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Usual adult occupation and risk of prostate cancer in West African men: The Ghana Prostate Study

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Abstract

Objectives: Established prostate cancer (PCa) risk factors include age, family history of PCa, and African ancestry. Studies, mostly among highly-screened, predominantly European ancestral populations, suggest that employment in certain occupations (e.g., farming, military) may also have an increased risk for PCa. Here, we evaluated the association between usual adult occupation and PCa risk in Ghanaian men, a population with historically low rates of PCa screening.

Methods: The Ghana Prostate Study is a case-control study of prostate cancer that was conducted from 2004–2012 in 749 cases and 964 controls. In-person interviews were conducted to collect information from participants, including longest held job. Industrial hygienists classified job titles into occupational categories. Unconditional logistic regression was used to calculate odds ratios (ORs) and 95% confidence intervals (CIs) for the association between longest held job and PCa risk (overall, aggressive (Gleason ≥ 7)), controlling for potential confounders.

Results: Risk was increased among men in management (overall PCa OR=2.2, 95% CI: 1.4, 3.2; aggressive PCa OR=2.2, 95%CI: 1.3, 3.5) and military occupations (overall PCa OR=3.4, 95%CI: 1.7, 7.0; aggressive PCa OR=3.5, 95%CI: 1.5, 8.3). Risks were also elevated for management and military specific jobs based on 3-digit level SOC definitions. Sensitivity analyses accounting for access to medical care did not show significant differences.

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Contributorship

All authors included on this paper fulfill the criteria of authorship. In addition, there is no one else who fulfills the criteria but has not been included as an author.

Competing Interest

No, there are no competing interests for any author.

Conclusions: Our study provides some evidence for increased risk of PCa among men in management and military occupations, which is consistent with the published literature. Additional research is needed to clarify the drivers of the associations between these occupations and PCa.

INTRODUCTION

Prostate cancer (PCa) is the second most common cancer among men worldwide and the fifth-leading cause of cancer related death in men in 2012.¹ The incidence rate of PCa varies more than 25-fold worldwide with higher incidence rates in Europe, Australia/New Zealand, and North America where access to prostate-specific antigen (PSA) screening results in greater detection of disease.¹² African cancer registries report much lower age-adjusted estimates of PCa incidence rates.³⁴ This may be due to a range of issues facing the region, including lack of screening, with reports of low PSA testing rates⁴ (prevalence of PSA screening during the study period was 4% in Ghana)⁵, and greater proportions of tumors with high Gleason scores compared with the United States or United Kingdom.⁶ This offers an opportunity to evaluate risk factors for prostate cancer among African men that are independent of tumor detection. It also provides a unique opportunity to shed light on potential risks factors for PCa in this region where PCa mortality rates are some of the highest in the world.

Several epidemiologic studies have assessed potential occupational risk factors for PCa and found that workers in the military/law enforcement, agriculture, managerial administration, public safety (including firefighters), or who work night-shifts have a higher risk for PCa compared with men employed in other occupations.^{7–21} These studies have mostly been conducted in Europe and North America, where employment can be tied to access to medical care and PSA screening, resulting in detection biases caused by high rates of PSA screening. High screening rates also lead to the diagnosis of a greater proportion of indolent PCa, as opposed to the more aggressive forms which have worse prognoses. Thus, some studies have been conducted in the pre-PSA era¹⁰ while others have focused on more aggressive disease, either those with a high Gleason score⁸ or cancers occurring in young men (early-onset)^{7,9}, since these cancers are less likely to be detected by screening.

Here, we investigated the association between occupation and PCa (both overall and aggressive) among a population with low PSA screening rates using the Ghana Prostate Study for which questionnaire information was available for 749 PCa cases and 964 controls.

