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Assessing lung cancer incidence disparities between Puerto Ricans and other racial/ethnic groups in the United States, 1992–2010

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Abstract

This study compared the incidence of lung cancer among Puerto Ricans (PRs) with that of Whites, Blacks, and Hispanics in the United States. We computed age-standardized rates of lung cancer during 1992–2010 and percentages of change over time. Standardized rate ratios (SRR) were estimated to assess racial/ethnic and gender differences. All men groups showed a significant decline in lung cancer over time but PRs observed the smallest change (−1.2%). For both men and women, PRs had lower incidence rates compared to other racial/ethnic groups (SRR<1; *P*<0.05). Among all groups, men reported higher incidence rates than women but PRs showed the largest gender disparity (SRR=2.29). This study showed that although PRs exhibited lower incidence rates of lung cancer, this subgroup of Hispanics faced a high burden of lung cancer, principally because PR men had the smallest decline over time and the largest gender difference among all groups.

Keywords

Puerto Ricans; lung cancer; cancer incidence; cancer disparities

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Introduction

Lung cancer rates vary considerably among countries and among racial/ethnic populations within countries (1). In the U.S., lung cancer is the second most common diagnosed cancer in both men and women, and it also ranks first in cancer deaths (2). During the past several decades, lung cancer rates have declined in the U.S., largely explained by a decline in the tobacco epidemic (3). Nonetheless, this reduction is not similar among both genders and racial/ethnic groups, resulting in cancer disparities. For instance, higher incidence rates are observed among non-Hispanic Black (NHB) men than in other populations, including non-Hispanic White (NHW) and U.S. Hispanic (USH) groups (3, 4). Despite such disparities, lung cancer is among the top four sites of cancer incidence among the three above mentioned racial/ethnic groups (5).

In Puerto Rico, a Commonwealth territory of the U.S., lung cancer is the third most common diagnosed cancer among men and the fifth among women (6.9% and 4.3% of all new cancers, respectively) (6). Lung cancer also ranks as the second deadliest cancer among Puerto Rican (PR) men and the third among women (13.1% and 9.7% of all cancer deaths, respectively) (6). Although there is extensive literature reporting lung cancer incidence trends for NHWs, NHBs, and USHs (2–5); PRs have not been included in those analyses. As of today, there is no study comparing recent lung cancer incidence data between PRs and other racial/ethnic groups in the U.S. Such a comparison is not only necessary to understand lung cancer differences across the increasingly diverse U.S. population but to inform public health interventions aimed at addressing existing cancer disparities in the U.S. mainland and territories, which is a vital element of the Nation's health agenda (7). Given the limited body of research on the burden of lung cancer in Puerto Rico, this study is aimed at assessing age-standardized incidence rates of lung cancer among PRs and compared these to that of NHWs, NHBs, and USHs for the period 1992–2010.

Methods

Data sources

Lung cancer data for PRs were obtained from the Puerto Rico Central Cancer Registry (PRCCR) and data for NHWs, NHBs, and USHs came from the Surveillance, Epidemiology, and End Results (SEER) program (SEER 13 database). The PRCCR, part of the Centers for Disease Control and Prevention's National Program of Cancer Registries, uses the coding standards of the SEER program and of the North American Association of Central Cancer Registries, which makes the PRCCR data fully comparable to the SEER data (6). The criteria specified in the third edition of the International Classification of Diseases for Oncology (ICD-O-3) were used to select lung cancer cases from 2001 to 2010 (8). Cases from 1992 to 2000 were originally reported using ICD-O-2 and later converted to ICD-O-3. USH were identified by the SEER program using a combination of medical record review and matching surnames against a list of Hispanic surnames (9). Our study does not account for group differences within the USH population. Data were analyzed for adults 40 years of age. This study was approved by the Institutional Review Board of the University of Puerto Rico Medical Sciences Campus.

Statistical analyses

For each racial/ethnic group, we applied the direct method to calculate age-standardized rates (ASR) per 100,000 individuals using the world standard population as reference. To assess the trends of lung cancer incidence, we calculated the annual ASR from 1992 to 2010 as follows:

$$ASR_i^k = \sum_{j=1}^{10} w_j \frac{d_{ij}^k}{n_{ij}^k}$$

where j represents a given age group, i represents a given racial/ethnic group, k represents a given year, w is the proportion of people in the world population to be evaluated, d is the number of new cases, and n is the total population (10). We also calculated the percentage of change in the ASR for the long-term of 1992–2010 and the latest 5-year period of 2006–2010. The significance of the percentage of change was determined by 95% confidence intervals (CI).

To assess racial/ethnic group differences, we grouped the ASR values for the 2006–2010 period as follows:

$$ASR_i = \sum_{j=1}^{10} w_j \frac{\sum_{k=2006}^{2010} d_{ij}^k}{\sum_{k=2006}^{2010} n_{ij}^k}$$

Then, the ratio of two ASR (ASR group$_i$/ASR group$_j$) between two groups (i and j) was estimated with 95% CI to compute differences in lung cancer incidence of PRs versus NHWs, NHBs, and USHs, respectively, and between men and women from the same racial/ethnic group. This ratio is referred to as the standardized rate ratio (SRR) (11). Following the example of others (3), we restricted the latter analysis for the short-term of 2006–2010 in order to provide the most recent and accurate estimates of SRRs. All analyses were stratified by sex and performed using Stata/SE version 12 (Stata Corp., LP, College Station, TX). A detailed description of our analysis plan is presented elsewhere (12, 13).

