

Perception and Reality: GIS in Environmental Justice through Pollution Prevention

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Abstract

Geographical information system (GIS) technology is an increasingly important tool of assessment and technical support for the Lincoln-Lancaster County (Nebraska) Health Department (LLCHD). It is a natural extension of the department's assessment functions and a profound area of innovation in public health information systems that impacts all LLCHD divisions. LLCHD is utilizing public health applications of GIS to enhance community health assessment and disease surveillance, environmental risk assessment, policy development, program evaluation and planning, decision support, public education, and health threat/event response. GIS has many valuable environmental justice applications. Using a recently completed survey titled *Environmental Health Hazard Risks in the Minority Community*, LLCHD used ArcView software to analyze the perceptions of minority populations regarding environmental risks in general and compared them with actual risks believed to be in their home or yard, neighborhood, and work or school. The department mapped these responses and then compared them with known environmental factors/risks from business hazardous chemical inventory (Tier 2 sites), air pollution point sources (Title V sites), Special Waste sites, age and condition of housing in the area (to determine the potential for asbestos or lead-based paint), and the water system (to show where the water comes from and how the system works). The results of this analysis depict the relationships between minority community perceptions and known environmental factors or events. This information enables LLCHD to target specific areas for educational programs, provide a measure of need for community education and risk prevention, better allocate public health resources, assess the effectiveness of community programs, and document public health impacts of land use planning options.

Keywords: minority, environmental justice, community perceptions

Introduction

The concept of environmental justice is relatively new, but the fact that certain neighborhoods bear more than their share of environmental hazards is not. The introduction from the *Environmental Health Hazard Risks in the Minority Community Survey* (1) commissioned by the Lincoln-Lancaster County (Nebraska) Health Department (LLCHD) introduces the concept of environmental justice very well:

The environmental movement has long been concerned with environmental health hazards—the health risks associated with environmental hazards. Environmental health hazards are substances that have been linked to particu-

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lar adverse health effects. Research has generated a great deal of agreement on the health risks posed by materials such as asbestos, lead, PCB's, agricultural chemicals, and smoke stack emissions.

It has been relatively recent that research has begun to focus on the level of risk that different segments of society face. As early as the turn of the century, people recognized that many urban health problems stemmed from the degraded environmental conditions found in the city—particularly the inner city—and that the poor bore a disproportionate share of that burden (Gottlieb 1993). Minority neighborhoods sustained an even greater share of the burden, but it was not until the 1970's that evidence was collected that revealed the correlation between poverty, race, and pollution (Kruvant 1975).

Research has shown the disproportionate risk the minority community bears. While some ethnic communities can be identified with specific health risks associated with traditional employment patterns, such as Hispanics and agricultural chemicals (Traux 1990), others can be identified with geographic distribution that targets minority communities, as in African-Americans and landfill sites (Bullard 1990). In addition, many health risks are associated with poverty and urban decay. Minority communities have historically been located in the poorer and more run down neighborhoods of cities, with their proportionately higher health risks associated with auto emissions, lead paint, and hazardous waste (Gottlieb 1993).

There is a need to understand which came first, the hazard or the minority population (Been 1994). Bullard lays the blame for environmental injustice on racism: "[E]nvironmental inequities do not result solely from differences in social class....[R]ace interpenetrates class and creates special health and environmental vulnerabilities. People of color are exposed to greater environmental hazards in their neighborhoods and on the job than are their white counterparts (Bullard 1993)." He points to studies that find elevated exposure levels by race, even holding social class constant, with respect to distribution of air pollution (Freeman 1971; Gelobter 1988), location of municipal landfills and incinerators (Bullard 1983, 1987), abandoned toxic-waste dumps (UCCCRJ 1987; Mohai and Bryant 1993), and lead poisoning in children (ATSDR 1988). The Commission for Racial Justice (1987) in a comprehensive national study on the demographic patterns associated with location of hazardous waste sites "found race to be the most important factor (i.e., more important than income, home ownership rate, and property value) in the location of hazardous waste sites."

The validity of these findings and the importance of this issue have been recognized at all levels of government. On February 11, 1994, the White House issued an executive order requiring federal agencies to consider environmental justice in all their actions and requiring the US Environmental Protection Agency (EPA) to gather data and issue new regulations concerning the distribution of environmental hazards (GAO 1995).

