

Abstracts

Poster session 2

P2.1 ASTHMA IN COTTON FACTORY WORKERS

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Introduction: Occupational related exposure to cotton dust has been implicated in exacerbation of airway diseases, including byssinosis, chronic bronchitis, and asthma. The role of separate components of cotton dust as agents of asthma among cotton factory workers still remains unclear.

Material and methods: A group of 158 cotton factory workers (77 with asthma and 81 with chronic bronchitis) was examined using a number of clinical and allergological tests. The working place environment was investigated for airborne cotton dust, bacteria, and moulds.

Results: Practically each technological stage demonstrated a concentration of airborne cotton dust exceeding threshold limit value. The cotton dust was contaminated with moulds (*Aspergillus fumigatus*, *Alternaria tenuis*, *Candida albicans*), and bacteria (staphylococci and aerogenic bacilli). The prevalence of asthma in this cotton factory was 25.5/1000 workers. The majority of patients with asthma (84.3%) was exposed to cotton dust for ≥ 16 years, and the asthma duration was 6 years on average. In workers with asthma, a high level of specific IgE-antibodies to fungoid allergens (*Alternaria* and *Candida*) and specific IgG-antibodies to cotton fibre allergen were revealed. An immunomodulator "thymogen" used in asthmatic patients effected a decrease of allergen specific IgG antibodies and clinical asthma improvement.

Conclusion: Allergen specific antibodies to some component of cotton dust were discovered among cotton factory workers with asthma, thus demonstrating participation of the antibodies in the complex asthma pathogenesis.

P2.2 RESPIRATORY RESPONSE TO ENDOTOXIN PREDICTS SYSTEMIC RESPONSE IN VOLUNTEERS IN A SWINE BARN

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Introduction: We wished to investigate if systemic response could be predicted by forced expiratory volume in 1 second (FEV₁) response in naive volunteers following swine barn exposure in which endotoxin was an exposure variable.

Methods: Naive males were tested at three exposure levels: baseline (laboratory); low endotoxin and dust (swine barn room treated with canola oil); and high endotoxin and dust (untreated swine barn room). Subjects were classified as "more responsive" (n=9) or "less responsive" (n=11) based on FEV₁ reduction following high endotoxin exposure. Health measures included pulmonary function testing, methacholine challenge, serum samples, and nasal lavage. Endotoxin, dust, hydrogen sulphide, carbon dioxide, and ammonia samples were collected from the barn.

Results: White blood cells and blood lymphocytes at low exposure, as well as nasal lavage counts at high exposure, were significantly greater in those who were more responsive compared with those who were less responsive. There was a significant increase in serum lymphocytes, serum IL6, total nasal lavage cells, and nasal IL8 at high exposure among more responsive subjects compared with those less responsive.

Conclusions: These findings raise the possibility that the respiratory response to high level exposure predicts systemic response throughout a range of exposures, including a trend at ambient "non-exposure" levels.

P2.3 WORK RELATED ASTHMA AT A DANISH SALMON PROCESSING PLANT

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Introduction: Several studies have demonstrated an association between exposure to allergens during handling and preparation of seafood and occupational asthma. The 14 kDa muscle protein, parvalbumin, has been identified as a major allergen in salmon. In a filleting department of a salmon processing plant with three cases of work related asthma due to sensitisation to salmon during a period of 8 months, parvalbumin was used as a measure of exposure in order to identify the levels of exposure at the plant.

Method: This was a cross sectional study of the 21 employees in the filleting department, including questionnaire, peak flow monitoring for 4 weeks, spirometry, metacholine provocation test,¹ specific IgE for salmon, cod, and herring, and total IgE, SPT for standard allergens, cod, and herring. Parvalbumin analysis was carried out with a polyclonal sandwich ELISA test.

Results: There were 17 workers who participated in the study. Two workers complained of work related wheezing, cough, and phlegm, and one of these had physician diagnosed asthma. All spirometries were within normal range, and two workers had a positive metacholine provocation test. None of the workers had a specific IgE for salmon. In spite of work related symptoms, the worker with physician diagnosed asthma did not wish to participate in a follow up investigation. The other worker experienced worsening of symptoms, and during follow up, this worker's specific IgE for salmon became positive, as did histamine release test for salmon. Average value of airborne parvalbumin was 50 ng/m (range 27.9 to 84 ng/m), the highest value measured at the filleting table. A comparative value measured at an office at the plant was 0.8 ng/m. As a consequence of a referral of another of the workers with work related asthma symptoms, renewed measurement of airborne parvalbumin, aerosols, and particles and clinical investigation of seafood allergy was initiated. The results will be presented at the conference.

Conclusion: Parvalbumin can be used as a measure of exposure. An ongoing investigation will elucidate a possible association between exposure and development of allergy towards salmon.

1. Yan K, Salome C, Woolcock AJ. Rapid method for measurement of bronchial hyperresponsiveness. *Thorax* 1983;**38**:760-65.

P2.4 EFFECT OF AIR POLLUTION DUE TO TRAFFIC ON PEF AND FEV₁ AMONG A GROUP OF TRAFFIC WARDENS

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Introduction: Traffic wardens' particular working conditions mean high exposure to vehicle exhaust emissions. Some of these (NO₂, SO₂, and ultrafine and fine particles) are irritating to the airways.

Objective: To evaluate the relationship between levels of air pollutants and variation in peak expiratory flow (PEF) and forced expiratory volume in 1 second (FEV₁) in a group of traffic wardens in Florence in the period of the year (February) in which the environmental pollution is highest.

Methods: In a group of 20 non-smoking municipal police officers (13 women and 7 men, with an average age of 34 years) with a negative history for asthma, PEF and FEV₁ were monitored for a week using a electronic peak flow and FEV₁ meter (Piko1). Meanwhile, PM4 pollution was detected by personal sampling, while fixed stations determined the value of exposition to NO₂, PM10, and PM2.5. Information about symptoms, traffic intensity, and working conditions were reported in a personal diary.

Results: No symptoms were reported during the working shift of the traffic wardens. PEF and FEV₁ values presented a significant decrease after compared with before shift work. A relationship between pre-FEV₁ and post-FEV₁ and the pollution levels recorded (NO₂, PM10, PM2.5, and PM4) showed this relationship was particularly significant between FEV₁ and NO₂ level during shift work.

Conclusions: Even though none of the subjects reported symptoms during their shift work, the decrease of PEF and FEV₁ underline the importance of environmental pollution control.

P2.5 WORK RELATED RESPIRATORY AND NASAL SYMPTOMS IN UK BAKERS: RELATIONSHIP TO WHEAT FLOUR AND ENZYME SENSITISATION

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Introduction: Work related respiratory and nasal symptoms suggestive of occupational asthma and rhinitis remain common in UK flour exposed populations. The exact cause and implication of such symptoms remains in some doubt, in particular the role of added enzymes to flour dust.

Methods: In order to investigate this further, we identified a cohort of 185 current flour exposed workers in a variety of UK based bakeries. All workers underwent a standard validated respiratory questionnaire used in all such epidemiological studies, enquiring about work related respiratory and nasal symptoms. In addition, blood sampling was carried out for subsequent assessment of sensitisation (radioallergen sorbent test (RAST) assessment of specific IgE) to wheat flour and added enzymes (including fungal amylase and xylanase). Of the 185 bakers seen, 154 had measures of specific IgE to the above allergens, and were stratified as follows; group 1, negative RAST to wheat flour and enzymes; group 2, positive RAST test to wheat flour allergen and negative to all enzymes; and group 3, positive RAST to any enzyme (irrespective of RAST result to wheat flour).

Results: In comparison to those with just wheat flour sensitivity (group 2), those with any enzyme sensitivity had an increased prevalence of both non-work related (odds ratio 16.9; 95% confidence interval 2.1 to 142.8) and work related nasal symptoms (14.8; 1.8 to 122). Furthermore, work related chest tightness (8.1; 1.9 to 34.4) and wheeze (6.2; 1.4 to 28.6) were significantly more common in group 3 than in group 1.

Conclusion: Sensitisation to enzymes in this cohort of bakers appears to be associated with the presence of non-work related and work related nasal symptoms, and with work related chest tightness and wheeze. All those involved in the health of bakers should be aware of the potential for sensitisation to enzymatic bread additives in addition to wheat flour allergy.

P2.6 OCCUPATIONAL ASTHMA: CURRENT PROVISION OF CARE IN THE UNITED KINGDOM

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Introduction: Epidemiological evidence suggests that occupational exposures account for approximately 10% of all adult onset asthma. Despite this, no agreed diagnostic approach is used in the UK to identify such patients.

Methods: In order to investigate current practice, we identified a cohort of 97 workers with possible occupational asthma from six national hospital centres in the UK with an interest in occupational asthma (OA). Workers were interviewed twice over 1 year, and all medical records were assessed in detail.

