



Indiana
Department
of
Health

VISUALIZING OBSTETRIC CARE GAPS FOR HOOSIERS USING DRIVE-TIME ANALYSIS

SARAH FEENEY
GIS ANALYST

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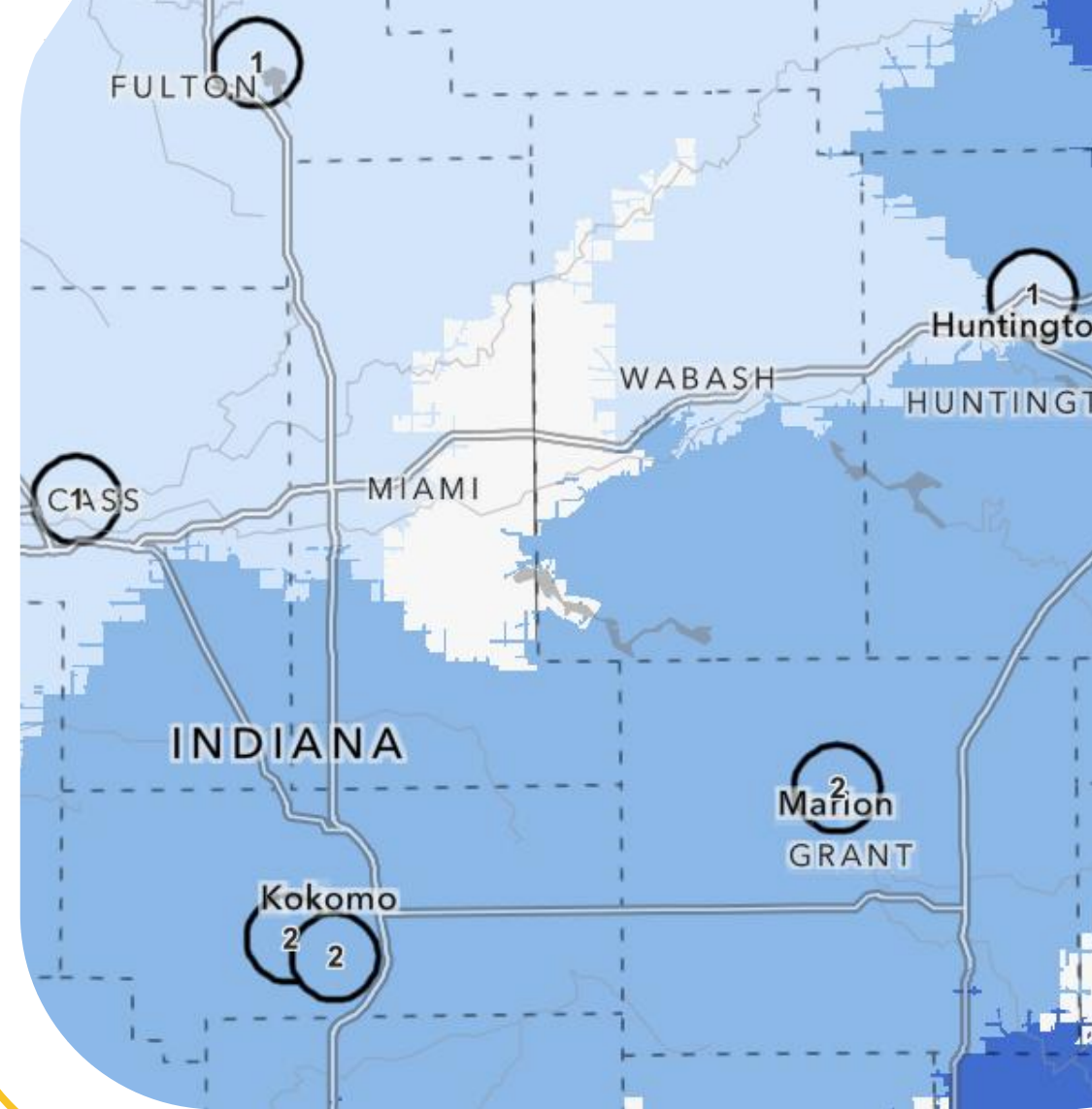
AGENCY PRIORITIES

- 1. Promote Maternal and Infant Mortality Health Outcomes**
- 2. Prevent Chronic Disease**
- 3. Improve Data Quality and Transparency**



What's Ahead

- Introduction
- Project Background
- Data & Analysis
- Applications
- Findings
- Demo





Introduction



Geographic Data in Public Health

At **IDOH**, we use geographic data to explore and understand:

The health behaviors and health statuses of Hoosiers

- How do indicators such as life expectancy, tobacco use, and obesity rates, etc., vary throughout Indiana?

Regional resources available to support population health

- From hospitals and dialysis centers to parks and hiking trails.

Where disease outbreaks begin & where they're spreading

- Where should testing supplies, vaccines, personnel and funding be focused?

