

Association Between Race and Survival of Patients With Non—Small-Cell Lung Cancer in the United States Veterans Affairs Population

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Abstract

An analysis of the Veterans Affairs Central Cancer Registry was conducted to determine whether racial disparities in non-small-cell lung cancer (NSCLC) outcomes exist in veterans. Among the 82,414 patients analyzed, African American patients had worse prognostic factors, but a better overall survival than Caucasians. In a single payer system with accessible healthcare, racial differences in NSCLC outcomes were absent.

Background: Racial disparities in outcomes of non—small-cell lung cancer (NSCLC) patients in the United States are well documented. A retrospective analysis of patients in the Veterans Affairs Central Cancer Registry was conducted to determine whether similar disparities exist in a population with a single-payer, accessible health care system.

Patients and Methods: Demographic data of patients diagnosed with NSCLC between January 1995 and February 2009 were analyzed using Kruskal-Wallis test or the χ^2 test. Multivariate Cox proportional hazards regression analysis was used to compare survival among races. **Results:** Of the 82,414 patients, 98% were male, 82% had a smoking history, and 81% were Caucasian. Caucasian individuals had better prognostic features compared with African-American individuals (stage I/II [24% vs. 21%]; Grade I/II [21% vs. 17%]). A larger proportion of Caucasian compared with African-American individuals received stage-appropriate treatment (surgery for stage I [48% vs. 41%; $P < .001$]; chemotherapy for stage IV [18% vs. 16%; $P = .003$]). African-American individuals had a lower risk of mortality compared with Caucasian individuals (hazard ratio, 0.94; 95% confidence interval, 0.92-0.96). **Conclusion:** Although African-American patients had a higher stage and grade of NSCLC, they had a better overall survival than Caucasian patients. In a single-payer system with accessible health care, previously described racial differences in lung cancer outcomes were not observed.

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Introduction

Lung cancer is the second most common cancer and the most common cause of cancer-related death in the United States (US).¹ The incidence of lung cancer in men varies by race. Caucasian

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men have an incidence of 79.3 and incidence in African-American men is 107.6 per 100,000 population.

The outcomes among African-American and Caucasian patients with non—small-cell lung cancer (NSCLC) in the US differ, with a poorer prognosis noted among African-American patients.²⁻⁶ Poor general health and limited access to health care for African-American individuals have been implicated as causal factors for these disparate outcomes.⁷ In addition, when equal access to care is provided, African-American patients with lung cancer are less likely than Caucasian patients to receive aggressive treatment.⁸ This study was designed to explore the possibility that differences in treatments received are responsible for these outcome disparities.

The Veterans Affairs (VA) health care system provides a comprehensive medical benefits package to all enrolled veterans that include a full range of preventive outpatient and inpatient care. Therefore, the VA health care system is characterized as more

accessible to its eligible veterans when compared with the health care available to the general American population. In this analysis, we used the public access National VA Central Cancer Registry (VACCR) database to test the hypothesis that racial differences are not a factor in survival outcome for patients with NSCLC managed in a single health care system.

Patients and Methods

Data Source

The VACCR contains demographic and clinical information of all patients who have been diagnosed and/or treated at 1 of 143 VA Medical Centers in the US. Data collected from electronic medical records of patients seen from individual VA Medical Centers are centrally aggregated and updated every 2 months. The VACCR data do not overlap with other national registries including the National Cancer Institute's Surveillance, Epidemiology, and End Results Program (SEER) database and the North American Association of Central Cancer Registry (NAACCR), thereby representing a unique population. The VACCR used the International Classification of Diseases (ICD)-O-2 from its inception in 1995 shifting to ICD-O-3 in 2001. Cases with an ICD-O-2 code of C340-349 or ICD-O-3 code of C34.0-C34.3 and C34.8-C34.9 were included in this analysis. Follow-up information of each patient in the registry is systematically gathered annually to ascertain if the patient has had a recurrence of cancer, a second course therapy, has disease, or is disease-free at the time of the follow-up.