METHODS

Study population

Details of this case-control study have been described previously.⁵²² Briefly, participants enrolled via either a population-based probability sample or clinical recruitment in Ghana. The population-based probability sample was conducted using the 2000 Ghana Population and Housing Census data as a sampling frame to recruit and screen ~1,000 men, aged 50–74 years, residing in the Greater Accra region in 2004–2006. A 3-staged sampling design was

used to select probability samples, from which 1,049 men were considered eligible. Among these, 9 refused to participate and 3 were too sick to be screened (98.8% participation rate). Each consented individual was brought to the Korle-Bu Teaching Hospital in Accra for both an in-person interview—conducted by trained interviewers using a structured questionnaire to collect demographic, medical, and occupational information—and a health examination. The health examination consisted of a digital rectal examination (DRE) and an over-night fasting blood sample for prostate specific antigen (PSA) testing. Participants with a PSA concentration of ≥ 2.5 ng/mL and/or a positive DRE, underwent biopsy at Korle-Bu hospital. Thus, of the 1,037 men that agreed to participate, 73 were found to have histologically confirmed PCa and were included in the case population. In addition, 676 newly diagnosed PCa cases (within a median of 140 days after diagnosis) were recruited from the Korle-Bu Teaching Hospital between 2008 and 2012 and completed the same structured questionnaire. Within Accra and the surrounding area, an estimated 85% of prostate cancer patients diagnosed within Ghana are referred to Korle-Bu's Urology Department for treatment. Thus, there are a total of 1,713 participants (n=749 PCa cases; n=964 controls) in the questionnaire component of the Ghana Prostate Study. The study was approved by institutional review boards at the University of Ghana and the National Cancer Institute.

Occupation

Occupational information was collected from a structured questionnaire administered by trained interviewers. Subjects reported occupational information on usual occupation (“what is the title of your longest held job”) and typical work tasks (“what kind of work did you mainly do”). Each subject's free-text responses were reviewed and coded to three-digit level groups within the 2010 Standard Occupational Classification (SOC) system (<http://www.bls.gov/soc>) by a trained industrial hygienist. Three-digit SOC level groups were used since we did not have sufficient information to code to a more detailed level. For classification levels, the highest level includes all of the lower coded prefixes. For example, all occupations in the two-digit classification level represent all codes with that two-digit prefix. For example, the participant that listed a job title as “professor in pharmacology” and a job task or main type of work as “lecturing”, would have been classified as having an “Education, Training, and Library Occupation” (25–0), and would have been placed in the “Post-secondary Teachers” grouping (25–1).”

Statistical Analyses

Unconditional logistic regression was used to estimate odds ratios (ORs) and 95% confidence intervals (95% CI) for the associations between selected occupations and PCa risk (overall PCa and aggressive PCa). Aggressive PCa cases were defined as a Gleason score greater than or equal to 7. Longest held job in each SOC group at the two and three-digit classification levels (SOC2 and SOC3, respectively) was compared to those who responded that they had not held regular employment for that job title. ORs were adjusted for birth year, education (secondary schooling, beyond secondary schooling, unknown); smoking status (ever, never, unknown); birth region (which was highly correlated with ethnicity), and medical insurance coverage (yes, no, unknown); all impacted the parameter estimates by more than 10%. Occupational groups with at least 10 subjects holding a given occupation were included for analysis. To explore possible differences in access to care and

possible PSA screening, we also conducted sensitivity analyses, stratifying by self-reported medical insurance coverage for selected occupations as well as by age and PCa risk (overall and aggressive). Likelihood ratio tests were used to assess differences between strata (p-interaction). All tests were two-sided and conducted at the $\alpha=0.05$ level. Analyses were conducted using SAS 9.4 (SAS Institute, Cary, NC).

RESULTS

Selected characteristics of controls and cases (overall and aggressive) are shown in Table 1. The cohort included a total of 1,713 participants (n=749 PCa cases; n=964 controls). Most cases (74.9%) and controls (67.8%) were born between 1931–1949. Forty percent of controls listed the Greater Accra region as their birth region, whereas the majority of cases (overall: 76.4%, aggressive: 78.8%) listed regions outside of greater Accra. More than half (63.1%) of the controls had less than secondary schooling, whereas less than half of cases (overall: 42.5%, aggressive: 46.3%) had less than secondary schooling. Almost half of all controls (45.9%), and around a third of all cases (overall: 33.6%, aggressive: 32.1%) identified as being ever smokers. Less than 5% of controls reported having medical insurance coverage (4.1%), whereas more than half of all cases had medical insurance (67.3%). Frequency of cases and controls by occupation can be found in Supplemental Table 1.

