

first employment [OR 8.1 (95% CI 3.2, 21) for > 30 vs < 15 years]. Surprisingly, after adjusting for years since first employment, age was still predictive of silicosis risk ( $p < 0.001$ ). Miners from Lesotho, who make up a large minority of the workforce, had an increased odds (OR 1.55; 95% CI 1.2, 1.9) of silicosis relative to South African miners.

**Conclusions** Goldmining shafts differ in silicosis risk independently of workforce age and length of mining service. Speculative explanations include higher silica fraction of the rock and greater intensity of exposure to silica. Basotho miners are at increased relative risk of silicosis, suggesting greater involvement in dustier jobs. The strong independent effect of age on silicosis risk, reported previously, remains to be explained.

## Session: 28. Health impact analysis physical factors

### 366 THE ASSOCIATION BETWEEN HEAT EXPOSURE AND WORK-RELATED INJURIES IN SOUTH AUSTRALIA, 2001–2010

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**Objective** To investigate the association between work-related injuries and temperature, to identify the groups of workers at high risk of heat-related injuries, and to explore the possible lagged effects of extreme heat on work-related injuries.

**Method** Workers' compensation claims data obtained from SafeWork South Australia for the period of 2001–2010 were transformed into time series format and merged with daily meteorological data. The impacts of temperature on daily work-related injury rates were estimated by using generalised estimating equation model with negative binomial distribution, a log link function and a first order autocorrelation structure. A piecewise linear spline function was utilised to quantify the effect of temperature on work-related injury rates below and above thresholds. The day of the week and long-term trends were adjusted.

**Result** Overall, there was an association between work-related injuries and temperature in South Australia. One degree Celsius increase in temperature below 38 was associated with 0.2% increase of injury rate. However, the injury risk declined significantly above this temperature. Specifically, the following groups of workers were at high risk of heat-related injury: male workers (IRR 1.004, 95% CI 1.002–1.005); and young workers aged < 24 (IRR 1.003, 95% CI 1.000–1.006). Occupations at risk were labourers and related workers (IRR 1.004, 95% CI 1.001–1.006), intermediate production and transport workers (IRR 1.002, 95% CI 1.000–1.004), and tradespersons and related workers (IRR 1.003, 95% CI 1.001–1.006). Industries showing an association between injuries and temperature were agriculture (IRR 1.007, 95% CI 1.002–1.013), construction (IRR 1.005, 95% CI 1.002–1.008), finance, property and business services (IRR 1.006, 95% CI 1.001–1.012), and overall outdoor industries (IRR 1.004, 95% CI 1.002–1.006). A lagged effect of extreme heat on work-related injury rates has not been found.

**Conclusion** The risk of work-related injuries is significantly associated with heat exposure, especially for vulnerable groups in the workplace.

### 367 INVESTIGATING OCCUPATIONAL FACTORS AND BIOMARKERS OF KIDNEY FUNCTION AMONG NICARAGUAN WORKERS

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**Objective** In Nicaragua, an epidemic of chronic kidney disease (CKD) with unknown aetiology has been described primarily among young, male sugarcane workers. Our goals were to characterise the type of kidney damage and evaluate the potential role of occupational factors.

**Methods** Our study population included 284 sugarcane workers, 51 miners, 60 construction workers, and 53 port workers in Western Nicaragua. For sugarcane workers in seven jobs (e.g. cane cutters, pesticide applicators, etc.), blood and urine samples were collected at the beginning and end of the 6-month sugarcane harvest. One round of samples were also collected from workers who were employed in the other three industries (but had never worked in the sugarcane industry). Biomarkers of kidney injury included serum creatinine, urinary albumin, and urinary neutrophil gelatinase-associated lipocalin (NGAL). Linear regression models were used to determine whether biomarkers of kidney injury increased during the harvest and/or varied by job.

**Results** Biomarkers of kidney injury were significantly different by sugarcane job and estimated glomerular filtration rate (eGFR) declined significantly during the harvest among those engaged in the most strenuous work tasks, while urine albumin remained low in all groups. Compared to factory workers, eGFR was lowest among cane cutters ( $p = 0.006$ ) and urinary NGAL was highest among cane cutters ( $p = 0.04$ ). Workers in other industries also had higher than expected prevalence of eGFR <60 mL/min/1.73 m<sup>2</sup>.

**Conclusions** Our results provide evidence that the type of kidney damage occurring in sugarcane workers, as well as among workers in other industries, is primarily tubulointerstitial (and not glomerular) in nature. Biomarkers of kidney injury varied by job and were highest among workers engaged in more strenuous physical labour. If acute kidney damage is on the causal pathway to CKD, heat or other work-related exposures may be contributing to this epidemic.

### 368 OCCUPATIONAL NOISE EXPOSURE AND SERUM LIPIDS: THE IMPACT OF NOISE EXPOSURE LEVEL AND HEARING PROTECTION

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**Objectives** Environmental and occupational noise exposure have been related to increased risk of cardiovascular disease. Activation of the physiological stress response and altered serum lipid levels have been proposed as alternative causal pathways. The objective of this study was to investigate the relation between occupational noise exposure and serum levels of total cholesterol, LDL-cholesterol, HDL-cholesterol, and triglycerides when

taking account of the use of hearing protection devices (HPD) and well-established predictors of lipid levels.

