# Geographic Information System (GIS) Mapping of Injury

Wendy J Pomerantz, MD, MS
Division of Emergency Medicine,
Cincinnati Children's Hospital, Cincinnati, OH

# Disclosure

- I have no relevant financial relationships with the manufacturer(s) of any commercial product(s) and/or provider(s) of commercial services discussed in this CME activity

# Objectives

- What is GIS?
- Why apply GIS to injury control?
- GIS for injury control
- GIS: Important considerations
- Practical applications

# What is GIS?

- An information system designed to allow visualization of spatial or geographical data
- Part of surveillance: the ongoing systematic collection, analysis, interpretation, and dissemination of health data
  - Monitor health events/detect trends
  - Allows for better decision making and setting priorities
  - Assist in storytelling and improved communication
  - Plan and implement programs
  - Evaluate programs

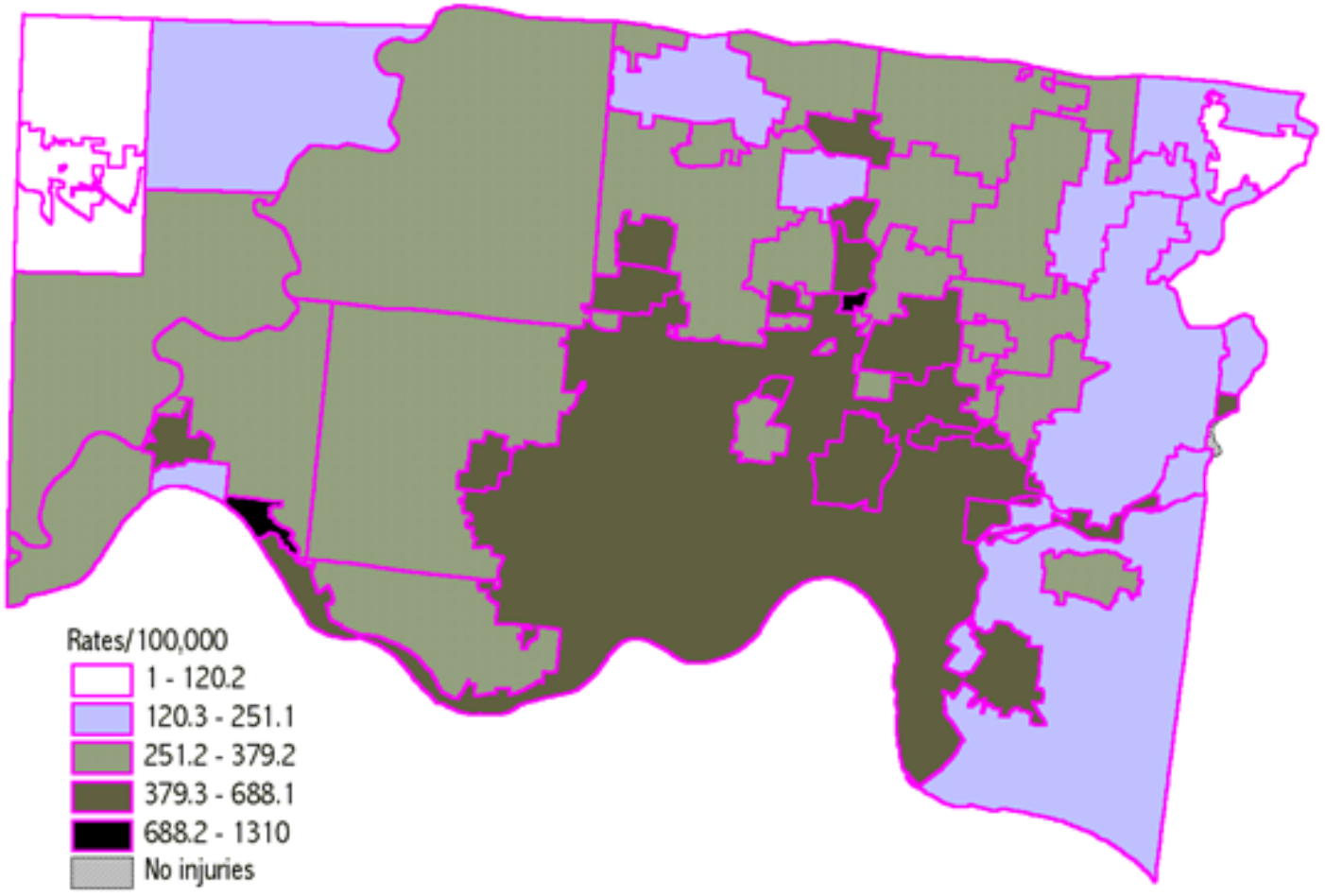
# Why a Map??

A domesticated canine mammal related to foxes and wolves

# Injury Rates by Jurisdiction

| JURISDICT | COUNT | TOTPOP | injrate |
|---|---|---|---|
| ADDYSTON | 11 | 342 | 1072.1 |
| AMBERLY VILLAGE | 6 | 485 | 412.4 |
| ANDERSON TWP | 62 | 9996 | 230.1 |
| ARLINGTON HEIGHTS | 9 | 229 | 1310.0 |
| BLUE ASH | 20 | 2424 | 275.0 |
| CHEVIOT | 25 | 1939 | 429.8 |
| CITY OF CINCINNATI | 1398 | 78972 | 590.1 |
| CLEVES | 10 | 532 | 626.6 |
| COLERAIN TWP | 111 | 13647 | 271.1 |
| COLUMBIA TWP | 11 | 902 | 406.5 |
| CROSBY TWP | 4 | 681 | 195.8 |
| DEER PARK | 12 | 1091 | 366.6 |
| DELHI TWP | 61 | 7393 | 275.0 |
| ELMWOOD PLACE | 11 | 759 | 483.1 |
| EVENDALE | 8 | 808 | 330.0 |
| FAIRFAX | 6 | 410 | 487.8 |
| FOREST PARK | 33 | 4381 | 251.1 |
| GLENDALE | 9 | 436 | 688.1 |
| GOLF MANOR | 10 | 888 | 375.4 |
| GREEN TWP | 110 | 11116 | 329.9 |
| GREENHILLS | 8 | 1006 | 265.1 |
| HARRISON | 4 | 2178 | 61.2 |
| HARRISON TWP | 1 | 1124 | 29.7 |
| INDIAN HILL | 6 | 1081 | 185.0 |
| LINCOLN HEIGHTS | 23 | 1363 | 562.5 |
| LOCKLAND | 16 | 956 | 557.9 |
| LOVELAND | 8 | 2218 | 120.2 |
| MADEIRA | 19 | 2150 | 294.6 |
| MARIEMONT | 4 | 539 | 247.4 |
| MIAMI TWP | 19 | 1920 | 329.9 |
| MILFORD | 0 | 0 | 0.0 |
| MONTGOMERY | 11 | 2051 | 178.8 |
| MOUNT HEALTHY | 19 | 1609 | 393.6 |
| NEWTOWN | 3 | 352 | 284.1 |
| NORTH BEND | 1 | 144 | 231.5 |
| NORTH COLLEGE HILL | 29 | 2327 | 415.4 |
| NORWOOD | 89 | 5124 | 579.0 |
| READING | 24 | 2273 | 352.0 |
| SAINT BERNARD | 10 | 1089 | 306.1 |
| SHARONVILLE | 18 | 2033 | 295.1 |
| SILVERTON | 10 | 967 | 344.7 |
| SPRINGDALE | 17 | 1996 | 283.9 |
| SPRINGFIELD TWP | 75 | 8733 | 286.3 |
| SYCAMORE TWP | 31 | 3673 | 281.3 |
| SYMMES TWP | 20 | 3129 | 213.1 |
| TERRACE PARK | 3 | 557 | 179.5 |
| WHITEWATER TWP | 12 | 1193 | 335.3 |
| WOODLAWN | 3 | 494 | 202.4 |
| WYOMING | 19 | 1670 | 379.2 |

# Injury Map


Rates/100,000
1 - 120.2
120.3 - 251.1
251.2 - 379.2
379.3 - 688.1
688.2 - 1310
No injuries

# Why apply GIS to Injury Control?

- Planning for community-based programs
- Evaluation of programs
- Inspiring community members
- Motivating public leaders
- Allows ability to engage stakeholders

# GIS for Injury Control

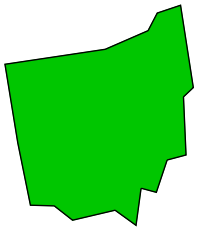
- What do you want to track?
- What are your data sources?
- How will you acquire the data?
- How will you assure data quality?
- How will you protect confidentiality?
- How will you analyze the data?
- How will you disseminate the data to stakeholders?

