

Disparities in Lung Cancer Incidence Rates and Trends by Histologic Type in the United States, 2004-2009

KA Houston, DrPH; SJ Henley, MSPH; J Li, MD, PhD; M White, ScD; and TR Richards, MD
Division of Cancer Prevention and Control, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention (CDC), Atlanta, GA

BACKGROUND AND OBJECTIVE

- Surveillance of histologic lung cancer types is important for monitoring population trends that may have implications for etiology and prevention, and understanding underlying causes for lung cancer trends over time. In the United States, there has been a shift in lung cancer incidence rates and trends by histologic type. From 1950 to early 1980, squamous cell carcinoma was most prevalent in men, and the most common type of lung cancer reported in U.S. tumor registries. By the 1980s, the incidence rate of adenocarcinoma had surpassed that of squamous cell carcinoma. Since then, adenocarcinoma has remained the most common histologic subtype in men and women.
- This study provides a comprehensive and recent description of disparities (i.e., sex, race, and geographic location) in histologic lung cancer incidence rates and trends for U.S. adults.

METHODS

- We analyzed data from CDC's National Program of Cancer Registries (NPCR) and the National Cancer Institute's Surveillance, Epidemiology and End Results (SEER) Program.
 - Together, these two programs collate cancer incidence data for the entire U.S. population
 - This report covers 98% of the U.S. population
- Lung and bronchus cancer cases were defined using site codes C34.0-C34.9 from the International Classification of Diseases for Oncology, Third Edition (ICD-0-3)
 - Cases without microscopic confirmation, identified through autopsy or death certificate only, and those with a diagnosis code of sarcomas or other specific or unspecified cancer types were excluded
 - Histologic types were defined using ICD-0-3 morphology codes

ANALYSIS

- Incidence rates calculated for men and women
 - SEER*State software version 8.0.1
 - 2000 U.S. standard population
 - By age group, race/ethnicity, and U.S. Census region
- Rate ratios (RR) examined differences in lung cancer rates between men and women.
- Temporal trends described using joinpoint analysis including annual percent change (APC) to quantify the change in incidence rates over time.

RESULTS

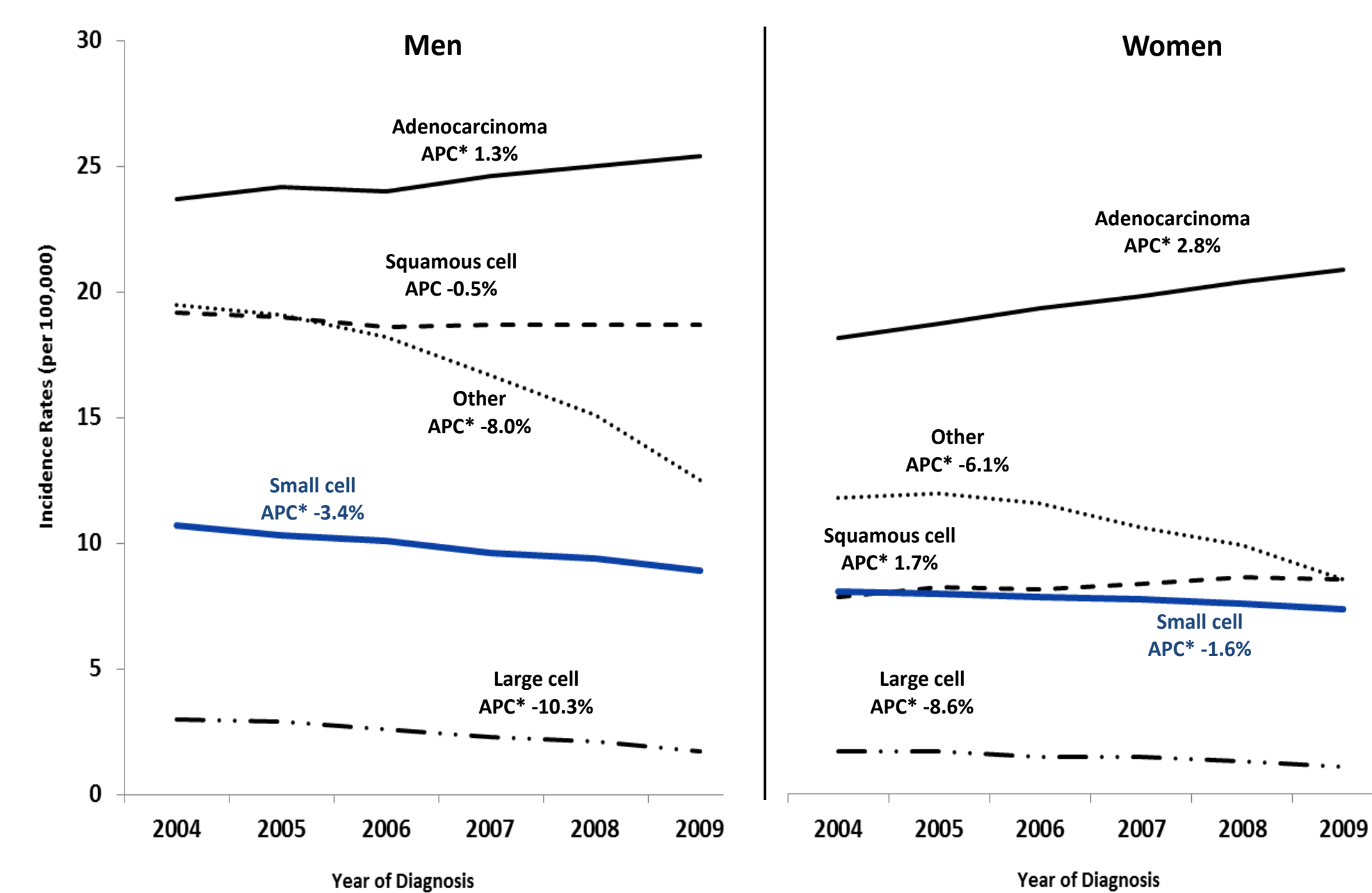
Lung Cancer Incidence Rates for Men and Women by Histologic Type – United States, 2004-2009

