Abstract 115: Brain and Other Nervous System Tumor Risk among Workers at the Long Beach Naval Shipyard: A Retrospective Cohort Study

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**INTRODUCTION:** To assess associations between long-term occupational exposures at the Long Beach Naval Shipyard (LBNSY) and the incidence and mortality of brain and other nervous system (ONS) tumors.

**METHODS:** The population sample included in a pilot study (PSC) consisted of 1,681 workers who completed health and exposure questionnaires in 1983 and 1985. In addition, a partial cohort (PC) from the LBNSY containing 13,932 workers randomly selected from employment records was also studied. Standardized incidence ratios (SIRs), standardized mortality ratios (SMRs), and proportional mortality ratios (PMRs) with 95% confidence intervals (CIs) were calculated based on data available from California’s Cancer Registry and Death Data Files compared to the general population of California.

**RESULTS:** The pilot study had a significantly decreased all cancer incidence (SIR 0.7; 95% CI 0.61-0.80) and decreased all cancer mortality (SMR 0.89; 95% CI 0.74-1.08); however, the larger partial cohort demonstrated an increased cancer mortality (PMR 1.24; 95% CI 1.17-1.30). Brain and ONS cancer incidence (PSC n=6: PC n=19) was elevated in the pilot study (SIR 1.25; 95% CI 0.56-2.78), but mortality was decreased overall in both cohorts (SMR 0.87; 95% 0.28-2.69; PMR 0.87; 95% CI 0.56-1.37). Occupations at greatest risk for brain and ONS tumors were electricians, equipment cleaners, machinists, painters, pipefitters, and possibly welders.

**CONCLUSIONS:** Although the total cancer incidence within the shipyard was decreased, cancers of the brain and ONS were increased overall, with particular occupations at greatest risk.
Abstract 118: The Heart of an Aviator

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INTRODUCTION: Cardiovascular disease is a leading cause of morbidity and mortality among military populations in the United States. Sudden and Subtle incapacitation from adverse cardiac events are a serious concern in military aerospace medicine. The long term results of aviation cardiac screening are unknown.

METHODS: In this study incidence density rates of adverse cardiac events are calculated using a select set of ICD 9 codes mined from the Defense Medical Epidemiology Database (DMED). An incidence rate ratio is then used to compare events between aviators and non-aviators. The groups are further divided by age, race, and sex and a chi squared analysis is performed on this stratified data. Data covering a ten year period between 2002 and 2011 is compiled in DMED and contains information from all ambulatory medical records of every active component military member totaling over 13.9 million person-years.

RESULTS: When military aviators are compared to military non-aviators the incidence density rate of adverse cardiac events was found to be significantly lower (7.77/10,000 person-years and 9.44/10,000 person-years respectively). Although this should be expected it is interesting that even when comparing younger military members this significant difference holds with an Incidence Rate Ratio of 0.60 (p<.00001) in age groups <30 and 30-39 years old. In fact the incidence density rate of adverse cardiac events is significantly lower for aviators in all studied demographics except for female aviators and race other than white.

CONCLUSIONS: This project examined the incidence of disease among active duty military members. Researching the incidence of these select adverse cardiac events among military aviators is warranted in the hopes that this analysis leads to preventive strategies that mitigate specific risks faced by this population. This study provides an evidence-based foundation to current service qualification decisions regarding the cardiac screening process for military aviators. Although this study cannot determine the cause for the difference in adverse cardiac event rates it does clearly demonstrate that a difference exists.
Abstract 121: Occupation and Computed Tomography Measurements of Chronic Obstructive Pulmonary Disease

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INTRODUCTION: Occupational exposures have been linked to the development of chronic obstructive pulmonary disease (COPD). However, there are no studies reporting associations between occupation and computed tomography (CT) measures of COPD, such as airway wall thickness and lung density.

METHODS: We analyzed data from a cross-sectional hospital and population-based study of current and past smokers conducted in Bergen, Norway between 2003 and 2005. 951 subjects completed an occupational questionnaire and underwent Chest CTs to evaluate lung density (% low attenuation areas - %LAA950) and airway wall thickness as a measure of chronic bronchitis. A categorical dust exposure measure, 0 (none), 1 (little), 2 (some) or 3 (definite), was derived based on job title and work type. We assessed the relationship between dust exposure and CT measures using multivariable regression, adjusted for age, sex, smoking and breath volume (adjusted for airway obstruction-adjusted CT volume).

RESULTS: After adjusting for covariates, occupations with “little” (N=206) and “some” (N=190) exposure to dust were associated with 27% (95% CI: 2%, 58%) and 32% (95% CI: 5%, 66%) higher %LAA950 compared to occupations with no dust exposure, respectively, indicating more emphysematous change. Occupations in the “definite” (N=60) dust exposure category showed a 33% (95% CI: 0.92%, 93%) higher %LAA950, though this was not statistically significant. Before adjusting for covariates, all levels of occupational dust exposure were associated with greater airway wall thickness, the other COPD phenotype, but this association was not statistically significant after adjusting for covariates.