Results: Of the 97 patients, 42 were confirmed by the physician as having occupational asthma. From the patient's perspective, 45 felt they had occupational asthma (33 with a physician confirmed diagnosis, 12 with no confirmed diagnosis of OA, 1 with chronic obstructive pulmonary disease and 1 with reactive airways dysfunction syndrome). Diagnostic testing varied widely between centres. Within the group of 42 workers confirmed as having occupational asthma, 13 (31%) had a documented positive OASYSII serial peak expiratory flow (PEF) work effect index, 15 (36%) had a negative work effect index, and serial PEF had not been measured in the remainder. Similarly, non-specific bronchial responsiveness had been confirmed in 26 (62%), not confirmed in 24%, and not carried out in the remainder.

Conclusion: OA represents a significant proportion of all asthma. Despite this, a national study in the UK has confirmed widely varying diagnostic practice and labelling. A national minimum standard of care and a diagnostic guidance for OA are urgently required.

P2.7 THE PREVALENCE OF ASTHMA AND ALLERGIC RHINITIS IN YOUNGER ADULTS. THE RAV STUDY: A POPULATION BASED STUDY IN WESTERN DENMARK

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Introduction: During the past few decades, many studies have reported an increased prevalence of asthma and allergy. Whether this results from a genuine increase in disease or an increase in diagnosis has been questioned. Since the early 1990s the European Community Respiratory Health Survey (ECRHS) has been conducted at 55 centres inside and outside Europe with the aim of estimating the variation in prevalence of asthma and known risk factors. Until now one Danish centre has participated, with the inclusion of some 3600 people in the questionnaire study only.

Methods: Following the ECRHS protocols, the survey consists of two parts: (a) a postal questionnaire about asthma, allergy, atopic disposition, smoking, and occupation, and (b) an in depth interview, lung function test, skin prick test, and blood samples. The questionnaire was mailed to 10 000 people in five counties drawn with even age and sex distribution from the Central Office of Civil Registration. In four counties, we arranged participation via the Internet. Reminders were sent twice. People reporting symptoms of asthma, plus 20% randomly selected people without symptoms, were/will be invited to the part 2 examination.

Results: Of 7275 people responding, 500 (7.1%) reported asthma attacks or use of asthma medication. Prevalence was higher in females (8.1% v 5.8%). Prevalence was highest in the youngest group of 20–24 years (9.1%) v 35–39 years (5.5%), while rhinitis (23.4%) did not show any gender or age dependency.

Conclusions: A significant increase in asthma prevalence was observed compared with the previous Danish study reporting 5% using the same questions. At the conference, questionnaire data on occupational exposure will be reported.

P2.8 INITIAL RESPIRATORY RESPONSES IN WELDING APPRENTICES

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Introduction: Promising findings from Fishwick *et al*¹ have documented an acute respiratory response to welding within 15 minutes after first daily exposure. To further pursue this finding along with evidence of increased airway reactivity in welders, we conducted a study of welding apprentices with baseline and 5 month follow up airway reactivity tests, and measured real time welding exposures in conjunction with serial pulmonary function tests (PFTs). Data collection was completed in April 2004 and preliminary results will be presented.

Methods: The study was conducted at Union Sheet Metal Worker and Iron Worker training centres. Exposures to total welding fumes, NO_x, and fluorides were collected during welding classes. Real time welding fume measurements were used to capture patterns of peak exposures in order link them with simultaneous serial PFTs taken before class, 15 minutes after welding, and after class. Baseline and 5 month follow up respiratory outcomes were obtained by questionnaire, PFT, and a cold air challenge test for airway reactivity. First year apprentices who do not have welding classes were included in the respiratory testing as a comparison group.

Results: A total of 116 apprentices completed both baseline and follow up respiratory data collection; more data are available from apprentices who participated a single time. Almost all participants were male, 45% currently smoked, and the mean age was 28 years old (range 18 to 44). In those without asthma, approximately 16% reacted to cold air challenge testing. Welding samples and serial PFTs were collected for 75 apprentices. Average levels of welding fume exposures (3.6 mg/m³) were below regulatory standards but high levels of peak exposures were measured. Further analyses linking exposures to respiratory outcomes will be carried out this summer.

Conclusions: Our findings will contribute to the documentation of respiratory health status in apprentice populations and characterisation of welding exposures, but more information will be useful for

determining the progression of respiratory disease in relation to occupational exposures.

1. Fishwick *et al* 1997.

P2.9 CASE–CONTROL STUDIES OF LOW EXPOSURES TO BENZENE: A DATA CONSISTENCY REVIEW

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There have been four major case–control studies of leukaemia in oil distribution and refinery workers, in the USA, Canada, Australia, and England. The results produced are discordant in that the Australian study shows evidence of leukaemia risks (excesses of exposure in cases over controls) at much lower levels than the other studies. This implies differences in the observed exposure–relationships between the studies. This review aims to examine the existing studies, characterising their similarities and differences, and concentrating on those aspects that might contribute to differences such as those observed. There may be many such differences, structural or methodological, in areas such as the nature of the populations studied, the methods of identifying the cases, the number of cases, the pattern and duration of their exposures, the completeness and reliability of work history data, the characterisation of individual exposure, and even the role of chance variation. The potential of each for producing the observed differences will be considered. A second and related purpose is to assess the prospects for combining the data sets for a pooled analysis, which would have greater power than the individual studies. The review will be carried out by a team of experienced epidemiologists and occupational hygienists, working closely with the principal investigators, and visiting each site to interview key workers and to inspect research records. Visits, over the summer of 2004, will follow a standardised protocol.

P2.10 INDOOR AIR QUALITY IN A 'LOW ALLERGEN' SCHOOL

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Introduction: Apart from the home, the school is the major indoor environment for school age children. In order to implement the concept of "healthy building" in schools, a "low allergen" school was set up in Perth in 2000.

Objective: To assess the effectiveness of the low allergen school in terms of indoor air quality.

Methods: The low allergen school and three closely matched control schools were selected for the study. Air pollutants (particulate matter (PM), formaldehyde (HCHO) and volatile organic compounds (VOCs)) and dust allergens (dust mite allergen Der p1 and cat allergen Fel d1) were measured four times in the target and the control schools: summer term, autumn holidays, winter term, and winter holidays.

Results: The low allergen school did not have significantly lower levels of airborne PM. Levels of HCHO in the low allergen school were lower than those in the control schools during summer rather than winter. No significant difference in levels of VOCs was found between the target school and the control schools. The low allergen school had significantly lower levels of dust allergens, relative to the control school, although the levels of dust mite allergens in all samples from the four study schools were very low, compared with the levels in houses.

Conclusions: The study has demonstrated that the low allergen school design can improve indoor air quality in some cases. It also highlights the challenging situation in implementing the concept 'healthy buildings' in school environments.

P2.11 NATURAL RUBBER LATEX GLOVE ALLERGY AMONG HOSPITAL STAFF IN THAILAND

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Introduction: The prevalence of type 1 natural rubber latex (NRL) glove allergy varies according to the population studied and the

methodologies used for assessment and investigation of NRL allergy. In Thailand, the only such study published indicated a prevalence of 3.1% among hospital employees.

Objective: To investigate the rate of type 1 self reported NRL glove related symptoms in three large hospitals located in different parts of Thailand.

Methods: A total of 3206 self-administered questionnaires were distributed to three hospitals: 1000 to Lumpang Hospital, 900 to Hadyai Hospital and 1306 to Rayong Hospital. The questionnaire collected information relevant to allergic symptoms to NRL gloves. Skin prick tests (SPTs) were performed with NRL (Stallergenes SA, Fresnes, France) at 1:200 w/v and common environmental allergens.

Results: Questionnaires were completed by 1948 of 3206 (60.8%) people. The majority of respondents were female staff (97.8%). The most common NRL glove allergic symptom was itching (21.6%), followed by redness of skin (11.3%), dried and chapped skin (9.7%), eye irritation (8.6%), runny nose (6.3%), breathlessness (1.4%), wheezing (1.2%), and lip swelling (0.7%). Collection of results from the SPTs is still in process.

Conclusion: Self reported Type 1 NRL glove allergic symptoms among Thai hospital employees was found in approximately 10% of respondents, and skin symptoms predominated.

P2.12 REPRODUCTIVE OUTCOMES IN DDT APPLICATORS

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Introduction: Adverse reproductive outcomes have been suggested in relation to dichlorodiphenyltrichloroethane (DDT) exposure. Epidemiological studies of fertility among men occupationally exposed to DDT might provide useful insights to confirm or reject the hypothesis.

Methods: We inquired into the reproductive history, including total number of children, sex distribution in the offspring, time to pregnancy (TTP), and number of spontaneous abortions and stillbirths of the spouses of 107 men first exposed to DDT in a 1946–1950 anti-malarial campaign in Sardinia, Italy. TTP in months at the first successful conception was estimated from population registers. Cumulative DDT exposure during the anti-malarial campaign was retrospectively estimated.

