ALL IN
DATA FOR COMMUNITY HEALTH
• Community Health Peer Learning Program
• Data Across Sectors for Health

Data Visualization

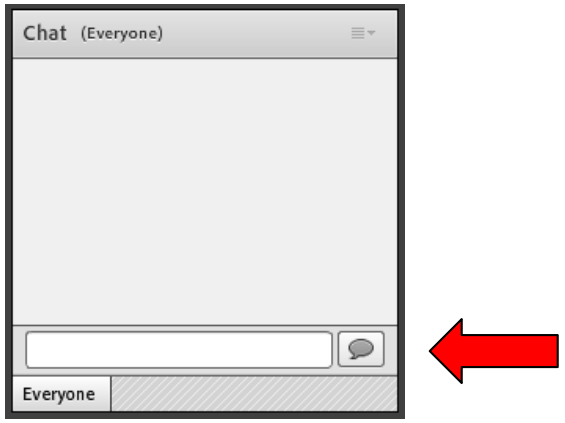
November 11, 2016
12:00 p.m. – 1:15 p.m. ET

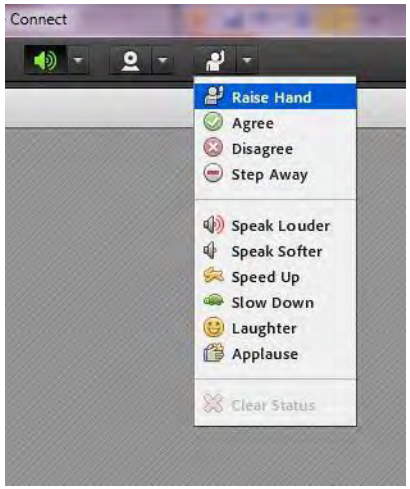
Meeting Information

- Conference Line: 1-866-269-6685
- Conference Code: 6763836672#
- Reminders:
  - Please **hard-mute your computer speakers** and the **speakers in the web conference**
  - Please **mute your phone line** when you are not speaking to minimize background noise
- Technical difficulties? Email us at chpinfo@academyhealth.org

Chat Feature

- To share your comments using the chat feature:
  - Click in the chat box on the left side of your screen
  - Type into the dialog box and click the send button
- To signal to presenters you have a question / comment:
  - Click on the drop down menu near the person icon and choose *raise your hand*





DASH and CHP are All In!

Community Health Peer Learning Program

- NPO: AcademyHealth, Washington D.C.
- Funded by ONC
- 10 Participant and 5 Subject Matter Expertise communities

Data Across Sectors for Health (DASH)

- NPO: Illinois Public Health Institute in partnership with the Michigan Public Health Institute
- Funded by RWJF
- 10 grantee communities

All In: Data for Community Health

1. Support a movement acknowledging the social determinants of health

2. Build an evidence base for the field of multi-sector data integration to improve health

3. **Utilize the power of peer learning and collaboration**

Purpose

1. Share how communities are using mapping and data visualization tools to engage partners in multisector data sharing collaborations

2. Discuss why data visualization is an important tool, how to get started, and key considerations

3. Explore how data is made available to internal and external partners in a way that ensures protection of personal health information

Presenters

Andrew Beck, MD MPH,
Assistant Professor and Attending Pediatrician, Cincinnati Children's Hospital Medical Center

Cole Brokamp, PhD,
Research Fellow, Cincinnati Children's Hospital Medical Center

Karen Hacker, MD, MPH,
Director, Allegheny County Health Department

Eric Hulsey, DrPH, MA,
Manager of Behavioral Health Analytics, Allegheny County Health Department

Claire Richmond, MS, MPH,
Project Manager, Healthy Homes Des Moines

Brett Burkhart,
Strategic Director, Shift Interactive, LLC

Data Visualization for Population Health Initiatives

Andrew Beck, MD MPH

Cole Brokamp, PhD

November 14, 2016

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Objectives

- State the case for using data to inform population health improvement
- Introduce the development of a platform through which data can be visualized (and shared)
- Demonstrate the prototype of the data sharing platform

Help Cincinnati's 66,000 kids be the healthiest in the nation through strong partnerships

Morbidity and Mortality

- Reduce annual infant deaths in Hamilton County by 33%
- Reduce disparity in hospital bed days by 15%, focusing on 2 high risk neighborhoods (Avondale and Price Hill)

Thriving

- Ensure 5 year olds have a 'healthy mind and body'*
- Increase percent of children reading proficiently by 3rd grade in Cincinnati Public Schools from 78% to 90%

**Bundle measure: immunization, BMI, dental, behavior, vision, emergent literacy, speech, hearing*

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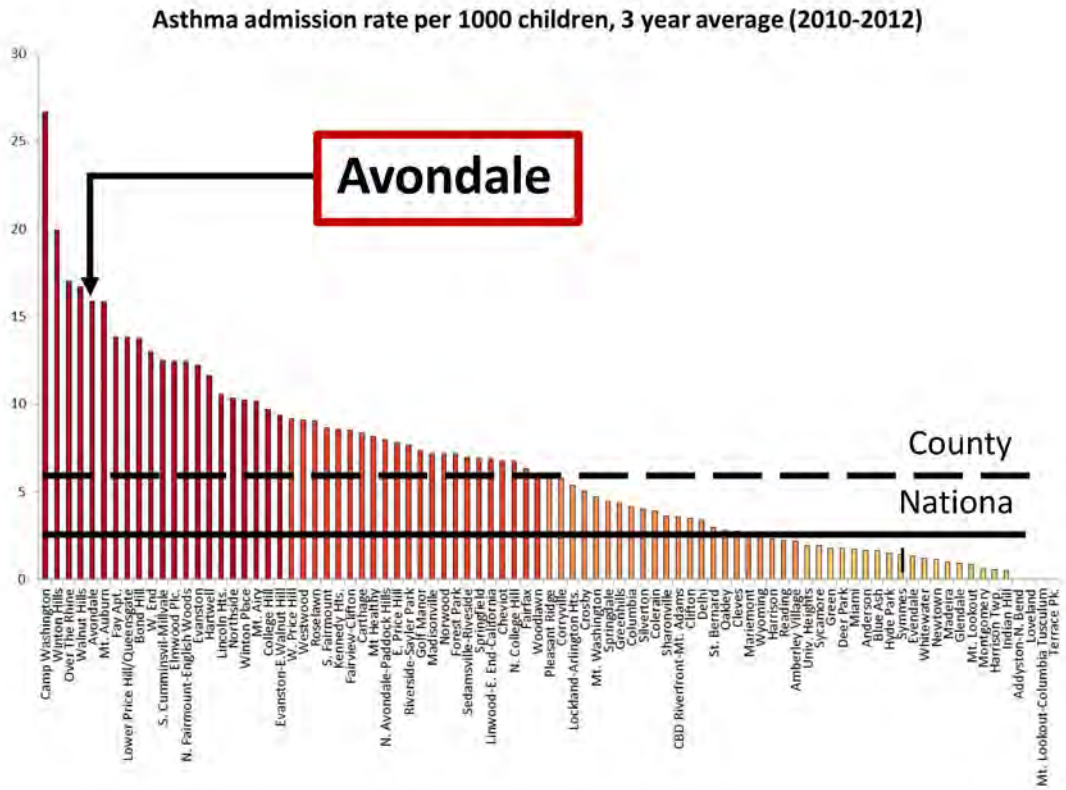
Population health disparities – asthma

- 1,000 in-county children admitted annually
  - Within 12 months:
    - 20% readmitted
    - 40% revisit ED
  - Neighborhood disparities
- Avondale admission rate:
  - >3 times county average
  - >7 times national average



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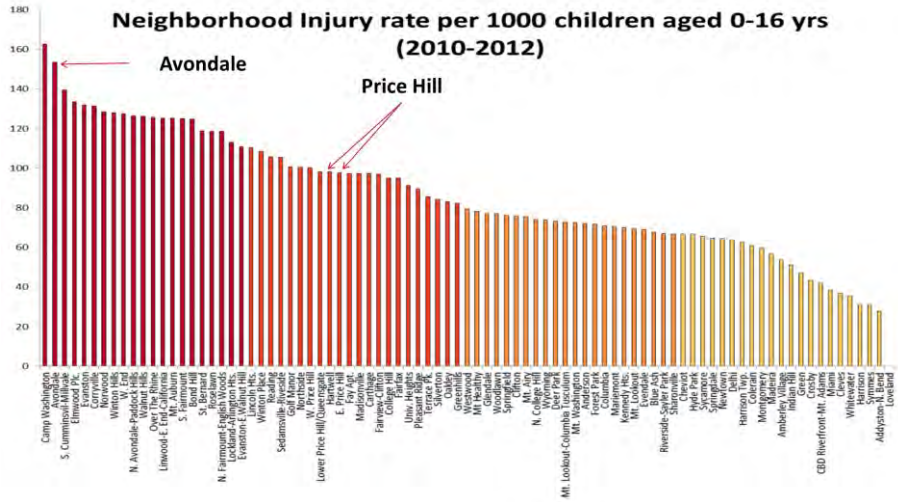

