Published in final edited form as:
*J Occup Environ Med*. 2008 October ; 50(10): 1167–1175. doi:10.1097/JOM.0b013e31817d3639.

# Occupation, Gender, Race, and Lung Cancer

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## Abstract

**Objective—**To examine associations between occupation and lung cancer by gender and race.

**Methods—**We used data from the Maryland Lung Cancer Study of nonsmall cell lung carcinoma (NSCLC), a multicenter case control study, to estimate odds ratios (ORs) of NSCLC in different occupations.

**Results—**After adjusting for smoking, environmental tobacco smoke, and other covariates, NSCLC ORs among women but not men were elevated in clerical-sales, service, and transportation-material handling occupations; ORs were significantly increased in all three categories (OR [95% confidence interval]: 4.07 [1.44 to 11.48]; 5.15 [1.62 to 16.34]; 7.82 [1.08 to 56.25], respectively), among black women, but only in transportation-material handling occupations (OR [95% confidence interval[: 3.43 [1.02 to 11.50]) among white women.

**Conclusions—**Women, especially black women, in certain occupations had increased NSCLC ORs.

Lung cancer cases in the United States have decreased among men but continue to increase among women, and specifically black women.[1–3] The former trend is attributed to the reduction in cigarette smoking, a well-established risk factor for lung cancer. Nevertheless, the latter trend remains unexplained because new cases are being diagnosed in women who have never smoked. Among other causes of lung cancer are occupational and/or environmental exposures to carcinogens,[4–12] including residential radon[13,14] and environmental tobacco smoke (ETS).[15] Associations between exposures to cooking oil vapors and coal fumes at home and high levels of lung cancer have been reported in nonsmoking women.[16,17] The combination of exposure to environmental risk factors and genetic differences has also been hypothesized to account for higher risks of lung cancer in women.[18–21]

There is a growing body of literature that addresses lung cancer and gender differences in susceptibility to tobacco-induced carcinogenesis.[18–24] We used the multicenter case-control Maryland Lung Cancer Study to determine whether gender and race differences existed when the associations between lung cancer and occupations were examined.

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## Materials and Methods

### Study Population

We analyzed the data collected for the Maryland Lung Cancer Study, a previously described multicenter case control study approved by the University of Maryland-Baltimore and the National Institutes of Health institutional review boards.[25] Briefly, all cases with histologically confirmed nonsmall cell primary lung tumors were selected from seven hospitals in the metropolitan Baltimore area. Population controls were recruited from the same Maryland counties of residence as the lung cancer cases by screening information obtained from the Department of Motor Vehicles. Cases and controls were matched on year of birth within strata of race and sex. The original study was designed to investigate potential genetic mechanisms underlying incidence variations by race and gender; therefore, black controls were oversampled. Among the eligibility criteria reported earlier, subjects had to be either white or black; free of known HIV, Hepatitis C Virus (HCV), and Hepatitis B Virus (HBV) diagnosis; US-born; residents of Baltimore City, adjacent Maryland counties, or the Maryland Eastern Shore; able to speak English well enough to be interviewed; non-institutionalized; and never interviewed as a control for the study (cases only).

### Data Collection

After informed consent was obtained, cases and controls were interviewed in person to collect data on sociodemographic characteristics, medical and occupational histories, and other determinants, including age, education level, marital status, state of birth, race, and current smoking status and smoking history. Histories of exposure to ETS during childhood, adulthood at home, and in the workplace for at least 5 years were also recorded. The medical history addressed whether or not the subjects had the following diseases: emphysema; chronic bronchitis; asthma; asbestosis; tuberculosis; or other lung illnesses, excluding cancer. Family cancer history was also recorded.

For all cases and controls used in this analysis, an occupational history was recorded, including job title and type of industry, and the beginning and end of each job period. A single reviewer coded job titles and industries, according to the Dictionary of Occupational Titles, 4th ed.[26] and the 2002 North American Industry Classification System,[27] respectively. In addition, each subject was asked about the job held the longest and the industry of that job. The job and industry codes were classified into nine and 14 categories, respectively.

