Occupational Cancer-2

06B.1 USE OF ARSENICAL PESTICIDES AND RISK OF LUNG CANCER AMONG FRENCH FARMERS

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Context Exposure to inorganic arsenicals, including occupational use of pesticides, is carcinogenic to the lung (IARC group 1). However epidemiological data are scarce for agricultural exposures. This work assesses lung cancer (LC) risk, including duration-effect relationships, associated to arsenicals use in farming, by gender and histology.

Methods We linked data from two French projects: (1) the Agriculture and Cancer (AGRICAN) cohort, a large prospective cohort of farmers and people affiliated to the French agricultural insurance scheme and (2) the Pesticide Matrix (PESTIMAT), a crop-exposure matrix. Incident lung cancer cases were collected and their histological subtype ascertained from cancer registries, from enrolment (2005–2007) to December 31 st 2013. The enrolment questionnaire included items on smoking history, and the involvement in 18 different breedings/crops and specific tasks, including pesticide application, with years of beginning and end. We performed Cox models, with age as timescale, adjusted on gender, smoking, and two activities found to be protective in previous analyses – cattle breeding and corn growing. The reference group included farmers having never applied any pesticide on any crop. We assessed risks for each inorganic compound (lead, sodium, aluminum, copper and calcium arsenate) and for overall exposure.

Results Nearly 10% (n=14 359 people) of the population was potentially exposed to arsenicals, in vineyard growing before 2001, or in fruit-tree or potato growing before 1973. We observed 98 incident LC among exposed people. Only women exhibited a higher risk of LC (HR 3.14 95% CI(1.42–6.96) for exposure to any compound, n=7 exposed cases, all adenocarcinomas), but with no duration-effect relationship. Risks were significantly elevated for lead, copper and sodium arsenate.

Conclusion We found an increased risk of LC, especially adenocarcinomas, among women. At this stage, exposure assessment was broad: the use of an exposure index, based on probability, frequency and intensity of use, will help refine the analyses.

06B.2 CANCER RISK BY ORE TYPE IN A MIXED MINERS COHORT

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Background and objectives Mining may involve exposure to many carcinogens, including respirable crystalline silica (RSC),

diesel engine exhaust (DEE), nickel (Ni), chromium (Cr), radon (Rn), and arsenic (As), which vary by ore being mined. The province of Ontario, Canada has a diverse mining sector with associated exposures including gold (RSC/DEE/As/Cr), uranium (RSC/DEE/Rn), and nickel-copper (DEE/Ni), and other ores (RSC/DEE). The study aim was to examine the risk of cancer by ore type in a mixed mining cohort.

Methods From 1928–1987 workers in the Ontario minerals industry were required to undergo an annual physical examination and chest x-ray, as well as record their mining work history in order to receive certification. Data from these exams was used to create the Mining Master File (MMF) cohort. Cancers were identified through linkage of the MMF with the Ontario Cancer Registry (1964–2017). Cancer risk among miners was compared to provincial rates using Standardized Incidence Ratios (SIR); internal analyses were conducted using Poisson regression.

Results Individuals who died or were lost before 1964, had missing or invalid data, or employment of less than two weeks were excluded. Too few women (n=161) were available for analysis. In total, 61 397 men were included in the analysis. Gold miners had excesses of lung (SIR=1.30, 95% CI=1.23–1.38) and nasopharyngeal cancer (SIR=2.34, 95% CI=1.39–3.70). Uranium miners had excesses of lung (SIR=1.57, 95%CI=1.45–1.70), bladder (SIR=1.20, 95% CI=1.02–1.40), and bone (SIR=2.45, 95%CI=1.30–4.19) cancers. Nickel-copper miners had excesses of lung (SIR=1.13, 95%CI=1.08–1.19), bone (SIR=2.02, 95%CI=1.32–2.96), and sinonasal cancer (SIR=1.73, 95%CI=1.12–2.56).

Conclusions Increased risks for specific cancers were observed among people who mined many different ore types. Most of the associations were as expected, but several (e.g., bone cancers) will undergo further investigation. Future analyses will examine the impact of combined exposures among miners of multiple ore types.

06B.3 RISK OF LEUKEMIA AFTER CHRONIC EXPOSURE TO GAMMA RADIATION AMONG ONTARIO URANIUM MINERS?

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Background and objectives Increases in leukemia risk after exposure to gamma radiation have been well-demonstrated among nuclear energy workers and atomic bomb survivors. Although uranium miners are also exposed to gamma radiation, its health effects are not well characterized, and assumed to be insignificant relative to the effects of radon decay products. The objective of this study is to quantify the effects of whole-body gamma radiation exposure on the incident risk of leukemia among Ontario Uranium Miners.

Methods Based on a retrospective cohort of 28 546 uranium miners, leukemia cases were identified through record linkages with the Canadian Cancer Registry and Canadian Mortality Database. Gamma doses were estimated through dose prediction models and badge dosimeter readings collated by the National Dose Registry, blinded from case status. Person-years at risk of leukemia were stratified by exposure category,

calendar period of employment, and attained age at risk. Poisson regression was used to model the risk (RR) of incident leukemia at increasing levels of cumulative gamma radiation exposure, adjusting for calendar period and attained age.

