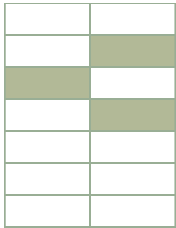


GIS for All Health Organizations

2008 ESRI Health GIS Conference



Washington, D.C., September 28, 2008



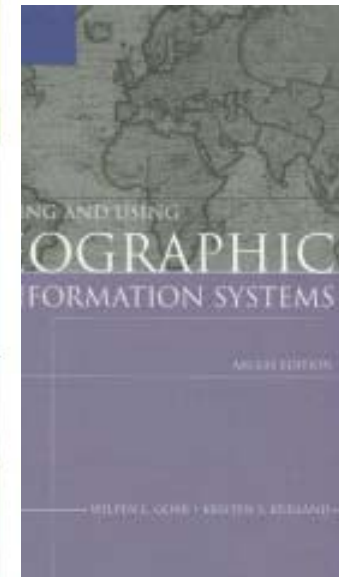
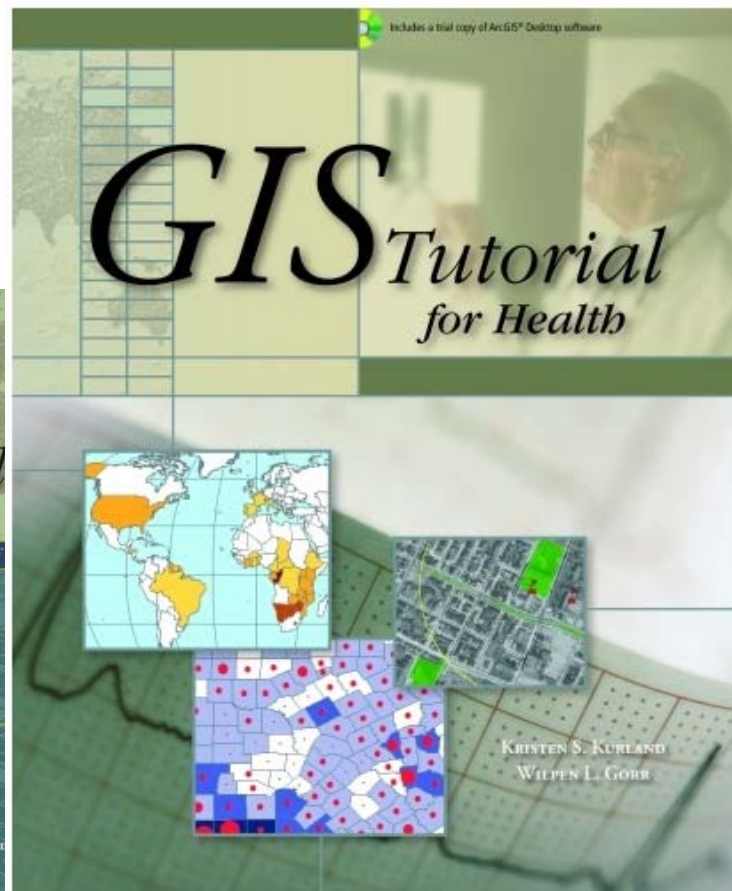
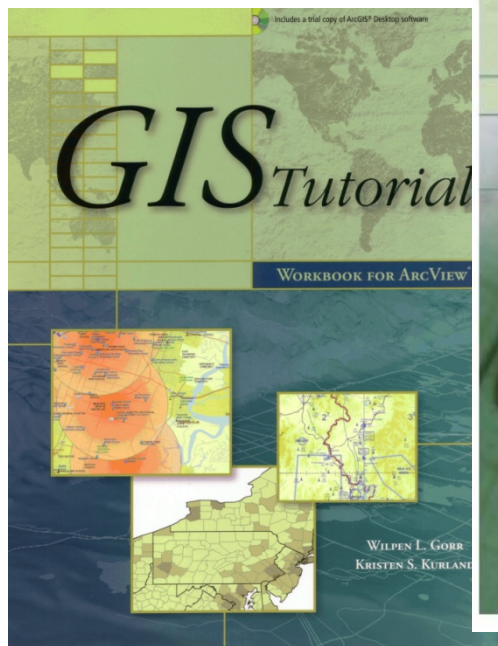
Introductions

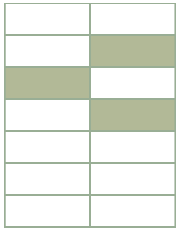
Kristen Kurland

- **Teaching Professor of Architecture and Public Policy**
- **Research**
 - Urban Design, Economic Development, Community Participation
 - Health and the Built Environment
 - Spatial Analysis Using GIS
- **Teaching**
 - CAD, BIM, 3D Visualization, CAFM, GIS,
 - Health Care Policy and Management
 - Infrastructure Management (Masters of Medical Management)

GIS Textbook Author

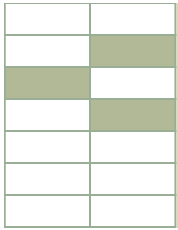
Co-authored with Heinz School Professor, Wil Gorr





Health Organizations using GIS

- **Public Health Agencies**
- **Social Services**
- **Hospitals, Medical Groups**
- **Insurance Companies**
- **Academics**
 - Medical Schools, Public Health Schools, Health Policy Schools, Nursing Schools, Medical Researchers, etc.
- **Health Policy Researchers/Think Tanks**
- **Government Agencies**
- **Others?**



GIS Levels

Basic

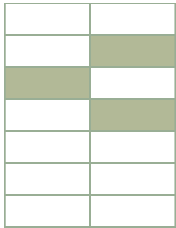
- Explore and map locations visually

Intermediate

- Spatial relationships/analysis

Advanced

- Complex spatial analysis



Basic GIS

Tools

- Google Maps, Visual Earth, etc.
- ArcGIS Server, ArcIMS
- ArcExplorer WEB

Pros

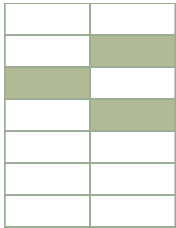
- Can be inexpensive, easy to map and access
- Show locations and visualizes health data
- Reaches large audiences

Cons

- Data might be difficult to interpret
- No analysis



Journalist Exploring Health Data



Online News Association

Top 10 Tech Trends

- Number 3: Geobrowsing

Using the Web to Cover Healthcare

- Panel:
 - Scott Hensley, Wall Street Journal
 - Kristen Kurland, CMU
 - M. Asif Ismail, Reporter, Center for Public Integrity
 - Matt Chittum, Data Delivery Editor, The Roanoke Times

The Geography of Aging

Sources: medicare.gov, Virginia Department for the Aging, Roanoke's LOA Area Agency on Aging and the New River Valley Agency on Aging



Name ▲	Resource type	Address	Phone	Accepts Medicare? Medicaid?	Website		
AVANTE AT ROANOKE	Nursing home	324 King George Ave SW Roanoke, VA 24016	(540) 345-8139	Yes/Yes	http://www.avantegroup.com	Map	Details
BERKSHIRE HEALTH & REHABILITATION CENTER	Nursing home	705 Clearview Drive Vinton, VA 24179	(540) 982-6691	Yes/Yes	http://www.mfa.net/berkshire	Map	Details
BRANDLOAKE NURSING	Nursing home	3827 Brandon Ave	(540) 778	Yes/Yes		Map	Details

Lead Poisoning

Virginia's Lead Cases



A look at how many of Virginia's children have lead in their blood

Roanoke's large stock of housing built before 1978 means hundreds and hundreds of local homes have coats of lead-based paint. Although not all of the below cases are from lead-paint in homes, the dust particles from peeling paint around windows and on walls is the largest source of elevated blood lead levels for children under 6 in this area, according to the Virginia Department of Health.

Source: *The Virginia Department of Health*

Last Updated: 11/15/2007

Related Links

- [Roanoke's Lead-Safe program on the block](#)
- [The Virginia Department of Health](#)

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Search for:

County/City:

Year:

Total Records: 136

Page 1 of 14 [Next >](#) [Last >>](#)

Records per Page:

Click on the column heading to sort the data

Year	County/City	Population < 72 Months	Number Tested	Number Elevated	Percent Elevated
2006	Accomack County	2792	747	6	1%
2006	Albemarle County	6000	700	4	1%
2006	Alexandria	9262	2034	10	1%
2006	Alleghany County	905	127	2	2%
2006	Amelia County	870	113	3	3%
2006	Amherst County	2234	334	1	0%



Government Agency Providing Data

Centers for Disease Control

Overweight and Obesity

- > [Introduction](#)
 - > [Defining Overweight and Obesity](#)
 - > [Obesity Trends](#)
 - > [Contributing Factors](#)
 - > [Health Consequences](#)
 - > [Economic Consequences](#)
 - > [Childhood Overweight](#)
 - > [State-Based Programs](#)
 - > [Recommendations](#)
 - > [Frequently Asked Questions \(FAQs\)](#)
 - > [Resources](#)
- ### Related Topics
- > [Healthy Weight](#)
 - > [BMI - Body Mass Index](#)
- ### Healthy Lifestyle Topics
- > [Nutrition](#)
 - > [Physical Activity](#)
 - > [Division of Nutrition, Physical Activity and Obesity](#)

U.S. Obesity Trends 1985–2007

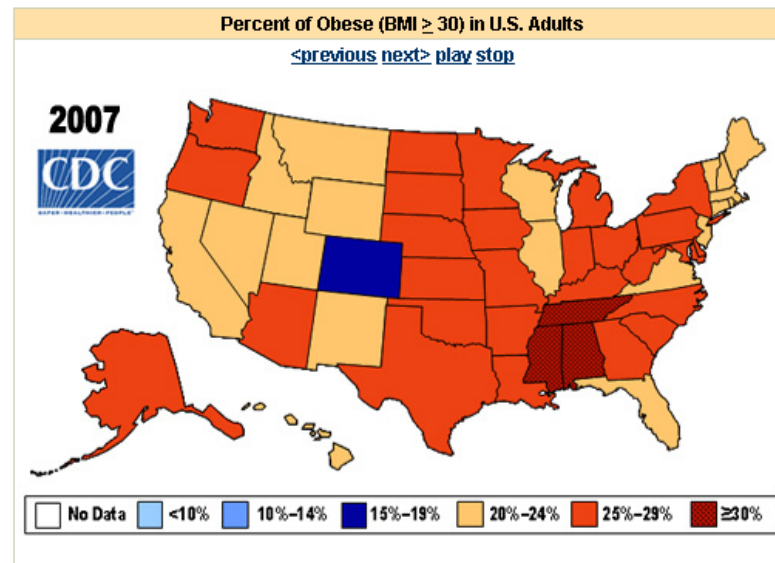
During the past 20 years there has been a dramatic increase in obesity in the United States. This slide set illustrates this trend by mapping the increased prevalence of obesity across each of the states.

In 2007, only one state (Colorado) had a prevalence of obesity less than 20%. Thirty states had a prevalence equal to or greater than 25%; three of these states (Alabama, Mississippi and Tennessee) had a prevalence of obesity equal to or greater than 30%.

The animated map below shows the United States obesity prevalence from 1985 through 2007.

Download the Obesity Trend Maps

The prevalence of obesity is depicted in a [PowerPoint slide presentation format](#)¹ (25 slides total, PPT-1.37Mb)
This is also available as a text-only [Acrobat file](#) (PDF-1.75Mb)





Social Services



Adelaide Department for Families and Communities

MapIQ

- **Assists with customer service**
- **Staff can locate appropriate services or facilities for the customer**
- **Agency Examples**
 - **Housing SA** – *Locate* a customer in a dwelling with access to appropriate services / facilities
 - **Disability SA** – *Find* a Disability SA service centre that the customer can access via public transport
 - **Problem Gambling** – *Find* Gambling counseling services for a client near their home
 - **Office for the Ageing** – Assist a customer with *Finding* a retirement village in a seaside suburb with doctor and Pharmacy services near by

MapIQ

The screenshot displays the DFC MapIQ web application in a Microsoft Internet Explorer browser window. The browser's address bar shows the URL: `http://saht06955.dfc.sa.gov.au/dfc_search/user_search_content.aspx?searchparam=gp glenelg`. The page header includes the Government of South Australia logo, the text "inside DFC", the slogan "connected brave ethical respectful", and the "MapIQ" logo. A navigation menu contains links for Home, GIS Team Site, DFC MapIQ, FAQ, and Feedback. A search bar on the right contains the text "gp glenelg".

The main content area features a map of the Marion area in South Australia. A tooltip is displayed over a location, containing the text: "Flinders Medical Centre", "Mental health - community treatment teams,", and "Marion". The map shows various streets such as George St, Finnis St, and Alawoona Av. A red circle highlights a specific area on the map, and a red "50" speed limit sign is visible on the left side.