Gaps in health service delivery

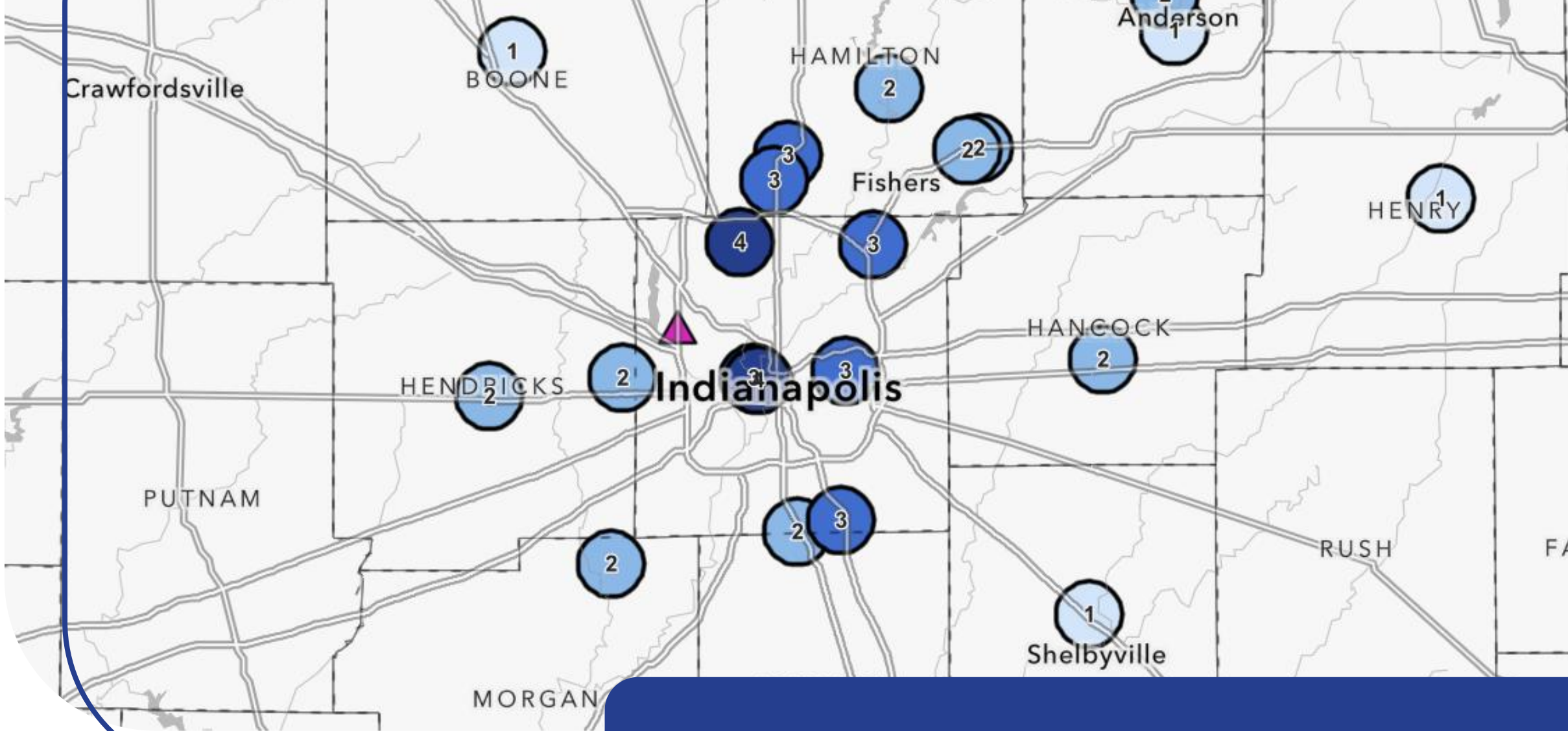
- Are services accessible to the populations who need them most?

How to mitigate the next public health emergency

- Prepare, prepare, prepare!

Where structural barriers to optimal health might exist

- For example: Where are Hoosiers most likely to encounter lead-based paint in their homes?



Project Background

Geography as a determinant of maternal and infant health

- Excessive travel time and distance can be major barriers to receiving appropriate and adequate perinatal care, especially for women in rural communities
- Hospital perinatal services and needs vary
 - Women with high-risk pregnancies may require specialty care at advanced facilities



Project Objectives

- Visualize hospital coverage
- Visualize access gaps

Then...

- Identify low-access communities
 - Estimate and quantify impact on pregnant mothers
 - Identify closest hospitals to low-access communities



Data & Analysis



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Data Sources

- Indiana Birthing hospitals
 - Labeled with perinatal level of care, I-IV
- Out-of-State birthing hospitals
- Accredited birth centers
- Indiana census tracts



Perinatal Levels of Care

Click image to read more on MCH's webpage

Levels of care for Indiana hospitals and birth centers	
Certification	Description
Level I	Obstetric and neonatal facilities caring for women with uncomplicated pregnancies and providing basic newborn care to physiologically stable infants.
Level II	Hospitals providing care to appropriate high-risk maternal patients and special care to infants who are moderately ill with problems expected to resolve rapidly.
Level III	Hospitals equipped to care for complex maternal medical conditions and obstetric complications as well as infants requiring neonatal intensive care.
Level IV	Hospitals providing comprehensive medical and surgical care to the most acutely ill and medically complex mothers and infants.

Indiana Department of Health, Maternal and Child Health



Analysis Approach: Phase 1

- Geocode facility layers
 - Utilized State MultiRole Geocoder to map facilities in ArcGIS Pro
- Generate 30 and 45 minute drive-times catchments
 - Utilizing near real-time traffic and road conditions provided by [ESRI Online routing services](#)
 - Dijkstra's algorithm used to travel along roads, stopping once time (e.g. 30 mins) runs out
 - Generated Detailed polygons in ArcGIS Pro

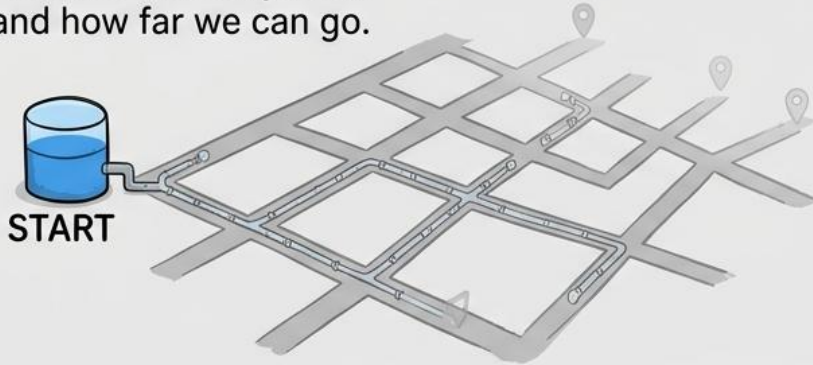
Many rural Hoosiers receive care at hospitals in neighboring states → Adding out-of-state birthing hospitals to analysis

