

10002- Respiratory Symptoms and Ventilatory Capacity in Metal Polishers
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To evaluate the long term effects of metal dusts on the bronchopulmonary system and the synergistic effect of cigarette smoke, a comparative study of spirometric measurements in 104 polishers and 90 unexposed controls was carried out in 25 brass and steelware polishing industries at Moradabad in northern India. The two groups were comparable in terms of age, height, smoking habit and socio-economic status. A total of 58.6 % of the polishers had one or more respiratory symptoms, compared to only 25.5 % of the controls ($p < 0.05$). Chronic cough was present in 21 polishers (20.2 %) as compared to 11.1 % of the controls. However, this difference was insignificant. Chronic phlegm was nearly three times as frequent among the polishers as among the controls (17.5 % vs 4.4 %) ($p < 0.005$). The prevalence of dyspnoea of varying grades was also significantly higher (16.3 % as opposed to 4.4 %) among the exposed groups. Chronic bronchitis (6.7 %) and occupational asthma (4.8 %) were found to be confined to polishers. The polishers also experienced acute respiratory symptoms during the work shift. The prevalence of acute respiratory symptoms was recorded for cough in 19 workers (44.1 %) followed by dyspnoea in 14 workers (32.5 %) and throat irritation in 11 workers (25.5 %). Comparison of the mean values of pulmonary function parameters in the polishers and the controls showed significant differences in the smoking and non-smoking groups ($p < 0.001$). The polishers exhibited significantly greater acute reductions in various lung functions over the work shift, particularly for forced expiratory flow over the 25-75 % portion of the spirogram (FEF₂₅₋₇₅ %) FEF₂₅ % and FEF₅₀ % than did the controls. Among the exposed group, the acute changes in the lung function were found to be significantly larger in the smoking than in the non-smoking polishers. The duration of exposure showed a direct correlation with the acute fall in lung function. Polishers who were exposed to dusts of various metals for more than 10 years showed a significantly greater acute reduction in all the pulmonary functions ($p < 0.001$) thereby indicating that occupational exposure to multimetals in the work environment of the polishing industry had deleterious respiratory effects.

10038- Occupation and the Risk of Adult Glioma in the United States

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Previous studies have observed increased glioma incidence associated with employment in the petroleum and electrical industries, and in farming. Several other occupations have also been associated with increased risk, but with rather inconsistent results between studies. We evaluated associations between occupational title and glioma incidence in adults. Cases were 489 patients with glioma diagnosed from 1994 to 1998 at three United States hospitals. Controls were 799 patients admitted to the same hospitals, treated for non-malignant conditions. An experienced industrial hygienist grouped occupations that were expected to have similar tasks and exposures. The risk of adult glioma was evaluated for those subjects who ever worked in an occupational group for at least six months, those who worked longer than five years in the occupation, and those with more than ten years latency since starting to work in the occupation. Several occupational groups were associated with increased glioma incidence for having ever worked in the occupation, including butchers and meat cutters (odds ratio [OR]=2.4; 95% confidence limits [CL]: 1.0, 6.0), computer programmers and analysts (OR=2.0; 95% CL: 1.0, 3.8), electricians (OR=1.8; 95% CL: 0.8, 4.1), general farmers and farmworkers (OR=2.5; 95% CL: 1.4, 4.7), inspectors, checkers, examiners, graders, and testers (OR=1.5; 95% CL: 0.8, 2.7), and investigators, examiners, adjustors, and appraisers (OR=1.7; 95% CL: 0.8, 3.7), physicians and physicians assistants (OR=2.4; 95% CL: 0.8, 7.2), and store managers (OR=1.6; 95% CL: 0.8, 3.1), whereas occupation as a childcare worker was associated with decreased glioma incidence (OR=0.4; 95% CL: 0.2, 0.9). These associations generally persisted when the subjects worked longer than five years in the occupation, and for those with more than ten years latency since starting to work in the occupation. Further investigation into specific tasks and work practices in these jobs provided clues about high-risk behaviors, such as not wearing gloves for butchers, and raising livestock or personally applying pesticides for farmers. This is our first analysis of occupation and will guide future exposure-specific assessments.

10067- Lung function tests in fire fighters exposed to plastic fumes: A case study.

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Acute exposure to hazardous fumes is quite common in many of the occupations in industrialized nations. Certain professions like the fire fighters carry a added risk of exposure to toxic fumes under extraordinary circumstances. We studied the Lung functions in twenty fire fighters exposed to toxic fumes from a major fire outbreak in plastic market of North Delhi, picked out randomly from the fire fighting team. All workers were smokers (average duration 14.09 years) and gave a history of cough, breathlessness, burning throat, chocking sensation and watering of eyes, after the exposure to the fumes, which persisted well after the accident. The lung functions were carried out on a computerized lung function machine (Spiro 232, P.K. Morgan). The results indicate a lower flow rates (FEF_{25%} & FEF_{75%}), however other lung functions were in the normal limits. The chest X-ray showed prominent bronchovascular markings in most of the subjects. The present study indicates that acute exposure to toxic fumes causes a certain discomfort, as indicated by the presence of clinical symptoms and also deterioration in the flow rates, with a minimal change in chest X-ray and lung volumes and capacities.

10092- CHRONIC DISEASES AND RISK FACTORS
IN SELECTED AGRICULTURAL COMMUNITIES (KIBBUTZS)
OF THE NEGEV, ISRAEL

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Background. Previously the authors reported the association of neurological disorders, unfavorable reproductive outcomes and cancer with occupational exposures in the Negev kibbutzs.

Objective. To evaluate the possible relationship between chronic diseases and environmental factors in selected kibbutzs of the Southern Israel.

Population and methods. The cross-sectional study sample consists of 324 individuals (144 males, 180 females) aged 40+ years, from five kibbutzs. The questionnaire includes information on demography, occupation, smoking, alcohol use, diet, hobbies, personal and family health history. Also dataset of chronic diseases was collected from medical records in the local clinics. The risk was estimated with logistic regression analysis. Odds ratio (OR) and 95% confidence interval (CI) were computed. The variables with significantly increased OR found with univariate analysis were included in the multivariate model.

Results. Chronic diseases of the respiratory system are associated with employment in livestock, poultry, stables (OR=1.96; CI =1.06-3.61) and the Asian-African origin compared to European-American one (OR=2.00, CI = 1.04-3.66). The same strength of association with these two risk factors is also revealed by the multivariate analysis. An increased risk of digestive tract diseases is related to occupation in construction (OR=5.03, CI= 0.98-25.3), as well as administration (OR=1.61, CI=1.01-2.50) and smoking (OR=1.66, CI=1.04-2.64). In the multivariate analysis, the association for construction is stronger (CI low level equals 1.02). For blood system diseases we found a significant association with landscape work (OR=4.5, CI = 1.33-15.33) and Asian -African origin (OR=2.87, CI=1.05-7.82). In the multivariate model we obtained similar results. The risk of age related hypertension and other diseases of the circulatory system is found to be significantly increased for: 1) immigrants in comparison with native Israelis, 2) people of European and American origin versus those from other continents. However, significance of the association in the multivariate regression analysis remained only for age (OR=1.07, CI=1.05-1.10). Individuals used drinking water from rivers and wells at age 0-15 (before kibbutz arrival) show an increased prevalence of thyroid gland diseases (OR=2.5, CI=1.02-6.16).

Conclusion. Cardiovascular diseases are associated only with demography; thyroid disorders are related to “pre-kibbutz” exposure. As a risk factor for respiratory, digestive and blood diseases, different type of occupation may be considered. The study results are worthy of further investigation.