Results Between 1969 and 2005, 116 incident cases of leukemia were identified. On average, these miners were employed for 4.4 years with a mean cumulative dose of 5.25 millisieverts (mSv). With exposure lagged by 2 years, preliminary analyses showed that when compared to the referent group (0 mSv), those with >30 mSv of cumulative gamma dose had a non-statistically significant increase in the risk of leukemia diagnosis (RR=2.04, 95% CI: 0.93, 4.51) with increasing, linear trend ($p=0.08$).

Conclusions Although our results did not show a statistically significant relationship between gamma radiation and leukemia incidence, it is likely due to low statistical power. Future work may include pooling the Ontario Uranium Miners cohort with other similar cohorts to better quantify the potential associated risks.

06B.4 LARYNGEAL CANCER RISKS IN WORKERS EXPOSED TO LUNG CARCINOGENS: EXPOSURE-EFFECT ANALYSES USING A QUANTITATIVE JOB EXPOSURE MATRIX

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Background Various occupational agents are suspected risk factors for laryngeal cancer. However, individual studies are often inadequate to investigate how such exposures relate to this relatively rare outcome. Important limitations include small sample sizes, lack of detail on exposure, and inadequate adjustment for confounders.

Methods This study applied quantitative estimates via SYN-JEM for four established occupational lung carcinogens to case-control data from five (Western European and Latin American) studies within the International Head and Neck Cancer Epidemiology Consortium. Participant job histories for $n=2256$ laryngeal cancer cases and $n=7857$ controls recruited from 1989–2007 were linked with quantitative SYN-JEM estimates via ISCO-68 codes. Logistic regression models were applied to assess the effects of occupational exposure to asbestos, respirable crystalline silica (RCS), chromium-VI, and nickel on laryngeal cancer risk while controlling for tobacco and alcohol consumption.

Results Increased ORs were observed for all agents evaluated. In males, a positive exposure-effect relationship was observed with duration of RCS exposure (p -value for trend <0.01). Relatively strong effects were also observed in the highest categories of career-cumulative chromium-VI exposure (>90 th percentile: OR=2.21, 95% CI=1.13–4.33) and career-average exposure (>90 th percentile: OR=2.96, 95% CI=1.51–5.79), and in the highest category of career-cumulative nickel/chromium-VI combined exposure (>90 th percentile: OR=1.51, 95% CI=1.01–2.26). These relationships weakened in analyses restricted to blue collar workers but interpretations remained unchanged.

Conclusions These results support causal links between exposure to known lung carcinogens and laryngeal cancer. Measures to reduce such exposures in workplaces could decrease the risk of both laryngeal and lung cancers.

06B.5 VARIATION IN NORDIC WORK-RELATED CANCER RISKS AFTER ADJUSTMENT FOR ALCOHOL AND TOBACCO

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Background Consumption of alcohol and tobacco strongly increases risk of cancer of the tongue, mouth, pharynx, larynx, and oesophagus, and are established risk factors also for cancer of the liver, colon, and rectum. It is well documented that these habits are unequally distributed among occupational groups. Most occupational cohort studies do not have information on these potentially important confounders, and may therefore be prone to bias.

Aim The aim of the study was to calculate standardized incidence ratios (SIRs) adjusted for alcohol and tobacco by occupation, and to compare to the unadjusted SIRs.

Material and methods The study is based on the Nordic Occupational Cancer (NOCCA) database.

We used confirmatory factor analysis models where the unobserved pattern of alcohol and tobacco consumption were considered a latent common factor, and the potential occupational variation on each cancer type latent site specific factors. Results were used to compute adjusted expected numbers of cancer from the reference rates and to calculate adjusted SIRs for the relevant cancer sites for each occupation.

Results Changes of risk estimates from significantly high to significantly low and vice versa were seen. Among Nordic farmers, unadjusted SIRs for cancer of the mouth and oesophagus were 0.56 (95% confidence interval [CI] 0.51–0.61) and 0.67 (CI 0.63–0.70), respectively. After adjustment, estimates changed to 1.10 (CI 1.01–1.21) and 1.16 (CI 1.10–1.22). Unadjusted SIR for pharynx cancer among wood workers was 0.83 (CI 0.75–0.91), adjusted SIR was 1.14 (CI 1.03–1.25). For larynx cancer, results in the opposite direction were seen: unadjusted SIR for economically inactive was 1.38 (CI 1.31–1.46) while the adjusted SIR was 0.91 (CI 0.86–0.96).

Conclusion Adjustment for the latent indicators of alcohol and tobacco consumption changed risk estimates for several occupations, and may guide in the identification of true risk factors and preventive strategies.

06B.6 OCCUPATIONAL RADIATION EXPOSURE AND THE RISK OF CANCER AND CARDIOVASCULAR DISEASES AMONG MEDICAL RADIATION WORKERS

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Background Medical radiation workers occupy the largest group of radiation workers and the numbers are rapidly