The challenge faced by our community health providers is the need for a better understanding of the environmental health risks faced by our communities' minority populations, the source of these risks, and how to best respond to this threat.

So in 1996, LLCHD started a three-year grant project funded by the EPA. During the first year of the grant, LLCHD created a survey instrument to survey members of the non-white population to determine their environmental health knowledge base; their environmental exposures at home, in the neighborhood, or at work or school; and their knowledge, beliefs, and practices related to hazardous materials.

In the second year of the grant, LLCHD used its geographical information system (GIS) to map the potential exposure to these populations from known contaminated sites and permitted release sites. In the third year of the grant, the department will use the information gained through the survey and analysis to educate the affected populations, regulators, and permit holders about how to use the Healthy Homes Program and the Technical Assistance Program to reduce the effects of identified potential exposures.

In the first year of the grant, the Environmental Health Hazard Risks in the Minority Community survey was created and a sample of the minority community was surveyed. The survey enabled LLCHD to identify and compare minority community pollution prevention and health risk awareness, attitudes, and behaviors with earlier baseline data established by the LLCHD Community Pollution Prevention Assessment project and the LLCHD Minority Behavior Risk Factor survey. The goals of the project were to develop an environmental health knowledge base; determine perceived environmental exposures at home and work; determine the knowledge level and identify beliefs and practices related to hazardous materials; and obtain a basic understanding of the pollution prevention ethic held by racial/ethnic minority groups in Lincoln.

Methods

The Environmental Health Hazard Risks in the Minority Community survey is the result of a literature review, a continuous exchange of ideas between the research team and LLCHD staff, and feedback from members of the racial/ethnic minority groups.

The survey was developed in three languages: English, Spanish, and Vietnamese. A large portion of the city's minority population is recent immigrants, and language barriers can pose a serious impediment to gathering data. Spanish and Vietnamese were determined to be the languages understood by a majority of the new immigrants who do not understand English or who speak it poorly. The pre-testing was done in all three languages during the first week of October 1996, and revisions were made based on feedback.

A main training session was held in mid-October 1996 at LLCHD. Overall, 28 surveyors were trained to conduct face-to-face interviews. Over half (61%) of the surveyors were bilingual in English and in either Spanish or Vietnamese. The goal was to complete 500 surveys with at least 100 from each racial/ethnic category. The racial/ethnic categories used were: American Indian, African American, Asians, and Hispanic (which conforms to US Census categories and facilitates the comparison of these data with US Census data and other information).

The sample population to interview was randomly selected by census blocks that contained five or more racial/ethnic minorities. All houses in these chosen blocks were visited and qualifying minority members interviewed. Surveys in the chosen sites were carried out during morning, afternoon, and evening hours, and on both weekdays and weekends.

The initial method, however, proved to be less than adequate in obtaining significant numbers of American Indians (the minimum 100 targeted). Therefore, with the American Indian population the "snowball technique" (requesting persons interviewed to help locate other American Indians) and the cooperation of agencies/organizations that service American Indians (e.g., the Indian Center) were used.

A total of 504 persons 18 years of age and older were surveyed the last week of November 1996. One hundred and eight (108) were Native Americans, 124 were African American, and 136 were "Other." One hundred and thirty-nine (139) were Hispanic, which can be of any race, but which, for the most part, fell into the Other category.

Results

The survey reported that 78.1% of minorities in Lincoln and Lancaster County believe that they are at the same or higher risk from environmental hazards than is the majority population. In addition, 80.2% reported that the pollution from neighboring business is either very harmful or somewhat harmful to their health. Nonetheless, it was difficult to distinguish, based on the survey report, a specific injustice originating from business and industry. The survey respondents reported specific hazards in the home, neighborhood, and at work and school that were associated as much with personal, community, and landlord behaviors as they were with business and industry behaviors.

According to the survey report, the top four environmental risk concerns in the home were contaminated water, garbage, carbon monoxide, and tobacco smoke. The greatest actual environmental risks in the home were reported as cockroaches, garbage, chipping paint, and poor indoor air quality. The top four environmental risks in the neighborhood were garbage, air pollution, contaminated water, and hazardous chemicals. The top four environmental risks at work and school were hazardous chemicals, tobacco smoke, air pollution, and asbestos.