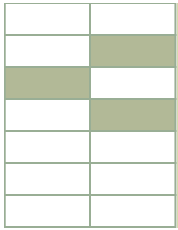
On the right side of the map, there are three search panels:

- Results**: Includes "Legend" and "Advanced" tabs.
- Tools**: Contains "Email" and "Print" options.
- Address Search**: Includes input fields for "Unit No", "House No", "Street*", "Street Type" (with a dropdown menu), and "Suburb*" (with a dropdown menu). A "GO" button is located below these fields.
- Proximity Search**: Includes a "You Clicked at (right mouse button):" section with input fields for "Easting" (value: 1324245.67) and "Northing" (value: 1661205.46). A "Distance" dropdown menu is set to "500 Metres". "GO" and "Clear" buttons are located at the bottom of this section.

The Windows taskbar at the bottom shows several open applications: "tart", "Untitled - Not...", "C:\ESRI\Conf...", "Paint Shop Pr...", "Microsoft Pow...", "CCP Player", and "SnagIt Captur...". The system clock indicates the time is 4:30 PM on 2/11/2006.



Other Examples?



Intermediate GIS

Tools

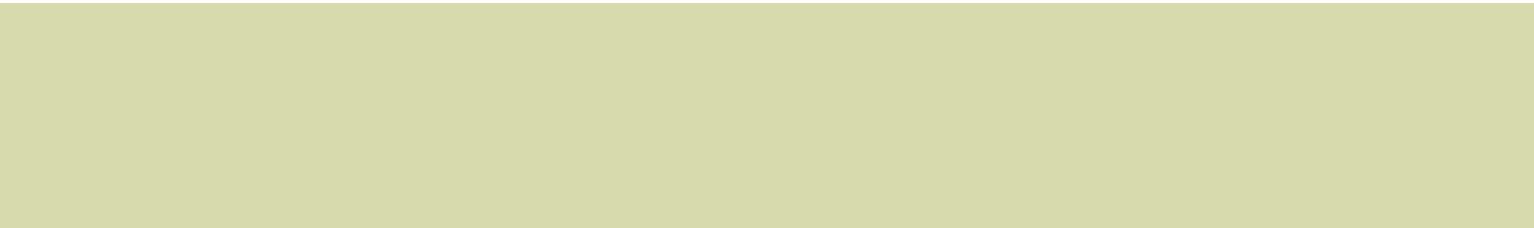
- Desktop GIS (ArcINFO, ArcView, ArcExplorer, ArcReader)

Pros

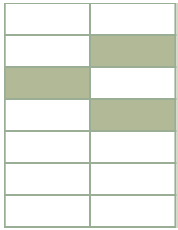
- Spatial analysis
- Improved modeling and planning

Cons

- Software and GIS layer updates can be costly
- Time constraints
- Requires GIS specialist
- Can be misleading if not done properly

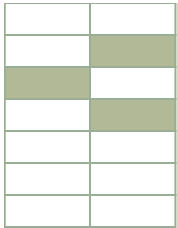


**Local Health Department Lead
Manager**



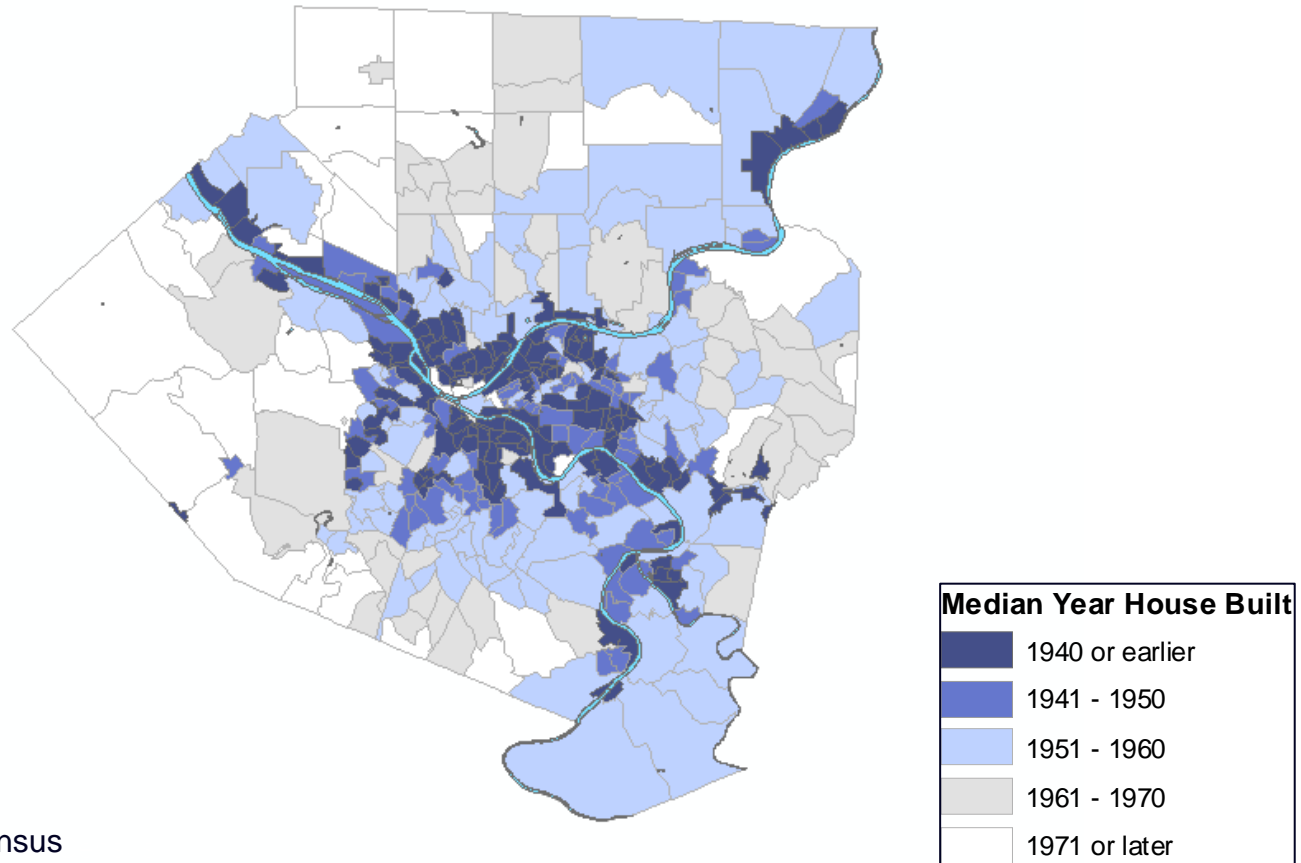
Lead Analysis

- **Analyzes lead poisoning in local neighborhoods compared to other demographic data**
- **Uses maps to show local pediatricians where trouble areas are**

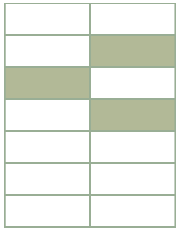


County Childhood Lead Study

Allegheny County, PA - Housing Data by Census Tract

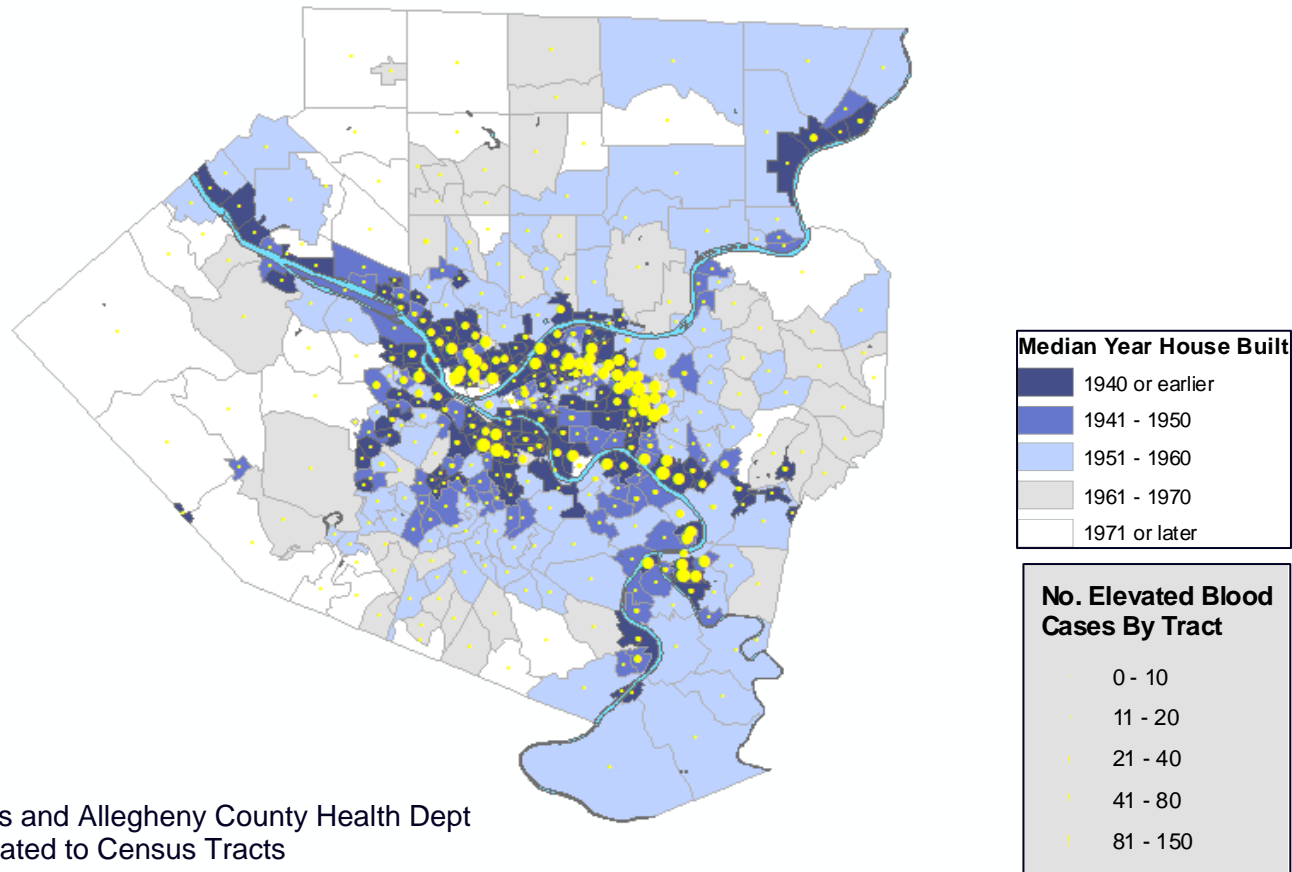


Source: U.S. Census

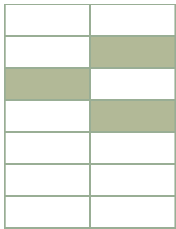


Cases of Children with Elevated Blood Levels Compared to Housing Age

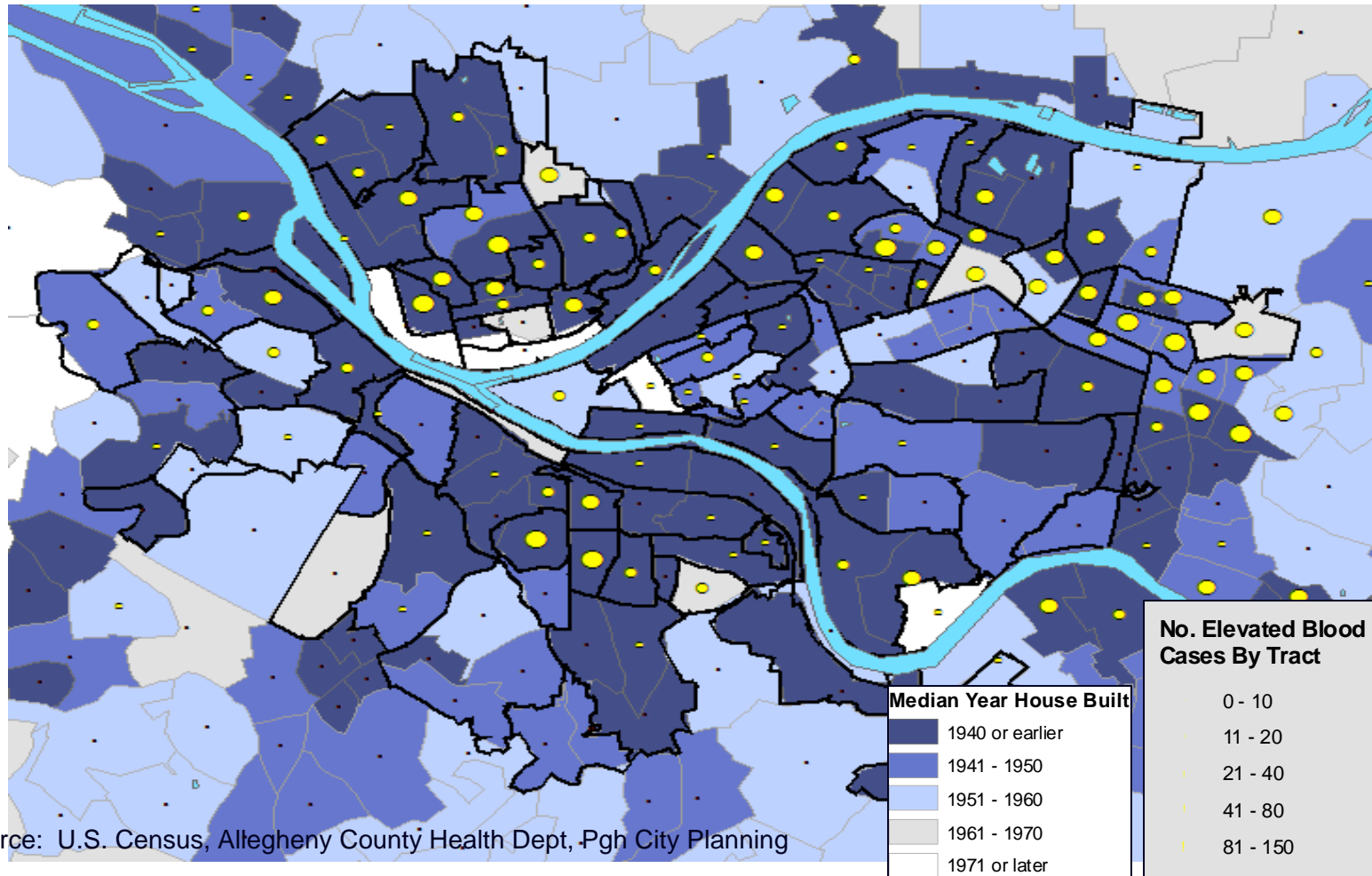
Allegheny County, PA- Housing Data by Census Tract



