Improvements in Surveillance and Public Health from the California Environmental Health Tracking Program

Jan 23, 2014

Paul English, PhD, MPH
Overview

- Background
- Components of California’s tracking program
- Examples and success stories
3 Background
California’s environmental health gap: Why we need environmental health surveillance

- 2000-2001-- Nationally and state recognized:
  - Rise in chronic diseases, such as asthma, learning disabilities, and autism
  - Exposure to environmental hazards accounted for a significant proportion of many chronic diseases
  - Gap in basic information on the relationship between the environment and health
  - $100 billion a year in California—fiscal toll from nine environmentally-related chronic diseases, due to related health care costs and lost productivity

- An effective surveillance system was needed to document and explore links between hazards, exposures, and health
Environmental Public Health Tracking

("Tracking" = "Surveillance")
Environmental Public Health Tracking Network (EPHTN)

A secure, web-based network that will provide access to environmental and health data that are collected by a wide variety of agencies.

- Compile and provide access to a core set of nationally consistent data and measures
- Exchange data
- Inform and interact with the public
- Enable the systematic linking of health effects, exposures, and/or hazard datasets on an ad-hoc or ongoing basis
- Provide a toolset for data analysis, visualization, reporting, and monitoring
- Provide security and protection to sensitive or critical data
States added in 2009:
• Colorado
• Kansas
• Louisiana
• Minnesota
• South Carolina
About us

- Within the California Dept of Public Health

- Mostly funded by the Centers for Disease Control and Prevention
  - 1 of 23 grantees

- Current staffing and expertise
  - 7 (CDC-funded), 3 (other grant funded), 1 state staff
  - Multidisciplinary project teams: Epidemiology, environmental science, GIS, software development, health education, program management, policy

- Mission: to provide data and information for public health action
CEHTP Program values
Guided by the principles of environmental justice and precaution

- **Participatory process**
  Facilitate and support the involvement of our stakeholders, including the community, throughout our program process.

- **Relevancy of actions**
  Produce meaningful tools, data, and information that is relevant to our stakeholders and useful for informing public health actions.

- **Scientific integrity and innovation**
  Analyze, interpret, and present data and information to our best understanding and ability, using the latest and most appropriate methods.

- **Transparency in decision making**
  Make the rationale for program activities and decisions available in a manner that is transparent and intelligible.
What should California’s Tracking Program do?

- Improve:
  - surveillance
  - value of existing data
  - access to data

- Inform:
  - policy and decision-making
  - program planning and resource allocation
  - land use and planning decisions

- Support community action/advocacy

- Identify communities at risk

- Support advancement of knowledge
  - Generate hypotheses
  - Develop methods
  - Facilitate research through data and tools

Make data more useful, understandable, and accessible for public health action by stakeholders at the community, local, and state level
Main Tracking Program Activities
Main program activities/components

- Web portal, tools, and services
- Research and special projects
- Data requests and collaborations
- Needs assessment, outreach, and capacity building
- Advisory group
Web Portal, Tools, and Services

- Provides public access
  - Data queries and downloadable datasets
  - General information about topic areas
  - Mapping tools

- Restricted access to some tools and services

Examples of topic areas/data
- Air
- Agricultural pesticide use
- Asthma
- Birth defects
- Biomonitoring
- Cancer
- Carbon monoxide poisoning
- Childhood lead poisoning
- Drinking water
- Heart attacks
- Heat-related vulnerability
- Housing
- Maternal and Infant Health
- Poverty
- Traffic
Welcome to the California Environmental Health Tracking Program (CEHTP) web portal.
We are working to improve public health by delivering science-based information on the trends and distributions of diseases and environmental threats, as well as the often complex relationships between them.
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Asthma Data Query Options

To view Asthma data, choose from the following options below, then click the Submit Query button.