Although the local Minority Advisory Committee (MAC) wholeheartedly agreed to refer minority businesses and businesses in minority communities to the pollution prevention technical assistance program, they also reflected a greater concern for household and community environmental health risks and endorsed approaches to reducing these risks. They clearly did not want an exclusive focus on reducing environmental health risks from business and industry but rather a focus on educating the minorities themselves on environmental risks in the home and community. The MAC agreed to and did propose activities that use the pollution prevention ethic to reduce these environmental health risks.

The survey report also noted some important findings:

- Although there is some indication that those who consider themselves more knowledgeable tend to also believe in the potential harm from identified hazards, it is not a consistent correlation. Those who considered themselves "somewhat knowledgeable," were apparently less knowledgeable than the "not knowledgeable."
- Lack of knowledge among respondents about proper hazardous material disposal sites and location of these sites (along with transportation difficulties in

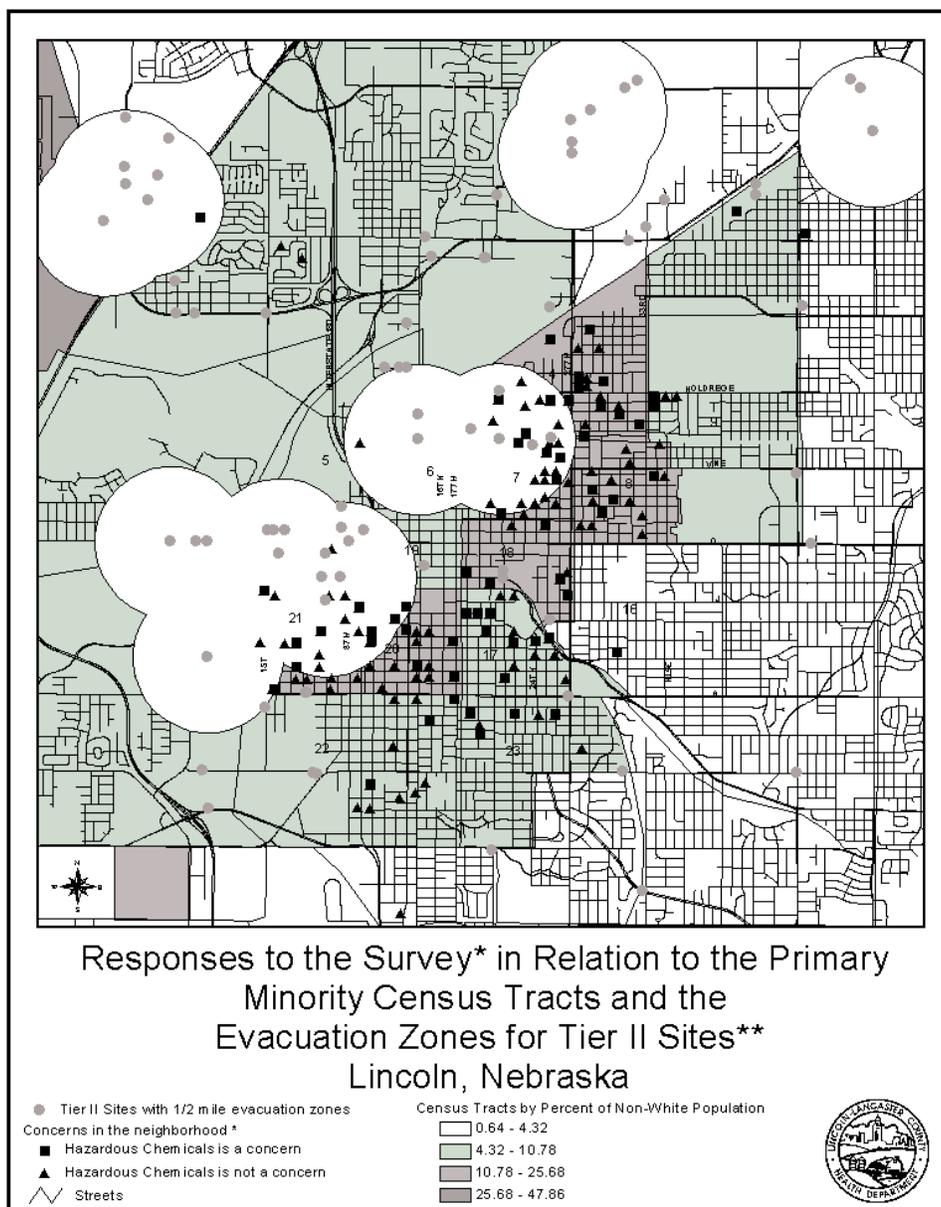


Figure 1 Responses to the minority community survey in relation to the primary minority census tracts and the evacuation zones for Tier II sites, Lincoln, NE, 1996.

getting to them) appears to be a partial but significant component of improper hazardous waste disposal.