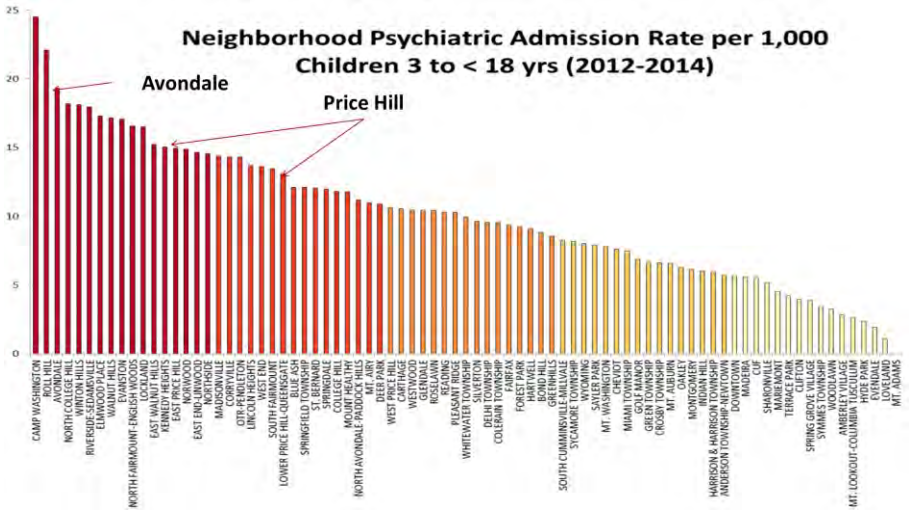

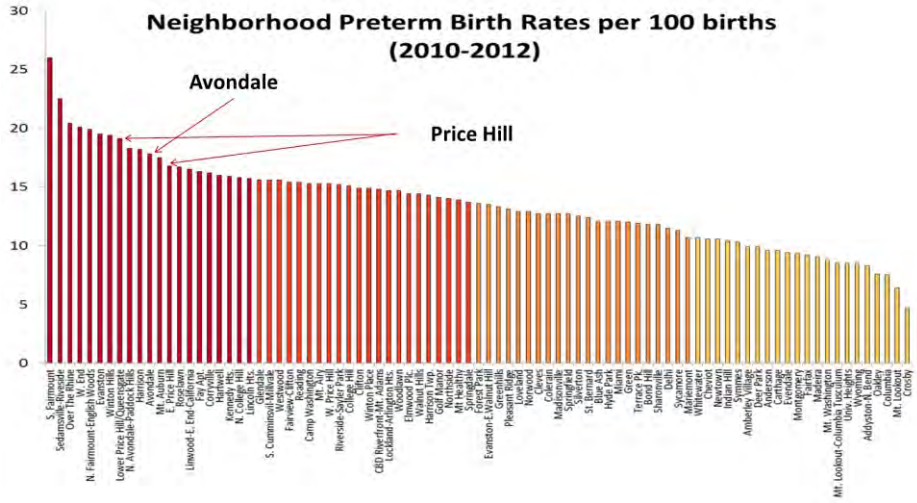

Population health disparities beyond asthma

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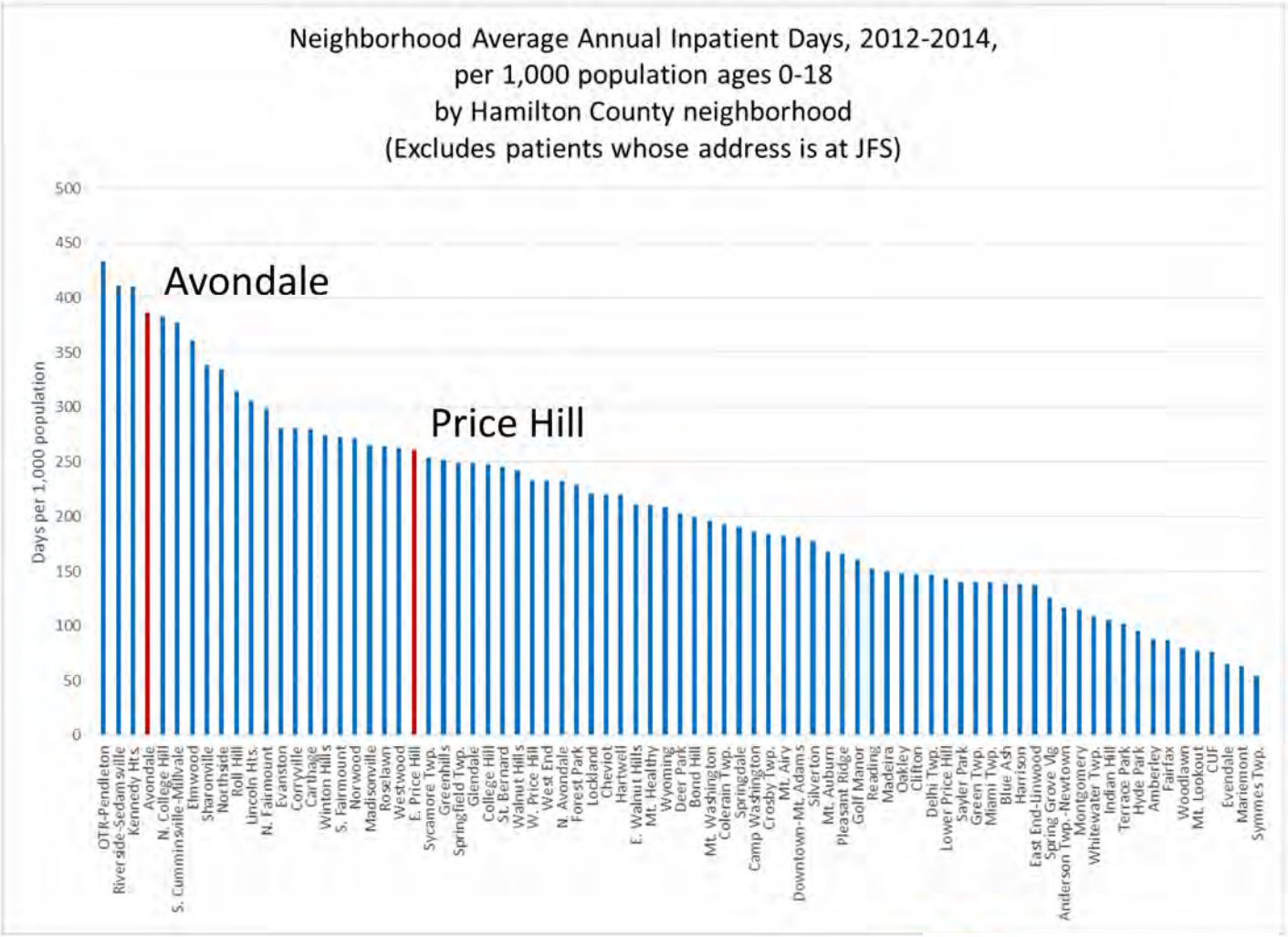
Disparities in total bed-days across County



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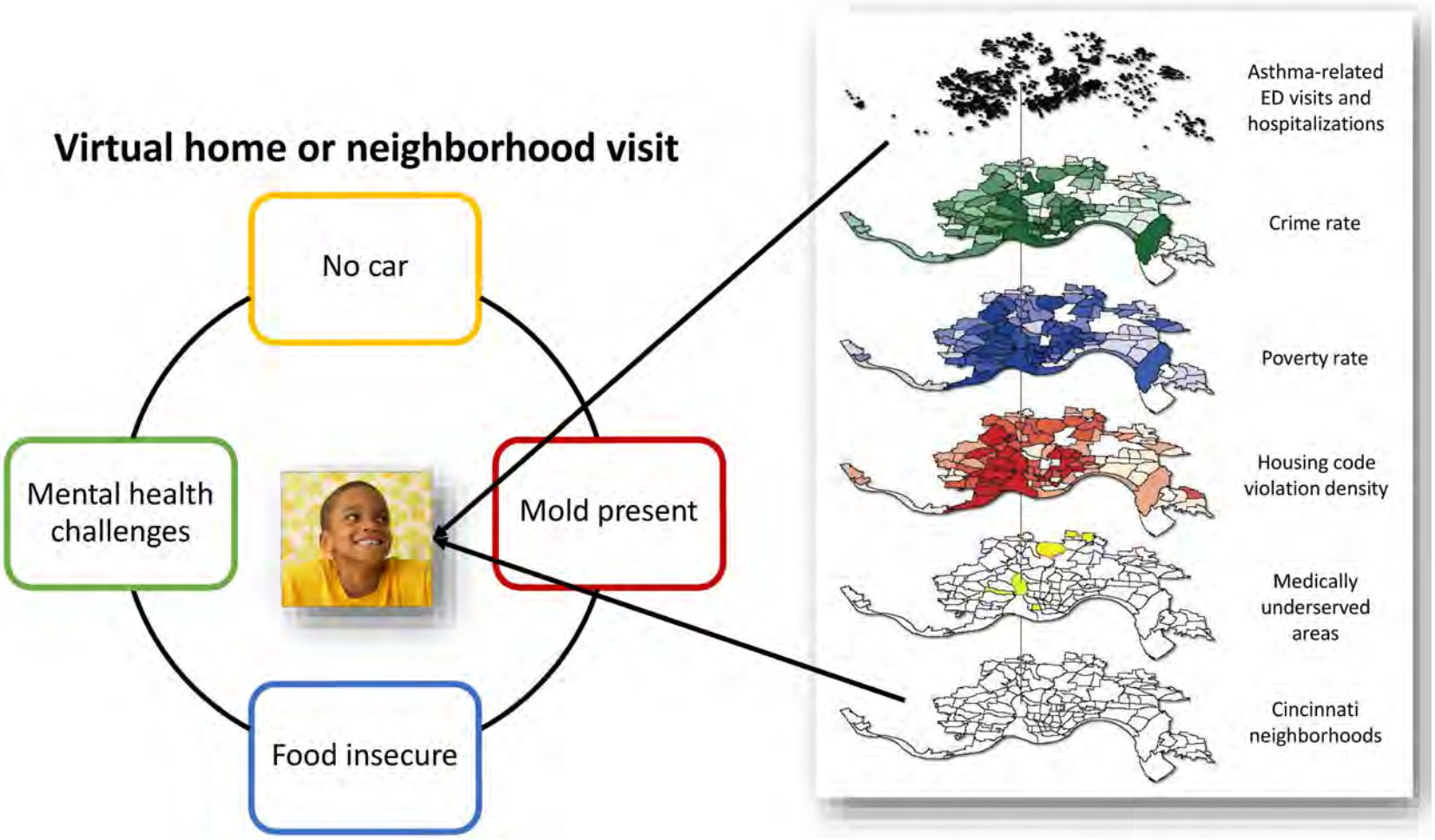
Enhance place-based risk assessments