### Variable Definitions and Statistical Analysis

Analyses were performed to describe the study population and assess the strength and significance of lung cancer risk association with different variables ($\chi^2$ test, *t* test, odds ratio [OR], 95% confidence interval) for women and men separately (Tables 1–3). The variables included mean age, gender, race (black or white), smoking status (never, former, or current), packyears (product of [number of packs smoked per day × number of years at this level]), birth region (Mid-Atlantic, including MD, DC, DE, PA, VA, and WV; or other), education level (completion of 5th to 9th grade; 10th or 11th grade, high school, or GED; some college or technical school, including AA; or college and above, including MS, PhD, and MD), marital status (single or never married; married or living with partner; or divorced, separated, or widowed), family cancer history (no, yes), asbestosis (no, yes), and other lung illnesses, excluding asbestosis (no, yes), and ETS exposure (no, yes). The job held the longest was used as the main independent variable. Considering the few cases and/or controls in the agriculture-fishery-forestry, processing, machine trades, and benchwork occupations, we grouped these categories into one; the job held the longest variable then had six categories (Table 2). The professional-technical-managerial category served as the reference group.

For the bivariate analysis, education was re-categorized (completion of high school and lower, completion of some college or higher), and the magnitude of ETS exposure was estimated ("none" if no ETS was reported in any of the three environments queried [childhood, adulthood, and the workplace], "low" if reported in one, "moderate" if in two, and "high" if in all three) (Table 3). For the unconditional logistic regression analyses, age and packyears were used as continuous variables (Table 4).

Age and race, and any variables with which lung cancer risk was significantly associated in the bivariate analysis, were included in the unconditional logistic regression analyses. They were also tested for potential interactions with the main variable of interest (the job held the longest) in separate models for men and women. The resulting model for each gender included smoking status, packyears, race, history of lung illness, ETS, and age; family cancer was only included in the model for men. Race, but not its interaction with the job held the longest, was significant in the models for both men and women. Therefore, we generated the final regression models by race, with the same covariates specified above, for each gender. All statistical analyses were performed using SAS version 9.1 software.

## Results

The Maryland Lung Cancer Study is an ongoing investigation that started in 1998. The sample we analyzed consisted of 655 cases and 457 population controls interviewed between 1998 and 2006, representing 90% and 88%, respectively, of those who were eligible and agreed to participate when they were contacted.

Table 1 shows the sociodemographic characteristics of the study sample. Among the cases, 73.6% were born in the mid-Atlantic States, and 64.9% were between 56 and 75 years old. The respective mean ages of cases and controls were 66.1 and 66.8, indicating very close matching. Smoking status was self-reported; among the cases, 46.4% were former and 47.2% were current smokers; among the controls, 47.3% were former and 11.8% were current smokers. Whereas 67.0% and 55.6% of the controls reported ETS exposure, 80.5% and 72.8% of the cases reported exposure to ETS in their childhood and at home during adulthood, respectively. Only 34.5% of the cases versus 48.6% of the controls had some college or higher education. As for marital status, 25% of the controls and 33.8% of the cases reported that they were divorced, separated, or widowed, whereas 71.5% of the controls and 60.5% of the cases said they were married or living with partners. Family history of cancer was reported by 81.7% of the cases and 76.4% of the controls. History of asbestosis was not common, with only 5.1% and 2.6% among the cases and the controls, respectively.

The jobs held the longest by women were predominantly in the 1) professional-technical-managerial, 2) clerical-sales, and 3) service categories (Table 2). The jobs held the longest by men encompassed all of the categories, albeit with very few in agriculture-fishery-forestry-related, processing, and benchwork, which includes assembly and repair across different industries. More women than men reported holding jobs for the longest time in the education, health care-social assistance, accommodations-food service, and other service industries, excluding public service, whereas more men than women reported working in the construction and transportation industries (Table 2).

Among those who reported working in the professional-technical-managerial category, 21% worked in public administration, 16.7% in education, 12.2% in health care, 8.3% in wholesale-retail sales, and 7% in insurance-finance-real estate industries. Of those reporting jobs in the service categories, 35% were in public administration, 20% in health care, 16.7% in accommodations-food services, and 13.5% in other services.

Of those indicating jobs held the longest in the clerical-sales category, the industry of the job was reported as wholesale-retail sales by 23%, insurance-finance-real estate by 21%, public administration by 15%, health care by 8.8%, and transportation-material handling by 7.9%. Of those with college and higher education, 56% held a professional-technical-managerial job, 20% worked in clerical-sales, and 4% to 7.8% were employed in the other categories. Among lung cancer cases, 59.1% of women and 77.3% of men reported having had exposure to ETS on the job for over 5 years, whereas among controls 44.1% of the women and 64.0% of the men reported such exposure.