Step 1 of 7 – Select asthma indicator:
- Hospitalizations due to asthma
- Emergency department visits due to asthma

Step 2 of 7 – Select year:
- 2009
- 2008
- 2007
- 2006
- 2005
- 2004
- 2003
- 2002
- 2001
- 2000

Step 3 of 7 – Select race/ethnicity:
- All Races/Ethnicities
- African-American/Black
- Asian-American/Pacific Islander
- Hispanic/Latino
- European American/White
- Other
Step 4 of 7 – Select age/sub-group:
- All Ages
- Age 0-4
- Age 5-17
- Age 18-34
- Age 35-64
- Age 65 and over

Step 5 of 7 – Select gender/sex:
- Both Sexes
- Male
- Female

Step 6 of 7 – Select geographic unit:
- Counties
- Zip Codes (Coming Soon)

Step 7 of 7 – Select measure calculation method:
- Age-adjusted rates
- Crude rates
- Spatially modeled age-adjusted rates
# Asthma Hospitalization and Emergency Department Visits Query Results

This query system automatically generates a table, map, and chart using the criteria you have chosen. To see the data in your desired format, click on the corresponding tabs below. View the Info tab to learn about the data and how they can be used. View the Sources tab for information about the underlying data sources.

To modify your query, click on the yellow box to the right. Options for other ways to visualize the data are listed on the right side bar.

## Hospitalizations due to asthma in California by County, All Races/Ethnicities, All Ages, Both Sexes, 2009

<table>
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<tr>
<th>County</th>
<th>Age Adj. Rate per 10,000</th>
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### Hospitals due to asthma in California by County, All Races/Ethnicities, All Ages, Both Sexes, 2009

#### Age Adj. Rate per 10,000

- **16.8 +**
- **13.6 – 16.8**
- **8.4 – 12.6**
- **4.2 – 8.4**
- **0 – 4.2**
- **No Data**

#### Labels:
- On | Off

**JOIN OUR LIST**
Get updates on our project activities and new features of our website. [Sign up for our newsletter here.](www.CEHTP.org)

**CONTACT US**
California Environmental Health Tracking Program
850 Marina Bay Pkwy, P.3
Richmond, CA 94804

(510) 630-3038

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[1] www.CEHTP.org
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Hospitalizations due to asthma in California by County, All Races/Ethnicities, All Ages, Both Sexes, 2009 [Notes]

| Age Adj. Rate per 10,000 | Imperial | Alameda | Fresno | Merced | San Bernardino | Tulare | Los Angeles | Contra Costa | San Joaquin | Yuba | Kings | Kern | Madera | Butte | Sacramento | California | Sutter | Humboldt | San Francisco | Shasta | Riverside | Santa Barbara | Solano | Ventura | San Diego | Los Angeles | Mendocino | Tehama | San Benito | Colusa | Plumas | Mendocino | Butte | Glenn | Sierra | Butte | Shasta | Modoc | Siskiyou | Trinity | Colusa | Shasta | Mariposa | Tuolumne | Calaveras | El Dorado | Placer | Yuba | Butte | Colusa | Sutter | Calaveras | Plumas | Siskiyou | Trinity | Del Norte |
|--------------------------|----------|---------|--------|--------|---------------|-------|-------------|-------------|-------------|------|-------|------|--------|-------|-------------|-------------|-------|----------|--------------|--------|----------|--------------|--------|---------|-------------|-----------|----------|-------------|--------|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------| --------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
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### Asthma Hospitalization and Prevention

This query system automatically generates an Info tab to learn about the data and how they are calculated. To modify your query, click on the yellow box.

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#### Map

#### Chart
Research/Special Projects

- Projects may utilize CEHTP
  - Data
  - Technical infrastructure, such as linkage tools
  - Other expertise

- Another way to provide data and information that is useful for public health action

- Opportunity to focus on issues of importance to Californians

- Project lead / co-lead
  - perchlorate and pesticide biomonitoring
  - breast cancer mapping
  - HIA on cap-and-trade
  - climate change community vulnerability mapping
  - Agricultural pesticides and autism study
  - heat-related illness and mortality report
  - Pesticides and schools study
  - Cost of children’s environmental diseases
Data Requests and Collaborations

- **Data requests**
  - For data not available on web portal, including data generated using CEHTP linkage services

- **Provide technical assistance**
  - Epidemiology and statistics
  - Communication and facilitation
  - Software development
  - GIS

