

of conventional or unconventional origin, is overwhelming the healthcare systems.

**Objectives** Collaborative efforts are needed to identify the aetiology of CKDu, and its prevention. To identify current knowledge and gaps, and to propose future research, the university-based program Salud, Trabajo y Ambiente en América Central (SALTRA) sponsored a workshop in Costa Rica, November 2012.

**Method** Over 50 researchers from 15 countries participated, with expertise in epidemiology, occupational health, clinical and experimental nephrology and nephropathology, environmental and social sciences. Recent findings were reported, including the first biopsy study in CKDu cases from the region, demonstrating an unexpected mixed pattern of glomerular and tubular sclerosis. A mechanistically plausible link between concomitant dehydration and high NSAID consumption, driven by extreme ergonomic work load and musculoskeletal strain, leading to kidney damage was also proposed.

**Results** Papers summarising current knowledge, and working group reports and recommendations are made openly available on a website. Summary presentations will be published in international peer-review journals. A Research Consortium (SALTRA coordinating) was initiated.

A Statement was issued noting the high prevalence of CKDu in Central America, poverty and deplorable work conditions as driving forces, and the lack of treatment. Urgent actions are demanded.

## Session: Q. Exposure assessment III

### 127 CHANGE IN SUBJECTIVE THERMAL SENSATION AND PREDICTED DISSATISFACTION AS A RESULT OF USING SUNSCREENS AND SUN-PROTECTIVE GLOVES

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**Objectives** Sunscreens and long-sleeved sun-protective gloves (gloves) were commonly used in Taiwan for protection against excess solar ultraviolet radiation. However, their use in the warm-and-humid weather typically encountered in Taiwan might significantly alter thermal comfort of the users. This study investigated the change in subjective thermal sensation of people as a result of using sunscreens and gloves to evaluate potential thermal stress.

**Methods** Three groups of participants (sunscreens, gloves, and control) each consisting of ten females were evaluated for their subjective sensation by thermal sensation vote (TSV) before and after adaptation to different thermal status in a microclimatic chamber. The status inside the chamber corresponded to a temperature of 22, 25, 28, 31, or 34°C and a relative humidity of 45, 60, or 75%. In each experiment, the participants in designated treatment were acclimatised in the chamber for 30 min, and the TSV was gauged at the beginning and end of acclimatisation. The data were analysed for temperatures of thermal neutrality and magnitudes of 80% thermal acceptability and comfort zones. The TSV were also compared to the skin temperature to define a thermal neutrality-equivalent thermoregulatory index.

**Results** As the percentage-of-predicted-dissatisfied modelling indicated, the percentage of thermal dissatisfaction among glove users was greater than that of sunscreen users. The neutral temperature increased after thermal adaptation for sunscreen users (25.5–26.4°C) but not for glove users. The thermal comfort

zone narrowed down in both the glove and sunscreen groups during adaptation.

**Conclusions** The use of gloves facilitated formation of a thermal pocket independent of the ambient thermal environment between the gloves and the skin surface, and as a result the heat accumulated inside the gloves was not sufficiently dissipated and causing thermal discomfort. The users should be alert of potential thermal stress.

### 128 DEVELOPMENT OF A JOB-EXPOSURE MATRIX (JEM) TO DESCRIBE PESTICIDE EXPOSURE IN SPANISH WORKERS (1996–2005)

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**Objectives** Pesticides are intensively used in Spain in a wide range of economic activities such as agriculture, farming, wood treatments or pest control, reaching in 2005 a consumption of more than 100,000 ton/year. Exposure to these substances has been proven to have negative effects on human health. However, there is little information available regarding the levels and frequency of exposure for workers, or the job titles associated with the worst exposure indicators. This study aimed to collect the available information on occupational pesticide exposure in Spain as a job-exposure matrix (JEM).

**Methods** The work was carried out in the context of MatEmEsp Project, which aims to build a Spanish general JEM for the period 1996–2005. Data from the Finnish JEM (FINJEM), Spanish companies risk assessments and the review of available literature was used to identify exposed occupations and relevant chemical agents in the study period as well as to establish the exposure estimates.

**Results** Ten active ingredients were selected as reference agents of the study period including fungicides, herbicides and insecticides. Of the 482 occupations in the Spanish job coding system, 45 were identified as exposed, with sufficient information to establish the exposure estimates. Regarding fungicides and herbicides, 39 occupations showed a low level of exposure whereas 6 were found to have a medium level. Within insecticides, a low exposure was found in 19 occupations while 26 showed a medium level.

**Conclusions** This is the first systematic collection of the available data on occupational exposure to pesticides in Spain following the JEM development methodology. Although low availability of measurements reduced the accuracy of the estimates established, they can be useful for epidemiological studies and health and safety management programs, amongst other uses. All collected data as well as the exposure estimates established can be found in the MatEmEsp website ([www.matemesp.org](http://www.matemesp.org)).

### 129 URINARY BENZENE AS A BIOMARKERS OF LOW-LEVEL EXPOSURE TO BENZENE

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We compared the ability of the urinary excretion of *trans*, *trans*-muconic acid (*t,t*-MA), *s*-phenylmercapturic acid (*s*-PMA)

and urinary benzene (U-Benz) to detect low level occupational and environmental exposure to benzene.

