

10434- Regional Variations in Breast Cancer Incidence Among Members of the California Teachers Study Cohort

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Within California, rates of breast cancer have tended to be higher in the San Francisco Bay Area and in the southern coastal area (Los Angeles, Orange and San Diego Counties) than in the remainder of the State. These variations in incidence are also evident among members of the California Teachers Study (CTS), a large cohort of 133,479 female professional school employees who have participated in a series of questionnaires and have been followed for cancer incidence since 1995. Of these, 121,742 (91%) could be assigned to a California census block group of residence at baseline and were included in these analyses. Linkage of the cohort to 1996-1999 California Cancer Registry (CCR) data identified 1,674 incident cases of invasive breast cancer. Compared to cohort members living in the remainder of the State, age and race/ethnicity adjusted relative risks for breast cancer, estimated via Cox modeling, were 1.21 (95% CI = 1.06 – 1.38) for Bay Area residents and 1.17 (95% CI= 1.05 – 1.30) for south coast residents. Adjustment for differences in socioeconomic and urban/rural characteristics of the block groups of residence reduced, but did not fully explain these differences (RR=1.16, 95% CI=1.00 – 1.35 for Bay Area members; RR=1.13, 95% CI=1.00 – 1.28 for south coast members). Further exploration of differences in regional profiles of personal and environmental risk factors thought to be associated with breast cancer is the subject of this research project.

10521- A GIS for Researchers and the Community, from the Long Island Breast Cancer Study Project
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Due to community concern over high rates of breast cancer, the National Cancer Institute (NCI) initiated the Long Island Breast Cancer Study Project (LIBCSP). As part of this Project, we developed a geographic information system (GIS) to enable researchers to more efficiently explore relationships of environmental exposures to breast cancer in Nassau and Suffolk Counties in New York. The ArcView-based GIS includes over 80 datasets, a metadata browser, and researcher-friendly analytical tools, ranging from a simple rate calculator to cluster and empirical Bayes analysis tools. An Oversight Committee of scientific, local government, and public representatives has provided advice on researchers' expectations, statistical approaches, and community needs, and has insured continued community involvement in the GIS. Researchers with approved protocols can use the full power of the GIS and its data. These include geospatial, demographic, and health data; air and water quality monitoring results; data on industrial releases, spills, hazardous materials, and radioactive sites or materials; land use and land cover; and weather and climate information. In Spring 2002, the website (www.healthgis-li.com) will allow researchers, the community and other visitors to glimpse the inner workings of the GIS through interactive mapping of potential exposures from air, water, and soil, and local breast cancer statistics using HTML and ArcExplorer.

10783- GIS analysis for hygiene service restructuring

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Restructuring of a hygiene service (HS) is based on the separation of the public health state administration and the state health supervision/control (SHS) from the expert service provided by the HS. One of the goals of the planned restructuring is the standardization of the state administration and the health state control.

In each individual region, the regional hygiene station should have the same basic administrative structure, which will be modified in specific cases according to the local conditions and an adequate (but necessarily the same!) number of employees needed for the state administration and state health supervision.

Objectives

The main goal of the analysis is the determination of the necessary number of employees of regional hygiene stations within the geographical region according to different hygienic specializations in the way that the existing employee force will be able to serve each district according to the requirements of an existing legislative.

We can separate the partial goals to two basic groups evaluation of relative (i.e. number of employees, economy indicators) and absolute indicators (i.e. determining significant differences among regions by activity of the state health supervision, and economy indicators)

Methods

The input data were obtained from the routinely collected annual reports on operations prepared by the hygiene service for the Czech Ministry of Health from the year 2001. Further available material included the efficiency of laboratory activity (price per one unit of laboratory activity) and regional HS economic activities (review of gains and investments per employee), and the number of supervised subjects. The population data used was obtained from the Census 2001.

The GIS was chosen to be a proper tool for the analysis of hygiene service and legal requirements in relationship with the geographical distribution. The result of the GIS analysis give a rough estimate of distribution of employees, expert services and hygienic branches needed.