- **Contributed to other projects**
  - Heat wave magnitudes & PH impacts (Margolis)
  - Hypospadias, genes & environment (Stanford)
  - Community vulnerability analysis (Pastor, Morello-Frosch)
  - Occupational fatality mapping (Occ. Health Branch, CDPH)
  - Heat vulnerability index validation (UC Berkeley)
  - 710 Freeway Expansion Project (Human Impact Partners)
Needs Assessment, Outreach, and Capacity Building

- Assess stakeholder needs to inform program activities
- Ensure stakeholders are aware of our resources
- Enhance users’ ability to understand and use our resources
- Collaboration with “data intermediaries”

Activities include

- Needs assessments like focus groups, surveys, usability testing
- Evaluation
- Ongoing communications, such as newsletter
- Project-specific outreach
- In-person and web-based presentations, demonstrations, and trainings
Advisory Group

- Provide guidance and feedback on program activities
- 27 members
- Meet in person 2-3 times a year
- Representing
  - Local, state, fed govt
  - CBOs and NGOs
  - Academia
  - Healthcare

Roles include
- Assist in data access as data stewards and user groups
- Provide guidance on data analysis, interpretation and visualization
- Collaborate on dissemination strategies and activities
- Use data, tools, and services for public health action
- Engage in program sustainability activities
Examples and Success Stories
Enhancing Existing Data

- Geocoding
- Sub-county mapping and spatial modeling
# Geocoding Service

## Problem
- Geocoding is essential to public health
  - Accurately mapping disease or other information
- Without our service, government programs:
  - Paid for commercial geocoding services
  - Used free services that were less accurate
  - Spent resources and time creating their own in-house geocoding capabilities
  - Did not geocode their data

## What We Did
- Created geocoding tool
  - Free for users (CDPH and program partners)
  - Highly accurate
  - Secure
  - High throughput (up to 1 million records per table; can geocode 300,000 records/hr)
  - Offered as web-based tool, desktop application, and API
- Developed tutorial and conducted trainings
Geocoding Service

Address: 850 Marina Bay
City: Richmond
Zip: 94804

Standardized address: 850 Marina Bay Pkwy, Richmond 94804-8403

7 Results

1. 1 (ungeocodable)
2. 2-TA_STREETS_ZIP_0708
3. 3-NatGeo_2008_ZIP
4. 4-TIGER_2007_ZIP
5. 6-google_10_2009
6. 7-yahoo_10_2009
7. 5-ZIP4_0708_Enhan2_loc

Extract Traffic Metrics
Geocoding Service: Successes

- Used over 63,000 times to geocode over 42 million addresses

- Used by over 50 programs for wide variety of public health purposes
  - Vital Statistics- real-time geocoding of death records
  - Cancer Detection- map provider locations, inform service delivery
  - Monitoring outbreaks- TB, STDs, vectors and vectorborne diseases
  - Emergency preparedness- mapping of sensitive sites, essential services

“The Geocoding Service is the best in California [state government]”
Sub-County Data

Problem

- County-level data are of limited utility for local-level action
- Data often displayed at county level
  - Concerns about confidentiality
  - Higher resolution data may be of limited utility when rates are suppressed

What We Did

- Explored display of community-level data through use of spatial statistics
  - Census tract maps offer higher resolution of patterns
  - Smoothed surface maps are not limited by political boundaries
- Verified utility of data with stakeholder advisory group
Preterm Birth in California by Census Tract, All Races/Ethnicities, 2006

NOTES ABOUT THE DATA

Preterm birth is a singleton birth prior to 37 weeks of gestation (about 8.5 months). Very preterm birth is a singleton birth prior to 32 weeks of gestation. Smoking cessation and reduced access to nutritious foods and medical services can lead to...
Sub-County Data: Successes

- Identified communities at risk and target activities
  - Fresno County MCH, childhood lead poisoning prevention activities
  - Informed asthma, air quality programs

- Assessed other possible risks
  - Fresno used data to examine MIH outcomes and lead

- Informed program planning
  - Fresno’s MCH 5-year needs assessment and planning document

