

Kp descriptor. Four of the investigated Kp QSARs show a R^2 close to 0.7 or higher when predicting Kp, suggesting a consistent performance of these models to serve as a tool of dermal hazard characterisation.

7 STATISTICAL MODELLING OF OCCUPATIONAL EXPOSURE TO POLYCYCLIC AROMATIC HYDROCARBONS USING OSHA DATA

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Objectives Polycyclic aromatic hydrocarbons (PAHs) are a group of chemicals consisting primarily of fused aromatic rings. As environmental pollutants, PAHs are of concern because some variants are carcinogenic. Our objective is to predict probabilities of PAH exposure based on industry to allow assessment of individual PAH exposure through occupational history.

Methods The Occupational Safety and Health Administration (OSHA) provided access to two PAH exposure databanks of U. S. workplace compliance testing compiled between 1979 and 2010. Multivariable logistic mixed-effects models were used to predict, for each industry, the probability of a PAH measurement exceeding OSHA's permissible exposure level (exceedance fraction, PEL = 0.200 mg/m³). Time, databank, and industry were included as fixed-effects while inspection number, i.e. an identifier for the compliancy inspector, was included as a random-effect. Industry codes, represented by Standard Industrial Classification or North American Industry Classification System, were maintained or collapsed based on the number of measurements per cell to ensure sufficient sample size.

Results Databank records were amalgamated to yield 2,509 day-specific personal measurements representing 756 companies across 45 states. Regardless of industry code used, analysis revealed that for 1980 less than 5% of industry codes had an exceedance fraction (EF) greater than 0.8. The remaining industry codes were equally distributed between an EF range of 0.2–0.8 and an EF less than 0.2. Overall, more than 80% of industry codes had an EF less than 0.5, databank indicator was marginally significant ($p < 0.10$), and there was an inverse temporal trend of exceeding the PEL, with lower risk in most recent years (albeit not statistically significant).

Conclusions These statistical models allow identification of industries with different risks of elevated PAH exposure. However, because exposure may not be homogeneous within industry codes, future work will involve incorporating information on jobs/occupations with industries to more accurately identify PAH exposure.

8 EMPLOYMENT CIRCUMSTANCES AND CHEMICAL CONTROL MEASURES PROVIDED TO WORKERS WITH DERMAL EXPOSURE TO CHEMICALS - RESULTS FROM A POPULATION-BASED SURVEY

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Objective Chemical exposures in workplaces are an important occupational health and safety problem; however, there is little

published information available about the provision of basic exposure controls to workers with dermal chemical exposures across industrial sectors. This analysis investigated relationships between occupational, workplace and demographic factors and the provision of personal protective measures and/or provision of administrative controls among survey respondents exposed to chemicals at work.

Methods The inaugural Australian National Hazard Exposure Worker Surveillance (NHEWS) survey was a large, population-based telephone survey of workers from all industries. Respondents who reported dermal chemical exposure at work were asked about protective measures provided to them in the workplace, which we classified as administrative measures or personal protective measures. An ordered logistic model was used to investigate the odds of having chemical exposure protections provided by workplace and demographic variables.

Results Workplace size was the strongest predictor for the provision of exposure protection systems incorporating both administrative measures and personal protective measures. Compared to workplaces with fewer than five employees, workers in workplaces with 200 or more employees were more likely to have more comprehensive exposure protection systems, incorporating both administrative and personal protective measures (OR 4.96, 95% CI 2.97–8.28). Permanent and fixed-term employment was also associated with more comprehensive exposure protection systems compared with temporary/casual employment (OR 1.56, 95% CI 1.09–2.22) and self-employment (OR 1.69, 95% CI 1.18–2.42).

Conclusion In the NHEWS survey, employment in small workplaces, non-permanent and self-employment arrangements were associated with less comprehensive exposure protection systems. This suggests that small workplaces and non-permanent or self-employed workers may be important intervention targets for improving workers' exposure protection. Further research investigating exposure control provision in small workplaces and among insecurely employed workers as well as evaluation research of interventions to reach these workers is recommended.

Session: B. Other

9 BLOOD LEAD DETERMINANTS AND PREVALENCE OF NEUROPSYCHIATRIC SYMPTOMS IN FIREARM USERS

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Background Blood lead continues to be a health risk for Mexican workers.

Objective To identify blood lead predictors and the prevalence of neuropsychiatric symptoms in firearm users.

Material and Methods A cross-sectional study was performed on 65 males. We obtained socio-occupational and determined venous blood lead (BPb), as well as neuropsychiatric symptoms using the Q-16 questionnaire.

Results The mean (SD) [min-max] age was 34.8 (6.9) [21–60] years; mean number of years working at the company was 14 (8.5) [1–48] years. Twenty percent (13) used leaded glazed clay pottery (PbGC) in the kitchen. During practice they fired a mean 72 shots (60) [20–250], and during their employed life 5483 (8322.5) [200 to 50 000]. Mean BPb was 6.4 (2.8) [2.7–14.4] mcg/dL. Two caretakers at the firing range had 29.6 and

51.7 mcg/dL BPb. Subjects who went to practice 12 or more times a year reported a greater percentage of miscarriages in their partners (24% *vs* 0%). Twelve percent (8) showed an increase ³⁵ in neuropsychiatric symptoms. The BPb multiple linear regression model explains $R^2 = 44.15\%$, as follows: those who had ≥ 12 practice sessions per year $\beta = 0.5339$ and use of PbGC $\beta = 0.3651$.

