Session: 18. Exposure assessment III

316 FIT OF N95 FILTERING FACEPIECE RESPIRATORS INFLUENCED BY GENDER, DESIGN OF FACEPIECE, AND ACTIVITY ENGAGED IN USE

Y C Lin, C-P Chen. *China Medical University, Taichung, Taiwan*

Objectives The N95 filtering facepiece respirators are often used as the last line of defense protecting the workers against threats of airborne particulate contaminants, and its leakage around the faceseal could result in a direct exposure to the unfiltered air. This study investigated the fit of N95 respirators among young Taiwanese under the influences of gender, facepiece design, and activity engaged when the respirators were used.
Methods In the study, all participants (60 males and 60 females) were first characterised for 19 facial dimensions frequently applied in fit-test panel design using anthropometric equipments. The participants were then qualitatively fit-tested with N95 masks of three distinct facepiece designs (cup, flat fold, and liner with exhalation valve). During the fit-test, the participants were required to perform a series of seven exercises. The results were compared using Principle Component Analysis to identify key facial dimensions influencing the respirator fit as well as their distributions.
Results Only 27% of the participants passed all seven exercises without a leakage detected, with the proportion in males significantly higher than that of females. The percentage of participants failing all exercises was the greatest with the liner model and the least with the flat-fold model. When the flat-fold and cup models were tested, deep breathing and talking resulted in higher rate of leakage than the others activities. The facial dimensions identified as being significant to respirator fit included face width, interpupillary distance, nose breadth, face length, nose protrusion, and subnasale-sellion length.
Conclusions The facial dimensions significant to respirator fit among Taiwanese suggested a need for a Taiwanese-based respirator fit-test panel. The users should include the flexibility of facepiece and the activity engaged when using the respirator as factors to consider when selecting a respirator so to reduce potential exposure due to inappropriate fit.

317 DISEASE GROUP DIFFERENCES IN BENZENE EXPOSURE IN A POOLED ANALYSIS OF PETROLEUM WORKER CASE-CONTROL STUDIES

[1]D C Glass, [2]Armstrong, [3]Pearlman, [3]Schnatter, [4]Tang, [5]Rushton. *[1]Monash University, Melbourne, Australia; [2]TWA8HR Occupational Hygiene Consulting, LLC, Branchburg, NJ, United States of America; [3]ExxonMobil Biomedical Sciences, Inc, Annandale, NJ, United States of America; [4]University of Pittsburgh, Pittsburgh, PA, United States of America; [5]Imperial College, London, United Kingdom*

Objectives To compare exposure to benzene across different lymphohaematopoietic subtypes in a pooled nested cased control study.
Methods Cases of acute myeloid leukaemia (AML), chronic myeloid leukaemia (CML), chronic lymphocytic leukaemia (CLL) myelodysplastic syndrome (MDS) and myeloproliferative disease (MPD) were identified in petroleum industry cohorts from UK, Canada and Australia and pooled with matched controls into a single study. For each job held by participants, the intensity of full shift exposure to benzene (ppm), the certainty of the estimate, job duration, probability of dermal and peak exposure were estimated using study defined metrics. Cumulative benzene exposure was calculated for each participant.
Results Benzene exposure was low, 90% of participants accumulated < 20 ppm-years. Mean cumulative exposure was 5.15 ppm-years, mean duration was 22 years and mean exposure intensity was 0.2 ppm. 46% of participants were allocated a peak exposure and 40% had a high probability of dermal exposure at least weekly.
For AML, mean duration was slightly longer for cases but maximum exposure intensity was slightly higher for controls. The mean cumulative and maximum exposure estimates were higher for MDS cases than for controls or for AML cases. CLL and CML cases had slightly higher mean estimates of duration and cumulative benzene exposure than their controls. MPD cases had lower exposure estimates than controls. AML cases and controls had longer employment duration than other disease groups. Higher exposure certainty scores confirmed the MDS case/control and MDS/AML differences.
Conclusions Benzene exposure estimates were lower overall than those in previous studies for all the disease groups. There was little difference in exposure between AML cases and controls and in general the exposure was less than for MDS cases. Certainty scores for exposure assessments can be used in sensitivity analyses to strengthen interpretations of the observed associations between exposure and risk.