Results: Still birth rate was elevated, and male/female ratio in the offspring reversed among DDT applicators compared with the unexposed subjects and to subjects exposed in jobs other than applicators. Among DDT applicators, still birth rate increased and male/female ratio decreased by tertile of cumulative DDT exposure. Fecundability ratio among spouses of DDT applicators was 0.72 (95% confidence interval 0.41 to 1.21) compared with the unexposed. Average number of children and abortion rate were unaffected by DDT exposure.

Conclusions: Our results provide some indication of adverse reproductive outcomes and a reduction in fertility among men heavily exposed to DDT.

P2.13 GYNAECOLOGICAL DISTURBANCES AMONG FEMALES ENGAGED IN THE MANUFACTURE OF SEX HORMONES

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Introduction: Numerous studies have established an association between exposure to sex hormones and many gynaecological problems.

Objective: To investigate the different gynaecological disturbances that may affect female workers occupationally engaged in the manufacture of contraceptive pills and other hormonal preparations.

Methods: The total number of female workers was 214, and there was a control group of 220 subjects. All workers were given a questionnaire. Gynaecological, obstetric, sexual, and endocrinal histories received special attention. Gynaecological examinations were carried out for married female workers (137 exposed, 180 controls).

Results: This study showed the presence of masculinising signs among the exposed group. There was also positive statistically significant difference between exposed and control workers on comparing gynaecological disorders. Hysterectomy was performed on 11.2% of exposed workers versus 3.6% of non-exposed workers. Our study showed a significant positive relationship between duration of exposure and the prevalence of hysterectomy cases. About 51% of married exposed workers had reproductive disorders in the form of miscarriage, birth defects, and sterility (statistically significant). Gynaecological examination showed that exposed workers suffered from vulvovaginitis (46.7%), cervical erosion (3.9%), and leucorrhoea (62.8%). About 12% of the exposed workers complained of some family health disturbances in

the form of precocious puberty in female children, and gynaecomastia in male children and husbands.

Conclusion: Occupational exposure to sex hormones was found to be a great risk to female workers and their families. We recommend health education for exposed workers, use of protective equipment, and enclosure of machines. Periodic medical examination should be carried out.

P2.14 LH, FSH, TESTOSTERONE AND OESTRADIOL LEVELS IN WORKERS EXPOSED TO LONG TERM EXPOSURE TO DDT

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Introduction: Many studies on animals have revealed that various dichlorodiphenyltrichloroethane (DDT) metabolites have endocrine effects, including blocking the action of male hormones.

Methods: We performed an observational study of 70 malaria control workers in the State of Guerrero, Mexico. Subjects were interviewed about their occupational history, reproductive performance and other relevant factors. Blood samples were collected to measure serum levels of DDT and metabolites, and hormone levels. DDT and metabolites levels were determined by gas chromatography with electron capture detection, sexual hormones by radioimmunoassay and pituitary hormones by immunoenzymic methods.

Results: Participants ranged in age from 22 to 69 years, and had been employed in the sanitation campaign for between 4 and 37 years. The mean (SD) levels ($\mu\text{g/g}$ of extractable lipids) of isomers of DDT and metabolites were: total DDT 81.74 (54.90); p-p-DDE, 45.83 (31.30); p-p-DDT 29.42 (20.82); p-p-DDD 2.71 (2.86); and o-p-DDT 0.66 (0.89). Significant ($p < 0.05$) correlations were observed between luteinising hormone (LH) with p-p-DDE (Pearson, $r = 0.28$) and p-p-DDT ($r = 0.26$), follicle stimulating hormone (FSH) with p-p-DDT ($r = 0.25$) and oestradiol with p-p-DDD ($r = 0.26$), and a negative association of o-p-DDT with testosterone ($r = -0.17$). Multivariate regression models adjusting for age and body mass index confirmed positive associations between \log_e LH and p-p-DDT ($\beta = 0.009$, 95% confidence interval (CI) 0.001 to 0.017; $R^2 = 0.21$), \log_e FSH with p-p-DDT ($\beta = 0.008$, 95% CI = 0.001 to 0.016; $R^2 = 0.23$) and oestradiol and p-p-DDD ($\beta = 0.861$, 95% CI = 0.012 to 1.709; $R^2 = 0.12$). Testosterone levels decreased with increasing o-p-DDT, adjusting in addition for frequency of sexual relations ($\beta = 0.861$, 95% CI = 0.012 to 1.709; $R^2 = 0.12$).

Conclusions: These results show a weak association between levels of DDT and metabolites and hormone levels. The increased pituitary hormones combined with the decreased testosterone levels indicate an impairment of the negative feedback normally exerted by steroid hormones on the hypothalamic-pituitary axis. This impairment may be related to effects of DDT in the pituitary-testes axis.

P2.15 FERTILITY AMONG SWEDISH FEMALE HAIRDRESSERS

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Introduction: Hairdressers are exposed to several factors that may affect their reproductive ability. These include the use of potentially hazardous chemicals on a daily basis, long or unfavourable working hours, work in a standing position, and a stressful working situation.

Methods: Women who had graduated from Swedish hairdresser school ($n = 2626$) were compared with women from the general population ($n = 2860$) with respect to time to pregnancy (TTP) and miscarriage risk. Furthermore, within the cohort of hairdressers, the effects of different hair treatments and of the other factors mentioned above were investigated. Information was collected through self administered questionnaires. The effects of exposure on TTP were estimated using the fecundability ratio (FR). For women whose TTP was longer than 12 months, including women who never conceived, TTP was stopped at 12 months. The miscarriage risk was estimated by the odds ratio (OR).

Results: The hairdressers were less successful in conceiving (FR 0.91; 95% confidence interval 0.83 to 0.99). The effect was reduced after excluding women who conceived in the first month of trying (0.96; 0.87 to 1.07). Within the hairdresser cohort, stress seemed to prolong the TTP (self employment: 0.86; 0.75 to 0.99; self perceived stressful working

situation: 0.81; 0.70 to 0.94). No effect was found from the different hair treatments. There was no difference between hairdressers and controls with respect to miscarriage risk (OR 1.12; 0.88 to 1.42), neither were there any effects of any of the hair treatments. However, hairdressers with a self perceived stressful working situation had an increased risk of miscarriage (adjusted OR 1.74; 1.02 to 2.98).

Conclusions: The present study gives some indications of a prolonged TTP among hairdressers. However, it cannot be ruled out that this is in part an effect of birth control bias. There was no increased miscarriage risk among hairdressers compared with controls. Within the hairdresser cohort, the use of different hair treatments did not affect either TTP nor miscarriage risk. Stress, measured as self employment and self perceived stressful working situation, seemed to affect both TTP and miscarriage risk.

P2.16 SURVEILLANCE OF THE WORK ENVIRONMENT IN THE ROYAL NORWEGIAN NAVY: HIGHER RISK OF CONGENITAL ANOMALIES FOUND IN THE OFFSPRING OF PERSONNEL WHO HAVE SERVED ABOARD A MISSILE TORPEDO BOAT

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Introduction: In the 1990s a number of congenital malformations were reported among children whose fathers had served aboard a Royal Norwegian Navy missile torpedo boat (MTB) especially equipped for electronic warfare transmission. The Navy asked the University of Bergen to look into this problem as part of a general health and work environment surveillance.

Methods: A questionnaire was sent out to all employees with some of the questions designed to detect whether there was a significant increase of congenital malformations among the offspring of personnel that had served aboard the MTB. A question about stillborn children or children dead within the first week of life was included. The employees were also asked whether they and their partner had ever tried to become pregnant more than 1 year without succeeding. Relative risks with 95% confidence intervals were calculated.

Results: If the parent had served aboard the MTB at the latest the year before the child was born, the relative risk of having a child with congenital malformations was 4.6 (95% confidence interval 2.6 to 8.4) compared with those in the Navy who had not served aboard at least the year before or not at all. If the parent had served aboard the MTB at the latest the year before the child was born, the relative risk of having a child that was stillborn or died within 1 week was 3.6 (95% CI 1.7 to 3.9). If the responder had ever served aboard the MTB, the relative risk of having tried to become pregnant more than 1 year without succeeding was 1.8 (95% CI 0.9 to 3.6), significant at 90% level.

Conclusions: This study has shown a highly significant over-representation of congenital malformations among offspring of personnel who have served aboard an MTB. Corresponding results were found for stillbirths and perinatal death, but with smaller figures. There was also a tendency towards having problems with fertility after having served aboard an MTB.