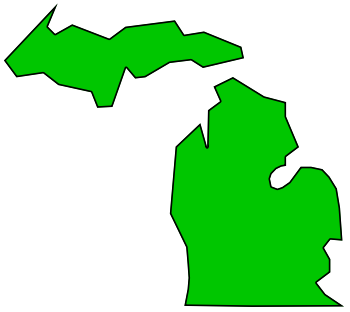
# GIS: Important Considerations

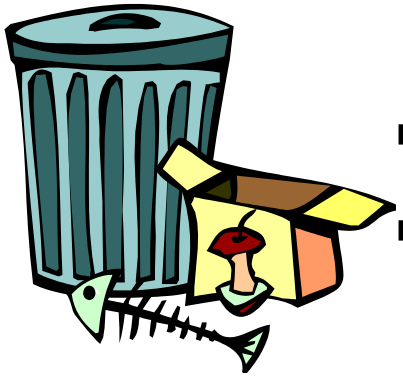
- Standard case definitions
- Location: place of injury versus residence
- Geographic unit of analysis
  - Zip codes? Block groups? Census tracts?
- Numerator issues
  - Serious injuries are statistically rare
- Denominator issues
  - Population density matters!

# Why Incidence Rates?

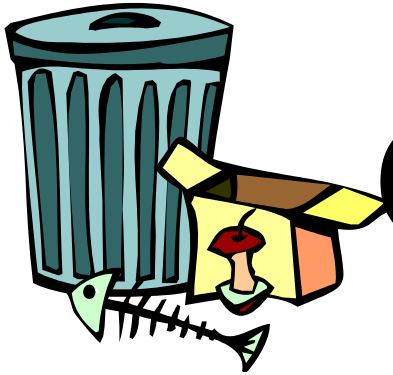
| | # injuries | population | incidence rate |
|---|---|---|---|
| Buckeye City | 100 | 100,000 | 100 per 100,000 |
| Wolverine Town | 250 | 500,000 | 50 per 100,000 |







**IN = OUT**



# Is your GIS Useful? Can it:

- Provide estimates of injury?
- Detect trends?
- Identify risk factors/markers for injury?
- Increase awareness of injury importance?
- Stimulate collaboration?
- Stimulate research?
- Evaluate effectivenss of programs?

# Practical Applications of GIS

- CAGIS
- Hamilton County Injury Surveillance System (HCISS)
- Children's Hospital data
- Place of Injury vs. address
- Program planning
- Picking an intervention area
- Limitations

# Cincinnati Area Geographic Information Systems--CAGIS

- Hamilton County
- Background maps
  - Census tracts
  - Townships
  - Zip codes
  - Streets
  - Addresses
  - Etc.

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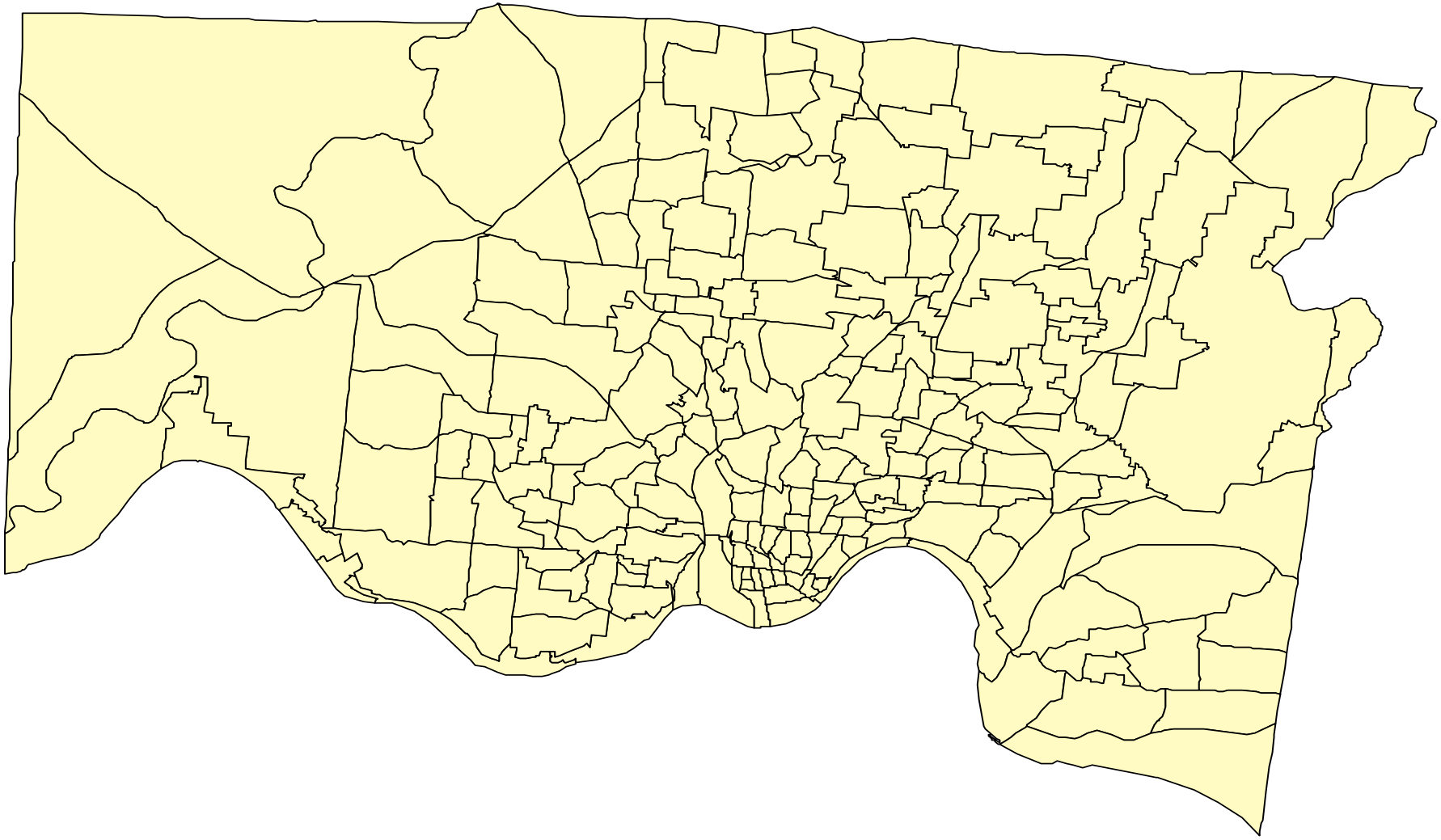
# Hamilton County Census Tracts



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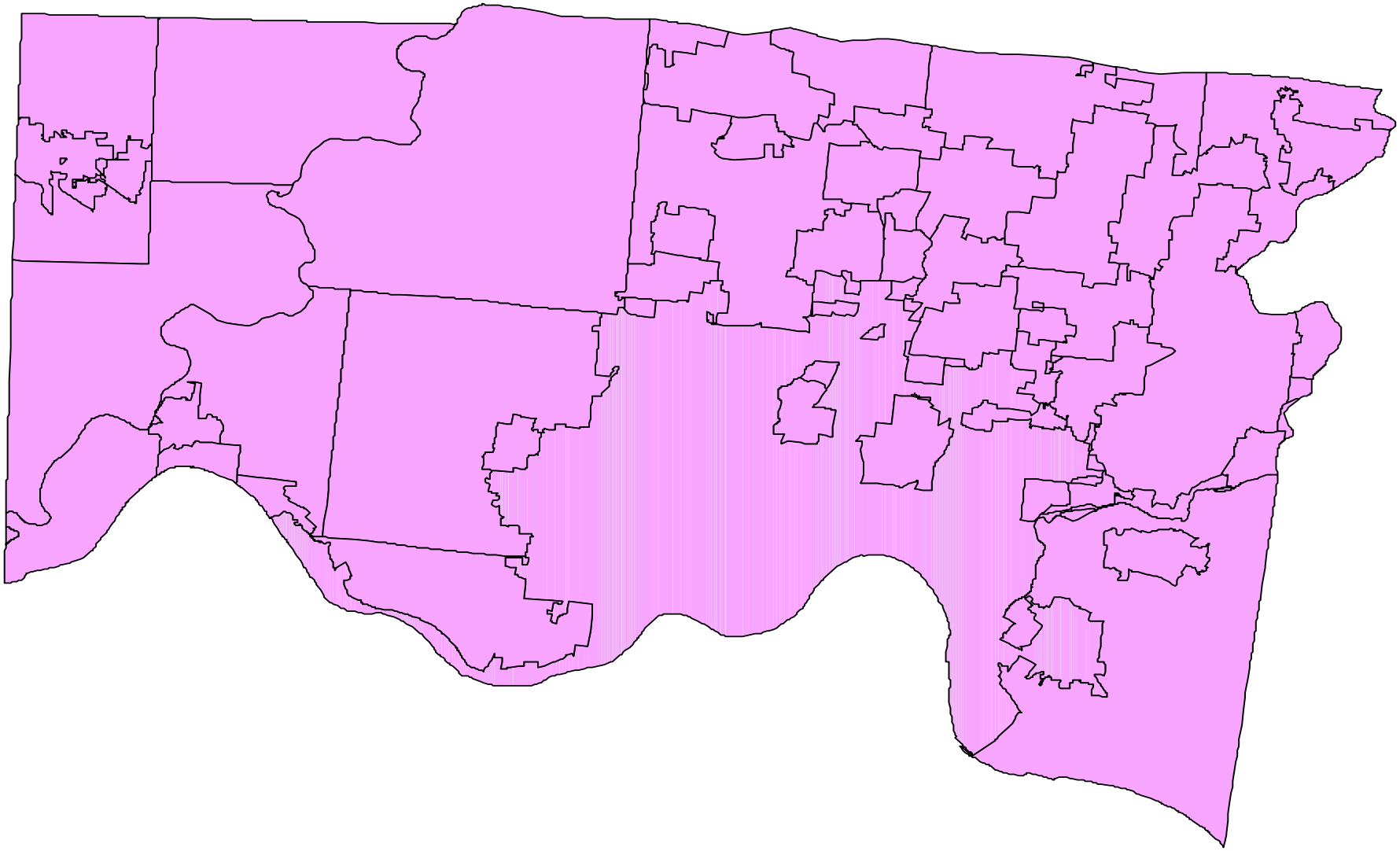
# Hamilton County Townships