The weight of each criterion is different for different hygienic branches. For some branches, other indicators are also important:

- The number of sources of drinking water and the number of supervised recreational bodies of water, the character of the land, sources of drinking water, services, structure of railway tracks, highways and other roads.
- Hygiene of children and adolescents - school facilities, summer camps, ski-camps, and outdoor schools.
- Occupational hygiene – industrial character of the region – presence of large industrial factories – mines, ironworks, the number of subjects in high-risk jobs
- Epidemiology – the number and size of public health facilities, hospitals, long-term occurrence of epidemics, citizen profiles

From the point of view of optimization of the planned changes, it is necessary to analytically evaluate the economical aspects as well. Consequently, we based our analysis on reviews of budgets of all HSs utilizing the following indicators: total investments, average salary, total income, income from the state sector, income from in-house activities, and the ratio between the income generated in-house and the total income.

10793- Historical pesticide exposure assessment using a geographic information system and self-report in a breast cancer study.

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Estimating historical pesticide exposures is important in evaluating health effects for diseases, such as cancer, with long latency. Environmental and biological sampling, which are useful measures for current exposures, are less relevant to exposures years ago. Interviews reveal individual pesticide use, but these methods are subject to recall bias and uninformative for the many exposures people cannot report for themselves. In the Cape Cod Breast Cancer and Environment Study, we developed an innovative geographic information system (GIS) to better assess historical residential exposures from wide-area pesticide application for gypsy moths and other tree pests, mosquito control, cranberry cultivation and other agriculture, golf courses, and rights of way. Using US EPA and Spray Drift Task Force air models, we developed a GIS tool that calculates relative exposure intensities taking into account multiple factors that affect pesticide drift: the distance of a home from pesticide application areas, the size of the sprayed areas, climate conditions during the early morning spring and summer hours when pesticides were applied, and the presence of a tree buffer to block drift. This new tool is widely applicable to exposure assessment for pesticides. We applied the tool to integrate data from state, federal, and local spray activities and land use maps for four periods beginning in 1951, and interview data identifying women's Cape addresses and self-reported home pesticide use. Addresses were mapped with a high degree of accuracy to each woman's housetop, using orthophotos. Results were analyzed for control subjects in order to construct exposure variables for a case-control study of 2100 women. Results indicate that nearly all study subjects who resided on the Cape during the 1950s were exposed to spraying for gypsy moths, and more recent residential development in previously forested areas was likely to result in exposures to residues of persistent organochlorines. In addition, about 30% of controls were exposed from cranberry bogs and nearly half from other agriculture. Fewer than 5% were exposed from golf courses and rights of way. Self-reported pesticide use was widespread, consistent with other studies. Results of a Household Exposure Study of air and dust samples from 120 of the homes provide a qualitative comparison, showing that more than a dozen pesticides, including both banned organochlorines and current-use pesticides, are found in a majority of Cape Cod homes. Pesticides are of interest in breast cancer research because many are shown to act as endocrine disruptors or animal mammary carcinogens. While recent studies have for the most part shown no association between DDT/DDE and breast cancer, the one-time serum and tissue measures in those studies may reflect exposures primarily to the weakly estrogenic DDE via diet rather than the more estrogenic parent DDT. Many of the pesticides applied on Cape Cod have not previously been assessed in breast cancer research.

10815- Using Environmental Measurements to Validate Estimates of Exposure to Air Pollution from Traffic Developed With a Geographic Information System (GIS)

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A wealth of electronic data that can be incorporated into a geographic information system (GIS) is now available from many sources. These data could potentially be a valuable resource in developing exposure estimates for public health research. For example, data on roadway classifications and traffic counts could be used to derive estimates of exposures to air pollutants from traffic, including fine particulate matter (PM_{2.5}) and various particle constituents which have been shown to be associated with a number of adverse health effects. In order to evaluate how well GIS-derived variables can be used to represent exposure, a pilot sampling program was implemented in an inner city neighborhood in Boston heavily impacted by diesel vehicles. Two backpacks equipped with monitors for measuring PM_{2.5}, ultrafine particles, carbon monoxide, and polycyclic aromatic hydrocarbons (PAHs) were deployed in locations with varying traffic levels. A portable weather station was used to record wind speed and direction, temperature and relative humidity, and an automatic traffic counter recorded traffic counts by vehicle class (including buses and trucks, considered a proxy for diesel vehicles). Results were compared to a permanent monitoring station located in the center of the neighborhood. ArcGIS spatial analyst extension software was used to estimate traffic density for 50 m cells throughout the neighborhood. These estimates were used to assign sampling locations to three traffic density categories. For PM_{2.5}, a positive association was observed between the ratio of mobile site concentrations to fixed monitoring site concentrations and traffic density estimates. The results of this pilot study suggest that GIS variables can potentially be an asset in the development of exposure assessments, particularly when they are combined with environmental measurements.