10097- Evaluation of Electrocardiograph Components of Workers Exposed to Carbon Disulfide

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Abstract

The objective of this study was to assess electrocardiogram manifestations from exposure to carbon disulfide (CS₂) for male workers with rayon manufacture. A total of 477 male workers (251 in the exposure group and 226 in the non-exposure group) received physical examinations and completed questionnaires. On site exposure levels to carbon disulfide were measured using ATD-400 passive sampling in areas for mechanics control, and chemical liquid filtered, ripened and manufactured, filament, knitted and woven, as well as carbon disulfide was recycled and disposed. The average carbon disulfide concentration obtained by personal samplings was 13.3 ppm (standard deviation (SD) = 4.0 ppm), near to that by area samplings, 13.1 ppm (SD = 11.2 ppm). Results showed that the cardiovascular abnormalities were prevalent among workers in the studied manufacture plants. Prevalence rates of hypertension were 39% (n = 98) among workers and 0.4% (n = 1) in reference group. After controlling for age, educational level, duration of employment, cholesterol level, smoking, drinking and coffee consumption, the multivariate logistic regression analysis revealed a higher risk of electrocardiography abnormality (odds ratio = 9.86, 95% confidence interval 3.9-25.1) for rayon workers, compared with reference. No other significant risk factor was disclosed in this study. In general, the associations that were observed with carbon disulfide exposure implicating the importance of environmental control of the chemical and of workers education in exposure prevention.

Key Words Carbon disulfide • Electrocardiography abnormality • Hypertension

10116- Atypical Metaplasia Identified in Sputum among Restaurant Employees

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Abstract

Pulmonary diseases, particularly lung cancer, have been associated with the exposure of environmental tobacco smoking (ETS) and cooking oil fumes in addition to smoking. These associations have not been observed for restaurant employees in Taiwan. This study attempted to investigate the lung cancer progression marker, the prevalence of metaplasia in sputum, among restaurant employees. Specimens were collected from 81 restaurant employees, 214 drivers and 186 community controls. Each subject received a pulmonary X-ray examination and completed a self-reported questionnaire for information on socio-demographic characteristics and life-style. Restaurant employees were younger, with larger portion of females and lower education level, and more prevalent in cooking oil fume exposure at home than controls. The restaurant chefs had the highest prevalence rate of calcification at pulmonary X-ray and metaplasia from sputum examinations. In conclusion, regardless younger in age and the potential healthy worker effect, the restaurant employees are at higher risk to be found with adverse markers in pulmonary health examination, particularly the restaurant chefs.

Key word: restaurant, X-ray, sputum, metaplasia

10140- ENVIRONMENTAL POLLUTION AND PULMONARY DISEASES IN ALBANIAN IRON AND STEEL INDUSTRY WORKERS

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Heavy industries, especially iron and steel plants, expose workers to industrial air pollution and irritating chemical elements present in industrial gases (e.g., sulfur dioxide, nitrous oxides, carbon monoxide, phenol, ozone, ammonia and hydrogen sulfide), as well as to extremes of temperature.

All these pollutants affected the pulmonary function of the workers causing pulmonary diseases, and especially *chronic bronchitis*. Chronic bronchitis has been a serious societal problem due to its high prevalence, chronic and latent course, resistance to treatment, and as a consequence, resultant economic losses. Both *endogenic* and *exogenic* factors contribute to the etiology of chronic bronchitis. *Endogenic* factors include allergic states, tracheobronchial tract disorders, morphological changes in the bronchial tree, chest deformities, and immunological dysfunction. *Exogenic* factors include bronchial viral infections, secondary bacterial superinfections, cigarette smoking, irritating chemicals, mechanical and thermal effects, synergistic action of allergic stimulators and irritating chemical substances, and climate.

This paper regards the correlation between occupational pollution in the Albanian iron and steel industry and the prevalence of lung diseases, especially *chronic bronchitis*, in the workers.

The results of this cross-sectional study show a wide variation in the concentrations of irritating gases, TSP and PM₁₀ (sulfur dioxide 2.67-18.69 mg/m³, carbon monoxide 3.5-23.4 mg/m³, total suspended matter 2.4-23.9 mg/m³, PM₁₀ 3.9-4.1 mg/m³). We have measured pulmonary functions in 324 workers of the iron and steel industry. Their Pulmonary Function Tests (PFTs) have shown that FEV₁ varied from 35%-99.5%, FVC from 44%-105%, and VC from 30%-135% of normal. Odds Ratios (OR) for developing chronic bronchitis were computed for the group as a whole (OR=2.3) and for the subgroup of smokers (OR=4.79).

Based on the American Thoracic Society's criteria for pulmonary impairment according to FEV₁ measurements, 18.9% of Albanian iron and steel workers suffer from "chronic obstructive pulmonary disease (COPD)"; 18.5% have "mild impairment" of the lungs; 3.1% "moderate" and 1.6% "severe".

10193- Prevalence of Musculoskeletal Discomfort among Health Care Workers in Taiwan

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Musculoskeletal discomfort is a common health problem among the working population, including health care workers (HCWs). Nurses are known to be at high risk of back pain; however, musculoskeletal problems among other HCWs are less extensively studied. To understand the prevalence of miscellaneous musculoskeletal discomforts of different bodily parts among various job descriptions in the health care setting, we conducted a self-administered questionnaire survey in 16 teaching hospitals in Taiwan. A total of 8645 (79.2%) workers completed the questionnaire survey satisfactorily. The results showed that nursing staff had the highest prevalence (90.0%) of musculoskeletal discomfort, followed by supporting staff (81.6%), technicians (79.9%), and medical doctors (69.0%). Among medical technicians, X-ray technicians had the highest risk of musculoskeletal complains, and the prevalence was 100%. Of the responded medical doctors, the prevalence of neck and shoulder discomfort was particularly high among dentists (93.0%). Lower back was the most common (55.3%) affected bodily part for all musculoskeletal discomfort. If limit of motion was taken as an indicator for severity of musculoskeletal discomfort, supporting personnel had the highest prevalence of problems in shoulder (4.5%), elbow (2.1%), buttock (2.1%), knee (5.1%), and ankle (2.2%); whereas nurse had the highest prevalence of problem in lower back (6.6%), wrist (3.3%), thigh (2.3%), and leg (3.8%). In conclusion, this survey showed that musculoskeletal discomforts were prevalent among all health care workers, while the distribution of bodily part and nature of the discomforts were rather different across job descriptions. Development of effective prevention strategies for musculoskeletal discomforts for each job description, to promote the health of all HCWs is warranted.

10199- Influence of smoking on blood pressure of workers of thermoelectric power station

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Background: It is largely known that cigarette smoking (S) and arterial hypertension (AH) are independent risk factors of cardiovascular diseases. We have wanted to reveal the influence of S on blood pressure (BP) of workers in Central Thermoelectric Power Station (CTPS) depending on different work conditions.

Methods: 169 workers (volunteers; all males; aged $51,1 \pm 0.2$) of CTPS were involved in the study. Depending on the level of industrial noise (IN) and electromagnetic field (EMF) workers were divided in 3 groups (G). GA: n=76, IN over 85 dBA, EMF 50 Hz. GB: n=46, IN lower than 85 dBA, EMF 50 Hz. GC: n=49, IN lower than 85 dBA, EMF lower than 50 Hz. Systolic BP (BPs) and diastolic BP (BPd) were measured in each group 6 times a day in fixed hours during work time. There were no significant differences in S, alcohol consumption, work experience, age, and body mass index between 3 groups. Statistical analyses have been done to three ages G (30-44 yrs., 45-59, 60 and over). Using T-test we compared the mean values of BPs and BPd of S and nonsmoking (NS) in each G – GA, GB, GC. Using Sheffe`s modified test the difference in mean values of BPs and BPd was estimated for 3 age G between GA-GB, GC-GB, GC-GA of S and NS. Thus, we have studied the influence of different professional factors on BP of S and NS separately.

Results: T-test shows that BP of NS is not statistically significantly higher for age G 30-44, 45-59 of GA, GB, and GC as compared with S. This difference of BPd becomes significant for GB in age 30-44, 45-59. BPs of S of GA in age 45-59, of GB, GC in age 60 and over is not statistically higher than for NS. This difference is significant for a GA in age 60 and over (BPs of NS-140,2+3,1; of S 165,1+6,2; $p < 0,001$). Earlier we have found out that the influence of IN over 85 dBA with EMF 50 Hz and shiftwork on BP increasing of workers appears in age G 45-59, 60 and over. Sheffe`s modified test shows that there is no such influence for NS 45-59.

Conclusion: We think that S cessation could protect from the influence of this professional factors on BP in age 45-59. Influence of IN over and lower 85 dBA with of EMF 50 Hz on BP increasing in age above 60 years old exists for S and NS. So for the age 60 and over professional factors influence on BP is more essential.