**Methods** This cross-sectional study included 460 Danish industrial workers and 69 financial workers included as a reference. They provided a serum sample and lipid levels were determined. All participants wore portable dosimeters that recorded noise exposure levels at the dominant shoulder every 5 seconds for a 24 hour period. We extracted measurements obtained during work and calculated the  $L_{Aeq}$  value. For 341 workers who kept a HPD diary we subtracted 10 dB from every noise recording obtained during HPD use and estimated the noise exposure level at the ear.

**Results** The mean measured noise exposure level was 80.0 dB (A) [range: 55.0–98.9] and the mean estimated level at the ear 77.8 dB(A) [range: 55.0–94.2]. The measured level was strongly associated with increasing levels of triglycerides ( $p = 0.01$ ), cholesterol-HDL ratio ( $p < 0.01$ ) and decreasing levels of HDL-cholesterol ( $p = 0.01$ ), but only in unadjusted analyses that did not account for HPD use. In analyses of estimated noise exposure level at the ear that were adjusted for body mass index and smoking status among others no effects were seen.

**Conclusion** No association between current occupational noise exposure level and serum lipid levels was observed. This does not indicate that a causal pathway between occupational and environmental noise exposure and cardiovascular disease, if such a relation exists, includes alteration of lipid levels.

### 369 ACUTE EFFECTS OF OCCUPATIONAL NOISE EXPOSURE ON 24-HOUR AMBULATORY BLOOD PRESSURE IN WORKERS WITH HYPERTENSION

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**Objectives** Hypertension is the prevalent disease in the workplace. Although the elevation of blood pressure from exposure to occupational noise has been recognised, research on susceptibility to occupational noise exposure in adults with hypertension is not reported. This repeated-measure study investigated the effects of occupational noise exposure on 24-hour ambulatory blood pressure in a cohort with hypertensive and normotensive workers.

**Methods** We enrolled 117 volunteers in an aircraft-manufacturing industrial cohort followed from 1998 to 2008. Individual noise exposure and personal blood pressure were determined simultaneously over 24 hours in 19 hypertensive and 98 normotensive workers during the working and non-working days. Linear mixed-effects regressions were used to investigate the effects of noise exposure on ambulatory systolic blood pressure (SBP) and diastolic blood pressure (DBP) between two groups during different periods by controlling for potential confounders.

**Results** Hypertensive workers had significantly higher mean values of ambulatory SBP (12.6 [95% confidence interval: 10.3–15.0] mmHg; 10.3 [7.8–12.8] mmHg) and DBP (8.0 [6.3–9.7] mmHg; 7.2 [5.3–9.1] mmHg) compared with normotensive workers on both working and non-working days. Such differences between two groups were obviously higher on the working day than on the non-working day. Per one A-weighted decibel (dBA) increase in the 24-hour average noise exposure was significantly associated with transient elevations of SBP (0.25 [0.15–0.36] mmHg) and DBP (0.16 [0.09–0.23] mmHg) among

hypertensive workers on the working day. Such effects on SBP and DBP still persisted at the 60-min time-lagged noise exposure and the increases of SBP were more pronounced in the hypertensive group than in the normotensive group.

**Conclusions** Hypertensive workers are more susceptible to noise exposure, especially the effect on ambulatory SBP. These results suggest a need for the more protection to the susceptible population.

### 370 CAN COMPENSATION STATISTICS DETECT THE IMPACT OF SUMMER OUTDOOR TEMPERATURES ON WORKERS' HEALTH AND SAFETY? PRELIMINARY RESULTS IN QUEBEC (CANADA)

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**Objectives** Increased temperatures associated with climate change are likely to have impacts on occupational health and safety all over the world. We aimed to explore potential relationships between summer outdoor temperatures and occupational compensation statistics for heat-related morbidity and mortality.

**Methods** Daily compensation counts in the region of Montreal for heat-related health outcomes (such as heat strain, heatstroke, loss of consciousness) were obtained from the workers' compensation board of Quebec for the months of May to September over the period 2000–2010. Daily summer outdoor temperatures for the study period were obtained from Environment Canada. Associations between daily compensation counts and temperatures were analysed with regular Poisson and negative binomial regression models.

**Results** There were 35 compensations for heat-related health outcomes during the 11-year period (for a working population of approximately 1.85 million). Incidence rate ratio (IRR) obtained from preliminary Poisson regression analyses was 1.76 (95% CI: 1.55–2.00) per 1°C temperature increase. This large IRR translates into a small increase in compensations, given the low compensation base rate (0.002 compensation per day for heat-related health problems) at the average temperature of 18.4 °C. Virtually identical results were obtained with a negative binomial regression. Analyses will be carried out for other regions of Quebec and for indirect impacts of heat (e.g. accidents/injuries related to fatigue and lack of vigilance), with various metrics of temperature (e.g. maximum and minimum, Wet Bulb globe Index), and will be stratified by industrial sectors, age and sex when possible.

**Conclusions** These preliminary results suggest that the effect of increases in summer temperatures can be detected in compensation statistics. The results of this work could prove useful for the surveillance of current and future occupational health and safety risks associated with outdoor temperatures and to orient interventions.

### 371 PRIORITY SETTING FOR FUTURE OCCUPATIONAL SAFETY AND HEALTH (OSH) RESEARCH IN EUROPE

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