Environmental Public Health Tracking Network: Colorado’s GIS Approach

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7 out of 10 deaths among Americans each year are from chronic diseases\(^1\)

Chronic diseases place an economic burden on the U.S. economy in excess of $1 trillion annually\(^2\)

Growing scientific evidence links environmental factors to many chronic diseases such as asthma, birth defects, and cancers

Researchers have linked exposures to some environmental hazards with specific diseases

- Exposure to asbestos and lung cancer
- Exposure to lead and decreased mental function in children

Other links remain unproven

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1. CDC - National Center for Health Statistics
Most environmental and health information is collected separately
- The information is scattered in a number of places and formats
- Difficult to study and monitor relationships

National Environmental Public Health Tracking Network (CDC)

The ongoing collection, integration, analysis, and interpretation of data about:

• Environmental hazards

• Exposure to environmental hazards

• Health effects potentially related to exposure to environmental hazards
• Health and environmental experts from states, cities, and other agencies helped CDC develop indicators.

• Based on many factors including priority for state and local health departments, priority for CDC, and whether or not data were available for a particular topic

• Nationally consistent data & measures

• Graph View, Table View, Map View

• Crude Data, Adjusted Rates, County and State Level Information
CDC funds health departments in states and 1 city to build and implement local tracking networks.

These state and local data systems also feed data into the national Tracking Network.

Public and Internal Portals

County vs. Community-level spatial data
• 8/1/09 – Colorado funded to join CDC’s national network

• Provide environmental and public health data through web-based portals

• Join other states in providing a national picture of selected environmental and health indicator data

• Expand environmental public health capacity at the state and local level

• Develop additional health and environmental indicators important to Colorado

• Working towards first public portal release > January 2011
Using GIS to examine health outcomes with corresponding environmental quality data

- Disease mapping: Long history (Snow).
- Environmental mapping: 1962 Canada Land Inventory (CLI) – an effort to determine the land capability for rural Canada by mapping information about soils, agriculture, recreation, wildlife, waterfowl, forestry, and land use at a scale of 1:50,000.

Time, measurement technique, and resolution of each theme is probably different.

- What we are trying to do with EPHT is to integrate data from very different data sources: environmental samples, land use, demographics, human health data (individual and aggregated).
- All have common link of geography (albeit at different scales).
Can the relationship between health outcome and our surrounding environment be described accurately by a geographical depiction?

When we put these together, geographically, the onto same map, the amount of exposure to the environmental theme is often assumed to be causal...

How do we account for variability to exposures on map?
Environmental health risk inventories

Community health profiles

In order to determine if a link exists between an environmental source and a pattern of health outcomes, users must collect more detailed information on the population and on specific environmental conditions.

Trace locations of individual people (patients, cases, or controls) back through time, to discover spatial clusters in the past or to determine past environmental exposures.

GIS serves as an initial tool for problem identification and hypothesis building in this link.

Data on health outcomes must be obtained from national, state, or local sources. As a rule, public health agencies may limit access and distribution of data.

Environmental Health Screening with GIS: Creating a Community Environmental Health Profile, Journal of Environmental Health, April, 2000 by John C. Pine, James H. Diaz
Mapping activities at CDPHE before EPHT
Focus on individual programs and priorities

• Previous mapping for these programs done on a project by project basis at different time intervals – with different objectives

• Need to bring together the best methods for creating, managing, and visualizing data based on requirements.

Questions we need to stop and ask:
• What are the sources and quality of our data?

• What are the national EPHT guidelines/recommendations for viewing data? Are other methods applicable to Colorado data?

• What are the cartographic standards that have been applied at CDPHE? How well is the data suited for interpretation on map?

• How does this all come together into a desirable and consistent product? Users – Technical Advisory Committee, local PH, interested citizens
EPHT Geospatial Workgroups

• Community Mapping Team
• Visualization Guidance Team
• Subgroups of the Standards and Network Development (SND) Workgroup
• Content Workgroups

• Objectives of Community Mapping Team:
  • Identify methods and tools to maintain confidentiality and reduce unstable rates due to small numbers when mapping health data at the community level.

  • Help build capacity in the state and national EPHT programs in the use of the tools.
Visualization Guidance Team (VGT)

• Review and describe how EPHT programs are mapping the nationally consistent data measures

• Recommend best practices for displaying and classifying non-suppressed and suppressed/unstable data, including guidance in cartography. (Nationally consistent data measures)

• Take into consideration the multiple mapping technologies that are being applied and will allow for the consistent and standardized display of data (where applicable and appropriate) across multiple portals in order to create visual consistency across portals.

• Get input and collaborate with Content Workgroups

• Empower users as well as data/GIS analysts and developers.
Our approach

- Develop, evaluate, and document our best practices for using our geospatial health and environmental data to support EPHT goals (National and State)

- Build on relationships and attend meetings with our EPHT data stewards and program staff

- Actively participate in discussions and decisions concerning portal development

- Implement the use of cartographic standards and map templates for developing EPHT products.

- Construction of our portal GIS services (development) environment (ArcGIS Server, SQL Server, SDE, Map Services, ArcGIS Viewer for Flex, etc.)

- Get input and collaborate with other portals through Geospatial Team

- Create first draft of static map images and get feedback (develop communication protocol)
Determining best practices
Standards matrix is a document for CDPHE map authors to use (and update) when developing products. Catalog of all mapping techniques used at CDPHE. Not just EPHT.

- Move from “basic inventory” to defining smoothing/data suppression techniques.
• Use of the template forces the look and feel of the maps to be consistent and increases the ability of map users to understand information throughout a series of maps.

• These templates are also used to introduce discussions among environmental and public health program specialists and data stewards concerning best methods to classify and visualize data.
Colorblind-safe schemes
Static Maps for the Colorado EPHT Portal (currently in development)

- User selects a data measure
- Notes about measure
- Table
- Chart
- Map
- Metadata
Static Maps for the Colorado EPHT Portal
View/Download PDF
(currently in development)
Different methods for classifying Asthma Hospitalization Rates
Classifying Asthma Hospitalization Rates

http://www.floridatracking.com/EPHTMap/FlexMapEPHT.html
High-Quality Map Images (PDF, JPG) for inclusion in portal(s)

Ability for users to connect to map services/download data

Digital Atlas (e.g. Atlas of Public Health for Colorado)

Interactive Mapping

- 4 Components
- Clear, consistent mapping, querying, overlay, and analysis products that utilize recent and historical data.
- Ability to educate users (and consumers) of these products on the limitations (and benefits) of using geospatial data in analyses.
Looking ahead..

- Role in Colorado EPHT
- Role in CDPHE
- Audience
- Limitations
Issues to tackle next

► Asthma hospitalizations, Heart Attacks (MI), Carbon Monoxide Poisoning, Air Quality, Water Quality

► Map products should maintain consistency with portal design

► Develop model for storing and distributing geospatial data

► Support geospatial workgroup efforts to document best practices and guidance for visualizing each data measure

► Continue to develop and document standards and templates

► Internal portal
The use of GIS technologies within the National Environmental Public Health Tracking Program has provided the GIS staff at CDPHE an opportunity to develop, document, and evaluate our internal methodologies used to visualize spatial data.
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