How can we get to this point?

Current use cases

- Using maps to develop **common language** between health care system and community partners, including:
  - Community pharmacies
  - Housing experts
  - Schools
  - Community organizers
- Prototypes …

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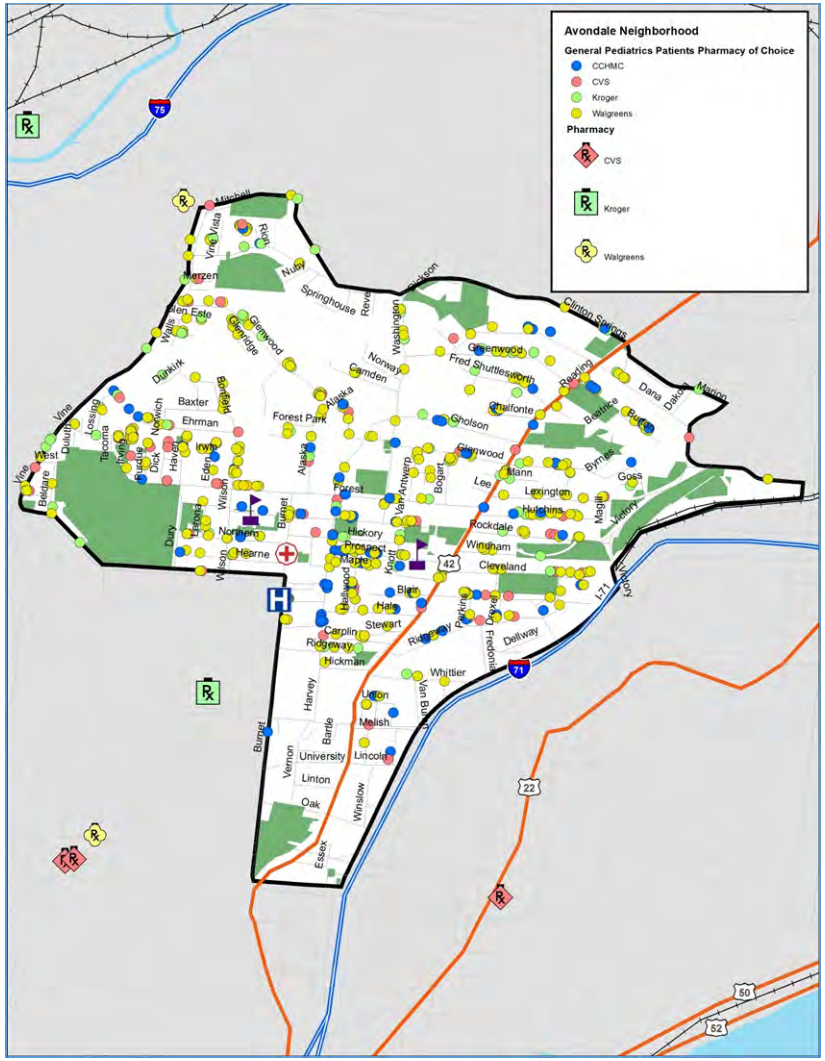

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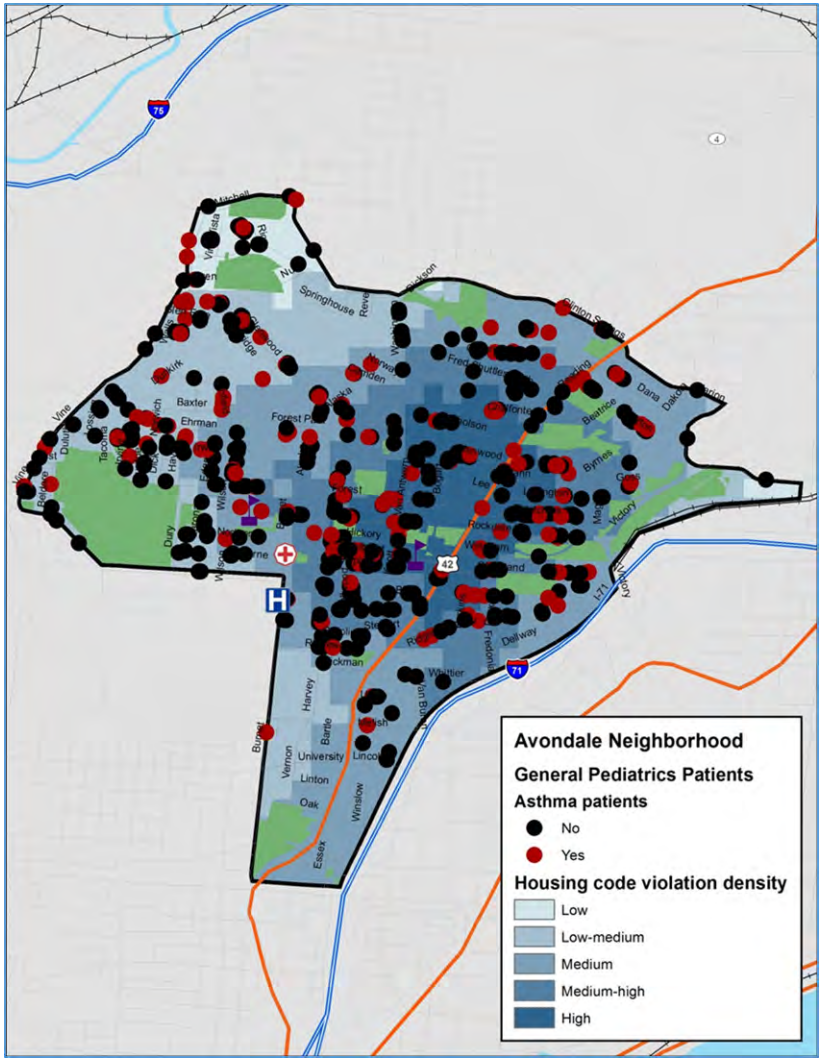

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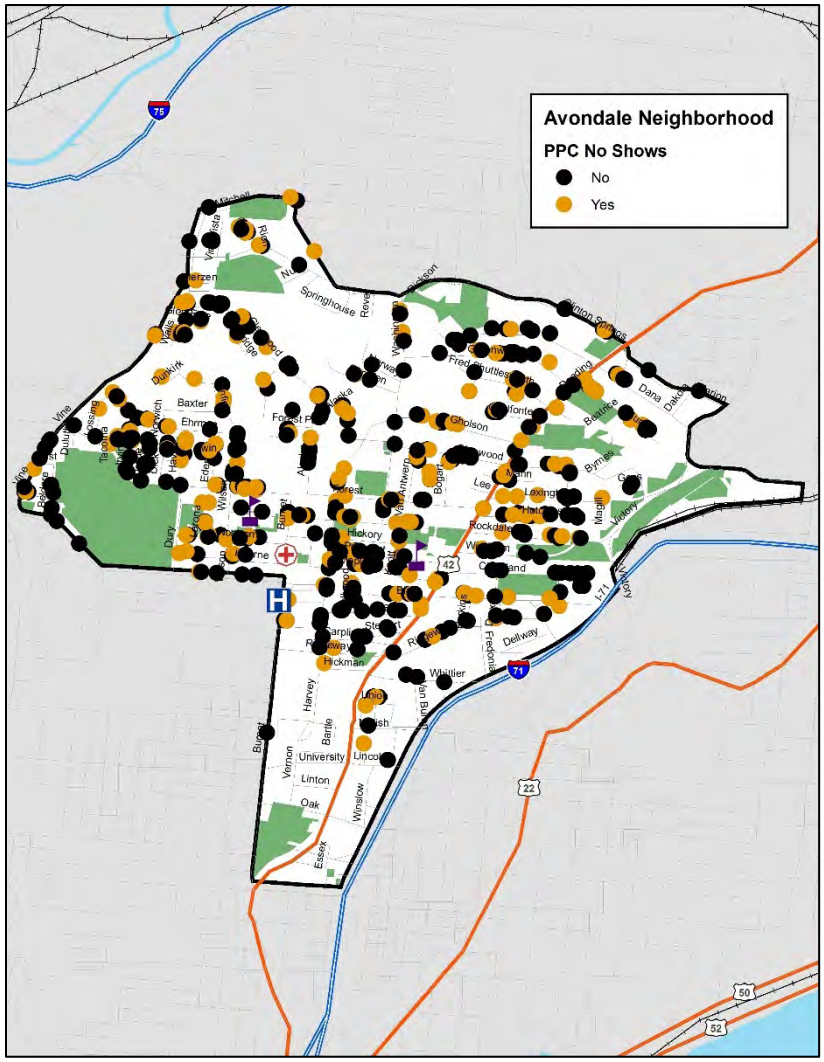

