

The compression force on lumbar disc was estimated by using the 3-Dimension Static Strength Prediction Program (3D-SSPP, Center for Ergonomics, University of Michigan) software system. For each job described, the load on lumbar disc was calculated as the product of the compression force and the duration of lifting in hours. The lifetime cumulative load (Newton*hours, Nh) for each participant was then estimated by summing up the load on lumbar disc for all jobs. Logistic regression was used to assess association between MRI abnormalities and lifetime cumulative lifting load.

Results The subjects were categorised into tertiles by lumbar cumulative lift load, i.e., $<4.0 \times 10^5$, $4.0 \times 10^5 \sim <8.9 \times 10^6$, and $> = 8.9 \times 10^6$ Nh. The prevalence rates of LDD findings varied by disc level. Observed LDD findings increased with cumulative lift load. At the L5-S1 disc level, MRI findings of disc height narrowing (Odds ratio, OR = 4.1, 95% Confidence interval, CI 1.9~10.1), dehydration (OR = 2.5, CI 1.5~4.1), disc protrusion (OR = 2.2, CI 1.2~4.1), annulus tear (OR = 2.2, CI 1.2~4.2), disc bulging (OR = 1.9, CI 1.2~3.1) was found among those with cumulative lifting load of $> = 8.9 \times 10^6$ Nh as compared to those with $<4.0 \times 10^5$ Newton-hours. The tests for trend were significant ($p < 0.05$) for all above-mentioned disc conditions.

Conclusions Our results suggest a dose-response relationship between cumulative lift load and LDD.

Session: 22. Miners and cancer

340 CANCER INCIDENCE AND MORTALITY AMONG UNDERGROUND AND SURFACE GOLD MINERS IN WESTERN AUSTRALIA

Peters, A Reid, L Fritschi, A W Musk, N de Klerk. *University of Western Australia, Perth, Australia*

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Background The Kalgoorlie gold miners' cohort was established in 1994, consisting of all workers (males only) who attended workplace health surveys in 1961, 1962, 1974, and 1975. In this study the follow-up of the cohort has been extended to 2011. Our objectives were (i) to estimate cancer mortality and incidence, for both surface and underground miners; and (ii) to examine the hypothesis that (underground) mining may be protective against prostate cancer.

Methods Standardised mortality and incidence ratios (SMRs and SIRs) and 95% confidence intervals (95% CI) were calculated to compare cancer mortality and incidence of the former Kalgoorlie miners with that of the Western Australian male population. Internal comparisons on duration of underground work were examined using Cox regression.

Results During 52,440 person-years of follow-up, 1,922 deaths were observed. Increased mortality from any cause was observed for the miners (SMR = 1.34, 95% CI 1.28–1.40), with hazard ratios indicating a trend for duration working underground ($p = 0.02$). For any cancer, mortality was increased for the total group of miners (SMR = 1.25, 95% CI 1.14–1.37). In the Cox models, lung cancer mortality and incidence were particularly increased among underground miners, even after adjustment for smoking. The SMR for prostate cancer suggested a lower risk for underground miners, but this was not supported by the incidence data with a significantly increased incidence of prostate cancer (SIR = 1.26, 95% CI 1.03–1.54) among underground miners.

Conclusions Overall cancer mortality and incidence was higher among Western Australian gold miners compared with the

general population, especially for lung cancer and particularly for underground mining. This study does not support the hypothesis that miners have a decreased risk of prostate cancer: the results indicate a positive association between working as a miner and prostate cancer.

341 RISK OF LUNG CANCER IN MINERS AND QUARRY WORKERS IN A POOLED ANALYSIS OF CASE-CONTROL STUDIES

¹B P Pesch, ¹Kendzia, ¹Taeger, ¹Behrens, ¹El Hadad, ²Olsson, ³Dahmann, ²Straif, ²Schüz, ¹Brüning. ¹Institute for Prevention and Occupational Medicine of the DGUV (IPA), Bochum, Germany; ²International Agency for Research on Cancer, Lyon, France; ³Institut für Gefahrstoff-Forschung, Bochum, Germany

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Objectives Epidemiological studies have indicated an increased lung cancer risk among miners. We present estimates of the lung cancer risk in miners and quarry workers using a pooled database of case-control studies (<http://synergy.iarc.fr>).