10212- Comparing Optimized Biomarkers and Exposure Control Measures to Reduce Disease in Beryllium Exposed Workers

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Despite efforts to reduce occupational exposure to beryllium, beryllium disease continues in most beryllium workplaces where thousands continue to be exposed. A primary tool to identify disease in its early stages is the beryllium lymphocyte proliferation test (BeLPT). This biomarker of exposure and effect has proved a useful tool for diagnosis and control of disease. A dose response relationship has been demonstrated for exposure and development of chronic beryllium disease (CBD), but not for exposure and a positive BeLPT. This implies that earlier disease identification may reduce even further the risk of development of CBD. Epidemiological data were used to develop a model for development of CBD, which allows for different assumptions of BeLPT administration frequency and Be exposure levels. Model simulations indicate that increasing frequency of the current test has limited impact on CBD occurrence due to the shallow dose response for CBD development. For a worker population, the cost of various BeLPT frequencies and expected disease costs are explored at several exposure levels; sensitivity analysis shows cost of illness as a driver in these calculations. A new or improved biomarker capable of identification of disease within one year would reduce CBD from 1.8% to 0.61% over the current test for an exposure level of 0.2 ppm (ACGIH guideline), and exposure reduction from 0.2 ppm to 0.02 ppm is estimated to reduce prevalence from 1.8% to 0.75%. Combining this exposure reduction and biomarker improvement may reduce prevalence from 1.8% to 0.18%, indicating the potential benefits of these options used in combination and thus, such estimates provide guidance for new or improved biomarker development. These evaluations have significant implications for other biomarkers of sensitization and provide approaches for biomarker development for immunotoxicants.

This proposal was prepared with support of U.S. Department of Energy, under Award No. DE-FG26 00NT40938. However, any opinions, findings, conclusions, or recommendations expressed are the author's and do not necessarily reflect the views of the DOE.

10220- Multiple analysis of blood pressure of workers of thermoelectric power station
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The relationship between blood pressure (BP) and vascular diseases is well established. In present work we perform a linear regression analysis for BP changes related to different work conditions, work experience(WE) and smoking (S).

Methods: 190 workers (volunteers; all males, aged 49.1 ± 0.1) of the Central Thermoelectric Power Station (CTPR) were involved in the study. Depending on the level of industrial noise (IN) and electromagnetic field (EMF), workers were divided in 3 groups (G). GA: n=91, IN over 85 dBA, EMF 50 Hz, shiftwork, GB: n=50, IN lower than 85 dBA, EMF 50 Hz. GC: n=49, IN lower than 85 dBA, EMF lower than 50 Hz. Systolic BP (BPs) and diastolic BP (BPd) have been measured in each group 6 times a day in fixed hours during work time. There were no significant differences in S, alcohol consumption, WE, age, body mass index between 3 groups. Linear regression (with b-coef.of regression) statistical analysis has been done to follow 4 age G – 20-29, 30-44, 45-59, 60 and over to find out changes of workers` BP related to work conditions(GA-GC), WE and S.

Results: BP in the age 20-29 is not exposed to changes under different factors. Influence of IN over and lower 85 dBA with or without EMF, shiftwork (from GA-GC) reveals in age G 45-59, 60 and over(for age G 45-59 BPs b-coef.= - 3,68; p = .001, BPd b-coef.= -1,79; p=.003, for the age G 60 and over BPs b-coef.= -8.40; BPd b-coef. = -5.33, p< .001).

As to BP changes related to WE, they also occur after 45 years old (for age G 45-59 BPs b-coef.= - 0.29, BPd b-coef.= -0.16; p=.005, for the age G 60 and over BPs b-coef.= -0.93; BPd b-coef. = -0.52, p< .001).

Regarding the S factor BPd is lower for S workers of two age G – 30-44, 45-59 (for age G 30-44 b-coef.= -2.32; p=.029, for 45-59 b-coef.= -2.14; p= .005). In the age of 60 and over increasing of BPs and BPd of S workers are not statistically significant.

Conclusion: Thus high risk G for an increasing of BP is GA with IN over 85 dBA, EMF, shiftwork in the age over 45. Low risk G is GC-IN lower than 85 dBA ,EMF lower than 50 Hz for the same age range. The slope of the descent line is higher for an age G 60 and over. So the more exposed factors we have, the more is the influence on BP.

After 45 years old (when the influence of these professional factors reveals) BP decreases coincidentally with increasing of WE.

BPd is lower for S workers than NS ones in the age 30-59.

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10228- Exposure to polycyclic aromatic hydrocarbons (PAH), other occupational exposures, and laryngeal cancer risk.

We performed a population-based, 1:3 frequency matched case-control study on laryngeal cancer in the Rhein-Neckar region in Germany. The study included 257 Cases (236 males, 21 females) aged 37-80, histologically confirmed and diagnosed between 1.5.1998 and 31.12.2000 and 769 population controls (702 males, 67 females). Occupational exposure as well as other risk factors were obtained with face-to-face interviews using a detailed standardized questionnaire. The complete individual work history was assessed. A detailed assessment of work conditions was obtained by job-specific questionnaires (JSQs) for selected jobs known to be associated with exposure to potential laryngeal carcinogens. Estimates for total exposure hours by substance were calculated based on JSQs. Published occupational hygiene data were used to infer semi-quantitative scores of exposure intensity for specific job tasks. A blood sample was taken to assess DNA repair capacity (enzyme activity of poly(ADP-ribose)polymerase) and polymorphisms of the genes GSTM1, GSTT1, ADH2+3 and ALDH2 were determined. Data were analysed using a conditional logistic regression model stratified by sex and age. Here we present the results on occupational exposures.

The table (exposure prevalence data for males only) shows a strong effect of PAH exposure on laryngeal cancer risk and a clear dose-response. There is a confounding effect of smoking and age, however, after careful adjustment for these factors an independent effect of PAH remained. Other occupational exposures (cement dust, wood dust) also showed increased risks with OR 2.39 (95% CI 1.38-4.14) for cement exposure and OR 1.89 (95% CI 1.13-3.16) for wood dust exposure.

PAH exposure and laryngeal cancer risk

PAH-Exposure		Cases		Controls		OR ₁	OR ₂	95% KI
		N	%	N	%			
Based on JSQs	no	213	90.3	685	97.6	1	1	-
	yes	23	9.7	17	2.4	4.49	2.60*	(1.24, 5.48)
Based on substance list	no	211	89.4	674	96.0	1	1	-
	yes	25	10.6	28	4.0	2.80	1.63	(0.85, 3.12)
Exposure duration (hours of exposure)	0	213	90.3	685	97.6	1	1	-
	>0-1300	6	2.5	8	1.1	2.43	1.53	(0.47, 5.0)
	>1300	17	7.2	9	1.3	6.40*	3.66*	(1.38, 9.7)

OR₁: Odds Ratio, stratified by age and sex

OR₂: Odds Ratio, stratified by age and sex, adjusted for smoking [log(packyears+1)] and alcohol [average daily consumption]

95% KI: 95 % confidence interval for OR₂ *: (p<0.01, two-sided)

In this study we have used the same occupational exposure assessments which have been previously used in two large lung cancer studies. Both methods of assessment gave similar results, while the assessment based on JSQ appeared to be more specific since anecdotal exposures are less likely to occur in the quantification process. Our findings are supported by risks associated with particular occupational groups in which the substance exposures in

question are a priori considered likely. Our study may contribute to classifying PAH as a causal risk factor for laryngeal cancer.

10250- Liver fibrosis in asymptomatic polyvinyl chloride workers

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This study was designed to determine whether vinyl chloride monomer (VCM) exposure is associated with liver fibrosis. A total of 347 workers with occupational exposure to VCM were systemically examined using liver ultrasonography and routine liver function tests. Vinyl chloride monomer cumulative dose (ppm-month) was estimated by summing the products of air VCM concentration levels and months of employment. The high cumulative exposure group was defined as the workers having history of high exposure jobs with cumulative doses greater than or equal to 3000 ppm-month. The moderate cumulative exposure group was defined as the workers having history of high exposure jobs with cumulative doses less than 3000 ppm-month. The low cumulative exposure group was defined as workers with no history of high exposure jobs. HBsAg, anti-HCV, alcohol drinking, tobacco smoking, and body mass index were also measured during physical examination. Liver fibrosis was defined in subjects with parenchymal liver disease or cirrhosis of liver diagnosed using ultrasonography. A significantly increased risks of developing liver fibrosis were found in the high cumulative exposure group (O.R. 6.0, 95% C.I. 1.5-30.9) and moderate cumulative exposure group (O.R. 5.1, 95% C.I. 1.4-25.2) when compared with the low cumulative exposure group. Hepatitis B and/or C infection and body mass index greater than or equal to 25 were also independent risk factors for liver fibrosis. We concluded that there was an increased risk of developing liver fibrosis in

PVC workers who had high exposure to VCM. We suggest that ultrasonographic examination be included in medical surveillance for PVC workers to detect chronic liver diseases.

