

10021 - Occupation and risk of esophageal and gastric cardia adenocarcinoma

Engel LS,¹ Vaughan TL,² Gammon MD,³ Chow WH,¹ Risch HA,⁴ Dubrow R,⁴ Mayne ST,⁴ Rotterdam H,⁵ Schoenberg JB,⁶ Stanford JL,² West AB,⁷ Blot WJ,⁸ Fraumeni, Jr. JF,¹

¹ Division of Cancer Epidemiology and Genetics, National Cancer Institute, Bethesda, MD

² Division of Public Health Sciences, Fred Hutchinson Cancer Research Center, and Department of Epidemiology, University of Washington, Seattle, WA

³ School of Public Health, University of North Carolina, Chapel Hill, NC

⁴ Departments of Epidemiology and Public Health, School of Medicine, Yale University, New Haven, CT

⁵ Department of Pathology, College of Physicians and Surgeons of Columbia University, New York, NY

⁶ Cancer Epidemiology Services, New Jersey Department of Health and Senior Services, Trenton, NJ

⁷ Department of Pathology, Yale University, New Haven, CT

⁸ International Epidemiology Institute, Rockville, MD

Adenocarcinomas of the esophagus and gastric cardia have risen dramatically in incidence over the past few decades. However, very little research has been conducted into occupational risk factors for these cancers. In this population-based case-control study, lifetime job histories were compared between cases of esophageal adenocarcinoma (n=283), gastric cardia adenocarcinoma (n=259), and population controls (n=689). Odds ratios (OR) and 95% confidence intervals (CI) for ever employment and by duration in various occupational and industrial categories were calculated using unconditional logistic regression. We observed an elevated risk of esophageal adenocarcinoma among persons ever employed in administrative support (OR=1.5; 95% CI=1.0-2.1); financial, insurance, and real estate (OR=1.6; 95% CI=1.0-2.4); and health services (OR=2.2; 95% CI=1.2-3.9). The risk of gastric cardia adenocarcinoma was increased among transportation workers (OR=1.7; 95% CI=1.1-2.6), as well as among carpenters (OR=1.8; 95% CI=0.9-3.9) and workers in the furniture manufacturing industry (OR=2.4; 95% CI=0.9-6.3). However, we observed few duration-response relations between length of employment in any category and cancer risk. In conclusion, this study revealed associations of esophageal adenocarcinoma with employment in administrative support, health services, and a category of financial, insurance, and real estate industries, and of gastric cardia adenocarcinoma with transportation and certain woodworking occupations. However, our results suggest that, overall, workplace exposures play a minor role in the etiology and upward trend of esophageal and gastric cardia adenocarcinomas.

10029 - Arsenic Methylation and Skin Cancer Risk in Southwestern Taiwan

Yen-Ching Chen,¹ Yu-Liang Leon Guo,² Huey-Jen Jenny Su,² Yu-Mei Hsueh,³ Thomas J. Smith,¹ Louise M. Ryan,⁴ Meei-Shyuan Lee,⁵ David C. Christiani¹

¹Occupational Health Program, Department of Environmental Health, Harvard School of Public Health, Boston, MA, USA; ²Department of Environmental and Occupational Health, Medical College, National Cheng-Kung University, Tainan, Taiwan; ³School of Medicine, Department of Public Health, Taipei Medical College, Taipei, Taiwan; ⁴Department of Biostatistics, Harvard School of Public Health, Boston, MA, USA; ⁵Department of Public Health, National Defense College, Taipei, Taiwan

Funding for the study was provided by the National Institute of Health grants ES 05947 and ES 00001

Abbreviations used: Arsenite, As(III); arsenate, As(V); monomethylarsonic acid, MMA(V); monomethylarsonous acid, MMA(III); dimethylarsinic acid, DMA(V); cumulative arsenic exposure, CAE; primary arsenic methylation ability, PAM; and secondary arsenic methylation ability, SAM; OR, odds ratio; CI, confidence interval.

ABSTRACT

Arsenic is a known carcinogen and people around the world expose to it. Data are especially lacking on low-level arsenic exposure. We conducted a hospital-based case-control study in southwestern Taiwan to explore the association among arsenic methylation ability, defined as the ratios of urinary MMA(V)/inorganic arsenic (primary arsenic methylation ability, PAM) and urinary DMA(V)/MMA(V) (secondary arsenic methylation ability, SAM), cumulative arsenic exposure (CAE) and the risk of skin cancer. From 1996 to December 1999, 76 newly-diagnosed skin cancer cases and 224 fracture and cataract patients (controls) were identified from the National Cheng-Kung University (NCKU) Medical Center. CAE was estimated using published well-written data collected in 1974 to 1976. Compared to a CAE \leq 2mg/L-year, CAE >15 mg/L-year was associated with an increased risk of skin cancer (OR, 7.48, 95 % CI, 1.65 to 33.99), given a low SAM (\leq 5). Compared to women, men (OR, 3.34; 95 % CI, 1.53 to 7.29) had higher risk of skin cancer when compared to women. Given the same level of PAM or SAM, men (OR, 3.25; 95 % CI, 1.43 to 7.40; OR, 4.02; 95 % CI, 1.69 to 9.56) had a higher risk of skin cancer when compared to women, respectively. Subjects with low SAM have a substantially increased risk of skin cancer, especially when combined with high CAE levels. Males in all strata of arsenic exposure and methylation ability are at higher risk of skin cancer.

10046 - The Incidence of Breast Cancer Associated with Long-Term Average Concentrations of Ambient Air Pollution. Results from the AHSMOG Study
W.L. Beeson, S.F. Knutsen, D.E. Abbey
(Loma Linda University, Loma Linda, CA 92350)

Breast cancer is still the most common nonskin cancer diagnosed in women in the U.S. each year accounting for approximately 30 percent of all female incident cancers. It has been estimated that over 203,000 U.S. women will develop breast cancer and almost 40,000 will die of it in 2002. There are marked geographic differences in the occurrence of breast cancer among the states suggesting possible environmental factors in the etiology of this disease. Some investigators have noted that the female breast is anatomically embedded in a major fat depot which stores and concentrates polycyclic aromatic hydrocarbons and can metabolize these hydrocarbons to carcinogenic metabolites. Respirable particulate matter of 10 microns or less in aerodynamic diameter (PM_{10}) proves a mechanism whereby toxic chemicals can be delivered into the deep lung where they can become systemic.

[Methods] A cohort of 6338 Non-Hispanic white California residents was followed prospectively from 1977 to 1992 to study the health effects of long-term cumulated ambient air pollution. The subjects completed a lifestyle questionnaire at baseline which included questions on diet, pregnancy characteristics, exposure to birth control pills and post-menopausal estrogens. The cohort was followed for cancer incidence and all cause mortality as well as ascertainment of monthly residence and work location zip codes. Individual monthly indices of ambient air pollution based on fixed-site monitoring stations were linked to individual health effects. Cancer incidence for the cohort was ascertained using a combination of two methods: 1) computer-assisted record linkage with local and statewide cancer registries and 2) medial records from self reported hospitalizations. Cox proportional hazards regression was used to estimate relative risk (RR) adjusting for age and other covariates.