P2.17 CORRELATION BETWEEN BIOREACTIVITY AND HEAVY METAL ELEMENTS OF PM10 IN BEIJING AIR

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Introduction: Air pollution is very harmful to the human body, especially to the lungs. The Olympic games will be held during the summer of 2008 in Beijing, thus Beijing air quality is of much more international concern than previously. Heavy metal elements and the bioreactivity of Beijing airborne particles $< 10 \mu\text{m}$ diameter (PM10) were assessed.

Method: PM10 in Beijing air was collected during March 2002–April 2003. Environmental scanning electron microscopy, inductively coupled plasma mass spectrometry and x ray diffraction were used to analyse the physicochemical characteristics. Bioreactivity of PM10 was assessed by plasmid DNA assay.

Results: Damage of plasmid DNA was induced by PM10 samples. TM50 of PM10 particles (bulk) collected at urban and comparison sites during winter was $900 \mu\text{g/ml}$ and $74 \mu\text{g/ml}$ respectively, and their soluble fractions were $540 \mu\text{g/ml}$ and $86 \mu\text{g/ml}$ correspondingly. However, TM50 of PM10 collected at the same sites in summer was different. TM50 of PM10 (bulk) at urban and comparison site was $116 \mu\text{g/ml}$ and $210 \mu\text{g/ml}$, and the soluble fractions were $180 \mu\text{g/ml}$ and $306 \mu\text{g/ml}$. Trace elements in PM10 were the main reason for oxidative damage to plasmid DNA.

Conclusion: Bioreactivity of Beijing PM10 varied substantially in different samples. This bioreactivity was mainly caused by heavy metals in PM10. Lead, zinc, and arsenic in PM10 (bulk) correlated with TM50; however, manganese, vanadium, and zinc in soluble fractions of PM10 could be the elements damaging plasmid DNA. Mass concentration of zinc in PM10 was the highest of the elements, and we suggest that zinc might be the element with the strongest oxidative capability to plasmid DNA.

P2.18 POLYCYCLIC AROMATIC HYDROCARBONS (PAHS): STUDY OF VALIDATION PARAMETERS TO DETERMINE 1-HYDROXYPYRENE IN URINE SAMPLES AND ITS USE AS A BIOLOGICAL MARKER IN ASPHALT FUME EXPOSURES

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Introduction: Information about the adverse effects of polycyclic aromatic hydrocarbons (PAHs) in human health has great importance, both scientifically and socially. Their high carcinogen potential, especially regarding lung cancer, and in some cases, skin and bladder cancer, has been shown in several epidemiological surveys. Such surveys, and the fact that PAHs may be found in several work environments, directly affecting many exposed workers, show the relevance of the current paper. According to the International Agency for Research on Cancer, six PAHs are probably carcinogens in humans. Owing to this fact and with the intention to prevent occupational exposure to these substances, biological monitoring using determination of urinary 1-hydroxypyrene is required. Such assessments supply a new alternative biomarker, urinary 1-hydroxypyrene (1-OHP), already acclaimed by the American Conference of Industrial Hygienists (2003).

Methods: In order to reach such objectives, this work defined the conditions of a high performance liquid chromatograph linked to a fluorescence detector, and validated the analytical parameters to determine 1-OHP in urine samples. The method to determine urinary 1-OHP was based on enzyme hydrolysis following a solid phase extraction (C₁₈).

Results: The method for quantification of 1-OHP was linear ($r^2 = 0.999$) in the study range (0.2–40.0 ng/mL). The detection and quantification limits were 0.5 ng/mL and 1.0 ng/mL, respectively. The precision and accuracy were adequate for this analysis (CV <15%) and the recovery maintained between 80 and 120%.

Conclusion: In conclusion, this validated method cannot only be considered useful for urinary 1-OHP analysis, but confirm its use as biological marker in asphalt fume exposures (PAHs).

P2.19 OCCUPATIONAL EXPOSURE TO DIOXINS AND TYPE 2 DIABETES MELLITUS IN MEXICAN CEMENT INDUSTRY WORKERS

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Introduction: Dioxins are chlorinated organic compounds, the source of which are industries, such as the cement industry, which utilise high temperature combustion. Their toxic power includes alteration of cellular transport of glucose and the capacity of insulin, with consequent effect in the form of type 2 diabetes mellitus (DMt2).

Objective: To investigate the association of occupational exposure to dioxins with DMt2 in cement industry workers.

Methods: We selected 112 workers, 56 with diagnosis of DMt2 and 56 without DMt2. In both groups, we explored type of work carried out, on the job tenure, daily exposure dose (DED) to dioxins, and DED to dioxins/years worked, estimated by a job exposure matrix. Occupational exposure to dioxins was categorised as nearly null–low, moderate, and high–extraordinarily high, while workplaces were classified as exceptionally little, very little, little, moderately, and considerably exposed to the dioxin source.

Results: DED to dioxins was significantly higher in workers with diabetes (odds ratio 11.38; 95% CI 0.26 to 17.07) than in workers without diabetes (1.70; 0.0569 to 17.07; $p = 0.001$), but not due to worker years (75.10; 0.005 to 324.3, and 6.60; 0.02 to 426.7, respectively ($p = 0.10$)). On considering DED/years worked as nearly null–low as reference group, OR for DMt2 in the high–extraordinarily high category was 3.5 (0.85 to 14.85), and in the moderate group was

1.75 (0.54 to 5.86). With workplace classified as exceptionally exposed to dioxin source as reference group, OR for DMt2 of considerably exposed was 3.07 (1.19 to 8.03); moderately exposed 0.22 (0.14 to 2.02); little exposed 14.28 (1.55 to 658.43), and very little exposed 0.46 (0.008 to 5.42).

Conclusions: Estimation of DED to dioxins was higher in workers with DMt2 accompanied by a moderate grade of dose–response of exposure according to years worked in the cement industry, while exposure to source of dioxins according to workplace position was only associated with workers with DMt2 who were classified as considerably exposed.

P2.20 BONE MINERAL DENSITY IN MEXICAN ENAMEL WORKERS OCCUPATIONALLY EXPOSED TO LEAD

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Introduction: In constant lead exposure, metal circulating in the bloodstream produces a certain degree of toxicity and yields asymptomatic or subclinical effects that become marked when blood values of lead reach 80–100 µg/dL. Subclinical lead effects have been commonly called biological markers of toxicity. Absorbed lead is accumulated primarily in the skeleton, which contains 90% of total lead stored in the organism.

Objective: To determine bone mineral density (BMD) in Mexican enamel workers occupationally exposed to lead.

Methods: This was a cross sectional comparative study carried out in the Mexico City metropolitan area. The study population comprised 50 workers exposed to lead and 60 workers not exposed to lead. Blood lead values (BLV) were tested by atomic absorption spectrophotometry. Additionally, we used dual energy radiographic absorptiometry to measure femoral neck and spinal column. Environmental lead levels at the work site were also measured.

Results: Mean (SD) BLV was 26.75 (9.70) µg/dL in exposed workers, and 7.32 (4.78) µg/dL in non-exposed workers; 86% of exposed and 5% of non-exposed workers had BLV above the lead threshold limit. Based on BLV, risk ratio (RR) and 95% confidence interval were 8.55 (4.23 to 17.3); $p < 0.001$. There were 33 exposed workers (66%) with high BLV, and 46% non-exposed workers had increased bone density (RR 1.5; 95% CI 1.00 to 2.44), $p = 0.043$. Increased BMD in the spinal column was found for 64% of exposed workers and 72% of non-exposed workers (RR: 0.83; 95% CI 0.55 to 1.26; $p = 0.39$). Lead environment monitoring reported 0.12 mg/m³ at the work site.

Conclusions: Mexican enamel workers with high BLV had significant changes in BMD, mainly in the femoral neck. Job seniority is a protective factor, because lead accumulated in the spinal column and femur provided greater BMD in workers exposed to this metal.

P2.21 OCCUPATIONAL HEALTH HAZARDS AMONG RICE FARMERS IN PATHUMTHANI, THAILAND

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Introduction: In Thailand, agriculture is one of the major occupations, and the main crop grown is rice.

Objective: To study processes in rice farming and to recognise occupational health hazards among each process.

Methods: The processes of rice farming and occupational health hazards were discussed by researchers and 24 rice farmer volunteers from study area. A questionnaire was developed to collect data about occupational health hazards during rice farming processes. Occupational health hazards during each process were analysed.