Table 2 shows the associations between the longest held occupation and prostate cancer risk for overall PCa and aggressive PCa compared to those who were not regularly employed in that occupational category. Men in management occupations (SOC2 11) had increased odds of having PCa compared with men who were not regularly employed in management occupations (OR = 2.2, 95% CI: 1.5, 3.3) including: chief executives (SOC3 11–1; OR = 3.3, 95% CI: 1.2, 9.1), advertising, marketing, promotions, public relations, and sales managers (SOC3 11–2; OR = 3.5, 95% CI: 1.1, 10.9), and operations specialties managers (SOC3 11–3; OR = 2.0, 95% CI: 1.2, 3.5). Results for all management occupations and risk of aggressive PCa risk were similar to the overall associations (SOC2 11; aggressive PCa OR = 2.2, 95% CI: 1.3–3.5). Additional analysis considering cases with a Gleason score of 8, compared to controls, also showed a significantly increased risk of prostate cancer (OR=2.16, 95% CI: 1.13, 4.15, data not shown). Men in military occupations (SOC2 55) also had higher odds of prostate cancer, both for overall and for aggressive PCa, compared with men who were not regularly employed in military specific occupations (overall: OR = 3.4, 95% CI: 1.7, 7.0; aggressive: OR = 3.5, 95% CI: 1.5, 8.3). The majority of these men were employed as special military officers and tactical operations leaders (SOC3 55–1; overall: OR = 4.4, 95% CI: 1.9, 10.2; aggressive: OR = 4.6, 95% CI: 1.6, 13.0).

We also observed several inverse and null associations between occupations held and prostate cancer risk (Table 2). For the most frequently reported occupations among controls, the odds of PCa were 50% lower for men employed in construction trades (SOC3 47–2, OR = 0.5, 95% CI: 0.3, 0.9) and in protective service occupations (SOC2 33, OR=0.5, 95% CI=0.2, 0.9), compared to men not regularly employed in these occupations. There was also an inverse association among construction trade workers for aggressive PCa as well (SOC3 47–2, OR=0.4, 95% CI=0.2, 0.9). There was no risk of overall PCa associated with regular

employment as a motor vehicle operator (SOC3 53–3, OR=1.0, 95% CI: 0.6, 1.8) or with farming occupations (SOC2 45, OR = 0.9, 95% CI: 0.5, 1.6, Table 2).

Table 3 shows results for the sensitivity analyses conducted among selected occupations and risk of PCa (overall and aggressive) stratified by reported medical insurance coverage. ORs for management occupations (SOC2 11) by strata of medical insurance were similar to those observed before stratification and were not significantly different (p-interaction=0.87 and 0.90 for overall and aggressive PCa, respectively). The association between employment in military specific occupations was slightly stronger among those without medical insurance coverage (SOC2 55, for PCa overall, OR = 4.0, 95% CI: 1.8, 8.7), while the effect estimate among those with medical insurance was 2.4 (95% CI: 0.3, 19.0). However, these were based on small numbers and the p-value for interaction was not statistically significant. Similarly, there was no other statistically significant difference by medical insurance for other occupations examined (all p-interaction>0.05). Stratified analyses by age to detect possible differences among older and younger men also showed a consistent positive association among men regularly employed in management and military occupations (data not shown).

DISCUSSION

In this analysis, we evaluated occupation as a risk factor for prostate cancer among Ghanaian men. We found higher risks for both overall and aggressive PCa among men regularly employed in management occupations as well as among men with military occupations, and inverse associations among men regularly employed in construction trades (both overall and aggressive PCa) and protective service occupations (PCa overall).