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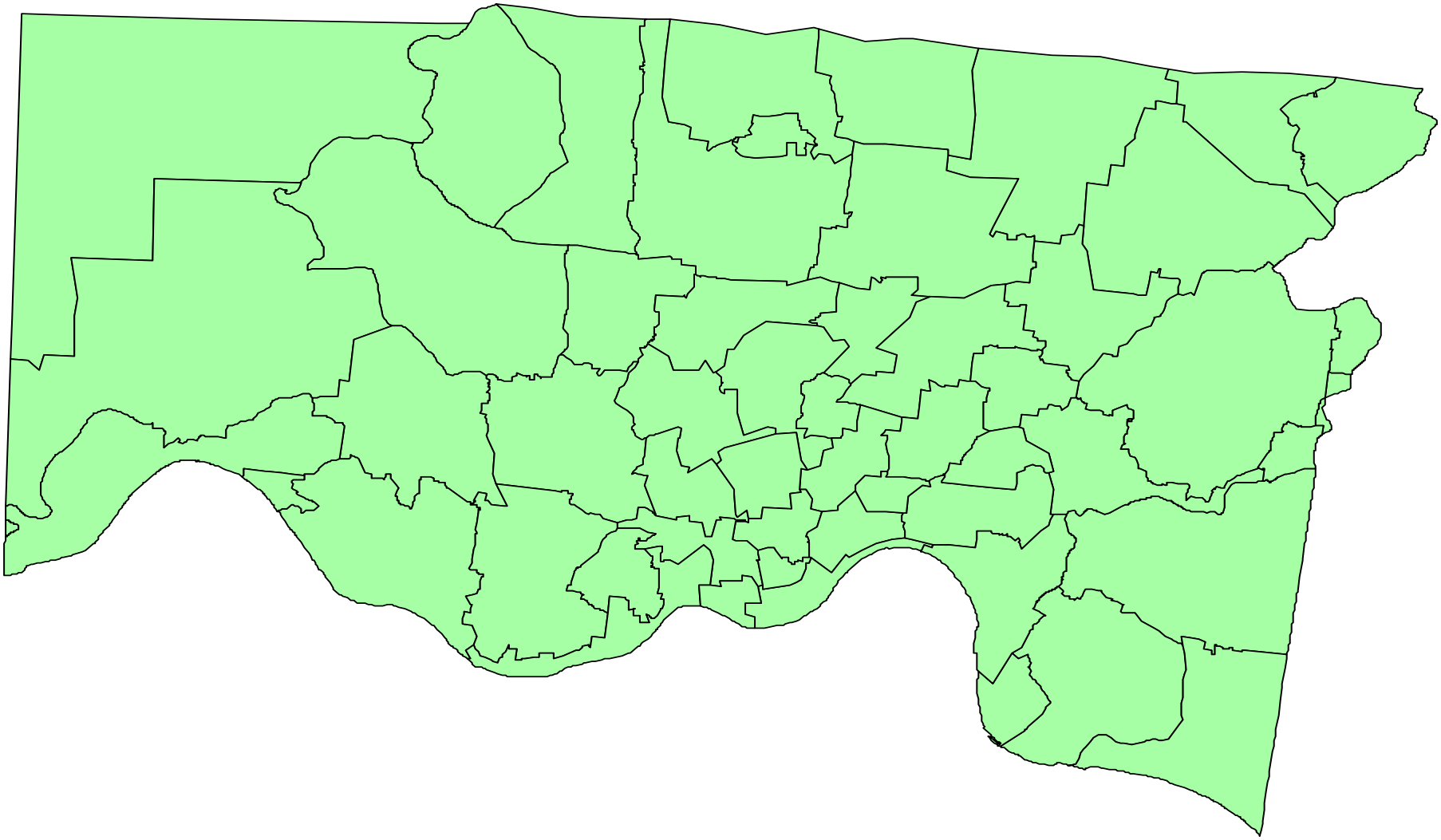
# Hamilton County Zip Codes



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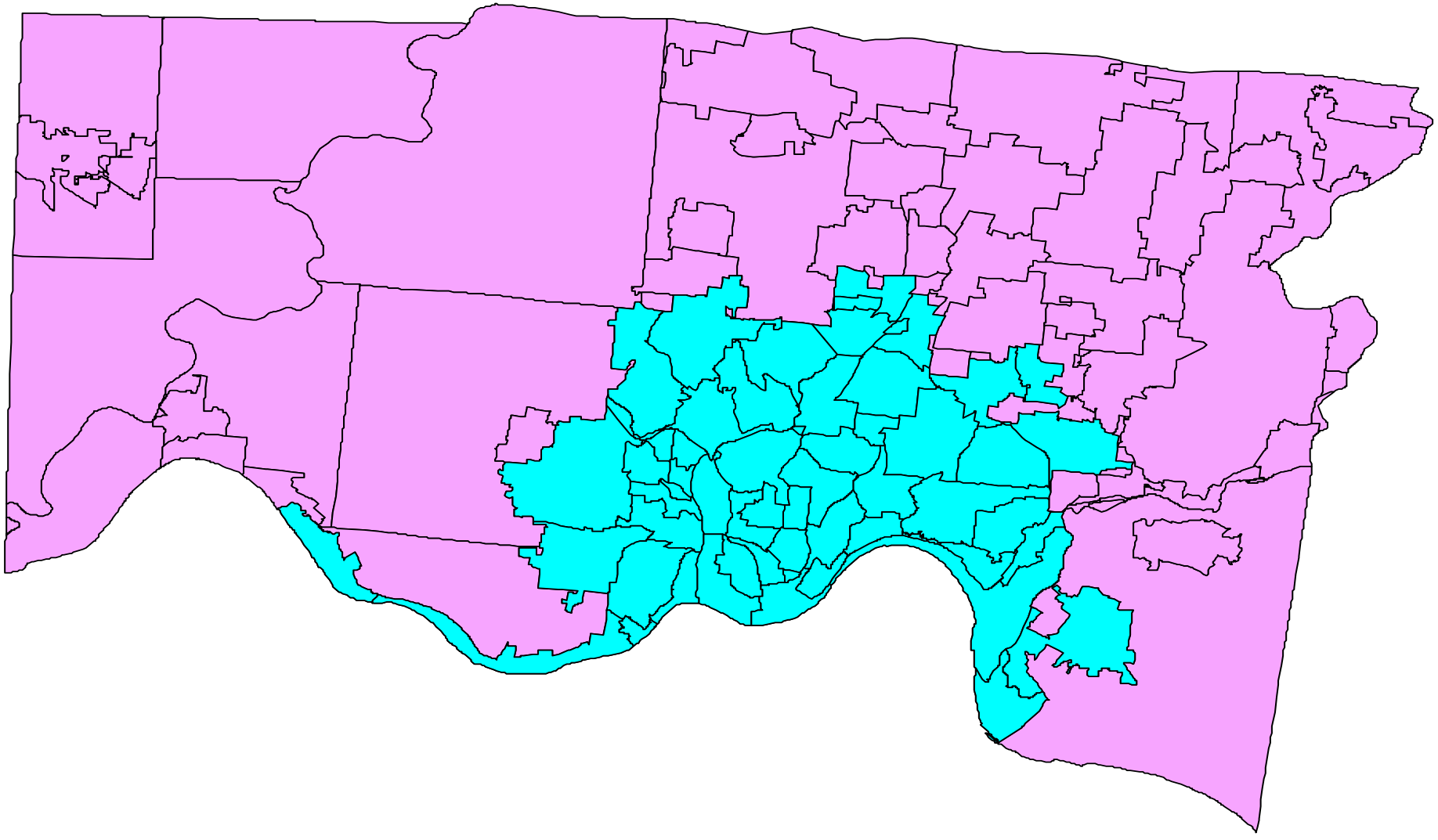
# Cincinnati Neighborhoods