- Most identified potentially risky substances as a danger to their health. One out of every four respondents believes asbestos and old car batteries are not

harmful to their health or do not know. About one in four do not believe or do not know that pollution from neighboring business can be harmful to their health.

Discussion

These findings are important to understanding the environmental justice issues in Lincoln and Lancaster County for two reasons. First, the general lack of environmental risk knowledge in the minority community makes specific identification of risk issues difficult. Survey results notwithstanding, at no time in this process has a minority representative suggested to LLCHD that a specific business was presenting excessive risk, nor has anyone indicated that they believe they were at a higher risk than the general community.

Second, the efforts to educate the general community in environmental health and risk identification were not effective in the minority communities. The lack of effectiveness is, in effect, the injustice. The minority communities expressed the need to address basic environmental education issues, specific high priority issues regarding risks in the home and communities, business and industry practices in the neighborhood, and an overall acceptance that pollution prevention would be the guiding set of principles to reduce these risks.

The current process of gaining guidance in these issues from the MAC will continue throughout this proposed grant. Also continuing will be the use of contract funds for the minority community organizations to perform activities that support the goal of using pollution prevention to educate the minority community and reduce environmental health risks.

There were three survey questions concerning environmental hazards that LLCHD concentrated on. The questions asked about people's concern over environmental hazards in their home or yard, neighborhood, and work or school. The environmental hazards we were most concerned about were asbestos, radon, garbage, medical waste, lead paint or dust, hazardous chemicals, contaminated water, air pollution, tobacco smoke, or carbon monoxide. The participants were asked to pick the three about which they were most concerned.

LLCHD was then able to analyze the responses to these questions by race, gender, income level, census block, and age. This technique allowed the department to identify specific areas for educational programs or comparison with known potential environmental hazards.

For example, the Asian community showed a higher than normal number of responses expressing concern about contaminated water. All people in Lincoln drink the same water, so why was one part of the community concerned about the water and the rest not? The conclusion was that many Asians in Lincoln are recent immigrants; because water quality was a concern in their native country, it is a concern here as well. The solution was to take members of the Asian community to the water treatment plant for a tour. This tour allowed them to see how the water was treated and to ask questions.

Applying the Results

The information gathered by census block gave the department the geographical information needed to compare minority perceptions with data on known potential environmental hazards. These data were from Tier II sites (businesses that house hazardous chemicals), Title V sites (businesses that emit air pollutants), and Special Waste sites. Using aerial photos and demographic information, LLCHD was able to analyze the community in a way that could not be done without GIS.

LLCHD used Tier II information to compare the evacuation zones based on chemical types with the residents' concern or lack of concern about hazardous chemicals in their neighborhood as stated in their survey responses. The *North American Emergency Response Guidebook* (2) provided information on the evacuation zones for the various chemicals stored on site at each Tier II facility. This information showed who was potentially in danger if there was a chemical spill. Using symbols to represent responses to the survey question and circular zones for the evacuation zones, the department was able to see who was concerned or not concerned about hazardous chemicals in their neighborhood in relation to Tier II facilities.

With this information, LLCHD was able to identify areas of the community as foci for the Technical Assistance Program (TAP) and the Healthy Homes Program (HHP). These two programs provide services that will make up the activities in the third year of the grant.

Technical Assistance Program

The first approach for reducing environmental risks uses the LLCHD TAP to provide targeted, on-site pollution prevention opportunity assessments to businesses located within minority communities. LLCHD has developed an innovative method for targeting specific businesses in minority communities. The TAP assesses the types of wastes produced by the business, pollution prevention options available for these types of wastes, level of outreach previously conducted, and the relative risk posed to the minority community from the business. The TAP will maintain community involvement in the business selection process by requesting input from minority community residents during MAC meetings. LLCHD believes that community voice is a crucial component in identifying and prioritizing environmental health risks in a community. Once the TAP has developed a list of potential business participants, these businesses will be contacted for appointments to conduct on-site pollution prevention assessments. Arrangements for translation services will be provided if necessary.

