

observed when the drop was attributed entirely to loss of convective heat. For males, the most pronounced change in thermoregulation was in skin moisture and TEWL, suggesting a greater thermal load from SRH exposure in males that required water evaporation from the skin to regain thermal balance.

Conclusions The exposure to SRH presented unique influences to core metabolism and thermoregulation compared to those from exposure to convective heat. Adequate clothing protecting against temperature step and the residual influence of SRH was necessary in thermal transient.

385 CALIFORNIA HEAT ILLNESS PREVENTION STUDY (CHIPS) IN IMMIGRANT LATINO FARM WORKERS

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Objectives To quantify the contributions of work intensity and ambient heat to the risk of heat illness in field labourers working with diverse crops.

Methods Field workers were assessed throughout a single day-time work shift. Body weight and blood osmolality changes, continuous heart rate and core body temperature (using ingested telemetry) were recorded. Personal and stationary (area) ambient air temperature and relative humidity were measured using individual data loggers and weather stations. Workers were questioned about their current and historical experiences with field work in the heat.

Results One-hundred workers were assessed between late June and August 2012 on seven farms in the California Central Valley. Thirteen were female, mean age was 36.8 (SD = 11.9) years. Ninety-four percent were born in Mexico, the remainder in the USA, and over 95% of the workers identified as Latino. Educational level was low; 47% had attended ≤ 6 years of school. Twenty-two percent lost over 1.5% of their original body weight (ACGIH suggested criteria for increased risk of dehydration), 80.2% increased serum osmolality, with 21% increasing $\geq 3\%$. Males lost significant weight (-0.56 kg, 95% CI -0.40 to -0.73 kg) as did those whose blood osmolality increased (-0.59 kg, 95% CI -0.34 to -0.85 kg). Associations will be assessed between heart rate, task, crop, ambient conditions and core body temperature.

Conclusions Field workers exhibited reduced hydration status over their work shift. Combined physiological and survey data may allow susceptibility to heat illness in summertime agricultural workers to be quantified.

386 ANNOYANCE FROM OCCUPATIONAL NOISE: THE IMPACT OF EXPOSURE LEVEL AND HEARING PROTECTION

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Objectives. Annoyance from transportation noise is well characterised but little is known about occupational noise. We investigated the relation between occupational noise exposure level, the use of hearing protection devices (HPD), and noise annoyance.

Methods We studied 452 industrial workers and 68 financial workers who post shift reported noise annoyance during work on a 5-point scale. Noise exposure level was recorded every 5 seconds at the dominant shoulder for 24 hours and we calculated the L_{Aeq} value for work hours. For 342 workers who kept a HPD diary, we subtracted 10 dB from every noise recording obtained during HPD use and estimated the L_{Aeq} value 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]. Fifty-one percent of workers exposed at a measured noise level ≥ 85 dB(A) were annoyed (the upper 3 points on the annoyance scale) and 14% highly annoyed (the upper 2 points). In a logistic regression model that also adjusted for neuroticism, annoyance increased monotonously with 6% per dB(A) (OR = 1.06, 95% CI 1.02–1.09). A slightly lower trend was seen per estimated L_{Aeq} level at the ear (OR = 1.04, 95% CI 0.99–1.07). HPD use was strongly associated with annoyance when adjusted for noise exposure level (OR 2.3, 95% CI 1.3–3.9).

Conclusions Increasing occupational noise exposure level was associated with increasing prevalence of annoyance but at a much lower annoyance level than seen for transportation noise. We documented no gainful effect of hearing protection, but the opposite. An obvious explanation is that noise annoyance is not solely a question of the amount of noise appearing at the ear but also other characteristics of a noisy work environment; furthermore, that HPD use is predicted by noise sensitivity and other individual characteristics that are associated with noise annoyance.

387 EXPOSURE TO PARTICLES AND NOISE DURING HIGHWAY MAINTENANCE WORK AND ASSOCIATED SHORT-TERM CARDIOVASCULAR HEALTH EFFECTS

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Objectives Highway maintenance workers are exposed to elevated particle and noise levels during their work. Exposure to particles as well as to noise has been linked to cardiovascular diseases. Thus, this worker population may be at higher cardiovascular risk. With our study we aimed to provide a better understanding of the workers' exposure and to assess associated short-term health effects.

Methods We monitored the particle and noise exposure of 18 road maintenance workers during five repeated, non-consecutive work shifts and measured health endpoints including blood pressure, selected blood markers for inflammation and thrombosis, continuous ECG as well as lung function and exhaled nitric oxide (FeNO).

Results The workers' exposure to particles and noise was variable between work shifts and depended on work activities. Fine particle ($PM_{2.5}$) mass concentrations over full work shifts ranged from 20.3 g/m^3 to 321 g/m^3 . Particle number concentrations were between 1.6E4 particles/ cm^3 and 4.1E5 particles/ cm^3 . Averaged noise levels were frequently above 85dB[A], ranging from 73.3 dB[A] to 99.6 dB[A]. The 17 subjects included for health assessments had an average age of 45.2 years (SD 7.6) and a BMI of 26.6 kg/m^2 (2.6). Average systolic/diastolic blood

pressure 15 hours after work was 120.3 (11.7)/77.0 (7.5) [mmHg]; mean FeNO 19.0 ppb (7.6). Mean blood levels of C reactive protein and IL-8 were 2.5 g/ml (3.7) and 12.2 pg/ml (3.8) respectively.

