



# Important prognostic factors for lung cancer in tobacco predominant Eastern North Carolina: Study based on a single cancer registry



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## ABSTRACT

**Background:** It is known that lung cancer incidence and mortality rate are higher in African Americans (AA) than whites. In Eastern North Carolina, there is a higher percentage of AA population than the national average (30.2% vs. 12.4%) and a higher incidence of lung cancer in this region. We investigated demography and survival of lung cancer patients diagnosed and treated in a single institution.

**Methods:** The study includes 2351 patients diagnosed with lung cancer between 2001 and 2010 at East Carolina University. AA and whites were compared by age, sex, race, stage, histology, smoking history and insurance information using chi-square analyses. Patient survival was modeled using Cox proportional hazards regression (SAS version 9.2).

**Results:** The distribution of lung cancer was 70% in whites and 30% in AA. The proportion of AA and whites differed significantly for age, sex, histology, stage, and insurance. Patients aged >70 ( $p < 0.0001$ ) and 51–70 ( $p = 0.0064$ ) died sooner than those  $\leq 50$  years old. Compared with squamous cell, SCLC had inferior survival (HR = 2.0, 95%CI = 1.7–2.3). Privately insured patients survived longer than those with medicare ( $p < 0.0001$ ), medicaid ( $p = 0.0009$ ), or no insurance ( $p < 0.0001$ ). The survival disadvantage for medicaid ( $p = 0.0076$ ) and no insurance ( $p = 0.0033$ ) persisted on multivariable analysis. Race was not a significant predictor of survival on multivariable analysis ( $p = 0.66$ ).

**Conclusion:** This is one of the largest lung cancer patient populations from a single institution showing demographic differences between the two races with similar survival outcome. Age, histology and type of insurance were strong predictors of survival outcome. Older age, small cell histology and medicaid and no insurance had significantly shorter overall survival.

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## 1. Introduction

Lung cancer is the second most common cancer among men and women in the United States (US) but is the leading cause of mortality in both. The incidence and mortality also can vary based on geographic location within the country. Cancer incidence in North Carolina (NC) is 471.8 per 100,000 of population compared with 465.1 in the US. Similarly, the death rate in NC (189.3) is higher than the US rate (178.1) [1].

The tobacco industry has traditionally been one of the most important industries in North Carolina and a backbone of the state's agricultural heritage [2].

Because of local tobacco cultivation (Fig. 1), lung cancer is one of the predominant cancers in the state with an incidence of 74.5 (vs. 65.6 in US) per 100,000 resulting in a very large patient population in the region.

Although, the annual lung cancer mortality is declining overall, it continues to remain high in racial and ethnic minorities. The outcome of lung cancer based on different race has been published in the literature [3]. It has been well reported that AA have shorter survival and higher mortality than whites in several cancer types including lung cancer. The documented cancer mortality rate in AA is 17% higher than whites [4]. The reason for this disparity still is not well understood. There has been significant controversy in this matter. Whether it is due to true biologic difference between the two races with AA having inherent biologic inferiority is not confirmed. In addition, the differences in insurance status also can

