

with workers born in India having a lower probability of being exposed (Predicted probability of exposure: 50 (95% CI 46,54) compared with the other migrant workers.

**Discussion** High strain jobs adversely affected wellbeing independent of migrant status. Job strain was not associated with either exposure to carcinogens or migrant status. However migrant status was associated with exposure to carcinogens.

#### 04C.5 PRECARIOUS WORK AND PRECARIOUS LIVES: AN ANALYSIS OF THE ASSOCIATION BETWEEN EMPLOYMENT RELATIONSHIPS AND ACCESS TO SOCIAL AND HEALTH BENEFITS

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10.1136/OEM-2019-EPI.100

**Background** Precarious employment relationships impact many facets of society, among them health and health inequities for workers and their families. The objective of the current analyses was to investigate the association between precarious employment and access to social and health employment benefits in the Canadian context.

**Methods** The General Social Survey (GSS) is an annual and national cross-sectional survey administered by Statistics Canada. The GSS2016 focused on social trends in education, work and home conditions to inform policy issues. The association between employment status (regular versus seasonal, term, casual) and access to employment benefits (pension, sick leave, vacation, disability, workers' compensation, parental leave, supplemental medical, and other) was investigated using multivariable logistic regression, adjusted for socio-demographic (age, sex, education, visible minority, immigrant), occupation and industry, and physical and mental disability characteristics.

**Results** Among those employed at the time of the survey (60.4% of 19 609 respondents), the majority had regular (80.8%) versus precarious seasonal (7.0%), casual (6.9%), or term (5.3%) employment. Twenty-eight percent of precarious workers reported no employment benefits compared to 6% of regular workers (ORadj=4.99, 95% CI 3.53, 7.05). By type of benefit, the greatest disparity between precarious employment and no benefits was reported for disability insurance (ORadj=2.45 95% CI 1.81, 3.32) and supplemental medical benefits (ORadj=2.54 95% CI 1.90, 3.38), while the least disparity was reported for workers' compensation benefits (ORadj=1.46 95% CI 1.11, 1.92).

**Discussion** Precarious work may equate to precarious living for a significant number of workers without pension, disability, sick leave, family or medical employment benefits. The impact of the observed disparity in employment benefits for workers with regular versus precarious attachment to the labour market warrants longer-term investigation, but the findings suggest that precarious work could be a significant social determinant of health.

#### 04C.6 'HEALTHY ON THE OUTSIDE, SICK ON THE INSIDE' - FORESTRY WORKERS, EMBODIMENT AND BIOSOCIALITY

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10.1136/OEM-2019-EPI.101

Health outcomes for workers in forestry are shaped by a complex range of exposures, including exposures related to the work environment generated by the industry itself and within a natural environment. We understand how the worker experiences these exposures is shaped by a range of contextual factors including external factors such as market prices and legislation; employer specific factors (e.g. pace of work, provision of Personal Protective Equipment (PPE)); to task specific factors (e.g. repetition, worker control). And, health outcomes from these exposures can range from immediate to delayed, and in duration from acute to chronic. This paper draws on a qualitative research project conducted with forestry workers, their contractors and the CEOs of corporate forests in New Zealand and argues that we need to know more if we are to intervene effectively. Face to face interviews and focus groups were conducted with 100 participants at multiple sites throughout New Zealand (Northland, Gisborne, Central North Island, Hawkes Bay, Wanganui and Otago). This paper focuses specifically on the experiential aspects of being a forestry worker and contractor and how the concept of embodiment and bio-sociality is a useful means by which to understand how bodies are produced and reproduced through labour, how labour converts bodies into social entities and that the body is not exclusively in either the biological or social world, rather bodies are made, have social value and the sociality of bodies shapes altered biologies. These concepts allow us to understand why it is that workers self-describe and are described as being 'healthy on the outside, sick on the inside' or 'fit on the outside, sick on the inside' and to unpack how social groups form around biological identities marked by ill health or illness susceptibility.

## Chemical and Physical Hazards

#### 04D.1 LONGITUDINAL ANALYSIS OF INCIDENCE OF BERYLLIUM SENSITIZATION IN A US NUCLEAR WORKFORCE

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10.1136/OEM-2019-EPI.102

The goal of this study was to evaluate trends in incidence of beryllium sensitization (BeS) and the impact of exposure regulation in a US Department of Energy (DOE) nuclear worker cohort. The 1999 DOE final rule for Chronic Beryllium Disease Prevention Program was established to accomplish three goals: reduce the number of workers currently exposed to beryllium; minimize exposures and the potential for exposure; and establish medical surveillance requirements to ensure early detection of disease. While the impact of this rule has been evaluated through observational reports, with decreases in exposure and reported cases, there have been no published studies assessing whether exposure reduction measures result in the prevention of BeS.

**Methods** We examined the incidence of beryllium sensitization in a cohort of 6915 workers with almost 29,000 BeLPT results obtained between 1994–2018. All workers

were employed at a single DOE nuclear site that implemented the DOE beryllium rule between 1999–2002. Workers were classified as BeS when they met one of the following definitions: two abnormal blood BeLPT results, one abnormal and one borderline blood BeLPT result, three borderline blood BeLPT results, or one abnormal lung lavage BeLPT result. Descriptive statistics, longitudinal analyses, and correlation analyses were utilized to evaluate the trends in incidence before and after implementation of the beryllium rule.