Source: U.S. Census and Allegheny County Health Dept
Note: Cases aggregated to Census Tracts

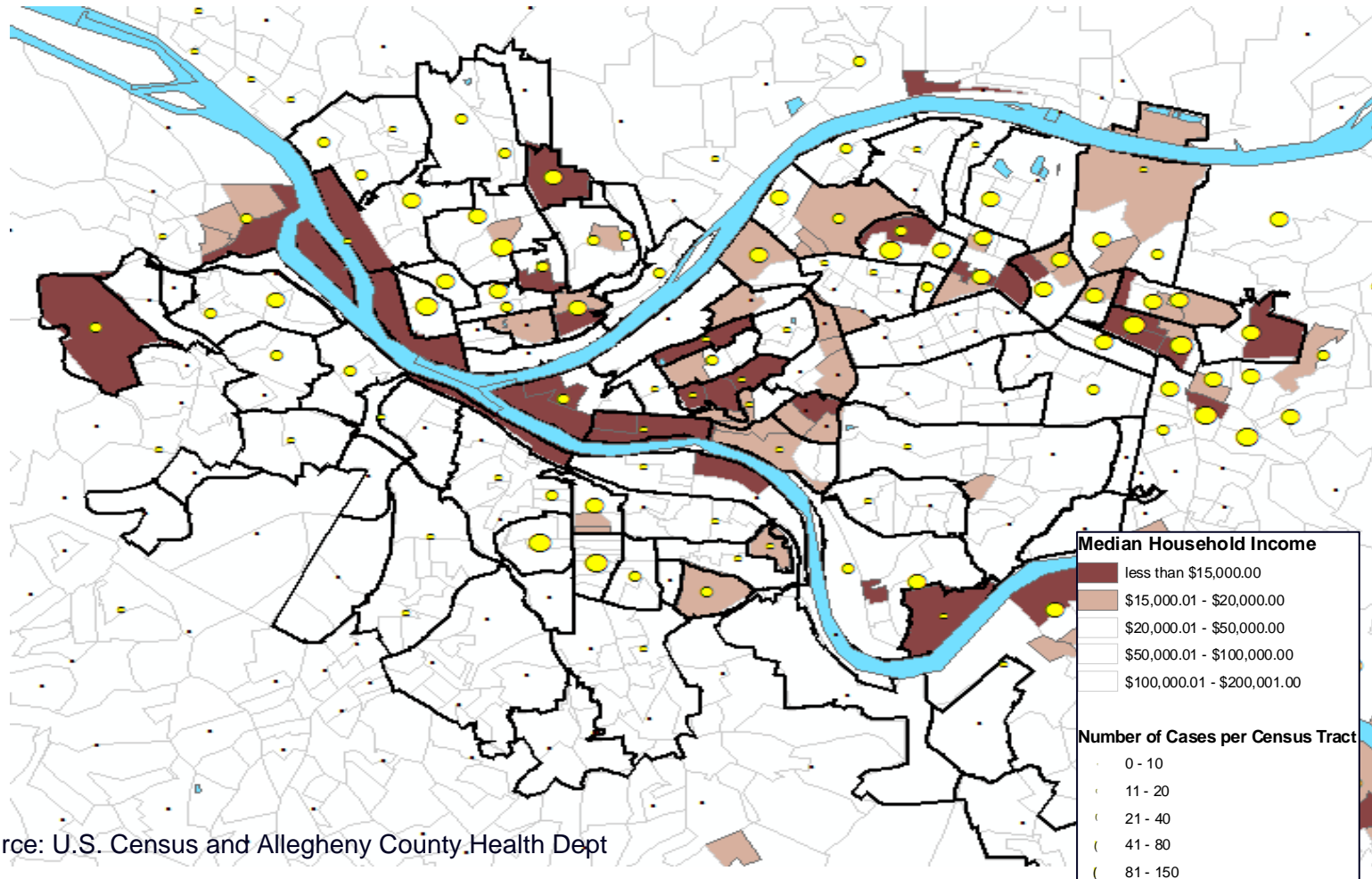


Map Zoomed to Neighborhoods

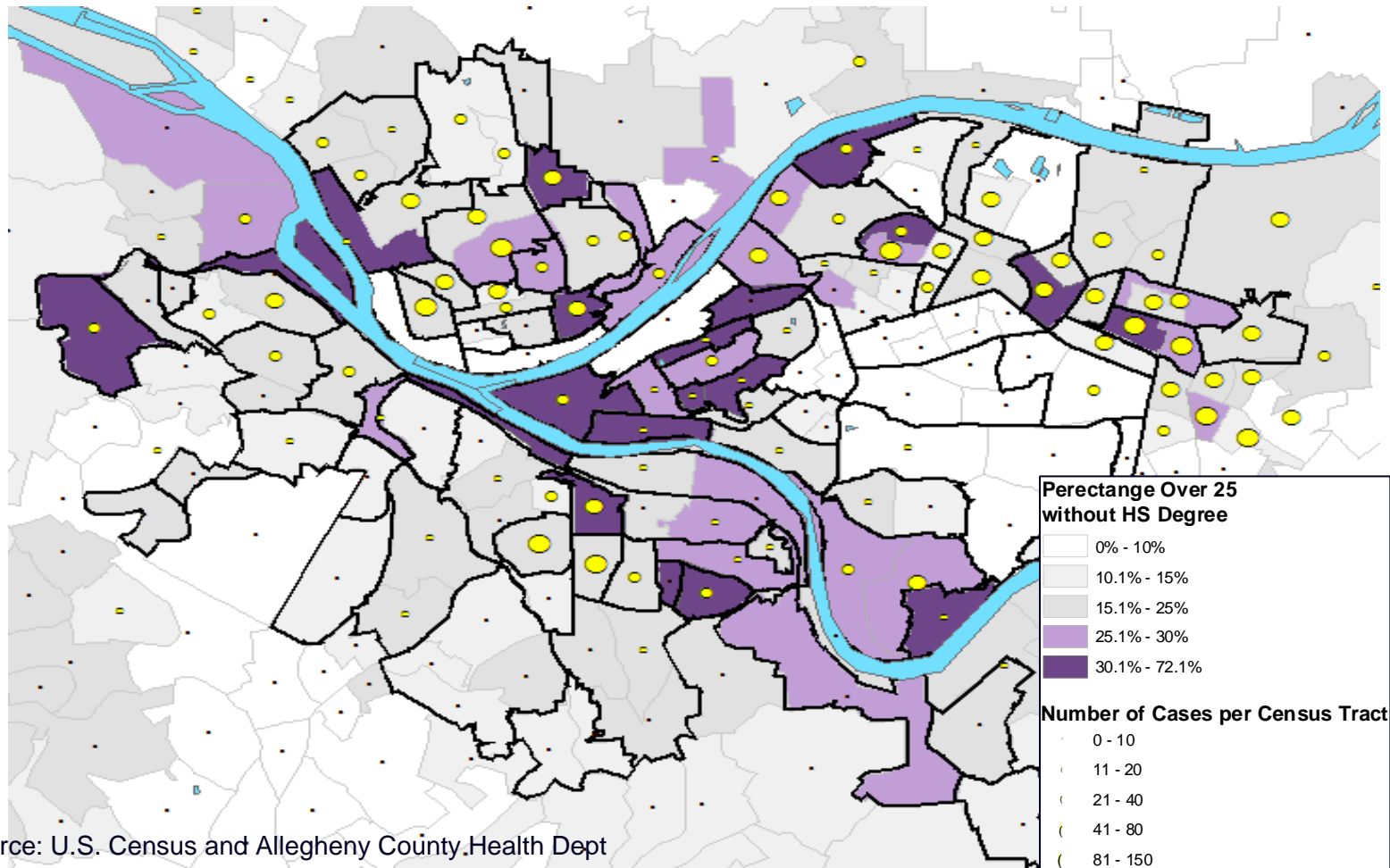


Source: U.S. Census, Allegheny County Health Dept, Pgh City Planning

Elevated Blood Level Cases Compared to Income

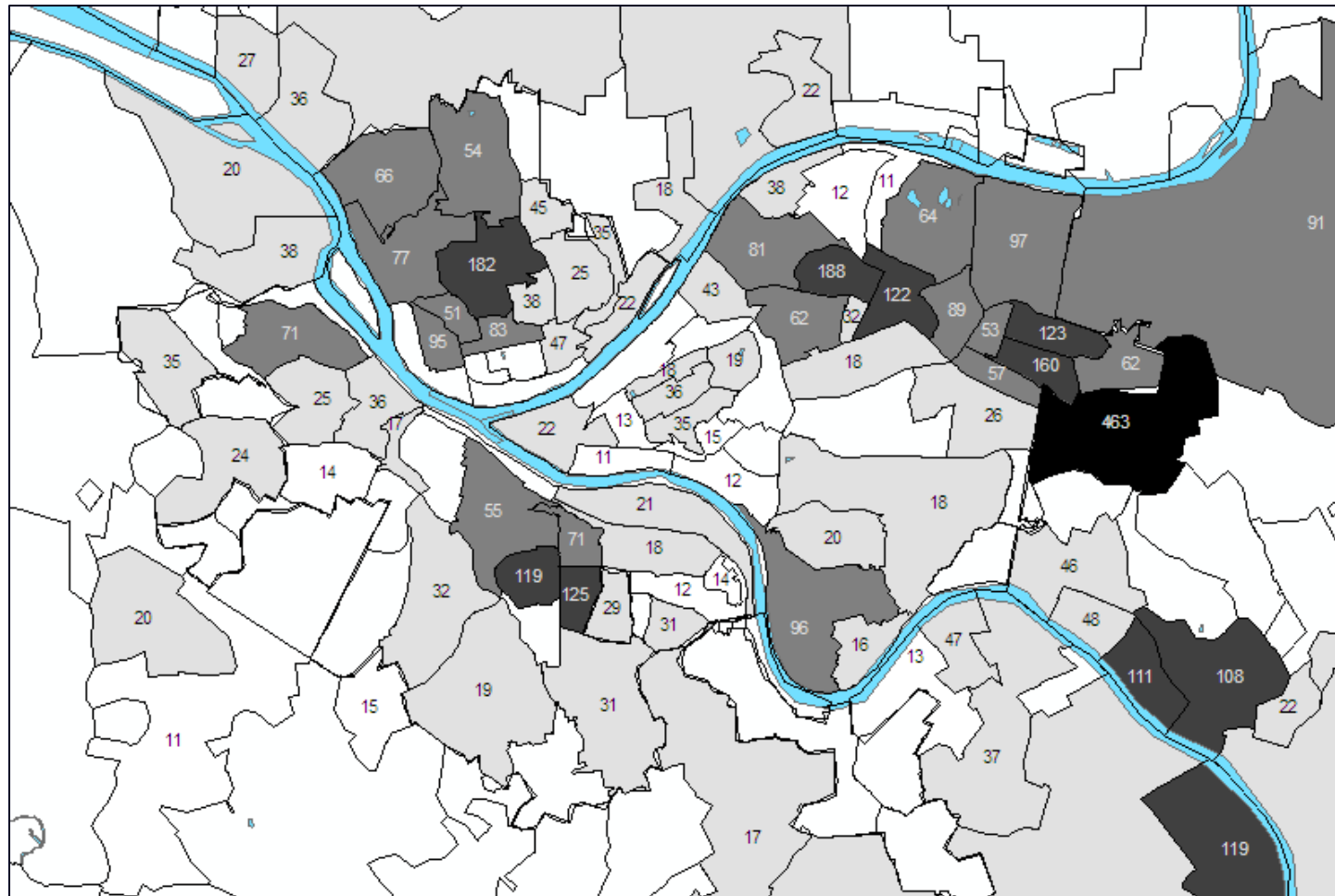


Elevated Blood Level Cases Compared to Educational Attainment



Source: U.S. Census and Allegheny County Health Dept

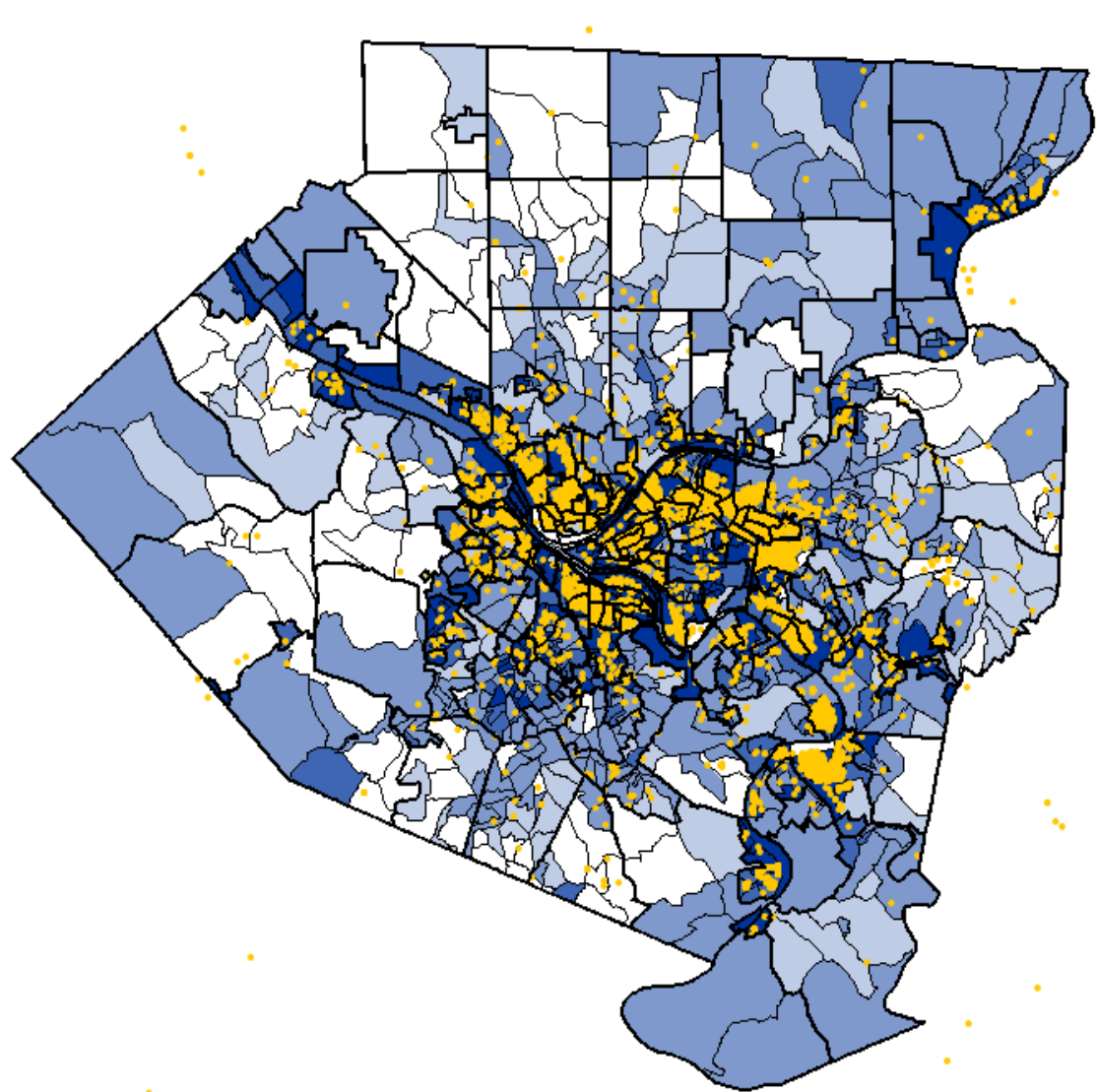
Elevated Blood Level Cases Aggregated to Neighborhoods





Layers

- MuniNeigh
 -
- Cases
 -
- Year Structure Built By Block Group
 - Less than 1940
 - 1940 - 1950
 - 1950 - 1960
 - 1960 - 1970
 - 1970 - 1996
- IncomeByBlockGroup
 - Less than \$15,000
 - \$15,000 - \$30,000
 - \$30,000 - \$45,000
 - \$45,000 - \$60,000
 - \$60,000 - \$75,000
 - \$75,000 - \$150,000
 - 150000 - 200001
- % Population Over 25 With a HS Degree
 - Less than 50%
 - 50% - 60%
 - 60% - 70%
 - 70% - 80%
 - 80% - 90%
 - 90% - 100%
- Number of Renter Occupied Units per Census Blo
 - Less than 10
 - 10 - 50
 - 50 - 125
 - 125 - 250
 - 250 - 529
- Population Under 18 By Census Tract
 - Less than 200





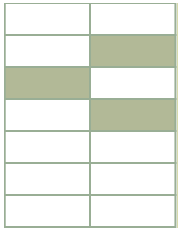
**Weight Management Clinic
Director/Staff**



WMWC Recommendations

Parents can help their children lead a healthier lifestyle by altering some common behaviors, such as:

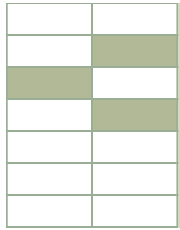