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Moving from prototype to platform

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App Aims

- Community member versus “expert/researcher”
- Who are you trying to reach?
- Single use / exploratory versus batch processing / statistical
- Make raw data available? downloadable?

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Tools

- Open source
- Data fetch/aggregate: bash
- Computation (Amazon EC2/S3, internal computational cluster)
- Geography tools: GEOS, GDAL, PROJ4 (and their respective wrappers for R, Python, qGIS)
- R Shiny (Server) / flexdashboard
- R/Javascript Interface for Interactive HTTP widgets:
  - mapping: Leaflet
  - visualization: Plotly
  - tables: DataTables

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Private Health Information Concerns

- Hosting servers (Amazon BAA, internal hosting, HIPPA compliance)
- Geocoding internally
- Jitter location points
- transform to heatmap / krigging
- restricted zooming on interactive maps and images

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GIS is more than mapping…

- Interactive and linked visualizations
- Statistics and distributions to put a place on a relative scale
- Predictive modeling and inference with different assumptions or model parameters
- Describing risk has been done, what can we do to manage risk?

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Be a part of a reproducible research pipeline

- Script *everything*: download, aggregating, spot fixing, converting projections, merging geospatial objects, saving, exporting
- Allow others (even your future self) to verify and build on your work
- Future fixes and changes are easier
- Work more shareable, easier to collaborate
- Work more scalable when it comes to deployment
- Using text/command based software also allows version management

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Application Feedback Cycle

- Track simple visit rate
- Focus groups (users/clinicians/community leaders)
- User studies (click rate, user behavior)
- A/B feature testing

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Future Work

- Embed in Electronic Health Record system
- GPS use for current location
- Better co-visualization strategies
- Implement near real time updates for acute exposures and outcomes (air pollution, combined sewer overflow events, allergens, heat, hospital visits and admissions, etc.)

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Data

Database	Example Data	Space	Time
Topologically Integrated Geographic Encoding and Referencing (TIGER)	Proximity to roadway, locations of airports, railroads, bodies of water, elevation	Exact location (nationwide)	Yearly
US Census American Community Survey (ACS)	Population, socioeconomic indicators	Census tract or block (nationwide)	Yearly
Spatiotemporal PM2.5 Predictions	Estimated air pollution exposure	Exact location (seven county area served by CCHMC)	Daily (2000 – 2015)
Moderate Resolution Imaging Spectroradiometer (MODIS)	Greenspace, land cover, aerosol optical thickness, surface reflectance	3km square grids (nationwide)	Daily (2000 – 2015)
Open Street Map (OSM)	Public transportation routes	Exact location	Current
Global Historical Climatology Network (GHCN)	Temperature, relative humidity, precipitation, wind speed and direction	Interpreted from > 5000 stations (nationwide)	Daily
National Emissions Inventory (NEI)	Location and amount of emissions	Exact location	Yearly
EPA Air Quality System (AQS)	Fixed site monitoring of ambient pollutant levels, air quality alerts	Interpreted from over 2500 stations (nationwide)	Daily
Smart Location Database (SLD)	Location efficiency, characteristics of the built environment	Census tract	2010
Cincinnati Area Geographic Information Systems (CAGIS)	School districts, crime density, combined sewer overflow sites, housing infractions, etc	Exact location (Greater Cincinnati Area)	Current
US Department of Transportation (DOT)	Highway traffic intensity	Exact location (nationwide)	Yearly
National Park Service Geospatial Sound Modeling (GSM)	Noise level	270 m sq grids (nationwide)	2015

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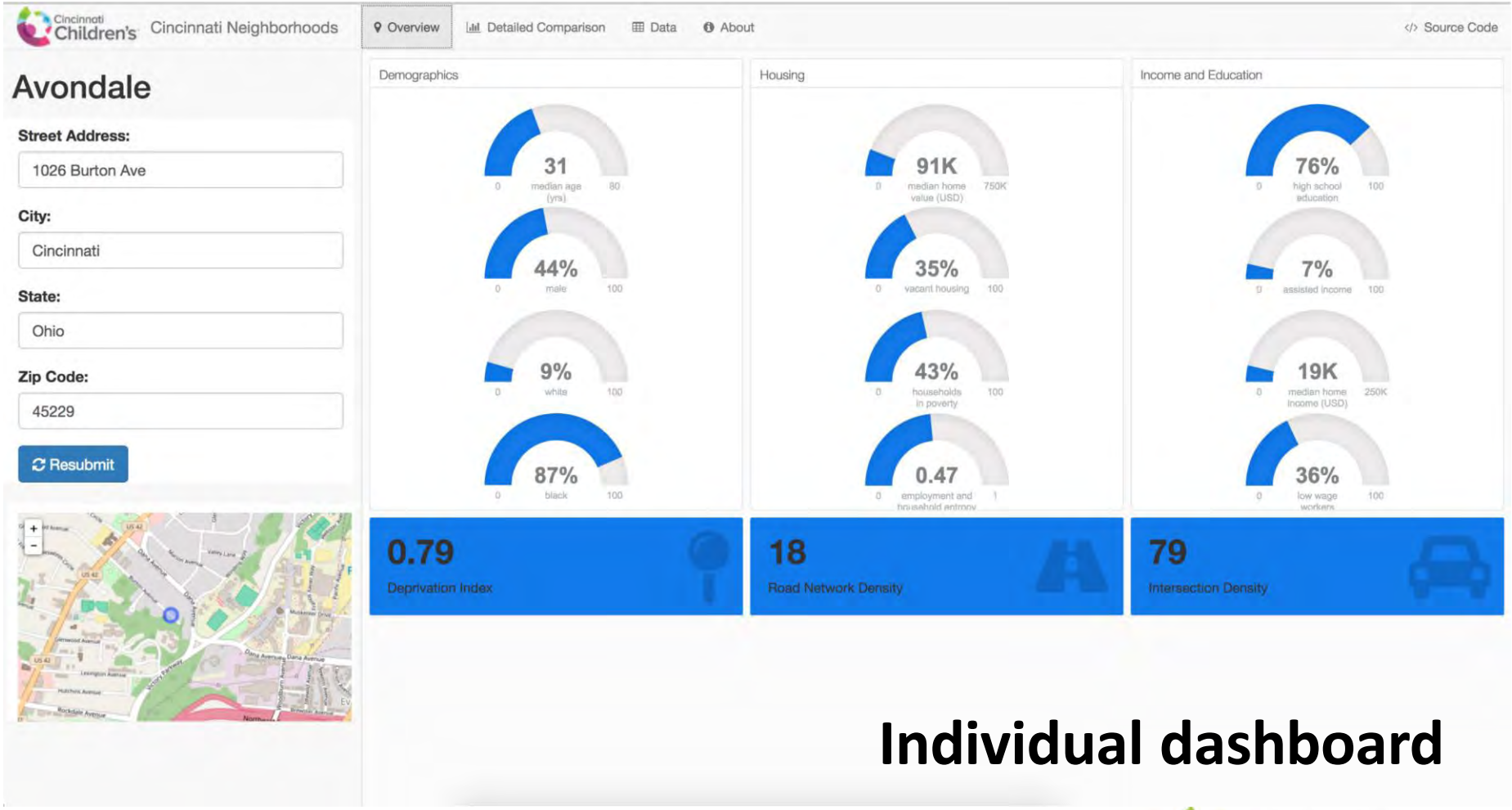

