Cancer Clusters in Lea County

New Mexico High School
Adventures in Supercomputing Challenge
Final Report
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Executive Summary

For an individual to experience unhealthy effects from an exposure to a substance, the substance must be toxic to humans, he/she must come into contact with that substance, and the concentration must be high enough for a long enough time period to cause a biological effect. A variety of chronic health conditions have long since been linked to exposure to chemically hazardous and radioactive materials. Cancer, defined as a group of diseases distinguished by the uncontrolled growth of abnormal cells, is of major concern. Studies have shown that I in 3 people alive today will develop cancer, and as of 1995, at least 8 million Americans presently living have had or do have the disease (American Cancer Society, ACS 1995). Cancer cells are created when a cell undergoes a permanent change by internal means or outside exposure. When a cell becomes cancerous it quits reacting normally to signals from the body and begins to multiply and destroy healthy tissue.

Our project is to study and develop a map of cancer clusters in and around Lea County. Residents of Lea County have voiced and documented concerns about the potential for adverse health effects that seem to be emerging in our area. Lea County is New Mexico's largest oil and natural gas producer. For the past two decades population in Lea County trends seem to have followed trends in the oil and natural gas industries. We received a copy of a report from the Waste-management Education and Research Consortium (WERC) on "Cancer Incidence Rates in Eddy and Lea Counties, New Mexico, 1970-1994". It was issued April 6, 1998. This report is an Epidemiology account of all known cancer incidences and types reported in these counties from 19701994. Our goal in this project is to use the information from the (WERC) consortium

report to enter these databases and interpret the data. We hope to program a C++ program from this data that would graphically interpret the results into a picture of Lea County and plot actual occurrences of cancer. We believe that this information would lead to determining factors that would identify the source of toxic exposure. We hope to find a correlation between exposure to possible carcinogens and the high cancer incidence rates in Lea County. Our intention is to plot these relationships on the supercomputer so that we could predict the future trends of cancer in our area.

As we attempted to interpret our data and form graphs, we realized that the information that we had was more relative to the incidences and types of cancers in Lea County than to the kinds of toxic exposures causing these cancers. In addition, we did not have access to the physical addresses of individuals in Lea County that were documented in the WERC report.

Introduction

We are a group of three girls and wanted to do a project related to women's issues, so we decided to address the issue of breast cancer. Through our acquisition of the WERC report we expanded our project to include all reported incidences in Lea County. We wanted to graphically represent cancer incidences over the last 20 years in Lea County, and plot these incidences on a map of Lea County. This graphical interpretation could help determine positions of exposure to carcinogenic chemicals, and possibly predict future trends.

Hypothesis

By mapping the documented incidences of cancer we believe that we will find specific areas in Lea County of high cancer incidence rates, and then link those areas to toxic exposure.

Research and Data

We began searching the Internet for information on cancer research. We contacted many research facilities including The Center for Disease Control, The New Mexico Tumor Registry, The County Health Department, The American Cancer Association, The WIPP Site, the Joe Arlington Cancer Research Center in Lubbock, Texas, and the University of New Mexico Medical School.

We found that the graphs in our report were too difficult for us to accurately interpret by ourselves, so we attempted to contact mentors that would be able to help

interpret this data. We found that participants were not eager to volunteer information on this controversial subject. However, from reading the report and graphing portions of the data we did find that the cancer incidence rates were substantially lower in Hispanics than Anglo people. We also noticed that there was a significant difference in the incidence rates between men and women. The rates in men were considerably higher than that of women (see graphs). We theorized the reason for the high incidence rates in men was due to the fact that men were more likely to work in oil refineries and oilrigs than women. We believe this is because benzene, a chemical produced by oil refineries, is a known human carcinogen.