Some rural Hoosiers may travel longer than 45 minutes to receive care at high-care hospitals → Add 60 minute catchments for L3/L4 hospitals

Process

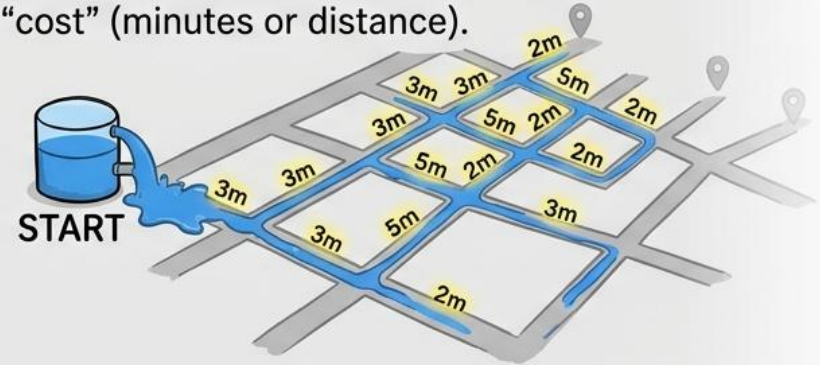
1. THE PROBLEM

Find the **fastest path...**
and how far we can go.



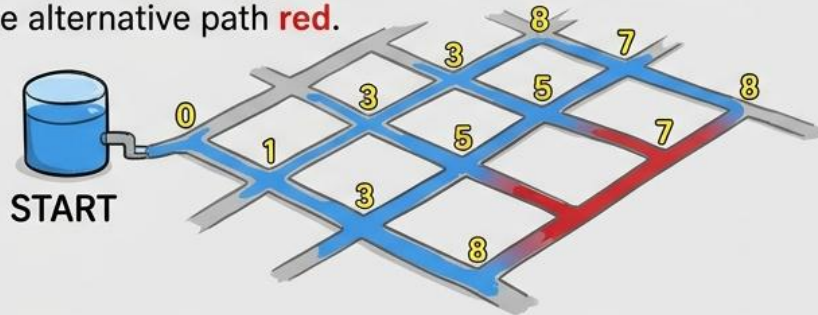
2. Dijkstra's: "Water Spill"

Pour water. Each street has a travel "cost" (minutes or distance).



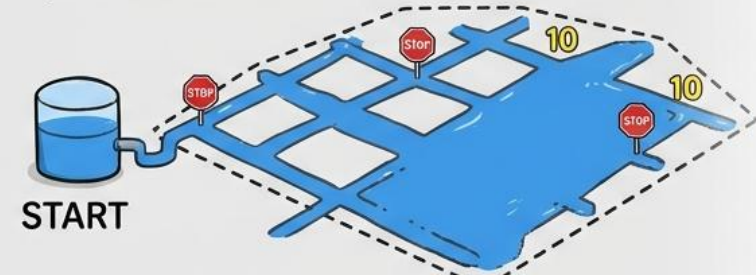
3. EXPLORING

The algorithm always follows the "**cheapest**" (fastest) flow first, updating a **lower total number** and turns the alternative path **red**.



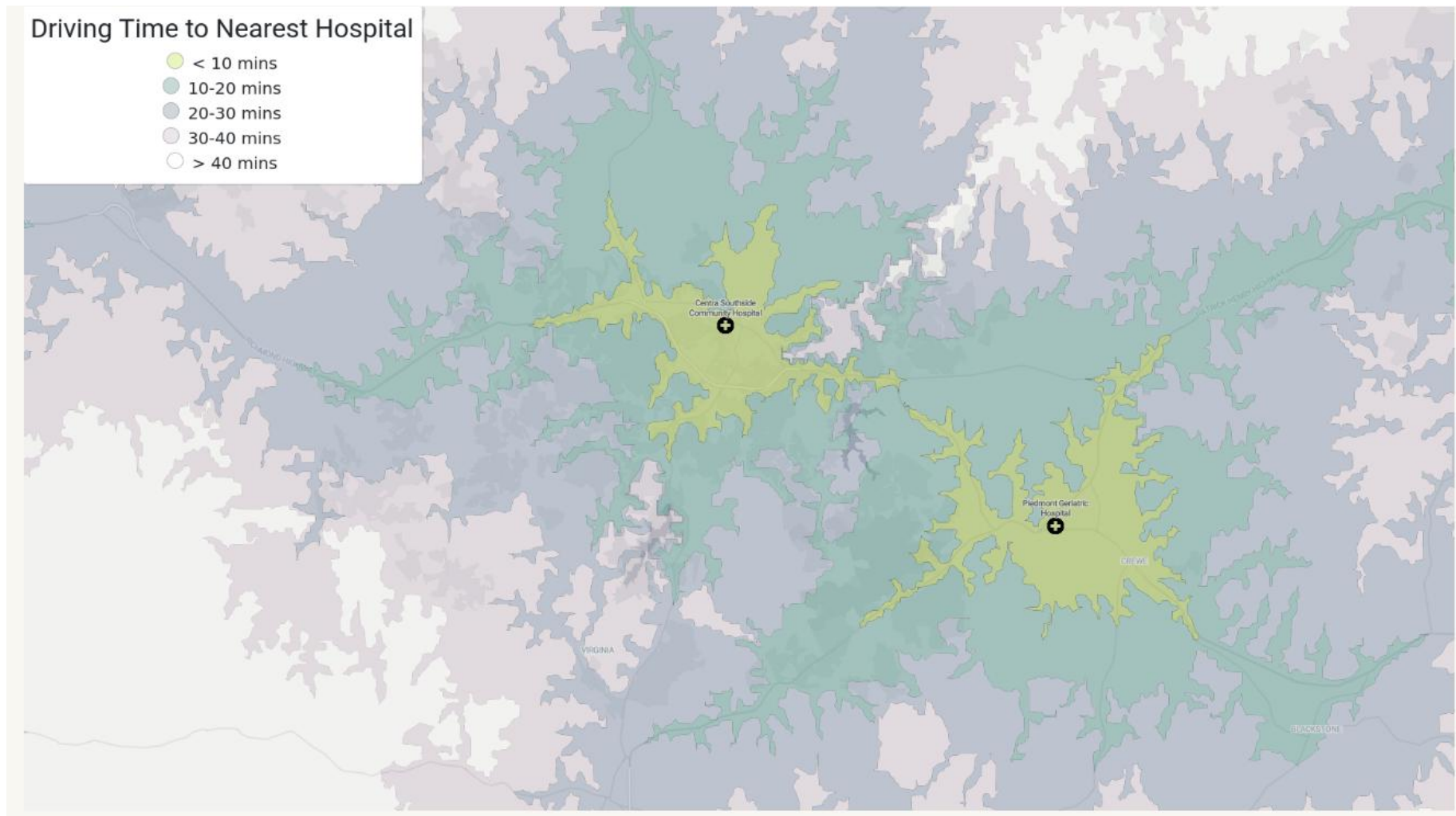
4. THE CUTOFF (10 Minutes)