In the bivariate analysis, there were statistically significant associations between some categories of the job held the longest and the risk of lung cancer; some associations were stronger in women than in men (Table 3). For women, the stronger associations were found between lung cancer and jobs in the clerical-sales, service, and "miscellaneous" job categories, whereas for men associations of borderline significance were noted between lung cancer and jobs in structural work (construction) and the miscellaneous category (Table 3). Smoking status was a major risk factor for developing lung cancer, with ORs of 5.98 and 24.31 among former and current smokers, respectively, and similar unadjusted ORs and trends were observed in men and women. Exposure to ETS was significantly associated with lung cancer in a dose-dependent manner (Table 3). Completion of some college or higher education was more protective among women (OR = 0.46) than among men (OR = 0.67). Family history of cancer was significantly associated with lung cancer in men but not in women. Self-reported history of lung illness other than asbestosis was significantly associated with lung cancer more so in women (OR = 3.63) than in men (OR = 2.83).

In the logistic regression model for women, the association between lung cancer and categories of job held the longest remained statistically significant after adjusting for smoking status, packyears of cigarette smoked, ETS exposure, race, age, and history of lung illness other than asbestosis (Table 4). In men, there was no significant association between lung cancer and the job held longest after adjusting for all the covariates (Table 4). Being black increased the odds of lung cancer in both men and women. Among the women who held jobs in the same categories, blacks had significantly higher odds of lung cancer than whites, even after adjusting for other covariates, including smoking. Furthermore, being a smoker increased the odds of lung cancer among black women more than among white women (Table 5). Among men, the adjusted ORs for having lung cancer were higher, although not statistically significant, in blacks compared to whites who worked in the same job categories. Unlike in women, being a smoker increased the odds of lung cancer among white more than among black men (Table 5).

## Discussion

This is an analysis of data from the Maryland Lung Cancer Study, a multicenter case control study that has been investigating potential genetic mechanisms underlying incidence variations by race and gender.[25] We found that women working in comparable job categories, and particularly black women, are at higher risk than men for having nonsmall cell lung carcinoma (NSCLC), even after adjusting for smoking and other contributing factors, including secondhand smoke. We found that smoking, as expected, was strongly associated with lung cancer, but we also observed that the association was greatest in black women.

Differences in lung cancer between men and women and blacks and whites have been studied with respect to smoking behavior.[18,28–33] Nevertheless, there are few studies that address lung cancer risk from occupational exposures and the differences with respect to race and gender. Several epidemiological studies have reported elevated risks of lung cancer among subjects working in construction and transportation,[4–12,34] even after adjustment for smoking. More men than women commonly hold these jobs. In our sample, only four women

cases held jobs categorized as structural work, which is represented mainly in the construction industry (Table 2). Truck driver and material handler are among the jobs included in the miscellaneous category, which was significantly associated with lung cancer in women, but not in men, after adjusting for smoking and other covariates.

A similar excess risk of lung cancer was observed for women, but not men, in service jobs (Table 4). Among the service jobs are cleaners, housekeepers, cosmetologists, domestic and building maintenance workers, and food- and beverage-servers. These individuals are routinely exposed to disinfectants and cleaning agents that contain a multitude of harmful chemicals, such as hydrocarbons, isopropyl alcohol, and phenol.[35] A previous study showed nonsmoking women launderers and drycleaners at high risk for lung cancer, but the study was limited to the white population.[36] Richiardi et al[37] reported increased risk of lung cancer for cleaners regardless of gender, whereas the elevated risks for bakers and plumbers were confined to males. Increased risk of lung cancer was also found previously among female beauticians,[38, 39] but another study reported that a higher frequency of smoking among cosmetologists most likely accounted for the excess of lung cancer in this occupational group.[40] The proportionate mortality ratios for lung cancer were high in waiters and waitresses, comparable with levels reported in the construction and trucking industries.[41] Nevertheless, the proportionate mortality ratios in those studies were not adjusted for smoking. In our study, service occupations were significantly associated with lung cancer in black women, even after adjustment for smoking and ETS.