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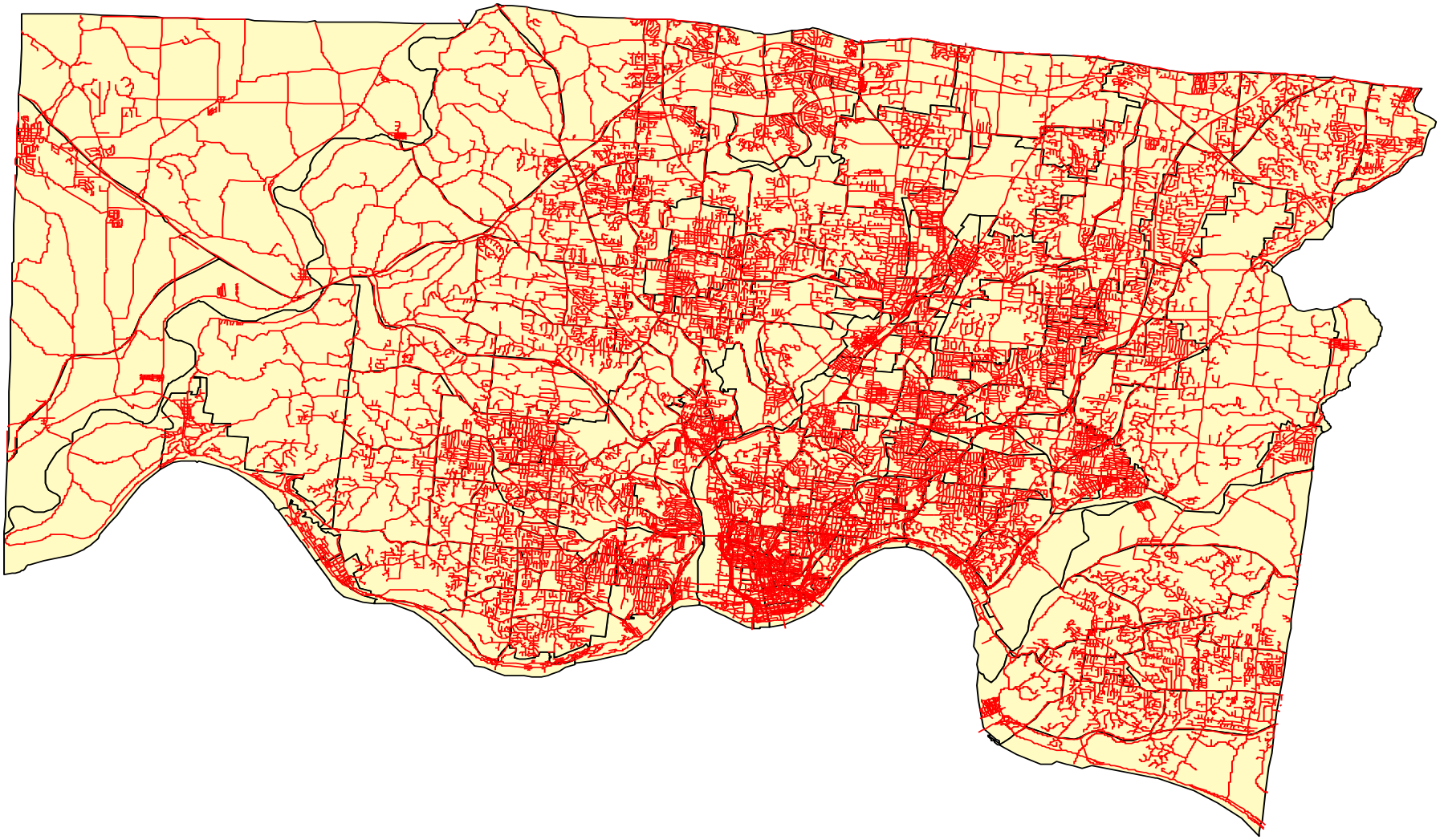
# Hamilton County Streets



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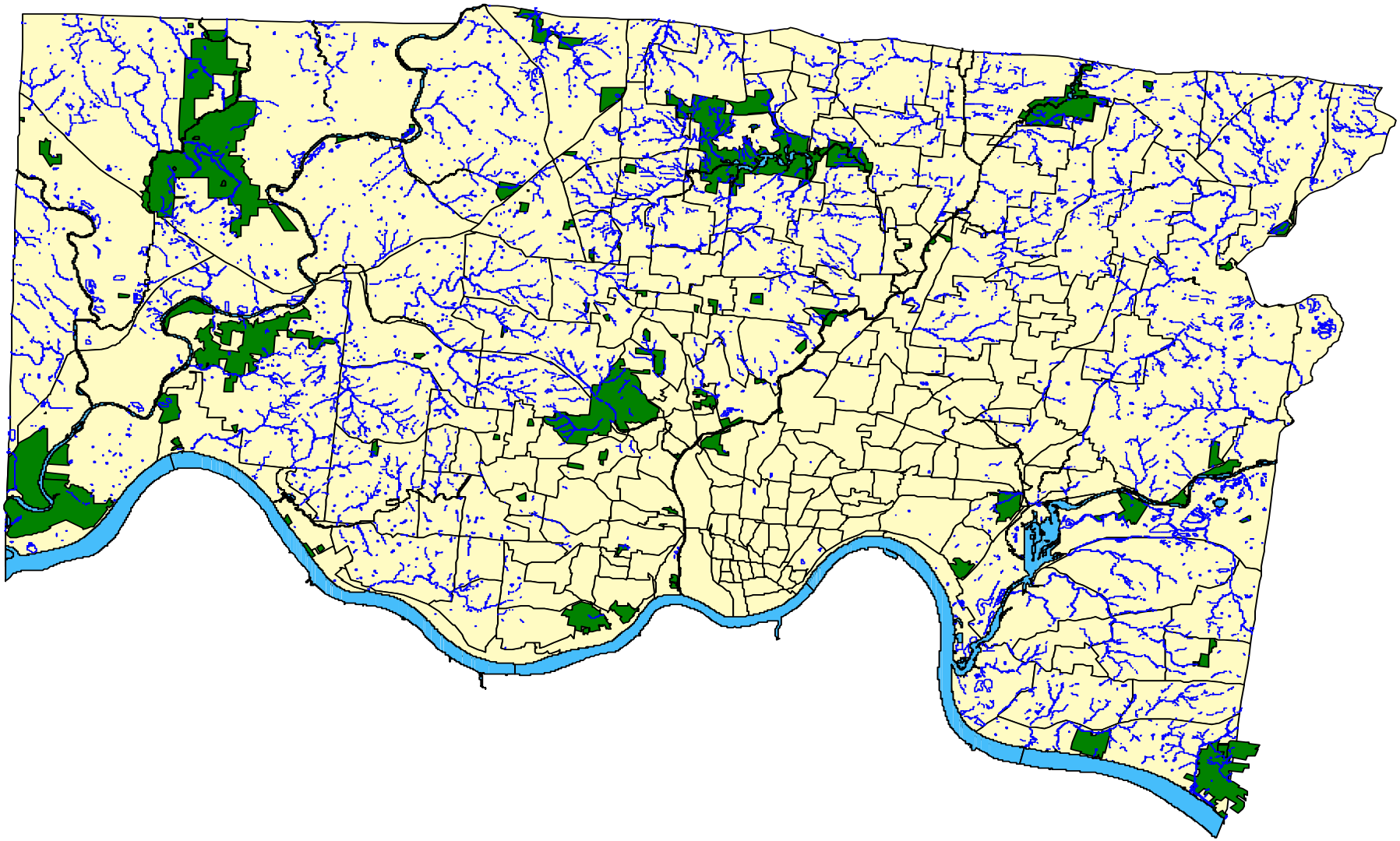
# Etc.