Stop pouring when total time reaches 10. Draw a shape around the furthest tips! Insprat time



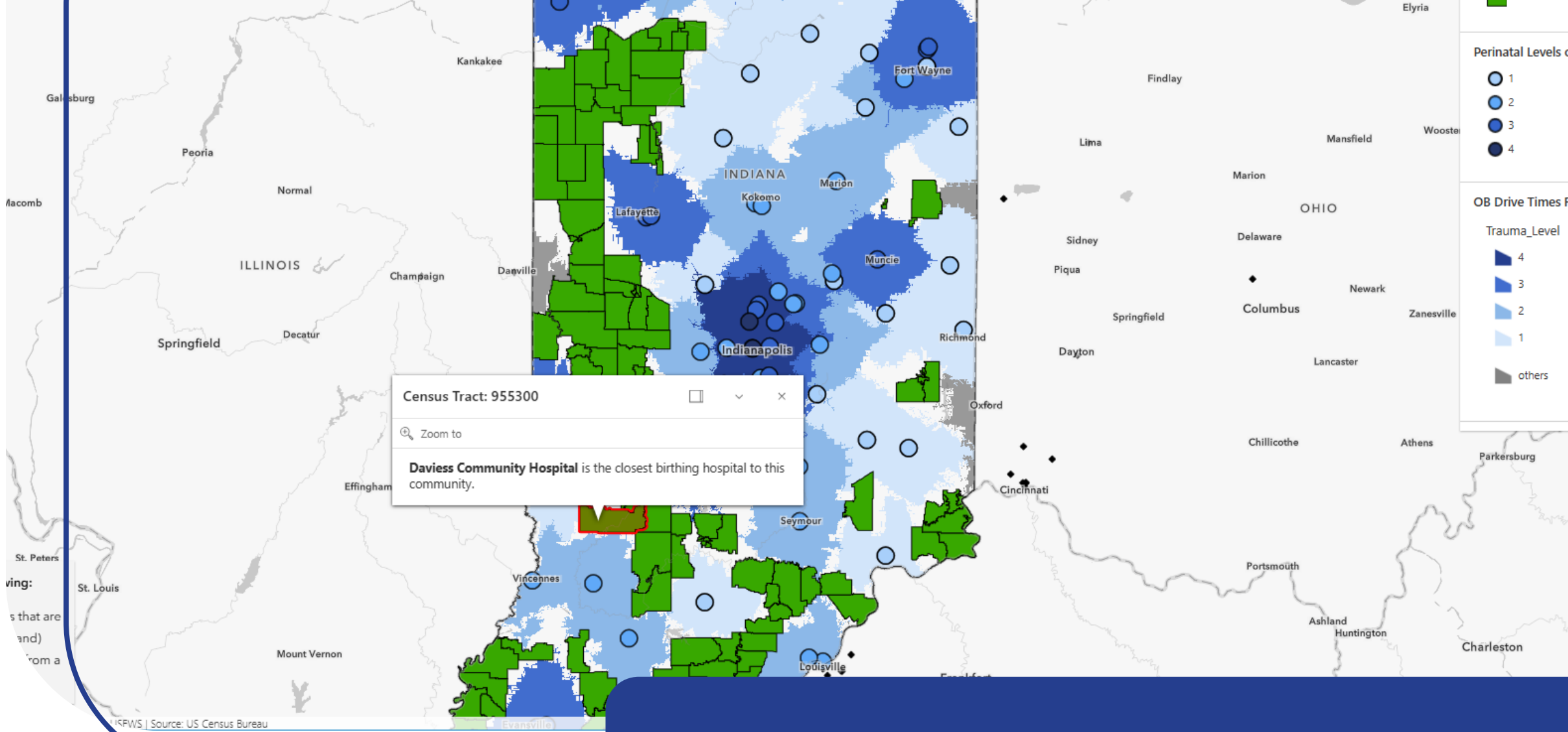
The entire animated cycle then repeat.

Result



Phase 2

- Identify low-access census tracts
 - Census tracts with $> 75\%$ of land area outside of a catchment were designated “low-access”
- Enrichment
 - Added additional demographic data to understand population characteristics
- Routing
 - Identified nearest hospital of any level to the centroid of low-access census tracts



Application Development

Application Uses




- Tracking of hospital changes + affect on communities throughout time
- Quantification of travel time for low-access communities
- Quantification of impact – how many Hoosiers must travel 45+ minutes for delivery services at a hospital?