[Results] A total of 122 incident breast cancers were identified. For cumulated long-term mean concentration of PM_{10} , an increase of one interquartile range (IQR) was associated with increased risk of breast cancer (RR=1.60; 95% confidence interval (CI): 1.24-2.07). Risk of breast cancer was also elevated for all investigated exceedance frequencies (40 – 100 $\mu\text{g}/\text{m}^3$). For example, an increase of one IQR in days per year exposed to ambient levels greater than 40 $\mu\text{g}/\text{m}^3$ was associated with increased breast cancer risk (RR=1.54; CI: 1.14-2.08). Similarly, for PM_{10} in excess of 100 $\mu\text{g}/\text{m}^3$, the risk of breast cancer was also elevated (RR=1.32; CI: 1.08-1.62). No association was observed for mean concentration of ozone or other pollutants.

[Conclusion] A positive association was found between risk of developing breast cancer and ambient particulate air pollution. It is possible that chronically breathing polluted air containing hydrocarbons may make one more susceptible to development of different diseases, including cancer. However, more studies are needed to assess the components of ambient particulate matter and whether the observed associations are causally related to the development of breast cancer in post menopausal women independent of the traditional breast cancer risk factors.

10093 - CANCER RISK AMONG
RESIDENTS OF AGRICULTURAL COMMUNITIES (KIBBUTZS)
IN THE NEGEV

Kordysh E, Bolotin A, Barchana M.

Department of Epidemiology, Ben-Gurion University of the Negev, Beersheba, Israel;
Israel Cancer Registry, Jerusalem, Israel

Background. The increased risk for agricultural workers and residents of areas with intensive practice of pesticides is shown in many epidemiological studies. Cancer clusters detected in some Negev kibbutzs (the southern Israel) are reported.

Objectives. To examine cancer rates in the Negev kibbutzs in order to estimate the cancer risk for the residents of the corresponding areas.

Methods. The dataset of cancer incidence among residents of 45 kibbutzs (which were established in the Southern Israel back in 40-50's) over 1972-1996 years was obtained from the Israel Cancer Registry and kibbutz local clinics. From 2 kibbutz unions we received the distribution of population by gender and age (14 age groups with 5-years interval) for every year within the observational period. As baseline rates, we used gender-age- and site specific incidence rates of the Jewish population in Israel in each of 25 years of observation. The standardized incidence ratio (SIR) and 95% confidence interval (CI) were calculated.

The distribution of kibbutz population by countries of origin is differing from that of the whole country. However, since this information (by sex and age) was unavailable for us, we did not make a controlling for this possible confounding effect. Therefore, we used age-adjusted rates of cancer incidence in 3 particular groups (immigrants from Europe-America, Asia-Africa, and native Israelis) for the whole country and calculated the following ratios: rates in each group by rates in the general population.

Results. The dataset we worked with consisted of 1144 cancer cases. For the 25-years period, we found an excess of malignant tumors for: all sites (SIR = 112, CI = 108-117); oral cavity and pharynx (SIR = 147, CI = 127-170); skin (particularly melanoma SIR = 140, CI = 125-158); female breast (SIR = 112, CI = 102-124); male reproductive system (SIR = 119, CI = 103-137); hematolymphopoietic tissues (SIR = 120, CI = 107-134); thyroid gland (SIR = 139, CI = 119-161). Calculating the rates separately for periods 1972-1984 and 1985-1996, we revealed a decrease of SIR in the second one.

Despite the fact that the Israeli population does not comprises only from European immigrants and native Israelis we assumed that kibbutz population consists of these two ethnic groups (we can justify this assumption saying that the proportion of Afro-Asians immigrants in kibbutz population is fairly small). Doing this we get that all the SIR (with except of thyroid, and oral cavity and pharynx) decrease.

Conclusion: We suggest an increased cancer risk among residents of the Negev kibbutzs with tendency to decrease at the last decade observed. Disregarding of the ethnic component might be responsible for the biased estimation of the baseline rates.

10114 - Consumption of Soybean products and Colorectal Cancer Risk--A Hospital-based Case-Control Study in Taiwan

Chih-Ching Yeh¹, Ling-Ling Hsieh², Reiping Tang³, Chung Rong Chang-Chieh³, Fung-Chang Sung^{1,4}

¹Institute of Environmental Health, National Taiwan University College of Public Health, Taipei 10020, Taiwan

²Department of Public Health, Chang Gung University, Tao-Yuan, Taiwan

³Colorectal Section, Chang Gung Memorial Hospital, Linkou, Taiwan

⁴Institute of Prevention Medicine, National Taiwan University College of Public Health, Taipei 10020, Taiwan

Abstract

The anticarcinogenic properties of soybean have been demonstrated in experimental studies. Existing epidemiologic data suggest that soybean may be protective for cancer risk. However, their beneficial effects on colorectal cancer are inconclusive. We conducted a hospital-based case-control study to clarify the association between soybean consumption, beyond other dietary factors and colorectal cancer risk in Taiwan. A total of 756 subjects (aged 19-85 years) with primary colorectal cancer histologically confirmed between January 1995 and January 1999 were included as cases. Age and sex matched 736 hospital controls free of the disease were recruited from health examination clinic. Dietary intake and other lifestyle activities were ascertained from a standardized questionnaire by an experienced interviewer. The unconditional multivariate logistic-regression analysis showed that colorectal cancer risk was inversely significantly associated with the soybean consumption (frequently vs. rarely; odds ratios (OR)=0.07 (95% confidence intervals (CI)=0.04-0.12) in male and OR=0.10 (95% CI=0.06-0.18) in female) and fruit/fruit juice consumption (having everyday vs. not-everyday, OR=0.58 (95% CI=0.39-0.87) in male and 0.54 (95% CI=0.35-0.85) in female), but positively associated with white meat consumption (everyday vs. ≤ 1 time/week; OR=2.19 (95% CI=1.20-4.00) in male and 2.20 (95% CI=1.11-4.41) in female) and entrails consumption (≥ 1 time/month vs. none; OR=2.89 (95% CI=1.70-4.91) in male and 3.24 (95% CI=1.85-5.66) in female). In addition, male cases were more likely than their controls to drink coffee and consume less fish/shrimp, and female cases were more likely than their controls to consume noodle and fish/shrimp. These findings suggest that the consumption of soybean has a strong beneficial effect in reducing colorectal cancer risk. The beneficial effect of fruit consumption and harmful effect of meat consumption on

colorectal cancer risk are also supported.

Key words: Colorectal cancer, soybean, diet, Taiwan.