Methods This analysis included occupational and smoking histories of 15,483 male lung cancer cases and 18,388 controls from 16 case-control studies of the SYNERGY project. Miners and quarry workers were identified from the International Standard Classification of Occupations (ISCO 1968). We differed between coal and ore mining using the International Standard Classification of Industries (ISIC Rev. 2). Odds ratios (OR) and 95% confidence intervals (CI) for developing lung cancer were estimated by logistic regression, adjusted for age, study centre, smoking and working in occupations known to entail a lung cancer risk.

Results A total of 696 lung cancer cases and 440 controls had worked for at least one year as miner. Ever working as miner was associated with an OR of 1.58 (95% CI 1.33 to 1.74). The majority of miners (472 cases, 311 controls) had worked in coal mining. Ever working in coal mining was associated with an OR of 1.43 (95% CI 1.20–1.70). The corresponding OR in ore mining was 1.65 (95% CI 1.03 to 2.63). Working for at least one year in quarries (79 cases and 45 controls) was associated with an OR of 1.61 (95% CI 1.05 to 2.46). We could not observe trends with duration or time since last employment as miner or quarry worker.

Conclusions Working in mines or quarries was associated with an elevated lung cancer risk. We found no trend by duration of employment. These results were derived from job titles and industry codes with detailed information on smoking and other occupations held during lifetime. Exposure to quartz or coal dust and the prevalence of silicosis could not be evaluated.

342 MORTALITY AND PROPORTIONAL CANCER INCIDENCE IN MINNESOTA TACONITE WORKERS

E M A Allen, Alexander, Mandel, Ramachandran, MacLehose, Nelson. *University of Minnesota, Minneapolis, United States of America*

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Objective In response to public concerns about health in Minnesota taconite mining workers, we evaluated the mortality and cancer experience in this population.

Methods From a cohort of 44,159 taconite workers born in 1920 or later, we selected 30,360 with at least one year of documented employment. Vital status and causes of death from death

certificates were ascertained through December 31, 2007. Cancer diagnoses from 1988 through 2010 were identified by the Minnesota Cancer Surveillance System (MCSS). Standardised mortality ratios (SMRs) and proportional cancer incidence ratios (PCIR) were calculated using Minnesota as the reference population.

Results We identified 9,012 deaths, of which 2,693 were cancers, including 943 lung cancers, and 30 mesotheliomas. Mortality from all causes was near unity (SMR = 1.02, 95% Confidence Interval (CI): 1.00–1.04). Mortality from lung cancer and mesothelioma were higher than expected; SMR = 1.16 (95% CI: 1.09–1.24) and 2.79 (95% CI: 1.88–3.98) respectively. SMRs were elevated for all heart diseases (SMR = 1.10, 95% CI: 1.06–1.14), hypertension with heart disease (SMR = 1.79, 95% CI: 1.37–2.30) and ischaemic heart disease (SMR = 1.11, 95% CI: 1.07–1.16). A total of 6,189 incident cancers were identified by MCSS including 1016 lung cancers, and 51 mesotheliomas. PCIRs for mesothelioma and lung cancer were 3.02 (95% CI: 2.24, 3.98) and 1.22 (95% CI: 1.15–1.30) respectively. Other proportionally elevated cancers include oral, esophageal, stomach, laryngeal, and bladder cancers.

Conclusions This analysis indicates taconite workers have an increased risk for certain cancers and cardiovascular disease. Exposures from taconite operations include crystalline silica, respirable dust and elongated mineral particles, including non-asbestiform amphiboles and cleavage fragments. Exposure to commercial asbestos is also possible. The extent to which such exposures contribute to disease burden is being investigated. Lifestyle factors, such as smoking, could also contribute to disease burden.

343 A CASE-CONTROL STUDY OF MESOTHELIOMA IN MINNESOTA IRON ORE MINERS

C L Lambert, Alexander, Mandel, Perlman, Ramachandran, MacLehose, Nelson. *University of Minnesota, Minneapolis, United States of America*

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Objectives An excess of mesothelioma has been found in iron ore miners in northeastern Minnesota. Miners of taconite, the current form of ore mined, face a number of potentially hazardous exposures. The intensive processing of taconite ore combined with the unique and variable geology of the Mesabi Iron Range create the potential for exposure to natural amphibole fibres, cleavage fragments, and respirable dust. Exposure differed in natural ore (hematite) mining where minimal processing was required. We performed a case-control study to evaluate the risk of mesothelioma associated with taconite mining employment.