Histology Type	Men				Women				Rate Ratio
	N	%	Rate ^a	95% CI	N	%	Rate ^a	95% CI	
Small Cell	82,363	14%	9.8	(9.7–9.9)	80,898	16%	7.9	(7.8–8.0)	1.3*
Non-Small Cell ^b	513,411	86%	62.5	(62.3–62.6)	419,604	84%	40.9	(40.8–41.0)	1.5*
Squamous	153,408	26%	18.8	(18.7–18.9)	87,035	17%	8.5	(8.4–8.6)	2.1*
Adenocarcinoma	201,918	34%	24.5	(24.4–24.6)	205,189	41%	20.0	(19.9–20.1)	1.3*
Large Cell	20,135	3%	2.4	(2.4–2.5)	14,855	3%	1.5	(1.4–1.5)	1.6*
Other non-small cell	137,950	23%	16.8	(16.7–16.9)	112,525	22%	10.9	(10.9–11.0)	1.5*

Abbreviations: CI = confidence interval
Small cell and non-small cell = 100%; non-small cell subcategories = 86%
Data are from population-based registries that participate in the National Program of Cancer Registries and/or the Surveillance, Epidemiology, and End Results and meet high-quality data criteria. These registries cover approximately 98% of the U.S. population.
^a Rates are per 100,000 and age-adjusted to the 2000 U.S. Standard Population (19 age groups—Census P25-1130) standard
^b Percentages for NSCLC subcategories equal 100% of the total NSCLC
* Rate for men is significantly different than the rate for women (referent group) (p<0.05)

- The relative size of the difference in incidence rates by sex was higher for squamous cell carcinoma (RR=2.1) compared with other histologic types.

Lung Cancer Incidence Trends by Sex: Small Cell vs. Non-Small Cell Lung Cancer Subtypes—United States, 2004–2009



Data are from population-based registries that participate in the National Program of Cancer Registries and/or the Surveillance, Epidemiology, and End Results and meet high-quality data criteria. These registries cover approximately 98% of the U.S. population.

- Adenocarcinoma rates continue to increase in men (APC=1.3%) and women
- Adenocarcinoma rates continue to increase in men (APC=1.3%) and women (APC=2.8%), and squamous cell rates are increasing in women only (APC=1.7%).