10174 - Arsenic Methylation and Bladder Cancer Risk

Yen-Ching Chen,¹ Huey-Jen Jenny Su,² Yu-Liang Leon Guo,² Yu-Mei Hsueh,³
Thomas J. Smith,¹ Louise M. Ryan,⁴ Meei-Shyuan Lee,⁵ David C. Christiani¹

ABSTRACT

Background. To date the mechanism of arsenic detoxification in humans remains unclear. Data are especially lacking on low-level arsenic exposure. We hypothesize that arsenic methylation ability, defined as the ratios of MMA(V)/inorganic arsenic (primary arsenic methylation ability) and DMA(V)/MMA(V) (secondary arsenic methylation ability), may modify the association between cumulative arsenic exposure and the risk of bladder cancer. In this study we investigated the relationship among arsenic methylation ability, cumulative arsenic exposure, and the risk of bladder cancer in a hospital-based case-control study in southwestern Taiwan.

Methods. From January 1996 to December 1999 we identified 49 patients with newly-diagnosed cases of bladder cancer at the National Cheng-Kung University (NCKU) Medical Center; controls consisted of 224 fracture and cataract patients selected from the same medical center. The levels of four urinary arsenic species (As(III), As(V), MMA(V), and DMA(V)) were determined in all subjects by using the high-performance liquid chromatography hydride-generation atomic absorption spectrometry (HPLC-HGAAS). Cumulative arsenic exposure was estimated by using published data collected in a survey from 1974 to 1976.

Results. Compared to a cumulative arsenic exposure ≤ 2 mg/L-year, cumulative arsenic exposure >12 mg/L-year was associated with an increased risk of bladder cancer (multivariate odds ratio, 4.23; 95 percent confidence interval, 1.12 to 16.01), in the setting of a low secondary arsenic methylation ability (≤ 4.8). Compared to women, smoking men (multivariate odds ratio, 6.23; 95 percent confidence interval, 1.88 to 20.62) and non-smoking men (multivariate odds ratio, 3.25; 95 percent confidence interval, 0.95 to 11.06) had higher risks of bladder cancer. Given the same level of primary arsenic methylation ability, smoking men (multivariate odds ratio, 9.80; 95 percent confidence interval, 2.40 to 40.10) and non-smoking men (multivariate odds ratio, 4.45; 95 percent confidence interval, 1.00 to 19.84) had a higher risk of bladder cancer when compared to women. With the same level of secondary arsenic methylation ability, both smoking men (multivariate odds ratio, 6.28; 95 percent confidence interval, 1.76 to 22.39) and non-smoking men (multivariate odds ratio, 3.31; 95 percent confidence interval, 0.84 to 12.97) had a higher risk of bladder cancer when compared to women.

Conclusions. Subjects with low secondary arsenic methylation ability (SAM) have a substantially increased risk of bladder cancer, especially when combined with high cumulative-exposure levels. Males in all strata of arsenic exposure and methylation ability are at higher risk of bladder cancer.

Abbreviations used: Arsenite, As(III); arsenate, As(V); monomethylarsonic acid, MMA(V); monomethylarsonous acid, MMA(III); dimethylarsinic acid, DMA(V); cumulative arsenic exposure, CAE; primary arsenic methylation ability, PAM; and secondary arsenic methylation ability, SAM.

10210 - Prostate Cancer Risk Posed by Cooked-Meat Heterocyclic Amines

Bogen, KT¹, and Keating, GA¹. (¹Health & Ecol. Assess. Div., L-396, Lawrence Livermore National Laboratory, Livermore, CA 94550, USA.)

Heterocyclic amines (HAs) formed in cooked meats are potent mutagens that cause many types of cancer in rodents; e.g., 2-amino-1-methyl-6-phenylimidazo[4,5-*b*]pyridine (PhIP) has been shown to be metabolically activated by human prostate tissue, to mutate prostate DNA, and to induce cancer of the colon, intestine, mammary gland, and prostate in rats. Recent case-control studies have shown that estimated human dietary HA intakes (categorized crudely, based on self-reported preferences for meat type, cooking method and/or doneness) are associated with elevated risks of colon, lung and breast cancer. Improved HA-exposure assessment has been achieved by estimating compound-specific HA intakes that correspond to individual meat intakes, cooking methods and doneness preferences. HA-specific concentration estimates using this method are based on combined laboratory data that predict HA concentrations from meat type, cooking method and meat doneness. To obtain an improved estimate of U.S. dietary HA intakes, this HA-exposure assessment method was used to analyze data from the U.S. Continuing Survey of Food Intakes by Individuals (CSFII) pertaining to meats consumed (including chicken and fish) and cooking methods used by >25,000 people between 1989 and 1996, adjusting for under-reported energy intake. In this new analysis, meat-doneness preferences were estimated using an augmented set of U.S. dietary survey data that characterize meat-doneness and cooking-method preferences by race-ethnicity. Consistent with our previous results based on earlier meat-preference survey data, PhIP was found to comprise ~65% of U.S. mean dietary intake of total HAs, with pan-frying and chicken being the single cooking method and meat type contributing the greatest to total estimated HA exposures. Although estimated total HA intakes were found not to differ much by age and by sex, African-American males were estimated to consume >3- and >2-fold more PhIP than white males at ages <16 and 30+ y, respectively, where a relatively greater preference for more well-done meats among African-Americans was assumed based on newly available survey data. We conclude that the difference in PhIP intakes indicated by HA-exposure analysis using CSFII data could, either partly or substantially, explain why prostate cancer kills ~2-fold more African-Americans than whites in the U.S. We plan to investigate this hypothesis in a prospective clinic-based study to compare PC-screening outcomes in African-Americans and whites in the East Bay area of California. [Work performed under auspices of the U.S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48, with funding by the National Cancer Institute (NIH Grant No. P01 CA55861-01).]

10264- INCIDENCE OF B-CELL MALIGNANCIES AMONG WOMEN LIVING ON FARMS:
RESULTS FROM THE IOWA WOMEN'S HEALTH STUDY

Cerhan, JR¹, Janney, CA¹, Ross, JA², Witzig, TE¹, Habermann, TM¹, Kay, NE¹, Folsom, AR²

¹Mayo Clinic, Rochester, MN , ²University of Minnesota, Minneapolis, MN

Background: Midwestern male farmers are at increased risk of developing B-cell malignancies. Using the Iowa Women's Health Study (IWHS) cohort with 7 years of follow-up, we previously reported that women living on farms, compared to women living elsewhere, were at increased risk of non-Hodgkin lymphoma (NHL) but not other common malignancies. We now report an extended follow-up of this cohort (14 years) for NHL risk, and also expand our evaluation to the common NHL subtypes, chronic lymphocytic leukemia (CLL), and multiple myeloma (MM).