We observed a higher risk of PCa among those in management occupations. Typical employment in managerial occupations is associated with exposure to fewer chemicals but also more time spent sedentary. Thus, it is possible that sedentary behavior could be related to the observed increased risk as some studies have linked this with PCa risk.^{23,24} It is also possible that management positions come with more responsibilities as the Ghana Statistical Service, in describing the 2015 labor force in Ghana, found that managers work a longer work week than the average worker in Ghana (40–49 hours on average), which may lead to the potential for increased stress levels.²⁵ However, it is still unclear what the role of stress and associated inflammatory processes is on PCa risk.^{26–28} Alternatively, other factors linked to white-collar employment, including higher socioeconomic status and improved access to health care, may explain some of the observed risk.^{29–31} Still, our sensitivity analyses suggest that access to medical care does not alter the relationship between regular employment in managerial occupations and risk of PCa, both overall and for aggressive disease. We also observed no differences by birth region/ethnicity among those employed in management occupations and subsequent risk of prostate cancer.

We also found higher risks for PCa among those men who reported military occupations as their longest held job. This finding is supported by other studies conducted in Canada¹² and across five Nordic nations^{7,10} that found that members of the armed forces had significantly higher risks for PCa. Reasons for this may be due to exposure to agents occurring during

military deployment including metals, pesticides, fuels, solvents, chemical/warfare agents, radiation, or shift-work, some of which have been linked to PCa risk independently.^{832–38} Alternatively, it has been suggested that these increased risks may be driven by greater detection of PCa as a result of more frequent health examinations which are required for military personnel, particularly in Europe and North America in the PSA-era.²³⁹ Here, we attempted to look at more aggressive disease, which is less likely to be detected by screening as well as by self-reported medical insurance coverage to evaluate if detection of PCa was driving the results in certain occupational groups. For military occupations, associations persist among men with aggressive disease and among those without medical insurance. These data suggest that enhanced access to health care may not drive the observed results. More work is needed to explore the specific exposures experienced by military personnel as possible risk factors for PCa.

Interestingly, we did not observe any association between farming occupations and risk of prostate cancer. Although there are several reports in the literature about farming or pesticide exposure and risk of PCa,^{8111240–42} findings have been quite mixed. Agriculture, forestry and fishing remains the main industry of employment in Ghana, providing employment for nearly half of the currently employed.²⁵ Despite this, employment in this industry in the more urban labor markets of Ghana, especially the Accra region, is much less common as less than 10% of households in the region report employment in this sector.²⁵ This is similar to proportions reported in this study of usual employment in the agricultural industry. Given the prevalence of employment in this industry in Ghana, particularly in the past, it is also possible that study participants may have held a job in agriculture in the past; without a full lifetime occupational history, it is difficult to fully characterize this. We also found a lower risk of PCa among men in protective service occupations, which is consistent with previously reported studies that found an increased risk of PCa among those in protective service occupations, such as firefighters and police.^{710–1216–18} In our study, however, the group driving the observed inverse association was mainly made up of security workers (security guards, SOC3 33–9). Firefighters and police officers (coded in SOC3 33–1) included only n=6 cases and n=18 controls and showed no increased risk. The small number of men holding these occupations may explain the observed differences with existing literature. We also found a similar lower risk of PCa among men in construction trades, where previous studies have reported both an elevated risk¹¹ and a null result¹⁰ between employment in this occupation and PCa. However, all prior studies reporting elevated risks had large sample sizes, included Caucasians predominantly, and took place in countries with good access to healthcare (e.g. Canada, the Netherlands, and five Nordic nations), which may have resulted in improved access to screening efforts.