We found that clerical-sales jobs were associated with excess lung cancer risk in women, regardless of their smoking status (similar to the pattern observed in service jobs, such as housekeepers, homemakers, and food- and beverage-servers). These jobs are performed primarily indoors, where exposure to potential hazards, including secondhand smoke, is possible. ETS is an established risk factor for lung cancer in nonsmokers[4]; however, even after adjusting for ETS, the elevated ORs of NSCLC remained among this study's women with the identified occupational categories. In a recent study,[33] elevated risk of lung cancer was reported in women librarians and curators, as well as in those exposed to cooking fumes.[16, 17] Radon, a radioactive gas that is prevalent in some homes, is the second major cause of lung cancer.[13,14] These potential exposures may explain the increased risk of NSCLC in women working in these indoor jobs.

There are several possible explanations for the disparity between blacks and whites with regard to their vulnerability and lung cancer. For example, more blacks are employed in industries where they can be overexposed to occupational hazards known to be associated with lung cancer, such as construction and chemical manufacturing. In our study, few women held jobs in these industries. In contrast, black women working in service and clerical-sales jobs had the highest risk for lung cancer, despite the fact that such jobs are commonly perceived to be a less likely source of hazardous exposure.

Another explanation is that blacks are more exposed or absorb more toxins from ETS than whites.[42,43] This explanation is supported by the fact that in the United States, where 20.4% of white women and 17.2% of black women are smokers,[44] the incidence rate of lung cancer is the same in both groups.[42] In our study, among the cases, black women were youngest at diagnosis (mean age at diagnosis: 62.3 years), significantly younger than black men (65.2; $P = 0.04$), white men (66.8; $P < 0.001$), and white women (67.1; $P < 0.001$). Therefore, our data, the analysis of which adjusted for exposure to secondhand smoke, are consistent with susceptibility differences between black and white women. Nevertheless, the possibility of differential environmental exposures to carcinogens, beyond those related to occupation, smoking, and ETS, cannot be ruled out; our study lacked data on such potential exposures.

Among both men and women, the apparent protective effect of at least a college education (Table 3) was partially confounded by smoking status; the unadjusted ORs became borderline significant once we adjusted for smoking status and packyears of cigarette smoking (data not shown). Education was not included in the model because it is closely correlated with the jobs. Between 54% and 61% of those with college and higher education held jobs in the professional-technical-managerial category. Among women, 26% and 27% of blacks and whites, respectively, had at least a college degree.

Previous studies have shown increased risk for lung cancer in subjects with prior lung diseases,[45,46] even after adjusting for smoking,[47] and in men and women nonsmokers.[48,49] In our study sample, after adjusting for smoking and other factors, an association between history of previous lung illness, excluding asbestosis, and lung cancer remained statistically significant only among white women.

Our study sample, which is limited to blacks and whites and skewed toward few jobs in the manufacturing, construction, and agriculture categories, does not represent the distribution of the US workforce. Nevertheless, it reflects employment distribution in the State of Maryland. Indeed, based on State[50] and federal[51] government statistics, public administration, health care, accommodations-food services, education, sales, business, and finance are the main industries in Maryland. It should also be mentioned that the study was originally designed to investigate genetic variations underlying the gender and race differences in lung cancer incidence, goals achieved readily when the epidemio-logical study is limited to two, rather than several, race/ethnic groups. We acknowledge the shift in the race/ethnicity of the American workforce over the past two to three decades; however, Maryland is one of the states with a continuing majority of black rather than Hispanic residents.[52]

In conclusion, we found that lung cancer risk differed in women and men even if they held jobs in the same category, with women and particularly black women being the most susceptible. Identical job titles do not mean identical task performance, and thus, do not equate with similar exposure; nonetheless, the data suggest that gender- and race-related biological, behavioral, and/or exposure differences in the workforce are possible. Further research on occupational causes of lung cancer with sufficient details on exposure among women and nonsmokers should be given high priority.

## Acknowledgements

We thank Donna Perlmutter, field supervisor for the Maryland Lung Cancer study; Lindsey Enewold, data manager; and Betty Williams, job coding and data entry specialist. We are grateful for Dr. Pat Langenberg's statistical advice.

This study was supported by NCI contract N02BC71006.