Methods: The IWHS is a population-based, prospective cohort study of 37,932 Iowa women who were aged 55-69 years and cancer-free when enrolled at baseline in 1986. Through 1999, 282 cases of NHL (197 nodal and 83 extranodal) were identified by linkage to the Iowa SEER Cancer Registry; cases included 150 diffuse, 59 follicular, 33 small lymphocytic, 9 high grade, 2 peripheral T-cell, and 29 unclassified. In addition, 63 cases of CLL and 72 cases of MM were identified during this same time period. Relative risks (RRs) and 95% confidence intervals (CI) were calculated using Cox regression, and multivariate models were adjusted for age, marital status, transfusion history, and smoking.

Results: In 1986, 19.6% of the women lived on a farm, while 46.5% lived in a town of population $\leq 10,000$ or non-farm rural area, and 33.8% lived in a town of population

>10,000. Compared to women not living on a farm in 1986, women living on a farm were at a slight increased risk of NHL overall (RR=1.28; 0.96-1.71). When stratified on nodal status, an increased risk was observed for nodal (RR=1.49; 1.06-2.08) but not extranodal (RR=0.84; 0.46-1.54) disease. Of the NHL subtypes, there were positive associations for small lymphocytic NHL (RR=1.51; 0.65-3.51), follicular NHL (RR=1.44; 0.78-2.65), and high grade NHL (RR=6.26; 1.60-24), but not diffuse NHL (RR=0.97; 0.64-1.49). There was no association of farm residence with CLL (RR=0.79; 0.38-1.62) or MM (RR=1.14; 0.62-2.09).

Conclusions: These results suggest that women living on farms are at increased risk for some (i.e., high grade) but not all (i.e., diffuse) aggressive lymphomas, and to a lesser degree for indolent lymphomas (i.e., small lymphocytic and follicular). There was no increase in risk for other B-cell malignancies (i.e., CLL and MM). The specific toxic exposures on farms that increase the risk of these neoplasms among farm women remain to be identified.

10311 - Pilot case-control study of exposure to organochlorines and risk of breast cancer in eastern Slovakia

Pavuk, M¹, Cerhan, JR², Lynch, CF³, Kocan, A⁴, Petrik, J⁴, Chovancova, J⁴

¹University of Texas School of Public Health, Dallas, USA, ²Health Sciences Research, Mayo Clinic, Rochester, USA, ³Department of Epidemiology, University of Iowa, Iowa City, USA, ⁴National Reference Center for Dioxins, Bratislava, Slovakia

This pilot case-control study was designed to investigate association between polychlorinated biphenyls (PCBs) and risk of breast cancer in the area of high environmental exposure in the Michalovce district of eastern Slovakia. Incident breast cancer cases from the Michalovce district diagnosed between May 1997 and May 1999 were recruited through the Oncology Department of the District Hospital. Fifteen individual PCB congeners, 2,2'-bis(4-chlorophenyl)-1,1-dichloroethylene (DDE), 2,2-bis(4-chlorophenyl)-1,1,1-trichloroethane (DDT), and hexachlorobenzene (HCB) were measured in the serum of 24 breast cancer patients and 88 population controls in 1998-99. The median levels of total PCBs were similar in cases (2586 ng/g of lipid) and controls (2682 ng/g of lipid). Higher serum levels (highest vs. lowest tertile) of total PCBs (OR = 0.42, 95%CI 0.10-1.82, p-for trend = 0.31), group 1 congeners (OR = 0.37, 95%CI 0.10-1.43, p-for trend = 0.02), group 2 congeners (OR = 0.32, 95%CI 0.07-1.56, p-for trend = 0.60), and group 3 congeners (OR = 0.49, 95%CI 0.12-2.04, p-for trend = 0.51), were inversely associated with risk of breast cancer. Higher serum levels of DDE (OR = 3.04, 95%CI 0.65-14.3, p-for trend = 0.10) were positively associated with risk of breast cancer, while there was no association for DDT (OR = 1.19, 95%CI 0.27-5.23, p-for trend = 0.68), and an inverse association for HCB (OR = 0.45, 95%CI 0.06-3.19, p-for trend = 0.67). PCB and HCB levels were inversely associated with risk of breast cancer in this highly exposed population. DDE, but not DDT, was positively associated with risk.

Environmental and individual risk factors for lung cancer in dwellers of a small town with unusually high cancer morbidity rates.

Katsnelson BA¹, Kosheleva AA¹, Kuzmin SV¹, Voronin SA², Makarov SV¹, Trofimova EA.¹

¹*Ural Regional Center for Environmental Epidemiology, Yekaterinburg, Russia,*

²*Sverdlovsk Regional SanEpid Control Center, Yekaterinburg, Russia*

The population of Karpinsk, a small coalmining community in the northern part of the Middle Urals, suffers from cancer morbidity rates markedly higher than both average regional rates and rates characteristic of many cities and towns in the Region (Sverdlovsk oblast') – even of those much more industrialized and polluted, in particular, with carcinogens. At a distance of ca. 9 km from Karpinsk there is a big aluminum electrolysis plant which carcinogenic PAH-containing emissions reach Karpinsk, but the cancer morbidity in the latter is higher than in a town situated close to that plant. As well as in the Region as a whole, lung cancer in Karpinsk is the most prevalent of all others. We looked for risk factors for this cancer in a community-based case-control study using: (a) a special questionnaire on individual features, (b) different approaches to assessment of different exposures (factual monitoring, mathematical modeling, exposure surrogates), and (c) two ways of data analysis: that based on a multivariant logistic regression and that based on pattern recognition mathematics. The results obtained with these two analytical methodologies were mutually corroborative. Along with some well-known individual carcinogenic risk factors (smoking, alcohol abuse, being an industrial employee as opposed to non-industrial employment, history of chronic bronchitis) that are not prevalent here more than usual, we found a significant unfavorable influence of a complex of features describing a home as “uncomfortable”, first of all, use of indoor coal burners both for heating, water boiling and in kitchen ranges. Just in this respect Karpinsk's position is outstanding due to the poorest development of central heating and gasification, easy access to and low price of local coal and high percentage of population living in small houses. Out of different ambient exposures, only the benzo(a)pyrene concentration in the vicinity of dwelling (as modeled taking into account both the above-mentioned PAH-containing industrial emissions and smoke from boiler-houses and local chimneys) were proved of some influence. We could not demonstrate the influence of radon in homes and of carcinogenic metals in soils around them based on available monitoring data.

10344 - The Association of Long-Term Average Mean Concentrations of Ambient Air Pollutants and Risk of Non-Hodgkin's Lymphomas (NHL) in Nonsmokers. Results from the AHSMOG Study.

W.L. Beeson, S.F. Knutsen, D.E. Abbey

(Center for Health Research, Loma Linda University, Loma Linda, CA 92350)

Non-Hodgkin's lymphomas (NHL) represent the sixth most common tumor type diagnosed in men in the U.S. each year and the fifth in women and is the fifth and sixth leading cause of cancer deaths in men and women, respectively. The frequency of NHL increased almost 7% a year during the last two decades, for reasons that have yet to be identified. Risk factors for NHL are largely unknown but in part involve reduced immune function and exposure to agricultural chemicals and perhaps hydrocarbons as well as exposure to certain infectious agents. Respirable particulate matter of 10 microns or less in aerodynamic diameter (PM₁₀) provide a mechanism whereby toxic chemicals can be delivered into the deep lung where they can become systemic.