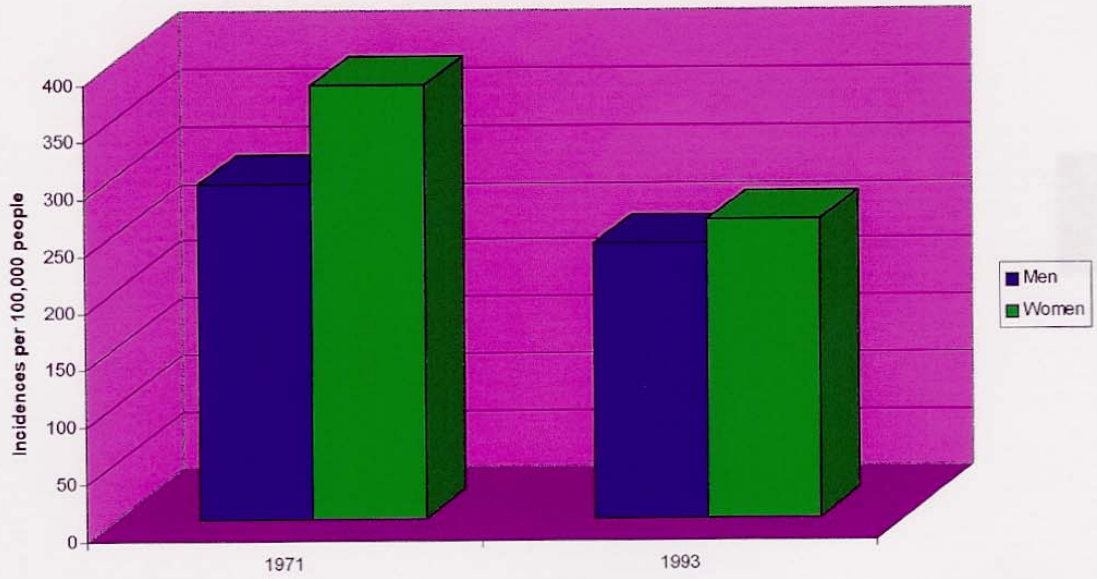
A carcinogen is defined as an agent that causes or tends to cause cancer. Many different chemicals have shown definite evidence of human carcinogenicity such as benzene, asbestos, vinyl chloride, arsenic, and aflatoxin. Definite carcinogenicity of chemicals has been studied in workplace conditions where sustained, high-dose exposures have been found. Others chemicals show probable evidence from animal experimentation to cause cancer and are considered probable human carcinogens. Examples of these would be chloroform, dichlorodiphenyltrichloroethane [DDT], formaldehyde, polychlorinated biphenyls [PCBs], and polycyclic aromatic hydrocarbons.

Benzene is a colorless, flammable liquid that has a sweet odor. It is a volatile chemical that evaporates quickly. Benzene is produced during natural processes, like volcanoes and forest fires, as well as human activities. It is an element of cigarette smoke and is widely used in the United States. Benzene is mostly used as a solvent, as a starting material for the synthesis of other chemicals, and as a gasoline additive. It is found in several hazardous waste sites around the country.

