O-159

DOES RADON CAUSE DISEASES OTHER THAN LUNG CANCER? RESULTS FROM THE GERMAN URANIUM MINER COHORT STUDY

¹Nora Fenske, Veronika Deffner, Maria Schnelzer, Michaela Kreuzer. ¹Federal Office for Radiation Protection, Germany

10.1136/OEM-2021-EPI.119

Introduction and Objectives Radon is an established risk factor for lung cancer. Less clear is whether radon causes other diseases than lung cancer. To further investigate such risks, updated mortality data from the German uranium miner cohort study (1946–2013) were analyzed.

Methods The cohort includes 58,974 men who were employed for at least 6 months between 1946 and 1989 at the former Wismut uranium mining company in Eastern Germany. Considered endpoints were mainly cancers other than lung cancer, circulatory diseases and non-malignant respiratory diseases. Exposure to radon and its progeny and external gamma radiation was retrospectively estimated through a comprehensive job-exposure matrix. Statistical modelling was performed by internal Poisson regression for grouped data with baseline stratification by age and calendar year. Excess relative risks (ERR) per 100 WLM (Working Level Month) and 95% confidence intervals (CI) were estimated for cumulative 5-year lagged exposure to radon (mean=280, median=33, max=3,224 WLM).

Results Within the follow-up period 1946–2013, a total of 5,122 cancer deaths other than lung cancer occurred. In this group, a statistically significant association was found (ERR/100 WLM=0.014; 95% CI: 0.006, 0.021). Regarding individual cancer sites, the majority of risk estimates were positive (14 out of 18), and two of them reached borderline significance (colon and liver cancer). This holds true even after adjustment for external gamma radiation. No increased ERR/100 WLM was found for the groups of deaths from circulatory diseases (n=10,665) and from non-malignant respiratory diseases excluding silicosis/other pneumoconiosis (n=1,674).

Conclusion Our findings provide some evidence of an increased mortality risk for cancers other than lung cancer associated with radon. Chance, confounding by unconsidered risk factors and uncertainty in exposure assessment cannot be completely ruled out. If present at all, the radon-related risk for diseases and cancers other than lung cancer is substantially lower than that for lung cancer.

O-174

MORTALITY IN A COHORT OF GERMAN UNDERGROUND URANIUM MINERS, 1960–2013

¹Veronika Deffner, Nora Fenske, Maria Schnelzer, Michaela Kreuzer. ¹Federal Office for Radiation Protection, Germany

10.1136/OEM-2021-EPI.120

Introduction and Objective Former German uranium miners had been exposed underground in the early years to high levels of radon and silica dust. The objective of these analyses is to compare mortality in the Wismut cohort with that of the male general population.

Methods A sub-cohort of 35,204 miners who worked at least 180 days between 1946 and 1989 underground, but never in processing or open pit mining was defined with observation period from 1960 to 2013. The underlying cause of death was available for 96.1% of the 18,510 deceased. For

numerous causes of death, observed deaths (O) were compared with expected deaths (E) based on external mortality rates for the general male population by standardized mortality ratios (SMR=O/E). Exposure to radon progeny and silica was retrospectively estimated by job-exposure matrices. SMR trends for different exposure levels were examined by the Poisson trend statistic.

Results A significant excess of lung cancer deaths was found (O=2,960; SMR=2.36; 95% CI: 2.28–2.45). Of the 27 considered cancer sites other than lung, SMR was statistically significantly increased for liver (O=175; SMR=1.34; 95% CI: 1.15–1.55) and stomach (O=504; SMR=1.28; 95% CI: 1.17–1.40) cancers. A significant excess mortality from non-malignant respiratory diseases was found (O=1,928; SMR=1.86; 95% CI: 1.78–1.94), mainly related to mortality from silicosis/other pneumoconiosis (O=941; SMR=22.62; 95% CI: 21.20–24.11) and influenza/pneumonia (O=294; SMR=1.13; 95% CI: 1.01–1.27). Additionally, significant mortality excesses occurred for infectious diseases (O=157; SMR=1.18; 95% CI: 1.01–1.38) and cerebrovascular diseases (O=1,335; SMR=1.33; 95% CI: 1.26–1.41). SMRs for lung and liver cancer significantly increased with cumulative radon exposure; SMRs for silicosis/other pneumoconiosis significantly increased with silica exposure.