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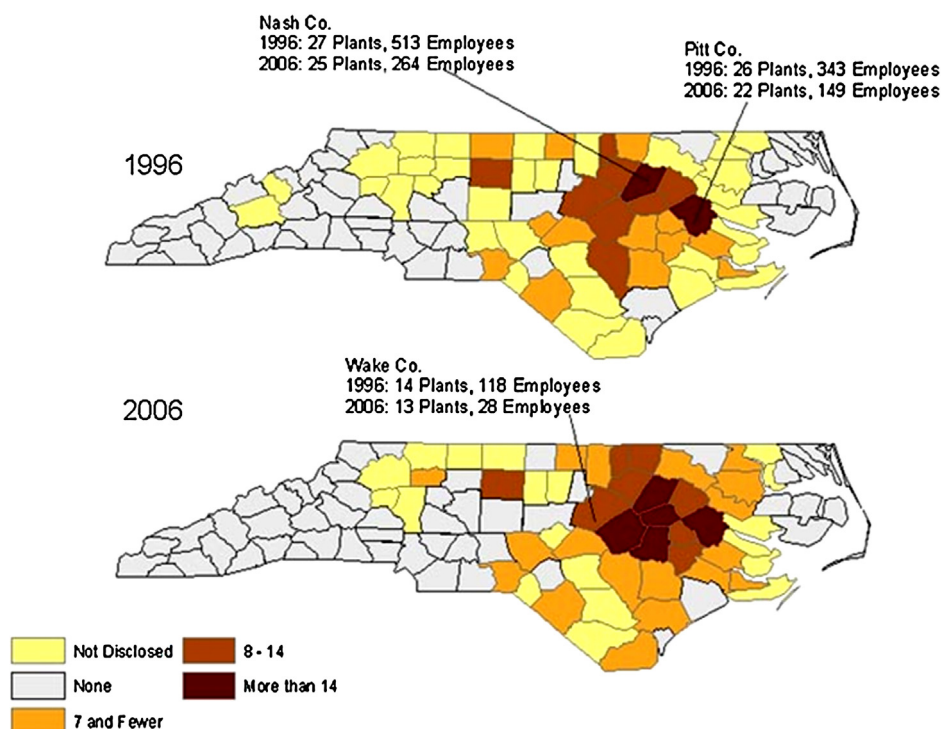


Fig. 1. Tobacco cultivation and industry in North Carolina.

contribute to difference in lung cancer treatment outcomes which indirectly may reflect socioeconomic status. The insurance system in the United States is divided between private and public providers and it is estimated that about 20% of the adults under 65 are uninsured [5]. Treatment delivery often can be different than the recommendation as a result of clinical reasons including underlying co-morbidities, patient's choice or advanced age and also as a result of non-clinical reasons such as minority race, low socioeconomic condition, cultural belief or insurance status.

Apart from known prognostic factors for lung cancer survival, several demographic factors including smoking status, histology, sex and performance status have been found to be independent prognostic factors in non-small cell lung cancer [6,7].

We undertook this retrospective analysis of all lung cancer patients that were diagnosed in a single cancer center and were included in a single cancer registry to analyze the outcome among white population compared with AA population as the percentage of AA race is higher than the national average in the Eastern part of North Carolina. We also examined various demographic factors as a prognostic factor for the overall survival outcome.

## 2. Methods and materials

### 2.1. Data source

This is a retrospective study. We extracted the data from the Vidant Healthcare Cancer registry. Using lung cancer variables, all patients who were diagnosed between 2001 and 2010 at the Leo Jenkins Cancer center, East Carolina University were identified. An Institutional Review Board (IRB) approval was obtained.

### 2.2. Variables

We collected data on age, race, histology, stage, smoking history, and insurance information. We also collected the treatment history including surgery, chemotherapy and radiation therapy. The

age was divided into 3 categories, less than 50 years, 51–70 years and over 70 years. The race was categorized as whites or African Americans. The histology were grouped as squamous cell, adenocarcinoma, non-small cell lung cancer (NSCLC) NOS, small cell lung cancer, large cell neuroendocrine, and others as any other histology. The smoking history was divided into three groups: never smokers, current and previous smokers and people using snuff. The insurance information was categorized into medicare with and without supplement, medicaid, no insurance and private. The treatment variables were divided into surgery, chemotherapy and radiation therapy.

### 2.3. Survival

Overall survival (OS) was defined as the number of months from the day of diagnosis to the day of death. All-cause mortality was used in the survival analysis. Patients were censored if they were alive at the last date of contact.

### 2.4. Statistical analysis

Comparisons of demographic, clinical and pathologic variables were made for patients between AAs and whites using Pearson's chi-square test. Univariable survival rate analyses were estimated using the Kaplan–Meier method, with comparison made between the groups using log-rank test. Multivariable analysis was performed using Cox proportional hazard model. All statistical analyses were performed using SAS 9.3 statistical software (SAS institute, Inc, Cary, NC). Statistical significance was assumed for a two-tailed  $p$  value less than 0.05.

## 3. Results

A total of 2351 patients were identified from the tumor registry with a confirmed diagnosis of lung cancer. The median age of the study population was 66.9 years. The median age was 64.4 years in

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