Methods Mesothelioma cases were identified through the Minnesota Cancer Surveillance System (MCSS) and death certificates from a cohort of 68,737 miners employed between the 1930s and 1982. Four controls of similar age were selected from the mining cohort for each case using an incidence density sampling protocol. Odds ratios and 95% confidence intervals were estimated with conditional logistic regression for years employed in all iron ore mining, taconite mining, and the earlier natural ore mining.

Results Eighty cases of mesothelioma were identified in this cohort. There is a slight elevation of mesothelioma risk for each additional year of work in iron ore mining (OR = 1.02, 95%CI 1.00–1.04) and taconite mining (OR = 1.03, 95%CI 1.00–1.07). No association was observed for years of employment in natural ore mining.

Conclusion These initial findings indicate a potential relationship between mesothelioma and employment in taconite mining and processing. The extent to which these cases are caused by exposure to taconite dust components, including cleavage fragments and non-fibrous amphiboles found in some zones of the Mesabi Range, or commercial asbestos will be explored in future analyses.

Session: 23. Biological agents

344 WHAT IS THE OCCUPATIONAL RISK FOR TRANSMISSION OF HELICOBACTER PYLORI TO HEALTHCARE WORKERS WORKING IN INSTITUTIONS FOR THE ELDERLY?

¹A A De Schryver, ²Van Hooste, ²Charlier, ²Colemonts, ³Hambach, ²Schouteden, ³Van Sprundel. ¹IDEWE/Universiteit Antwerpen, Leuven, Belgium; ²IDEWE, Leuven, Belgium; ³University of Antwerpen, Antwerp, Belgium

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Background and Objectives *Helicobacter pylori* was discovered in 1984, but its transmission is not yet clear. Direct person-to-person transmission is most likely and could be relevant to occupational transmission particularly in healthcare workers (HCWs) in institutions for elderly people (IEP). Prevalence of *H.pylori* increases with age, and studies have shown a prevalence up to 85% in people living in IEP.

Methods We compared the occupational risk for *H. pylori* in HCWs working in IEP (n = 198) to non-exposed controls (n = 250) in a cross-sectional study using serology. We calculated crude and age-adjusted prevalence; in bivariate analysis we compared both groups for a number of established general life-style and occupational risk factors. We applied logistic regression, Poisson regression with robust variance estimator and binomial regression, using established risk factors as covariates.

Results The crude prevalence of seropositivity was 14.6% (95% CI 9.7–19.6) in HCWs en 13.6% (95%CI 9.4–17.8) in controls. Age-standardised prevalence was 14.2% versus 14.9% (difference not significant) respectively. Univariate analysis of seropositivity showed no significant associations with frequency of faecal contact, washing and feeding of elderly persons, contact with vomit, handling nasogastric tubes or washing linen. Using logistic regression, OR was 0.9 (95% CI 0.5 - 1.6) in HCWs compared to non-exposed controls after adjusting for other risk factors; only age (OR 3.2 -95% CI 1.6–6.3) and travel to developing countries (OR 2.0 -CI 1.1–3.9) predicted seropositivity to *H. pylori*. In Poisson and log binomial regression, prevalence ratio (PR) was 0.9 (95%CI 0.6–1.5) and 0.9 (95%CI 0.6–1.4); only age and travel contributed significantly to *H.pylori* seropositivity in both models.

Conclusions In our study, using 3 multivariate methods (logistic regression, Poisson regression and binomial regression), the prevalence of *H.pylori* seropositivity was not significantly higher in HCWs compared to non-exposed controls. No significant associations between *H.pylori* seropositive status and occupational exposures were shown.

345 PATTERNS OF S.AUREUS AND MRSA COLONIZATION AND INFECTION IN US SWINE VETERINARIANS

R Davies, Sreevatsan, Sun, Yang. *University of Minnesota, St. Paul, United States of America*

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