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Environmental health

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A COMPARATIVE CHARACTERISTIC OF THE AIR POLLUTION IN AN INDUSTRIALIZED REGION OF BULGARIA BEFORE AND AFTER THE ECONOMIC CRISIS (1980-2001)

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More than forty years the atmosphere of Dimitrovgrad (a town with population at about 54 thousand people and situated in the Thracian lowland) has been regularly polluted by the chemical industry (production of nitric and phosphate fertilizers), production of cement and asbestos-cement articles, power production (the electric power station uses low energy coal with high contents of sulfur and ash) and well developed motor transport. The strong economic crisis after 1989 led to an abrupt decline in the industrial output of pollutants' sources. The Aim of the present study was to compare the air pollution in the town of Dimitrovgrad before and after industrial decrease.

Materials and Methods: The air pollution was controlled at three permanent stations for manual tests. Dust (TSPM), SO2, NO2, H2S, HF and lead aerosols were systematically examined. The production of phosphates was stopped in 1994 which caused the concentration of HF to fall practically to zero and its control was abandoned. The concentrations of ammonia are controlled since 1993. All tests have been carried out according to the Bulgarian Standards, during the first working ten days of each month, four times daily for gases with duration of thirty minutes and eight hours continuously for TSPM and lead aerosols.

Results: Considerable decline of the TSPM and SO2 concentrations after 1989 were found, respectively: TSPM from 0.84 ± 0.114 to 0.13 ± 0.0064 mg/m^3 and SO2 - from 0.22 ± 0.013 to 0.03 ± 0.004 mg/m^3. Mean year levels of lead aerosols are under the Bulgarian limits (0.001 mg/m^3) during the total period, but before crisis they reached up to 0.0009 ± 0.00007 mg/m^3 (X$\pm$SE) and after 1989 - up to 0.00005 ± 0.000006 mg/m^3; The result is similar about mean year concentrations of H2S (up to 0.03 ± 0.0034 mg/m^3 before 1990 and 0.00045 ± 0.00013 mg/m^3 after it) but the presence of quite high and quite low concentrations is probably due to a lack of rhythm in the production during the crisis period and leads to a burst like discharge of pollutants. The nitric oxides (like NO2) are at levels below the limits during the total investigated period and there is no tendency for decrease after 1989 (the mean year concentrations are between 0.029 ± 0.0008 and 0.008 ± 0.0011 mg/m^3). That fact probably is a result of the great number of second hand cars used after 1989. NH3 levels are over the limits (0.04 mg/m^3) - up to 1.04 ± 0.90 mg/m^3 during all years, except for 1999 (0.034 ± 0.0016 mg/m^3) and for 2000 (0.037 ± 0.0019).

Conclusion: A reliable decrease of the air pollution in the town of Dimitrovgrad was found after 1989 compared to the previous period in accord with the industrial decline.

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ESTABLISHING HEALTH EPIDEMIOLOGY FOR CHEMICAL SPILLS IN MINING INDUSTRIES

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Objectives: To look into health epidemiology of investigating and handling chemical spills in mining industries.

Methods: The research study was a preliminary study for a framework on how to investigate and handle chemical spills from a metallic mining industry in the Philippines. Consultations with experts from other disciplines such as sociology, epidemiology, occupational and environmental health, engineering, applied chemistry and social work were done.

Chemical spills in the country from mining industries are not uncommon. When such emergencies arise, there is a need to develop a standard procedure on the proper investigation, gathering of data and handling of the situation. The basic elements should include primarily the following: investigation of the workplace; investigation of the immediate environment, and health investigations among community dwellers, establishing parameters of emergency management. Investigation of the workplace involves a detailed account of the industrial accident, the causes of leaks or spillage into the external environment such as the river system, looking into the breakdown of work process, machines and other facilities. The chemical composition and amount of use are necessary to establish too. Then a profiling of the external environment can be done for the ambient air, river sitemaps and soil (whichever is affected). Samples of water and soil should be done on a scale and spatial basis to establish distance of affectation. Air sampling of chemical exposures shall provide data on concentrations. Then affectation of livestocks and people must also be investigated. This can be done by sampling nearby residents and getting some biologic samples from blood or urine, whichever is more efficient to establish biologic determinants. From such data gathering, the researcher can establish rating systems on which are the most affected and serious areas/ people and the consequent appropriate management.