10275- Influence of smoking on blood pressure of workers of thermoelectric power station

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Department of Occupational Health

Background: It is largely known that cigarette smoking (S) and arterial hypertension (AH) are independent risk factors of cardiovascular diseases. We have wanted to reveal the influence of S on blood pressure (BP) of workers in Central Thermoelectric Power Station (CTPS) depending on different work conditions.

Methods: 169 workers (volunteers; all males; aged $51,1 \pm 0.2$) of CTPS were involved in the study. Depending on the level of industrial noise (IN) and electromagnetic field (EMF) workers were divided in 3 groups (G). GA: n=76, IN over 85 dBA, EMF 50 Hz. GB: n=46, IN lower than 85 dBA, EMF 50 Hz. GC: n=49, IN lower than 85 dBA, EMF lower than 50 Hz. Systolic BP (BPs) and diastolic BP (BPd) were measured in each group 6 times a day in fixed hours during work time. There were no significant differences in S, alcohol consumption, work experience, age, and body mass index between 3 groups. Statistical analyses have been done to three ages G (30-44 yrs., 45-59, 60 and over). Using T-test we compared the mean values of BPs and BPd of S and nonsmoking (NS) in each G – GA, GB, GC. Using Sheffe`s modified test the difference in mean values of BPs and BPd was estimated for 3 age G between GA-GB, GC-GB, GC-GA of S and NS. Thus, we have studied the influence of different professional factors on BP of S and NS separately.

Results: T-test shows that BP of NS is not statistically significantly higher for age G 30-44, 45-59 of GA, GB, and GC as compared with S. This difference of BPd becomes significant for GB in age 30-44, 45-59. BPs of S of GA in age 45-59, of GB, GC in age 60 and over is not statistically higher than for NS. This difference is significant for a GA in age 60 and over (BPs of NS-140,2+3,1; of S 165,1+6,2; $p < 0,001$). Earlier we have found out that IN over 85 dBA with EMF 50 Hz and shiftwork lead to BP increasing of workers in age G 45-59, 60 and over. Sheffe`s modified test shows that there is such influence only for S in 45-59 age (BPs difference—GB-GA= -8.98, $p = 0.010$; GC-GA= -10.18, $p = 0.001$; BPd difference GB-GA= -5.80, $p = 0.001$, GC-GA= -3.65, $p = 0.031$). However this influence is not observed for NS.

Conclusion: We think that S cessation could protect from the influence of this professional factors on BP in age 45-59. Influence of IN over and lower 85 dBA with of EMF 50 Hz on BP increasing in age above 60 years old exists for S and NS. So for the age 60 and over professional factors influence on BP is more essential.

10282- Evaluation of the covariance structure of dust exposures in the European carbon black industry

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In a previous paper, trends in personal inhalable dust exposure in the European carbon black industry were investigated. For those analyses, it was assumed that the variance components were homogeneous across time and factory. This paper investigates if this assumption was valid or if assuming different covariance structures will improve the fit of the models and alter conclusions about estimated trends. Personal inhalable dust exposure data were available from two surveys (3 years apart) in 19 factories. All workers were classified into one of eight job categories. In total, 6478 inhalable dust measurements from 2371 workers were available for the analyses. For each job category, Proc Mixed in SAS (v6.12) on a UNIX system was used to estimate the random (worker identity) and fixed effects (survey, factory and interaction term). Heterogeneity of variance components across the main fixed effects was evaluated. The models tested were: 1) homogeneous within- and between-worker variance components (compound symmetry covariance structure within a job category); 2) homogeneous within-worker and heterogeneous between-worker variance components; and, 3) heterogeneous within- and between-worker variance components. Models with heterogeneous variance components across factory and factory×survey combinations could not be fitted since they resulted in infinite likelihood estimates. Log-likelihood ratio tests were used to determine which model had the best fit. The results of the analyses showed that for most job categories the model did not improve significantly when allowing heterogeneous variance components across the fixed effects. For those cases where the fit of the model was improved, the effects on the median fixed effect of survey (across all the factories) were small. For ‘Administrative staff’ the median fixed effect for survey (comparing the first with the second survey) changed from 0.318 (range –0.297, 1.088) to 0.345 (range –0.156, 1.110); for ‘Fitters/welders’ the median fixed effect for survey changed from 0.350 (range –0.625, 1.676) to 0.347 (range –0.580, 1.932); and for ‘Warehousemen’ from 0.301 (range –1.368, 0.636) to 0.268 (range –1.757, 0.619). For the ‘Warehousemen’, the fixed effects of survey and the interaction term between survey and factory were no longer statistically significant after introducing heterogeneous between-worker variance components for all factory and survey combinations. The fit of the overall model, combining the models for each job category, was not improved by heterogeneous variance components across survey and factory. In conclusion, it appears that, in general, our previous assumption regarding the homogeneity of the variance components across time periods and factories for the time trends analyses of inhalable dust exposure in the carbon black industry were justified.

10297- ISEA abstract

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Title: Estimating Historical Benzene Exposures (1936–1976) Among Rubber Hydrochloride (Pliofilm) Workers Using Probabilistic Modeling Techniques

Abstract:

The current OSHA Permissible Exposure Limit (PEL) and ACGIH Threshold Limit Value (TLV) for benzene are based primarily on the epidemiology data for the rubber hydrochloride (Pliofilm) workers. Previous assessments of this cohort by Rinsky (1981, 1987), Crump and Allen (1984), and Paustenbach et al. (1992) relied on different assumptions about workplace practices and processes over time, as well as different exposure data and assumptions, thereby yielding significantly different estimates of benzene dose for certain jobs. Given the inherent limitations and uncertainties involved in estimating historical exposures for this cohort, a “distributional” rather than a “point-estimate” approach should be more informative. In this paper, we describe a probabilistic exposure assessment of the Pliofilm workers in which we incorporated the universe of plausible exposure factors, and we discuss the impacts of various exposure parameters and assumptions on estimated doses. The new analysis also addresses and discusses the importance of many of the criticisms raised by Utterback and Rinsky (1995) in their evaluation of the Paustenbach et al. (1992) paper.

In this analysis, spatial and temporal benzene air concentrations are characterized by separate probability distributions for background versus peak data, which are based on plant sampling and similar production processes, as well as assumptions about compliance with TLV changes over time. The likely uptake of benzene from dermal exposures was calculated based on probability distributions for several factors, including surface area, contact rate and duration, and skin absorption. Other components of the assessment that were characterized by probability distributions include improved engineering controls over time, extended work hours and plant shut-down during the early years, effectiveness of personal protective equipment, and accuracy of monitoring devices. Estimated benzene doses are reported as equivalent 8-hour time-weighted airborne concentrations for 12 job categories from 1939 to 1976 (St. Mary’s facility) and 1936 to 1965 (Akron I and II facilities).

We conclude that estimated benzene doses for St. Mary’s workers were highest for four jobs (neutralizer, quencher, knifeman, spreader), typically ranging from about 50 to 100 ppm during 1939–1946, and 10 to 50 ppm during 1947–1976 at the 95th percentile. These doses are about 1.5 times greater than those estimated at the 50th percentile, and 2–3 times greater than for other jobs in the Pliofilm process. Estimated doses for Akron I and II were nearly 2-fold higher than for St. Mary’s; however, there is a significant level of uncertainty in these concentrations. Benzene doses at the 95th percentile were similar in magnitude to those predicted by Paustenbach et al. (1992) for many jobs; however, this analysis (which incorporates new information that was not available in 1992) suggests that the prior study over- and under-estimated exposures for some

job/years by about a factor of two. Doses at the 50th percentile were similar to those estimated by Rinsky (1981, 1987) and Crump and Allen (1984) for some jobs, but these studies also significantly over- or under-estimated exposures for some job/years. The current estimates incorporate the most likely range of plausible exposure values, thereby providing a better characterization of the potential workplace exposures for this cohort. These data could be combined with the current or future mortality information to calculate a new potency factor for benzene.