[Methods]: In 1977, 6338 nonsmoking, non-Hispanic white California residents were enrolled in a prospective cohort study on the health effects of ambient air pollution. The subjects completed a lifestyle questionnaire at baseline which included past smoking history, history of exposure to environmental tobacco smoke (ETS), occupational exposures to dusts and fumes and other lifestyle characteristics. The cohort was followed for monthly residence and work zip codes as well as updates on smoking, ETS, and lifestyle. Based on information on ambient air pollution levels measured at fixed-site monitoring stations maintained by the California Air Resources Board, individual monthly indices of ambient air pollution exposures were developed for each participant of the cohort. Cancer incidence for the cohort from 4/1/77 to 4/1/92 was ascertained using a combination of two methods: 1) computer-assisted record linkage with local and statewide cancer registries and 2) medical records from self reported hospitalizations. Cox proportional hazards regression was used to estimate relative risk (RR) adjusting for age and other selected covariates.

[Results]: A total of 34 incident NHL occurred during follow-up, 14 males and 20 females. For PM₁₀, an increase of one interquartile range (IQR) in days exposed to ambient levels greater than 100 ug/m³ was associated with higher risk of developing NHL (Males: Relative Risk (RR)=2.39; 95% Confidence Interval (CI): 1.45-3.97). Females: RR=1.57; CI: 0.84-2.94). Also for ozone, an increase of one IQR in hours exposed to ambient levels greater than 150 ppb was associated with increased risk on NHL (Males: RR=3.61; CI: 1.69-7.76; Females: RR=2.36; CI: 1.02-5.50).

[Conclusion]: A strong positive association was found between risk of developing Non-Hodgkin's lymphoma and ambient air pollution levels of both particulate matter (PM₁₀) and ozone. It is possible that chronically breathing polluted air affects the immune system and thus makes one more susceptible to development of different diseases, including cancer. However, more studies are needed to assess whether the observed associations are causally related to development of NHL.

10512 - Cancer incidence and mortality in the industrial city of Sumgayit, Azerbaijan

Andruchow J, Soskolne CL, University of Alberta
Racioppi F, World Health Organization, Rome Division
Makhmudov E, Asadov A, Environmental Rehabilitation of Sumgayit
Senthilselvan A, Cherry NM, University of Alberta
Bryant H, Alberta Cancer Board

Background: The city of Sumgayit, Azerbaijan, was founded in 1949, a centrepiece of Soviet industrial production. During peak production, more than 40 factories were actively producing a diverse array of industrial products, including synthetic rubber, chlorine, aluminium and detergents. The primary goal of Soviet central planners was maximizing low-cost production, which came at the expense of environmental and occupational health and safety. Consequently, factory workers and residents of the city were exposed to a combination of high-level occupational and environmental pollution for several decades. Residents of Sumgayit have long-standing fears that their health has been compromised by these exposures.

Objective: This study is a collaborative effort between the United Nations Development Programme (UNDP), the World Health Organization (WHO) European Region, the Azerbaijan Republic Ministry of Health (MoH), and the University of Alberta (UofA) to evaluate the perceived negative health impacts of long-term occupational and environmental pollution.

Methods: Cancer was selected as the health outcome because of known carcinogenic exposures present in Sumgayit industry, its usefulness in studying long-term exposure effects, and access to population-level cancer data from the MoH. Cancer incidence and mortality rates, through the period 1980-2000, were compared between Sumgayit and several other regions of Azerbaijan, and selected international comparisons were made. Confounding lifestyle factors were controlled through the conduct of an interviewer-administered questionnaire in each of the study regions, assessing smoking history, alcohol consumption, dietary factors, and family history of cancer. Several cancer sites were selected for study by frequency and etiology: larynx, lung, urinary bladder, female breast, and all sites combined. Because of data quality and completeness issues, some analyses were restricted to certain subsets of the selected data.

Results: For both males and females, age-standardized incidence rates in Azerbaijan were found to be unexpectedly low, approximately one-third that of rates in Canada. Crude mortality rates also show similar patterns with respect to international data. Cancer rates in Sumgayit are considerably higher than national averages and rates in other selected regions of Azerbaijan. Standardized Morbidity Ratios (SMRs) between Sumgayit and national averages range from 1.20 (95% CI 1.04-1.39) for breast cancer, to 1.38 (95% CI 1.04-1.82) for laryngeal cancer, 1.47 (95% CI 1.40-1.55) for all cancer sites combined, 1.61 (95% CI 1.40-1.85) for lung cancer, and a high of 2.36 (95% CI 1.84-3.01) for bladder cancer. These results are consistent with more rigorous Poisson regression analysis. Dose-response effects were observed with selected lesser-exposed comparison regions in Azerbaijan.

Conclusions: One possible reason for the disparity between Azerbaijan and Canada is poor diagnosis and case reporting in Azerbaijan. Evidence supporting this claim is the

dramatic decrease in recorded cancer rates during the early 1990s when the newly independent Azeri health care system was severely strained. Because the same stresses likely would have been uniformly distributed throughout Azerbaijan, internal comparisons were conducted. They demonstrated that Sumgayit, associated with the highest levels of pollution in Azerbaijan, experienced higher levels of both cancer morbidity and mortality. Because certain cancers are so elevated, case-control studies could be helpful to elucidate causation.

10631 - Pesticides Levels in Adipose Tissue and Non-Hodgkin's Lymphoma

Jones, E.L.¹, Quintana, P.J.E.¹, Delfino, R.J.^{1,2}, Ziogas, A.², Kutz, F.W.³

¹San Diego State University Graduate School of Public Health, San Diego, CA, USA,