Conclusion: This is a significant study that came up with a standard management procedure on how to investigate chemical spills/ contaminations from mining industries to control and arrest the adverse effects of chemical spillage into the health, property and livelihood of community dwellers.

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INFLUENCE OF THE LOW-DEGREE ATMOSPHERIC POLLUTION ON CARDIOPULMONARY FUNCTIONS AMONG CHILDREN BELONGING TO DIFFERENT ETHNIC GROUPS

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The changes in the respiratory and cardio-vascular function are a sensitive indicator of the influence of high-degree atmospheric pollution. However, when the latter is near the admissible levels of the pollutants, it usually does not lead to clinical manifestations. In such cases the evaluation method preferred is carrying out functional investigations including physical exertion tests. On the other hand, it is known that the ethnic difference is one of the factors determining the physical development as well as cardio-pulmonary functions. The Aim of the present study was to make a snapshot of the differences in anthropometric measurements and cardiopulmonary function between Bulgarian and Romany children living in à low level air polluted environment. The study was carried out during May 2001. Twenty four healthy children - 13 Bulgarian and 11 Romany at similar age (10.7 ± 0.9 years; mean$\pm$SD) took part in it. All of them have lived in a residential district situated close to a cement plant, and have attended at a school located not far from of 800-1000 m to the plant. The air pollution assessment was based over the data of a regular monitoring station located near the school.

Results: TSPM - 0.13 ± 0.010 mg/m^3 (mean year concentration $\pm$ SE); Pb - 0.05 ± 0.007 µg/m^3; SO2 - 0.025 ± 0.005 mg/m^3; NO2 - 0.012 ± 0.001 mg/m^3; H2S - 0.017 ± 0.015 mg/m^3; NH3 - 0.060 ± 0.003 mg/m^3. There ware no significant differences between two groups of children concerning passive smoking and types of heating. Bulgarians were significantly taller (height cm = 143 ± 6 vs. 135 ± 6; p=0.007) and heavier (weight kg = 38 ± 10 vs. $29\pm;4$; p=0.012) than Romany children. There were significant differences in thoracic dimensions (thoracic circumference at full inspiration cm =74 ± 7 vs. 67 ± 3) and the actual values of the corresponding spirometric parameters (vital capacity (VC) and forced expiratory volume in one second (FEV1.0) between the two ethnic groups. Presenting the data as persentage of predicted normals removed the diference (VC%pred =104.3 ± 10.7 vs 103.0 ± 13.0; p=0.745 and FEV1.0% pred = 108.7 ± 12.0 vs $110.8\pm;12.0$; p=0.674). We found that Romany children have significantly lower diffusion capacity than their Bulgarian schoolmates (TL,CO = 4.25 ± 0.70 vs. 5.23 ± 1.00; p=0.011). The data from the incremental treadmill test showed that "standardized" peak oxygen uptake does not differ significantly between the two ethnic groups - VO2/kg ml.min-1.kg-1 = 33.9 ± 3.8 vs. 34.8 ± 6.8; p= 0.720, although significantly higher as absolute value - VO2 = 1282 ± 347 vs. 982 ± 115; p=0.012. Tidal volume (VT) and total exercise ventilation (VE) follow the same pattern.

Conclusions: Ethnic differences between Bulgarian and Romany children living in a low level air pollution conditions above all things are mass dependent with the exception of diffusion capacity.