Results: There were six processes of rice farming. During the land preparing process, hazards included stepping on sharp objects (83.2%), exposure to dusts and smoke from burning rice stalks (77.6%), vibration from ploughing machine (67.5%), lifting heavy pumping hoses (66.4%), exposure to diesel fumes (65.1%) and loud noise (53%) from ploughing truck, ploughing truck accidents (37.6%), injuries from ploughing blades (35.2%), and injuries from ploughing machines (20.6%). During the seed soaking and scattering process, farmers were injured carrying heavy seed containers (75.9%), stepping on humid soil (66%), and by puncture from bamboo sticks of seed containers (49.2%). During the pesticide

mixing and spraying process, hazards included carrying pesticides sprayer (69.6%), acute pesticide toxicity (65%), vibration of pesticide sprayer (57.7%), and dropping pesticide sprayer on the feet (21.2%). During the fertiliser applying process, the hazards were carrying heavy fertiliser containers (75.9%), exposure to fertilisers (61.3%), and puncture by bamboo sticks of fertiliser containers (49.2%). During the weed pulling process, injuries occurred from incorrect posture (16.6%), and during the rice harvesting process, the hazards were exposure to grain dust (81.4%), carrying rice sacks (65.1%), and exposure to vibration (58.1%) and loud noise (54.1%) from harvesting truck.

Conclusions: Rice farmers are facing health hazards during various processes of farming. Appropriate intervention should be used to reduce these hazards.

P2.22 SEX DIFFERENCES IN WORK RELATED RISK FROM EXPOSURE TO FLUORINE

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Introduction: A 7 year study was carried out to evaluate sex differences in work related risk from exposure to fluorine and its compounds in an enamel enterprise.

Methods: Air monitoring in all workplaces was performed during the study period for fluorine and its compounds, and 85 male and 85 female exposed workers (and the same number of controls) were investigated. The applied tests comprised an evidential questionnaire for detecting fluorine effects, bronchitis record, clinical and functional ventilatory examinations, and urinary fluorine measurement. Linear regression analyses were used to identify sex differences in incidence of some fluorine induced diseases and the level of exposure.

Results: The fluorine values in the air of workplaces ranged from 0.07 to 2.75 mg/m³ air (maximum allowable concentration MAC 2 mg/m³ air). There were 43.8% of female workers and 32.6% of male workers presenting with chronic rhinitis, laryngotracheitis, and bronchitis. The incidence of chronic bronchitis was significantly ($p < 0.05$) higher in female compared with male smokers. The values of urinary fluorine were higher in the exposed versus the control group. Linear regression analyses showed a positive relationship between chronic irritative bronchitis ($r = 0.83$ for women and $r = 0.65$ for men) and the level of exposure.

Conclusions: Fluorine and its compounds are responsible for the induction of chronic irritative respiratory diseases in exposed workers. The incidence and gravity of respiratory diseases was higher in women compared with men, indicating that sex was a work-related risk factor in disease induction.

P2.23 OCCUPATIONAL HEALTH RISK AMONG HIGHLAND SALT MAKERS

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Introduction: In fiscal year of 2000, the Thai government launched a project titled One Tambon One Product (OTOP), a project aimed at development and promotion of high quality home based products via marketing strategies. The increasingly higher demand for homemade products renders occupational health and safety an important issue. Salt making in Bo Klua, Nan has become an OTOP.

Methods: A survey was conducted to investigate working condition and working environment of home based salt makers in the north of Thailand. Heat and lighting conditions were measured inside salt boiling huts and comparisons were made between rainy season and summer. Urinary specific gravity and heat related symptoms were recorded.

Results: Wet bulb globe temperature (WBGT) in front of the stoves and fuel loading area averaged 26.6 ($n = 12$) in June compared with 27.8 ($n = 12$) in April the following year. WBGT behind the stoves averaged 26.8 ($n = 2$) and 29.2 ($n = 9$) respectively. Salt makers donated spot urine samples for specific gravity measurement, which ranged from 1.016 to 1.030 ($n = 7$). Eight out of ten salt makers reported musculoskeletal symptoms, while six reported severe nose irritation and three had experienced syncope.

Conclusions: Highland salt makers had significant occupational exposure to heat. However, health risk could possibly be reduced by oral hydration.

P2.24 OCCUPATIONAL EPIDEMIOLOGY STUDIES PRODUCED IN BRAZIL

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Introduction: The production of studies in the field of workers' health in Brazil has increased since its inclusion in the Federal Constitution in 1988, as a consequence of the movement of the Brazilian Sanitary Reform. It opened the opportunity for a broader understanding of workers' health impairment and of workplace conditions, which naturally reinforced the importance of the conduction of epidemiological studies.

Methods: This is a descriptive and exploratory study. The unit of analysis was the abstract of all studies related to workers' health, published in the annals of the five Brazilian Meetings of Epidemiology (BME), from 1990 to 2002. Each abstract was selected based on its title and its content. These data were codified, organised in structured records, and analysed through the software Epi-Info (version 6.0).

Results: We found 499 studies in the field of occupational epidemiology; 10% of all epidemiological studies accepted by the scientific committees of the BME. This proportion increased from the first to the last meeting. Most studies were produced by investigators from Sao Paulo (21.6%); Rio de Janeiro (18.6%), and Bahia (17.6%).

The majority of the studies was produced by public institutions (88.9%), particularly by universities (57.1%) and the health services (24.8%). Approximately 80% were descriptive studies, presenting results about occupational injuries and diseases, mainly neuromuscular syndromes and hearing loss, health surveillance, and workplace surveillance. A few studies used cohort or case-control designs.

Conclusions: Occupational health studies are an important fraction of the epidemiological studies accepted by the BME, executed mainly by public universities, but researchers should invest more in analytical approaches. The Brazilian workplaces combine features of developed and undeveloped countries, and it requires the conduction of deeper investigations.

P2.25 THE ROLE OF ORGANOPHOSPHATE PESTICIDE EXPOSURE IN THE AETIOLOGY OF SUICIDE AMONG FARM WORKERS IN THE WESTERN CAPE

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Objective: To investigate whether exposure to organophosphate (OP) pesticides contributes to the causation of suicide among farm workers.

Methods: A mortuary record review of nine mortuaries in the rural Western Cape was conducted for the period 1995-1999.

Results: There were 154 suicides. The most common methods of suicide were hanging ($n = 34$; 25%), firearms ($n = 35$; 23%), exhaust fumes ($n = 18$; 12%), and medication overdoses ($n = 16$; 10%). Pesticides were used relatively infrequently as the method of suicide ($n = 8$; 5%). However, pesticides were significantly more commonly used as the method of suicide among farm workers (5/40; 12.5%) compared with non-farm workers (3/114; 2.6%). Farm workers were more than five times as likely to use pesticides to commit suicide compared with non-farm workers (odds ratio 5.29; 95% confidence interval 0.96 to 35.28; $p = 0.04$).

Discussion: The findings suggest that reducing access to pesticides should be a component of suicide prevention efforts among farm workers in the Western Cape.

P2.26 FOUR STEP PROCESS OF HEALTH RISK MANAGEMENT AND MONITORING OF PESTICIDE POISONING: HEALTH PROMOTION AND PREVENTION PROGRAMME IN AGRICULTURE

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Introduction: In Thailand, illness from pesticide poisoning has been one of the most common occurrences in rural areas due to their remoteness from healthcare facilities. Measurement and assessment of health risk from pesticide helps survival of these victims and prevents new outbreaks of pesticide poisoning. This descriptive study aims to outline the four step process of health risk management and monitoring: (a) identifying which types of pesticides and potential health effects of pesticides have been used by the farmers; (b) exposure assessment; (c) risk management; and (d) monitoring the level of pesticide poisoning.

Methods: The instrument includes four parts: questionnaire, farmer's health profile, cholinesterase blood testing, and risk management pamphlet. The data was collected from March 2003 to February 2004. The study population comprised 79 farmers and 133 controls from the general population located in Kokchang Tambon.

Results: There were a total of 212 participants; 112 (52.8%) women and 100 (47.2%) men. The mean (SD) age of 212 participants was 48.54 (12.75) years (range 18–85). There were 78 (98.7%) farmers who used pesticides to increase their harvests. Organophosphates and carbamates were the most popular (56%–60%). Five farmers (6.3%) had an acute pesticide allergy. The pesticide poisoning exposure assessment, monitoring twice every 3 months showed the percentage of normal levels of pesticide exposure increased from 30% to 54% and 59% (farmers) and from 27.8% to 33.1% and 45.1% (controls). Risk management was given by using a brochure with practical information.

Conclusions: The four step process of health risk management and monitoring of farmers in Kokchang Tambon provided an increasing awareness to residents of pesticide poisoning, resulting in lower levels of continual pesticide exposure in both farmers and the general population, reflected by the increasing percentage of normal level blood tests. This will eventually lead to the prevention of unnecessary visits to healthcare facilities.

P2.27 ACUTE PESTICIDE RELATED ILLNESS AMONG EMERGENCY RESPONDERS AND HEALTHCARE PROFESSIONALS IN 13 STATES OF THE USA, 1993–2000

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Introduction: Emergency responders, such as firefighters, police officers, and paramedics, are among the first to arrive to the scene of a pesticide related emergency event. This report will summarise pesticide related illnesses among emergency responders and healthcare personnel that occurred between 1993–2000.

