate	Urban Rate	Rural - Urban Rate Difference ^c	Rural Rate	Urban Rate	Rural - Urban Rate Difference ^c	Rural Rate	Urban Rate	Rural - Urban Rate Difference ^c	
Total	40.6	30.2	10.4	123.2	110.2	13.0	163.8	140.4	23.4	44.4%
Females										
Overall	33.5	25.7	7.8	105.3	96.3	9.0	138.8	122.0	16.8	46.4%
Age group (years) ^e										
<45	0.7	0.4	0.2	10.9	9.4	1.6	11.6	9.8	1.8	13.3%
45–54	20.1	10.7	9.4	88.6	74.9	13.7	108.7	85.6	23.1	40.7%
55–64	81.2	50.1	31.1	200.1	173.2	26.9	281.3	223.2	58.0	53.6%
65–74	146.8	108.9	37.9	361.3	332.5	28.9	508.1	441.3	66.7	56.7%
75–84	234.6	202.0	32.6	645.8	607.1	38.7	880.4	809.1	71.3	45.7%
≥85	200.5	219.3	−18.8	1026.2	1017.5	8.7	1226.7	1236.8	−10.1	186.5%
Race and ethnicity ^f										
NH American Indian or Alaska Native	29.5	19.9	9.6	99.5	72.9	26.6	129.1	92.8	36.3	26.6%
NH Asian or Pacific Islander	22.6	14.4	8.2	67.4	66.2	1.2	90.1	80.6	9.4	86.9%
NH Black or African American	24.6	25.1	−0.5	121.3	117.6	3.7	145.9	142.7	3.2	−15.4%
NH White	35.5	29.2	6.3	105.8	97.6	8.2	141.3	126.7	14.6	43.6%
Hispanic or Latino	12.2	10.7	1.5	78.9	79.7	−0.8	91.1	90.3	0.7	199.0%
Males										
Overall	49.0	35.9	13.2	146.2	129.6	16.6	195.2	165.5	29.8	44.2%
Age group (years) ^e										
<45	0.8	0.5	0.2	8.9	7.8	1.1	9.7	8.3	1.3	16.5%
45–54	21.4	11.8	9.6	86.2	67.0	19.2	107.7	78.8	28.9	33.4%
55–64	106.4	65.1	41.3	259.2	211.0	48.2	365.6	276.1	89.5	46.2%

Age-Adjusted Cancer Death Rates ^b										
Variable	Lung Cancer			All Cancers Except Lung Cancer			All Cancers Combined			% Contribution of Lung Cancer ^d
	Rural Rate	Urban Rate	Rural - Urban Rate Difference ^c	Rural Rate	Urban Rate	Rural - Urban Rate Difference ^c	Rural Rate	Urban Rate	Rural - Urban Rate Difference ^c	
65–74	218.3	158.0	60.3	520.0	459.5	60.5	738.3	617.5	120.8	49.9%
75–84	355.9	282.2	73.7	980.8	895.1	85.7	1336.7	1177.4	159.3	46.2%
≥85	387.1	333.9	53.1	1794.6	1714.7	79.8	2181.6	2048.6	133.0	40.0%
Race and ethnicity ^f										
NH American Indian or Alaska Native	38.4	25.5	12.9	131.1	98.7	32.3	169.5	124.2	45.3	28.6%
NH Asian or Pacific Islander	22.8	23.6	−0.8	80.7	82.1	−1.4	103.5	105.7	−2.3	37.1%
NH Black or African American	60.2	43.9	16.4	167.8	158.5	9.3	228.0	202.3	25.7	63.7%
NH White	50.2	38.4	11.8	147.8	133.1	14.7	198.0	171.5	26.4	44.7%
Hispanic or Latino	18.9	18.5	0.4	102.9	103.7	−0.8	121.8	122.2	−0.4	−107.5%

Abbreviations: NH, non-Hispanic.

^a Defined using the 2013 National Center for Health Statistics Urban-Rural Classification Scheme for Counties.

^b Per 100,000 persons and age-adjusted to the 2000 standard population for the United States.

^c Positive rural-urban rate differences represent higher death rates in rural counties. Negative rate differences represent higher death rates in urban counties.

^d Represents the percentage contribution of lung cancer to excess all-cancer mortality. Percentages were calculated by dividing the rural - urban rate difference for lung cancer over the rural - urban rate difference for all cancers combined. Percentages > 100% indicate that the rural-urban rate difference for lung cancer was larger than the rural-urban rate difference for all cancers combined. A negative rate difference for lung cancer indicates that lung cancer contributed to excess all-cancer mortality in urban counties.

^e We used 10-year age groups to calculate age-specific death rates. Age-adjusted rates were calculated for <45 years because these years contained multiple age groups.

^f Race and ethnicity (Hispanic or Latino origin) were reported separately on the death certificate and combined for this analysis. Hispanic or Latino persons could be of any race. Deaths of persons with Hispanic or Latino origin "Not Stated" were included in overall counts but were not included in specific racial and ethnic group counts.