“You have helped us in a huge way.”
- Fresno County Director of Public Health Nursing
Making Data More Useful and Accessible

- Childhood lead poisoning
- Mapping and linkage tools
Childhood Lead Poisoning

Problem
- Childhood lead poisoning still a problem in CA
- Blood lead screening data collected by CLPPB
- County-level data was not publicly available

What We Did
- Worked with CLPPB to get permission to display data
- Developed text and data query system to display data on
  - Blood lead levels
  - Age of housing
  - Poverty
Data on childhood lead poisoning now available publicly for the first time

- Used for program planning in Nevada County
  - To identify data discrepancies
  - To assess trends and gaps to inform 3-year planning process

- Used to advocate for more funding for childhood lead poisoning prevention programs

Childhood Lead Poisoning: Successes
# Mapping and Linkage Tools

<table>
<thead>
<tr>
<th>Problem</th>
<th>What We Did</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Data for environmental hazards often not available in useful or accessible formats</td>
<td>- Developed mapping tools that enable users to visualize pesticide and traffic data for their community</td>
</tr>
<tr>
<td>- Pesticide use data in datasets containing millions of records</td>
<td>- Developed linkage tools that enable users to link their data with pesticide or traffic data by geography and time</td>
</tr>
<tr>
<td>- Traffic data not easily accessed or interpreted for public health use</td>
<td></td>
</tr>
</tbody>
</table>
Pesticide Mapping and Linkage Tools
Traffic volume linkage tool

### CEHTP Spatial Linkage Demonstration

Enter coordinates in Alameda County:

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Highest Gauss-adjusted traffic volume segment within buffer (vehicles/day)</td>
<td>5,833</td>
</tr>
<tr>
<td>2. Unadjusted traffic volume of highest segment within buffer (vehicles/day)</td>
<td>41,000</td>
</tr>
<tr>
<td>3. Direction to highest segment within buffer (degrees ccw from east)</td>
<td>152</td>
</tr>
<tr>
<td>4. Distance to highest segment within buffer (meters)</td>
<td>334</td>
</tr>
<tr>
<td>5. Gauss-adjusted traffic volume of nearest segment within buffer (vehicles/day)</td>
<td>5,833</td>
</tr>
<tr>
<td>6. Unadjusted traffic volume of nearest segment within buffer (vehicles/day)</td>
<td>7,469</td>
</tr>
<tr>
<td>7. Direction to nearest segment within buffer (degrees ccw from east)</td>
<td>155</td>
</tr>
<tr>
<td>8. Distance to nearest segment within buffer (meters)</td>
<td>43</td>
</tr>
<tr>
<td>9. Sum of all Gauss-adjusted traffic volumes within buffer (vehicles/day)</td>
<td>13,294</td>
</tr>
<tr>
<td>10. Sum of all unadjusted traffic volumes within buffer (vehicles/day)</td>
<td>184,336</td>
</tr>
</tbody>
</table>

*average annual daily traffic

**ccw=counter clockwise
Mapping and Linkage Tools: Successes

- Public data now more accessible to the public and more useful for public health purposes

- Uses of pesticide mapping and linkage tools
  - Identify site for pesticide biomonitoring project
  - Conduct studies on pesticides and autism; pesticides and birth defects

- Uses of traffic linkage tool
  - Screen proposed development projects for possible health impacts
  - Conduct study on traffic and asthma
Conducting Surveillance and Collecting Data

- Breast cancer mapping project
- Water system boundary tool
Breast Cancer Mapping Project

Problem

- No proactive breast cancer “cluster” detection
- Breast cancer information not provided at community level
- Scientific experts unsure about selecting a method for sub-county mapping
  - Concern about utility and

What We Did

- Convened advisory group of breast cancer advocates
  - Guided the development of breast cancer mapping protocol, results dissemination
- Created mapping protocol
  - Use Scan Statistic at census tract level
  - Exclude results arising from population shifts or temporary changes in detection rates
Final Areas of Concern

Many areas are located within counties that do not, as a whole, have rates much higher than the state rate.
Final Areas of Concern