Strengths of our study include availability of detailed clinical information for defining prostate cancer aggressiveness and expert review of longest held job. In addition, this is the first study conducted among African men, who live in a region with low PSA screening (reducing the likelihood of over-diagnosis) during the study period. However, there were also limitations. Study participants reported only their usual adult occupation, rather than a full lifetime occupational history and information on typical number of jobs held in a lifetime among men in Ghana is not readily available. Information about the duration of employment for longest held job was also unavailable. In addition, numbers of cases and

controls were small in some groups, limiting our power to detect effects among certain occupations. The analyses were also based on occupation, which may be considered as a proxy for potential exposures within those occupations; and although the use of industry and occupational classifications is a useful tool to be able to study risk in occupational studies⁴³, it still prompts the desire for more accurate exposure assessment. The recruitment strategy for this study resulted in a different age distribution among cases and controls. Since this may be related to occupation (and types of jobs held over a lifetime), we did explore sensitivity analysis, stratifying the association by age to detect possible differences among older and younger men. Results continued to show a consistent positive association among men regularly employed in management and military occupations. Finally, due to the large number of occupations assessed in this analysis, we cannot rule out the possibility that some of our findings might be due to chance.

Our results suggest that Ghanaian men employed in management or military occupations may be at higher risk for PCa. These findings are consistent with results reported from other studies conducted in populations of European decent with higher-PSA screening rates. We also found protective effects for men employed in protective services and construction trades in Ghana, a finding inconsistent with evidence in the literature. This study provides insight into occupational risk factors for prostate cancer in a region of the world that is all-too rarely studied. Our findings suggest a need to identify possible exposures driving observed increased risks.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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KEY MESSAGES

What is already known about this subject?

Studies suggest that workers in certain occupations, including military/law enforcement, agriculture, managerial administration, public safety, and night-shift workers, may have increased risk for prostate cancer (PCa); however, most of these studies are limited to European ancestral populations who have high rates of prostate-specific antigen (PSA) screening, which can lead to biased results.

What are the new findings?

A study of usual occupation among Ghanaian men, who have very low rates of PSA screening, showed 2 and 3 times the risk of PCa overall and aggressive PCa for those employed in management and military occupations.

How might this impact on policy in the foreseeable future?

As there are no current preventable/modifiable risk factors for prostate cancer, future work identifying the specific exposures in these occupations driving the increased risks may provide important clues for prostate cancer prevention.

Table 1.

Selected characteristics among cases and controls from the Ghana prostate study. *

Characteristic	Control =964 N (%)	Overall Case =749 N (%)	Aggressive Case =486 N (%)
<u>Birth year</u>			
1913–1930	15 (1.6)	110 (14.7)	73 (15.0)
1931–1940	305 (31.7)	342 (45.7)	230 (47.3)
1941–1949	348 (36.1)	219 (29.2)	136 (28.0)
1950–1966	296 (30.7)	78 (10.4)	47 (9.7)
<u>Ethnicity</u>			
Asante	84 (8.7)	103 (13.8)	62 (12.8)
Akwapim	52 (5.4)	59 (7.9)	38 (7.8)
Fante	104 (10.8)	104 (13.9)	70 (14.4)
Other Akan	73 (7.6)	105 (14.0)	70 (14.4)
Ga-Adangbe	369 (38.3)	190 (25.4)	118 (24.3)
Ewe	169 (17.5)	120 (16)	80 (16.5)
Guan/Mole-Dagbani/Grussi/Gruma/Hausa	60 (6.2)	31 (4.1)	20 (4.1)
Other	52 (5.4)	35(4.7)	27 (5.6)
Unknown	1 (0.1)	2 (0.2)	1 (0.2)
<u>Birth Region</u>			
Western/Central	117 (12.1)	127 (17.0)	86 (17.7)
Greater Accra	386 (40.0)	177 (23.6)	103 (21.2)
Volta	129 (13.4)	105 (14.0)	75 (15.4)
Eastern	175 (18.2)	173 (23.1)	120 (24.7)
Ashanti/Brong-Ahafo	85 (8.8)	106 (14.2)	59 (12.1)
Northern/Upper West/Upper East	39 (4.1)	35 (4.7)	23 (4.7)
Unknown	33 (3.4)	26 (3.4)	20 (4.1)
<u>Education</u>			
Up to Secondary School	608 (63.1)	318 (42.5)	225 (46.3)
Secondary School or more	343 (35.6)	426 (56.9)	259 (53.3)
Unknown	13 (1.3)	5 (0.6)	2 (0.4)
<u>Smoking Status</u>			
Ever	442 (45.9)	252 (33.6)	156 (32.1)
Never	521 (54.0)	494 (66.0)	329 (67.7)
Unknown	1 (0.1)	3 (0.4)	1 (0.2)
<u>Has medical insurance</u>			
Yes	39 (4.1)	504 (67.3)	363 (74.7)
No	905 (93.9)	236 (31.5)	117 (24.1)
Unknown	20 (2.07)	9 (1.2)	6 (1.2)

