Applying Geographic Information Systems To Public Health

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Executive Summary

As technology advances and we enter an age where computers are replacing paper, Geographical Information Systems (GIS) will move public health into the new millennium. GIS is a tool that uses maps and data to plot specific points on mapping software. Various states and some areas of Kentucky are already using GIS in public health, so our goal was to explore how this instrument was being used and learn new ways to apply it. Specifically, we wanted to learn how GIS could help local health departments improve the health of Kentucky's citizens.

Our work led us on a quest to expand our knowledge of GIS, particularly how it worked and how it could be applied to public health. What we discovered was that this system has great potential to mobilize public health. We discovered that although it was technically challenging, it was also extremely versatile and potentially useful in many areas of public health. We demonstrated this through three mini-GIS projects that will improve public health when implemented.

The goal of this project was to make a case for using GIS in public health. To achieve our goal we used a five-part approach. First, we educated ourselves with respect to how GIS was being used around the country. Second, we learned how to use the software. Third, we demonstrated three ways GIS could be applied to public health. Fourth, we surveyed local health department directors to determine their awareness of GIS and their interest in beginning a program. Finally, we developed a resource guide for health departments interested in beginning a GIS program.

Applying GIS to Public Health

Introduction/Background

Surveillance of infectious disease or disease mapping has been recorded taking place as early as the 1800's when a man named Dr. John Snow plotted the location of deaths from cholera in a London neighborhood. Dr. Snow marked plots on a map where deaths were taking place and marked water pumps with a cross. This map showed the highest concentration of deaths occurred near the Broad Street water pump. The water pump was removed and the epidemic of cholera in this London area ended. This marked the beginning of the use of maps to fight disease.

GIS is an information system that is designed to work with data referenced by spatial or geographic coordinates. In other words, a GIS can be regarded as the high-tech equivalent of the paper map. A GIS program can be used to answer many questions such as; what is the fastest route from one patient home to another or; why is there a cluster of TB patients living in one area of town or; where are the locations of homes that have lead-based paint in them or were built before the 1950's?

Research for this project showed that applications of GIS are limitless for local health departments. The types of projects that can be conducted are limited only by the data that is available to the health departments. This project demonstrates a few of the possibilities. Local health departments in Kentucky can use this high-tech mapping program to locate concentrations of failed septic systems, what children should (or should not be) tested for lead, and secure locations for mass vaccination clinics in relation to area hospitals.

Currently only a few health departments in Kentucky are using GIS.

Project Description

The goal of this project is to raise awareness of the uses of a GIS and give specific examples of how a GIS could benefit various programs within a health department. By providing examples of GIS applications, resources, and other information, this project will encourage and support health departments interested in starting and maintaining a GIS program.

Objectives

- To educate ourselves with respect to how GIS is being used around the country
- To learn how to use a GIS software
- To demonstrate the use of 3 GIS projects applicable to Public Health.
- To develop a resource guide for health departments interested in beginning a GIS program.

- To motivate local health directors to implement a GIS program.

Methodology

We began our project by learning what data was available and appropriate for our use. We accomplished this by contacting our Area Development District GIS Technician. We also searched websites for U.S. Census data, county boundaries, building locations, and road centerline data.

The group felt we needed training on using GIS software and invited an ESRI representative to educate us on GIS and its use in public health. After gathering already existing data we used a Geographical Positioning System unit to map the locations of the failed septic systems. In doing this project we realized the value of ESRI Technical Support to provide assistance for using the mapping software.

While our mapping endeavors were ongoing, we surveyed the local health department directors in order to evaluate current use of GIS in Kentucky local health departments, and identify their resource needs.

Timeline:

August 2002 - Identified Essential Public Health Services to drive our Change Master Project.

September 2002 - Contacted Area Development District GIS Technician to identify availability of existing GIS data; Invited ESRI Rep to educate the Change Master group on use of GIS for public health.

October 2002 - Identified the Louisville-Jefferson County lead-screening program to demonstrate current use of GIS. Contacted state led program and the CDC to acquire information and support for using GIS for other lead programs.

November 2002- Identified failed septic systems to demonstrate another use of GIS for public health environmentalist. GPS failed septic systems.

December 2002- Reviewed online Kentucky census data, subscribe to GIS listserv to acquire current use ideas from other health departments around the United States.

January 2003- Establish a GIS map to identify mass vaccination clinic sites in the Gateway District and their relationship to a hospital.