Conclusions Our database serves as a basis to investigate short-term health effects using mixed effect regression models. We hypothesise to find particle related changes in heart rate variability and inflammation markers and we will investigate combined health effects of particles and noise. The variable exposure and the low association between particles and noise are a good opportunity to study health outcomes related to these two exposure types in the near-road environment.

This abstract does not necessarily represent US EPA policy.

388 EXPOSURE ASSESSMENT FOR A CANADIAN CENSUS COHORT STUDY OF NIGHT SHIFT WORK AND CANCER RISKS

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Objectives Shift work has been categorised as a probable human carcinogen by the International Agency for Research on Cancer. This is an exposure assessment for a study of shift work and cancer in a cohort created by linkage of the Canadian national cancer registry and the 1991 long form census, which recorded occupation and industry of employment for 2.1 million Canadians, but did not query specific exposures. We used a contemporary (1993) survey to characterise shift work exposures by occupation, industry, and sex.

Methods Analyses were conducted on the 1993 Survey of Labour and Income Dynamics (SLID) to determine the prevalence of night shift work in the contemporary population, highly exposed industries and occupations and sex differences in shift work prevalence within industries. All analyses were restricted to the employed population and weighted to account for sampling methodology.

Results 17% of employed 1993 SLID respondents were exposed to night shift work, with 5% of reporting a regular evening work schedule, 2% a regular night shift and 10% a rotating shift. Night shift work was most common (>65%) in pulping control operators in the pulp and paper industry; food service helpers, servers and bartenders in hotels and motels; uncommissioned police officers; and light duty cleaners. Exposure to shift work was similar in men and women (18% vs 16%), but sex differences were apparent in certain industries. Within protective services (includes police) shift work prevalence was 11% in women and 20% in men while within hospitals prevalence was 37% in women and 29% in men.

Conclusions This exposure assessment for a census cohort has the advantage of drawing from a contemporary population based sample, demonstrating that occupation, industry and sex are important dimensions for a shift work exposure matrix designed for application to a census cohort or other general population sample.

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389 RISK OF TOTAL AND AGGRESSIVE PROSTATE CANCER AND PESTICIDE USE IN THE AGRICULTURAL HEALTH STUDY

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Objectives Pesticides have been associated with prostate cancer risk, but few studies have evaluated specific pesticides and studies have not explored differences by subtype to identify important risk for the more lethal, aggressive, form of prostate cancer. Therefore, we studied the risk of prostate cancer associated with specific pesticides among 1,962 incident cases, including 919 cases of aggressive prostate cancer (distant Stage or poorly differentiated or Gleason ≥ 7 or fatal prostate cancer) diagnosed between 1993 and 2007 from 54,412 men of the Agricultural Health Study (AHS) cohort.

Methods Poisson regression analysis was used to calculate rate ratios (RR) and 95% confidence intervals (95% CI) for lifetime use of 48 pesticides and prostate cancer incidence.

Results There was no overall association between any specific pesticide and prostate cancer risk. However, three organophosphate insecticides were significantly associated with aggressive prostate cancer: fonofos (RR for the highest quartile of exposure (Q4) versus nonexposed = 1.63, 95% CI: 1.22–2.17; p-trend <0.001), malathion (RR for Q4 versus nonexposed = 1.43, 95% CI: 1.08–1.88; p-trend = 0.04), and terbufos (RR for Q4 versus nonexposed = 1.29, 95% CI: 1.02–1.64; p-trend = 0.03). The organochlorine insecticide aldrin was also significantly associated with risk of aggressive prostate cancer with a RR for Q4 versus nonexposed = 1.49, 95% CI: 1.03–2.18; p-trend = 0.02.

Conclusions Four insecticides were observed to increase the risk of aggressive prostate cancer in the AHS. Advantages of this analysis over previous analyses include a large number of prostate cancer cases and detailed information on lifetime use of specific pesticides. This is the first time specific pesticides have been studied and implicated as risk factors for aggressive prostate cancer and may suggest that pesticides play a role in prostate cancer progression rather than at the earlier initiation stage of transformation.

390 THE PIPAH STUDY: A NEW PROSPECTIVE STUDY OF PESTICIDE APPLICATORS

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Objectives The PIPAH Study, a new prospective study of professional pesticide applicators in Great Britain is being established. The objectives of the study will be to monitor the long-term health of these pesticide applicators and to investigate associations between health outcomes and occupational exposure to pesticides.

Methods The 21,000 members of two national registers of professional pesticide applicators will be invited to participate in the study. The schedule of reminders includes a postcard sent to all potential participants shortly after the initial invitation, an article in the trade journal for pesticide applicators, and a full study pack sent to non-responders. Those who agree to participate will complete a general questionnaire covering their work history, previous pesticide usage, personal and family medical history, signs/symptoms of neurological disease, socioeconomic factors, diet and lifestyle. This can be completed using the paper questionnaire sent to them or online. New members of the two registers will be invited to participate in the study in a rolling recruitment programme.