Products




- OB Drive-Time Analysis Application
 - Displays facilities, current drive-time catchments, and low-access census tracts
- Archive Application
 - Serves as historical “tracker”, displaying changes in hospital coverage overtime
- Nearest Hospital tool (internal)
 - Used by internal teams to identify the closest birthing hospital to any address
 - Used to identify closest higher level facility (L3/L4) to a lower level facility (L1/L2) for patient transfer

Filter by Level Facility List

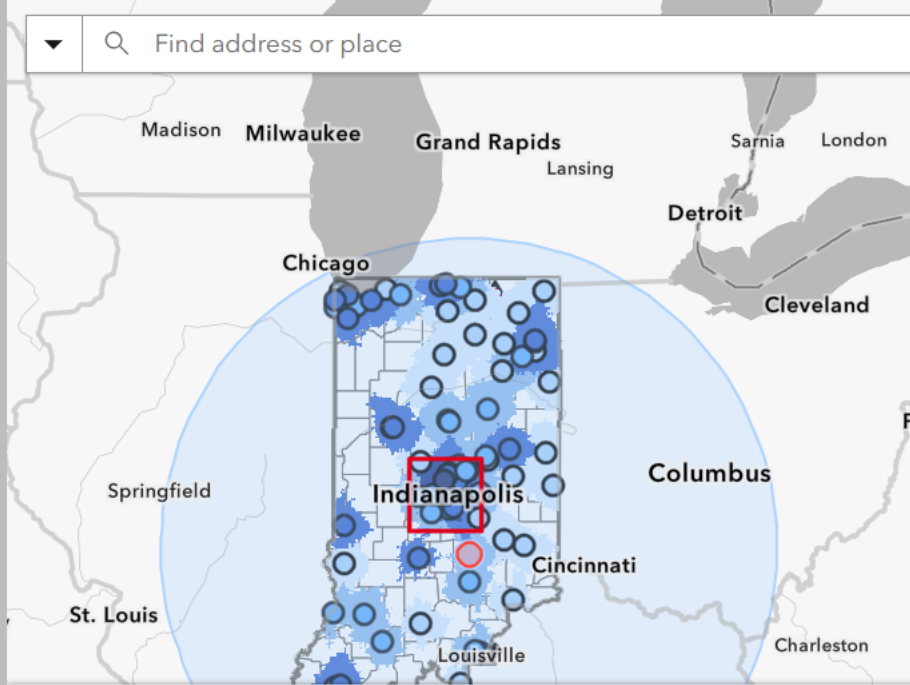
Search hospitals by name, address, zipcode or city

- 
Columbus Regional Hospital
 2400 East 17th St, Columbus, IN, 47201
- 
Bremen Hospital
 1020 High Rd, Bremen, IN, 46506
- 
Ascension St. Vincent Anderson
 2015 Jackson Street, Anderson, IN, 46016

Search birthing centers by name, address, zipcode o...

- 
Auburn Birthing Center LLC
 1915 Wesley Rd, Auburn, IN, 46706
- 
Sacred Roots Birth Center Northeast
 7950 N Shadeland Ave, Suite 500, Indianapolis, IN, 46250
- 
Sacred Roots Midwifery Birth Center, LLC

Find address or place



Columbus Regional Hospital

Level of Care: 2

2400 East 17th St, Columbus, 47201

1 of 3

Nearby Tool

- Select a facility using its map symbol/the facility list **OR**
- Search for an address within the map (Find address or place) **OR**
- Activate point button below and manually select a location on the map.

Location: Miles

Input location: 2400 17TH ST, COLUMBUS, IN, 47201

Out of State Facilities GIO	↑ 1 >
Perinatal Levels of Care Facilities - L3	↑ 1 >
Perinatal Levels of Care Facilities - L4	↑ 1 >
<ul style="list-style-type: none"> Approximate Distance 41.54 mi 	
IU Health Riley Hospital for Children	⊞
Level of Care: 4	
705 Riley Hospital Dr, Indianapolis, 46202	