10376- OCCUPATIONAL RISK ASSESSMENT IN THE HEALTH CARE WORKERS IN RISK OF GENOTOXIC CHANGES

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Material and methods: Health care workers from East Slovakia hospitals were examined on mutagenic genotoxic risk during occupational exposure. The cross-sectional survey was based on risk assessment among three groups: exposed, unexposed and reference group from national reference survey. Data from 4 exposed groups included 62 workers from different hazard hospital wards. The workplaces of risk groups were exposed to ionising radiation, cytostatic drugs, anaesthesiology gases.

The cytogenetic markers data from 4 exposed groups were compared with 4 control groups (42 workers) generally and also for each group separately. Each control group was conducted from the same hospital but from occupationally unexposed health care workers f.e.: paediatric dept., dermatology dept.. The cytogenetic outcomes of exposed groups were also compared with the national reference standards obtained from National Environmental Genotoxic Survey. The exposed and unexposed workers were also examined by questionnaires for follow up negative life style factors, particularly smoking.

The tests of mutagenicity included CALP (cytogenetic analysis of peripheral lymphocytes), SCE (sister chromatids exchange), MN (frequency of micronucleolus per 1000 cells) and urine mutagenicity AT Ames Test on bacterial culture *Salmonella Typhi murium*.

The data were compared with chi-square test and OR were calculated. All data are adjusted on sex, age and smoking status.

Results: Statistical analysis of exposed health care workers groups compared with National Environmental Genotoxic Survey doesn't show any exceeded mutation activity in the exposed groups, generally (4 groups together) and separately compared also. Basic standards levels from the reference national survey were used with followed levels: CALP 2% of aberrant cells, SCE 5-10/ per cell, MN $8,8 \pm 2,6$, urine AT RT/RC³ 2 in 60% of population.

Statistical analysis of 4 exposed groups with control groups indicates following outcomes:

CALP - no statistically significant results, compared were each of 4 groups separately with control groups or together one general exposed workers group with one general control group.

SCE -statistically significant higher results only in 3 exposed groups compared with 3 control each other.

MN - statistically not significant results.

AT urine - statistically not significant results, but in 3 exposed groups higher Ames urine test results.

The differences between smokers and non smokers - did not show statistical significance, in some cases CALP have non-smokers even worse results then smokers.

Results and conclusions: The study shows very small differences in mutation risk between exposed health care workers and two groups of control (reference national control, control group from the same hospital). The smoking preference has no statistical impact on genotoxic changes measured by cytogenetic analysis of peripheral lymphocytes.

10481- FACTORS INFLUENCING ELEMENTAL CARBON EXPOSURE IN THE US TRUCKING INDUSTRY

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OBJECTIVES: In studies conducted to assess the risk of lung cancer among truck drivers, the excess lung cancer risk observed has been attributed to diesel exhaust exposure. This relationship has been questioned because measurements and historical work records validating the linkage between diesel exhaust exposure, other non-diesel sources of combustion particulate, and work as a truck driver are limited. As part of a study of the feasibility of an epidemiologic study to assess the health risk attributable to diesel exhaust exposure in the US trucking industry, several other exposure factors were considered in addition to job title alone. They included the historical relationship between job title and industry use of diesel-powered vehicles, work location within a trucking terminal, terminal location and size, and current measurements of exposure to elemental carbon (EC), a marker of diesel exhaust, and organic carbon (OC). **METHODS:** With the cooperation of the four largest unionized less-than-truckload (LTL) trucking companies in the US, the Motor Freight Carriers Association (the industry trade association), and the International Brotherhood of Teamsters (organized labor), we interviewed long-term employees and reviewed historical records of truck fleet composition. An exposure assessment was conducted at two large terminals (>500 workers each) in an urban area (Atlanta) and in four small terminals (<30 workers) in rural New England. Personal exposure to EC and OC was measured using a TissueQuartz filter in a URG cyclone. The NIOSH 5040 thermo-optical method was used for analysis. **RESULTS:** Long haul truck drivers began to drive diesel-powered vehicles in the 1950s and 1960s, whereas diesel trucks were used in city-based pickup and delivery truck fleets starting in the 1970s. Current EC measurements suggested that approximately half the exposure on a terminal dock came from sources outside the terminal. Both terminal size and terminal location (urban, rural) were determinants of particulate exposure. There was a 7-fold range of EC exposure based on terminal size and location. **CONCLUSIONS:** These results indicate that epidemiologic study of truck drivers and other workers in the US trucking industry must consider fleet composition, terminal size and terminal location, as well as calendar-time and job title in the assessment of exposure to minimize misclassification.

10491- Is the Healthy Worker Effect stronger in areas where asthma is more common?

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Associations between occupational exposures in the current job and asthma have been investigated in several cross-sectional studies. It has been recognized that the Healthy Worker Effect can bias these associations if less asthmatic than non-asthmatic subjects enter exposed jobs and/or if incident asthma cases quit exposed jobs. We aimed to investigate the proportion of asthmatics in exposed jobs in relation to the local asthma prevalence within the European Community Respiratory Health Survey. We performed analyses of 16,752 working subjects of both sexes aged 20 to 45 years from a random population sample of 40 study centers in 19 industrialized countries. The current job of each subject was coded according to the OPCS-1980 system and linked to an external job exposure matrix resulting in a classification of no, low or high occupational exposure to dusts, gases or fumes. The prevalence rate of current asthma symptoms or medication ranged from 3% to 18% across the centers. Depending on the center, between 3% and 25% of the subjects worked in jobs with high occupational exposures. In centers with a high community prevalence of asthma, the proportion of asthmatics in high exposure jobs was lower than in centers with a low community prevalence of asthma; Spearman's correlation coefficient (r) was -0.35 ; $p=0.03$. The proportion of non-asthmatics working in high exposure jobs was not associated with the community prevalence of asthma (r was -0.06 ; $p=0.71$). The center-specific odds ratio for asthma associated with high exposures ranged from 0.4 to 3.7, and was lower in centers with a higher asthma prevalence (r was -0.43 ; $p=0.007$). We conclude that in areas where asthma is more common, less asthmatics work in high exposure jobs. This phenomenon may result in a stronger Healthy Worker Effect in these areas, indicated by lower risk estimates for asthma associated with current occupational exposures. Our findings suggest a greater awareness of occupational risk factors when asthma constitutes a bigger community health issue.

10545- SOME IMMUNOLOGICAL PARAMETERS IN WORKERS EXPOSED TO HEAVY METALS

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The objective of the study was to assess the association of hair chromium (HCr), cadmium (HCd) and T, B cells, immunoglobulins IgA, IgG, IgM and phagocytosis index (PhI).

Methods. A cross-sectional survey included 308 Ceramics Plant workers (94 men and 214 women) and 226 randomly selected controls (53 men and 173 women) aged 18-75. Analysis of HCr and HCd made by AAS with Zeeman's effect. T and B cell count determined by E and EAC rosette formation method. Concentration of IgA, IgG, IgM in serum measured by radial immunodiffusion method by Mancini. PhI determined by latex phagocytosis of neutrophils.

Results. HCr of men in 1st, 2nd and 3rd tertiles varied 0.01-0.4 µg/g, 0.44-0.75 µg/g and 0.78-9.25 µg/g, HCd - 0.01-0.14 µg/g, 0.15-0.33 µg/g and 0.34-4.18 µg/g. HCr of women in 1st, 2nd and 3rd tertiles varied 0.01-0.36 µg/g, 0.37-0.79 µg/g and 0.81-4.43 µg/g, HCd - 0.01-0.12 µg/g, 0.13-0.29 µg/g and 0.3-9.0 µg/g.

