ORIGINAL ARTICLE

Histologic Lung Cancer Incidence Rates and Trends Vary by Race/Ethnicity and Residential County

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ABSTRACT

Introduction: Lung cancer incidence is higher among non-Hispanic (NH) blacks than among the NH white and Hispanic populations in the United States. However, national cancer estimates may not always reflect the cancer burden in terms of disparities and incidence in small geographic areas, especially urban-rural disparities. Moreover, there is a gap in the literature regarding rural-urban disparities in terms of cancer histologic type.

Methods: Using population-based cancer registry data—Surveillance, Epidemiology and End Results and National Program of Cancer Registries data—we present age-adjusted histologic rates and trends by race/ethnicity and residential county location at the time of first cancer diagnosis. Rate ratios were calculated to examine racial/ethnic differences in rates. Annual percent change was calculated to measure changes in rates over time.

Results: We found that declines in squamous cell carcinoma are occurring fastest in metropolitan counties, whereas rates of adenocarcinoma increased fastest in counties nonadjacent to metropolitan areas. Further, although NH black men have increased lung cancer incidence compared with NH white and Hispanic men in all geographic locations, we found that the degree of the disparity increases with increasing rurality of residence. Finally, we discovered that among women whose lung cancer was diagnosed when they were younger than 55 years, the incidence of squamous cell carcinoma and adenocarcinoma was higher for NH blacks than for NH whites.

Conclusions: Our results highlight disparities among NH blacks in nonadjacent rural areas. These findings may have significant impact for the implementation of smoking cessation and lung cancer screening programs.

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Keywords: Lung cancer; Histology; Incidence; Surveillance; Health disparities; Registry

Introduction

Although cigarette smoking has decreased significantly over the past few decades, disparities in tobacco use and lung cancer incidence in terms of race, ethnicity, education, and socioeconomic status remain in the United States.[1–4] The main types of lung cancer include SCLC and NSCLC (adenocarcinoma, squamous cell carcinoma, and large cell carcinoma). Approximately 80% to 85% of lung cancers are NSCLC and 10% to 15% are SCLC. Most lung cancers are due to smoking; however, the strength of association varies by histologic subtype.[5] Evidence suggests that cigarette smoking is more strongly associated with SCLC and squamous cell carcinoma and less associated with adenocarcinoma and large call carcinoma.[6–8] Public health campaigns around the negative health consequences of smoking initiated a decline in smoking prevalence and a decrease in lung cancer incidence toward the end of the last century. Squamous cell carcinoma and SCLC declined, but the adenocarcinoma subtype increased. Although some of these histologic changes are attributable to the global decline in smoking prevalence,[4] changes in the design

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and composition of cigarettes—both of which modified inhalation and patterns of use—are also attributable causes.[4, 9–11] Racial and ethnic differences in smoking behaviors and lung carcinogenesis[12] suggest that some racial/ethnic groups are more susceptible to lung cancer.[2] For instance, despite lower smoking prevalence rates,[2] later age of smoking initiation,[13–15] and lower number of cigarettes smoked per day,[13] non-Hispanic (NH) blacks are disproportionately affected by lung cancer compared with NH whites.[13,16–19] Furthermore, among Hispanic populations, the incidence of lung cancer is lower than among NH whites[20]—a trend that is also observed among first-generation U.S. Hispanics[21]—whereas the prevalence of smoking in the aggregate is approximately 40% to 50% lower than in NH whites, though it is worth noting that there are marked differences in smoking patterns according to country of origin.[13,20] Collectively, cigarette smoking patterns appear to contribute to, but not fully explain racial/ethnic disparities in lung cancer incidence.[22–26] Thus, some aspects of racial/ethnic disparities in lung cancer incidence may be associated with modifiable exposures or other unmeasured facets of tobacco use.[27]

Geographical residence—and associated environmental exposures such as smoking, radon, pollution, and other unknown factors—is one potential cofactor that mediates racial/ethnic disparities in lung cancer incidence.[28] Smoking rates and unhealthy behaviors, for example, are higher in rural areas.[29–31] A recent comprehensive description of histologic lung cancer incidence rates and trends in the United States demonstrated that lung cancer rates overall are highest in the South, whereas lung adenocarcinoma rates are highest in the Northeast region.[3,19] Moreover, recent work has suggested that higher altitude is associated with reduced incidence of lung cancer.[32–34] Few studies have examined differences in lung cancer incidence by using small or well-defined geographic regions. These studies are important, as they may help to identify regions with patients at high risk for lung cancer that can be targeted for outreach and implementation of low-dose computed tomography (LDCT) screening. Efforts are also needed to reduce disparities in rural and urban lung cancer rates; to do so, however, one first needs to identify and characterize these disparities. In this study, we have examined county-level lung cancer incidence rates by histologic subtype, with an emphasis on racial/ethnic and geographical differences.

Materials and Methods

Data Sources

Data on incident lung and bronchus cancer cases diagnosed between 2004 and 2013 were obtained from the Centers for Disease Control and Prevention National Programs of Cancer Registries (NPCR) and the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) registries. Together, these two registries provide cancer incidence data for 100% of the U.S population without duplication of individual registries. NPCR and SEER are required to have fewer than two unresolved duplicates per 1000 cases to meet USCS publication criteria. The Registry Plus Link Plus system was used to detect duplicate records. All registries that met the United States Cancer Statistics data quality standards were included. Minnesota and Kansas were excluded from the study because of missing county-level data, and Nevada was excluded because statewide data did not meet high-quality standards for all study years, resulting in 96.5% coverage of the U.S. population.

Because the influence of cigarette smoke on the risk of lung cancer histologic subtypes is not equal,[8] we examined incidence rates and trends for all major histologic lung cancer subtypes. Lung cancer histologic groups were defined by using International Classification of Diseases for Oncology, Version 3, codes as follows: SCLC (8002–8005 and 8041–8045); NSCLC (8046); squamous (8052, 8070–8076, 8078, 8083–8084, 8094, 8120, and 8123); adenocarcinoma (8050, 8140–8141, 8144, 8201, 8250–8255, 8260, 8290, 8310, 8320, 8323, 8333, 8470, 8480, 8481, 8490, 8507, 8550, 8570, 8572, 8574, and 8576); large cell (8012–8014, 8021, and 8082); carcinoma, NOS (8000, 8001, 8010, 8020, and 8230); other specified types (8022, 8030, 8031–8033, 8200, 8240, 8241, 8244–8246, 8249, 8430, 8560, 8562, and 8575); sarcoma (8800–8805, 8810, 8811, 8815, 8830, 8890, 8900, 8940, 9040, 9041, 9043, 9120, 9133, 9220, 9231, 9473, and 9540) (Supplementary Table 1). Cases were restricted to non-Hispanic (NH) white, NH black, and Hispanic adults ($\geq$18 years), with Hispanic ethnicity being mutually exclusive from race categories. Cases verified by autopsy only or death certificate only and not microscopically confirmed were excluded from the study.

Using state-county American National Standards Institute codes, which are also referred to as Federal Information Processing Standards codes, we coded incidence data by assigning 2003 county-level Rural-Urban Continuum Codes (RUCCs) on the basis of county of residence at the time of first diagnosis. RUCC is a system for county-level assessment of rurality and urbanization with codes ranging from 1 to 9 that was developed by the United States Department of Agriculture.[35] For metropolitan-nonmetropolitan variation analysis, counties were categorized as metropolitan (RUCC codes 1–3), adjacent to metropolitan (RUCC codes 4, 6, and 8), or nonadjacent to metropolitan (RUCC codes 5, 7, and 9).[28] RUCC codes 1 to 3 correspond to counties