**Methods** We monitored airborne benzene by personal air sampling, and U-Benz, *s*-PMA, *t,t*-MA and cotinine (U-Cotinine) in spot urine samples, collected at 8 am and 8 pm, in 32 oil refinery workers and 65 subjects, randomly selected among the general population of urban and suburban Cagliari, Italy.

**Results** The median concentration of airborne benzene was 25.2 g/m<sup>3</sup> in oil refinery workers, and 8.5 g/m<sup>3</sup> in the general population subgroup. U-Benz in morning and evening samples was significantly more elevated among oil refinery workers than the general population subgroup ( $p = 0.012$ , and  $p = 7.4 \times 10^{-7}$ , respectively) and among current smokers compared to non-smokers ( $p = 5.2 \times 10^{-8}$ , and  $p = 5.2 \times 10^{-5}$  respectively). Benzene biomarkers and their readings in the two sampling phases were well correlated to each other. The Spearman's correlation coefficient with airborne benzene was significant for U-Benz in the evening sample, but not for *t,t*-MA and *s*-PMA in either sampling. Morning U-Cotinine excretion showed a good correlation with U-Benz in the morning and in the evening sampling ( $p < 0.001$ ), and with *s*-PMA in the evening sample ( $p < 0.001$ ), but not with *t,t*-MA in either samplings. *t,t*-MA in the evening sample was the only biomarker showing a moderate inverse correlation with BMI ( $p < 0.05$ ). The multiple regression analysis adjusting by BMI and number of cigarettes smoked during the day confirmed the results of the univariate analysis.

**Discussion** Our results suggest that unmetabolised U-Benz would allow a more reliable biomonitoring of low-level exposure to benzene than *s*-PMA and *t,t*-MA.

### 130 DEVELOPMENT OF A PESTICIDE CROP/LIVESTOCK EXPOSURE MATRIX USING DATA FROM THREE AGRICULTURAL COHORT STUDIES IN THE AGRICOL CONSORTIUM

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**Objectives** Excess risk of lympho-hematopoietic malignancies has been documented in farmers. Although numerous studies have investigated associations of various pesticides with lympho-hematopoietic malignancies, results have been inconsistent. A crop/livestock-exposure matrix for estimating exposures to pesticides is being developed for a pooled analysis of lympho-hematopoietic malignancies in farmers.

**Methods** Data arise from the United States Agricultural Health Study (AHS), the French Agriculture and Cancer Study (AGRICAN), and the Cancer in the Norwegian Agricultural Population Study. When study data are unavailable, historical information on region and crop/livestock specific pesticide use are being gathered from agricultural records, experts, and the French PESTIMAT matrix. Selection of matrix axes is based on information availability and importance in predicting pesticide exposures; of crop/ livestock categories is based on major commodities in each

country and common production across or frequent production within the cohorts; and of chemical groups is based on frequency of use and *a priori* expectations of associations with lympho-hematopoietic malignancies.

**Results** The cohorts contain varying levels of exposure information. AHS contains information on ever lifetime chemical use for 52,394 private applicators. AGRICAN contains data on crops/livestock ever produced in the lifetime of 182,132 farmers. For each 10-year agricultural census from 1969–1989, the Norwegian cohort contains data on crops/livestock farmed by 248,000 farmers and spouses. Matrix axes will be defined by time period, crop/ livestock produced and pesticide chemical group. Matrix cells will be filled with pesticide use information by chemical group and, if possible, chemical substance. Crop/ livestock groups will include major categories such as corn, grains, potatoes, soybeans, tobacco, vineyards, poultry, beef cattle, dairy cattle, swine and sheep/goats.

**Conclusions** This work demonstrates the development of a pesticide exposure matrix using pooled data from multiple countries, which will be used for the largest evaluation of pesticides and lympho-hematopoietic malignancies to date.

### 131 RESPIRABLE QUARTZ EXPOSURE ON TWO MEDIUM-SIZED FARMS IN SOUTHERN MOZAMBIQUE

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**Background** Little is known about the potential for overexposure to respirable quartz in farming, in most parts of the world.

**Objectives** To measure respirable dust and quartz exposure of tractor operators on two medium-sized dry climate farms.

**Methods** This is a descriptive cross-sectional study design of dust exposure of four tractor operators. Farms were selected by convenience sampling. The MDHS 14/3 and FTIR MDHS 101 HSE methods were used to measure dust and to analyse the mass of quartz in dust, respectively.

**Results** Seventy respirable dust measurements were done. Respirable dust and quartz ranged from 0.01 to 2.88mg/m<sup>3</sup> and 0.001 to 0.30mg/m<sup>3</sup>. All operators had at least one respirable quartz exposure above 0.1 mg/m<sup>3</sup>. Only 17% of respirable quartz concentrations were lower than the ACGIH TLV of 0.025 mg/m<sup>3</sup>.

**Conclusion** The potential for over-exposure to respirable quartz was demonstrated. There was a great deal of variability in these farms which has implications for sampling strategies for dust in farming.

## Session: R. Musculoskeletal disease

### 132 REPEAT WORKER'S COMPENSATION CLAIMS: A PROSPECTIVE ANALYSIS IN ONTARIO, CANADA AND VICTORIA, AUSTRALIA

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**Objective** Many of the demographic and labour market characteristics of workers that are associated with the risk of work-