**Results** Results indicated a general decrease in exposure and BeS incidence rates, though there are some years with notable increases presumably due to increased clean-up activity, where construction and decommissioning workers had opportunity for exposure from legacy beryllium operation materials that were not part of normal current production activity.

**Conclusion** These findings provide support for the hypothesis that the DOE Beryllium Rule helps prevent beryllium sensitization. Future research will more precisely assess the relationship between beryllium exposure levels and beryllium incidence over time.

#### 04D.3 BONE LEAD ASSOCIATIONS WITH BLOOD LEAD, KIDNEY FUNCTION, AND BLOOD PRESSURE AMONG U.S., LEAD-EXPOSED WORKERS IN A SURVEILLANCE PROGRAM

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10.1136/OEM-2019-EPI.103

**Objectives** Bone lead and past blood lead (BL) levels may be more strongly associated with current health effects than current BL, representing recent exposure. We examined whether current bone lead is correlated with maximum past BL, and compared three measures of lead as predictors for current blood pressure (BP) and kidney function among workers with past occupational exposure to lead.

**Methods** Adult men in a lead surveillance program living within 200 miles of New York City were enrolled in this observational study during 2016–2017. We gathered data on current bone and BL, BP, and estimated glomerular filtration rate (eGFR). Maximum past BL was obtained from prior surveillance program data. Regression models were used to determine associations of health endpoints with different measures of lead.

**Results** Among 211 participants, median (interquartile range) bone lead, maximum past BL, and current BL were 13.8 (9.4–19.5) µg of lead per gram of bone mineral, 29.0 (14.0–38.0) µg/dl, and 2.5 (1.5–4.4) µg/dl, respectively. Both maximum past and current BL were significantly associated with current bone lead in adjusted analyses ( $p < 0.0001$  for both), with associations driven by those with the highest BL levels. Bone lead was associated with increased systolic BP ( $p = 0.02$ , model R-square = 0.16), but quartile analyses were not monotonic. Bone lead was also non-significantly associated with decreased (worse) eGFR (regression coefficient = -0.15,  $p = 0.18$ , model R-square = 0.28).

**Conclusions** Bone lead was significantly associated with past maximum and current BL. Bone lead, but not past maximum or current BL, was associated with elevated systolic BP.

#### 04D.4 CHANGES IN KIDNEY FUNCTION AMONG SUGARCANE CUTTERS ON A MODERATELY HOT SUGAR PLANTATION IN SOUTH AFRICA

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10.1136/OEM-2019-EPI.104

**Introduction** Epidemic chronic kidney disease of unknown cause (CKDu) occurs among sugar cane workers, notably cane cutters doing heavy manual work in hot tropical environments in Mesoamerica. Repetitive dehydration consequent on strenuous work in heat is posited as the cause. A Nicaraguan cohort study showed remarkable kidney function decreases across six weeks of the cane cutting season consistent with the dehydration hypothesis. This Nicaraguan study was replicated on a sugar plantation in South Africa about 3 500 kms from the equator and cooler than previous study locations to examine whether less extreme ambient conditions resulted in reduced kidney stress.

**Methods** 38 cane cutters and 36 referents of similar socio-economic status but doing less strenuous work on the same plantations provided pre- and post-shift blood and urine samples for measures of kidney function and hydration on Day 1 and Week 9 of the cutting season. Frozen specimens were transported to a chemical pathology laboratory in Johannesburg for analysis. Parameters measured included cystatin C, eGFR (derived from cystatin C), serum creatinine, serum neutrophil gelatinase-associated lipocalin (NGAL), serum uric acid and osmolality.

**Results** Minimum and maximum temperatures were 20.9 and 26.5°C on Day 1 and 13.6 and 26.6°C on Week 9. There were clinically modest, albeit statistically significant, increases in mean cystatin C pre-shift values between Day 1 and Week 9 in the cane cutters: 0.847 to 1.011 mg/L ( $p = 0.00$ ) which means a considerable decline in eGFR. Other results were not consistent among the various markers of effect on the kidneys. The magnitude of the increase in cystatin C among referents was similar to the cutters: 0.771 to 0.904 mg/L.

**Conclusions** Kidney function markers seemed to be much less affected in the cooler study location than in the hotter one.

#### 04D.5 LEFT SIDED HEARING LOSS AMONG HEAVY EQUIPMENT OPERATORS (HEOS) IN MINING INDUSTRY

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10.1136/OEM-2019-EPI.105

**Introduction** Open surface mining is utilized to extract limestone for the production of cement. Using heavy motor vehicles (HMs) and other earthmoving equipment, skilled personnel [HEOs] perform this operation. HEOs are exposed to significant noise (80–90 dBA) emitted by these HMs for about 8 hours a day. We report the results of pure tone audiometry (PTA) conducted on HEOs as part of a health surveillance programme.

**Methods** In this observational study, 108 HEOs working in a large scale mining industry in South India were assessed for