

Objectives The goal of this study was to measure outdoor workers' exposure to solar UVR in a Canadian setting, and to examine their sun protection behaviours at work and leisure.

Method Participants were recruited via trade unions and companies with outdoor operations. Workers wore an electronic dosimeter that measured UVR intensity once/minute for 5 working days and completed a questionnaire on skin cancer risk factors, sun protection behaviours, and job characteristics. Dosimeter data was converted to UVIndex and Standard Erythral Dose (SED), an indicator for the potential for sunburn.

Results Seventy-eight outdoor workers were recruited. The workers were largely male (95%), with a mean age of 38 years. Workers that reported the most outdoor working hours had the highest measured UVR exposure (mean SED of 2.6, >8 times the level of those reporting ≥ 1 outdoor hour). Workers who reported the most outdoor hours at work also reported the most outdoor hours at leisure. Over 70% of workers reported using sleeved shirts, hats, and sunglasses at work 'often or always'. Sunscreen and shade-seeking were low, with 29% and 8% reporting these behaviours at work, respectively. Despite reasonable protective behaviours, 70% of workers reported ≥ 1 sunburn last summer; this climbed to 80% among those who worked outside all day.

Conclusions Outdoor workers in Canada are at risk of high solar UVR exposure during the summer. They participate selectively in sun protective behaviours, opting more often for clothing protection than sunscreen or shade protection. Most experience acute damage from exposure (i.e. sunburn) despite attempting to protect themselves.

0212 EPIDEMIOLOGICAL SURVEILLANCE OF WORK-RELATED INJURIES IN NORWAY: AN ENDURING CHALLENGE

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Objectives Data on work-related injury is critical in devising preventive strategies. In Norway, there are different systems that yield epidemiological data on work-related injuries, both fatal and non-fatal. In this study we attempt to profile the multitude of challenges for surveillance of work-related injuries.

Method We collated information from several Norwegian studies that evaluated the different systems that yield epidemiological data on work-related injuries. These studies identified many challenges with regards to injury data collected by different institutions like the Labour Inspection, Public Health Institute, Registry of Private Insurance Companies and Hospital Based Registry. Several public documents that concern national strategies and policies for improving work-related injury surveillance in Norway were also examined.

Results None of the injury surveillance systems provided an accurate representation of work-related injuries. However, it is fair to submit that surveillance of work-related fatal injuries has improved in the last few years. Unfortunately, the same cannot be said about non-fatal injuries attributed to work. Our findings indicate an unintentional, yet substantial breakdown of the work-related injury surveillance infrastructure. This breakdown could be attributed to among others, underreporting,

fragmentation of workers occupational safety and health responsibility, lack of coordination between the national agencies, and inapt use of available technologies.

Conclusions Significant gains have been made in the past few years with regards to fatal injury surveillance. However, the surveillance of non-fatal injuries remains noticeably tenuous. Lack of reliable surveillance data on work-related injuries remains an enduring challenge for our preventive efforts.

0215 ACROMIOCLAVICULAR JOINT DEGENERATION IN RELATION TO CUMULATIVE OCCUPATIONAL MECHANICAL EXPOSURES: A MAGNETIC RESONANCE IMAGING STUDY

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Objectives Little is known about the influence of occupational mechanical shoulder exposures on the development of acromioclavicular joint degeneration. We aimed to evaluate if arm elevation >90°, force requirements, and repetitive work are associated with acromioclavicular joint degeneration as assessed by magnetic resonance imaging (MRI).

Method The study population participated in a study in 2000–2001, where we performed MRI examinations of the right shoulder of 136 right-handed, 40–50 year old men from a historical cohort of machinists, car mechanics, and house painters. In 2011–2012, we re-examined these men. Two radiologists evaluated the images, blinded to exposures status and symptoms. Acromioclavicular joint degeneration was registered in case of subchondral irregularities, joint capsule swelling with adjacent bone marrow oedema and/or subacromial spurs. Cumulative exposures since baseline were obtained by combining self-reported work histories with a job exposure matrix based on expert judgement. We applied multivariable logistic regression adjusted for measured BMI, questionnaire information on smoking, and age.

Results Of the original population, 129 could be invited, and 90 (70%) participated. Their mean age was 55.1 years (SD 2.8, range 50–60). The prevalence of acromioclavicular joint degeneration was 64% against 43% at baseline. Prevalent MRI findings showed a relation to forceful work: OR 4.0 (95% CI 1.3–12.1). Incident MRI findings were also related to forceful work, without reaching significance. Arm elevation and repetitive work were not associated with the outcome.

Conclusions Forceful work seems to be a risk factor for acromioclavicular joint degeneration as assessed by MRI at 50–60 years of age.

0216 CONTROLLING HEALTHY WORKER SURVIVOR BIAS OF THE RADON-LUNG CANCER DOSE-RESPONSE IN A COHORT OF URANIUM MINERS

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Objectives Radon is a leading cause of lung cancer and is estimated to cause nearly 20 000 deaths per year in the United

States. Studies of underground miners, who often were exposed to high concentrations of radon, have been used to estimate public health impacts of domestic radon exposure. The healthy worker survivor bias - a condition resulting when individuals in relatively good health tend to work longer and thus become more exposed than individuals in relatively poor health - may be influencing estimates of occupational radon impacts on lung cancer, but this bias has not been thoroughly explored.