All immunological indices were adjusted by age, alcohol, lead, manganese, cadmium or chromium. Mean of T cell count in men from 2nd Cr tertile and in women from 3rd Cd tertile was significantly lower than in 1st one (69.8% vs. 74.9%, $p < 0.05$; 72.7% vs. 76.3%, $p < 0.05$). Mean of IgA in persons from 3rd Cr tertile was higher than in persons from 1st one (2.2 g/l 95%CI 2.0-2.4 vs. 2.0 g/l 95%CI 1.9-2.1, $p < 0.05$). Mean of IgM in women from 3rd Cr tertile and in man from 2nd Cd tertile was higher than in 1st one (1.5 g/l 95%CI 1.3-1.6 vs. 1.2 g/l 95%CI 1.1-1.3, $p < 0.01$; 1.1 g/l 95%CI 0.9-1.2 vs. 0.9 g/l 95%CI 0.7-1.0, $p < 0.05$). Mean of IgG in women from 1st and 2nd Cr tertiles and from 2nd Cd tertile was lower than in 3rd one (11.9 g/l 95%CI 11.1-12.8, 12.4 g/l 95%CI 11.3-13.6 and 14.2 g/l 95%CI 13.1-15.4, $p < 0.05$; 11.9 g/l 95%CI 10.8-12.9 vs. 13.8 g/l 95%CI 12.5-15.2, $p < 0.05$). PhI in women from 2nd and 3rd Cr and Cd tertiles was lower than in women from 1st one (57.5%, 54.7% and 65.0%, $p < 0.01$; 60.4%, 53.2% and 64.5%, $p < 0.05$). PhI in men from 1st and 3rd Cd tertiles was lower than in men from 2nd one (62.9%, 58.0% and 71.8%, $p < 0.01$). There was no significant difference in B cell count and IgA neither in men, nor in women from different Cr and Cd tertiles. Increased HCr was related to greater number of women having decreased count of T and B cells and lower PhI as well as to higher concentration of IgG. Increased HCd was related to greater number of persons having decreased count of T and B cells and lower PhI.

Conclusion. So, the data obtained show that chromium and cadmium suppress the indices of cellular immunity and phagocytosis and chromium activates parameters of humoral immunity.

10586- EPIDEMIOLOGIC AND EXPOSURE ASSESSMENT STUDY OF THE ASSOCIATION OF PARTICULATE EXPOSURE AND LUNG CANCER IN THE TRUCKING INDUSTRY

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Although diesel exhaust particulates are considered a probable human lung carcinogen, interpretations of past epidemiologic studies are limited. The Trucking Industry Particle Study funded by National Cancer Institute (4/2001-3/2005) will combine an extensive nationwide exposure assessment directly with a retrospective epidemiologic study of lung cancer mortality in US trucking industry workers. With the cooperation of the four largest unionized less-than-truckload (LTL) trucking companies in the US, the Motor Freight Carriers Association (the industry trade association), and the International Brotherhood of Teamsters (organized labor), we have identified a cohort of 55,750 long-term trucking company workers employed in 1985 with previous diesel exposure. Cause-specific mortality will be assessed through the year 2000 using the National Death Index. The exposure assessment will include visits to 36 large (>100 employees) and 72 small (< 100) terminals across the US and Southern Canada. Personal and area samples of particulate matter less than 2.5 microns (PM_{2.5}), elemental carbon (EC), and organic carbon (OC) will be obtained for all job titles and work locations, including loading docks and in long-haul and city trucks. High volume samples will be collected to identify organic compounds that serve to indicate the source of EC. Current and historical information on truck fleet, work locations, and job duties will be collected from each company and used to develop models for the estimation of retrospective exposure. Exposure will be linked to the work history records of each employee using job title, calendar-time, and work location that will permit the development of quantitative and semi-quantitative exposure categories for each individual. Factors such as urban or rural terminal location and local air pollution will be considered as well as occupational exposures. Based on the age-distribution of the cohort, we estimate that there will be 6,400 deaths, 800 from lung cancer, by the end of follow-up. Sample size calculations indicate that we will be able to detect a relative risk of lung cancer of 1.2-1.3 ($\alpha=0.05, 1-\beta=0.80$) depending on which job titles are included. Exposure data collected to demonstrate the feasibility of this project indicate that particle exposure in trucking company workers include levels similar to the general population. Therefore, the results of this study will be relevant to understanding general population risk of lung cancer from diesel emissions and other fine particulate air pollution.

10607- Does a family history indicate higher work-related breast cancer risks?

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Background: A family history of breast cancer can occur because of shared genetic factors among relatives, shared environment among relatives, or the chance occurrence of unrelated cases in a family. Whatever the cause, a family history might indicate that a woman has increased susceptibility to the disease. Therefore, women with a family history might have an increased risk of developing breast cancer as the result of work-related factors. We set out to test this hypothesis using data from a recent case-control study in British Columbia (BC). Methods: We analyzed data from a large case-control study (Band et al, JOEM 2000, Vol 42:284-310). Cases (n = 1018) were all women under age 75 who were diagnosed with breast cancer in BC between June 1, 1988 and June 30, 1989. Controls (n = 1035) were women who were randomly selected from the 1989 BC Provincial Voters List and age-matched to the cases. Women completed a mailed questionnaire that asked, among several things, about their family history of breast cancer and their occupational history. A positive family history was defined as having a mother or sister with breast cancer. Occupations and industries were classified using standard codes. Logistic regression was used to estimate the risk of breast cancer for women in various jobs and industries – depending on whether or not they had a family history of breast cancer. Pre-menopausal and post-menopausal breast cancer risks were analyzed separately. Results: For occupations classified as “Natural Science and Engineering Managers, General Managers, Other Senior Officials” or industries classified as “General Merchandising Stores” or “Department Stores”; there was a 3-fold or greater risk of pre-menopausal breast cancer for women with a family history disease (compared to women without a family history of disease). For occupations classified as “Social Sciences”, or industries classified as “Women’s Clothing”, “Household Furniture, Appliances and Furnishings, Retail”, “Jewelry Stores and Watch and Jewelry Repair Shops”, “Insurance”, “Accounting and Bookkeeping Services”, “Social Service Administration” or “General Administrative Services”; there was a 3-fold or greater risk of post-menopausal breast cancer for women with a family history disease (compared to women without a family history of disease). None of the differences in risk between women with and without a family history were statistically significant. Conclusions: For some types of work, a woman’s risk of developing breast cancer might be increased if she has a family history of the disease. Case-control studies, even large ones, are unlikely to have sufficient power to detect this because women having a specific occupation, and a close relative with breast cancer, are relatively rare.

10714- ENVIRONMENTAL POLLUTION AND PULMONARY DISEASES IN ALBANIAN IRON AND STEEL INDUSTRY WORKERS

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Heavy industries, especially iron and steel plants, expose workers to industrial air pollution and irritating chemical elements present in industrial gases (e.g., sulfur dioxide, nitrous oxides, carbon monoxide, phenol, ozone, ammonia and hydrogen sulfide), as well as to extremes of temperature.

All these pollutants affected the pulmonary function of the workers causing pulmonary diseases, and especially *chronic bronchitis*. Chronic bronchitis has been a serious societal problem due to its high prevalence, chronic and latent course, resistance to treatment, and as a consequence, resultant economic losses. Both *endogenic* and *exogenic* factors contribute to the etiology of chronic bronchitis. *Endogenic* factors include allergic states, tracheobronchial tract disorders, morphological changes in the bronchial tree, chest deformities, and immunological dysfunction. *Exogenic* factors include bronchial viral infections, secondary bacterial superinfections, cigarette smoking, irritating chemicals, mechanical and thermal effects, synergistic action of allergic stimulators and irritating chemical substances, and climate.

This paper regards the correlation between occupational pollution in the Albanian iron and steel industry and the prevalence of lung diseases, especially *chronic bronchitis*, in the workers.

The results of this cross-sectional study show a wide variation in the concentrations of irritating gases, TSP and PM₁₀ (sulfur dioxide 2.67-18.69 mg/m³, carbon monoxide 3.5-23.4 mg/m³, total suspended matter 2.4-23.9 mg/m³, PM₁₀ 3.9-4.1 mg/m³). We have measured pulmonary functions in 324 workers of the iron and steel industry. Their Pulmonary Function Tests (PFTs) have shown that FEV₁ varied from 35%-99.5%, FVC from 44%-105%, and VC from 30%-135% of normal. Odds Ratios (OR) for developing chronic bronchitis were computed for the group as a whole (OR=2.3) and for the subgroup of smokers (OR=4.79).