Individual dashboard

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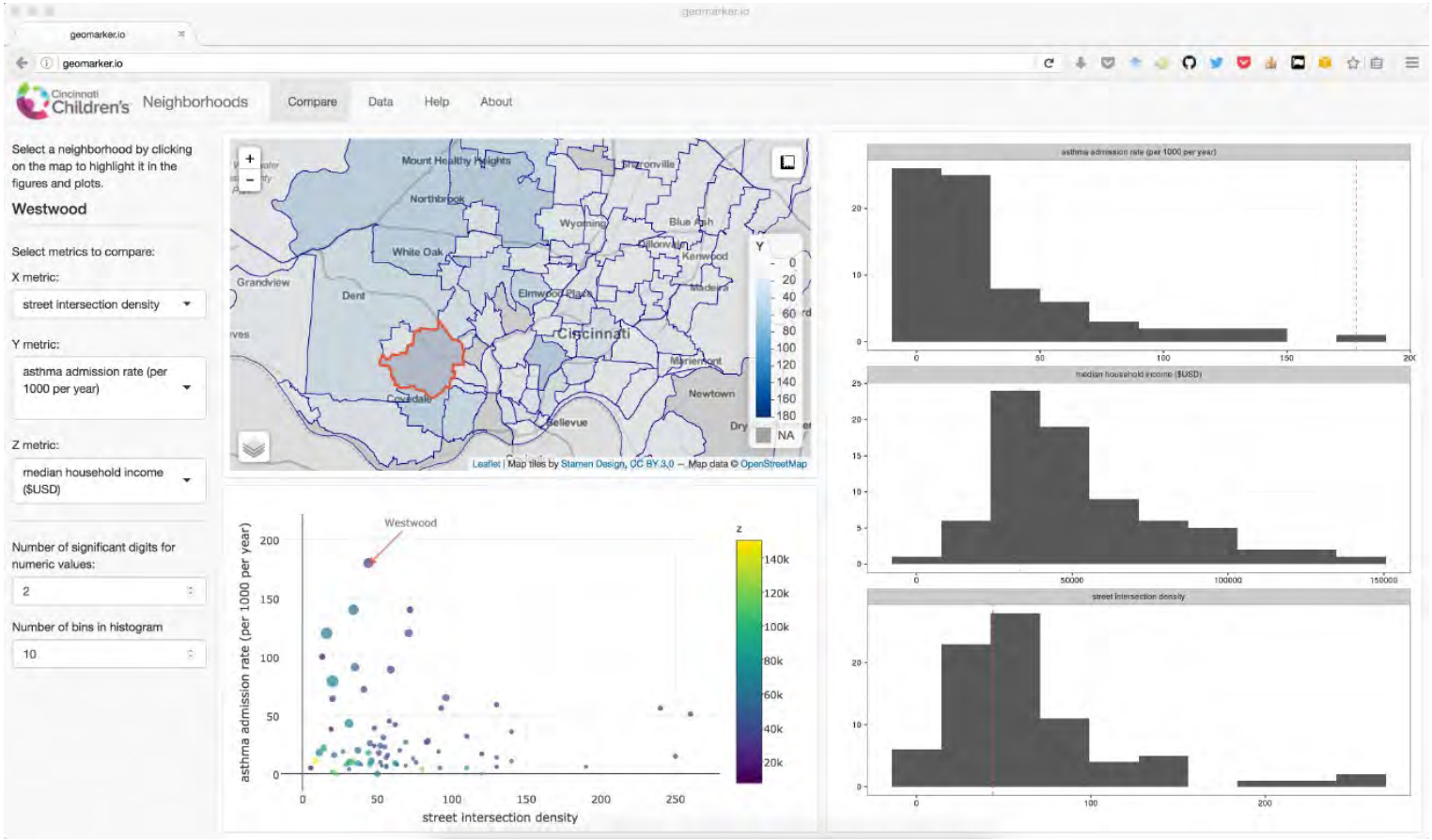

http://geomarker.io

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Comments? Questions?

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Appendix

Application Deployment

- **Docker**: a software containerization platform
- Makes your software stack reproducible from the ground up
- No more software dependency issues (“But it worked on my computer!”)
- Like a VM, but runs on linux kernel
- Makes scaling development
- GUI available for linux/windows/mac to share private images

shiny_docker: A robust method to automatically dockerize your R Shiny Application (*https://github.com/cole-brokamp/shiny_docker)*

automagic: Parse R code to automagically install required R packages ahead of time (*https://github.com/cole-brokamp/automagic)*

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Allegheny County Data Sharing Alliance for Health (ACDSAH)

Data Visualization Webinar

Vision: a connected data warehouse that provides multi-source data for cross sector decision making to impact the health of the 130 municipalities and 1.2 million residents in Allegheny County.

Project Introduction

Goal: Build a connected data system of multi-source datasets to improve the cardiovascular health of residents in Allegheny County

- Data System "Social Determinant Data Warehouse"
  - Select datasets will be used in a simulated model (FRED model - Framework for Reconstructing Epidemiological Dynamics @ U. Pitt) to examine the distribution of CVD throughout Allegheny County and test interventions in high need areas.
  - The data collected can be used on an ongoing basis to support ACHD projects, specifically the Plan for a Healthier Allegheny (PHA)
  - Provide both the project partners and citizens with public access to the collection of relevant health determinates datasets

Who We Are

- **Lead Agency**- Allegheny County Health Department

- **ACDSAH partners**:
  - Allegheny County Department of Human Services
  - Allegheny County Economic Development
  - UPMC Health Plan, Gateway Health Plan, Highmark Health Plan
  - Jewish Health Care Foundation and
  - Carnegie Mellon Traffic21 Institute,
  - The University of Pittsburgh GSPH
  - RAND Corporation

The Data

Health Inputs

-Obesity rates
-Smoking rates

-Medical claims data
  Hypertension
  Diabetes
  Hyperlipidemia
Diagnosed & Diagnosed + Meds

  Co-morbidity
Hypertension + Diabetes+
Hyperlipidemia (diagnosed)

  Anxiety medication
  Depression medication

-Hospitalization
(PHC4 zip codes only)
  due to diabetes
  due to hypertension or stroke

Natural Environment

-Air Quality
  TRI
  Diesel particulate

-Land Use
  Woodlands/ forest
  Greenways Barren
  Land

Social

-Demographics
  Age
  Race
  Gender
  Median income
  Poverty rates
  Employment Rates
  Educational attainment
-Access to Transportation
  Vehicle Ownership
  Commute time to work
-Homicide
-Age of Death

Built Environment

-Land use
  Roadways
  Parks
  Trails
  Agriculture land
  Urban
-Traffic Data
  911 response time
  Hourly Traffic Counts
-Health facilities
  Primary Care
  Hospitals
-Vacant properties
-Home ownership/ rentals
-Age of housing
-Walk Scores
-Illegal dump Sites
-Food Access
  Fast food
  Farmers markets
  Supermarkets
-Food deserts
-Tobacco vendors
-Alcohol vendors
-Exempt clean air vendors

Compiling the Data

- Health Department utilizes an internal server as a data repository to store and organize the DASH data. (ArcGIS and Excel are used for geocoding and aggregation)

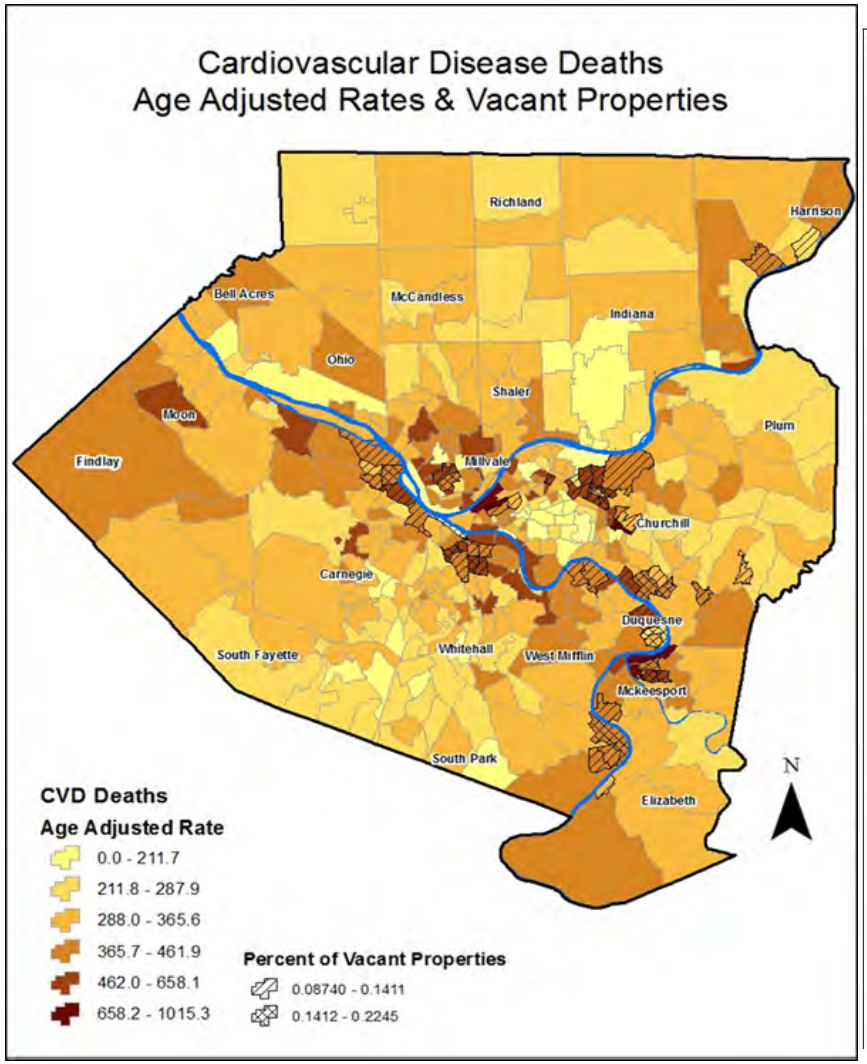
- Building the data set at the census tract level