# Hamilton County Injury Surveillance System--HCISS

- County-wide injury surveillance system
- Begun in 1996
- Data from all hospitals in county
- Data includes: name, address, age, gender, race, injury mechanism, intent, outcome
- Calculate injury rates

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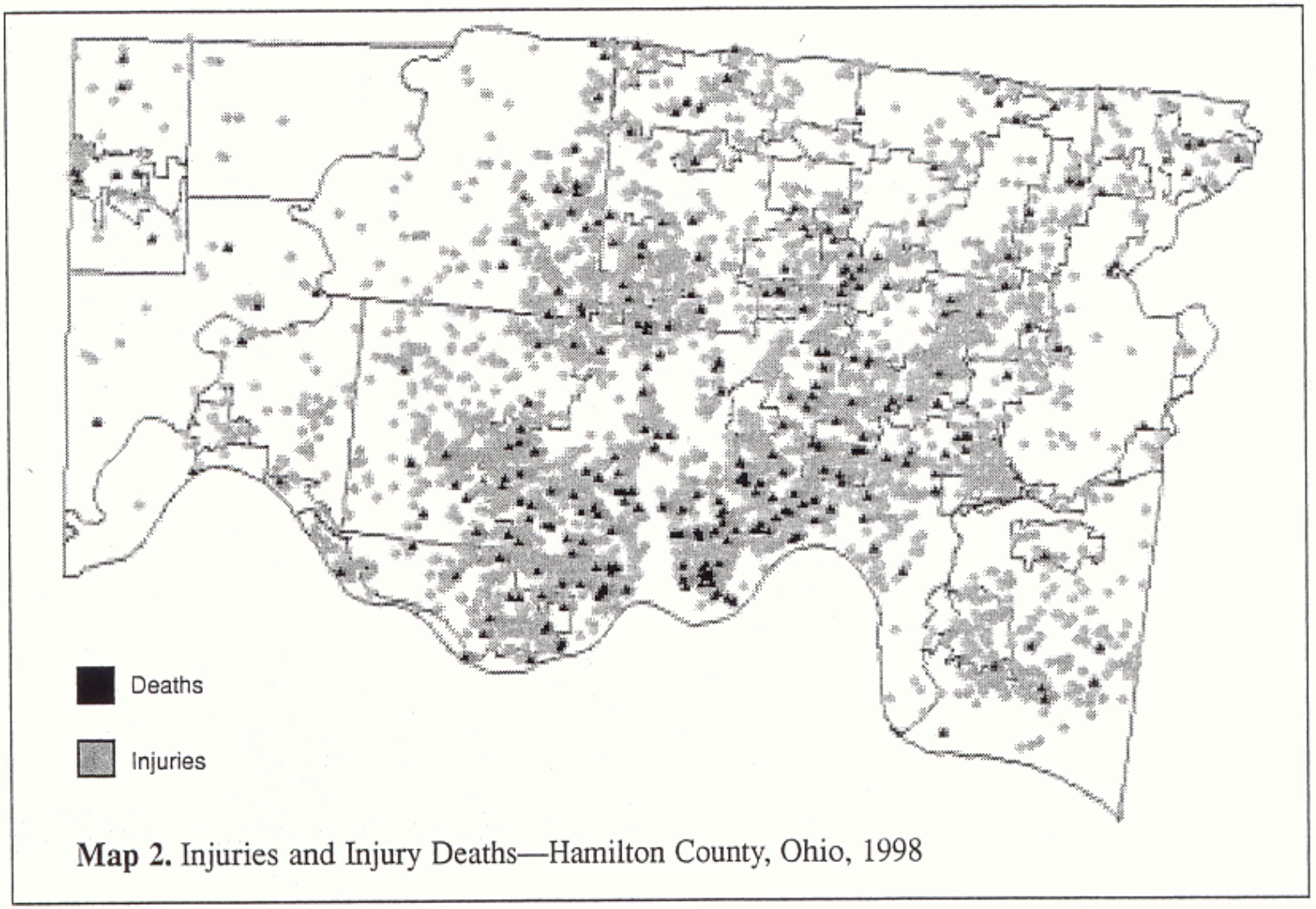
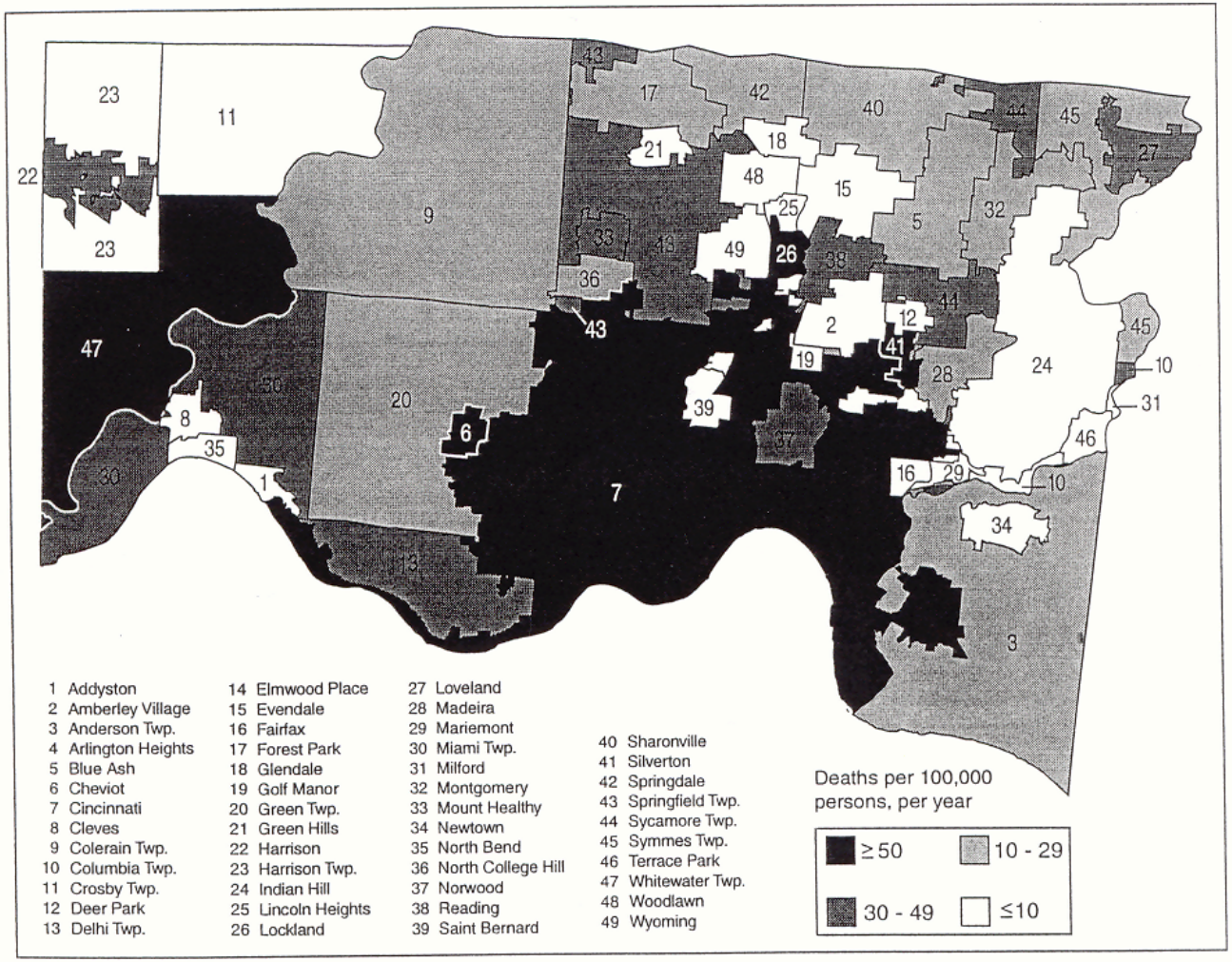
# Hamilton County Injuries & Deaths