318 DETERMINANTS OF PERSONAL EXPOSURE TO INHALABLE DUST AND ENDOTOXIN AMONG DANISH DAIRY FARMERS

[1]I Basinas, [1]Sigsgaard, [2]Erlandsen, [3]Kromhout, [3]Heederik, [1]Schlünssen. *[1]Department of Public Health, Aarhus University, Aarhus, Denmark; [2]Department of Public Health, Institute of Biostatistics, Aarhus University, Aarhus, Denmark; [3]Institute for Risk Assessment Sciences (IRAS), Utrecht University, Utrecht, The Netherlands*

Objective To indentify working tasks which determine the level of personal exposure of dairy cattle farmers to inhalable dust and endotoxin.
Methods 124 personal full-shift inhalable dust measurements were performed in 77 farmers from 26 dairy operations. The concentration of collected dust on the samples was estimated gravimetrically and its endotoxin content by the kinetic chromogenic Limulus Amebocyte Lysate assay. During monitoring all tasks performed by the farmers were registered in self-administrated activity diaries, and walk-through surveys were performed in every compartment of the visited farm. Effects of working tasks on the log-transformed dust and endotoxin concentrations were examined in Linear mixed effects models. Worker and farm identity were treated as random effects, and working tasks as fixed effects.
Results Measured concentrations for inhalable dust ranged between 0.2 and 9.8 mg/m^3 and for endotoxin between 17.6 and 5890 EU/m^3. Preliminary models with 12 and 14 working tasks for endotoxin and dust respectively explained 27% and 23% of the overall variability in exposure. Preparation and spread of bedding, re-penning of animals and handling of feeding materials in storage areas were all strong predictors for both

dust and endotoxin exposure. Decreased dust exposures were seen when cleaning of milking areas or reparation of buildings was performed. Robotic milking was associated with increased dust levels when compared to parlour milking.

Conclusion These initial findings provide information on working tasks that determine the level of personal exposure to dust and endotoxin during dairy farming. By June 2013, the authors intend to present results from statistical models which will examine the combined effects of farm characteristics and working tasks.

319 OCCUPATIONAL EXPOSURES IN VETERINARIANS: FINDINGS FROM A NATIONAL SURVEILLANCE PROJECT (CAREX CANADA)

[1]L Hall, [1]Peters, [1]Davies, [2]Demers. [1]University of British Columbia, Vancouver, Canada; [2]Occupational Cancer Research Centre, Cancer Care Ontario, Toronto, Canada

Objectives Veterinarians work in a variety of environments with diverse patient types. Risk of physical injury and zoonoses are common concerns for this group, but other exposures may also produce adverse health outcomes. The objective of this study was to identify Canadian veterinary exposure prevalence and levels for ionising radiation (IR) and antineoplastic agents (AAs), as part of the CAREX Canada project.

Methods For IR, we used 2008 whole-body dose data from a national government exposure registry. Veterinarians with measured levels of exposure were identified. The proportions exposed were combined with 2011 national veterinary statistics to estimate the prevalence range within two exposure categories. For AAs, prevalence and exposure category estimates were formed by combining the 2011 national veterinary statistics with information on practice type and AA usage rates obtained from provincial veterinary associations, peer-reviewed literature, and veterinary field experts.