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## TABLE 1

Sociodemographic Characteristics and Medical Histories of the Study Sample (Lung Cancer Cases and Population Controls)

| Characteristic | Controls *N* = 457 *n* (%) | Cases *N* = 655 *n* (%) | *P* ($\chi^2$ or *t* Test) |
|---|---|---|---|
| Mean age (yr) | 66.8 | 66.1 | 0.22 |
| Gender | | | |
| Female | 229 (50.1) | 323 (49.3) | 0.79 |
| Male | 228 (49.9) | 332 (50.7) | |
| Race | | | |
| Black | 229 (50.1) | 182 (27.8) | <0.001 |
| White | 228 (49.9) | 473 (72.2) | |
| Missing 1 | | | |
| Smoking status | | | |
| Never | 187 (40.9) | 42 (6.4) | |
| Former | 216 (47.3) | 304 (46.4) | <0.0001 |
| Current | 54 (11.8) | 309 (47.2) | |
| Mean packyears of cigarette smoked | | | |
| Female | | | |
| Black | 7.8 | 32.1 | <0.0001 |
| White | 10.0 | 37.2 | <0.0001 |
| Male | | | |
| Black | 16.4 | 39.2 | <0.0001 |
| White | 20.5 | 49.6 | <0.0001 |
| Birth region | | | |
| Other than mid-Atlantic | 145 (32.1) | 172 (26.4) | 0.04 |
| Mid-Atlantic (MD, DC, DE, PA, VA, WV) | 307 (67.9) | 479 (73.6) | |
| Missing 9 | | | |
| Education | | | |
| 5th to 9th grade | 100 (21.9) | 160 (24.4) | |
| 10th, 11th, high school grad, or GED | 135 (29.5) | 269 (41.1) | <0.0001 |
| Some college or technical school (including AA) | 127 (27.8) | 133 (20.3) | |
| College graduate and above (including MS, PhD, MD) | 95 (20.8) | 93 (14.2) | |
| Marital status | | | |
| Single, never married | 16 (3.5) | 37 (5.7) | |
| Married, living with partner | 327 (71.5) | 396 (60.5) | 0.0006 |
| Divorced, separated, widowed | 114 (25.0) | 221 (33.8) | |
| Missing 2 | | | |
| Family cancer history | | | |
| No | 108 (23.6) | 120 (18.3) | 0.03 |
| Yes | 349 (76.4) | 534 (81.7) | |
| Missing 1 | | | |
| Asbestosis | | | |
| No | 445 (97.4) | 621 (94.9) | 0.04 |
| Yes | 12 (2.6) | 33 (5.1) | |
| Missing 1 | | | |
| History of other lung illness, excluding asbestosis | | | |
| No | 431 (94.3) | 549 (83.9) | <0.0001 |
| Yes | 26 (5.7) | 105 (16.1) | |
| Missing 1 | | | |
| Environmental tobacco smoke exposure in the home | | | |
| Childhood | | | |
| No | 151 (33.0) | 128 (19.5) | <0.0001 |
| Yes | 306 (67.0) | 527 (80.5) | |
| Adulthood | | | |
| No | 203 (44.4) | 178 (27.2) | <0.0001 |
| Yes | 254 (55.6) | 477 (72.8) | |