* All p-values were <0.001 for chi-square tests of difference between cases and controls

Table 2.

Association between selected occupations and prostate cancer for controls and cases (overall and aggressive).

SOC Code	Controls N (%)	All Cases N (%)	Aggressive Cases N (%)	OR All 95% CI	OR Aggressive 95% CI
<u>11 Management Occupations</u>	77 (7.9)	182 (24.2)	111 (22.8)	2.2 (1.5, 3.3)	2.2 (1.3, 3.5)
11-1 Chief Executives	8 (0.5)	28 (3.7)	13 (2.7)	3.3 (1.2, 9.1)	2.3 (0.6, 8.3)
11-2 Advertising, Marketing, Promotions, Public Relations, and Sales Managers	5 (0.5)	23 (1.3)	12 (2.5)	3.5 (1.1, 10.9)	3.7 (1.0, 13.5)
11-3 Operations Specialties Managers	39 (4.0)	88 (11.7)	59 (12.1)	2.0 (1.2, 3.5)	1.8 (0.9, 3.5)
11-9 Other Management Occupations	25 (2.6)	43 (5.6)	27 (5.6)	1.8 (0.9, 3.7)	2.4 (1.0, 5.4)
<u>13 Business and Financial Operations Occupations</u>	74 (7.8)	62 (8.3)	36 (7.4)	0.7 (0.4, 1.2)	0.4 (0.2, 0.9)
13-1 Business Operations	43 (4.5)	34 (4.5)	21 (4.3)	0.7 (0.3, 1.6)	0.6 (0.2, 1.6)
13-2 Financial Specialists	31 (3.2)	28 (3.7)	15 (3.1)	0.7 (0.3, 1.5)	0.3 (0.1, 1.0)
<u>17 Architecture and Engineering Occupations</u>	20 (2.1)	24 (3.2)	18 (3.7)	1.9 (0.9, 4.1)	2.2 (0.9, 5.7)
17-1 Architects, Surveyors, and Cartographers	4 (0.4)	11 (1.5)	10 (2.1)	5.9 (1.3, 26.1)	9.9 (1.9, 51.9)
17-2 Engineers	5 (0.5)	8 (1.1)	6 (1.2)	1.2 (0.3, 5.4)	1.3 (0.2, 7.6)
17-3 Drafters, Engineering Technicians, and Mapping Technicians	11 (1.1)	5 (0.7)	2 (0.4)	1.1 (0.3, 4.0)	0.4 (0.04, 4.8)
<u>25 Education, Training, and Library Occupations</u>	36 (3.7)	50 (6.7)	26 (5.4)	1.1 (0.6, 2.0)	1.1 (0.5, 2.4)
25-1 Postsecondary Teachers	30 (3.1)	44 (5.9)	23 (4.7)	1.2 (0.6, 2.3)	1.2 (0.5, 2.7)
<u>27 Arts, Design, Entertainment, Sports, and Media Occupations</u>	23 (2.4)	13 (1.7)	9 (1.9)	0.4 (0.2, 1.3)	0.5 (0.1, 1.8)
27-1 Arts, Design, Entertainment, Sports, and Media Occupations	17 (1.8)	7 (0.9)	5 (1.0)	0.4 (0.1, 1.6)	0.5 (0.1, 12.2)
<u>29 Healthcare Practitioners and Technical Occupations</u>	4 (0.5)	14 (1.7)	8 (1.7)	7.1 (1.9, 25.8)	10.6 (2.4, 46.6)
<u>33 Protective Service Occupations</u>	72 (7.5)	23 (3.1)	20 (4.1)	0.5 (0.2, 0.9)	0.8 (0.4, 1.8)
33-1 Supervisors of Protective Service Workers	18 (1.9)	6 (0.8)	6 (1.2)	0.6 (0.2, 2.0)	1.1 (0.3, 4.2)
33-3 Law Enforcement Workers	8 (0.8)	10 (1.3)	9 (1.9)	1.3 (0.4, 4.4)	2.3 (0.6, 8.7)
33-9 Other Protective Service Workers	46 (4.8)	7 (0.9)	5 (1.0)	0.2 (0.1, 0.6)	0.3 (0.1, 1.2)
<u>41 Sales and Related Occupations</u>	55 (5.7)	22 (2.9)	19 (3.9)	0.5 (0.2, 1.0)	0.8 (0.3, 1.7)
41-1 Supervisors of Sales Workers	23 (2.4)	14 (1.9)	13 (2.7)	0.5 (0.2, 1.5)	1.0 (0.3, 2.9)
41-2 Retail Sales Worker	19 (2.0)	6 (0.8)	5 (1.0)	0.5 (0.2, 1.7)	0.9 (0.2, 3.3)
<u>43 Office and Administrative Support Occupations</u>	50 (5.1)	37 (4.9)	22 (4.5)	0.9 (0.5, 1.7)	0.9 (0.4, 1.9)
43-1 Supervisors of Office and Administrative Support Workers	5 (0.5)	9 (1.2)	5 (1.0)	1.1 (0.3, 4.1)	0.8 (0.2, 4.5)
43-3 Financial Clerks	4 (0.4)	10 (1.3)	5 (1.0)	2.8 (0.6, 11.8)	4.6 (0.9, 22.8)
43-6 Secretaries and Administrative Assistants	9 (0.9)	10 (1.3)	7 (1.4)	0.5 (0.1, 1.7)	0.4 (0.1, 2.0)
43-9 Other Office and Administrative Support Workers	19 (2.0)	6 (0.8)	5 (1.0)	0.7 (0.2, 2.5)	0.9 (0.2, 3.9)