²University of California, Irvine, School of Medicine, Irvine, CA, USA

³USEPA Environmental Science Center, Fort Meade, MD

This case-control study examined the relationship between Non-Hodgkin's Lymphoma (NHL) and organochlorine pesticide exposure. NHL is the sixth leading cause of cancer related death in the United States, and ranks fourth in number of person years lost to cancer each year. In 2000 there were approximately 55,400 new cases of NHL in the US, and since the 1960's the incidence of NHL has been steadily rising across genders, age groups, and national regions, at a rate of about 3% per year. Many causes are being examined as possible explanations for this increase, including exposure to pesticides. This study makes use of a data set originally collected between 1970 and 1982 by US Environmental Protection Agency's National Human Adipose Tissue Survey. Adipose samples were randomly collected from cadavers and surgical patients and levels of the following organochlorine pesticides and pesticide metabolites were determined: DDT, DDE, Mirex, beta-BHC, dieldrin, trans-nonachlor, oxychlordane, heptachlor epoxide, and hexachlorobenzene. From the original study population, 173 NHL cases were identified and matched to 307 controls selected from subjects with a bone injury and no cancer diagnosis. Cases and controls were matched on the demographic variables sex, age, region of origin within the US, and race/ethnicity. A logistic regression model was fitted in a stepwise fashion. Pesticide levels used in the model were lipid-adjusted. In the final model, higher levels of heptachlor epoxide (a metabolite of heptachlor) and trans-nonachlor (found in technical grade heptachlor and chlordane and also a metabolite of chlordane) were significantly associated with NHL. Those in the highest quartile of exposure to heptachlor epoxide (mean 0.229 ppm, range 0.141-0.875 ppm) had more than a fourfold increased chance of having NHL than those in the lowest exposure quartile (mean 0.0395 ppm, range <LOD - 0.0602 ppm) [odds ratio 4.6, 95% CI 2.6, 8.2, $p < 0.0001$]. Compared to those ($n = 340$) exposed below the limit of detection (LOD), exposure to trans-nonachlor above the LOD ($n=140$, mean 0.179ppm, range 0.0198-0.769ppm) was associated with 2.8 times increased risk of NHL (95% CI 1.8, 4.3, $p < 0.0001$). Strengths of this study are that patient recall of exposure is not relied on for exposure data and the study size is relatively large compared to similar studies that make use of human tissue analysis for pesticide exposure data. This is the first study to show an association between NHL and human adipose concentrations of compounds related to heptachlor. This study generally supports the findings of other authors who have reported an association between organochlorine pesticide exposure and increased risk of NHL.

Abstract # 10660

EPIDEMIOLOGY OF ESOPHAGUS CANCER IN BAKU AND SOME RURAL DISTRICTS

MARDANLI F., BAGIROVA N., CHALILOV H.

National Oncological center, University Khazar

It has for the first time defined the volume of the standardized indicator of cancer of esophagus in the whole republic and among the urban and rural populations by taking into account their ages and sexes.

It has determined the level of the spread of cancer of esophagus among the rural and population, revealed its features depending on the age, sex, ethnic, professional peculiarities, group of blood, rhesus-factor, the stage of illness, biochemical and clinical indices and the historical data.

It has for the first time studied and revealed the impact of a complex of factors on the indices of the cancer of esophagus among the rural and urban population namely: the presence of a number of microelements in various objects of the environment, consumption of alcohol and tobacco, professional, or occupational adherence, clinical and biochemical indices, group of blood by revealing the criterially significant facts in the of cancer of esophagus.

Practical value of work in the places with high content of copper in the objects of environment, which is an antagonist of molybdenum, the frequency of patients with cancer of esophagus is high which requires a constant in zones of high risk of the cancer of esophagus.

The prophylaxis of the cancer of esophagus must be complex in nature, which must include clinical and biochemical indices, as well as the data concerning the environment.

**SEROLOGICAL MARKERS OF INFECTIONS CAUSED BY HEPATITIS
VIRUSES AMONG HEALTHY POPULATION AND SOME CATEGORIES
OF PATIENTS IN BAKU**

F.A.Mardanli, M.K.Mamedov, S.G.Orujev, A.E.Dadashova
National center of oncology of the Azerbaijan Republic, Baku;
City Medical college No.2, Baku

Taking into account that now systematically data concerning of the transfusionally trans-mitted viral hepatitis (hepatitis B, C and G) spreading in the Azerbaijan Republic now are absent, we summarized our results obtained during serological investigation performed at the last 4 years for detection of hepatitis B, C and G viral infections among some groups of local population in the biggest city and the capital of the Azerbaijan Republic - in Baku.

We investigated blood serums of 1306 adult healthy persons (blood donors), 840 healthy primary school children, 1168 patients hospitalized with "acute hepatitis" diagnosis and 1712 patients with different malignant tumors for revealing of HBsAg and antibodies to hepatitis C virus (anti-HCV) with the help of ELISA-kits made by "Hoffman-La Roche" (Switzerland) and for re-vealing antibodies to E2-zone protein of hepatitis G virus (anti-HGV) with the help of ELISA-kit produced by "Vector" (Russia).

Results obtained show HBsAg was detected: in 3.68% adult persons, in 1.90% children, in 42.0% patients with acute hepatitis and in 13.0% patients with malignant tumors. Anti-HCV in the blood serum were detected: in 6.51% adult persons, in 2.50% children, in 11.04% patients with acute hepatitis and in 17,0% patients with malignant tumors. Anti-HGV in the blood serum were detected: in 5.1% adult persons (children and patients with acute hepatitis were not tested for detecting anti-HGV) and in 14,6% patients with malignant tumors. These data demonstrated that hepatitis B, C and G viral infection wildly enough spread in Baku and directly confirmed existence of positive correlation between spreading of these infections.

**INFLUENCE OF A SURGICAL TRAUMA ON THE FUNCTIONAL CONDITION
OF A LIVER AT THE PATIENTS WITH THE COMPLICATED FORMS
OF THE CANCER OF STOMACH AND COLON.**

A.R.Aliyev, E.I.Ibragimov.

National centre of oncology of Azerbaijan Republic - in Baku.

By the purpose of research was the definition of breadth of distribution hepatopaties and weight hepatocellular disfunctions at the patients by a cancer of a stomach (CS) and colon (CC), study etiology of structure hepatopaties, influence of surgical aggression on a liver, correlation hepatopaties with current and results of surgical treatment.

In job were involved 252 surgicals interventions of the patients CS and CC, investigated clinical, biochemical at stages of surgical treatment, serological, ultrasonografical (UST) by methods.

In result is established, that hepatopaties at the patients CS and CC III-IV by stages are widely distributed, and, at the complicated clinical current frequency and the degree of severity them is higher, than at not complicated.

At the patients CS and CC with established hepatopatya, approximately, at 30% come to light serologicals markers of infections caused hepatitis "B" and "C" viruses, and at 37% - it are marked UST attributes of a pathology of a liver and bodies, functionally connected to her.

On the clinical classification, offered by us, hepatopaties, approximately, at 48% of the investigated patients is ascertained true hepatopatya, and at 52% - jet. In 90% cases its(her) subclinical phase, and in 10% - manifestal is established.

The surgical aggression results in increase of a degree of severity hepatopatya. The frequency of registration hepatopaties after developed in National centre of oncology of plastic operations is much lower, than after classical. Hepatopaties are one of criteria of operational risk. The realization hepatoprotective of therapy reduces in early postoperation the period frequency of occurrence of a various sort of complications.

10676 - Occupational exposure to immunoactive agents and risk for lymphoma

S. de Sanjosé, JP. Zock, N. Cavallé, E. Domingo-Domènech, D. Turuguet, R. Font, T. Alvaro, M. García, S. Kennedy, M. Kogevinas. Department of Epidemiology and Cancer Registry, Catalan Institute of Oncology, Barcelona (Spain); UBC, Vancouver, BC, Canada; Municipal Institute of Medical Research (IMIM), Barcelona, Spain.