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ANALYSIS OF PULMONARY FUNCTIONS AMONG CHILDREN WHO LIVED UNDER MASSIVE AIR POLLUTION IN THEIR EARLY CHILDHOOD

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Dimitrovgrad was highly industrialized region in Bulgaria up to 1990 with developped chemical industry, cement and asbestos-cement industry as well as energy production (steam power plant based on low calorie lignite with high ash and sulphur contents). The main ecological problem for more than four decades has been air pollution. Environmental factors including massive air pollution during early childhood contribute to a great extent for the unfavorable consequences during later life. One of the most important aftermaths is the impairment of pulmonary function. The Aim of the present study was to investigate the pulmonary function among children from the town of Dimitrovgrad who lived under massive air pollution during their early childhood.

Material and methods: Ninety children (41 boys and 49 girls, height =145±6 cm, weight = 38±9 kg) residents of Dimitrovgrad were studied in 1996. They represented the first cohort, born in 1985. Ninety three children (49 boys and 44 girls, height =144±7 cm, weight = 37±9 kg) living in the same town and attending the same schools represented the second cohort and were tested in 2001 (born 1990). The data for the air pollution based on systematic control by Regional Inspectorate of Environment and Waters describe two periods: 1985-1989 (I) and 1990-1994 (II). The first period was characterized by massive air pollution and the first cohort suffered its negative impact during their early childhood. The second period documents rapid decline of air pollution when the children of the second cohort were born and raised.

Results: The average year concentrations of air pollutants before and after industrial crisis are folowing [1985-1989 (I); 1990-1994 (II)]: TSPM (mg/m³)- I-0.55, II-0.34, p<0.001; SO2 (mg/m³)- I - 0.12,II - 0.07, p<0.05; Pb (μg/m³)- I0.79, II - 0.28, P<0.001; H2S (mg/m³)- I - 0.021, II - 0.013, p<0.05; HF (mg/m³)- I - 0.016, II - 0.005, p<0.001. The average concentration of NO2 is higher during the second period (0.018 vs. 0.021 mg/m³, p<0.05) probably because of using a great number of second hand cars. We found significantly lower mean values in the first group for: FVC (2.34±0.36 vs. 2.50±0.38 L; P=0.004), FEV1 (2.16±0.32 vs. 2.29±0.33 L; P=0.010), MEF 50% (2.86±0.71 vs. 3.04±0.70 L.s-1; P=0.009), TLC (3.05±0.37 vs. 3.43±0.47 L; P=0.001), and no difference for TL,CO (5.66±0.80 vs. 5.57±1.07 mL.min-1.kPa-1; P=0.515).

Conclusions: 1) Significantly higher levels of air pollutants were found in the period 1985-1989 in the town of Dimitrovgrad in comparison with 1990-1994. 2) Severe air pollution during first years of life has detrimental effect on the development of children's pulmonary functions.

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STUDY OF THE SHORT-TERM EFFECTS OF AIR POLLUTION ON MORTALITY IN PAMPLONA METROPOLITAN AREA

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Introduction: EMECAS is a collaborative project that seeks to evaluate the short-term effect of air pollution on mortality and hospital admissions. The objective of this project is to examine the time dynamic relationship between air pollution lag indicators and mortality and select the best pollutant indicator in order to carry out further analyses.

Methods: Pamplona, metropolitan area has a population of 267.675 inhabitants. The period of the study goes from 1995 to 1999. Death Certificates were obtained from Navarra Institute of Public Health. The daily number of deaths in Pamplona metropolitan area was computed. Death were clasified according the ICD-9. From Air Pollution Networks we collected data for 24 hours daily levels of black smoke, total suspended particles (TSP), particles less than 10 m (PM10), SO2, and NO2; 8 hours maximum moving average of CO and ozone; and, lastly, 1 hour maximum of SO2, NO2 and ozone. Meteorological data were obtained from Pamplona Airport meteorological station (located 4 km away from the City Hall) Magnitude of association was estimated using generalized additive models (GAM) under a Poisson distribution controlling for confusion and over dispersion, as well as allowing for non-linear relationships. Co-variables included were trend, temperature, humidity, barometric pressure, influenza, day of the week, and unusual events. All calculations were computed using the S-Plus software.