Methods: Data were obtained from the Sentinel Event Notification System for Occupational Risks Pesticides programme (SENSOR-Pesticides), from the California Department of Pesticide Regulation (CDPR), and from the Hazardous Substances Emergency Events Surveillance (HSEES) system. Data on illnesses among emergency responders exposed to pesticides while responding to emergency events were sought, as were data on illnesses among healthcare professionals exposed to pesticides while caring for pesticide contaminated patients.

Results: A total of 289 cases were identified from 13 states. Firefighters accounted for 94 cases (33%), law enforcement officers for 80 (28%), paramedics for 40 (14%), healthcare professionals caring for pesticide contaminated patients for 24 (8%), and auxiliary hospital/clinic staff (such as receptionists and billing clerks) for 8. Finally, 43 cases were other occupations (n=1) or unspecified first responders (n=42). Among the 193 cases with information on activity responsible for exposure, most were exposed while performing non-patient care activities related to a pesticide release event (67%), while the remainder involved exposure, to some degree, to a pesticide contaminated patient. Most cases were exposed to insecticides (54%), most commonly organophosphates, carbamates, or pyrethroids. Most had low severity illnesses (89%), and the remainder had illnesses of moderate severity.

Conclusions: The findings highlight the health risks faced by emergency personnel responding to pesticide release events, and healthcare professionals treating pesticide contaminated patients. Recommendations to prevent pesticide related illnesses among these workers will be provided.

P2.28 LEVELS OF CHOLINESTERASE AND SYMPTOMS IN MEN AND WOMEN AGRICULTURAL WORKERS BEFORE EXPOSURE TO PESTICIDES

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Objective: To determine the basal concentration level of red cell cholinesterase and the prevalence of muscarinic and nicotinic symptoms in agricultural workers.

Methods: A crossover study was performed in 493 migrant workers hired by an agricultural company in the state of Sinaloa, Mexico. Cholinesterase levels were determined with the Magnotti field method. Information about sociodemographic, working background, and pathological and non-pathological conditions was gathered. Frequency,

central tendency, and dispersion measurements were used to describe the data. For the statistical analysis of the differences between two groups, *t* tests were used, and for multiple comparisons, analysis of variance and Tukey's test were used. Levels of significance and confidence intervals were established, with $\alpha=0.05$ and 95% respectively.

Results: The mean (SD) level of cholinesterase was from 4.22 (0.77) U/ml. The average level of cholinesterase adjusted to the level of haemoglobin was 33.1 (6.79) U/g Hb. The average for men was 4.29 (0.80); for women, 3.98 (0.61); and for children, 3.87 (0.60) U/ml. Significant differences were found in the results from the analysis of variance of the different age and precedence of the groups of workers. Anaemia was found in 54% of the women and 51% of the children. Most of the sicknesses and symptoms reported were more common in women than in men.

Conclusions: There are no data in the literature about the normal concentrations of cholinesterase and the prevalence of symptoms in people without previous exposure to organophosphate pesticides. Therefore, the levels of cholinesterase and the prevalence of symptoms found in the Mexican workers in this study may be a referent for studies that evaluate the possible effects of the exposure to organophosphates on the health of agricultural populations.

P2.29 MALIGNANT SKIN MELANOMA

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Introduction: The difficulty in surveillance of occupational diseases makes the use of other methods and complementary sources of information necessary, such as the study of occupational sentinel events at hospital discharges.

Methods: The analysed events were cases that were discharged from hospitals in Spain during 2001 with a diagnosis of malignant melanoma. We excluded duplicates and did an analysis with sex, age, and province as variables. We describe the geographical pattern of the disease and we study the relationship with the distribution of risk factors for this illness with the activity sector "agriculture and fishing".

Results: Discharge rate per 100 000 inhabitants with this disease for the Spanish population is 5.01, and for the employed population is 8.4. We found higher rates for women; this could be explained, in part, by the fact that many employed women are not reported as employees in the labour statistics, so the denominator of the rate diminishes. Comparing between age groups, the 45–65 year group for both sexes had more cases. Geographical distribution of cases was not uniform throughout the territory; the pattern showed higher rates in the northeast and south of Spain for men, and in the north and east for women.

Conclusions: There was a correlation between the observed geographic pattern and the economic sector of activity, although it would be interesting to study this spatial analysis in depth. The employment of hospital discharges as a complementary source for health surveillance in occupational health is useful, because it allows identification of occupational diseases that is not possible with traditional sources.

P2.30 PREVALENCE OF RESPIRATORY DISEASE AND HEARING LOSS AMONG WORKERS IN A SHIPBUILDING FACTORY

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Introduction: Occupational diseases and injuries are, in principle, preventable. The correct diagnosis and approach to treatment of a worker with an occupational illness or injury is essential to maximise opportunity for tertiary prevention. Occupational surveillance is the systemic and ongoing collection, analysis, and dissemination of information on disease, injury, or hazard for the prevention of morbidity and mortality.

Objective: To survey prevalence of respiratory disease and hearing loss among workers in a shipbuilding factory.

Methods: Data were collected from medical surveillance forms including age, experience, weight and height, smoking habit, workplace, and respiratory disease and hearing impairment. The statistical tests were performed by SPSS.

Results: A total of 438 workers' files were selected and analysed for determine respiratory and hearing impairment. The mean (SD) age and experience of the 436 workers was 34 (8.7) and 7.8 (7) years respectively. There were 159 cases of hearing impairment and 162

cases of respiratory disease. There were 102 (23.4%) smokers and 334 (76.6%) non-smokers. Prevalence of right and left ear hearing impairment and bilateral impairment was 41.7%, 41.1%, and 36.5% respectively. Prevalence of respiratory disease was 37.2% of total population. Hearing impairment and respiratory disease increased with increasing age ($p < 0.001$ and $p = 0.033$ respectively), and with increasing experience ($p = 0.005$ and $p = 0.008$ respectively). There were significant differences in prevalence of the respiratory disease and hearing loss between occupational groups ($p = 0.005$).

Conclusions: Hearing impairment and respiratory disease were common in a shipbuilding factory. There were significant differences in the prevalence with age and experience and between occupational groups.

P2.31 WORK RELATED HEALTH FACTORS AMONG OPERATORS IN OIL AND GAS PRODUCTION

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Introduction: Owing to strict safety regulations, workers in the Norwegian oil and gas industry are subjected to special health requirements. Furthermore, the operators are exposed to a range of chemical substances during drilling and production processes.

Methods: The Hordaland Health Study 1997–1999 was conducted as a collaboration between the National Health Screening Service, the University of Bergen, and local health services. All individuals living in Hordaland County, Norway at the time of study and born between 1953 and 1957 were included. A total of 10 263 males attended, with a participation rate of 57%. Self administered questionnaires provided information on demographics, lifestyle, and health factors such as asthma, allergy, chronic bronchitis, and eczema. The questionnaire also included the SF-12 Health Survey, assessing the health related quality of life in summary scales with physical and mental components.

Results: In total, 68 male operators in oil and gas production completed the questionnaire. This group comprised operators at offshore oil/gas rigs and onshore refineries. On average they had been in this work for 13 years. The operators had high scores on both the physical and mental components of the SF-12 compared with most other occupational groups. The prevalence of hand eczema during the past year was 23% compared with 16% for the total population. Eczema on other parts of the body was reported by 23% of the workers. The prevalence of chronic bronchitis was 11% compared with 3% for the total population.

Conclusion: The operators in oil and gas production had high physical and mental health scores. Eczema and chronic bronchitis might be caused by exposure to drilling mud or to hydrocarbons from the production lines. More research on a more representative population is needed to verify these findings.

P2.32 ANALYSIS OF COAL MINERS MORTALITY DATA

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Introduction: Mortality data for the coal miners of Queensland and New South Wales was extracted for a heart disease risk factor project and has been analysed to provide age specific death rates from various diseases for miners. For an industry that employs about 10 000 miners in each of Queensland and New South Wales, the numbers of people that die each year from various disorders presents statistical limitations to this approach. The validity of the data is also challenged by a death reporting system that focuses on clinical cause of death rather than that exploring potential occupational contributors. Some perspective on these errors is provided by an analysis of death data provided from claims for early superannuation payouts. The discussion explores how these data may contribute to improved safety management systems for occupational exposures.

Methods: Data of miner deaths was examined to estimate age specific death rates. Methodological issues examined include limited numbers of deaths per year, wide range of causes, and reliability of reporting of cause. Using comparisons with death rates for specific age groups and diseases, and comparing this with general community data, a potential measure of the effectiveness of occupational health management systems was obtained.

Results: The study includes 11 810 records, of which more detailed analysis was undertaken on 3188 deaths between 1996 and 2000.