The VACCR adheres to standards established by the American College of Surgeons Commission on Cancer Facility Oncology Registry Data Standards for data collection and definitions and must pass NAACCR electronic quality assurance edits before being merged and consolidated into the master database. The data capture rate is similar to that of the SEER database.

Study Population

Patients with NSCLC (all histologies) included in the VACCR database between January 1995 and February 2009, were identified. Abstracted data included: age at diagnosis, sex, race, smoking history, disease stage, treatment received, and survival status. Race was self-identified at registration into the VA system and is captured from the electronic medical record. Patients were classified as Caucasian, African-American, Asian, or Native American. Overall survival was defined as the time from the pathologic diagnosis of lung cancer to the date of death (from all causes) or last contact. Follow-up information available in October 2010 was used in the analysis. Tumor staging was performed according to the American Joint Committee on Cancer 6th Edition. This study was approved by the VA-Nebraska Western Iowa Health Care System Institutional Review Board.

Statistical Analysis

Demographic data were stratified by race and compared using Kruskal-Wallis test or χ^2 test for continuous and categorical data respectively. Univariate probabilities of overall survival were calculated using the Kaplan-Meier estimator; the log-rank test was used for univariate comparisons across racial groups. Multivariate analyses of overall survival were performed using Cox proportional hazards regression, with racial group forced in the model building (main effect), using Caucasian patients as the reference group.

Prognostic factors tested for its association with overall survival included: age at diagnosis, sex, history of smoking, family history of cancer, disease stage, and treatment received. A category for missing data was created for each of the covariates so that model building used all the patients included in this study. The assumption of proportional hazards was tested using a time-dependent covariate. All covariates met the assumption of proportionality. Covariates significantly associated with the outcome were identified by forward stepwise selection at a significance level of $\leq .05$.

First-order interactions between racial groups and all significant covariates were tested. No interactions were noted. The overall covariate effects for the main effect race were tested using the Wald test. Because of multiple comparisons in the main effect, a P value of $\leq .03$ was considered statistically significant (Bonferroni correction). All P values were calculated as 2-sided tests.

To account for possible miscoding of patients during the early years of VACCR, a separate analysis of patients diagnosed after January 1, 2006 ($n = 18,254$) was performed. This cutoff date was chosen because the data are recent enough to ensure accurate classification and also a long enough amount of time to allow comparison of outcomes for all stages of presentation. For sensitivity analyses, patients who received the stage-appropriate treatment (surgery for stage I and II, multimodality therapy for stage III, and chemotherapy for stage IV) were analyzed separately as were patients diagnosed after January 1, 2006. In an effort to exclude the influence of treatment variations by race, a further subset analysis was conducted for untreated NSCLC patients. All analyses were performed using SAS version 9.2 for Windows.

Results

Patient Population

Data for 92,700 patients were available. The relevant information for this study was available for 82,414 (89%) patients with NSCLC. Five percent of the whole population ($n = 5143$) had some missing information or were miscoded. One hundred and thirteen patients had wrong/miscoded tumor grade, and 939 had wrong/miscoded clinical stage. Patients missing follow-up information ($n = 2976$), race ($n = 1106$), and sex ($n = 9$) were also excluded from this analysis. Of the patients included in this analysis, 81,118 (98%) were male and 78,207 (82%) were former or current smokers. These included 67,032 (81%) Caucasian patients, 14,791 (18%) African-American patients, 300 (0.35%) Asian patients, and 291 (0.35%) Native American patients. The VACCR does not identify Hispanic as a separate category.

Patient Characteristics According to Race

The demographic features of the patients by race are presented in Table 1. Caucasian patients had better risk features at presentation than African-American patients; early-stage disease (stages I or II combined [24% vs. 21%; $P < .001$]), and low-grade tumors (grades I or II combined [21% vs. 17%; $P < .001$]). Nearly half of the patients had no tumor grade identification, but no significant racial differences were noted in the evaluable patients.

Thirty-five percent of African-American patients, 34% of Caucasian patients ($P < .001$), 36% of Native American patients, and 35% of Asian patients ($P = .007$) did not receive lung cancer treatment. More Caucasian patients received recommended

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