Results: Average levels of pollutants were, in general, low to moderate exceeding only the case of PM10 the European limit values. There was an association between black smoke levels and death by respiratory diseases RR=1,01073 (95% CI: 1.00022 - 1.02134), the same happened with respiratory diseases where black smoke levels (2 days lag) increased the risk RR 1,00845 (95% CI 1.0020 - 1.01677). Other pollutant related with cardiovascular diseases were CO with a RR of 1.14 (95% CI 1.007 -1.300) and SO2 where the RR was 1.01 (95% CI 1,001 -1.021). Mortality by all the death causes was related with SO2 and NO2 levels, the same happened in the case of mortality by all causes of death in people elder than 70 years.

Conclusions: We have observed a relation between daily mortality and air polution, in all pollutants but CO and NO2 lag 0 for daily maximum measures and 0-1 lag average for daily mean measures appears as the most consistent estimates of the short-term relationship between air pollutants and mortality. For CO and NO2 the relationship seems to be more delayed, lag 3.

Study funded by the Spanish Ministry of Health (FIS 00/0010-07).

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AIR POLLUTION LAGGED EFFECTS ASSESSMENT ON CARDIOVASCUALAR MORBIDITY IN THE EMECAS PROJECT

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Introduction: The EMECAS project is a multicentric study aimed to assess the effect of air pollution on mortality and morbidity in 16 Spanish cities. City-specific analyses have been done in each city following a standarised protocol, using Poisson Generalized Additive models. Daily number of hospital admissions for cardiovascular diseases have been studied: all cardiovascular (CVS), heart (HD), ischaemic (IHD), and cerebrovascular (CBS) diseases. For each cause, if available, the following measures of pollution were considered: daily mean of black smoke, PM10 or TSP, SO2 and NO2, 8 hours moving average of CO and ozone and daily hourly maximum of SO2, NO2, CO and ozone. As it could be a delay in the effect of air pollution several lags from 0 to 3, and average of lags 0 and 1 and lags 2 and 3 of each pollutant were considered in separate models. For ozone, analyses only for warm period were carried out. As is clear, a lot of information has been obtained from this great amount of analyses.

Objectives: To examine the time dynamic relationship between air pollution lag indicators and hospital admissions for cardiovascular diseases and select the best pollutant indicator in order to carry out further analyses.

Methods: For each outcome, the estimates for each pollutant lag or lag average were combined using fixed or ramdom effect models as necessary. Heterogeneity was tested according to DerSimonian and Laird procedure (p≤0.2). Pooled estimators were graphically plotted against lags, and the most significant effect was detected.

Results: In general, the meta-analysis detected a statistically significant association between pollutants and CVS for all causes except CBS. The impact was greater in HD and CVS. The pattern over lags was the same in the three first outcomes. For daily maximum of SO2, NO2 and CO the lag of higher impact was lag 0. For 24 hours daily means of SO2, NO2 and CO best retards were 0-1 lag average and lag 0, in all but CBS and global SO2 for IHD, these indicators were statistically significant. For particulates, except in CBS, 0-1 lag average or lag 0 were the indicators with greater and positive effect, statistically significant in 2/3 of cases. In CBS lag 1 had the best, but negative non-significant effect. Finally for ozone, lag 3 and 2-3 lag average were the best indicators. The effect was significant for all causes, except for CBS.

Conclusions: In all pollutant but ozone, lag 0 for daily maximum measures and 0-1 lag average for daily mean measures appear as the most consistent estimates. For ozone the relationship seems to be more delayed, i.e. lag 3 and 2-3 lag average. These result provide useful indication in selection of air pollutant time indicators for further analyses.