SOC Code	Controls N (%)	All Cases N (%)	Aggressive Cases N (%)	OR All 95% CI	OR Aggressive 95% CI
<u>45 Farming, Fishing, and Forestry Occupations</u>	78 (8.1)	51 (6.8)	33 (6.8)	0.9 (0.5, 1.6)	0.7 (0.3, 1.6)
45-2 Agricultural Workers	60 (6.2)	51 (6.8)	33 (6.8)	1.0 (0.6, 2.0)	0.8 (0.3, 1.9)
45-3 Fishing and Hunting Workers	18 (1.9)	0 (0.0)	0 (0.0)		
<u>47 Construction and Extraction Occupations</u>	110 (11.4)	36 (11.3)	24 (4.9)	0.6 (0.3, 1.0)	0.4 (0.2, 0.9)
47-2 Construction Trades Workers	98 (10.1)	28 (3.9)	19 (3.9)	0.5 (0.3, 0.9)	0.4 (0.2, 0.9)
<u>49 Installation, Maintenance, and Repair Occupations</u>	75 (7.8)	31 (4.1)	18 (3.7)	0.5 (0.3, 1.0)	0.4 (0.2, 0.9)
49-1 Supervisors of Installation, Maintenance, and Repair Workers	11 (1.1)	9 (1.2)	6 (1.2)	0.7 (0.2, 2.6)	0.9 (0.2, 4.0)
49-2 Electrical and Electronic Equipment Mechanics, Installers, and Repairers	28 (2.9)	9 (1.2)	5 (1.0)	0.5 (0.2, 1.4)	0.4 (0.1, 1.5)
<u>51 Production Occupations</u>	81 (8.4)	27 (3.6)	21 (4.3)	0.6 (0.3, 1.2)	0.8 (0.4, 1.8)
51-6 Textile, Apparel, and Furnishings Workers	34 (3.5)	8 (1.1)	6 (1.2)	0.6 (0.2, 1.7)	0.6 (0.1, 2.9)
<u>53 Transportation and Material Moving Occupations</u>	113 (11.8)	58 (7.7)	41 (8.4)	1.2 (0.7, 1.9)	1.3 (0.7, 2.4)
53-3 Motor Vehicle Operators	93 (9.7)	43 (5.7)	30 (6.2)	1.0 (0.6, 1.8)	1.0 (0.5, 2.0)
53-5 Water Transportation Workers	9 (0.9)	6 (0.8)	5 (1.0)	1.3 (0.3, 4.6)	2.6 (0.7, 9.8)
<u>55 Military Specific Occupations</u>	17 (1.8)	51 (6.8)	37 (2.6)	3.4 (1.7, 7.0)	3.5 (1.5, 8.3)
55-1 Military Officer Special and Tactical Operations Leaders	11 (1.1)	42 (5.6)	29 (6.0)	4.4 (1.9, 10.2)	4.6 (1.6, 13.0)
55-3 Specialists and Crew Members	5(0.5)	9 (1.2)	8 (1.7)	2.4 (0.6, 10.3)	2.6 (0.5, 13.5)