- **Fast food:** Limit fast food consumption to no more than once per week.
- **Sweet beverages:** Limit sweet beverage consumption (artificial fruit juice, regular soda, sports drinks, energy drinks and chocolate milk) to no more than one 8 oz. serving per day.
- **Media time:** Limit total media time (TV, Internet, video games) to no more than two hours per day.
- **Lack of family meals:** Have dinner together as a family at least three times per week.
- **Lack of “habitual” (usual) activity:** Encourage physically active “free time” activities such as walking, taking the stairs and playing sports with friends for at least 30 minutes a day.



WMWC Research Objective

To evaluate if the degree of pediatric obesity, assessed by BMI Z scores, is related to proximity to fast food restaurants or distance from parks

To determine if the effectiveness of treatment is related to the following: age, gender, race/ethnicity, number of follow up visits, and proximity to the center



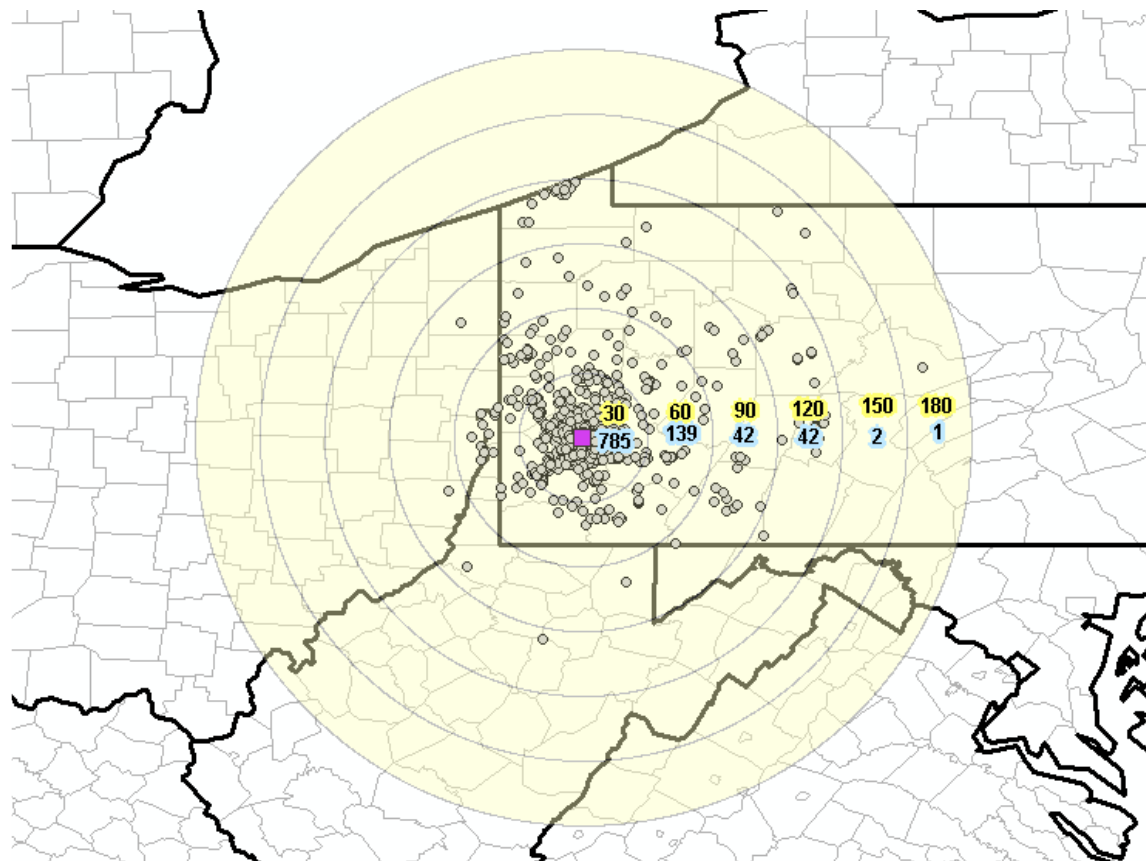
Design/Methods

- **1,014 patient addresses were mapped with GIS, and then overlaid with layers showing socioeconomic, political, school, and neighborhood districts, parks, and fast food.**
- **Distance buffers from the WMWC were created and overlaid with addresses and BMI Z score changes**

Proximity to Center Results

Proximity to the center was unrelated to likelihood of follow-up visits

Travel distances (miles) compared to number of patients (all)