## TABLE 2

Categories and Industries of Jobs Held the Longest by Cases and Controls

| Categories and Industries of Jobs Held the Longest | Controls *N* =457 | | Cases *N* =655 | |
|---|---|---|---|---|
| | Women, *N* = 229 *n* (%) | Men, *N* = 228 *n* (%) | Women, *N* = 323 *n* (%) | Men, *N* = 332 *n* (%) |
| Category of job held the longest | | | | |
| Professional-technical-managerial | 122 (53.3) | 102 (44.7) | 100 (31.0) | 116 (34.9) |
| Clerical-sales | 59 (25.8) | 25 (10.9) | 106 (32.8) | 37 (11.1) |
| Service* | 25 (10.9) | 26 (11.4) | 61 (18.9) | 43 (13.0) |
| Agricultural-fishery-forestry-related | 0 | 3 (1.3) | 1 (0.3) | 7 (2.1) |
| Processing | 3 (1.3) | 4 (1.8) | 4 (1.2) | 13 (3.9) |
| Machine trades | 3 (1.3) | 23 (10.1) | 6 (1.9) | 24 (7.2) |
| Benchwork | 7 (3.0) | 4 (1.8) | 7 (2.2) | 5 (1.5) |
| Structural work | 0 | 21 (9.2) | 4 (1.2) | 45 (13.6) |
| Miscellaneous† | 10 (4.4) | 20 (8.8) | 34 (10.5) | 42 (12.7) |
| Industry of job held the longest | | | | |
| Agriculture-mining-utilities | 4 (1.7) | 8 (3.5) | 9 (2.8) | 10 (3.0) |
| Construction | 0 | 12 (5.3) | 4 (1.2) | 33 (10.0) |
| Manufacturing | 15 (6.5) | 34 (14.9) | 33 (10.2) | 65 (19.6) |
| Wholesale-retail trade | 17 (7.4) | 15 (6.6) | 30 (9.3) | 34 (10.3) |
| Transportation-warehousing | 4 (1.7) | 25 (10.9) | 12 (3.7) | 31 (9.4) |
| Information-finance-real estate | 21 (9.2) | 18 (7.9) | 26 (8.1) | 29 (8.8) |
| Administration support-waste management | 0 | 5 (2.2) | 11 (3.4) | 12 (3.6) |
| Educational services | 45 (19.7) | 16 (7.0) | 28 (8.7) | 8 (2.4) |
| Healthcare-social assistance | 45 (19.7) | 7 (3.1) | 46 (14.2) | 8 (2.4) |
| Art-entertainment-recreation | 3 (1.3) | 1 (0.4) | 2 (0.6) | 2 (0.6) |
| Accommodations-food services | 6 (2.6) | 2 (0.9) | 31 (9.6) | 6 (1.8) |
| Services (except public service) | 21 (9.2) | 8 (3.5) | 32 (9.9) | 7 (2.1) |
| Public service-administration | 34 (14.9) | 57 (25.0) | 39 (12.1) | 63 (19.0) |
| Professional-technical-managerial | 14 (6.11) | 20 (8.8) | 20 (6.2) | 23 (6.9) |
| ETS‡ exposure at work for >5 yr | | | | |
| No | 128 (55.9) | 82 (36.0) | 132 (40.9) | 75 (22.7) |
| Yes | 101 (44.1) | 146 (64.0) | 191 (59.1) | 256 (77.3) |

* Includes domestic, food, lodging, recreation, cosmetology, laundry, and protective service occupations.

† Includes truck driver, transportation, packaging, and material handling occupations.

‡ Environmental tobacco smoke.

**TABLE 3**

Bivariate Analyses of Associations (Unadjusted Odds Ratios) of Lung Cancer and Independent Variables in Women and Men Who Worked in Comparable Job Categories

| Independent Variable | Women (*N* = 552) | | | | Men (*N* = 560) | | | |
|---|---|---|---|---|---|---|---|---|
| | Controls *n* (%) | Cases *n* (%) | OR | 95% CI | Controls *n* (%) | Cases *n* (%) | OR | 95% CI |
| Main predictor variable | | | | | | | | |
| Category of job held the longest | | | | | | | | |
| Professional-technical-managerial | 122 (53.3) | 100 (30.96) | Referent | | 102 (44.7) | 116 (34.9) | Referent | |
| Clerical-sales | 59 (25.8) | 106 (32.8) | 2.19 | 1.45–3.32 | 25 (11.0) | 37 (11.1) | 1.3 | 0.73–2.31 |
| Service | 25 (10.9) | 61 (18.9) | 2.98 | 1.74–5.08 | 26 (11.4) | 43 (12.9) | 1.45 | 0.84–2.53 |
| Agricultural-fishery-forestry-processing-machine trades-benchwork* | 13 (5.7) | 18 (5.6) | 1.69 | 0.79–3.62 | 34 (14.9) | 49 (14.8) | 1.27 | 0.76–2.12 |
| Structural work | 0 | 4 (1.2) | † | † | 21 (9.21) | 45 (13.6) | 1.88 | 1.05–3.37 |
| Miscellaneous‡ | 10 (4.4) | 34 (10.5) | 4.15 | 1.95–8.81 | 20 (8.8) | 42 (12.7) | 1.85 | 1.01–8.35 |
| Covariate | | | | | | | | |
| Smoking status | | | | | | | | |
| Never | 110 (48.0) | 25 (7.7) | Referent | | 77 (33.8) | 17 (5.1) | Referent | |
| Former | 94 (41.1) | 139 (43.0) | 6.51 | 3.92–10.80 | 122 (53.5) | 165 (49.7) | 6.13 | 3.45–10.89 |
| Current | 25 (10.9) | 159 (49.2) | 27.98 | 15.28–51.26 | 29 (12.7) | 150 (45.2) | 23.43 | 12.12–45.26 |
| Education | | | | | | | | |
| High school and lower | 115 (50.2) | 222 (68.7) | Referent | | 120 (52.6) | 207 (62.4) | Referent | |
| Some college and higher | 114 (49.8) | 101 (31.3) | 0.46 | 0.32–0.66 | 108 (47.4) | 125 (37.6) | 0.67 | 0.48–0.94 |
| History of lung illness§ | | | | | | | | |
| No | 218 (95.2) | 273 (84.5) | Referent | | 213 (93.4) | 276 (83.4) | Referent | |
| Yes | 11 (4.8) | 50 (15.5) | 3.63 | 1.85–7.14 | 15 (6.6) | 55 (16.62) | 2.83 | 1.56–5.15 |
| Asbestosis | | | | | | | | |
| No | 227 (99.1) | 320 (99.1) | Referent | | 218 (95.6) | 301 (90.9) | Referent | |
| Yes | 2 (0.9) | 3 (0.9) | 1.06 | 0.18–6.42 | 10 (4.4) | 30 (9.1) | 2.17 | 1.04–4.54 |
| Family history of cancer | | | | | | | | |
| No | 36 (15.7) | 41 (12.7) | Referent | | 72 (31.6) | 79 (23.9) | Referent | |
| Yes | 193 (84.3) | 282 (87.3) | 1.28 | 0.79–2.08 | 156 (68.4) | 252 (76.1) | 1.47 | 1.01–2.15 |
| ETS exposure‖ | | | | | | | | |
| None | 19 (8.3) | 8 (2.5) | Referent | | 13 (5.7) | 10 (3.0) | Referent | |
| Low | 73 (31.9) | 42 (13.0) | 1.37 | 0.55–3.39 | 77 (33.8) | 59 (17.8) | 0.99 | 0.41–2.43 |
| Moderate | 85 (37.1) | 137 (42.4) | 3.83 | 1.61–9.13 | 83 (36.4) | 120 (36.3) | 1.88 | 0.78–4.49 |
| High | 52 (22.7) | 136 (42.1) | 6.21 | 2.56–15.06 | 55 (24.1) | 142 (42.9) | 3.36 | 1.39–8.10 |