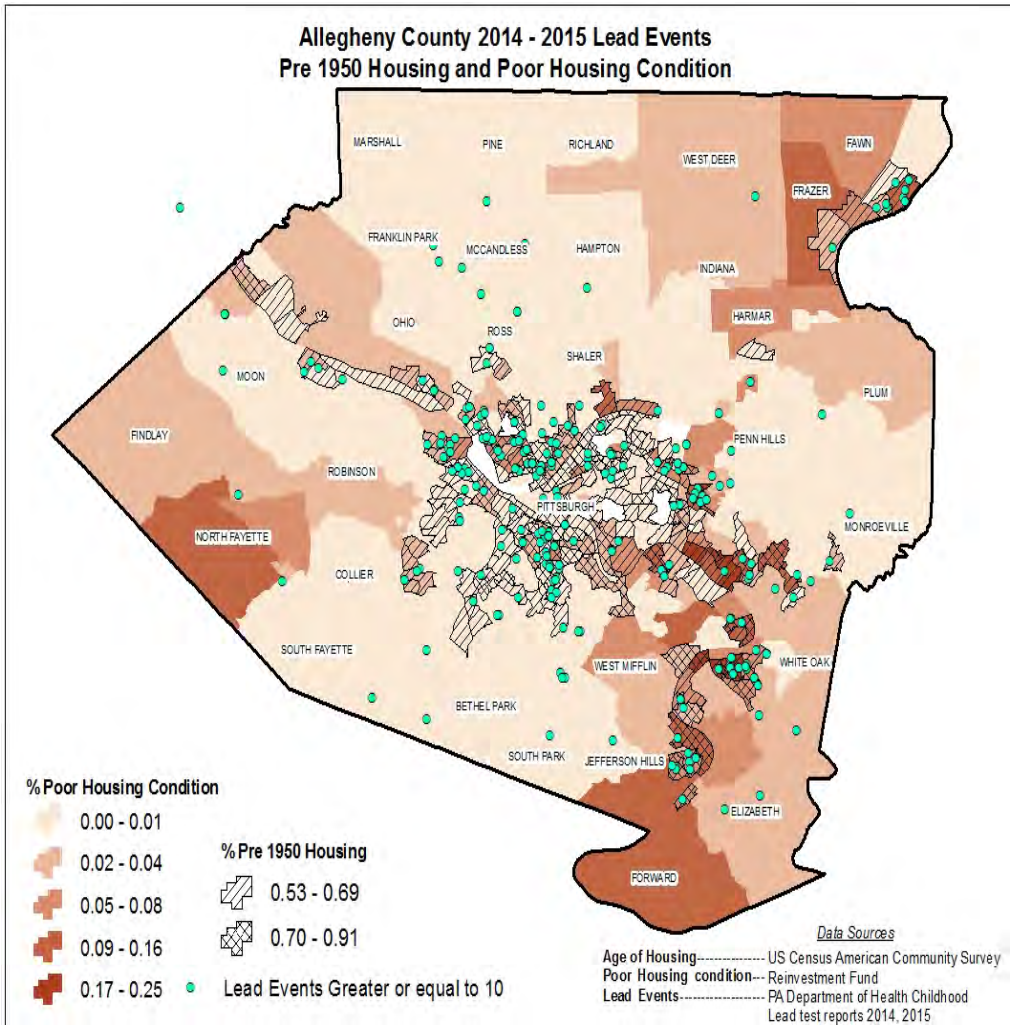
- Human Services has developed a data warehouse integrating data sources at the individual level

Data Tools & Features

- Current Visualization tools
  - ArcGIS
    - To identify areas to target
  - Online Community Profiles (University of Pittsburgh, University Center Social & Urban Research (UCSUR)
    - To provide community with maps of their data
    - To store data for future analysis
  - Healthy Communities Institute (HCI) “community indicators”
    - Public dashboards of county data
  - FRED
    - Visual models that demonstrate response to interventions

ArcGIS





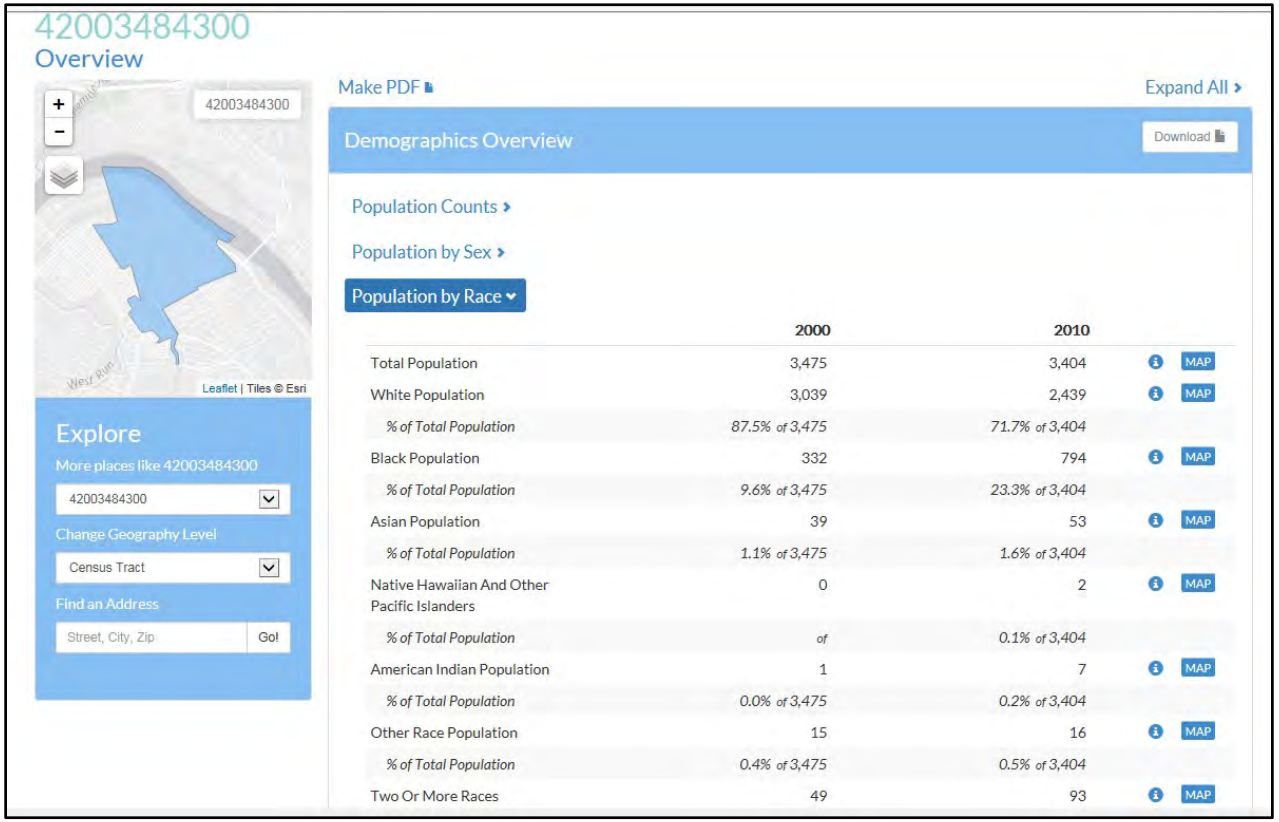
Audience: Public, Staff, Foundations, Health Care, Other County and City institutions

Pros: layering of issues, see patterns

Cons: not interactive

University Center for Social and Urban Research (UCSUR)