Conclusion Underground miners of this cohort showed a clear excess mortality for lung cancer and silicosis/other pneumoconiosis even for those later hired with lower exposures. Further research is ongoing to investigate exposure-response-relationships via internal analyses in more detail.

O-277

SOLAR UVR EXPOSURE AMONG OUTDOOR WORKERS IN ALBERTA: MEASUREMENTS AND PROTECTIVE BEHAVIOURS

¹Cheryl Peters, Ela Rydz, Andrew Harper, Brandon Leong, Victoria H Arrandale, Sunil Kalia, Thomas Tenkate, Lindsay Forsman-Phillips, D Linn Holness. ¹University of Calgary, Canada

10.1136/OEM-2021-EPI.121

Introduction Workplace solar UVR exposure has significant health and economic impacts. However, occupational exposure and sun protection behaviour data are scarcely available.

Objectives This study aimed to characterize outdoor workers' full-day solar UVR exposures and their determinants, as well as the prevalence and determinants of sun protection behaviours used at work and leisure.

Methods We collected personal dosimetry measurements over one week using calibrated, electronic UVR dosimeters, and outdoor workers' demographics, skin cancer risk factors, job information, and sun habits at work and leisure using self-completed questionnaires. Workers' mean daily solar UVR exposure (standard erythemal dose, SED), corrected for repeated measurements, was summarized, and determinants of exposure were assessed using marginal models. The frequency of specific protective behaviours at leisure and work was compared. Sun protection scores were calculated, and the determinants of these scores for both settings were modelled using multiple linear regression.

Results We recruited 179 workers and collected 883 full-day measurements. The mean dose among all workers was 1.9 SED (range: 0.03–16.6). Nearly half of all measurements exceeded the recommended international limit (1.3 SED). Landscape and maintenance workers (2.6 SED), and trade and

recreation workers (1.8 SED) had the highest mean exposures. Job title, dosimeter placement, forecast, and hours spent outside were predictors of daily SED. At work, wearing a sleeved shirt (81% often/always) and hat (73%) were most prevalent, while seeking shade (12%) and applying sunscreen (36%) were least prevalent. Sun protection scores were higher at work than leisure. Hours spent outdoors was a strong determinant for the work and leisure models. Additional leisure model predictors were eye colour, sex, skin type, and job group.

Conclusion Outdoor workers are exposed to high solar UVR levels and use different sun protective behaviours at work and leisure. These findings can inform future monitoring studies and exposure reduction initiatives.

0-296 RADON EXPOSURE AND RISK OF DEATH FROM CIRCULATORY SYSTEM DISEASES AMONG A LARGE COHORT OF URANIUM MINERS – THE PUMA STUDY

¹Estelle Rage - de Moissy, David B Richardson, Paul Demers, Minh Do, Nathan DeBono, Nora Fenske, Veronika Deffner, Michaela Kreuzer, Jonathan Samet, Stephen Bertke, Kaitlin Kelly-Reif, Mary Schubauer-Berigan, Ladislav Tomasek, Lydia Zablotska, Charles Wigg. ¹Institute for Radiological Protection and Nuclear Safety (IRSN), France

10.1136/OEM-2021-EPI.122

Introduction Numerous studies highlighted the association between radon exposure and lung cancer risk. Nevertheless the question of radon-related risks for non-cancer diseases, and more specifically circulatory system diseases (CSD) have received limited investigation. Among uranium miners, only one cohort observed an association between radon exposure and CSD.

Objectives To investigate the relationship between cumulative radon exposure and CSD mortality in the PUMA study (Pooled Uranium Miners Analysis), a large international pooled set of cohorts of uranium miners.

Methods The PUMA study includes seven cohorts of uranium miners from Czechia, France, Germany, Canada and USA. Annual radon exposure has been estimated individually and expressed in Working Level Months (WLM). The relationship between cumulative radon exposure, applying a 5-years lag, and CSD death, and more specifically ischemic heart disease and cerebrovascular disease, was assessed with an internal Poisson regression model integrating a linear excess relative risk (ERR) structure, expressed per 100 WLM.