10823- Proximity to crops and residential exposure to agricultural pesticides in Iowa. Ward MH¹, Nuckols JR², Giglierano J³, Wolter C³, Miller RS², Colt JS¹, Camann D⁴. ¹National Cancer Institute; ²Wilkes Technologies, Inc; ³Iowa Geologic Survey Bureau; ⁴Southwest Research Institute

Farm families and rural residences can be exposed to agricultural pesticides through the proximity of their homes to crop fields treated with pesticides. Various factors are likely to affect exposure levels including the distance to and area of crop fields around the home, chemical characteristics of the pesticides applied, meteorological factors, and whether household members are engaged in agricultural work. We previously developed geographic information system (GIS)-based metrics to determine the area of and distance to crops within specified buffer areas around residences as a means of identifying populations likely to be exposed to agricultural pesticides in Nebraska (Ward et al., 2000). We applied the metrics to residences in a case-control study of non-Hodgkin's lymphoma in Iowa. In this study, we also incorporated output from the AgDRIFTTM model (version 2.03) for predicting primary drift from pesticide applications and created additional predictive metrics. The case-control study included a detailed interview about home, garden, and occupational use of pesticides. We also measured pesticide levels in dust samples taken from participants' vacuum bags. The location of homes was determined by global positioning system measurements. Using spring and summer satellite images from two paths/rows in south central Iowa, we created land cover maps to identify corn and soybean fields (>90% of crops grown) and other types of land use for each year of the study (1998-2000). Based on data for 225 Iowa participants who resided in this area (about 40% of participants), 63.1% of residences had corn or soybean fields within 500 meters of their home, an intermediate distance for primary drift from aerial and ground application methods. The majority (56%) of homes with crops within 500 meters was located within town boundaries, thus indicating the potential for agricultural pesticide exposure among town residents. The Iowa population potentially exposed to agricultural pesticides was substantially higher than our previous results for Nebraska, where only 22% of study population had crops within 500 meters of their residence. Based on the first 200 dust samples from Iowa, the corn herbicides detected were: dicamba (32.5%), metolachlor (21.5%), atrazine (12.5%), acetochlor (7.5%), and alachlor (6.7%). Methods were developed to measure dust levels of the soybean herbicides, pendimethalin and trifluralin and 3 relatively new corn herbicides, bromoxynil, bentazone, and dimethenamid. We will validate the GIS-based metrics by comparing the metric pesticide predictions to corn and soybean herbicide levels measured in the Iowa residential dust samples.

10829- Using geographic information systems to assess exposure to incinerator emissions – a pilot study in Portugal

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Objectives

The aim of this paper is to present the use of geographical information systems (GIS) to assess population exposure to incinerator emissions using a case study in Portugal. An integrated information system within a GIS environment was developed to assess the relationships between environment and health at a geographical level. The research focused on the case study of two incinerators in Portugal and aimed at improving the understanding of the links between environmental exposures, risks and health outcomes associated to this type of industry.

Methods

The Atmospheric Dispersion Modelling System 3 (ADMS – 3) was used to estimate air pollution levels in the study area according to different emission and meteorological scenarios. Local monitoring data were used for model calibration. The model outputs were imported into GIS and transformed into the vector model. The spatial analysis addressed the contributions of long term averaged concentrations versus short term averaged concentrations to human exposure to this type of emissions and highlighted the affected populations.

Results

The data base development and management for this particular GIS project indicated the need to delineate policy guidelines for environmental and health data collection in the Portuguese case and a protocol is suggested.