Introduction. Several occupational exposures have been related to lymphomas but despite numerous studies findings are inconsistent. Lymphomas are strongly associated with immunosuppression. Patients with asthma have been found in various studies having a low lymphoma risk. We evaluated whether occupational exposures linked to immune system dependent mechanisms, IgE or non-IgE mediated, are associated with lymphoma risk. We applied a newly developed job exposure matrix (JEM) for studies on occupational asthma that allowed the evaluation of specific exposures associated with immune related mechanisms.

Methods: The study is part of the international EPILYMPH multicentric case-control study and includes 347 consecutively diagnosed cases with malignant lymphoid neoplasms from four hospitals in Spain. All cases had histological or cytological diagnosis and were classified following the WHO classification. Cases were compared to 378 hospital controls with no hematological disease matched by center, sex and age. Trained personnel interviewed cases and controls. Response rates were above 85%. Information was obtained for all jobs longer than one year. An industrial hygienist coded occupations using ISCO-88 codes and applied the JEM. The JEM evaluates 7 High Molecular Weight (HMW) agents, 6 Low Molecular Weight (LMW) agents, and other exposures not directly related to immune related mechanisms. These latter were not examined in this study. The full application of the JEM includes a second step of expert judgement and has not been yet completed. Odds ratios and 95 confidence limits are adjusted for age and sex (OR, 95%CI).

Results: Exposure to any HMW agent was not associated with lymphoma risk (OR=0.97). Among HMW agents, a lower risk was found for exposure to animal derived agents (OR=0.30, 0.13-0.71, exposures lagged over 10 years), and a non-statistically significant excess risk was observed for exposure to biological enzymes (OR = 2.0, 0.36-11, lagged 10 years). No consistent pattern was observed for 4 other categories of HMW agents. Exposure to any low molecular weight agent (LMW) was associated with a slightly lower risk for lymphomas (OR=0.81). Among the 6 categories of LMW agents a decreased risk was observed for exposure to wood dusts (OR=0.38, 0.15-0.93, lagged 10 years).

Conclusions. The exposures evaluated tended to be associated with a decreased lymphoma risk although results were not entirely consistent. A more specific analysis of lymphoma subtypes and the full application of the JEM are underway and will be presented.

1071 - Historical Exposure to Inorganic Compounds in a Nested Case-control Study of Breast Cancer. E.S. O'Leary*, J.E. Vena, J.L. Freudenheim, (SUNY at Stony Brook, NY 11794-8036; SUNY at Buffalo, NY 14214)

Few studies of risk factors for breast cancer have estimated historical exposures to inorganic compounds. These compounds are found in drinking water and point sources of pollution. Nitrates have been linked to other cancers, but not breast cancer. One occupational study found a slight increased risk for breast cancer in women exposed to metals at work (Cantor, 1995). Cadmium may affect estrogenic activity and was found to increase the growth of human breast cancer lines in cell culture (Garcia-Morales, 1994).

We estimated the historical environmental exposure to nitrates and metals (cadmium, chromium, and arsenic) in 105 women diagnosed with breast cancer between 1980-1992 and 210 age and race-matched controls from a cohort of residentially stable Long Island residents who had completed a short mailed questionnaire. Mean levels between 1977 and the censor date (date of diagnosis/reference date or date moved from the residence, whichever came first) of nitrates were estimated for the relevant water districts from records obtained from the county health departments. Cadmium, chromium, and arsenic were categorized as detected or not detected between 1977 and the censor date. None of the wells in the water districts studied exceeded the maximum contaminant levels for these compounds. Geographic information software was used to calculate the distance between residences and hazardous waste sites (HWS) and toxic release inventory sites (TRIs) containing metals. Odds ratios (OR) and 95% confidence intervals (CI) were computed by unconditional logistic regression and adjusted for known breast cancer risk factors. The OR for residence in a water district in the highest tertile of exposure to nitrates (> 2.72 ppm) compared to the lowest tertile was 1.40 (95% CI 0.74-2.66), with 37% cases and 34% controls residing in such a water district. The OR for breast cancer and residence in a water district with detectable levels of each metal compared to residence in a water district with no-detectable levels are as follows: cadmium: 1.22 (95% CI 0.73-2.05), with 46% cases and 38% controls exposed; chromium: 1.41 (95% CI 0.77-2.58), with 27% cases and 19% controls exposed; and arsenic: 1.31 (95% CI 0.76-2.26), with 35% cases and 28% controls exposed. The OR for residence within one mile of a HWS containing metals was 1.18 (95% CI, 0.56 - 2.51), with 17% cases and 15% controls exposed and the OR for residence within one mile of a TRI site containing metals was 1.58 (95% CI, 0.52 - 4.76), with 9% cases and 4% controls exposed. These findings do not support a role of exposure to nitrates or metals in relation to breast cancer etiology.

10781 - Consumption of cured meats during pregnancy and risk of brain cancer in children.

Y.K. Shim, W.E. Kaye. Agency for Toxic Substances and Disease Registry, 1600 Clifton Road, Atlanta, GA 30333.

Introduction/Rationale. Brain cancer is the second most common cancer in children. However, the causes of brain cancers are largely unknown, and the only risk factors that have been consistently associated with increased risk are radiation exposure and certain hereditary conditions. Consumption of cured meats during pregnancy has been an area of focus, primarily because animal experiments have shown that oral administration of certain N-nitroso compounds (e.g., N-ethyl-N-nitrosourea) into pregnant rats results in a high incidence of neurogenic tumors in offspring. It also has been suggested that vitamins C and E may have protective effect for brain cancers by blocking the formation of N-nitroso compounds. We examined mother's diet during pregnancy as part of a population-based case-control study of environmental risk factors for childhood brain cancer.

Methods. All cases were diagnosed at less than 10 years of age during 1993-1997 with primary malignant tumor of the brain. Only the first primary cancers were included in the study and lymphomas arising from the brain were excluded. We identified all incidence cases from statewide cancer registries of Florida, New Jersey, Pennsylvania, and New York, excluding New York City. Controls were identified by random digit dialing. One control was selected for each case by matching to the case's race, birth year (within one year), and state of residence at the time of diagnosis. We conducted computer-assisted telephone interviews with the 1052 eligible mothers (526 case-control sets) to collect information on consumption of cured meats, fruits and vegetables, dietary supplements, and alcohol, as well as information on smoking habits during pregnancy. We calculated odds ratios by employing conditional logistic regression analysis.