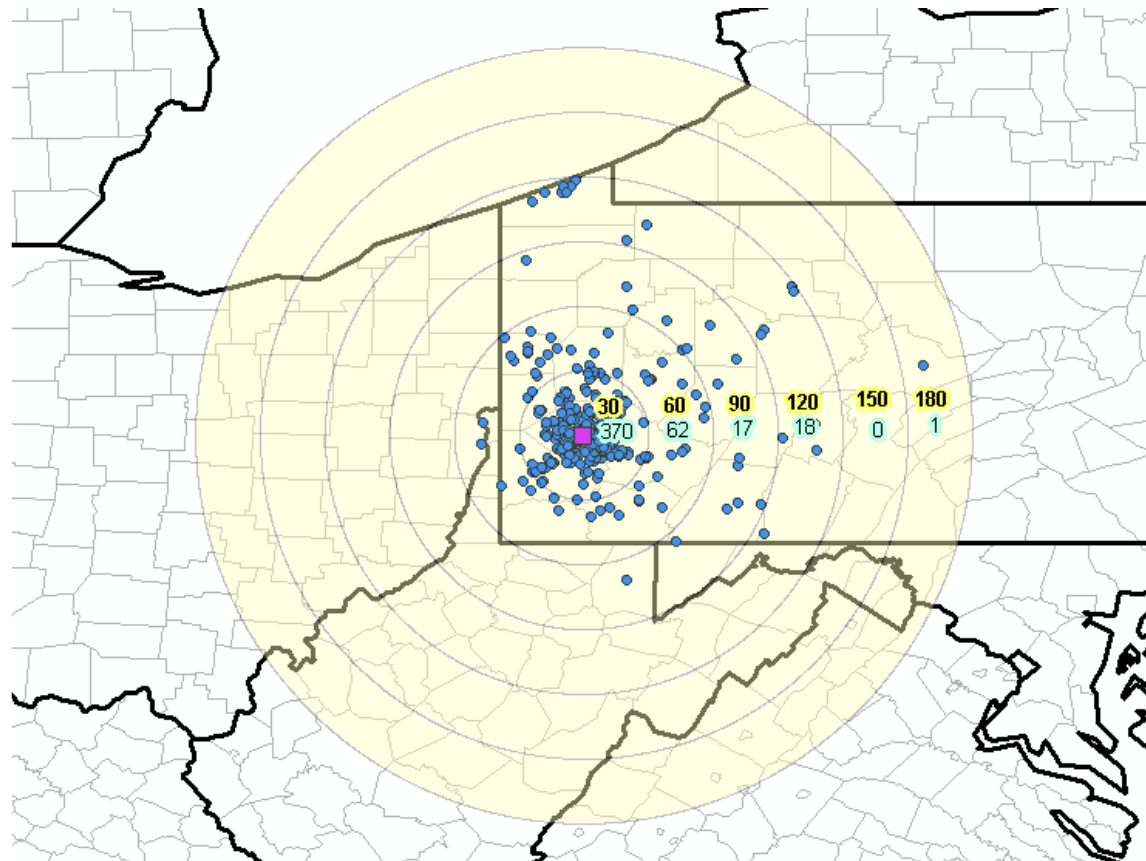


- -2.16 - -0.50
- -0.49 - 0.50
- 0.51 - 2.87

Proximity to Center Results

Proximity to the center was unrelated to likelihood of follow-up visits

Travel distances compared to number of patients with follow up visits

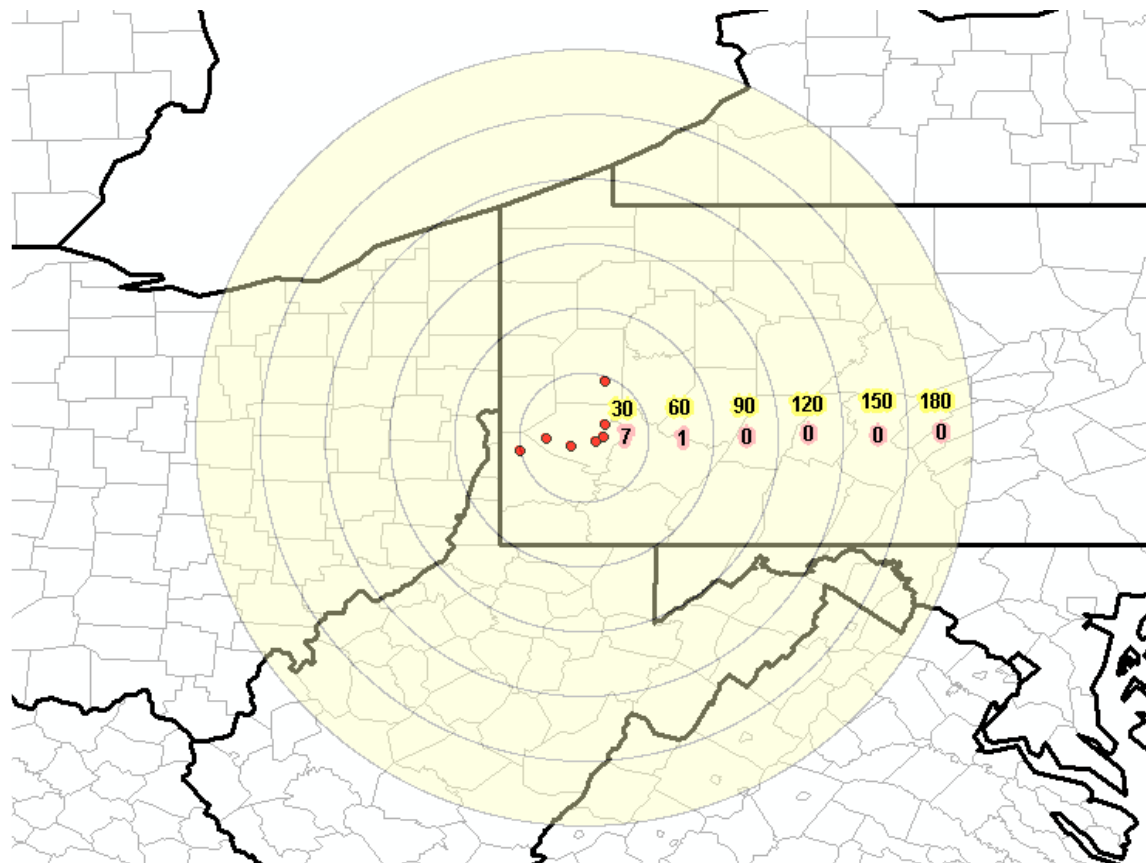


- -2.16 - -0.50
- -0.49 - 0.50
- 0.51 - 2.87

Proximity to Center Results

Proximity to the center was unrelated to success in BMI decreases

Travel distances: Z score change (.5 to 2.81) N= 8

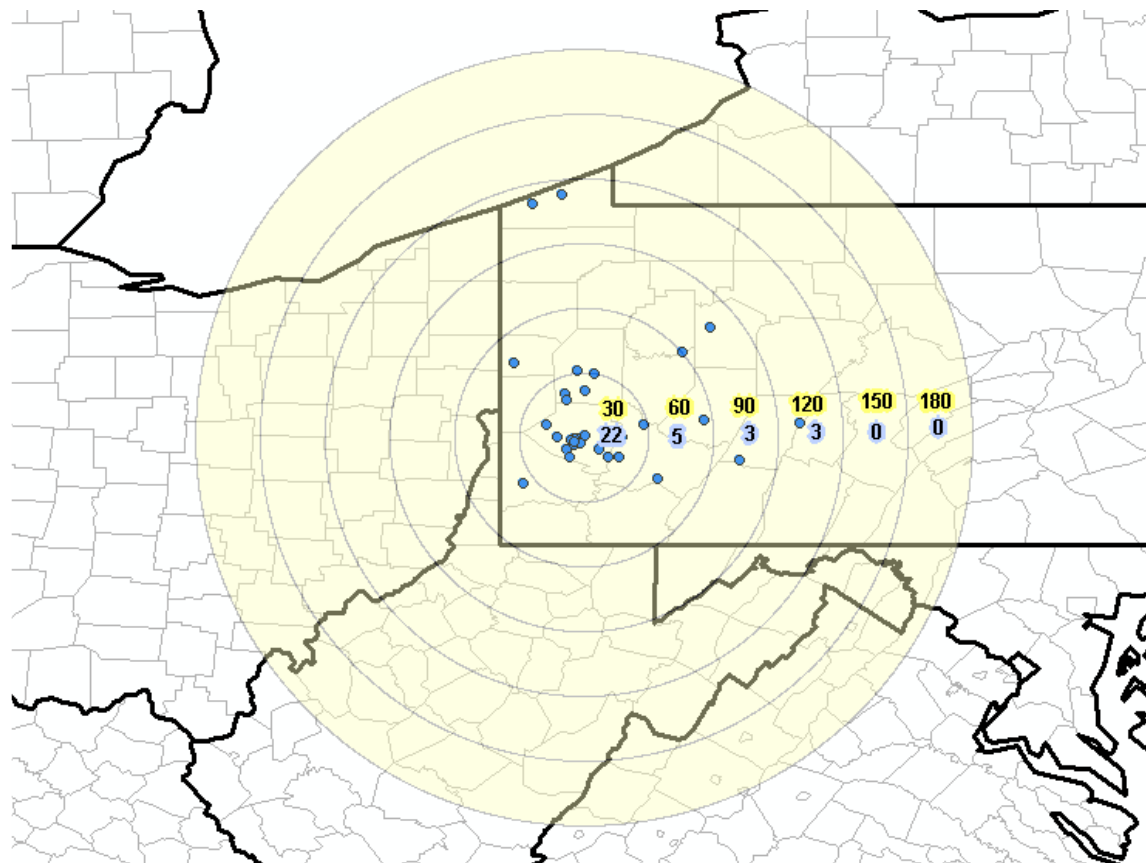


- -2.16 - -0.50
- -0.49 - 0.50
- 0.51 - 2.87

Proximity to Center Results

Proximity to the center was unrelated to success in BMI decreases

Travel distances : Z score change (-.5 to -2.16), N= 38

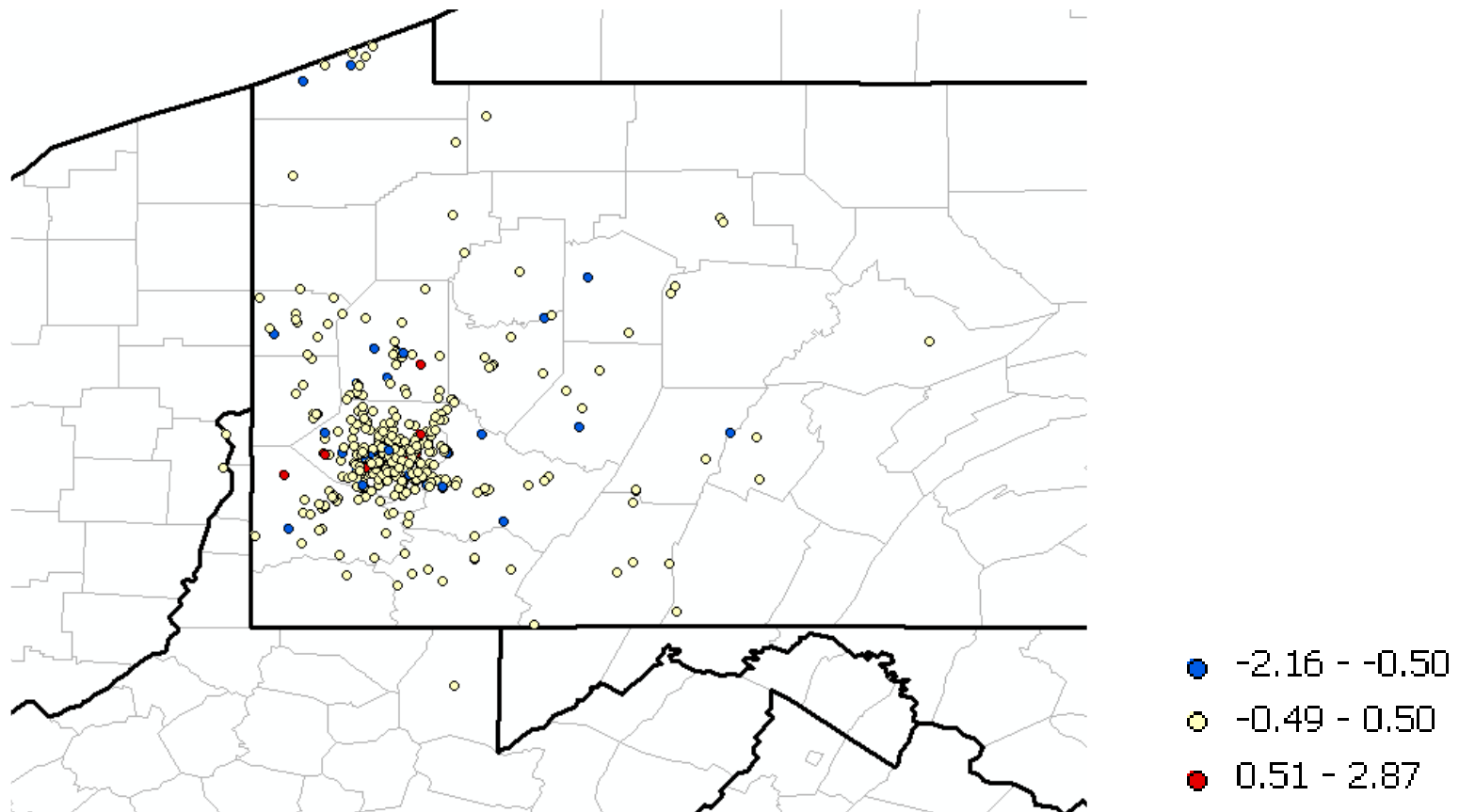


- -2.16 - -0.50
- -0.49 - 0.50
- 0.51 - 2.87

Follow Up Visit Results

Patients with more than 5 visits showed the most improvement

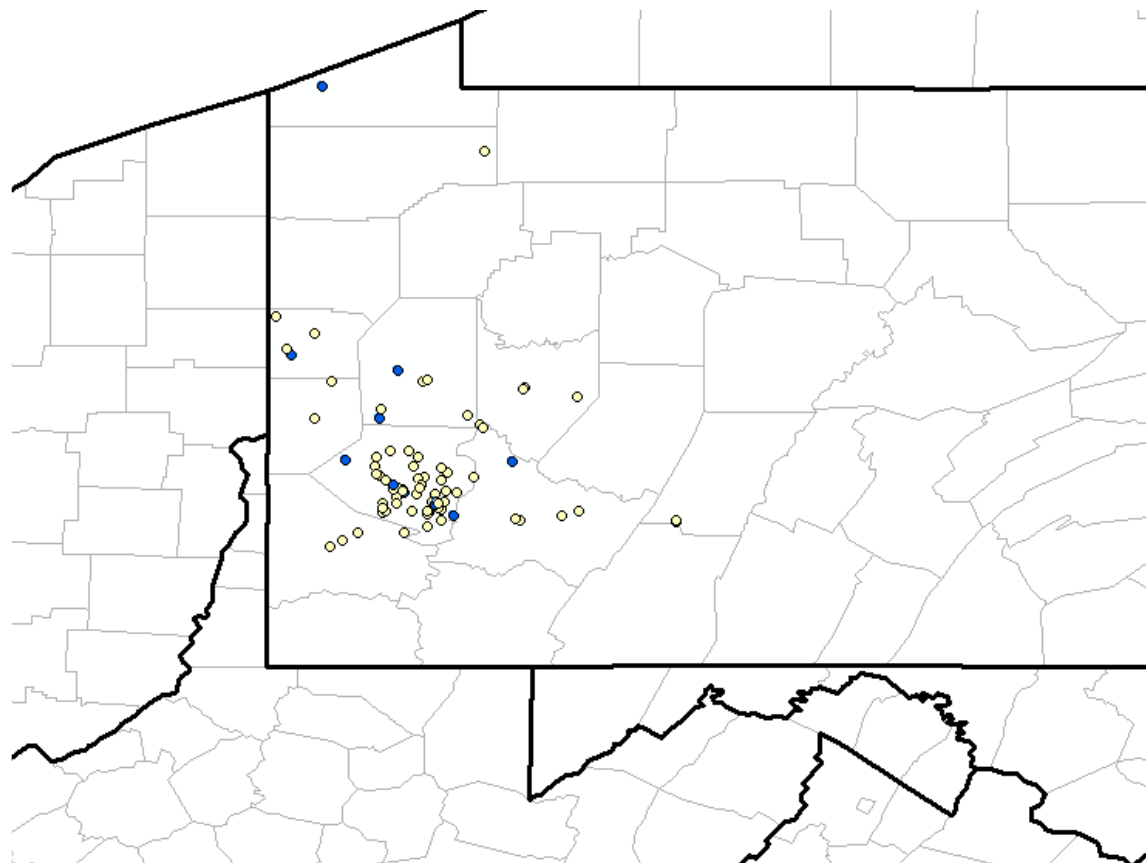
Z score changes: Patients with any follow up visits