Conclusions

This method offers an improvement in the delineation of areas of exposure around point sources in comparison with the traditional distance based methods. If environmental and health data are collected in a standard and consistent fashion and made available for management purposes, the system developed can be used at various scales providing a powerful tool for decision support and policy definition.

10832- A Geographic Information System (GIS)-Based Exposure Metric for Estimating Nitrate in Drinking Water Supplies

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Nitrate is a precursor in the endogenous formation of N-nitroso compounds which are potent animal carcinogens. Elevated nitrate levels in drinking water have been associated with an increased risk of some cancers and other adverse health outcomes. Private wells are not regulated and often exceed the Maximum Contaminant Level of 10 mg/L nitrate-nitrogen in agricultural areas including our study area, the Platte River Basin in Colorado and Nebraska. Due to the lack of nitrate data for private wells this population is often excluded from epidemiologic studies in spite of their higher exposure levels. We have developed an exposure metric for nitrates in drinking water supplies for use in a small area ecologic analysis of cancer incidence. The study area consists of 344 census block groups (CBG) located within the Platte River Basin (population = 368,803). We first assigned utility-based nitrate data to communities served by public water supplies in CBG. For the population on private well supplies, we developed a GIS-based regression model that predicts nitrate levels in the predominant ground-water aquifer used as a water supply. Variables in the model were derived from 12 GIS data layers, and include water supply characterization data, water table data, land cover (crop type), soils data, fertilizer applications, distance to streams, and location of livestock feeding operations. Results from the model were used to assign nitrate exposure levels for private wells in each CBG. We then computed a population-weighted average of the private and public water supply exposure indices for each census block group for use in our epidemiological study. Preliminary results from the application of our model indicate that proximity of corn agriculture, surface streams, and irrigation can be used as explanatory variables in assigning a nitrate exposure index to populations using well water supplies in hydrological settings such as the Platte River Basin. Similar explanatory variables for nitrate in the same study region were reported by Dunliner et al. (1996). The results of the study also demonstrate the utility of a GIS-based approach in applying such exposure metrics to a subpopulation that is normally excluded from epidemiological studies of nitrates in drinking water supplies.

10845- Beryllium exposures at a nuclear weapons production facility: Applying the sentinel case approach to improve exposure assessment

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Beryllium is known to cause a chronic immunologically-mediated granulomatous lung disorder at low exposures in susceptible individuals. Workers at Hanford have been exposed to unknown concentrations of beryllium as a result of fuel fabrication, research and clean up activities at this former nuclear weapons production facility. In the future, site remediation workers may also be exposed during decontamination and demolition (D&D) of old facilities. The purpose of this study is to combine work exposure histories and beryllium sensitization and disease data with location of beryllium work on an easily visualized map to determine the extent of potential exposures at Hanford and identify buildings which may be high risk for D&D workers.

The data has been collected through medical surveillance programs for former production workers from the site. This target population is all surviving individuals who worked in buildings where beryllium was known or suspected to have been used at Hanford. To date, 3,269 former production workers have been identified as potentially exposed to beryllium at this work site. Questionnaire survey to assess occupational exposure have been obtained from 786 of these workers along with peripheral blood samples collected for beryllium lymphocyte proliferation testing (BeLPT) to date. The rate of sensitization (2 positive BeLPTs) is over 2.4%. Half of the workers report activities in one or more high risk buildings (based upon process history) and 76% report some beryllium exposure. Only 15% recall exposure measurements taken during their tenure.

Analysis is ongoing, and includes computation of person-years by job title and building and the production of a risk density map of the fuel fabrication area (300 Area) based upon person years working with or near beryllium. These data are combined geographically with data on where beryllium sensitized and diseased subjects worked. These sentinel health events add important information to the risk density map. Along with information from the industrial hygiene exposure assessment currently underway, the sentinel cases can be used to direct more extensive exposure monitoring in the highest risk buildings slated for D & D.

10946- Toward Understanding the Spatial Variation of Childhood Blood Lead Levels in El Paso, Texas.