CONCLUSIONS: Dust exposure, as defined by occupational title and work type, was associated with more areas of low lung density, reflecting more lung emphysema. Lack of precision in the exposure estimate limited the power of the study to detect a dose-response relationship. The lack of association of estimated dust exposure with airway wall thickness, suggests that there is no association of dust exposure with chronic bronchitis. Future studies using a job exposure matrix may allow more precise exposure estimation and quantification of the associations with CT measures of COPD.
Abstract 122: Association between BMI at initial enlistment and development of obstructive sleep apnea (OSA) in the U.S. Armed Forces

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INTRODUCTION: Recently the incidence of Obstructive Sleep Apnea (OSA) in the military has risen dramatically. OSA is considered “service connected” and compensable by the VA. Obesity is the strongest risk factor. The association between BMI at initial enlistment and development of OSA has yet to be assessed.

METHODS: A random sample of 550,000 active duty enlisted service members was obtained and followed prospectively from 1 January 2008 through 31 December 2012 or until diagnosis with OSA or until separation from the military or death of the service member. The main exposure variable of interest was accession BMI (kg/m^2) recorded at the time of enlistment. The main outcome of interest was obstructive sleep apnea.

RESULTS: Crude RRs for overweight (BMI of 25-29.9) and obese (BMI > 30) categories were calculated by using the normal weight group (BMI of 18.5-24.9) as the reference. Results showed that service members who were overweight (RR: 1.68; 95% CI: 1.64, 1.73) and obese (RR: 2.81; 95% CI 2.28, 2.95) at the time of enlistment were at increased risk for developing OSA compared to the reference group. Underweight personnel (enlistment BMI <18.5) were at the lowest risk (RR: 0.63, 95% CI: 0.56, 0.69).

CONCLUSIONS: Enlistment BMI plays an important role in the development OSA and may provide a valuable tool in developing preventative interventions in higher-risk groups. Screening for excess body-fat at time of enlistment uses BMI and these findings may prompt further consideration of its application.
Abstract 123: Impact of Early Opioid Prescribing Practice in the Emergency Department for Acute Occupational Low Back Pain

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INTRODUCTION: Initial management of acute occupational low back pain (ALBP) commonly occurs in the ED, where opioid prescribing decisions vary and may stray from clinical guidelines that recommend limited opioid use. This study explores how opioids received in the ED impacts work disability and other outcomes.

METHODS: Compensable lost-time ALBP cases seen in the ED within 3 days postonset of injury (N=2887) were selected from a nationally representative Workers’ Compensation dataset. Multivariate models estimated the effect of early opioids (received within 2 days of ED visit) on disability duration, long-term opioid use, total medical costs, and subsequent surgeries, adjusting for injury severity and demographic characteristics. Morphine equivalent amount (MEA) was calculated for the early opioids received and separated into quartiles to determine dose-response relationships with these outcomes. The impact of later (7-30 days postonset of injury) opioid prescriptions received was also explored.

RESULTS: Of the cohort, 12% received early opioids. Early opioid use was significantly associated with long-term opioid use (adjusted RR=1.29, p=.01), but no significant increase in risk was observed for subsequent surgeries (adjusted RR=1.33, p=.11). Disability duration was not related to early opioid use. Total medical costs were substantially higher (Mean=$8946, p=.003) for the highest MEA group, compared to all other MEA groups. Compared to those without later opioids, those who received later opioids had longer work disability (p<.01), higher total medical costs (p<.01), and an increased risk of long-term opioid use (p<.0001). An increased risk for subsequent surgeries was observed in those who received >1 later opioid prescription (p<.05).

CONCLUSIONS: This study found that approximately 1 out of 8 workers who were initially evaluated in the ED for ALBP received opioid prescriptions, suggesting that in recent years ED physicians are complying with evidence-based LBP management guidelines. Early opioid use was not related to disability duration, but impacted long-term opioid use and medical costs. These results suggest that an excessive initial opioid dose may be an initiating factor for catastrophic claims, and later opioid use, during what appears to be a critical period, is potentially detrimental in terms of longer work disability and greater medical utilization.
Abstract 140: Cognitive Impairment among Rescue/Recovery/Clean-up Workers Exposed to the WTC 9/11 Disaster

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INTRODUCTION: The 9/11 World Trade Center (WTC) Disaster resulted in chronic health problems among survivors. Rescue/recovery workers (RRW), having the highest exposures, would likely be at highest risk for health problems. Our aim was to evaluate cognitive impairment among RRW with and without prevalent PTSD.