*Pooled into one category because of sparse numbers.

†Number too small for analysis.

‡Includes truck driver, transportation, packaging, and material handling occupations.

§Excluding asbestosis.

‖Environmental tobacco smoke (ETS) exposure: None, no exposure in childhood, adulthood, or workplace. Low, any one of those three exposures. Moderate, two of those three exposures. High, all of those three exposures.

OR indicates unadjusted odds ratio; CI, confidence interval.

## TABLE 4

Multivariate Logistic Regression Models for Lung Cancer Among Women and Men Who Worked in Comparable Job Categories

| Independent Variable | Women (*N* = 552) | | Men (*N* = 560) | |
|---|---|---|---|---|
| | AOR | 95% CI | AOR | 95% CI |
| Main predictor variable | | | | |
| Category of job held the longest | | | | |
| Professional-technical-managerial | Referent | | Referent | |
| Clerical-sales | 1.79 | 1.05–3.07 | 0.99 | 0.49–1.99 |
| Service | 2.04 | 0.98–4.23 | 1.25 | 0.64–2.45 |
| Agricultural-fishery-forestry-processing-machine trades-benchwork* | 1.11 | 0.40–3.06 | 1.03 | 0.54–1.94 |
| Structural work | † | † | 1.13 | 0.55–2.30 |
| Miscellaneous‡ | 4.54 | 1.69–12.19 | 1.69 | 0.79–3.59 |
| Covariate | | | | |
| Smoking status | | | | |
| Never | Referent | | Referent | |
| Former | 1.54 | 0.78–3.02 | 2.13 | 1.05–4.30 |
| Current | 5.21 | 2.20–12.33 | 5.72 | 2.44–13.41 |
| Packyears of cigarettes smoked | 1.05 | 1.04–1.07 | 1.03 | 1.02–1.04 |
| ETS exposure§ | | | | |
| None | Referent | | Referent | |
| Low | 0.78 | 0.24–2.51 | 0.65 | 0.23–1.88 |
| Moderate | 1.47 | 0.48–4.50 | 0.53 | 0.19–1.53 |
| High | 1.57 | 0.49–4.99 | 0.83 | 0.29–2.42 |
| Race (black) | 2.44 | 1.49–3.99 | 2.04 | 1.30–3.20 |
| Age (yr) | 1.01 | 0.98–1.03 | 0.99 | 0.97–1.01 |
| History of lung illness3 | 3.79 | 1.71–8.41 | 1.72 | 0.86–3.44 |
| Family history of cancer | ¶ | ¶ | 1.44 | 0.90–2.30 |

*Pooled into one category because of sparse numbers.