The on-site business pollution prevention assessments will serve three purposes. They will:

- Identify pollution prevention and waste reduction opportunities that can reduce risk to minority community residents.
- Further the effort to educate businesses about the pollution prevention waste reduction hierarchy.
- Propose alternative processes and technologies that result in toxicity reduction in minority communities.

To increase the benefit to the community, the TAP will attempt to communicate with businesses that have not participated in community meetings by:

- Using mailings, phone inquiries, information packets, newspapers, trade associations, flyers, and brochures.
- Providing workshop presentations.
- Networking with community or private organizations that interact with the Lancaster County business community.

Healthy Homes Program

The second approach for reducing environmental health risks for minority community residents is via the LLCHD Healthy Homes Program (HHP). This program was established in 1992 as a community integrated service system functioning within LLCHD. Because the program had such a dramatic impact in the minority community, it now receives permanent funding from the Lincoln-Lancaster County Board of Health and the Lincoln City Council.

The HHP improves and/or enhances the health of minority community residents by providing educational outreach services to minority families. This is a one-on-one approach that uses an HHP outreach worker to work with minorities to improve their overall health, the health of their children, and the health of their unborn children. HHP services include:

- Improved access to health care
- Education and parent support
- Healthy behaviors
- Proper nutrition
- Advocacy for families
- Information and referral service
- Early prenatal care
- Exercise
- Dental care and education
- Education and screening for prevention of cardiovascular disease, cancer, and diabetes
- Cultural awareness and opportunities to learn about cultural differences
- Prevention of childhood diseases
 - Immunizations
 - Well child exams
 - Injury prevention

In addition to providing information on the aforementioned benefits, in the third year of the project, the HHP outreach workers will receive training in environmental health hazards and pollution prevention concepts, methodologies, and techniques. This will enable the HHP outreach workers to deliver the pollution prevention ethic directly into minority communities. Teaching minority community residents about pollution prevention will allow them to make more informed decisions about product selection, disposal, housekeeping, and neighborhood standards. For example, teaching them the signal words on products will facilitate choosing less toxic products for use in the home and, therefore, minimize environmental health risks for the homeowner and the community. This knowledge empowers minority community residents to take a day-to-day role in reducing environmental health risks using the pollution prevention ethic. More

importantly, the HHP program encourages minority community residents to become lifelong learners and to become aware of how environment and lifestyle changes affect their overall well being and health.

LLCHD believes that this activity is a logical addition to the third year of the Minority Community Environmental Justice through Pollution Prevention project because the HHP is well established and is highly respected by the minority community. Furthermore, LLCHD believes that sustainability is important in addressing environmental health risks in the minority community. By providing the HHP outreach workers with training in environmental health issues and pollution prevention principles, this program will continue to influence and affect the lives of minority community residents long after the Minority Community Environmental Justice through Pollution Prevention project is finished.

Conclusion

The survey instrument told LLCHD about the knowledge of the minority community in relation to environmental hazards. This information tells not only about the people's knowledge of environmental hazards, but also whether they are being affected or could potentially be affected by environmental hazards in their home or yard, in their neighborhood, at work, or at school. With this information, LLCHD was able to determine whether their concerns were legitimate based on the location of the businesses in the neighborhood, and whether the department needed to visit the businesses in the neighborhood. If their concerns were not legitimate, then LLCHD would need to improve its outreach programs or add an environmental awareness component to the Healthy Homes program, which would educate the community.

GIS is a powerful analytical tool for identifying areas of the community for outreach and technical assistance. GIS gives the ability to analyze demographic information and determine where in the community to concentrate LLCHD outreach efforts. With the demographic information, more specific questions can be asked, like the relationship of industrial businesses to lower income populations and their potential exposure to air pollutants or potential risks from hazardous chemicals. At the same time, this information guides the Technical Assistance Program to work with businesses on pollution prevention. The ability to overlay multiple layers of data, to find patterns in data that the department has previously gathered or obtained from other agencies, gives the department a technique for analyzing the community in a way that was otherwise impossible. Spatially locating businesses, community facilities, responses from surveys (if they have addresses), and demographic information allows LLCHD to identify patterns of disbursement quickly and relatively easily. Also, as modeling techniques become available for use in ArcView GIS (ESRI, Redlands, CA), exposures and studies for specific populations can be done.

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