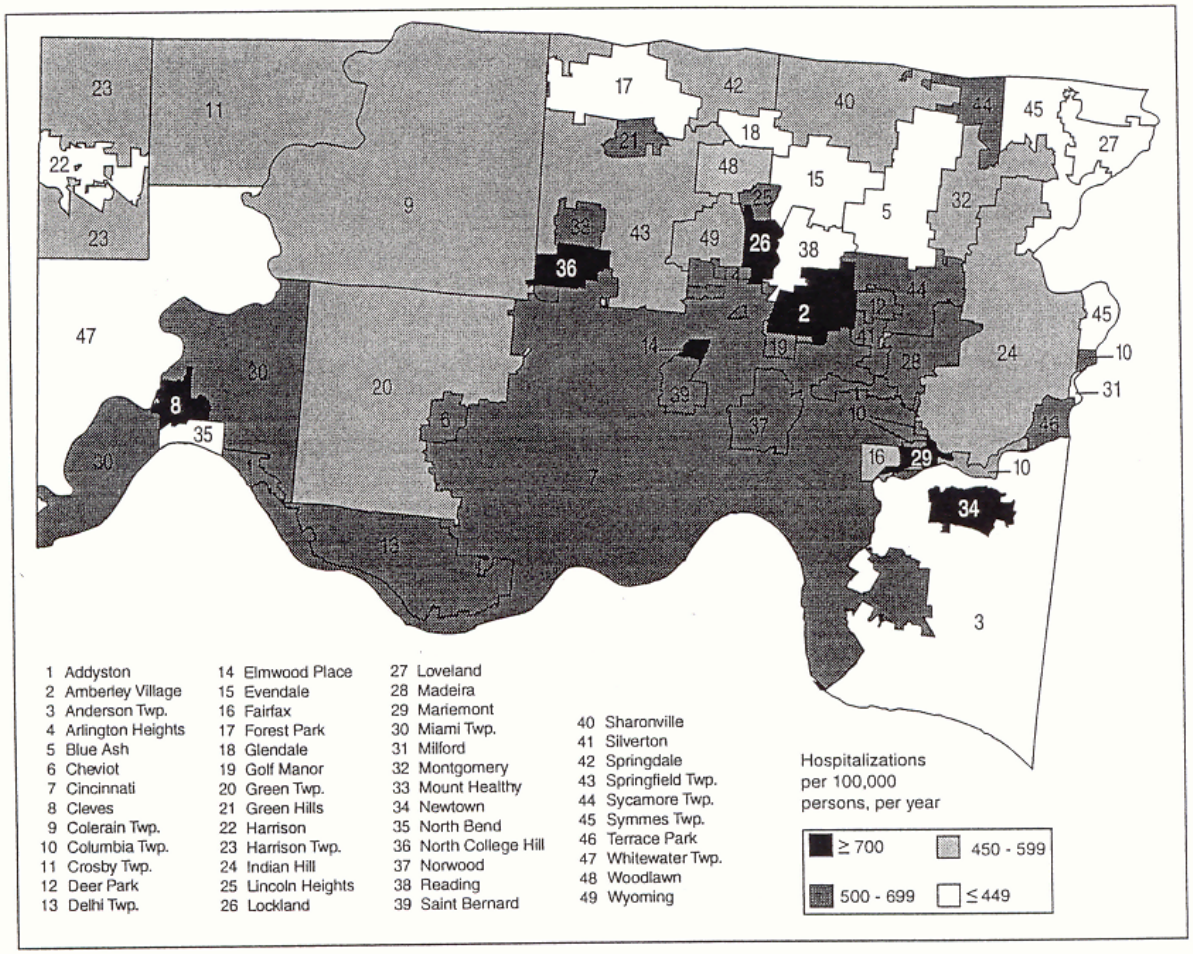

**Map 2.** Injuries and Injury Deaths—Hamilton County, Ohio, 1998

# Hamilton County Deaths



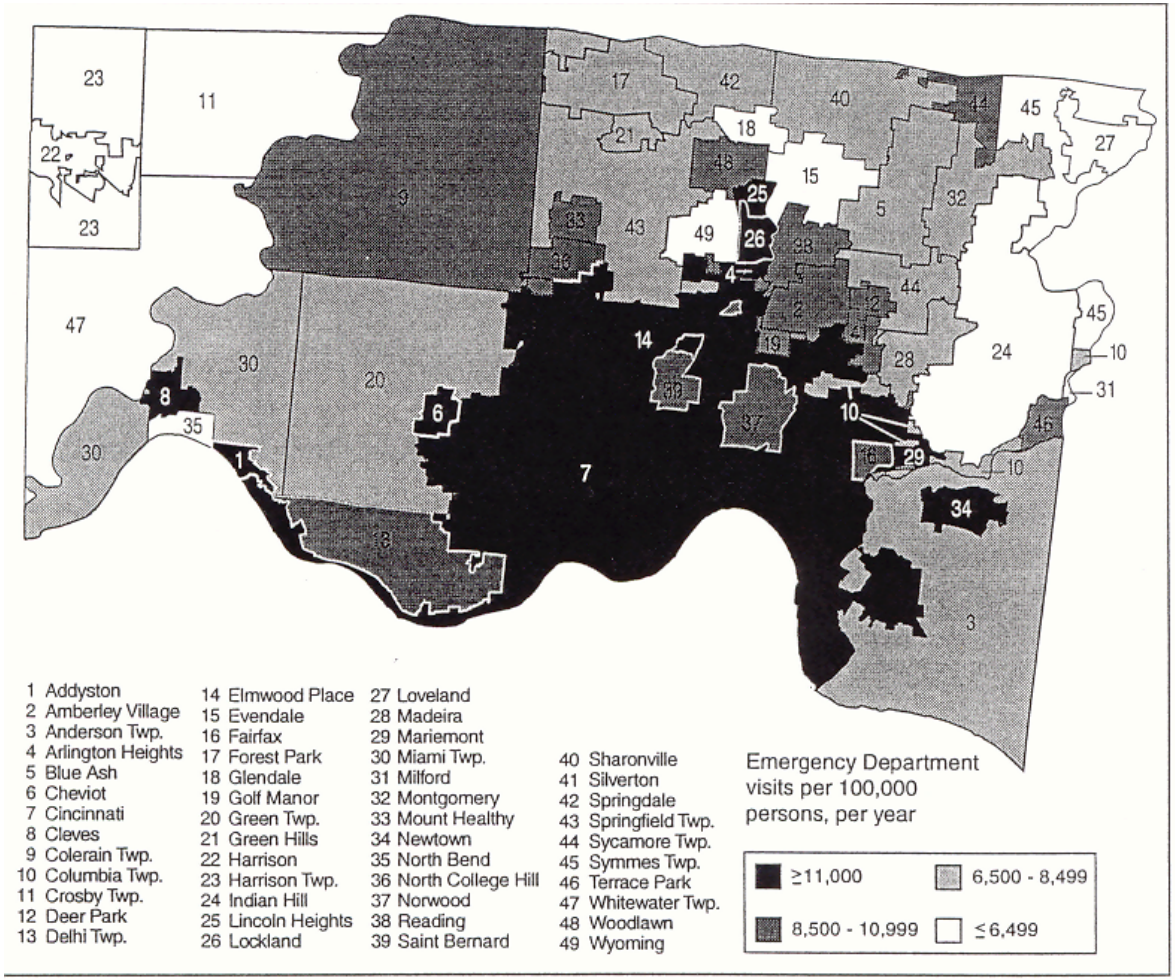

Map 1. Injury Death Rates, by Political Jurisdiction— Hamilton County, Ohio, 1997-2000

# Hamilton County Injury Hospitalizations




Map 2. Injury Hospitalization Rates, by Political Jurisdiction—
Hamilton County, Ohio, 2000

# Hamilton County ED Injury Visits




Map 3. Injury Emergency Department Visit Rates, by Political Jurisdiction—Hamilton County, Ohio, 2000

# HCISS

- Identify high-risk populations
- Identify injury trends
- Evaluate prevention efforts
- Examine geographical and socioeconomic variations in injuries
- Provides data for analytic studies
- Visual representation of numerical data

# HCISS

- Other advantages
  - Population-based
  - Someone else does geocoding
- Disadvantages
  - Limited data available
  - Validity of data unclear
  - Someone else controls data

# Cincinnati Children's Trauma Registry

- Hospital Trauma Registry
- Population-based for hospitalized kids <15 y.o.
- Not population-based for >15 y.o., ED visits, or deaths

# Cincinnati Children's Trauma Registry

- Advantages
  - I control the data
  - More comprehensive data available
  - Good quality, valid data
  - More timely data
- Disadvantages
  - I do geocoding (80% first-time hits)
  - Not population based