February 2003- Email survey to local health department directors questions GIS and it's current use.
March 2003- Reviewed survey results. Developed maps to demonstrate GIS use in lead program, environmental program, and bioterrorism program.

April 2003- Compiled GIS resource guide for local health departments. Presented Change Master Team Project.

Essential Public Health Services

Essential Public Health Service #3

Inform, educate, and empower people about health issues

This public health service is clearly established because GIS enables a visual representation of complicated data that depicts the health status of an area or community.

Essential Public Health Service #10

Research for new insights and innovative solutions to health problems

Creating a map of the epidemiology of any illness allows for the visual relation between a disease and it's origin. Yesterday Cholera, today Smallpox.

Results

A survey of Local Health Department Directors showed that there is a large interest in GIS and applying this to their health departments if the funding was available or that the program could show that it would pay for itself.

1. Do you know what Geographic Information System (GIS) is?
   Yes 21 No 4

2. Does you health department currently use GIS?
   Yes 10 No 15

3. Would you consider using GIS in your health department?
   Yes 16 No 2 Not Sure 4

4. What would be the single most important factor you would need to consider when trying to decide whether or not to implement a GIS program?
   Cost, funding resources 17
   Trained personnel 4
   Benefit to public health 1

**Most “yes” responses for question #2 was in regards to the Class V well mapping by environmentalists.

We found there is a large range between $1,500 and $30,000 needed to start a GIS program within a health department, but that there are avenues of obtaining funding for this type of project. Also, by partnering with the local area development districts costs can be significantly reduced.

We discovered GIS can be cost effective and truly useful to the health department.
Example:

> Mapping failed septic systems enabled one health department to secure significant funding for septic system upgrades and communicate the need to community residents.

Conclusions

In conclusion, we find that there is a use of GIS in public health, and we demonstrated that with our three GIS mini projects. However, we understand that GIS start up can be costly and time consuming, so it must prove itself worthy to the local health department. Three areas of Kentucky have already acknowledged G IS benefits by starting their own programs, hopefully their programs will serve as a model for all of Kentucky to follow suit. We would like to encourage the next scholar class to focus on and produce a cost-benefits analysis of GIS.

Leadership Development Opportunities

Allison Adams
KPHLI has been a real experience for me. I have enjoyed the camaraderie and networking that goes along with the education. Learning GIS as part of our Change Master project has proven very beneficial. I believe that to improve Kentucky's public health status that we need to begin with education and prevention. I think GIS has the potential to lead public health in the right direction. Picture maps produced through GIS that show disease prevalence will be good ammunition to secure buy-in of community partners to assist with education and prevention. I plan to apply the knowledge I gained from KPHLI to my work on a daily basis. I feel the information provided at the summits have instilled in me the importance of public health and the necessity for continuous improvement

Mike Mattox
The Kentucky Public Health Leadership Institute experience has been beneficial to me. It has made me realize that "leadership" consists of more than just position or experience. It includes the ability to work with others to set common goals and to combine efforts to reach those goals in such as way as to make everyone involved feel like they have made a contribution and a difference. Additionally, it has helped me realize that I have much work to do if I am to improve my leadership skills and truly become a "leader".

Our project, GIS in Public Health, aspired to promote the use of Geographic Information Systems as a public health tool and to provide the information and resources needed for health departments to begin a GIS program. Working to achieve this goal with my teammates was

challenging, fun, and very educational. I learned a few things about myself, about other health programs, and about GIS technology. With respect to self-improvement, I learned that I must be more confident about my ideas, that I must be more aware of the demands, goals, and time constraints of others, and that also, I must improve my ability to organize my thoughts, my time, and persistence in working to achieve goals.

By being aware of my strengths and weaknesses I know I will become a better worker. I hope I can become a "leader" that can make a difference. However, even if I don't become the kind of leader that I'd like to be, I believe the Kentucky Public Health Leadership Institute has been a valuable personal growth and development experience. I am going to continue to work apply Geographic Information Systems technology to public health. I will continue to promote its use in my health department, seek grant funding, and develop partnerships with other agencies currently using GIS. I am certain that I would not have pursued these goals had I not attended KPHLI.

Shannon Dunn

There are so many benefits from going through the leadership institute and being a part of this project that it is hard to name them all. This leadership institute allowed for a great opportunity of networking, especially when I have only been in public health for a few short years. This project allowed me to branched out from my nursing background and training and allowed me to discover and learn more about a whole different realm of public health. This project was fascinating and will hopefully open doors to new and exciting opportunities in my career.