Follow Up Visit Results

Patients with more than 5 visits showed the most improvement

Patients ≥ 5 follow up visits

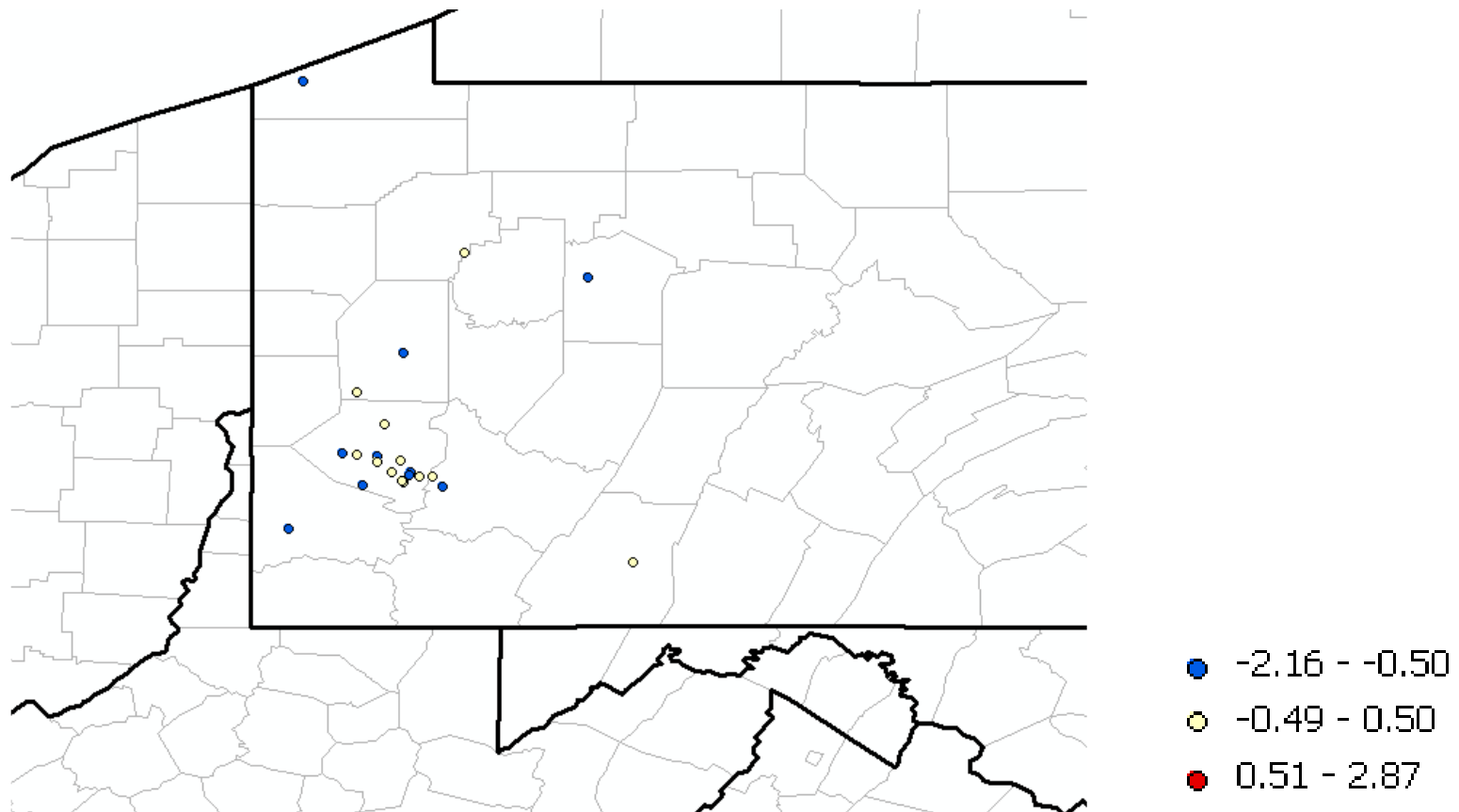


- -2.16 - -0.50
- -0.49 - 0.50
- 0.51 - 2.87

Age Results

Children < 5 years showed the highest mean change in a positive BMI Z score (most improved).

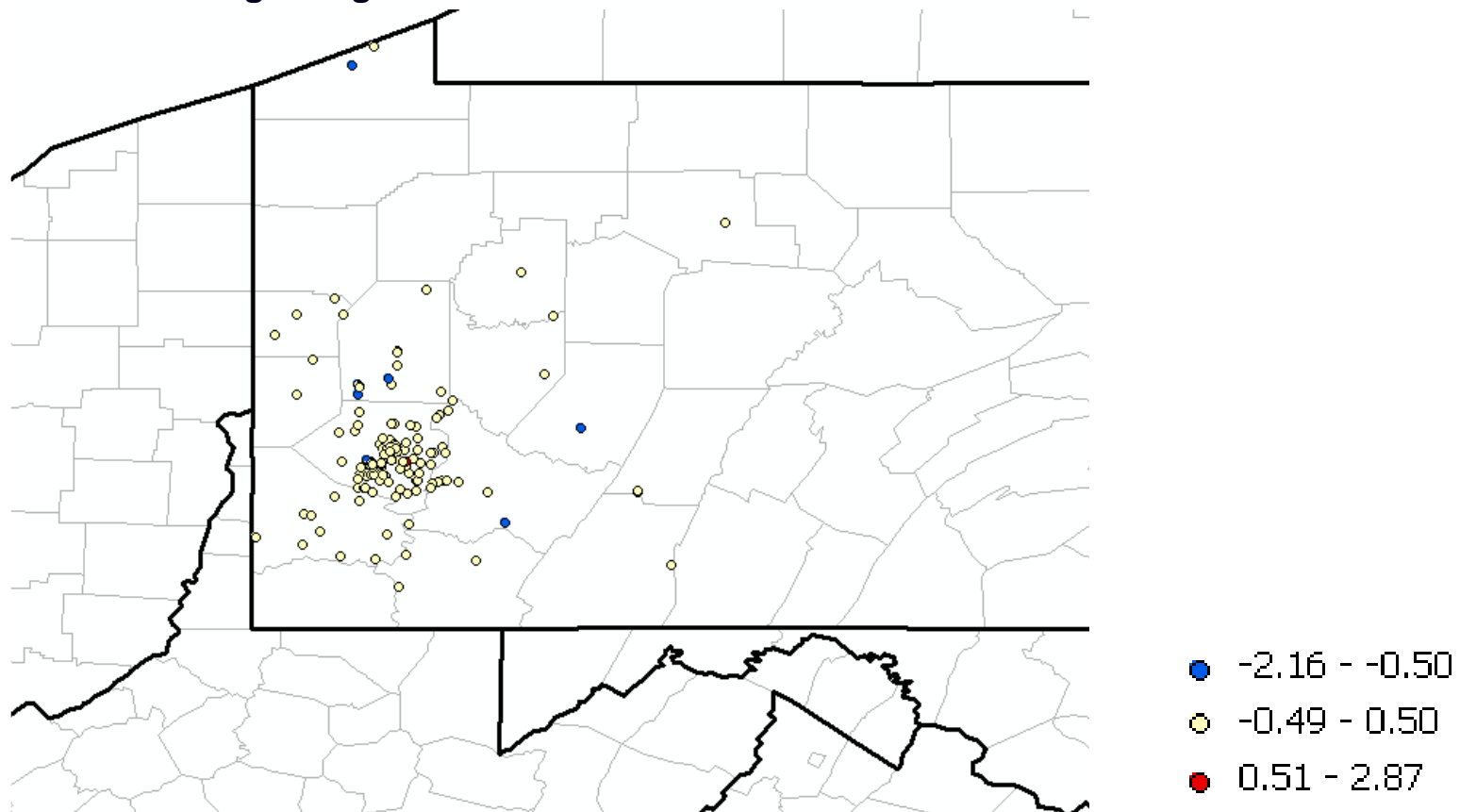
Z score changes: Age <=5



Age Results

The median baseline age of patients with highly improved BMI Z score changes (> -1.0) was 7.2 years

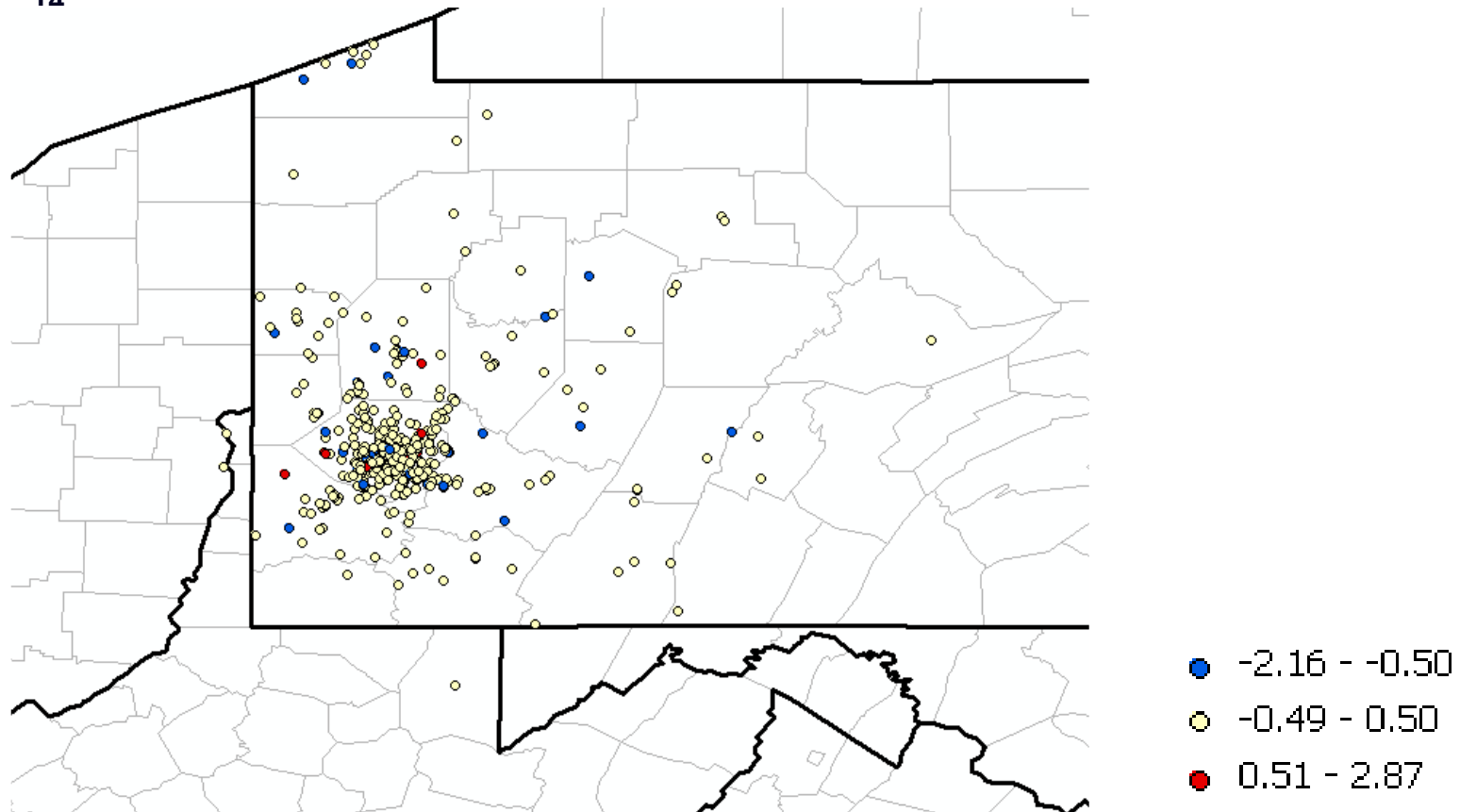
Z score changes: Ages > 5 and < 10



Age Results

The median baseline age of patients with highly negative BMI Z score changes (> 1.0 .) was 12.8 years

Z Score Changes: Ages > 10 and < 14



Parks and Fast Food Results

Of patients with moderate BMI decrease (Z score change > -0.5)