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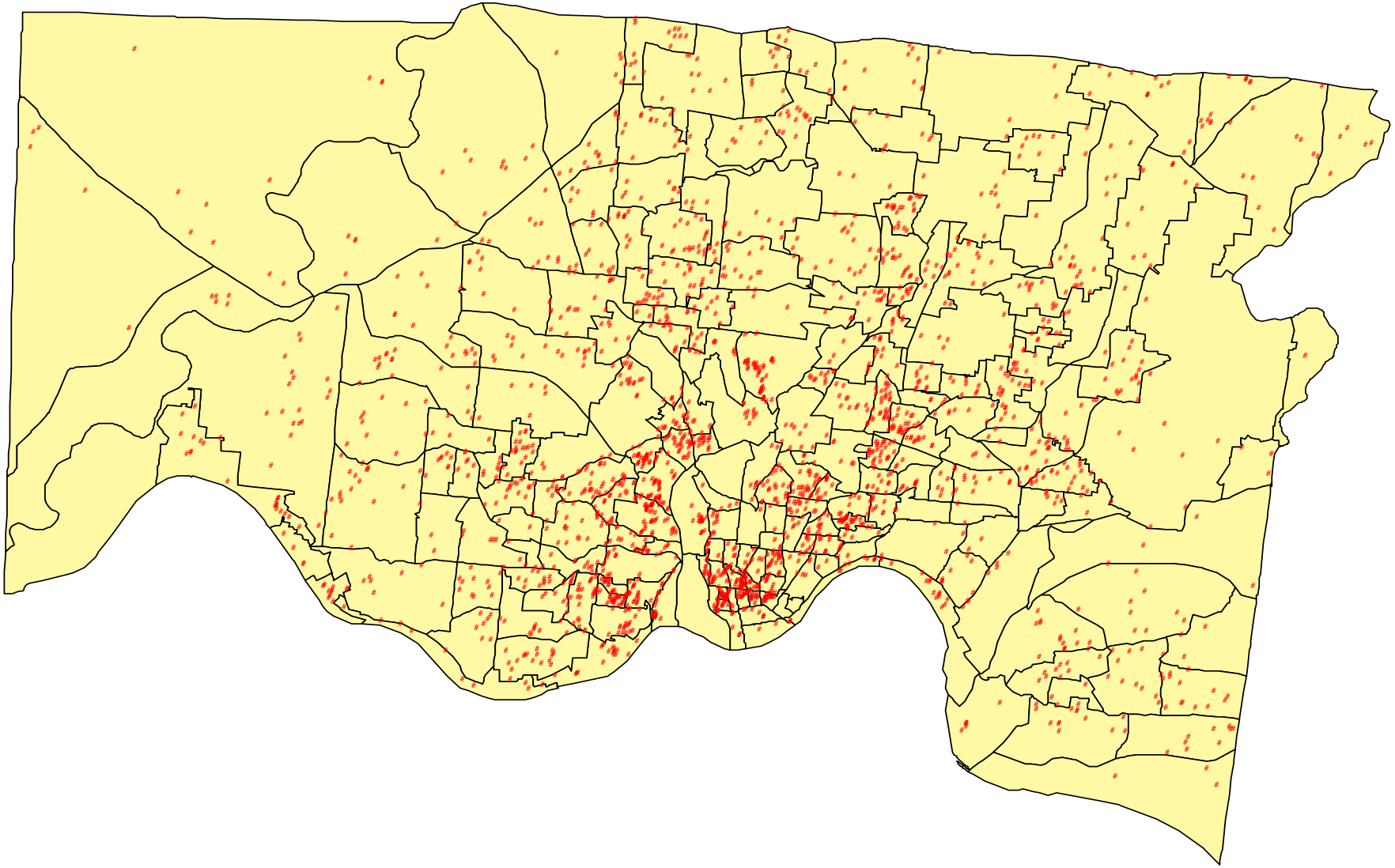
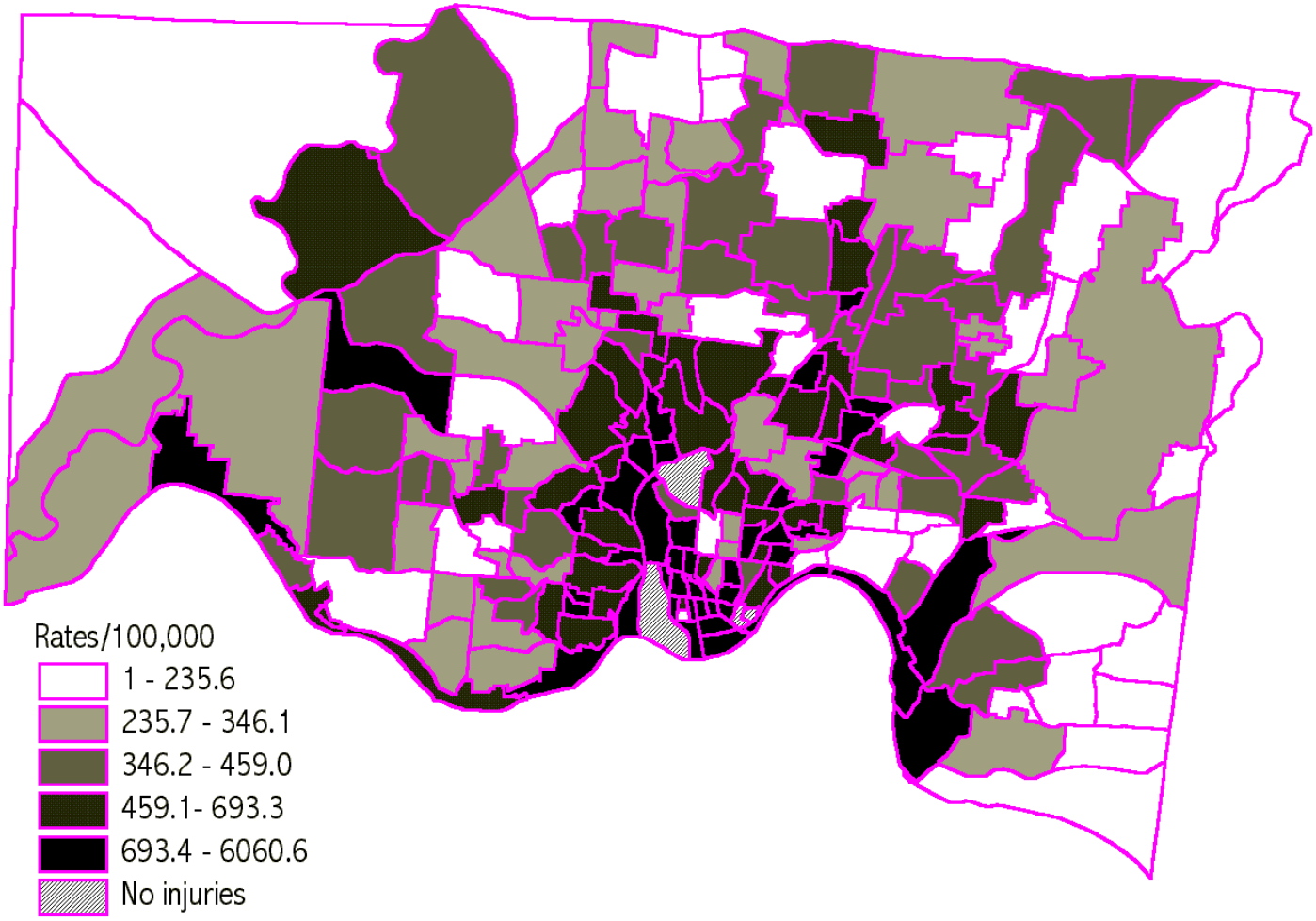
# Injuries to Kids in Hamilton County, Ohio



# Injury Rates by Census Tract to Children in Hamilton County



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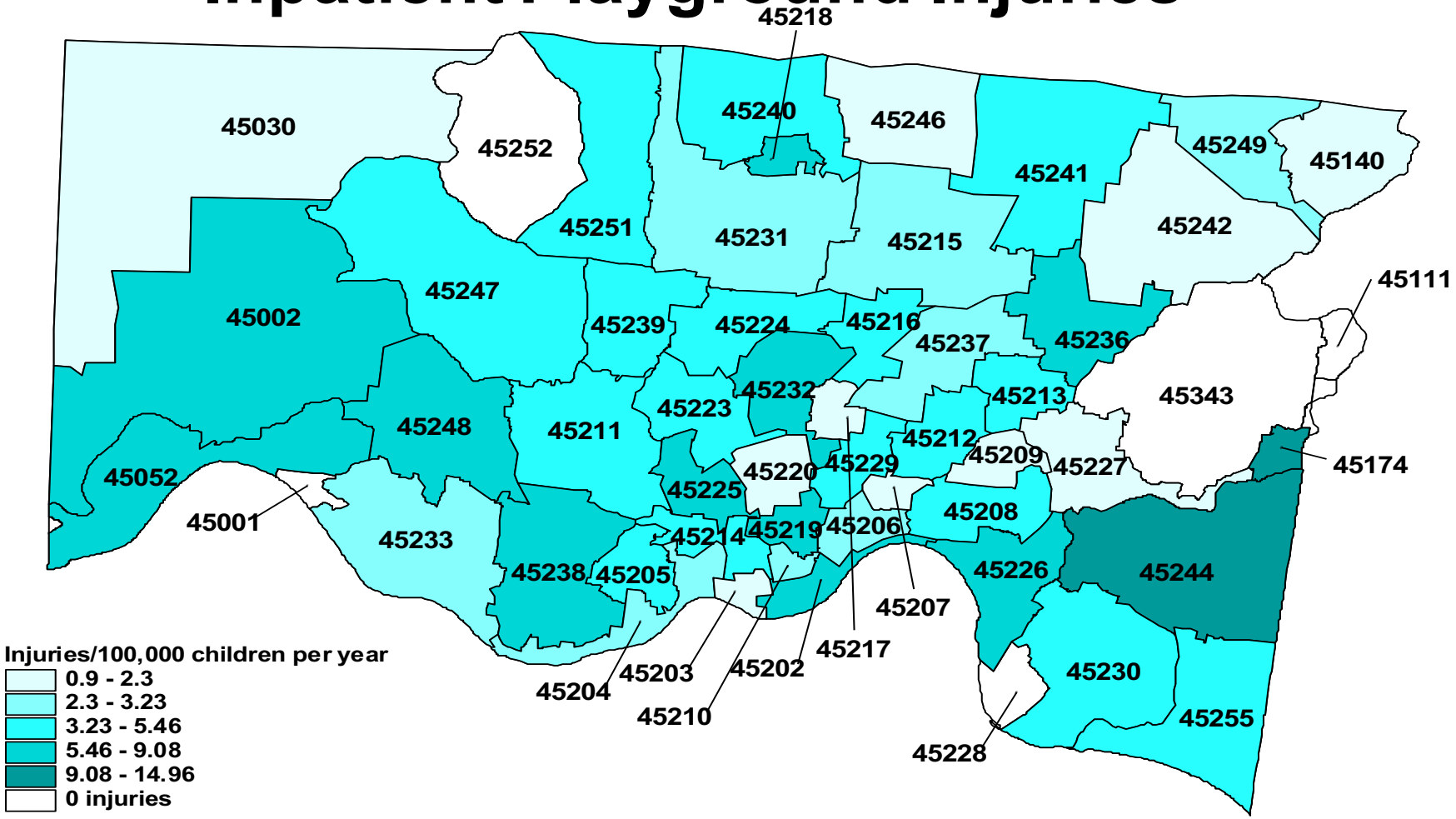
# Inpatient Playground Injuries