Conclusions: Current occupational health and safety data recording systems grossly under report the effects of long term occupational illness. The approach demonstrated provides a long term performance measure for occupational health and safety management systems. The next step in the development of these systems is to link cumulative exposure data to these and related adverse health outcomes and to develop trigger levels for health interventions that better manage the risk of unacceptable occupational health outcomes.

P2.33 CARPAL TUNNEL SYNDROME AS OCCUPATIONAL SENTINEL EVENT AT DISCHARGES

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Introduction: During the past 10 years, the rates of musculoskeletal occupational diseases has increased fourfold in Spain, according to official health and disease statistics, mirroring results from other developed countries. Despite this, most of these illnesses continue to be hidden as common diseases. The difficulty in occupational disease surveillance makes the use of other methods and complementary sources of information, such as the study of occupational sentinel events at hospital discharge, necessary.

Methods: We analysed cases discharged in Spain during 2001 with a diagnosis of carpal tunnel syndrome. We excluded duplicates and those in which there was a diagnosis of another base illness contributing to the appearance of the carpal tunnel syndrome. We performed an analysis with sex, age, and place as variables, and investigated the geographical pattern of the disease to determine if there were any differences between regions that could allow planning of preventive intervention.

Results: Hospital discharge rate per 100 000 inhabitants with this disease in the Spanish population was 18.65, which rose to 28.43 for the employed population. The highest number of discharged cases fell in the age group 45–65 years for both sexes. Geographical distribution of cases was not uniform for all the territory; the pattern showed higher rates in the central northern part of the peninsula for men, and the northeast and east for women.

Conclusions: The use of discharge data as a complementary source for health surveillance in occupational health is useful, because it allows collection of data on occupational diseases that is not possible with traditional sources. This study has demonstrated that regional differences could allow planning of preventive intervention.

P2.34 INVESTIGATING EXPOSURE OF WORKERS TO SOLVENTS IN A TRADITIONAL HANDICRAFT VILLAGE

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Introduction: Under recent open door and market economy policies in Vietnam, small scale enterprises in traditional careers have been developing in villages. In many enterprises, use of solvents has been rising in both quantity and type.

Objective: To evaluate the exposure of workers to solvents in a traditional village producing wooden fine arts; to evaluate the occupational health and safety system, and to suggest interventions.

Methods: We measured concentration of solvents in the air at the workplace, interviewed workers, managers, and local medical staffs using questionnaires, and conducted medical examination for workers. The results showed that workers were exposed to several kinds of solvents, such as toluene, xylene, dichloromethane, and dichloromethane. Although concentrations of these solvents did not exceed maximum allowable concentrations, there was some evidence of effects of solvents on workers' health. The rate of workers complaining of some symptoms was rather high: headache (33.3%), tiredness (34.4%), nausea (25.6%), sleep disorders (35.8%), skin itching (13%), and nose irritation (20%) among them. Of 220 workers who underwent medical examination, 40.5% suffered from skin diseases, and there were 63 cases (28.6%) of pulmonary symptoms. The results of lung function in 63 cases showed that 31 cases had lung function disorders (49%). Among 52 painters, there were 33 cases of sore throat (62.3%). After the working day, workers' capacity in performing some neurobehavioural tests decreased significantly. There was no occupational health and safety system available in any enterprise in this village.

Conclusion: Some recommendations were drawn up in order to improve the working conditions, including reorganising workplaces,

setting up occupational health and safety systems, and providing education and information.

P2.35 ENVIRONMENTAL AND BIOLOGICAL MONITORING OF LEAD IN URBAN AIR AND IN URBAN SERVICE WORKERS' URINE

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Introduction: Lead is a non-essential element, and the health problems caused by environmental and occupational exposure to it are a focus of public health attention.

Objective: To establish the consequences of atmospheric lead concentrations and those of urinary lead concentrations in workers employed as urban cleaners in Tehran, Iran.

Methods: Urban lead was measured using the Environmental Protection Agency sampling method followed by determination by atomic absorption spectrometry.

Results: Except on Thursdays and Fridays (the Iranian weekend), the mean (SD) atmospheric concentration of lead in all selected sampling urban stations was 1.9 (0.32) $\mu\text{g}/\text{m}^3$, which was above the maximum allowable concentration of 1.5 $\mu\text{g}/\text{m}^3$. End shift urinary samples were analysed using Health and Safety Executive (HSE) methodology. Lead levels in 77.1% of the urine samples were higher than the HSE recommended limits (643.86 (353.73)). Independent *t* test showed a significant difference between urinary lead concentrations in the case and control groups ($p < 0.001$). The mean value of urinary lead in the non-smoking cases showed a significant increase ($p = 0.043$). Pearson correlation test showed a significant relationship between urinary lead content and age, duration of employment, level, and smoking habits in the case and control groups ($r = 0.472$, $p = 0.011$; $r = 0.385$, $p = 0.632$; and $r = 0.632$, $p = 0.009$ respectively). Kruskal-Wallis test indicated that urinary lead levels were independent of workers' education level and work shifts.

Conclusions: Although nowadays leadfree fuel is being used in urban transportation systems, other sources mean that high levels remain in the urban air, causing adverse environmental and biological effects to the public, particularly to urban service cleaners. Therefore, attention should be paid to controlling industrial processes located in and around large cities, which release lead into the environment.

P2.36 EVALUATION OF DENTAL TECHNICIANS' EXPOSURE TO METHYL METHACRYLATE IN TEHRAN, IRAN

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Introduction: The major use of methyl methacrylate (MMA) is in the fabrication of complete or partial denture bases to support artificial teeth. Owing to the irritative and systemic effects of MMA, it has been reported as a risk factor for occupational asthma.

Objective: To evaluate dental technicians' exposure to MMA and to assess their health.

Methods: We evaluated 51 technicians from 20 laboratories with direct or indirect exposure to MMA based on their personal breathing zone concentrations of MMA. A 3 day investigation was conducted in each laboratory. The air samples were collected using XAD-2 adsorbent tubes, according to NIOSH method 2537. After sampling, MMA was extracted using a chemical adsorption method, and analysis took place using a gas chromatograph equipped with an FID detector and MXT-1 column. All subjects were also interviewed to obtain information on their health, focusing on respiratory and dermal symptoms.

Results: The obtained data showed that the technicians involved in the mixing and packing operations had the highest exposure: mean (SD) of 79.94 (19.94) ppm, while the other technicians were exposed to 69.12 (10.22) ppm; the latter concurs much more with concentrations reported by other studies. The geometric standard deviation for time weighted average concentration of MMA was 0.14 ppm, indicating a non-noticeable variation for day to day study. In contrast, the geometric deviation within the day was 2.03, indicating a considerable within day variation. Cough and skin dryness were the most common health symptoms.

Conclusions: MMA concentrations were more than time weighted average threshold limit value. Therefore, dental technicians are at risk and they should avoid direct contact with MMA, and room ventilation should be efficiently optimised.

P2.37 MEASURING AND CHARACTERISING MOTOR EXHAUST EXPOSURE IN SWEDEN FOR DEVELOPMENT OF A JOB-EXPOSURE-MATRIX

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Introduction: Diesel exhaust is classified as probably carcinogenic and petrol exhaust as possibly carcinogenic to humans. Small particles from vehicle exhaust are suspected to increase the risk for cardiovascular diseases. Individual exposure assessment was performed in two case referent studies of lung cancer and myocardial infarction.

Methods: We performed 3 day measurements for 60 people in exposed occupations in Stockholm, Sweden, to classify the lifelong occupational retrospective dose of motor exhaust (both diesel and petrol). All measurements were personal samplings. Particles and elemental carbon (EC) were measured with pump units and gravimetric determination of PM1 and PM2.5. EC was analysed with the method BG,ZH 1/120.44-2. A real time monitoring particle instrument (data RAM) was used to measure fluctuations of total suspended particles (<PM10) during one working day. NO₂ was measured with diffusive samplers. The occupations studied were selected to represent nine predetermined groups, reflecting type of exhaust, working indoors or outdoors, and different working tasks. The results of the measurements will be used to develop job exposure matrixes (JEM) for different types of particles and NO₂ from 1950 to 1990. These JEMs will be used as a basis for individual, quantitative exposure assessments.

Results: The measurements showed marked differences in motor exhaust levels in different occupations. Exposure levels values were generally higher during indoor than outdoor work and for diesel exhaust compared with petrol exhaust. Working in tunnel constructions yielded very high levels of particles, EC, and NO₂.

Conclusions: There are marked differences in exposure levels in exhaust exposed occupations. JEMs, based on information from the measurements make it possible to quantify lifelong motor exhaust exposure.