Application Demo



OB Drive-Time Analysis Application



Findings and Implications



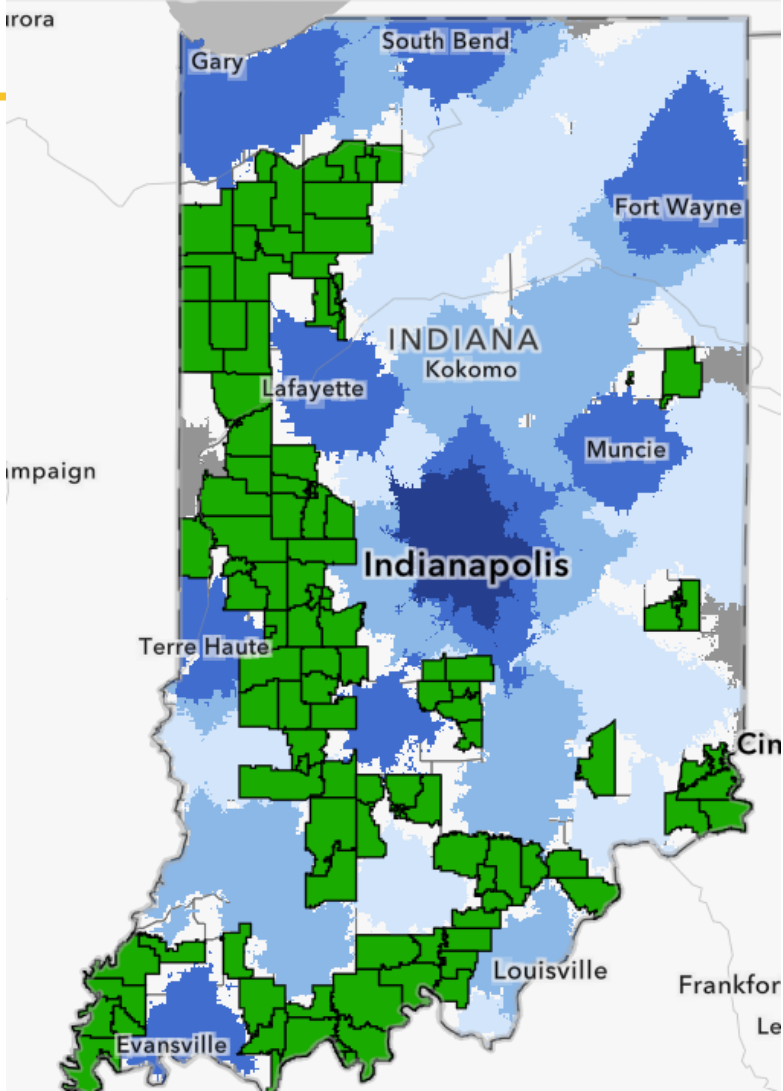
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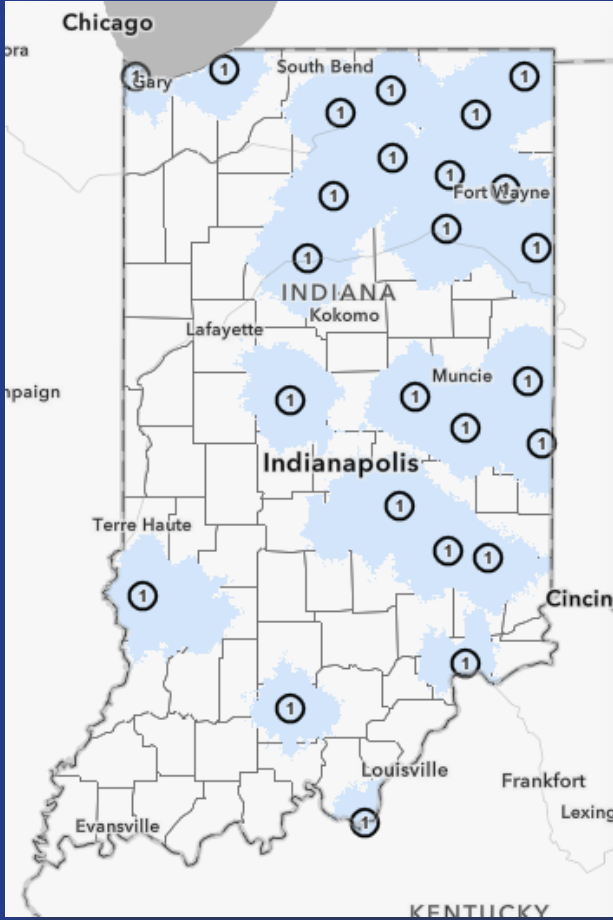
Findings

73 birthing hospitals located in Indiana

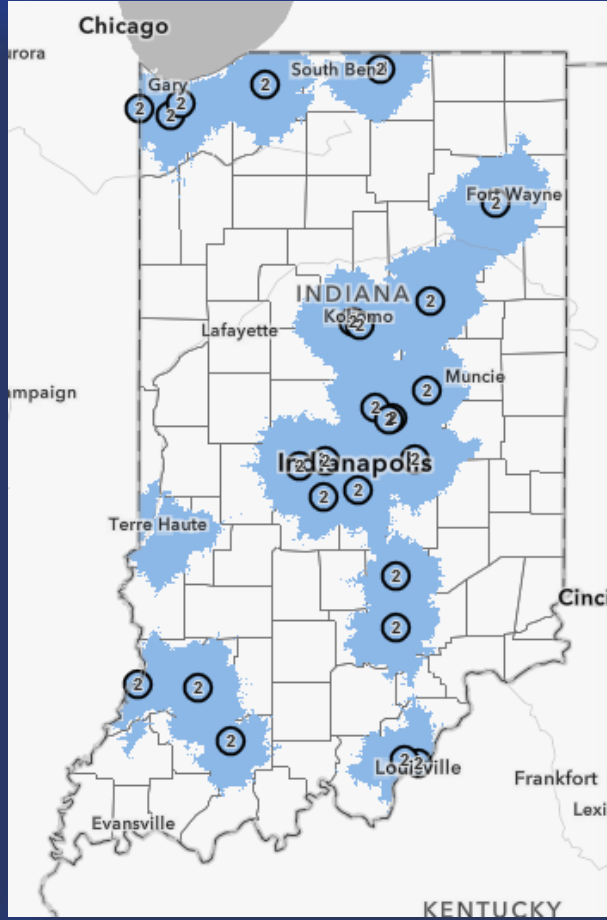
Level 1	Level 2	Level 3	Level 4
25	25	21	2

- 130 low access communities identified, 10 of which fall outside 45 minutes
- Over 460,000 Hoosiers in 2020 fell outside of 30 minutes by car to any birthing hospital
- Nearly 32,000 Hoosiers in 2020 fell outside of 45 minutes by car to any birthing hospital