# What are we going to map? Place of Injury vs. Residence

- Place of Injury
  - Exactly where injuries are occurring
  - Target high risk areas
- Residence
  - Can examine socioeconomic indicators with home addresses
  - Target high-risk groups

# Program Planning

- Mapping by injury mechanism
- Target specific injuries in specific places
- Target areas at high risk for all types of injuries

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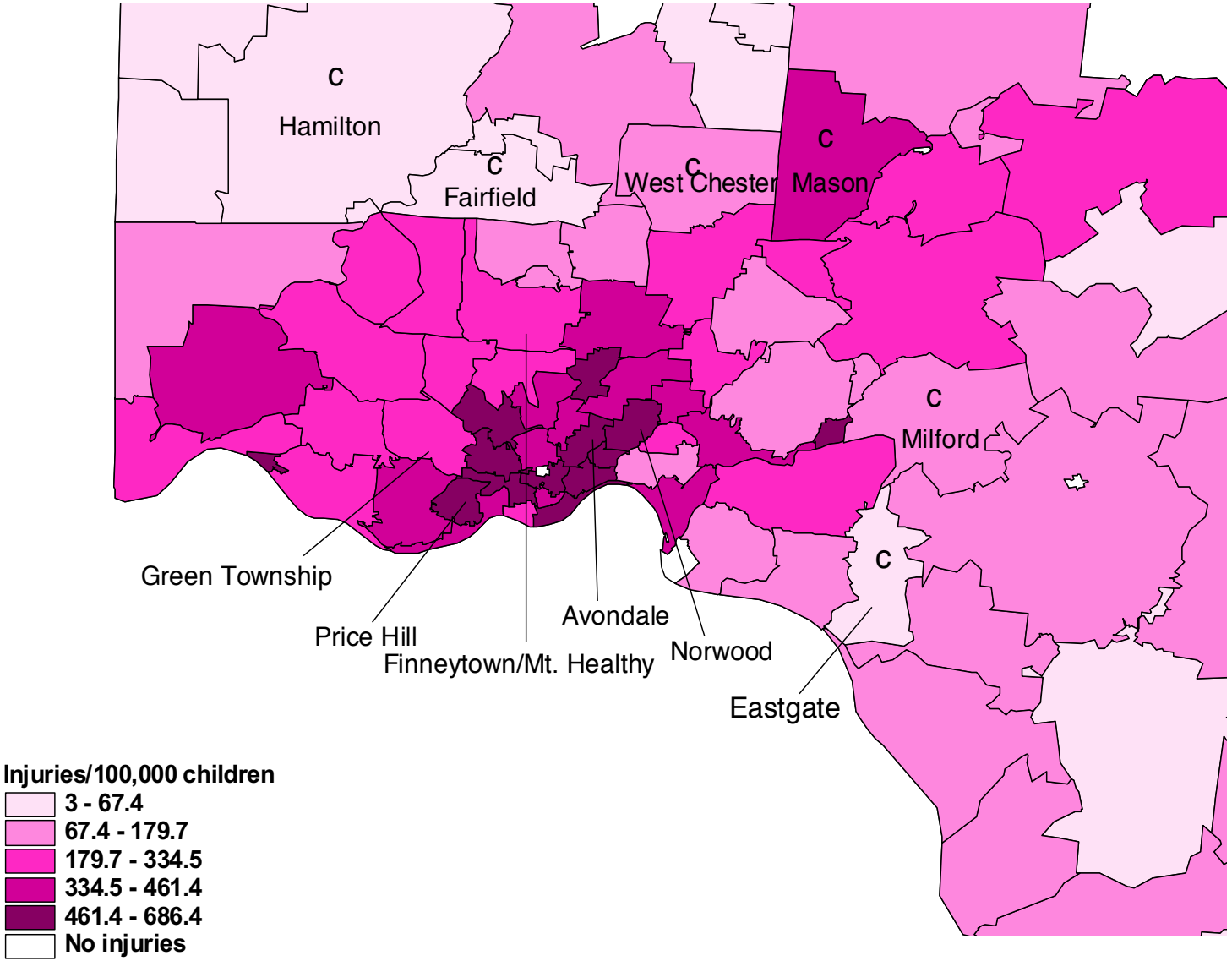
# Bike Injuries in Ohio



# Picking an Intervention Area

- Where are most injuries occurring?
- What type of injuries are most common?
- Where are the most common types of injuries occurring?
- Can we find similar areas to compare interventions?

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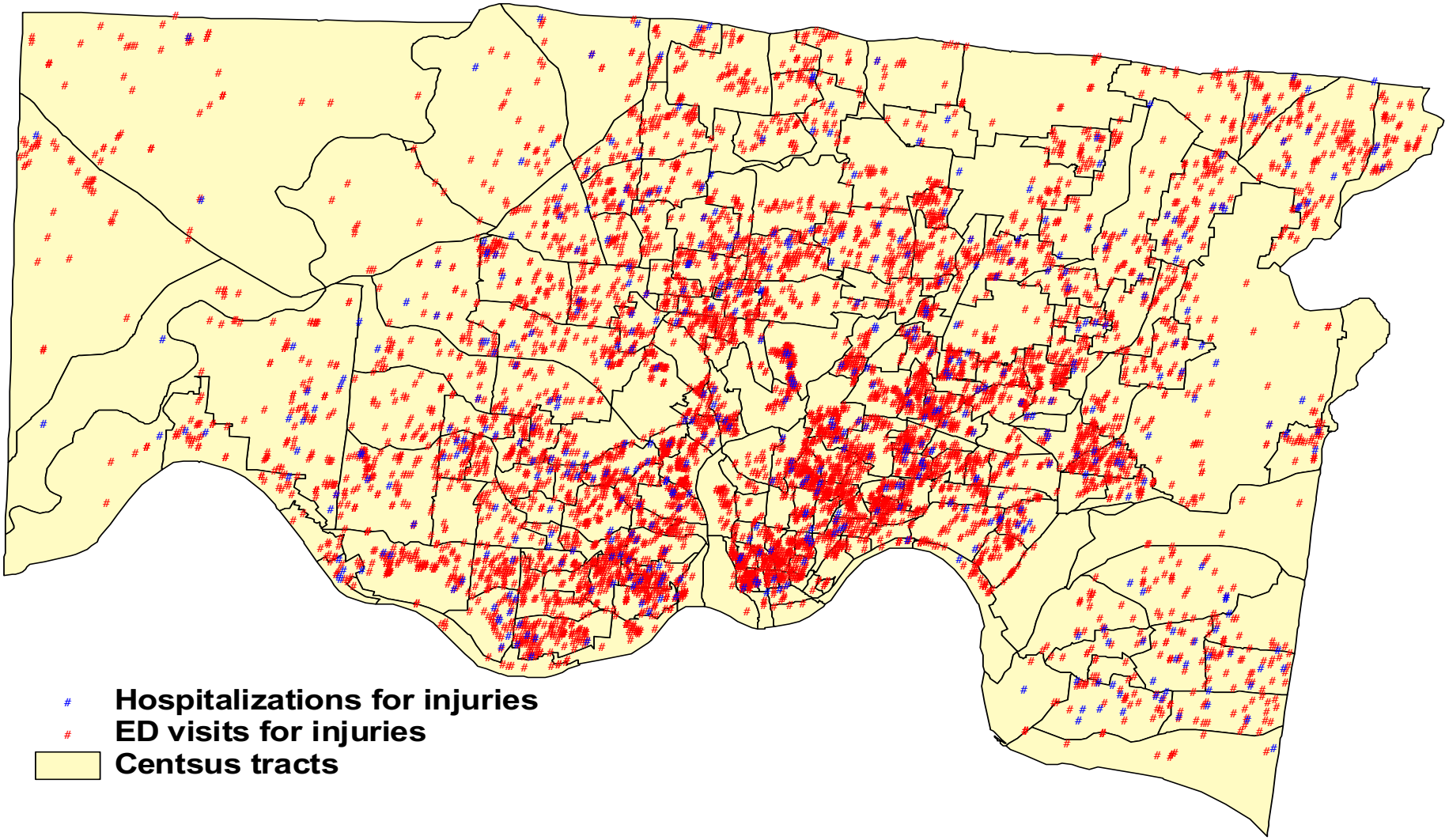
# Sports Injuries in Hamilton County



# Practical Examples of Limitations

- Address mapping
  - Need to be entered into database correctly
  - Need to exist
  - Need to be able to map
- Ecological fallacy
  - Examines small areas
  - May not apply to individuals
- Can only report aggregate data
  - Be careful with maps
  - Remove patient identifiers

# Summary

- GIS can be used to enhance injury prevention and control activities
- It provides a visual representation of data
- It can be used to detect trends in injuries
- It can be used for planning implementation and evaluation

# Summary

- GIS can be used to enhance injury prevention and control activities
- It provides a visual representation of data
- It can be used to detect trends in injuries
- It can be used for planning implementation and evaluation
- Maps are cool!

# Questions?