P2.38 EXPOSURE TO PARTICLES AND NO₂ AMONG TRAFFIC WARDENS IN STOCKHOLM, SWEDEN

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Introduction: Recent research during the 1990s has confirmed a correlation between exposure to fine particles in city air and cardiovascular and pulmonary disease. Exposure to diesel and petrol exhaust is an important source of particles. In a programme at our department, we studied the relationship of myocardial infarction and particles and diesel exhaust exposure for different occupations exposed to exhaust. We have now looked at traffic wardens to explore exposure sources and compared levels with other job groups and with the environmental background.

Methods: In total, 30 full shift personal samplings were performed for wardens in city and suburban areas. Real time monitoring particle instruments (data RAM) were used to measure TSP (total suspended particles; <PM10), fluctuations, and variability during the work shifts. An industrial hygienist accompanied the wardens to observe causes of fluctuations in exposure levels, carrying the real time monitoring instrument. NO₂ was measured by diffusive samplers and environmental background levels by monitoring stations.

Results: Traffic wardens had higher exposure to particles and NO₂ (35 $\mu\text{g}/\text{m}^3$ TSP and 21 $\mu\text{g}/\text{m}^3$ NO₂) than the urban background level, but lower exposure than professional drivers in Stockholm (42 $\mu\text{g}/\text{m}^3$ TSP and 58 $\mu\text{g}/\text{m}^3$ NO₂). Traffic wardens patrolling in suburban areas had lower exposure (27 $\mu\text{g}/\text{m}^3$ TSP and 19 $\mu\text{g}/\text{m}^3$ NO₂) than those in the city centre (39 $\mu\text{g}/\text{m}^3$ TSP and 23 $\mu\text{g}/\text{m}^3$ NO₂). High peaks of particle exposure were observed during subway travelling and specific temporary activities in the streets. Particle variability during and between days were greater for traffic wardens compared with background stationary measurements.

Conclusions: Particle concentration in relation to NO₂ was higher for traffic wardens than for professional drivers, but the level was lower. The traffic wardens' NO₂ exposure was close to background level, indicating that their particle exposure comes from sources other than traffic, such as subway travelling and wear from the streets. Gravimetric particle sampling will now be performed in our following programme.

P2.39 DOES THE USE OF WEB BASED QUESTIONNAIRES IN EPIDEMIOLOGICAL STUDIES IMPOSE SELECTION BIAS?

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Introduction: Use of the Internet has become an everyday thing to most people in many western countries. In 2003, 79% of the adult Danish population had access to the Internet either at work or at home. Data collecting using the Internet could be cost effective, especially in reducing the costs and time consumption of entering data. The few studies based on this technology have mainly been in the fields of psychology, and behavioural and social sciences. We wished to study the feasibility of this approach in an epidemiological study, and to see whether this option would increase the participation rate in the younger group.

Method: In the Danish RAV study (presented at another session in this conference) a total of 10 000 people aged 20–45 years in five counties were asked to answer a questionnaire about asthma, allergy, atopic disposition, smoking, and occupation. Subjects were drawn with even age and gender distribution from the Central Office of Civil Registration. The paper version of the questionnaire was sent to all, but in four counties (8000 people) the participants were additionally offered the opportunity to answer the questionnaire via the Internet. Information on this option was given in the lower part of the introduction letter, but not at the end, making this information a rather low priority.

Results: Of 5760 participants in these four counties, 363 (6.3%) used the Internet. Men did so more frequently than women: 8.6% v 4.4% ($p < 0.001$). Age did not affect the way the participants chose to answer.

Conclusions: With the use of Internet based questionnaires in epidemiological studies, selection bias due to gender should be addressed. The use of the new system did not change the problem of the low participation rate in young people.

P2.40 THE CHALLENGES OF SYSTEMATIC REVIEW AND META-ANALYSIS IN OCCUPATIONAL EPIDEMIOLOGY: AN ILLUSTRATION FROM THE CHEMICAL INDUSTRY

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Introduction: There has been relatively little use of systematic review and meta-analysis methods to combine results of studies of occupational risks. Most have been limited to simple synthesis of overall risk estimates for a broad range of causes. For example, the paper by Greenberg *et al*, of cohort studies of chemical manufacturing industry workers, was restricted to studies from the USA and Western Europe and no analysis was carried out by industry sector, job, or specific exposures. This paper reports some of the methodological challenges being faced in an update and expansion of this work.

Methods: The update includes papers up to 2003, papers published in English from countries outside North America and Western Europe, and within industry case-control studies. Analytical methods address the effects of publication and reporting bias, heterogeneity and study quality. Toxicological considerations are used to facilitate appropriate grouping of industries, processes, and exposures.

Results: Considerable challenges exist for development of a reference search strategy, including diversity of industry sectors, processes, and potential hazards, and the definition of a chemical manufacturing worker. Many occupational studies are only reported in the 'grey' literature and frequently several papers have been published relating to the same study group. The literature in this field is diverse in the method of reporting, with differing subgroups of cohorts, health outcomes, and exposure categories, the latter often being 'proxy' variables such as job title or duration of work. We have developed a database for systematically extracting such information, which also facilitates identification of variables for consideration in a meta-analysis. Aspects of the quality of studies, such as representativeness, assessment of exposure and outcomes, and adequacy of follow-up, are also being defined.

Discussion: This update will explore the validity and robustness of the previous meta-analysis, and identify and evaluate potential sources of bias. It will form the basis of guidelines for carrying out systematic reviews and meta-analyses for occupational health.

1. Greenberg RS, Mandel JS, Pastides H, *et al*. A meta-analysis of cohort studies describing mortality and cancer incidence among chemical workers in the United States and western Europe. *Epidemiology* 2001;12:727–40.

P2.41 INTERACTION OF CHROMIUM AND NICKEL IN DETERMINING OCCUPATIONAL ASTHMA AMONG ELECTROPLATERS

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Objectives: 1) to determine the prevalence of occupational asthma among electroplaters exposed to chromium and nickel. 2) to study the interaction between chromium and nickel in determining occupational asthma.

Methodology: 225 electroplaters were divided according to airborne exposure to chromium and nickel results. 105 zinc galvanizers acted as controls. The Medical Research Council modified questionnaire was used. Interaction with respect to prevalence rates was measured according to Kahn's method. Then it was defined according to the Kupper and Hagan formula.

Results: Using the Kupper and Hagan formula interaction of chromium and nickel could be defined as the existence of nonzero values of $(AB - aB) / (A - ab)$. This difference compares the arithmetic effect of A (high exposure to chrome) on the prevalence rate of occupational asthma when B (high exposure to nickel) is absent. The chromium nickel interaction was calculated as $(0.3157 - 0.25) - (0.4687 - 0.2521) = -0.15$. Nickel was also controlled using the Mantel and Haenszel formula that combines the odds ratio for separate strata into an overall summary estimate of odds ratio relating chromium exposure to the risk of occupational asthma. The overall odds ratio was estimated as follows: $OR = 12 \times 34 / 102 + 2 \times 86 / 123 \times 26 \times 3 / 102 + 6 \times 29 / 123 = 2.47$. Thus, instead of estimating the odds ratio as 2.07 in previous results we see that the odds ratio has increased. This can be interpreted as showing that nickel exposure has no effect or "if any" a negative effect on the prevalence of work related occupational asthmatic symptoms.

Conclusion: Chromium has a higher influence in causing occupational asthma amongst electroplaters.

P2.42 UPPER LIMB DISORDERS IN THE PRIMARY HEALTH SERVICES

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Introduction: Upper limb disorders are difficult to handle according to the diagnostic tradition focusing on disorders localized to muscles, tendons, and joints. Newer research has revealed an advantage of inclusion of the neurogenous tissue in the diagnostic tradition and treatment. This project, comprising two substudies, has focused on compression neuropathy disorders.

Methods: Study 1 investigated the reliability of a manual clinical method in diagnosing upper limb neuropathy and the correlation between neuropathy diagnoses and symptoms. Tests of muscle strength, sensibility disturbances, and mechanical allodynia along nerve trunks were performed by two independent examiners in 41 consecutive patients in a department of occupational medicine. In Study 2, comprising 161 patients from the primary health sector, the aim was to describe and discuss the diagnostic distribution of upper limb disorders by two sets of diagnostic criteria, including criteria defined in Study 1. Additionally measurements of vibration perception thresholds disclosing dysfunction of peripheral nerves in patients were compared with vibration thresholds in 40 controls.

Results: The reliability of a manual method in diagnosing neuropathy was found moderate to good for most parameters tested, as well as the correlation between muscle strength reduction and symptoms supposed to reflect neuropathy. In Study 2 there was an overall agreement on a neuropathy diagnoses in 75% of limbs defined with neuropathy, but on a focal level there were big discrepancies. The vibratory perception threshold was generally increased in all groups of patients with upper limb disorders.

Conclusion: This study documents the necessity of further research concerning the definition of diagnostic criteria of neuropathy at proximal localizations, and a critical revision of criteria for peripheral localizations as well as the differential diagnoses. This is of importance in the treatment and further prognoses of the patients.