METHODS: The World Trade Center Health Registry is a voluntary longitudinal cohort study. Surveys collected demographics as well as 9/11 related exposures and health outcomes. We limited analysis to RRW workers who completed data collection over 3 waves (2003-04, 2006-07, 2011-12). WTC exposure among RRW was classified from low to very high based on sum of twelve 9/11 exposures. Cognitive impairment was self-reported frequent trouble remembering things over the prior 7 days, and presence and/or worsening of memory loss or confusion over the past 12 months. A PTSD Checklist score of 44 or greater was used to assess the presence of probable PTSD.

RESULTS: Of 18,932 RRW, 2,436 (12.9%) had PTSD. Among those without PTSD, 7.9% in the low exposure group were cognitively impaired, 8.9% with medium exposure, 10.3% with high exposure, and 14.4% with very high exposure (P<0.0001). Among those with PTSD, 33.6% in the low exposure group were cognitively impaired, 33.5% with medium exposure, 32.5% with high exposure, and 38.1% with very high exposure (P=0.33).

CONCLUSIONS: In RRW without PTSD, there is a dose-response for increased prevalence of cognitive impairment with increasing exposure. However, approximately one-third of RRW with probable PTSD have cognitive impairment regardless of exposure level. These results suggest that, among RRW, the presence of PTSD alone may be indicative of accelerated cognitive impairment. These findings will encourage physicians and other health care providers to conduct cognitive screening and also help these WTC survivors to make informed decisions about their health.
Abstract 147: Modeled Deposition of Inhaled Particulate Matter in Athletes at Exertion

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INTRODUCTION: Mechanisms and effects of inhaled environmental particulate matter on athletic performance is not well understood. To formulate a framework on which future studies may be developed relating regional airway deposition to subsequent performance effects in athletes at exertion, modeling is indicated.

METHODS: Multiple-Path Particle Dosimetry computer modeling was utilized to predict regional deposition of particles in 26 male athletes at increasing levels of exertion. Deposition doses of inhaled spherical, monodisperse particles of unit density measuring 0.05, 0.1, 1.0, 2.5, and 10.0 μm in diameter were calculated. Repeated Measures ANOVA testing was used to test for differences in regional airway deposition (naso-oro-pharyngo-larangeal, tracheobronchial, pulmonary, and total airway) at exertion.

RESULTS: Analysis revealed a statistically significant effect of increasing exertion (p<0.01) on deposition of all particle sizes in all airway regions. Trends indicate possible phenomena that may impact athletic performance. While overall total airway deposition dose of all particle diameters increases as expected with increasing exertion, pulmonary regional deposition dose at exertion tapers off and decreases in the case of larger particles (2.5 and 10.0 μm).

CONCLUSIONS: To assess the impact of inhaled particulate matter on athletic performance, understanding of regional deposition and subsequent physiologic impacts is critical. This study indicates that while overall total airway deposited doses increase with increasing exertion, deposited doses in the pulmonary region (deep lung) may be reduced at higher levels of exertion, depending on particle diameter. Future studies should focus on elucidating mechanisms of acute and chronic performance effects based on regional deposition and subsequent response to inhaled particles.
Abstract 152: Characterization of the Healthy Worker Effect Among Residents of the United States

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INTRODUCTION: The healthy worker effect (HWE) is a well-known epidemiological confounder that may be defined as a standardized morbidity ratio or standardized mortality ratio of less than one for an occupational population. The aim of this study is to characterize the HWE among United States residents.

METHODS: The National Health and Nutrition Examination Survey (NHANES) is a multi-stage probability sample of United States residents that collects demographic, occupational, and health information. We calculated the prevalence of chronic medical conditions (asthma, emphysema, chronic bronchitis, liver disease, congestive heart failure, heart attack, coronary heart disease, stroke, and cancer) and health risk factors (cigarette smoking, obesity, at-risk alcohol use) for working and non-working respondents both overall and at each decade of life. Pearson’s chi-square analysis or Fisher’s Exact Test was used to determine if differences in prevalence were statistically significant.

RESULTS: Workers had a lower prevalence for asthma, emphysema, chronic bronchitis, liver disease, congestive heart failure, heart attack, coronary heart disease, stroke and cancer as compared to non-workers, both overall and after controlling for age. Workers had a lower prevalence of obesity and a higher prevalence of at-risk drinking as compared to non-workers, both overall and after controlling for age. These differences were statistically significant across almost every decade of life. In an example of the Yule-Simpson Paradox, non-workers had an overall lower prevalence of cigarette smoking, while workers had a lower prevalence of cigarette smoking across every age range after stratifying by decade of life.

CONCLUSIONS: We characterized the HWE among residents of the United States. Workers had a statistically significant lower prevalence of several chronic medical conditions and health risk factors as compared to non-workers, although workers did have a statistically significant higher prevalence of at-risk drinking. Strengths of this study include the significant power generated by the large sample size, while limitations include the use of a cross-sectional sample. Future research directions may include further characterizing the HWE by race/ethnicity, gender, and type of occupation.