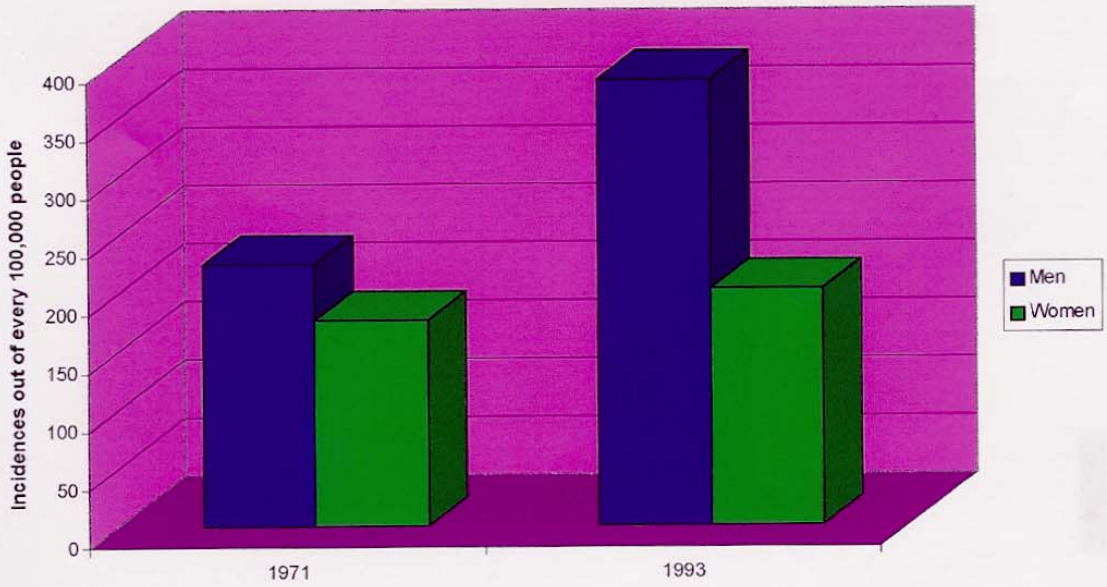
People are exposed to benzene through work, in the general environment. and through the use of some consumer products. Benzene can either be absorbed through the skin or inhaled. Industrial workers who use or make benzene may be exposed to high concentrations of it. These industries include the rubber industries, oil refineries, chemical plants, shoe manufacturers, and the gasoline related industries. Gasoline, car exhaust fumes, emissions from coke ovens, and cigarette smoke causes most of the benzene that occurs naturally in the environment. Benzene can be found in several household products, such as glues, cleaning products, detergents, art supplies, and paint strippers.

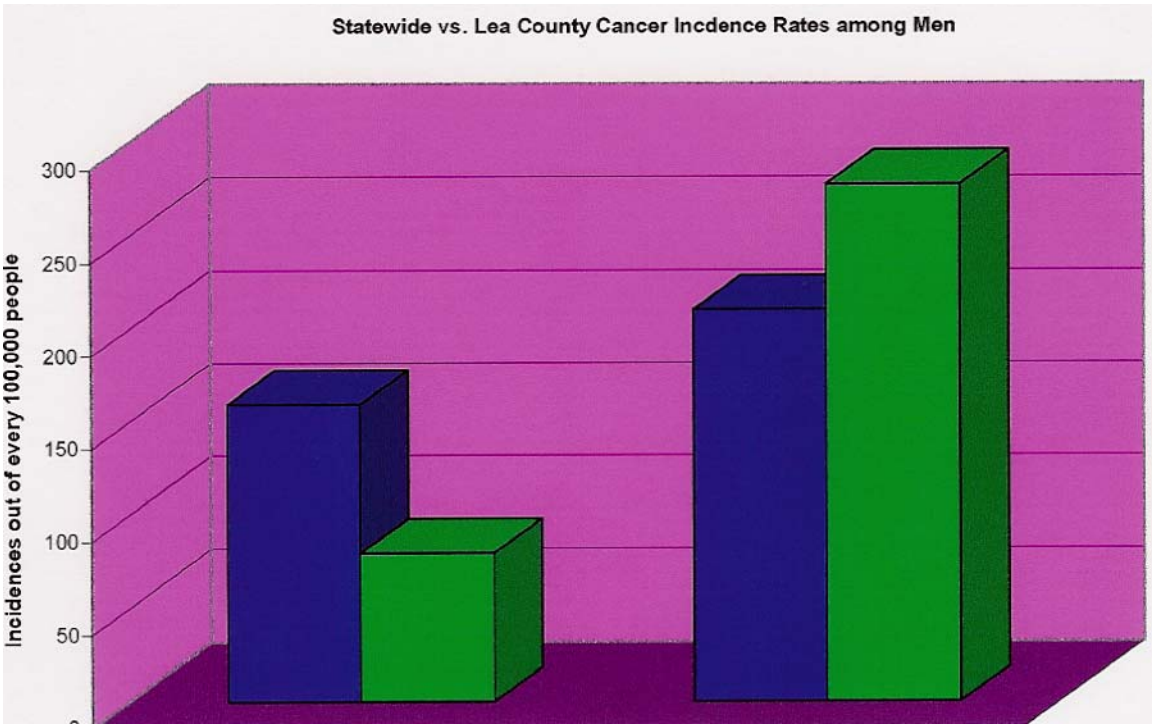
Studies show that carcinogenic chemicals in our diets play a critical role in causing breast cancer. A chemical called PhIP, a carcinogen that damages DNA, causes mammary carcinomas in female rats, and is often found in cooked meats associated with dietary fat. PhIP is metabolized like most carcinogens to an active carcinogenic form in the body. It is evident that PUP exposure is widespread, PUP has been found in homecooked and restaurant foods at levels up to hundreds of parts-per-billion. There are currently no laws to regulate or limit the exposure to PUP since it is formed naturally from cooked meats.