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SHORT TERM EFFECT OF POLLEN AND ALTERNARIA SPORES LEVELS ON MORTALITY AND URGENT HOSPITAL ADMISSIONS IN VALENCIA FROM 1996 TO 1999

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Introduction: Environmental levels of pollen and fungal spores have been related with development or worsening of some diseases. Graminae pollen levels have been associated with worsening of asthma and increases of healthcare services demand, although there is not strong evidence about the relationship between other pollen species and morbidity or mortality. However, atmospheric levels of fungal spores have been related with respiratory diseases and they are considered as a risk factor for respiratory failure in young asthmatic patients. The objective of this study is to analyze the short term effect of pollen and Alternaria spores on mortality and urgent hospital admissions in Valencia from 1996 to 1999.

Methods: Time series of daily deaths (all causes and respiratory diseases) and daily urgent hospital admissions (caused by respiratory diseases, asthma and cardiovascular diseases) were related with daily averages of the atmospheric concentration of total pollen (grains/m³), Graminae pollen (grains/m³) and Alternaria spores (spores/m³). The effect of trend, seasonality, cyclic changes, temperature, relative humidity, influenza incidence, holydays, unusual days, weekday and particulated air pollution was controlled. Information about pollen levels was obtained from Spanish Net of Alergobiología. A descriptive analysis (including graphic representations of series and relationships between variables) and a multivariated analysis using Poisson generalised additive models were performed. Relative risks (RR) and their confidence intervals (CI95%) were estimated for a change in interquartile range of pollen or spores levels (90 grains/m³ for the total pollen counts, 6 grains/m³ for Graminae pollen and 30 esporas/m³ for Alternaria alternata).

Results: We did not find clear associations between pollen or spores and total mortality or urgent hospital admission caused by asthma. A weak relation between urgent hospital admissions by respiratory diseases and total pollen counts was found. RR for 7 days average of total pollen concentrations were 1.02 (CI95%:1.01, 1.04). Associations between urgent hospital admissions caused by cardiovascular diseases and the same day levels of total pollen (RR: 1.02, CI95%: 1.00, 1.03) and of Graminae pollen (RR: 1.01, CI95%: 1.00, 1.02) were detected. For respiratory diseases mortality, a constant and positive association with total pollen levels was found, being the RR for 7 days average 1.07 (CI95%: 1.04, 1.11)

Conclusions: A 90 grains/m3 increase in seven days average of total pollen counts could raise respiratory diseases mortality in approximately a 7%.

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AN EXCESS OF BIRTH DEFECTS IN AN AREA AT "HIGH RISK OF ENVIRONMENTAL CRISIS" IN ITALY

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Introduction: The study area is the Province of Siracusa in the South-East of Sicily island, Italy. The study area includes the municipalities of Augusta, Priolo and Melilli in which is sited an industrial area that has been classified as at "high risk of environmental crisis" by the Italian Ministry of Environment (Act n. 349/86). This area hosts petrochemical industrial activities that may entail noxious exposures, through occupation and environment. An epidemiological descriptive study on malformed newborns residing in the Siracusa province was carried out using data routinely collected by the Sicilian Registry of Birth Defects (I.S.MA.C.).
Methods: The rates of selected birth defects, analysed by municipalities of the Siracusa province for the 1991-2000 period, were compared to different standard rates (Eastern Sicily Registry, ESR; mean rates of the other italian registries of congenital malformations, IR). To calculate prevalence rates the number of births and stillbirths was obtained from the Birth Registry Office of relevant municipalities. Data were analysed for selected malformations and for groups of conditions. Heterogeneity among municipalities was tested by chi-square, and annual trends by chi-square for trend.
Results: The prevalence rate of total malformations for the Siracusa province (133/10.000) was significantly lower than the standard rates (ESR: 182/10.000; IR: 197/10.000). A significant excess resulted for the three municipalities (SMR_{ESR}=1.2, SMR_{IR}=1.1) and for the rest of the Siracusa province (SMR=1.9). Data resulted significantly heterogeneous among municipalities and over time due to a decrease of the total anomalies' occurrence in the last years (chi^2 trend = 28.2 p<0.00; chi^2 among municipalities p=0.00). The industrial area of Augusta-Priolo-Melilli showed a significant excess also for hypospadias (SMR_{ESR}=2.3, SMR_{IR}=1.8) and for digestive system (SMR_{ESR}=2.1, SMR_{IR}=2.2). In addition hypospadias and digestive defects were still significant versus the rest of the Siracusa province (SMR=2.1 and 2.6 respectively).
Conclusions: High hypospadias rate, such as the one we observed, is rarely reported in literature. However it must be taken into account that hypospadias, particularly mild forms, are subject to high diagnostic variability. Recently, epidemiologic studies have reported hypospadias in association with environmental pollutants acting as endocrine disruptors. Also the excess of anomalies of the digestive system deserves attention though the increase of some of these defects may be influenced by diagnostic variability. The descriptive nature of the study, carried out at the municipality level, and the absence of information for individual environmental and occupational exposure and confounders make it difficult, at this stage, to estabilish a direct causal relation between malformations and main petrochemical pollutants. Nonetheless, excesses found in the three municipalities including the industrial area, are indicative of a possible link between risk factors and observed prevalences.