Results In 2008, 26% of Canadian veterinarians were monitored for IR exposure. Of the 3,155 veterinarians monitored, 282 (8.9%) had a dose >0 mSv. Extrapolating to all veterinarians in Canada, we estimate a maximum of 1070 are exposed to IR doses above zero mSv. The majority (n = 278–1055) fall within a low dose category (>0–1mSv) while n = 4–15 are exposed to levels between 1–5 mSv. None had doses >5 mSv. We estimate that 18% of veterinarians (n = 2,200) are exposed to AAs; these fall into two categories of moderate exposure, defined as "low frequency, low control" (n = 2,180) and "high frequency, high control" (n = 20).

Conclusions CAREX Canada's exposure estimates could be used to assist in the development of epidemiological studies or risk assessments. Our estimates indicate that exposure to IR and AAs in veterinarians is low, however the accuracy of our findings is limited by data sources of varying quality. We plan to refine our current estimates and assess other exposures in veterinary settings.

320 EXPOSURE ASSESSMENT OF THORACIC AEROSOL IN AN INTERNATIONAL PROSPECTIVE STUDY OF CEMENT PRODUCTION WORKERS

H N Notø, Eduard. National Institute of Occupational Health, Oslo, Norway

Hilde Notø, Karl-Christian Nordby, ⬜'ivind Skare, Helge Kjuus and Wijnand Eduard

Background and Objectives Respiratory effects have been linked to aerosol exposure in cement production workers. This presentation aims at estimating annual exposure levels to thoracic aerosol during the study period. The thoracic fraction was chosen because dynamic lung function was the main outcome of the international study.

Methods We collected 7120 personal shift measurements of thoracic aerosol contributed by 2866 persons within 8 job types in 24 plants in 2007, 2009 and 2011. Measurements above 150 mg/m^3 were excluded as light microscope analysis revealed larger particles than expected from the thoracic convention (N = 63). Measurements with absolute Z-scores above 3.29 in models including job type, plant and year were also excluded (N = 44), as well as samples with technical errors (N = 71). Arithmetic mean (AM) exposures were estimated using mixed regression modelling of the ln-transformed exposure. The final model included plant, job type, plant*job type, year, plant*year and season as fixed effects, individuals as random effect, and plant-specific residuals.

Results Of the workers 86% had been measured more than once, on average 2.4 times. All fixed factors contributed significantly to the models. Plant specific residuals also improved the model significantly. A job exposure matrix was constructed for plant-specific job types for each year averaged across seasons. AM exposure levels were estimated by exponentiation of the sum of the regression coefficients of the fixed effects and the half of the plant-specific residual variances. The estimated exposure varied between job types and plants from 0.13 to 14 mg/m^3.

321 OCCUPATIONAL EXPOSURES TO KNOWN AND SUSPECTED CARCINOGENS IN THE CANADIAN CONSTRUCTION INDUSTRY

[1]B Ge, [1]Peters, [2]Demers. [1]University of British Columbia, Vancouver, Canada; [2]Occupational Cancer Research Centre, Toronto, Canada

Objectives CAREX Canada aims to estimate the number of Canadian workers exposed to various carcinogens in the workplace. The objectives of this work is to determine the number of workers exposed to different carcinogens in the construction industry in Canada and identify high risk occupations within the industry for exposure.

Methods Data from the Canadian Workplace Exposure Database (CWED), published relevant Canadian and US scientific literature, data from previous European CAREX projects, government grey literature and other technical reports were used to develop exposure proportions for each occupation in the construction industry. These proportions are combined with 2006 Canadian census of population data to obtain the prevalence of exposure for 30 carcinogens selected to be relevant in the Canadian context.

Results Canadian construction workers, with a total population of 1.07 million, are estimated to have over 1,188,000 exposures to the 30 selected carcinogens. Some workers are likely exposed to more than one substance at a time. Carcinogens with substantial number of workers exposed include: solar ultraviolet radiation (343,000 workers exposed), crystalline silica (240,000 exposed), wood dust (166,000 exposed), asbestos (134,000 exposed), diesel engine exhaust (84,000 exposed), lead and lead compounds (51,000 exposed) and bitumen (50,000 exposed).