Men Lung Cancer Incidence Rates by Age, Race/Ethnicity, and Census Region—United States, 2004–2009

Characteristics	Small Cell		Squamous Cell		Adenocarcinoma		Large Cell		Other Non-Small Cell	
	Rate ^a	95% CI	Rate ^a	95% CI	Rate ^a	95% CI	Rate ^a	95% CI	Rate ^a	95% CI
Age										
< 40	0.1	(0.1–0.1)	0.1	(0.1–0.1)	0.3	(0.3–0.3)	0.0	(0.0–0.0)	0.3	(0.2–0.3)
40–49	2.8	(2.8–2.9)	3.4	(3.3–3.5)	7.2	(7.0–7.3)	0.8	(0.8–0.9)	5.2	(5.1–5.3)
50–59	13.4	(13.2–13.6)	18.8	(18.5–19.0)	28.9	(28.6–29.2)	3.1	(3.0–3.2)	20.1	(19.8–20.3)
60–69	39.4	(38.9–39.9)	69.6	(68.9–70.2)	87.8	(87.1–88.5)	9.0	(8.8–9.2)	58.0	(57.4–58.6)
70–79	59.7	(58.9–60.4)	128.0	(127.0–129.1)	156.2	(155.1–157.4)	15.0	(14.6–15.4)	104.2	(103.2–105.2)
80+	43.6	(42.8–44.5)	105.7	(104.4–107.0)	133.0	(131.5–134.5)	12.0	(11.5–12.4)	96.6	(95.4–97.9)
Race/Ethnicity										
NH, White	10.7	(10.6–10.7)	19.4	(19.3–19.5)	25.0	(24.9–25.2)	2.5	(2.5–2.5)	17.0	(16.9–17.1)
NH, Black	8.6	(8.4–8.8)	25.2	(24.8–25.6)	29.1	(28.7–29.5)	3.1	(2.9–3.2)	22.4	(22.1–22.8)
NH, AI/AN	7.5	(6.7–8.3)	15.1	(13.9–16.3)	14.2	(13.1–15.3)	2.0	(1.6–2.4)	12.1	(11.1–13.1)
NH, A/PI	4.3	(4.0–4.5)	8.9	(8.5–9.2)	19.4	(18.9–20.0)	1.2	(1.1–1.3)	10.2	(9.8–10.6)
Hispanic	4.7	(4.6–4.9)	9.1	(8.9–9.4)	14.3	(14.0–14.6)	1.2	(1.1–1.3)	9.9	(9.7–10.2)
Census Region ^b										
Northeast	9.1	(9.0–9.3)	18.0	(17.8–18.2)	27.1	(26.8–27.3)	1.8	(1.8–1.9)	15.1	(14.9–15.3)
Midwest	11.0	(10.8–11.1)	20.4	(20.2–20.6)	25.4	(25.1–25.6)	2.6	(2.5–2.6)	17.2	(17.0–17.4)
South	11.2	(11.1–11.3)	21.9	(21.7–22.1)	25.2	(25.0–25.4)	3.2	(3.1–3.2)	19.3	(19.1–19.4)
West	6.8	(6.7–6.9)	12.5	(12.3–12.7)	20.1	(19.9–20.3)	1.5	(1.5–1.6)	13.6	(13.5–13.8)

Abbreviations: CI = confidence interval
Data are from population-based registries that participate in the National Program of Cancer Registries and/or the Surveillance, Epidemiology, and End Results and meet high-quality data criteria. These registries cover approximately 98% of the U.S. population.
^a Rates are per 100,000 and age-adjusted to the 2000 U.S. Standard Population (19 age groups—Census P25-1130) standard
^b Categorized by US census region

- Histologic rates for black men exceeded those for white men, except for small cell carcinoma where rates were higher among white men.
- Histologic rates for men were lower in the West compared to those living in other Census regions.

Women Lung Cancer Incidence Rates by Age, Race/Ethnicity, and Census Region—United States, 2004–2009