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EFECTOS A CORTO PLAZO DE LA CONTAMINACIÓN ATMOSFÉRICA SOBRE LA MORBILIDAD RESPIRATORIA EN LA CIUDAD DE VIGO: UN ESTUDIO CASE-CROSSOVER

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Antecedentes: Son numerosos los estudios epidemiológicos que relacionan contaminación atmosférica con mortalidad y morbilidad a través de ingresos hospitalarios. Sin embargo, son más escasos los estudios que la relacionan con morbilidad a través de llamadas a servicios de urgencia. Por otro lado, no se ha valorado en profundidad el efecto del polen sobre estos indicadores de salud. Por ello, se plantea un estudio case-crossover para valorar la influencia de las contaminaciones atmosférica y polínica en las llamadas al 061.
Métodos: El estudio se ha realizado en el municipio de Vigo entre los años 1996 y 1999. Se recogieron las llamadas al Centro de Emergencia Médicas 061 por enfermedades respiratorias. Y los datos de contaminación por SO2 y humos negros de la Red de Vigilancia y Prevención de la Contaminación Atmosférica en Vigo. Se realizó un diseño case-crossover bidireccional simétrico con un periodo control de 7 días antes y 7 días después del evento. El análisis estadístico se realizó mediante regresión logística condicional. Se elaboró un modelo basal (utilizando como criterio la minimización del AIC) en el que se valoraba la temperatura, humedad (ambos incluidos como natural-splines con 4 grados de libertad y con retardos 1, 2 y 3 y promedios 01 y 23), día de la semana, días festivos y gripe. A continuación se elaboraron modelos uniexposición con contaminantes y pólenes valorando retardos 1, 2 y 3 y promedios 01 y 23. También se realizó un modelo multiexposición en el que se incluían aquellas exposiciones que presentaban una p < 0,1 en el modelo uniexposición. Finalmente, se realizó una análisis de sensibilidad del modelo, valorando la relación con urgencias de tipo digestivo.
Resultados: El modelo basal incluía: el día de la semana, los días festivos, la epidemia de gripe, los promedios 01 y 23 de la temperatura y el promedio 01 de la humedad. Los resultados son significativos para el promedio 23 de la temperatura, dando una relación no lineal. En el modelo uniexposición se observa que la probabilidad de llamar al servicio de urgencias 061 por causas respiratorias parece estar relacionada con los niveles de polen de gramíneas, abedul, aliso, quenopodio y ciprés. En el modelo multiexposición de contaminantes y pólenes, se encontraron resultados significativos para el aliso (retardo 2), el quenopodio y el ciprés. No se encontró relación entre ninguna de las variables de exposición (contaminación y polen) y enfermedades digestivas.
Conclusiones: Algunos pólenes y variables meteorológicas están asociados a la morbilidad respiratoria. No se encontró asociación entre llamadas al centro de Emergencias Médicas 061 y contaminación atmosférica.