Results The PUMA study includes 119,709 male uranium miners hired between 1942 and 1996. The follow-up duration was between 30–39 years in each of the cohorts, contributing to 4.3 million person-years. The mean value of cumulative radon exposure in individual cohorts ranged between 31 and 580 WLM. At the end of follow-up, 52,450 miners were dead (44% of the cohort), and among them 17,494 deaths from CSD were recorded. The exposure-risk relationship did not show any increase in CSD risk associated with cumulative radon exposure (ERR/100 WLM=2.3.10–4; 95% confidence interval [-0.0033; 0.0042]). No increase in risk was observed for ischemic heart disease or cerebrovascular disease death.

Conclusion The PUMA study has a large study population and a high level of statistical power. These preliminary results did not show any increased risk for CSD mortality among uranium miners.

0-312 OCCUPATIONAL EXPOSURE LEVELS OF SOLAR ULTRAVIOLET RADIATION: AN EPHOR REVIEW

¹Elsa Toft Würtz, Mark Cherrie, Calvin Ge, Kasper Grandahl, Johnni Hansen, Anna Dahlman-Höglund, Ingrid Sivesind Mehlum, Alberto Modenese, Hilde Notö, Cheryl Peters, Jenny Selander, Svetlana Solovieva, Vivi Schlünssen, Marc Wittlich, Henrik Albert Kolstad. ¹Aarhus University Hospital, Denmark

10.1136/OEM-2021-EPI.123

Introduction Exposure to solar ultraviolet radiation (UVR) is the main cause of malignant melanoma, squamous cell carcinoma, and basal cell carcinoma of the skin, a risk factor of cataract, and the primary predictor of Vitamin-D levels. The UVR exposure level depends on several factors such as time of day, season, latitude and altitude, activity, and vary across occupations, with high levels reported in various outdoor jobs. Personal measurements are typically reported as full shift cumulative Standard Erythema Dose (SED).

Objective To conduct a systematic review of occupational solar UVR exposure levels.

Methods We performed a PubMed search for literature presenting personal solar UVR exposure levels measured by wearable UVR sensors during work and added papers identified from reference lists. We screened title and abstract of 1,005 papers, full text reviewed 113 papers, and extracted data from 42 included studies. Job descriptions were coded according to the International Standard Classification of Occupations (ISCO-88) on the 4-digit level.

Results In total, UVR exposure levels of 35,345 personal workday measurements of mainly construction workers, farmers, seamen, teachers, expeditioners, and athletes were included. They covered all year, 6am - 6pm working hours, latitudes from 20–75° north and 10–68° south, and altitudes in the 0–8000 m range. Repeated measurements were included in 76% of the studies. Eleven different polysulphone film, UV-sensitive spore, or electronic irradiance sensors placed on head, neck, shoulder, chest, back, arm, or wrist were used. Exposure levels varied between 0.4 SED for laboratory workers and 28.6 SED for construction workers.

Conclusion The established measurement database will be used in the development of a general population quantitative job exposure matrix (JEM) as part of the European Exposome Project for Health and Occupational Research (EPHOR). The UV-JEM will be applied in multi-centre European occupational cohort studies of adverse and beneficial effects of exposure to UVR.

Respiratory Effects

0-39 LIFETIME OCCUPATIONAL EXPOSURES AND CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD) RISK IN THE UK BIOBANK COHORT

¹Sara De Matteis, Debbie Jarvis, Lucy Darnton, Dario Consonni, Hans Kromhout, Sally Hutchings, Steven Sadhra, David Fishwick, Roel Vermeulen, Lesley Rushton, Paul Cullinan. ¹Imperial College London, United Kingdom

10.1136/OEM-2021-EPI.124

Introduction Occupational exposures are important, preventable causes of chronic obstructive pulmonary disease (COPD). We previously found an increased COPD risk among six occupations by analysing lifetime job-histories and lung function data in the population-based UK Biobank cohort.