* Odds ratios (OR) adjusted for birth year, education, birth region, medical insurance, smoking

† Aggressive prostate cancer is defined from the Medical Record Abstracts and Histopathology reports as a case that has a Gleason score of 7 or more

** Occupational group represents longest held job

*** The referent group for all occupations are those who were not regularly employed in that occupational category

Table 3.

Association between selected occupations (compared to all other occupations) and prostate cancer stratified by reported medical insurance coverage.

SOC Code	Had Insurance		No Insurance		P-interaction ***
	N Cases (%)	OR 95% CI	N Cases (%)	OR 95% CI	
11 Management Occupations					
All Prostate Cancer*	123	2.3 (0.7, 8.2)	56	2.3 (1.5, 3.5)	0.87
Aggressive >7**	80	2.3 (0.6, 8.4)	29	2.2 (1.2, 3.8)	0.90
13 Business and Financial Operations Occupations					
All Prostate Cancer	45	0.3 (0.1, 0.9)	16	0.9 (0.5, 1.6)	0.09
Aggressive Prostate Cancer	30	0.3 (0.1, 0.8)	6	0.7 (0.3, 1.7)	0.16
33 Protective Service Occupations					
All Prostate Cancer	16	1.1 (0.1, 8.7)	7	0.4 (0.2, 0.8)	0.36
Aggressive Prostate Cancer	14	1.3 (0.2, 10.7)	6	0.7 (0.3, 1.8)	0.63
43 Office and Administrative Support Occupations					
All Prostate Cancer	21	0.7 (0.1, 3.3)	16	1.0 (0.5, 1.9)	0.78
Aggressive Prostate Cancer	14	0.6 (0.1, 3.4)	8	0.9 (0.4, 2.2)	0.82
53 Transportation and Material Moving Occupations					
All Prostate Cancer	34	1.1 (0.3, 4.2)	24	1.3 (0.8, 2.1)	0.87
Aggressive Prostate Cancer	28	1.4 (0.4, 5.3)	13	1.4 (0.7, 2.7)	0.96
55 Military Specific Occupations					
All Prostate Cancer	35	2.4 (0.3, 19.0)	16	4.0 (1.8, 8.7)	0.62
Aggressive Prostate Cancer	28	2.7 (0.3, 21.9)	9	4.4 (1.7, 11.3)	0.67

^{*} Odds ratios adjusted for birth year, education, birth region, smoking

^{**} Aggressive prostate cancer is defined as a Gleason score 7

^{***} Multiplicative interaction between selected occupations and risk of PCa (overall and aggressive)