Results. None of the cured meats examined (hotdog, sausage, bacon, and various lunch meats) showed

significantly increased risks, although most of them demonstrated marginally positive relationships. In the combined analysis, consumption of one or more of these cured meats was not associated with a significantly elevated risk. Neither mother's smoking nor alcohol consumption during pregnancy was a significant risk factor. Neither the consumption of fruits and vegetables, nor intake of multivitamin, folic acid, or calcium supplements was associated with a significant reduction in risk for brain cancer. However, a significant protective effect was observed for the intake of vitamin C, vitamin E, or iron supplements after adjusting for the effect of mother's education and smoking.

Conclusion. Mother's intake of vitamin C, vitamin E, or iron supplements during pregnancy was associated with a significant protective effect against brain cancer in childhood. This study did not confirm previous suggestions that mother's consumption of cured meats during pregnancy may be associated with the risk of developing brain cancer in childhood. However, these findings should be interpreted with caution because of possible recall bias, multiple comparison problems, and uncontrolled confounding effects.

GEOGRAPHIC VARIATION IN SOLAR ULTRAVIOLET RADIATION AND
INCIDENCE OF MALIGNANT MELANOMA

Lambert W.

Oregon Health & Science University, Portland, OR, USA

Ultraviolet radiation (UVR) in sunlight is widely recognized as a cause of malignant melanoma of the skin. Because surface levels of solar UVR are predicted to increase in the 21st century due to reduction of stratospheric ozone, there is concern that the incidence of this skin cancer will increase. In addition, changes in global climate may influence the amount of cloud cover and air pollution in the lower atmosphere, also influencing surface UVR levels. Although there are many uncertainties about the future state of the atmosphere, and the ramifications for solar UVR exposure and skin cancer, quantification of the dose-response relationship is useful for risk analysis and the evaluation of benefits associated with reducing emissions of ozone depleting chemicals. Epidemiological analyses conducted in the 1980s (Scotto J and Fears TR, *Ca Invest* 1987; 5:275-283) characterized the dose-response relationship using latitude and limited direct measurements of UVR intensity. This paper presents an updated analysis of dose-response, employing population-based melanoma incidence data from the Surveillance, Epidemiology, and End Results (SEER) Program and satellite measurements of ground level UV from the National Oceanographic and Atmospheric Administration (NOAA). Age-adjusted incidence (1970 U.S. Standard) was calculated for each of the nine SEER registries over 1973 to 1998. The incidence of malignant melanoma for males and female adults ages 20 years and older varied from 14 cases per 100,000 in Detroit to 39 cases per 100,000 in Hawaii. When incidence rates were regressed on yearly average cumulative maximum UV Index days (1996-2001), a strong linear dose-response relationship was observed: incidence $10^{-4} = 0.0087$ (cumulative UV Index days per year) + 3.37, $R^2 = 0.61$. The strength of the linear relationship was surprising given the opportunity for exposure error associated with migration. Interestingly, the explained variance and slope increased when Seattle, a metropolitan area that received large numbers of migrants from California during the 1980s, was withheld from the regression model (slope = 0.0105, $R^2 = 0.74$). The parameters estimated from this model represent the incidence of cancer across a 25-year period when outdoor activity patterns and use of personal protection (sun screen and clothing) changed. Despite these limitations, the estimated slope is derived from large populations living in settings with widely differing solar UVR intensity and represents a stable estimate useful for predicting increases in incidence associated with the reduction of stratospheric ozone and greater amounts of solar UVR reaching the earth's surface. Arguably, validity of the model is strengthened by use of the UV Index, an exposure metric that is directly related to erythemal dose (mJ/cm^2) and burning of the skin. This paper will present analyses of the relationship of melanoma incidence with surface UVR, for men and women, region, and latitude, and will characterize dose-response relationships for the periods 1973-1985 and 1985-1998.

**Risk Assessment and Management of Carcinogens:
Comparison of Environmental, Occupational, and Military Approaches**

Veronique Hauschild, MPH

U.S. Army Center for Health Promotion and Preventive Medicine
Aberdeen Proving Ground, Edgewood Area, MD 21010-5403
410-436-5213

Veronique.Hauschild@apg.amedd.army.mil

Approaches to identifying, quantifying, and ultimately managing hazards that potentially increase an exposed population's risk of developing cancer or other chronic health effects vary amongst U.S. organizations. Agencies such as the US EPA, US FDA, OSHA, and the NRC each have specific responsibilities to mitigate such risks. Recently the US DoD has also had to address this issue. Each agency has developed its own procedures for collecting and interpreting data – and estimating risk. Each organization has also established its own definition of acceptable risk. Risk managers need to be aware of the underlying differences when making decisions. Ideally, a more standardized system would facilitate better public health decision-making. This presentation presents key examples of the different approaches and proposes possibilities for developing more balanced and consistent characterizations of carcinogenic risk.

Association between bladder cancer and mate consumption in Argentina

Bates MN¹, Hopenhayn-Rich C², Rey OA³, Smith AH¹. 1. School of Public Health, University of California, Berkeley, CA 94720-7360; 2. Dept. of Preventive Medicine & Environmental Health, College of Medicine, University of Kentucky; 3. Villa Maria, Cordoba, Argentina.

Objectives

Mate is a popular “tea”, made from the herb *Ilex paraguariensis*, and widely consumed in a number of South American countries. Consumption of mate in Argentina is in two forms: mate con bombilla, in which the infusion is consumed at near boiling temperature through a metal straw (bombilla), and mate cocido, which is consumed at a lower temperature. A number of studies have suggested that mate consumption may be associated with cancers of the esophagus, oral cavity, lung, and bladder. Although the high temperature at which mate is sometimes consumed has been assumed to play a role in the oral and esophageal cancers, mate extracts have been shown to contain genotoxic substances. There is evidence of an interaction between tobacco smoking and mate in the association with bladder cancer. The purpose of this study was to investigate whether consumption of mate was associated with bladder cancer and whether there was any interaction with tobacco smoking.

Methods

This was a bladder cancer case-control study involving 114 matched case-control pairs recruited in the Cordoba province of Argentina. Detailed data on consumption of tobacco products and various beverages, including mate, were collected by questionnaire. Separate estimates of consumption were recorded for three time-points: the present, 20 years ago and 40 years ago. Primary analysis was carried out using conditional logistic regression. To investigate a possible interaction with smoking, the match was broken and unconditional logistic regression was used to examine smokers and non-smokers separately. Analyses involving smokers were adjusted for 3 levels of smoking. All analyses were adjusted for age, sex, and level of education.

Results

Consumption of mate con bombilla 20 years ago was associated with bladder cancer risk (odds ratio [OR] = 2.1, 95% confidence interval [CI]: 0.8-5.7). This relationship was stronger in people who had ever smoked cigarettes (OR = 3.6, 95% CI: 1.1-11.5), and was not present in never-smokers (OR = 0.76). Similar, but weaker relationships were present for mate con bombilla consumption 40 years ago. Consumption of mate cocido was only weakly, if at all, associated with bladder cancer.

Conclusions

The results of this study are consistent with a previous study in Uruguay that showed increased risks of bladder cancer with joint consumption of mate and tobacco.