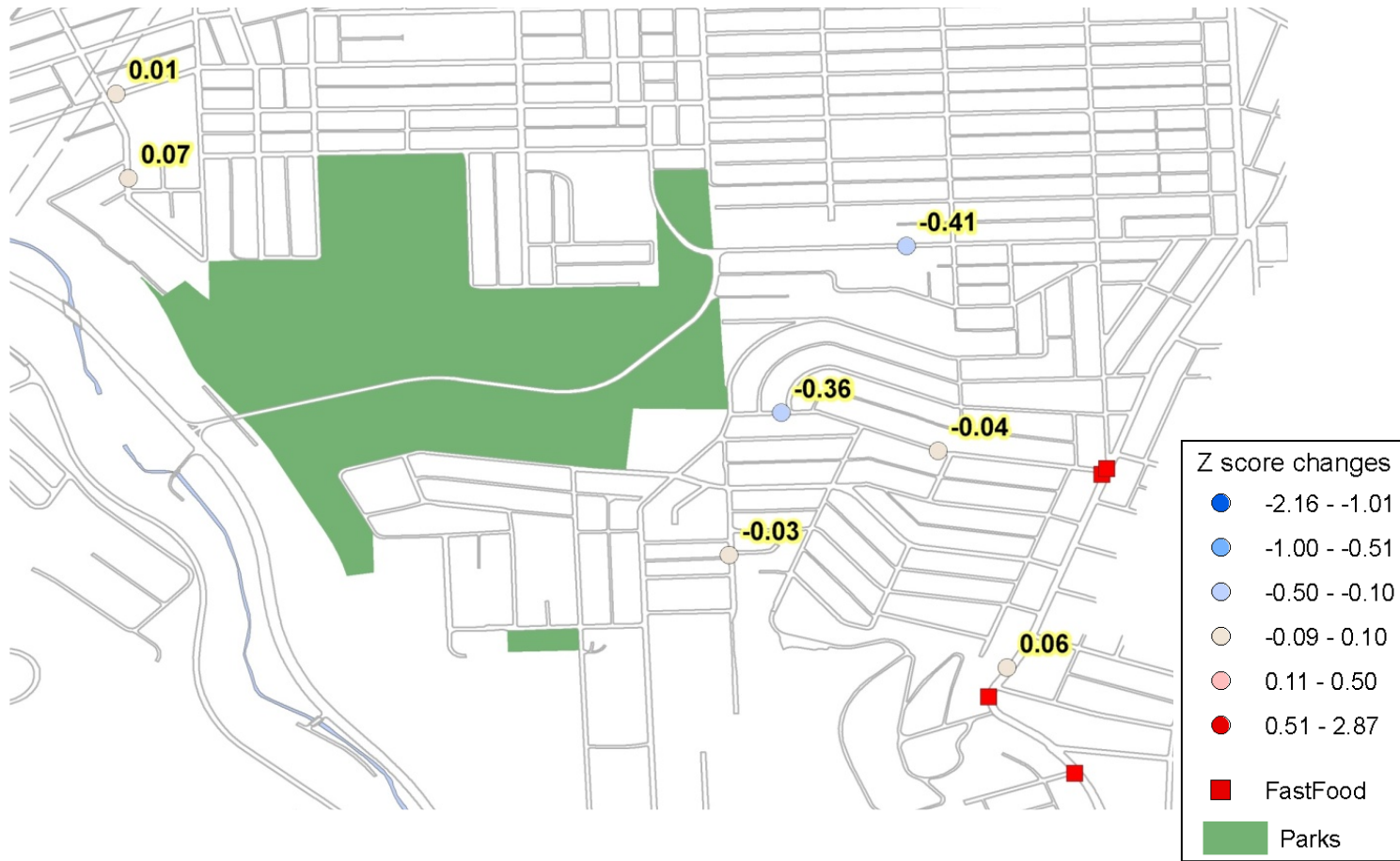
- **43.7% live within 1200 feet of a park**
- **56.3% farther than 1200 feet**
- **Mean distance to fast food is 1.1 miles.**

Of patients with moderate BMI increases (Z score change > 0.5)

- **16.7% live within 1200 feet of a park**
- **83.3% farther than 1200 feet**
- **Mean distance from fast food is .8 miles.**

Parks and Fast Food Results

Patient Locations Compared to Fast Food and Parks



Application of Geographic Information Systems (GIS) Mapping in a Pediatric Obesity Center

Kristen S Kurland, BA, Tamara S Hannon, MD, Goutham Rao, MD, Dana Rofey, PhD,
Fida Bacha, MD, Ingrid M Libman, MD PhD, and Silva Arslanian, MD

Weight Management & Wellness Center (WMWC), Children's Hospital of Pittsburgh and Carnegie Mellon University, Pittsburgh, PA, USA



Background

- Childhood obesity result and environmental causes
- GIS mapping can be used to correlate factors of obesity.
- We used GIS to investigate factors of obesity and whether proximity to fast food restaurants impacted upon the success of treatment.

What is GIS?

- Geographic Information Systems designed for the geographically referenced data.
- GIS uses advanced analytical tools to analyze the spatial relationships between cultural, biological, demographic, and physical phenomena.

Objectives

- 1) To evaluate if the degree of obesity assessed by BMI Z score is related to fast food restaurants.
- 2) To determine if the effect of treatment is related to the following: race/ethnicity, number of visits, and proximity to the treatment center.

Design/Methods

- Patient addresses (n=1,000) were mapped using GIS, and then overlaid with additional layers including neighborhood distribution, distance from treatment center, and overlaid with patient changes following treatment.

Results

- Proximity to Center**
 - Proximity to the center was associated with the likelihood of follow-up visits.
- Follow Up Visits**
 - Patients with more follow-up visits had more improvement (mean change = -0.07).

Patient Proximity to Center and Number of Follow-up Visits

Pennsylvania Median Household Income Compared to Z Score Changes

Results Continued



Patients whose BMI Z score (> -1.0) was 7.2 yrs, and those whose BMI Z score worsened.

Patients who showed the most improvement in response to therapy (-0.44.)

Income in U.S. Census block groups with highly obese patients (>-1.0) is \$43,198.

Income in U.S. Census block groups with highly obese patients (>-1.0) is \$46,134.

City Only, n=291
 Mean decrease (Z score) in BMI Z score within 600 feet of a fast food restaurant: 0-1,200 feet and 56.25%

Mean increase (Z score) in BMI Z score within 600 feet of a fast food restaurant: 0-1,200 feet, and 83.3% live

County Only, n=291
 Mean decrease (Z score) in BMI Z score within 600 feet of a fast food restaurant: 0-1,200 feet, and 83.3% live

Mean increase (Z score) in BMI Z score within 600 feet of a fast food restaurant: 0-1,200 feet, and 83.3% live

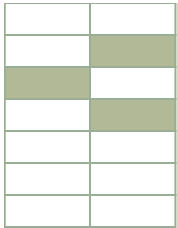
Genetic, sociocultural, and environmental factors assess environmental

Environmental determinants of obesity: diet, physical activity, and other factors have an impact upon

potential physical and environmental analysis of our patient population: park types and usage, sidewalk conditions (e.g. convenience, safety, crime and safety, wet conditions, lighting,



Other Examples?



Advanced GIS

Tools

- Desktop GIS Extensions (Spatial Analyst, Spatial Statistics, Network Analyst, etc.)

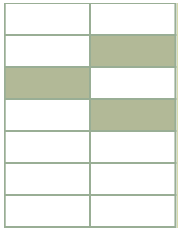
Pros

- Advanced spatial analysis
- Unique insight, investigations, and potential solutions

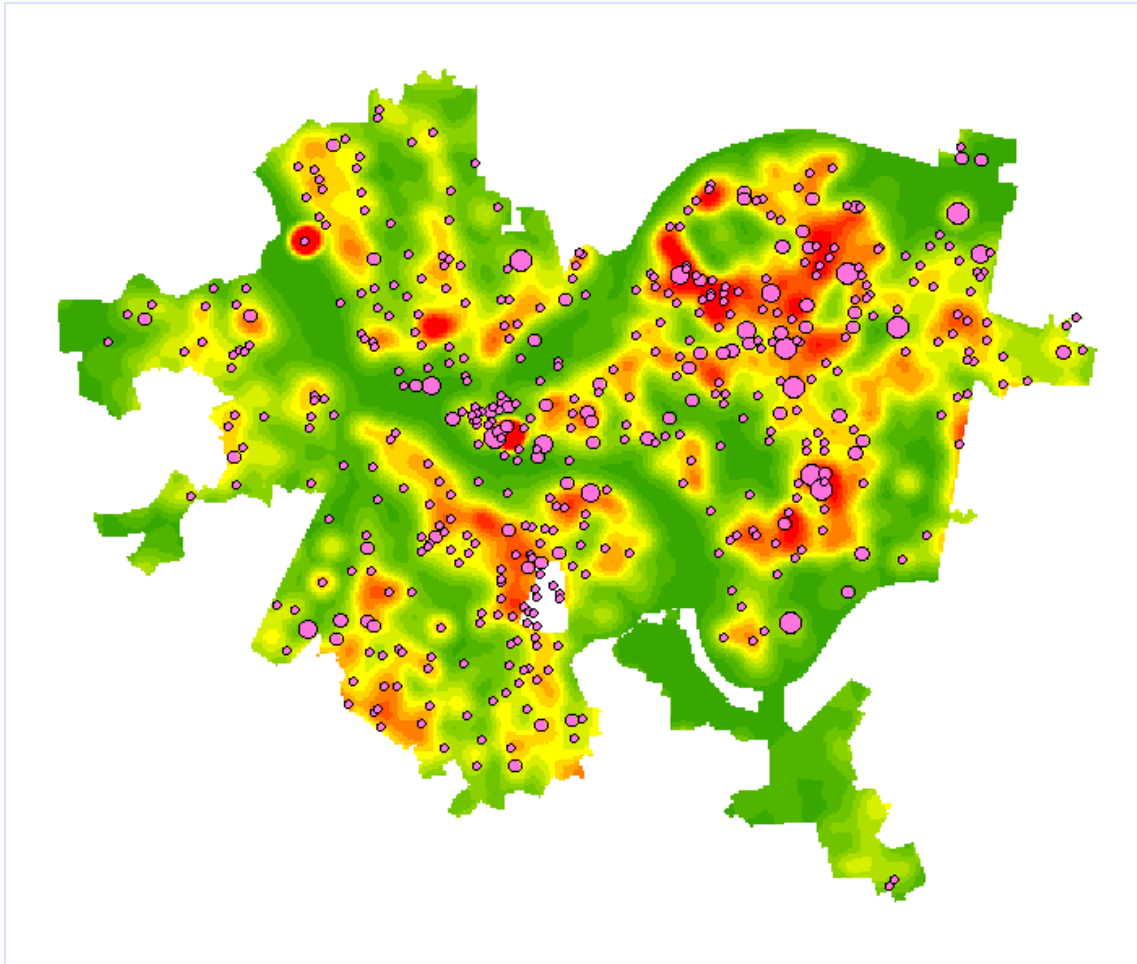
Cons

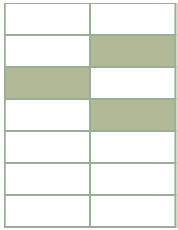
- Maps must be “published” (smaller audiences)
- Requires advanced desktop GIS training

Researcher Studying Heart Attacks



Heart attack density map

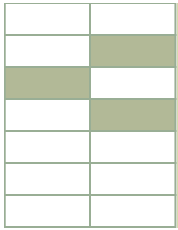




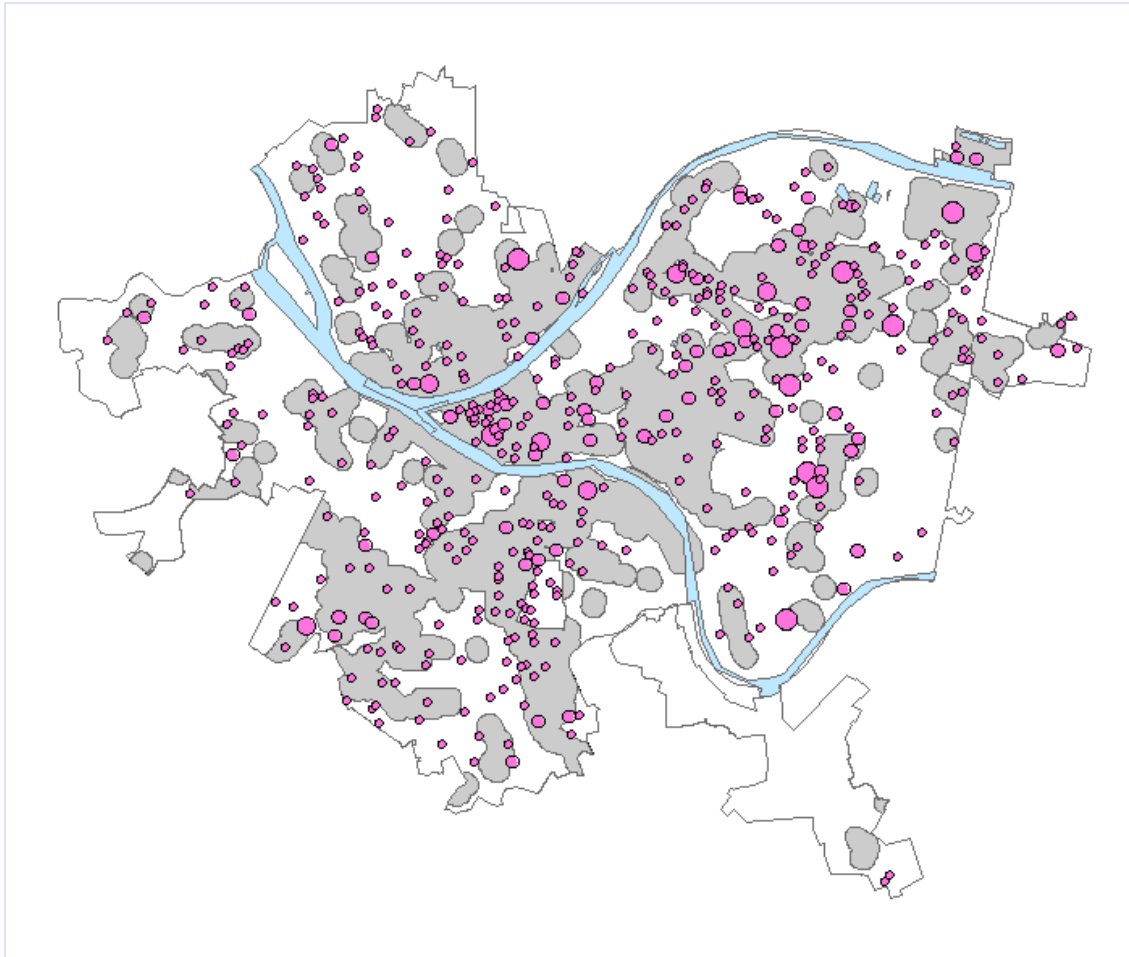
Site Suitability Study

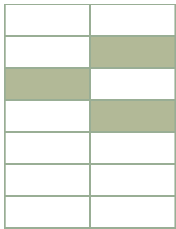
Query kernel density map for areas that are commercially zoned and have high density and merit a defibrillator