- West LA / East Ventura
- South Orange
- North SF Bay
- South SF Bay

County boundaries
Comparing areas of concern with counties

Invasive breast cancer rates aggregated over 2000-2008
Breast Cancer Mapping Project: Successes

- Established community-led proactive breast cancer mapping protocol using established statistical methods
- Identified areas of concern in counties previously unknown to have elevated rates
- Ventura County hospital used results to educate providers and target outreach activities to populations at risk as identified in report
Water System Boundary Tool

Problem

- 8000+ public water systems
  - No requirement for reporting of customer service areas
  - Many water systems lack the capacity to digitize their maps
- System boundary information needed
  - Emergency preparedness
  - Outbreak investigations
  - Epidemiology

What We Did

- Developed web-based tool to crowd-source boundary data collection
  - Secure access by public water system and state personnel
  - Can upload, draw, edit, and download boundaries
  - Can input multiple boundaries per system to track changes over time
  - Boundaries available to the public as a single statewide map as well as for individual systems
Water System Boundary Tool: Successes

- Collected data for water systems serving 90% of state population

- Enabled or enhanced research studies
  - Water costs; nitrate pollution in agricultural communities; cumulative impacts

- Support drinking water management activities
  - Water supply permits, sample siting plans, reporting requirements
  - Identify locations of private well users
  - Create plans to improve drinking water quality and waste water management
Conducting Research

- Pesticides use near schools
- Cost of environmental disease in children
Pesticides and Schools Study

Problem

- Agricultural pesticides widely used in CA
- Childhood exposure to pesticides raises special concerns, because children
- Proximity to fields increases probability of exposure

What We Did

- Assess amount and types of ag pesticides used near public schools
  - For top 15 ag counties
  - Public schools: 2,511
  - Students enrolled: 1,457,230
  - 2.3 million pesticide records

- Enhanced data
  - Digitized school boundaries
  - Linked pesticide use data, field location data, and
Pesticides and Schools Study

- Undergoing final approval
- Created list of “pesticides of public health concern”
- Improved geographic data on schools
- Identified pesticides with highest use near schools
- Identified counties/schools with highest pesticide use nearby
- Characterized populations attending schools near the most pesticide use
Cost of Environmental Disease in Children

Problem
- Growing concern about the environment and the relationship with health
- Costs drive many policy decisions
- Economic analysis useful for setting priorities, resource allocation, and considering pollution prevention

What We Did
- Currently conducting study
  1) Select significant childhood diseases known to be impacted by the environment
  2) Calculate the disease burden
  3) Determine the costs (direct, indirect, lost potential earnings, annual &/or lifetime)
  4) Estimate the environmental contribution to the
Informing Policy and Planning

- Validation of heat alerts
- Climate change vulnerability assessment
# Heat Alert Sensitivity Study

<table>
<thead>
<tr>
<th>Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Due to budget cuts, the City of San Jose wanted evidence for maintaining for cooling centers</td>
</tr>
<tr>
<td>- Heat alert systems are a first line of defense, trigger preventative action</td>
</tr>
<tr>
<td>- No overall consistent criteria to define thresholds for heat alerts</td>
</tr>
<tr>
<td>- No systematic</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What We Did</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Used CEHTP data to confirmed accuracy of heat alerts</td>
</tr>
<tr>
<td>- Assessed if heat alerts predicted times when people suffered the most heat illness</td>
</tr>
<tr>
<td>- In San Jose area, heat-related emergency room visits peaked following heat alerts</td>
</tr>
<tr>
<td>- Visit subsided when the heat alerts stopped</td>
</tr>
</tbody>
</table>
Number of Heat-related emergency room visits during Heat Products, May 2008, San Francisco Bay Area
Heat Alert Sensitivity Study: Successes

- Results informed budget, policy decisions
  - City of San Jose decided to allow cooling centers to open as part of the city’s heat alert response

- Conducted similar analysis in Los Angeles
## Climate Change Vulnerability Assessment

### Problem
- Multiple factors affect a community’s vulnerability to climate change
  - Risk of exposure to environmental impacts of climate change
  - Capacity to adapt to changing environment
  - Sensitivity to climate change events

