



Among US Adults, Veteran Status of Any Branch Affiliation is Associated with Increased Incidence of Any/All Cancers

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INTRODUCTION

Prior research on the link between military service and cancer have focused on specific exposures, branches, or assignments. Limited research exists on the overall association between service and cancer considering all branches of military and any/all solid-organ and skin cancers.

BACKGROUND

CANCER

- 1,658,370 new cases of cancer were diagnosed in the USA in 2015; and over half a million died from the disease that same year^[1].

OCCUPATIONAL RISK

- Many occupations carry additional well-known risks, e.g. mining, firefighting, medical professionals, but the military branches have largely lacked attention and research (on a broad scale), to investigate what occupational exposures may excessively render them more susceptible to certain diseases, including cancer.

PRIOR TARGETED RESEARCH

- US Coast Guard* Marine Inspectors and Non Inspectors were shown to have *decreased all-cause life expectancy*, as well as discrepant deficits for all malignant neoplasms.^[2]
- Operation Ranch Hand*, the unit responsible for spraying *Agent Orange* in the *Vietnam War* had increased risk for prostate cancer and *melanoma*.^[3-4]
- A French study found a decreased mean age for *testicular cancer* diagnosis to be 6.6 years younger for men in the military (30.8 years) when compared to the general public (37.4 years).^[5] The U.S. military has observed similar findings with the mean age at diagnosis approximately 29.8 years.^[6] And there is particular concern for *aviation fuels causing stage 1 testicular germ cell tumors*.^[5] Another study looking at veterans deployed during the Persian Gulf War found that they were more likely to develop testicular cancer when compared to non-Gulf War veterans.^[7]
- The Agency for Toxic Substances and Disease Registry (ATSDR) succeeded in publishing a critical Health Assessment in 1997, which found a statistically significant association between the exposure to toxic water at *Camp Lejeune* and *adverse pregnancy outcomes* (such as small gestational age).

OBJECTIVES

Assess the association between veteran status and any/all cancers.

Research Question:

Is there an association between a history of serving in any branch of the military and any cancer diagnosis?

Hypothesis:

With previous significant findings from research conducted on similar topics, most commonly specific cancer diagnosis with unambiguous branches of military, deployments, service time, locations, or duties, I hypothesize that overall, veterans would have a higher prevalence of cancer, than civilians in the US population.

METHODS

The **Behavioral Risk Factor Surveillance Survey (BRFSS)** is a cross sectional telephone survey of non-institutionalized adults (≥ 18 years old) living in households in the US. The BRFSS uses complex survey design involving stratification and multistage sampling to yield nationally representative estimates. Using data from 2013 (n=491,773) a cross-sectional analysis of data was used to determine the association between veteran status and a history of any/all non-skin cancers. Participants with a missing data on veteran status and self-reported non-skin cancer diagnosis were excluded (n=2,917 <1%). **The final analytic sample included 488,856 observations.** Chi square tests were used to test for differences in characteristics among those who are and are not veterans. Eleven potential confounders were initially considered for this research. However, through bivariate analysis, comparisons of crude and adjusted odds ratios (ORs), as well as calculations of percent change between the two, plus model building and estimations through forward and backward stepwise estimation and deletion—six were eliminated from the final regression model (health insurance coverage, heavy drinking habits^[8], BMI>25 overweight/obese^[9-11], fruit intake of at least 1 serving daily, vegetable intake of at least one serving daily, and any exercise in past 30 days). Unadjusted and adjusted odds ratios (OR) and 95% confidence intervals (CI) for the association between veteran status and non-skin cancer diagnosis were calculated using logistic regression.

RESULTS

Table 2: Unadjusted and Adjusted Odds Ratio of Cancer Among Veterans: BRFSS 2013

Characteristics	Crude Odds Ratio (95% CI)*	Adjusted Odds Ratio (95% CI)**
Veteran	No (ref)	1.00 (ref)
	Yes (2.20, 2.38)	1.45 (1.38, 1.52)
Age	18-34 (0.038, 0.045)	0.061 (0.056, 0.066)
	35-54 (0.15, 0.17)	0.205 (0.196, 0.215)
	55-64 (0.40, 0.43)	0.47 (0.45, 0.49)
	65+ (ref)	1.00 (ref)
Sex	Male (ref)	1.00 (ref)
	Female (1.27, 1.35)	1.38 (1.33, 1.44)
Ethnic Background	White (ref)	1.00 (ref)
	Black (0.31, 0.36)	0.40 (0.37, 0.43)
	Hispanic (0.20, 0.24)	0.38 (0.35, 0.42)
	Other (0.26, 0.33)	0.44 (0.39, 0.49)
At Least 1 Primary Care Doctor	No (ref)	1.00 (ref)
	Yes (3.89, 4.40)	1.72 (1.61, 1.84)
Smoker Status	No, Never (ref)	1.00 (ref)
	Yes, Former or Current (1.58, 1.68)	1.25 (1.21, 1.30)

RESULTS CONTINUED

Bivariate analysis revealed that 12.5% of respondents were veterans (n=61,505), and 11% had cancer (n=82,275). **Unadjusted rates of cancer diagnosis were higher among veterans (20%) compared to non-veterans/civilians (10%, P < 0.001).**

Unadjusted, non-institutionalized adults in the USA who are veterans have 2.29 the odds of any/all cancer compared to those who are non-veterans (P < 0.001).

In a multivariable logistic regression model controlling for age, sex, ethnicity, smoking status, and access to a primary care doctor, veteran status was associated with **45% increased odds of cancer diagnosis** (OR 1.45, 95% CI 1.38, 1.52).

CONCLUSION

Discussion

- A more thorough understanding of the occupational risks to which we expose our military is more than just an ethical concern. The costs to society and burden on quality of life is impacted, and is particularly exorbitant considering the premature and uncharacteristic manifestations of malignancies in the veteran population^[2, 5-7, 12-15]. This study demonstrates that, consistent with our hypothesis, veterans are associated with a higher incidence of cancer and to my knowledge, this is the first study to look at the broad association of this occupational exposure as a risk factor for any/all cancer. Though cancer-specific or branch-specific research is valuable, so too is the comprehensive understanding of the association of these two variables. I believe these findings are novel and substantively add to the literature on veterans and cancer for a myriad of reasons, including: the political and medical leverage it affords for cancer clusters within the veteran population that have gained little saliency^[12-15], the generalizability of the data gleaned, the impact on policy and public programming such as providing backing to cessation interventions within the veteran community^[16] and the implications of the effectiveness of the VA system, of which more than 10% of the veteran population is unaware or unsure of their available benefits.

Limitations:

- Cross Sectional Data. Difficult to establish causality.

Implications:

- Prospective, as well as retrospective, studies are necessary to determine direction of this association. General physicians and internists encountering veteran patients, particularly within the Veteran Affairs (VA) system my consider particular attention to cancer screening for this population.

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