†Number too small for analysis.

‡Includes truck driver, transportation, packaging, and material handling occupations.

§Environmental tobacco smoke (ETS) exposure: none, no exposure in childhood, adulthood, or workplace; low, any one of those three exposures; moderate, two of those three exposures; high, all of those three exposures.

||xcluding asbestosis.

¶Family history of cancer was not significant in women and therefore it was not included in the model.

AOR indicates adjusted odds ratio; CI, confidence interval.

**TABLE 5**

Multivariate Logistic Regression Models for Lung Cancer Among Black and White Women and Men Who Worked in Comparable Job Categories

| | Women | | | | Men | | | |
|---|---|---|---|---|---|---|---|---|
| | Black | | Whites | | Black | | Whites | |
| **Independent Variable** | **AOR** | **95% CI** | **AOR** | **95% CI** | **AOR** | **95% CI** | **AOR** | **95% CI** |
| Main predictor variable | | | | | | | | |
| Category of job held the longest | | | | | | | | |
| Professional-technical-managerial | Referent | | Referent | | Referent | | Referent | |
| Clerical-sales | 4.07 | 1.44–11.48 | 1.32 | 0.69–2.55 | 0.64 | 0.15–2.75 | 1.14 | 0.48–2.73 |
| Service | 5.15 | 1.62–16.34 | 1.10 | 0.39–3.15 | 2.48 | 0.82–7.42 | 0.83 | 0.33–2.07 |
| Agricultural-fishery-forestry-processing-machine trades-benchwork* | 1.72 | 0.45–6.61 | 0.51 | 0.09–2.66 | 1.33 | 0.45–3.91 | 0.93 | 0.40–2.15 |
| Structural work | † | | † | | 3.23 | 0.92–11.37 | 0.63 | 0.26–1.53 |
| Miscellaneous‡ | 7.82 | 1.08–56.25 | 3.43 | 1.02–11.50 | 2.54 | 0.87–7.35 | 2.05 | 0.52–8.13 |
| Covariate | | | | | | | | |
| Smoking status | | | | | | | | |
| Never | Referent | | Referent | | Referent | | Referent | |
| Former | 4.56 | 1.23–16.82 | 1.03 | 0.43–2.47 | 1.79 | 0.50–6.40 | 2.50 | 1.03–6.06 |
| Current | 8.46 | 2.02–35.48 | 4.10 | 1.23–13.67 | 5.07 | 1.24–20.73 | 6.39 | 2.05–19.95 |
| Packyears of cigarettes smoked | 1.05 | 1.02–1.09 | 1.06 | 1.04–1.09 | 1.03 | 1.01–1.06 | 1.02 | 1.01–1.04 |
| ETS exposure§ | | | | | | | | |
| None | Referent | | Referent | | Referent | | Referent | |
| Low | 0.93 | 0.08–10.65 | 0.67 | 0.15–2.99 | 1.69 | 0.29–9.88 | 0.33 | 0.07–1.55 |
| Moderate | 2.74 | 0.27–27.63 | 0.99 | 0.23–4.23 | 0.96 | 0.15–5.88 | 0.30 | 0.06–1.38 |
| High | 4.38 | 0.42–45.57 | 0.93 | 0.20–4.29 | 1.97 | 0.31–12.32 | 0.44 | 0.09–2.02 |
| Age (yr) | 0.94 | 0.89–0.98 | 1.04 | 1.00–1.07 | 0.95 | 0.90–0.99 | 1.00 | 0.97–1.03 |
| History of lung illness3 | 2.15 | 0.61–7.62 | 3.90 | 1.33–11.59 | 2.40 | 0.57–10.01 | 1.53 | 0.67–3.50 |
| Family history of cancer | ¶ | | ¶ | | 0.75 | 0.35–1.57 | 2.14 | 1.13–4.03 |

*Pooled into one category because of sparse numbers.

†Number too small for analysis.

‡Includes truck driver, transportation, packaging, and material handling occupations.

§Environmental tobacco smoke (ETS) exposure: none, no exposure in childhood, adulthood, or workplace; low, any one of those three exposures; moderate, two of those three exposures; high, all of those three exposures.

||Excluding asbestosis.

¶Family history of cancer was not significant in women and therefore it was not included in the model.

AOR indicates adjusted odds ratio; CI, confidence interval.