- Commercial area
- 25 block area
- 10 or more heart attacks every 5 years in locations where bystander help is possible

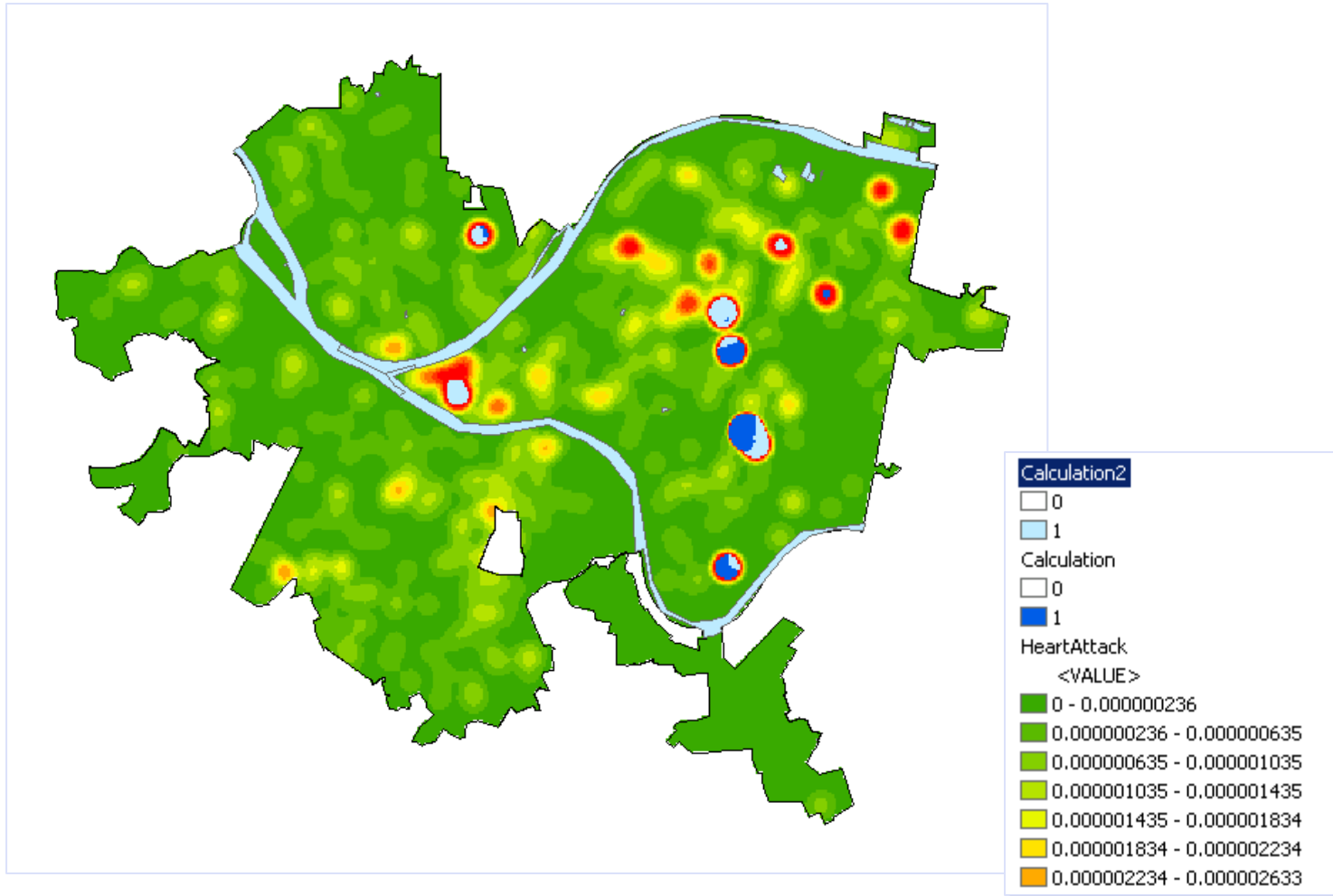


Site Suitability Study

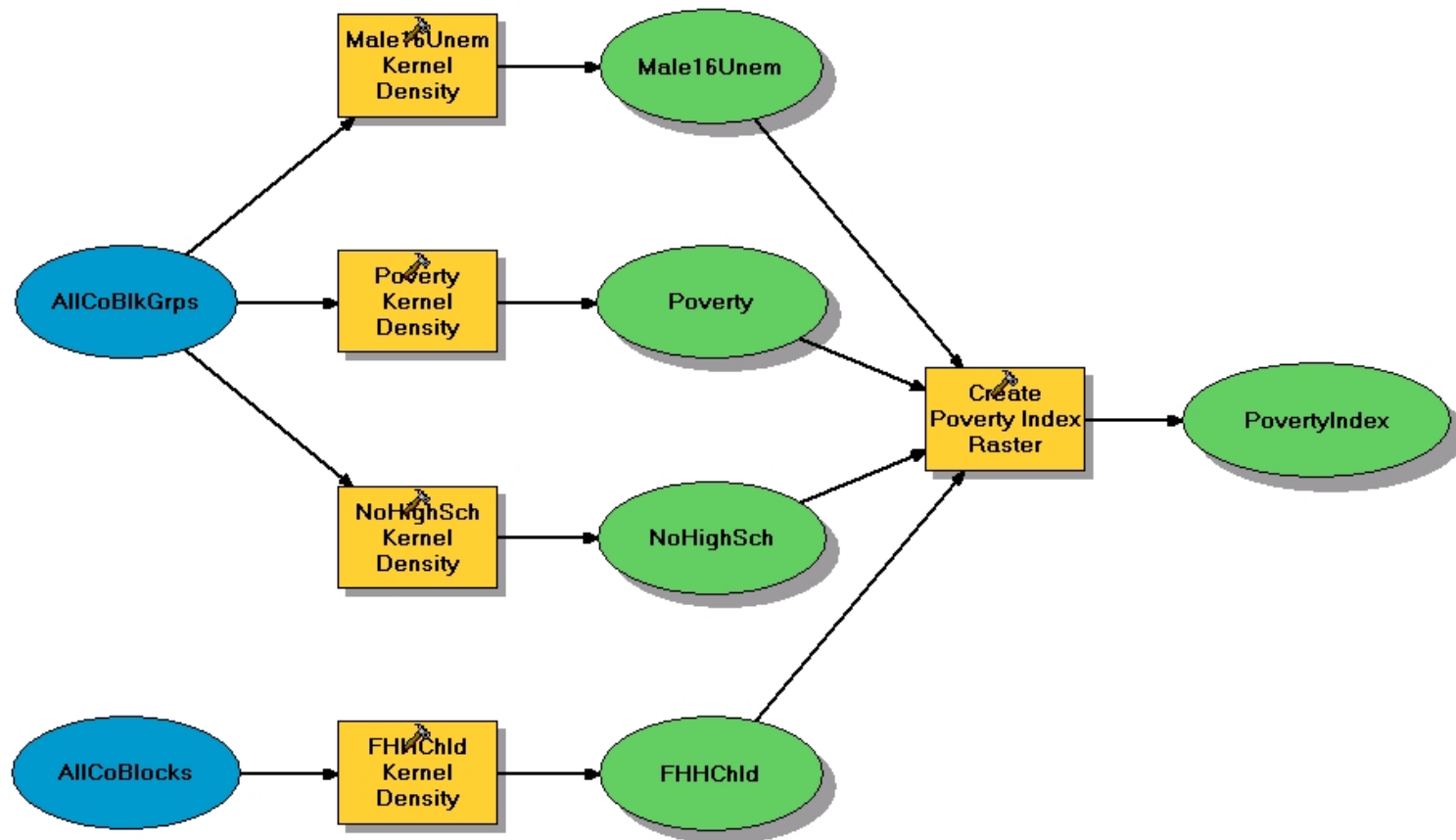


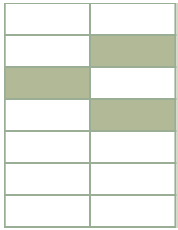


Compound Query Result

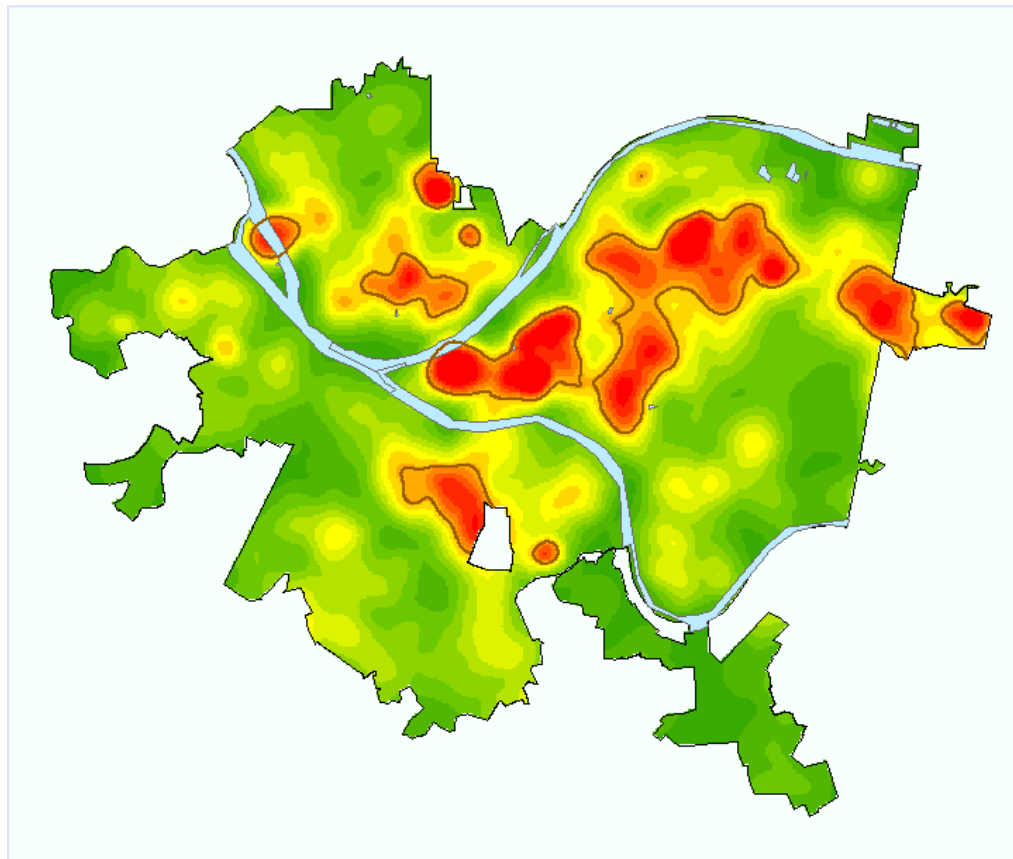


Poverty Index Model



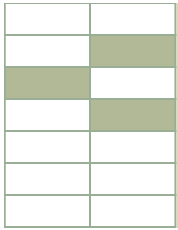


Poverty Contour Map



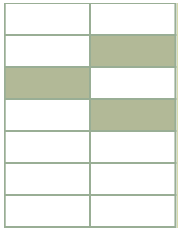


Other Examples?



Keys to Success

- **Understand application capabilities and limits**
- **Proper budget for project**
- **Provide resources for staff**
- **Develop collaborations**
- **Others?**



Thank You!

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