- UCSUR maintains a western PA regional data center where Community profiles allow users can find and download datasets to map and visualize data (Partnership is facilitated by Allegheny County Statistics)



https://profiles.ucsur.pitt.edu/profiles/census-tract/42003202300/education/

Audience; researchers, community organizations; county departments, foundations

Pros: gives interactive ability to layer maps, currently available at no cost

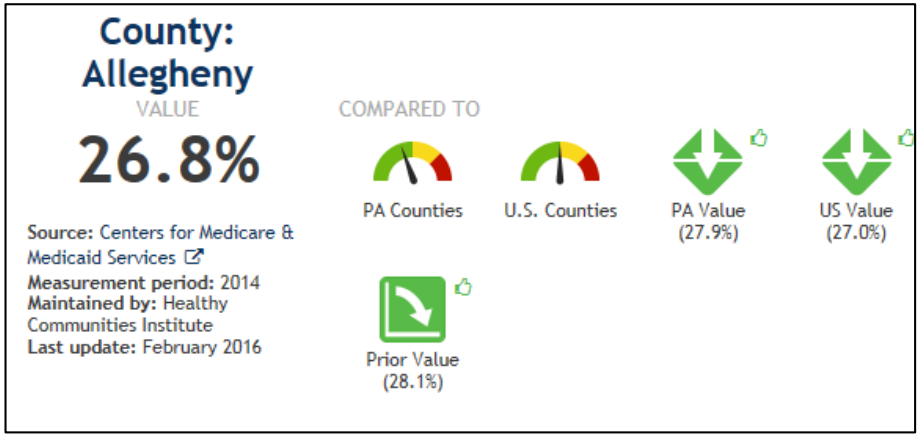
Cons: too academic

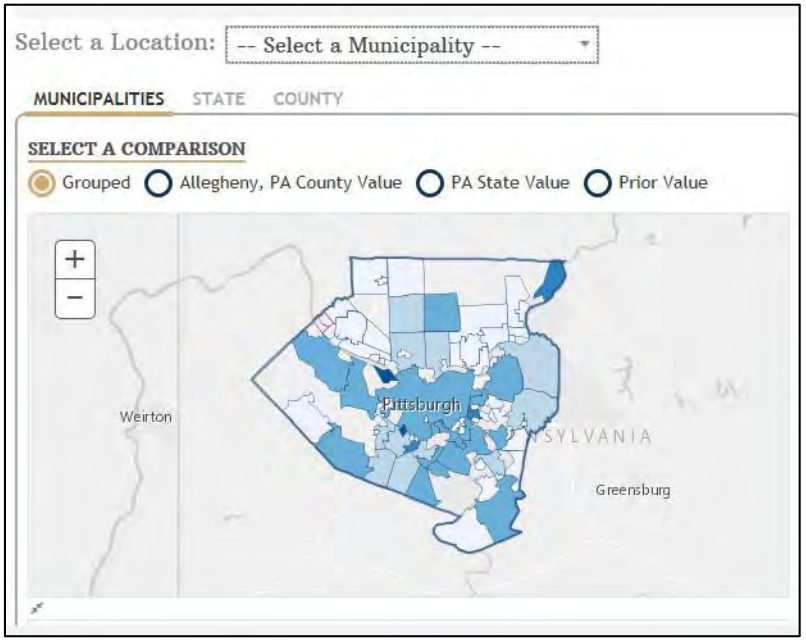
Healthy Community Institute (HCI)

Audience: public, ACHD, community organizations

Pros: very user friendly, easy to understand, continually updated

Cons: requires work to input new data, annual licensing fee, no input into updates





http://www.achd.net/aci/index.html?hcn=%2Findex.php%3Fmodule%3Dindicators%26controller%3Dindex%26action%3Dview%26indicatorId%3D2064%26localeId%3D2297%26hcnembedredirect_%3D1

Framework for Reconstructing Epidemiological Dynamics

"FRED"

- Uses a modeling system based on synthetic populations that capture the demographic and geographic distributions of the population.

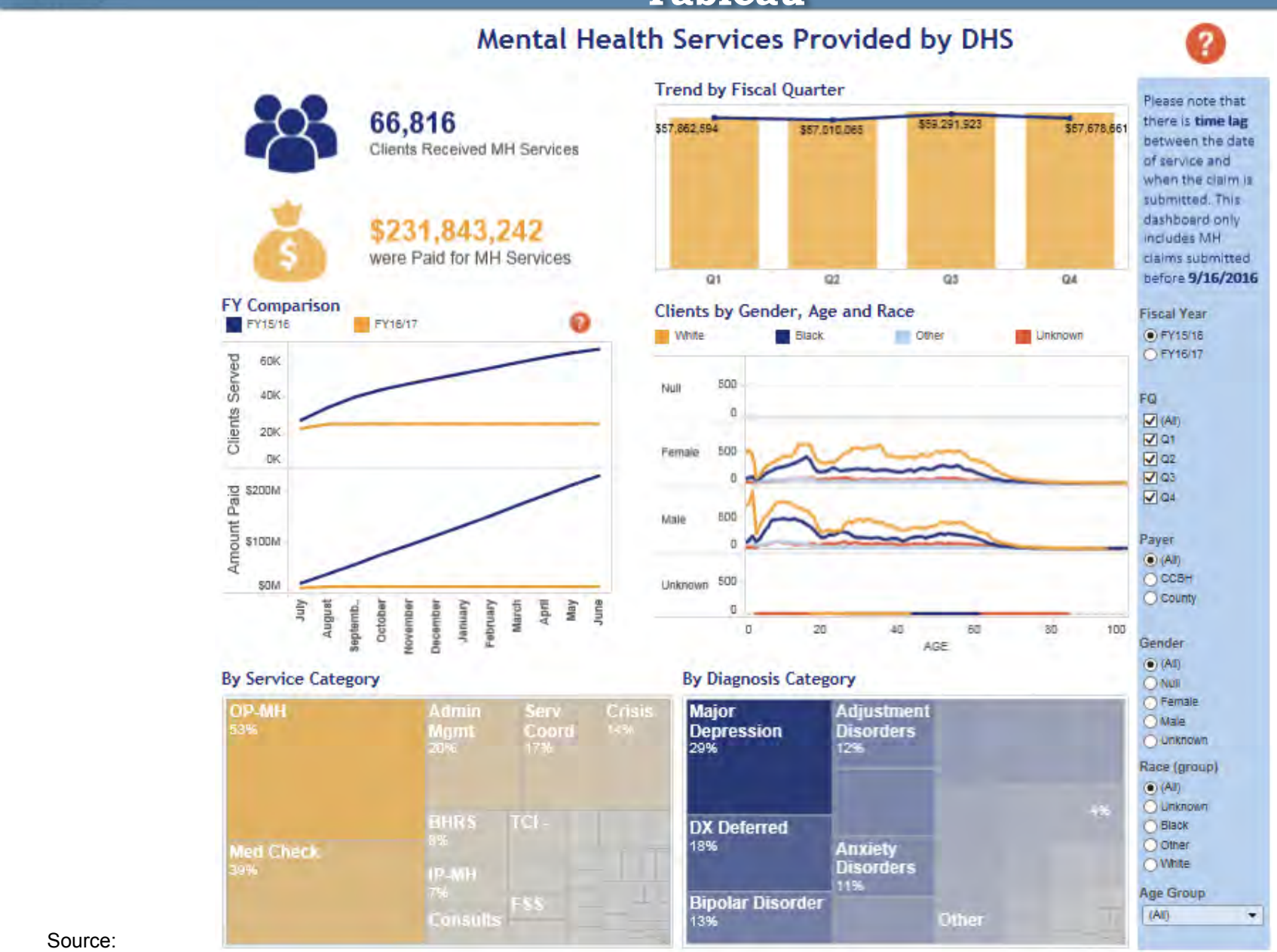
- A strength of the model is its ability to visualize patters of incident occurrence and predict how interventions may change the way a disease looks.

- FRED has the potential for live action visualization.

New Visualization Tools

- Tableau (ACHD)
  - for more interactive dashboards
  - ***Pros:*** interactive, ability to download data directly, data can be shared with other jurisdictions
  - ***Cons:*** annual cost, training curve

Allegheny County Human Services Tableau



Source:
https://tableau.alleghenycounty.us/#/signin?externalRedirect=%2Fviews%2FMHDashboardforDHS%2FMHDashboardforDHS%3F:embed%3Dy&site=

Lessons Learned

- No one visualization strategy meets all needs
  - Academics, open data, community members
- Try to build on existing opportunities for sustainability
- Is it best to use many or choose one?

Next Steps

- Work internally with IT to track the types of users & downloads that are currently happening on the county website.

- Identify the audience ACHD is reaching and select the next visualization strategies with the goal of reaching a broader audience.

- Choose a visualization strategy(s) that allows both more in-depth data downloads for organizational reports & partner grant writing in addition to providing the general public with the information they desire.