Based on the American Thoracic Society's criteria for pulmonary impairment according to FEV₁ measurements, 18.9% of Albanian iron and steel workers suffer from "chronic obstructive pulmonary disease (COPD)"; 18.5% have "mild impairment" of the lungs; 3.1% "moderate" and 1.6% "severe".

10737- Cancer incidence among workers with multiple carcinogenic chemical exposure.

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Bis-chloromethylether (BC), benzidine (BZ) and beta-naphtylamine (BN), each of them is a well known carcinogenic chemical. However, there is no report on multiple exposure to these chemicals. The objective of this study is to examine cancer incidence among workers with multiple exposure to above chemicals. We traced 194 male workers exposed to any of five chemicals: BC, BZ, BN, dianisidine(DA) and alpha-naphtylamine(AN). The follow-up period was 1974-2000. Standardized incidence rate (SIR) were computed based on local cancer registry statistics. Nested case control study was performed for lung cancer cases to examine association between exposure and incidence. SIR study showed excess risks for all cancer (Obs 30/Exp 18.4, SIR 1.63, 95%CI 1.10-2.32), liver (7, 3.5, 2.01, 0.81-4.04), lung (8, 2.8, 2.83, 1.22-5.58) and Bladder (3, 0.5, 5.99, 1.24-17.51). For lung cancer cases, 6 cases were exposed to BZ, 5 cases were exposed to BC and 6 cases were exposed to BN. Two cases were exposed to BC, BZ and BN. For bladder cancer, 1 case were exposed to BN but non of 3 cases were exposed to BZ. For urinary tract cancer including renal cell carcinoma and cancer of ureter, 4 out of 6 cases were exposed only to DA. Nested case control study showed elevated odds ratios for each of three chemicals. Odds ratio (OR) for BZ exposure (exposure periods < 2years) was 12.5 (95%CI 1.9-80.2) but that for the group with longer exposure periods was 3.7 (0.3-51.3). ORs for exposure to BN and BC were 4.8(exp < 2yrs), 4.0 (exp >= 2yrs), 2.9 (exp < 2yrs), 1.0 (exp >= 2yrs), respectively, but none of them was statistically significant. Regarding smoking habits, all of lung cancer cases were smokers. Blinkman indexes for 6 out of 8 were over 400. Multiple logistic regression showed elevated ORs for BZ and BN exposure after adjusting smoking habit. They were not statistically significant, however. It is well known that the target organ of BZ and BN is bladder and that of BC is lung. In our cohort, however, most of lung cancer cases were exposed to two of these three chemicals. Only one bladder cancer case was exposed to BN. These findings are inconsistent with previous ones and may suggest certain effects due to multiple exposure to those chemicals, though we have to admit that we might simply look at effect of smoking. Currently, our study has serious limitation because of small sample size. We are planing to expand the sample size and collect more detailed information on exposure to chemicals.

10739- Systematic review of adverse health outcomes in Gulf War veterans

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Gulf War veterans have expressed concern over a possible increase in risk for a range of adverse health outcomes following their deployment. We aimed to systematically identify and summarize the findings from studies that have measured the following outcomes amongst Gulf War veterans: mortality, hospitalizations, adverse reproductive outcomes, psychiatric disorders, multi-symptom conditions and pain. Studies published between 1990-2001 were identified by searching a range of electronic databases including EMBASE, MEDLINE, ASSIA, SIGLE and PsycINFO. Reference lists and websites were searched and key researchers were contacted. This search strategy identified a total of 5,387 studies. Studies were included if they compared the prevalence of any health outcome in both Gulf War veterans and non-Gulf veterans. 2,296 abstracts were independently reviewed by two authors. 409 full articles were sought for further review. Those studies which investigated “hard” measurements of health outcome (mortality n=4, hospitalization n=8, adverse reproductive outcomes n=9) provided little evidence to support the hypothesis that Gulf War veterans were at increased risk of these outcomes. Indeed there was some evidence for a decreased risk of hospitalization or death due to illness amongst Gulf War veterans which probably reflects a healthy warrior effect. There was also some indication of how reporting bias might affect the observed results. For example, the studies which used obstetric records to ascertain birth defects amongst offspring of Gulf War veterans reported no statistically significant association, whereas both studies which relied on veterans’ self-report observed an approximate two fold increase in risk. Each of the individual studies which assessed “softer” outcomes and which relied on self-report consistently demonstrated a higher prevalence of symptoms amongst Gulf War veterans. For example, Gulf deployment was associated with Post Traumatic Stress Disorder (OR 3.2, 95% CI 2.2-4.6; 9 studies), chronic multi-symptom illness (OR 3.7, 95% CI 2.7-5.1; 4 studies), and joint pain (OR 2.5, 95% CI 2.4-2.6; 7 studies). In these three meta-analyses, a wide range of prevalence estimates was evident between studies even though they claimed to be

measuring the same outcome. Although it seems clear that a greater proportion of Gulf War veterans than non-Gulf veterans do report a range of symptoms following their deployment, a critical assessment of the methodological quality of the individual studies suggests that at least some of this association might be explained by selection bias, response bias, measurement bias and confounding.

10740- Evaluating Potential for Occupational Pesticide Exposure in the NHANES-III

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The Third National Health and Nutrition Examination Survey (NHANES-III) was conducted from 1988 - 1994 as a stratified random sample of the U.S. Population. The participating subjects completed a detailed questionnaire and most underwent a comprehensive physical examination. A sub-sample of the examined subjects voluntarily provided urine samples for analysis of 12 pesticide residues. Although these subjects do not constitute a randomly sampled cohort, the sub-sample can probably be treated as a pseudo-random sample and analyzed accordingly because the decision to donate or not donate urine was not based on their likelihood to be exposed to pesticides. Because exposure to pesticides may be from occupational exposures, we sought to test whether there was an association with the subjects reported "usual occupation or industry" and "most recent job or industry worked". We developed a triad of job categories by expectation of exposure from known commercial and industrial job categories, ranging from likelihoods of lowest exposure to middling exposure to highest exposure. None of the 978 subjects was a licensed pesticide applicator. We ranked the 978 subjects' by estimated job exposure categories, gender, age groupings, race/ethnicity and other key variables. These variables included number of urinary pesticide residues found above the minimum detectable levels ($\mu\text{g/L}$ urine), and number of analytes found above the 90th and 95th percentiles of the 12 frequency distributions. The preliminary results showed that there was no significant association between herbicide residues levels in the urine and jobs with potential

exposures, but there was an indication that urinary insecticide residues were higher among subjects who had a higher potential for insecticide exposure on their most recent job. This association suggests that there is a likelihood that some exposure to insecticides of the U.S. population may be coming from exposure to insecticides in occupational environments.

10854- RISK ASSEMENT OF PNEUMOCONIOSIS TO WORKERS EXPOSED TO AIRBORNE QUART IN FOUNDRIES

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OBJECTIVES. Airborne dust in foundries contains significant quantities of quarts, which is known to cause silicosis. Starting from the finding of alarming increase of the pneumoconiosis in factories, we made a cross-sectional study in 3 foundries, to determine the chest x-ray alterations due to Si O₂ particles.

METHODS. A short variant of the questionnaire recommended by CE was used for the clinic data and occupational history. Chest x-ray was made and interpreted in order to identify pneumoconiosis, according to standard procedures. 925 workers were medically examined and provided occupational histories. The data were analyzed adjusting to age and smoking habit.

RESULTS. Analyses of data according to ILO scheme, found 176 men with small pneumoconiotic shadows of profusion under 1 and 49 x-ray with small spots q, r of category 1 or 2 conglomerate opacities, 2 silicotuberculosis, 6 tuberculosis and 2 pulmonary chronic fibrosis of Welders. All patients were than examined in the Occupational Medicine Hospital in Cluj-Napoca. There were confirmed 9 patients with small spots p, category 0/1, 41 silicosis with small opacities q, r profusion 1-3, 1 tuberculosis and 1 pulmonary chronic fibrosis of welders.

CONCLUSIONS. It is very important that industry focuses on reducing respirable quart concentration in specific jobs and to follow-up the workers exposed to dust.