Characteristics	Small Cell		Squamous Cell		Adenocarcinoma		Large Cell		Other Non-Small Cell	
	Rate ^a	95% CI	Rate ^a	95% CI	Rate ^a	95% CI	Rate ^a	95% CI	Rate ^a	95% CI
Age										
< 40	0.1	(0.0–0.1)	0.1	(0.0–0.1)	0.4	(0.3–0.4)	0.0	(0.0–0.0)	0.3	(0.3–0.3)
40–49	3.0	(2.9–3.1)	1.9	(1.8–2.0)	9.3	(9.2–9.5)	0.7	(0.7–0.8)	5.0	(4.9–5.2)
50–59	12.0	(11.8–12.2)	8.0	(7.9–8.2)	28.2	(27.9–28.5)	2.1	(2.1–2.2)	14.7	(14.4–14.9)
60–69	34.7	(34.3–35.1)	32.8	(32.4–33.2)	76.5	(75.9–77.1)	5.6	(5.4–5.7)	40.2	(39.7–40.6)
70–79	46.9	(46.3–47.5)	61.6	(60.9–62.2)	117.7	(116.8–118.6)	8.6	(8.3–8.8)	64.9	(64.2–65.6)
80+	23.7	(23.2–24.1)	38.2	(37.6–38.8)	80.9	(80.1–81.8)	5.4	(5.2–5.6)	48.4	(47.8–49.1)
Race/Ethnicity										
NH, White	9.0	(8.9–9.1)	9.1	(9.1–9.2)	21.2	(21.1–21.3)	1.6	(1.6–1.6)	11.7	(11.6–11.8)
NH, Black	5.6	(5.5–5.8)	9.2	(9.0–9.4)	18.6	(18.3–18.9)	1.4	(1.4–1.5)	11.1	(10.9–11.3)
NH, AI/AN	7.4	(6.8–8.2)	8.0	(7.3–8.8)	13.3	(12.3–14.2)	1.1	(0.9–1.4)	8.1	(7.4–8.9)
NH, A/PI	1.7	(1.5–1.8)	2.6	(2.4–2.7)	15.3	(14.9–15.7)	0.5	(0.4–0.6)	5.0	(4.8–5.3)
Hispanic	2.8	(2.7–2.9)	3.4	(3.3–3.6)	10.7	(10.5–10.9)	0.6	(0.5–0.6)	5.6	(5.5–5.8)
Census Region ^b										
Northeast	7.6	(7.4–7.7)	8.4	(8.3–8.6)	23.4	(23.2–23.6)	1.2	(1.2–1.3)	10.7	(10.6–10.9)
Midwest	9.1	(9.0–9.2)	9.4	(9.3–9.5)	20.4	(20.2–20.6)	1.5	(1.4–1.5)	11.5	(11.3–11.6)
South	8.6	(8.5–8.7)	9.2	(9.1–9.3)	19.0	(18.8–19.1)	1.8	(1.8–1.8)	11.4	(11.3–11.5)
West	5.8	(5.7–5.9)	6.3	(6.2–6.4)	18.2	(18.0–18.3)	1.0	(1.0–1.1)	9.9	(9.7–10.0)

Abbreviations: CI = confidence interval
Data are from population-based registries that participate in the National Program of Cancer Registries and/or the Surveillance, Epidemiology, and End Results and meet high-quality data criteria. These registries cover approximately 98% of the U.S. population.
^a Rates are per 100,000 and age-adjusted to the 2000 U.S. Standard Population (19 age groups—Census P25-1130) standard
^b Categorized by US census region

- Histologic subtype rates for white women exceeded rates for black women
- Rates for small cell carcinoma in NH AI/AN women (7.4) exceeded those for NH black women (5.6)
- Histologic rates for women were lower in the West compared to those living in other Census regions.

SUMMARY AND CONCLUSION

- Lung adenocarcinoma is the most frequently diagnosed histologic type of lung cancer in the U.S.
- Previous studies examining histologic lung cancer incidence used data that was not representative of the entire U.S. population.
- Results from this study provide a more comprehensive description of recent histologic lung cancer incidence rates and trends for the entire nation.
- Lung adenocarcinoma is increasing in men and women, but the rate of increase is more rapid in women than men.
- Rates for other histologic types have decreased or remained relatively stable. However, among women squamous cell lung cancer continues to increase, with rates being highest among NH white and NH AI/AN women.
- More research is needed to understand factors that may be contributing to observed differences in lung cancer histology. Identification or understanding of factors acting in addition to, or in synergy, with cigarette smoking.

STRENGTHS AND LIMITATIONS

Strengths

- Analyzed cancer data from population-based cancer registries for the entire U.S. population.
- Large sample size allowed examination of histologic rates and trends by sex, age, race/ethnicity, and geographic region.

Limitations

- Lack of data on smoking and inability to examine incidence by smoking behavior/status.
- Potential for misclassification of race/ethnicity particularly among NH AI/AN.

ACKNOWLEDGEMENTS

We gratefully acknowledge the contributions of the state and regional cancer registry staffs for their work in collecting the data used in this study.

REFERENCE

Houston KA, Henley SJ, Li J, White MC, Richards TB. Patterns in lung cancer incidence rates and trends by histologic type in the United States, 2004-2009. Lung Cancer. 2014 Oct;86(1):22-8.

CONTACT INFORMATION

Keisha A. Houston, DrPH, MPH
Epidemiologist
Epidemiology and Applied Research Branch
Division of Cancer Prevention and Control, Centers for Disease Control and Prevention
Email: brn0@cdc.gov; Phone: (770) 488-3096