Statewide Cancer Incidence Rates



Lea County Cancer Incidence Rates




Statewide vs. Lea County Cancer Incdence Rates among Men
Incidences out of every 100,000 people
300
250
200
150
100
50

Results and Conclusions

Privacy issues were not taken into account when we began this project, and the information that we need was not available to us. Since we did not have access to the physical addresses of the cancer victims in the WERC report, locations near to possible toxic exposures could not be identified.

Due to the legal ramifications of a project of this kind, dealing with lawyers and large oil companies, information was not given to us. We spoke to several people at the)XTIPP site and no one ever called us back. We finally contacted a statistician at the WIPP site who gave us several ideas on planning and setting up a research project. We didn't hear back from him although we called him several times. We spoke to an education specialist, a graduate student, and a research physician at the Joe Arlington Cancer Center in Lubbock, Texas. These people were very kind and helpful but did not have the time to mentor us on this project. We called the National Cancer Institute and they gave us many avenues for research but could not provide mentorship. We attended the ENCOMPASS workshop at the High Performance Computing Center at UTNM and hoped to use this program in some function with the information that we had from the WERC report to predict future outbreaks. We left e-mail address with a couple of people at this workshop and no one replied.

We realize that this project was probably harder than we anticipated and most of the people that we spoke to did not want to get involved in a project of this magnitude. We thought that this would be a simple graphical interpretation of incidences of cancer in Lea County, and simply wanted to learn to do a C++ program that would show a map of Lea County and light up the clusters so they could be viewed and perhaps determine a

site of toxic chemicals or carcinogens that could be related to where people live or work. We did not intend or imagine the political ramifications that would come from researching a project of this kind. Professional people were not willing to discuss the kinds of information that we needed to continue with the project. We were also not allowed access to the databases that were used for the statistical information in WERC report. We wrongly assumed in the beginning of this project that we would have free access to this information and would be able to program an array that would draw from the database and plot a picture.

Even though we did not complete this project to our liking, we believe that the cause for the higher cancer incidence rates in men in Lea County is due to the fact that men are more likely to work in the oil field than women. This conclusion is reached from the research that we did and the people that we spoke to along the way. We have no absolute proof of this conclusion; we have just drawn this hypothesis so that we could possibly continue with this study in the future.

Future Applications

In the process of attempting to carry out this project we have learned a lot about privacy and legal issues. Although our research led us to one dead end after another, we feel that our initial idea was good, and would have been very informative if we had the access to the necessary information and therefore been able to complete the graphical interpretation and mapping. If this information was made available in the future, or another avenue of obtaining it was known, we could acquire the programming skills to complete this *project.*

Acknowledgments

Throughout the course of our project there was one person who stood by our side. She was always willing to help us, whether by assisting in research, making countless phone calls, or just to provide moral support. We would like to extend our greatest appreciation for Pam Gray, our wonderful teacher.

We would also like to thank Jimmy Crawford for accompanying us on our various trips and always being willing to lend a helping hand.

Being a part of Super Computing Challenge this year, and living alone in the Southeast comer of the state, has required us to travel to several overnight workshops. We would like to thank our principal Mr. Brown for allowing us to go on these trips even when it required us to miss school. Also, we would like to thank the School Board for providing the funding for these trips.

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