10934- How Much or When? Work Exposures and the Risk of Musculoskeletal Injury among Health Care Workers

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Purpose: To further our understanding of the nature of associations between work exposures and musculoskeletal injuries by investigating, for both work organization and biomechanical factors, the effect of current exposures at the time of a musculoskeletal injury, average exposure during the past 12 months, and cumulative exposure from the start of follow-up to the time of injury.

Methods: This was a retrospective cohort study of all lost-time compensation claims for musculoskeletal injuries between January 1992 and December 1998 in a population of hospital workers from British Columbia (n=4445). Using exposure matrices developed as part of a previous study, biomechanical and work organization scores were assigned at monthly intervals to employees based on their occupation and demographic characteristics. Current exposure was assessed during the month of injury, average exposure over the past 12 months, and cumulative exposure from the start of follow-up. Exposure scores were modeled as categorical variables (quartiles based on the distribution of scores) with a higher category indicating more (negative) biomechanical and work organization demands. Using Cox regression, hazard ratios (HR) and 95% confidence intervals (CI) were computed to estimate associations between exposures and time to injury. Separate models were constructed for current, average and cumulative exposures.

Results: In the final adjusted models, employees with higher biomechanical demands had significantly higher risks of claims for musculoskeletal injuries. Risks were relatively consistent for current, average and cumulative exposures with a seven-fold increase observed for lower-body claims (HR for current exposure=7.43, 95% CI 4.40, 12.53) and a two-fold increased risk observed for upper-body claims (HR for current exposure=2.53, 95% CI 1.46, 4.37). For upper-body claims, the risk of a musculoskeletal injury was also significantly elevated for employees with lower job control. Cumulative exposure was associated with the highest risk (HR =5.53, 95% CI 2.34, 13.05). Employees working during periods of higher departmental sicktime or overtime also had significantly higher risks of musculoskeletal injury. Both cumulative and average exposure scores were associated with the highest risks. For example, cumulative exposure to department sicktime was associated with the highest risk of lower-body claims (HR=4.91, 95% CI 2.36, 10.21) compared to average (HRR=3.48, 95% CI 2.02, 5.98) or current exposures (HRR=2.02, 95% CI 1.35, 3.00).

Conclusion: Different exposure time windows may be more important for explaining the risk of musculoskeletal injuries. The results indicate that for work organization factors, the average exposure during the 12 months preceding the month of claim and the cumulative exposure from the start of follow-up to the month of claim held the greatest risk (i.e. highest HR) compared to current exposure during the month of a claim. Results for biomechanical factors were more consistent across the current, average and cumulative measures.

10950- Prevalence of Musculoskeletal Discomfort among Health Care Workers in Taiwan

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Musculoskeletal discomfort is a common health problem among the working population, including health care workers (HCWs). Nurses are known to be at high risk of back pain; however, musculoskeletal problems among other HCWs are less extensively studied. To understand the prevalence of miscellaneous musculoskeletal discomforts of different bodily parts among various job descriptions in the health care setting, we conducted a self-administered questionnaire survey in 16 teaching hospitals in Taiwan. A total of 8645 (79.2%) workers completed the questionnaire survey satisfactorily. The results showed that nursing staff had the highest prevalence (90.0%) of musculoskeletal discomfort, followed by supporting staff (81.6%), technicians (79.9%), and medical doctors (69.0%). Among medical technicians, X-ray technicians had the highest risk of musculoskeletal complains, and the prevalence was 100%. Of the responded medical doctors, the prevalence of neck and shoulder discomfort was particularly high among dentists (93.0%). Lower back was the most common (55.3%) affected bodily part for all musculoskeletal discomfort. If limit of motion was taken as an indicator for severity of musculoskeletal discomfort, supporting personnel had the highest prevalence of problems in shoulder (4.5%), elbow (2.1%), buttock (2.1%), knee (5.1%), and ankle (2.2%); whereas nurse had the highest prevalence of problem in lower back (6.6%), wrist (3.3%), thigh (2.3%), and leg (3.8%). In conclusion, this survey showed that musculoskeletal discomforts were prevalent among all health care workers, while the distribution of bodily part and nature of the discomforts were rather different across job descriptions. Development of effective prevention strategies for musculoskeletal discomforts for each job description, to promote the health of all HCWs is warranted.

10998- Estimating bias in the silicosis and lung cancer association using meta-analysis.
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Background: Using data from compensation claimant sources is thought to introduce bias into occupational epidemiology studies. This bias has been assumed to operate in the relationship between silicosis and lung cancer, so that subjects from compensation programs will have better lung cancer detection than those from medical sources.

Hypothesis: We tested the theory that lung cancer risk was greater among compensation claimants with silicosis than among noncompensation patients with silicosis, i.e., those diagnosed from hospitalized, surveillance, or clinical sources.

Methods: Stata's meta-analysis program was used to examine the associations in 48 pulmonary cancer epidemiology studies published between 1980 and 1999. The test statistic using meta-regression with 2 variance components was applied to test whether the meta-analyses were different from each other.

Findings: The meta-analysis relative risk (RR) for 26 compensation studies was 2.33 and for 22 noncompensation studies the RR was 2.39, both $p < 0.05$. The test statistic was 0.35 and nonsignificant. Excluding 11 Japanese studies because of uncertainty of methods, left 19 compensation studies and meta-analysis of 2.16; 18 noncompensation produced a RR of 2.20; and the test statistic was 0.12, also nonsignificant.

Conclusions: Contrary to expectation, the compensated-related silicosis patients had a lung cancer RR of 2.33 compared to the clinically diagnosed silicosis with a RR of 2.39. These findings clearly suggest that using compensation based sources of data does not introduce a bias into the silicosis and lung cancer relationship. Furthermore, our findings support the general consistency of a pulmonary cancer $RR > 2.0$ for silicosis patients, regardless of whether silicosis was determined from compensation or from medical sources.

11007- TITLE: Job-exposure-health profile for workers exposed to respirable dusts in textile units of Tamilnadu, India: results of preliminary investigations

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OBJECTIVES: It has been long since recognized that cotton and textile industry workers are exposed to various airborne hazards especially in developing country settings, resulting in various degrees of respiratory impairments. However, a comprehensive, sector specific, regional job-hazard/ job-exposure profile for workers in these units in Southern India has not been compiled. This study presents results of preliminary investigations aimed at assessing quantitative exposures to respirable dusts in units involved in dry cotton processing operations together with assessments of respiratory health status of the workers.

METHODS: Two large (>500 workers), two medium (100-500 workers) and four small (<100 workers) cotton textile units were chosen initially for monitoring the workplace environment for respirable dusts using NIOSH protocol 0600. Health monitoring was conducted in 88 workers of a single unit, which included a detailed history (including the WHO questionnaire for diagnosis of byssinosis), clinical examination and pulmonary function tests. Workers with prior history of tuberculosis were excluded.

RESULTS: Respirable dust concentrations were determined in blow room (n=35), carding/ drawing/roving (n=50), combing (n=6), spinning (n=45), warping/sizing (n=9), weaving (n=32), winding/reeling/doubling (n=31) locations. 8-hour time-weighted average exposures ranged from 0.38 mg/m³ to 1.54 mg/m³. Concentrations in the blow room were significantly higher than all other locations in these units, followed by carding/drawing/roving areas. Concentrations were the lowest in warping and sizing locations. Of the 88 workers monitored, the prevalence of respiratory symptoms (including cough with sputum and breathlessness) was higher, in non-smokers working in the shop floor areas (64%) as compared to the office areas (36%). In addition, 4 out of 64 non-smoking shop floor workers reported hemoptysis. Age-adjusted pulmonary function values were significantly lower in nonsmokers working in the shop-floor dusty areas as compared to office workers {FVC (L)- 2.8 and 3.2; FEV₁ (L)-2.4 and 2.8;PEF (L/sec) - 6.0and 7.4 respectively}. The sample size was too small to make comparisons across sub-groups of workers in different shop-floor locations.

CONCLUSIONS: Additional exposure and health assessments are currently being carried out with a view to compile sector wide job-exposure- health profiles for the cotton textile units of Tamil Nadu, India. Such profiles are expected to aid the development of a regional occupational health database for use in local regulation and resource allocation for interventions.