### What We Did
- Developed methodology to screen for areas of greatest concern
- Piloted in two counties: Fresno and Los Angeles
Climate Change Vulnerability Assessment*

- Data were ranked by quintiles and mapped for census tracts; Final vulnerability score a sum & re-ranking across all metric ranks

* English et al, Intl J Climate Change, 2013

<table>
<thead>
<tr>
<th>Metric</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central air conditioning</td>
<td>CA Energy Commission (2009)</td>
</tr>
<tr>
<td>Tree canopy</td>
<td>National Land Cover Database (2001)</td>
</tr>
<tr>
<td>Impervious surface</td>
<td>National Land Cover Database (2001)</td>
</tr>
<tr>
<td>Public transit routes</td>
<td>SCAG 2011; Fresno COG 2011</td>
</tr>
<tr>
<td>Elderly living alone</td>
<td>Census 2000</td>
</tr>
<tr>
<td>Household car access</td>
<td>Census 2000</td>
</tr>
<tr>
<td>Wildfire risk</td>
<td>CAL FIRE 2003</td>
</tr>
<tr>
<td>Flood risk</td>
<td>FEMA (Fresno 2009; LA 2008)</td>
</tr>
<tr>
<td>Sea rise inundation</td>
<td>Pacific Institute 2009 (LA only)</td>
</tr>
</tbody>
</table>
Final CDPH Climate Scores

LA County (including residential & sensitive populations land use mask)
46% of African Americans and 36% of Latinos reside in the two highest risk categories compared to 30% of whites.

Los Angeles County
In LA County, median income in the highest risk area is 40% lower than the lowest risk area.
Climate Change Vulnerability Assessment: Successes

- Developed screening methodology that can be used and adapted locally

- Los Angeles Department of Public Health used results to:
  - Plan for service deliveries during climate related emergencies (such as extended heat events and power outages)
  - Coordinate with Community Emergency Response Teams to assist the vulnerable populations in their cities when impacted
Acknowledgements

- CEHTP staff:
  - Natalie Collins
  - Liang Guo
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  - Jackie Valle
  - Alexa Wilkie
  - Michelle Wong

- Tracking Implementation Advisory Group

- Environmental Health Investigations Branch, California Department of Public Health

- National Environmental Health Tracking Program, Centers for Disease Control and Prevention
Publications


- Carmichael, SL.; Yang, W; Kegley, S; Guo, L; Lammer, E; Wolff, C; English, P; Shaw, G. Hypospadias and residential proximity to pesticide applications. 2013. Pediatrics. in press.


Publications (cont)


Flowchart for Content Areas:

Data acquisition → Data cleaning, management, geocoding → Calculate NCDMs, other measures, and modeled statistics → Incorporate into indicators repository → Create/update data query interface → Create/update supporting text and metadata → Deployment → Outreach

Data refresh (annually and as needed)

Push NCDMs to CDC

Testing:
- Check data for consistency
- Check with content experts*/resources
- Validate XML and/or confirmation from CDC
- Check data display
- Review by content experts*
- User testing/usability

*Content experts include data stewards and staff from content specific programs and organizations. Background text will be developed in a parallel process, and will also be reviewed by content experts when appropriate.
Flowchart for Tools:

Data acquisition → Data cleaning, management → Pilot major functions → Develop software (web-enable) → Deployment → Outreach

Data refresh (as needed) → Outline/refine user requirements → Communications:
- Instructions
- Documentation
- Text
- Tutorials
- Metadata
- Other usability enhancements

Testing:

Check data for consistency → Check data for consistency → Check for major bottlenecks → Test functionality → Internal and partner review for usability → User testing
What we track/data we use

- Health
- Environmental
- Demographic
- Geographic
Data collection and access

Hazards:
- Air quality
- Pesticides
- Drinking water quality
- Traffic

Exposures:
- Childhood lead poisoning
- Biomonitoring
- Carbon Monoxide poisoning

Health:
- Maternal and Infant Health
- Birth defects
- Heart Attacks
- Cancer
- Asthma

Differ by:
- Data steward
- Purpose for collection
- Data quality, format
- Data availability
- Funding