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Recent events have prompted the Texas Natural Resource Conservation Commission (TNRCC) and the Environmental Protection Agency (EPA) to conduct a systematic sampling of soils in the El Paso City area for heavy metals. Concerned that lead-contaminated soils may be contributing to lead poisonings in children in El Paso, we at the Texas Department of Health (TDH) utilized data from TDH's Childhood Lead Poisoning Prevention Program (CLPPP) to address that concern. CLPPP data on children's blood-lead levels contains information on each child's residence. We made use of this to perform a spatial visualization of the childhood blood lead results and to advance our ability to identify potential risk factors. CLPPP data from 1997 to 2000 was used in our analyses for children whose residence was listed as El Paso County. Results from the first venous sample taken for children under age six were used in the majority of analyses. Blood lead test results greater than or equal to 10 micrograms per deciliter were coded as being elevated. ArcView v.3.2 was used to geocode the children living within the City of El Paso. U.S. census data from 1990 was used for the census tract shape files. Maps were created showing each child's residence and blood lead level status in the City of El Paso along with maps overlaying this information onto census tract variables such as median age of housing. Choropleth maps of the percentage of elevated kids tests for each census tract were generated. DMAP (Univ. of Iowa) was utilized with the ArcView Spatial Analyst extension to create spatially continuous distributions of the rates of elevated blood lead levels. The ArcView 3D extension was used to map the concentration of individual blood lead in elevated children throughout the city and the technique of small multiples was employed to visualize the map as it is rotated around a vertical axis in space. Ninety-five percent of the children in the data set (42,134 of 44,243) were geocoded for their residential address. Overall, 2.2% of the children's first venous test was elevated for blood lead. The age group with the highest percentage of elevated blood leads was 3 year olds (3.2%); children under one year had the lowest rates (0.5%). Significant differences were observed between census tracts for percentage of children with elevated blood lead and a spatially continuous distribution of the rates showed similar results. Median age of housing appeared to be correlated with rates of elevated blood leads. Overall, employing spatial analysis has lead to a better understanding of this public health issue for the City of El Paso and the methodology makes possible integrating numerous variables for use in future statistical models seeking to identify risk factors for elevated blood levels in children.

10992- Environmental Justice and Ambient Health Risks: A GIS Approach to Outdoor Air Pollution Exposure in Hamilton, 1986-1996

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This research builds on past environmental justice work in Hamilton which has found that groups of low socio-economic status are exposed to disproportionately high environmental health risks. The authors address three questions: 1. Having found that various air pollutants are distributed inequitably among social groups in Hamilton, is this persistent over time? 2. Do changing levels of air pollution raise or reduce inequities? 3. Can urban-focussed justice research be aided by the urban studies literature which has also shown consistent disparities in exposure to spatial externalities amongst social groups. The focus of this paper is first on the application of GIS and spatial analysis to produce pollution surfaces of total suspended particulate matter (TSP) as monitored by Hamilton's air monitoring network. The second focus will be on the assignment of TSP levels to the city's neighbourhoods (census tracts) using population-weighted centroids, and the pooling of these values with socio-demographic data drawn from the census for analysis. In the context of changing census tract boundaries and shifting centroids from 1986 to 1996, these steps were carried out using a universal kriging procedure following a point kriging method. As an optimal interpolator, kriging can be used in the Hamilton context given the existence of a highly punctuated TSP surface, driven largely by point source emitters agglomerated in the city's central core. Point kriging reduces the error propagation associated with the creation of pollution surfaces and the assignment of values based on more common methods, such as overlay techniques. In so doing, exposure assessment is improved and, more importantly, variations in TSP levels are more accurately captured in the analysis of social areas in the city. The results show that inequity persists over time and is consistent despite changing TSP levels in the region over the study period. Using ordinary least squares and spatial regression techniques, a number of socio-demographic are found important in predicting TSP levels. Dwelling value is the most robust and consistent predictor of TSP, which confirms the importance of social status in much of the justice literature. The testing of variables important in urban studies, such as the presence of lone-parent families, augments justice research by throwing light on the family status dimension of environmental inequity. The paper concludes that, in relation to TSP, environmental injustice remains a persistent feature in Hamilton wherein social deprivation is associated with disproportionately high environmental health hazards.