Results

Trends of age-standardized rates (1992–2010)

Figure 1 shows different time-trends of lung cancer incidence between racial/ethnic groups; both PR men and women had the lowest rates from 1992 to 2010. All men groups showed a statistically significant ($P<0.05$) decline over time but PRs observed the smallest percentage of change (–1.2%). Among women, a statistically significant decline was only observed for PRs (–0.4%; $P<0.05$). In contrast, both NHW and NHB women groups observed statistically significant increase over time. On the other hand, all racial/ethnic groups observed a statistically significant decline in lung cancer incidence from 2006 to 2010 (data not shown); among men, the largest decline was observed in NHBs (–3.0%) and among women, in PRs (–0.4%).

Standardized rate ratios (2006–2010)

Both PR men and women had the lowest age-standardized incidence when compared to their NHW, NHB, and USH counterparts (Table 1). Among all racial/ethnic groups, men reported higher incidence rates than women ($P<0.05$), and the PR group showed the largest gender difference in lung cancer among groups (SRR= 2.29; 95% CI= 2.13–2.46). For both men and women, PRs had lower incidences of lung cancer than the other three groups ($P<0.05$). Incidence rates were four times lower in PR men than NHB men (SRR= 0.26; 95% CI= 0.25–0.27) and five times lower in PR women than NHW (SRR= 0.20; 95% CI= 0.19–0.21) and NHB women (SRR= 0.19; 95% CI= 0.18–0.20).

Discussion

This study indicates that lung cancer incidence rates among PRs were lower compared to those of NHWs, NHBs, and USHs. These results may be explained by differences in smoking prevalence across racial/ethnic groups. The unequivocal role of tobacco use in causing lung cancer is one of the most thoroughly documented causal relationships in biomedical research (14). Historically, PRs have reported a much lower prevalence of cigarette smoking than NHW, NHB, and USH groups (15, 16), potentially explaining why PRs showed a lower incidence of lung cancer for both men and women as compared to the other groups.

The declining trends of lung cancer occurrence observed in all men groups could be explained by the descending patterns of smoking prevalence among these populations. Evidence shows that lung cancer trends follow the smoking patterns occurring approximately three decades earlier in a population (17, 18). Smoking prevalence among U.S. adult men has decreased from 51.9% in 1965 to 21.5% in 2010 (19). Declining trends in smoking have also been reported specifically for NHW, NHB, and USH men (16). Historical data on cigarette use among PR adults also shows declining trends of smoking for this group (15). In opposition to the declining trends observed in men, only PR women showed a decreased trend in lung cancer. An explanation for these findings might be that women smoking patterns have been reported to be lagged by several decades behind those of men (17, 18). All these different patterns of smoking prevalence and lung cancer trends between men and women might explain the large gender disparities observed across all racial/ethnic groups in this study.

Genetic polymorphisms (e.g., GSTM1 null) resulting in variation in metabolism of tobacco carcinogens may also influence lung cancer risk. Although we have found no published research on genotype-associated susceptibility of lung cancer among PRs, Xie *et al.* (20) conducted a case-control study to investigate the role of GSTM1 in oral cancer risk in this population. The authors found that risks increased with increasing cigarette use (P for trend <0.0001) among PR with the GSTM1-present genotype, up to 9 times higher risk (OR= 9.5; 95% CI= 3.0–30) among the heaviest smokers.

The strength of this study arises from the quality of the data analyzed. Ninety five percent of all cancer cases diagnosed in Puerto Rico are appropriately reported to the PRCCR, which is a rate comparable to the U.S. (6). However, some limitations should be acknowledged. First,

we were unable to compare lung cancer data between mainland and island PRs because the SEER program classifies all Hispanic individuals who live in the continental U.S. under the broad category of Hispanics. Second, we were unable to analyze data on lung cancer risk factors because neither the PRCCR nor the SEER program collects such information. It will be important as others cite and use our data to keep in mind that when statewide tobacco control interventions are introduced, larger reductions in lung cancer incidence are expected among populations with higher smoking prevalence because they may experience larger changes in smoking cessation over time.

In conclusion, despite the lower rates of lung cancer observed among PRs as compared to other racial/ethnic groups in the U.S., lung cancer continues to be a public health priority in Puerto Rico; principally because PR men had the smallest decline over time and the largest gender difference.

Acknowledgements

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Figure 1.
Trends for lung cancer incidence by race/ethnic group, 1992–2010.

Table 1

Age-standardized incidence rates (per 100,000) and standardized rate ratios for lung cancer, 2006–2010.

| | Age-standardized incidence (per 100,000) | | | | SRR (95% CI)[a] | | |
	PR	NHW	NHB	USH	PR vs. NHW[b]	PR vs. NHB[b]	PR vs. USH[b]
Men	52.4	150.9	197.3	86.4	0.35 (0.33–0.36)	0.26 (0.25–0.27)	0.63 (0.60–0.67)
Women	22.3	112.8	112.0	53.2	0.20 (0.19–0.21)	0.19 (0.18–0.20)	0.43 (0.40–0.46)
SRR (95% CI)[c]	2.29 (2.13–2.46)	1.29 (1.27–1.31)	1.70 (1.64–1.76)	1.56 (1.49–1.64)			

Legend: PR = Puerto Ricans; NHW = non-Hispanic whites; NHB = non-Hispanic blacks; USH = U.S. Hispanics.

[a] SRR = standardized rate ratios; 95% CI = 95% confidence intervals.

[b] Reference group.

[c] SRR = standardized rate ratios; 95% CI = 95% confidence intervals; women as the reference group.