Method We implement G-estimation of a structural nested accelerated failure time model to adjust for time-varying confounding by employment history to partially control the healthy worker survivor bias in the Colorado Plateau uranium miners cohort.

Results 615 miners in our cohort died of lung cancer. Assuming no time-varying confounding, we estimate a time ratio (95% confidence intervals) per 1000 working level months of exposure of 1.55 (1.53, 1.58), and 1.95 (1.86, 2.04) when to control healthy worker survivor bias, a relative increase of 126%. Estimates of the radon-associated excess cases were 118 under standard methods and 179 when we controlled for the healthy worker survivor bias.

Conclusions There is evidence of a healthy worker survivor bias in standard analyses of the radon-lung cancer association in this cohort. The findings suggest need for further consideration of current estimates of the health impact of radon in occupational and environmental settings.

0217 THE NIEHS GULF STUDY: MENTAL HEALTH SYMPTOMS AMONG PARTICIPANTS INVOLVED IN THE DEEPWATER HORIZON OIL SPILL CLEAN-UP

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Objectives Workers and communities impacted by previous oil spills have shown increases in adverse mental health outcomes. The GuLF STUDY is investigating potential health effects among workers involved in the Deepwater Horizon oil spill clean-up response. Participants confronted physical and psychosocial stressors including exposures to oil and dispersants, income uncertainties, and challenges of family and community disruption.

Method Information on demographics, health, and clean-up experience was collected by telephone. Standardised surveys administered to 11 210 participants during home visits captured mental health outcomes including depression, anxiety, PTSD, resiliency, and perceived stress. A summary measure of adverse mental health was defined as having a poor outcome on at least one of the five standardised scales. Mental health outcomes were evaluated in relation to clean-up jobs in models that excluded individuals with pre-existing doctor-diagnosed mental health conditions and controlled for socioeconomic and other factors that contribute to mental well-being.

Results Preliminary analysis using the summary mental health measure indicate that persons who worked on oil-spill cleanup were more likely to report adverse mental health outcomes than those who did not, with ORs of 1.4 (95% CI: 1.1–1.9) for rig and barge workers who worked closer to the source of the oil spill and 1.3 (95% CI: 1.1–1.5) for those with land-based clean-up jobs compared to those who did not actively work on the clean-up effort.

Conclusions Adverse mental health outcomes were found among individuals in the GuLF STUDY population but further work is necessary to clarify the factors leading to these outcomes.

0218 PRESSURE PAIN SENSITIVITY AND STRESS

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Objectives During clinical observations of patients with heart diseases and stress related disorders, it has been observed increased pain sensitivity on specific locations on the skin of the sternum.

Method This sensitivity was measured as the pressure pain sensitivity (PPS) by Ull Metre instrument. Measured PPS values 60 or more indicate high PPS, values below 40 indicate low PPS.

Results There are presented results of PPS measurements in 371 men (av. age 43.6 + 10.4 years, 19–66 years); 345 of them were without diagnosis of disease. Average PPS values (whole group) were 36.6 + 9.5 (1. measurement) and 36.7 + 8.5 (2. measurement) ($r = 0.89$). Road drivers (177 men, PPS values 35.7 + 9.4, resp. 36.4 + 10.9) were not significantly different against other occupations (194 men, PPS values 36.5 + 9.5, resp. 37.8 + 11.4). Men with neuropsychological disorders were statistically significantly different against asymptomatic men (PPS values 50.8 + 14.8, resp. 67.3 + 11.4 vs. 38.8 + 13.3, resp. 35.5 + 5.9, $p = 0.002$, resp. less than 0.001) and also against men with different diagnosis (PPS values 50.8 + 14.8, resp. 67.3 + 11.4 vs. 38.8 + 13.3, resp. 43.4 + 19.7, $p = 0.015$, resp. 0.001). Men with other than neuropsychological symptoms doesn't differ significantly in PPS values against asymptomatic men.

Conclusions Method of measurement of PPS could be helpful in medical fitness assessment to work in safety related occupations and is useful for health promotion intervention program. Supported by research project of Charles University in Prague PRVOUK P25/LF1/2.

0220 IDENTIFICATION OF SHORT-TERM, LONG-TERM AND LIFELONG DNA METHYLATION MARKERS OF EXPOSURE TO TOBACCO SMOKE: EVIDENCE FROM EPIC AND NOWAC STUDIES

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Objectives The aim of our study is to validate and complement recently reported epigenetic biomarkers of exposure to tobacco smoke based on data from two cohorts and to characterise their prospective nature.

Method We used case-control data from studies nested in two prospective cohorts: the Italian component of the European Prospective Investigation into Cancer and Nutrition study ($N = 620$) and the Norwegian Women and Cancer study ($N = 382$) as a validation dataset. For each of the participant, genome wide methylation profiles were acquired from blood samples collected at enrolment using the Illumina HM450 DNA methylation array. We performed epigenome wide association studies within each dataset to assess the relation between methylation levels and smoking-related variables, controlling for technical variation (batch effects) and confounding factors (including white blood cell composition).