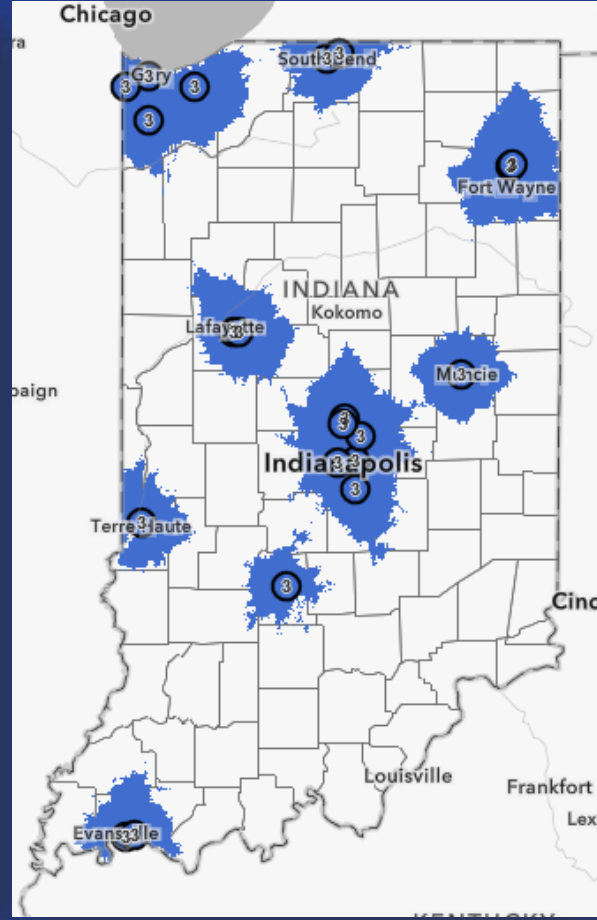




Level 1



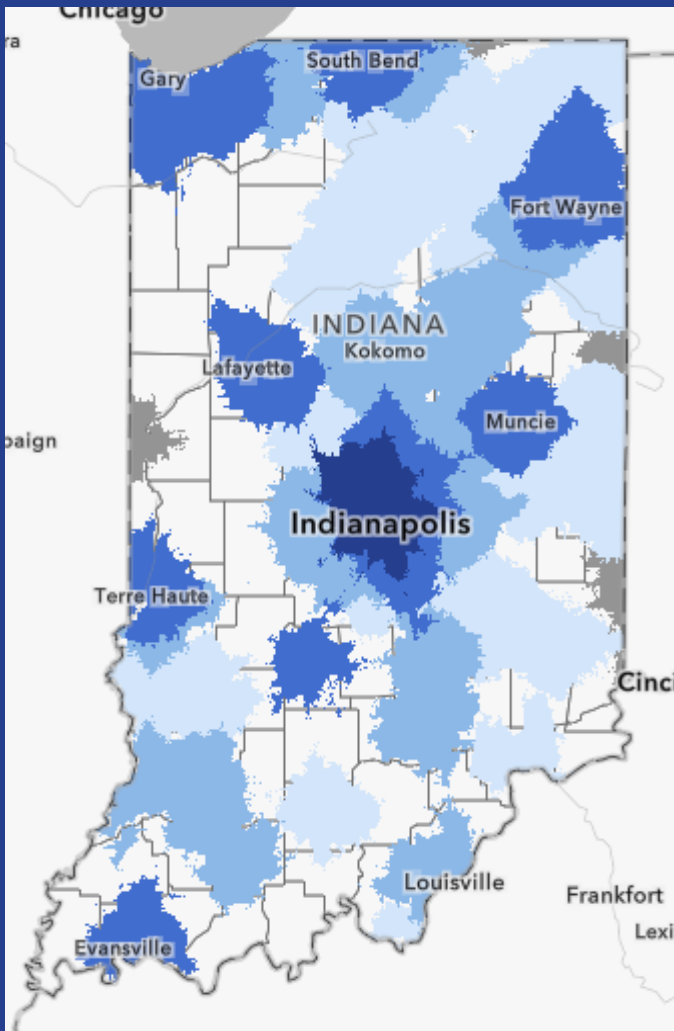
Level 2



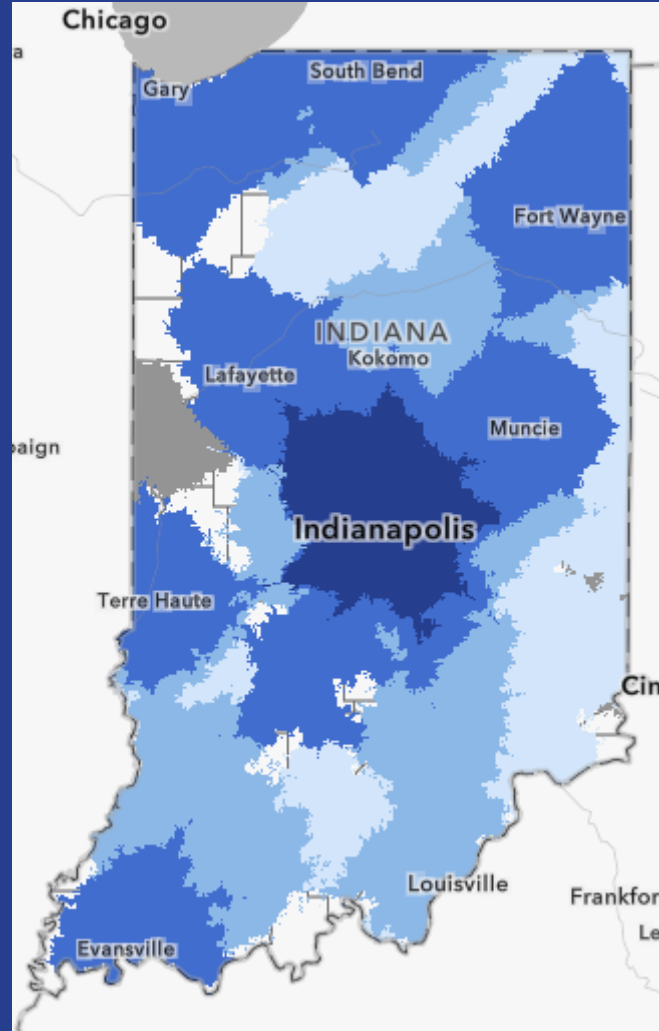
Level 3



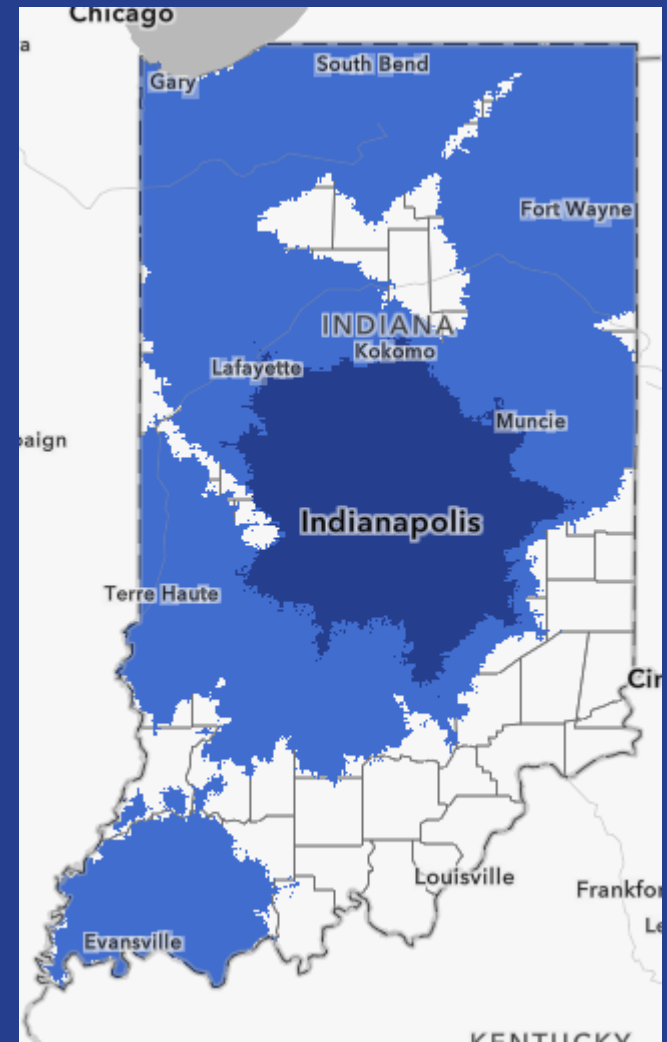
Level 4



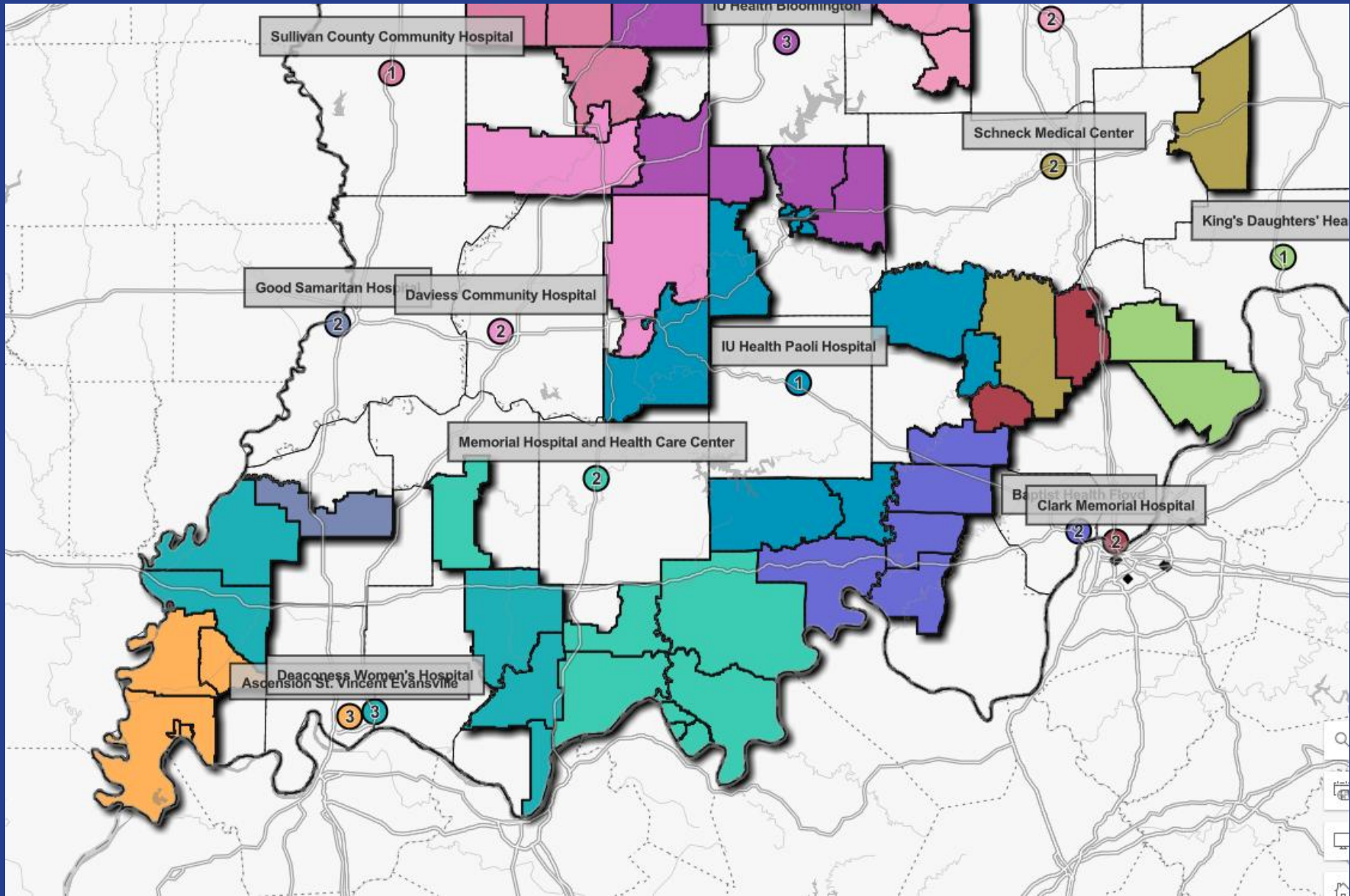
30 minutes



45 minutes



60 minutes
(L3/L4)



Future Enhancements

- Inclusion of additional perinatal care provider types
- Inclusion of prenatal care providers to capture continuity of care
- Impact analysis in the case of rural hospital closures

Questions?

Sarah Feeney

GIS Analyst

sfeeney@health.in.gov