Conclusions Using firearms and PbGC contribute to increasing BPb in the studied personnel. The BPb concentrations found, despite being low, are a health risk, as evidenced by the prevalence of neuropsychiatric symptoms. The caretakers at the shooting range are at a higher risk.

10 THE ASSOCIATION BETWEEN PARAOXONASE (PON1) POLYMORPHISMS AND CARDIOVASCULAR INJURIES AMONG NANOWORKERS

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Objectives The market of nanomaterials products is rapidly expanding. The lack of scientific evidence describing accompanying exposure and cardiovascular health risks regarding its guidance and regulation. The objectives of this study was to examine (1) the association between different nanomaterials exposure and cardiovascular biomarkers and (2) effect of *PON1 Q192R* genetic polymorphism on cardiovascular biomarkers among nanoworkers.

Methods In this cross-sectional study, we recruited 258 workers exposed to nanomaterials and 200 non-exposed controls from 14 nanomaterial handling plants in Taiwan from 2009 to 2011. The non-exposed controls were selected from the same plants, but they did not handle nanomaterials. We used the control banding matrix to categorize the risk level of nanoworkers. For each participant, we collected blood specimens to measure cardiovascular biomarkers and genotyping of *PON1 (Q192R)*. In addition, heart rate variability (HRV) was tested.

Results *PON1 Q192R* genetic polymorphism associated with PON1 activity and HRV (SDNN, RMSSD, and TP). We also found that different nanomaterials exposure affected particular cardiovascular biomarkers by controlling *PON1 Q192R* genetic polymorphism. Such as nano-carbon tube exposure resulted in a decrease in fibrinogen. Nano-SiO₂, nano-TiO₂ and nano-Ag exposure separately resulted in an increase in fibrinogen, VCT and RMSSD.

Conclusion This study adopted comprehensive cardiovascular examinations to establish the association between different nanomaterials exposure and cardiovascular injuries. We also found possible causal associations that NPs may activate the autonomic nervous system and result in alterations of heart rate variability. Additionally, *PON1 Q192R* genetic polymorphisms were significant variables for PON1 activity and HRV.

11 SECOND HAND TOBACCO SMOKE EXPOSURE AND CHANGES IN HEART RATE VARIABILITY AMONG CONSTRUCTION WORKERS

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Objective Although it has been well defined that long-term exposure to secondhand smoke (SHS) is associated with cardiovascular mortality, the acute cardiovascular effects of SHS exposure are still being explored. The aim of this study was to examine cardiovascular autonomic response, as measured by heart rate variability (HRV), to short-term SHS exposure among boilermaker construction workers.

Methods Boilermakers were recruited from a local apprentice hall where they were monitored while exposed to SHS for approximately 6 hours. A repeated measures study design was used where resting 5-lead ECGs were taken from individuals before SHS exposure (baseline), following SHS exposure (post) and the morning following SHS exposure (next-morning). The ECG recording was analysed in time (SDNN, rMSSD) and frequency (LF, HF) domain parameters in 5-minute averages. Personal SHS exposure was monitored through SidepakTM Aerosol Monitor and quantified by fine particulate matter (PM_{2.5}). Separate linear mixed-effects regression models were used to compare post- or next-morning after controlling for baseline. Exposure-response relationships with PM_{2.5} were examined.

Results 52 male boilermakers, including 30 non-smokers, were monitored between June 2010 and June 2012. The mean SHS exposure was 167 $\mu\text{g}/\text{m}^3$. After SHS exposure post 5-minute SDNN, rMSSD, LF and HF were significantly ($p < 0.05$) lower than before SHS exposure. We observed significant ($p < 0.05$) differences in SDNN, rMSSD, LF and HF between smoker and non-smokers. However, this effect had no linear dose-response relationship with PM_{2.5}. The next morning SDNN, rMSSD, LF and HF were also significantly ($p < 0.05$) lower than the baseline, but no linear dose-response with PM_{2.5} was observed.

Conclusion We observed a change in HRV both immediately and the next morning following SHS exposure. However, results indicated that there was no linear dose-response relationship between PM_{2.5} and HRV. It is unclear whether SHS-derived PM_{2.5} or other factors contributed to the altered cardiovascular autonomic response.

12 MORTALITY AND ACUTE MYOCARDIAL INFARCTION IN RCS EXPOSED WORKERS AT A SWEDISH PORCELAIN FACTORY

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Objectives Exposure to silica dust is a health hazard in the ceramic industry. The Swedish porcelain factory Gustavsberg started production in 1827, and have since 1971 performed occupational measurements of respirable crystalline silica dust (RCS). We have studied mortality and incidence of acute myocardial infarction (AMI) among workers at the factory.

Methods Exposure data from 436 personal measurements of RCS and respirable dust from 1971–2006 were processed and annual average of exposure levels were calculated. Exposure before 1971 was estimated. Analyses of mortality included 648 men and 315 women, employed for at least one year at the factory in 1958–2009. Forty three different causes of death were studied. Separate analyses of incidence of first time event of AMI included 358 men and 217 women.

Analyses were performed for all workers and for men and women separately. We also studied the effect of latency, duration and cumulative exposure to RCS and respirable dust.