HEALTHY
HOMES
des moines
All In:
DATA
VISUALIZATION
WEBINAR

PARTNERS & **COLLABORATORS**

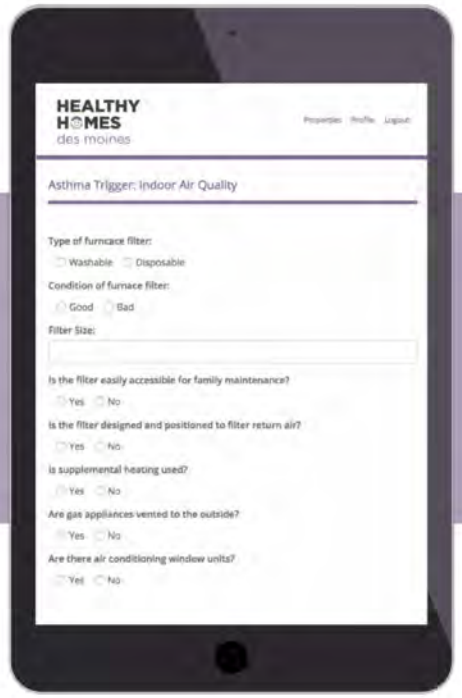
PRIMARY **AIMS**

Minimize asthma outside clinic walls

Children age 2-12

Households making < 80% of AMI

DATA **SOURCES**

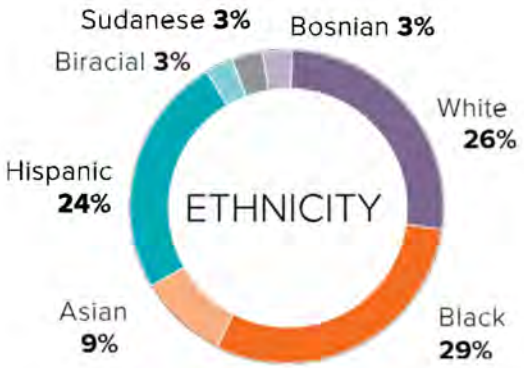


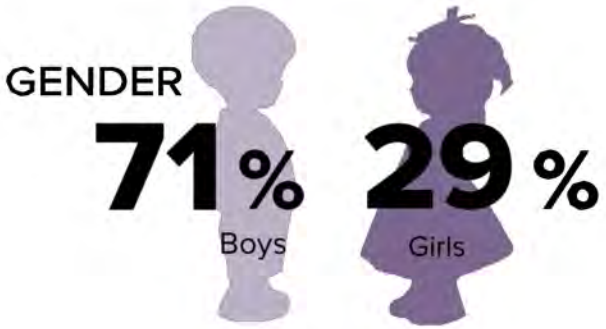
Family Survey Results

Inspection Data

Provider Referrals

HHDSM SO FAR

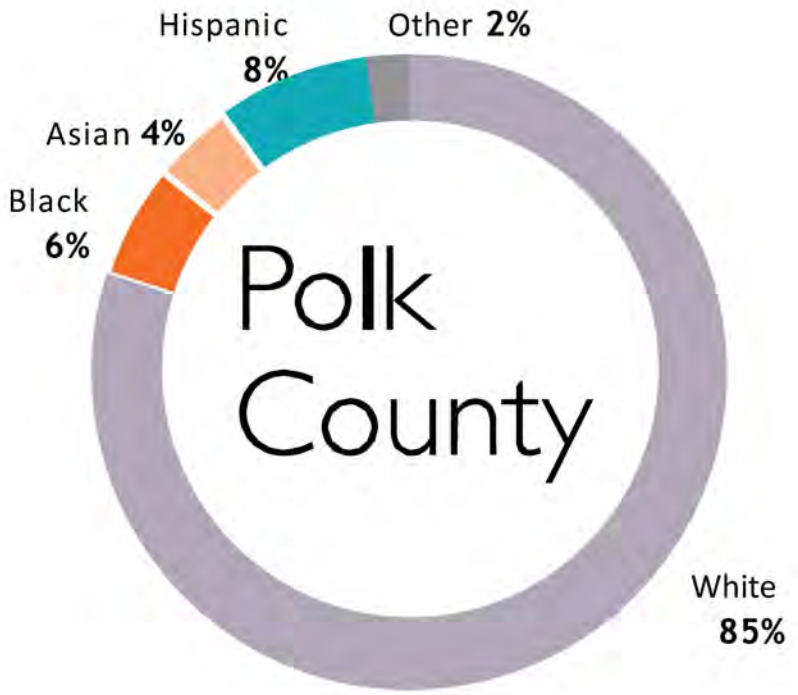


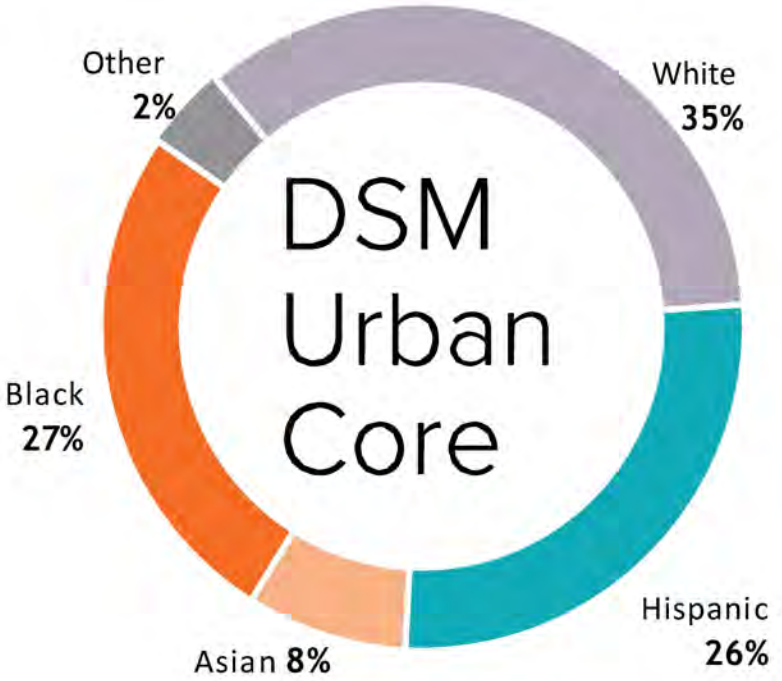


AVERAGE AGE

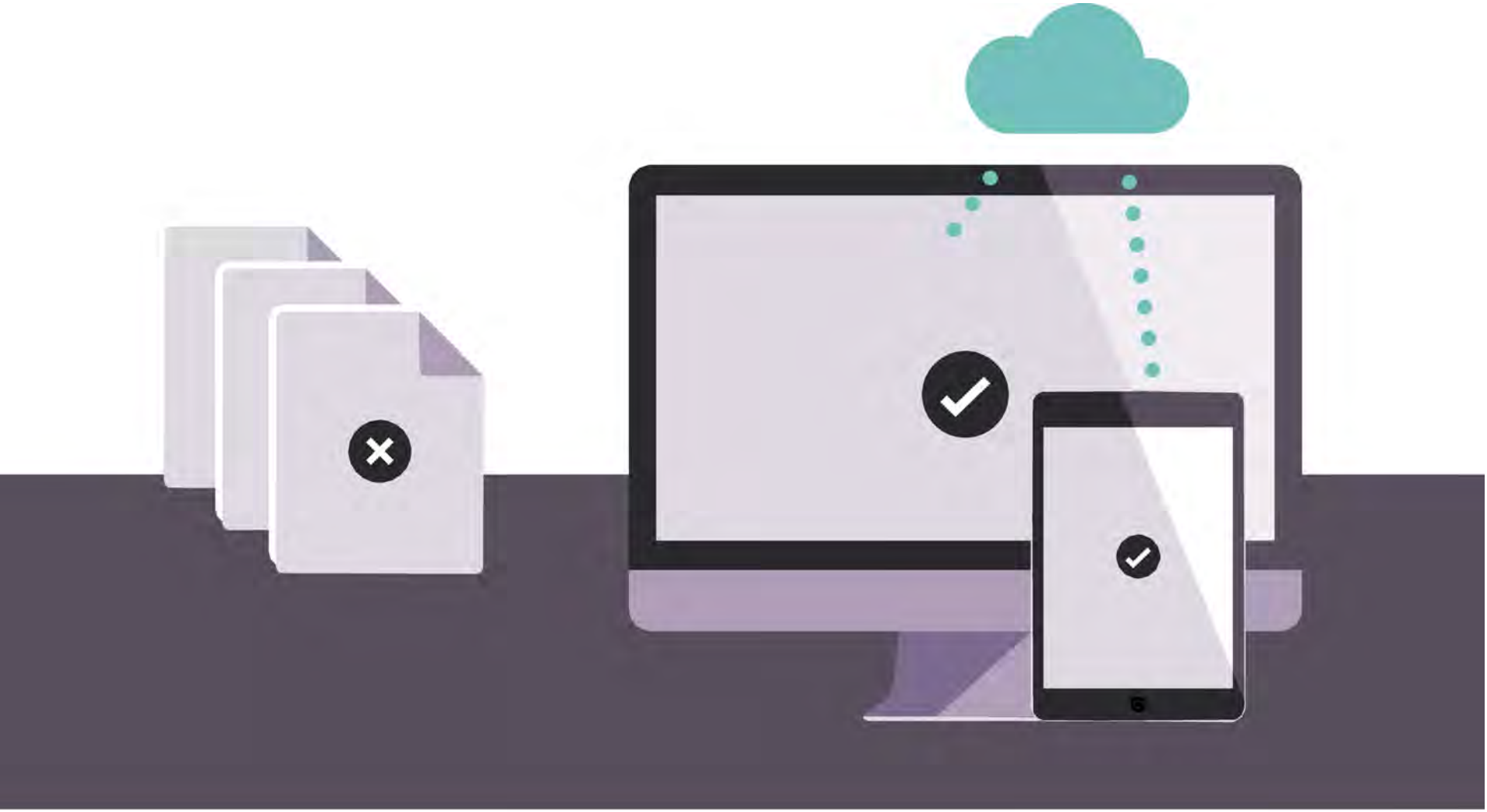
The average age of children referred to HHDSM increased slightly over the last quarter from 6 to 7 years.

URBAN CORE DEMOGRAPHICS

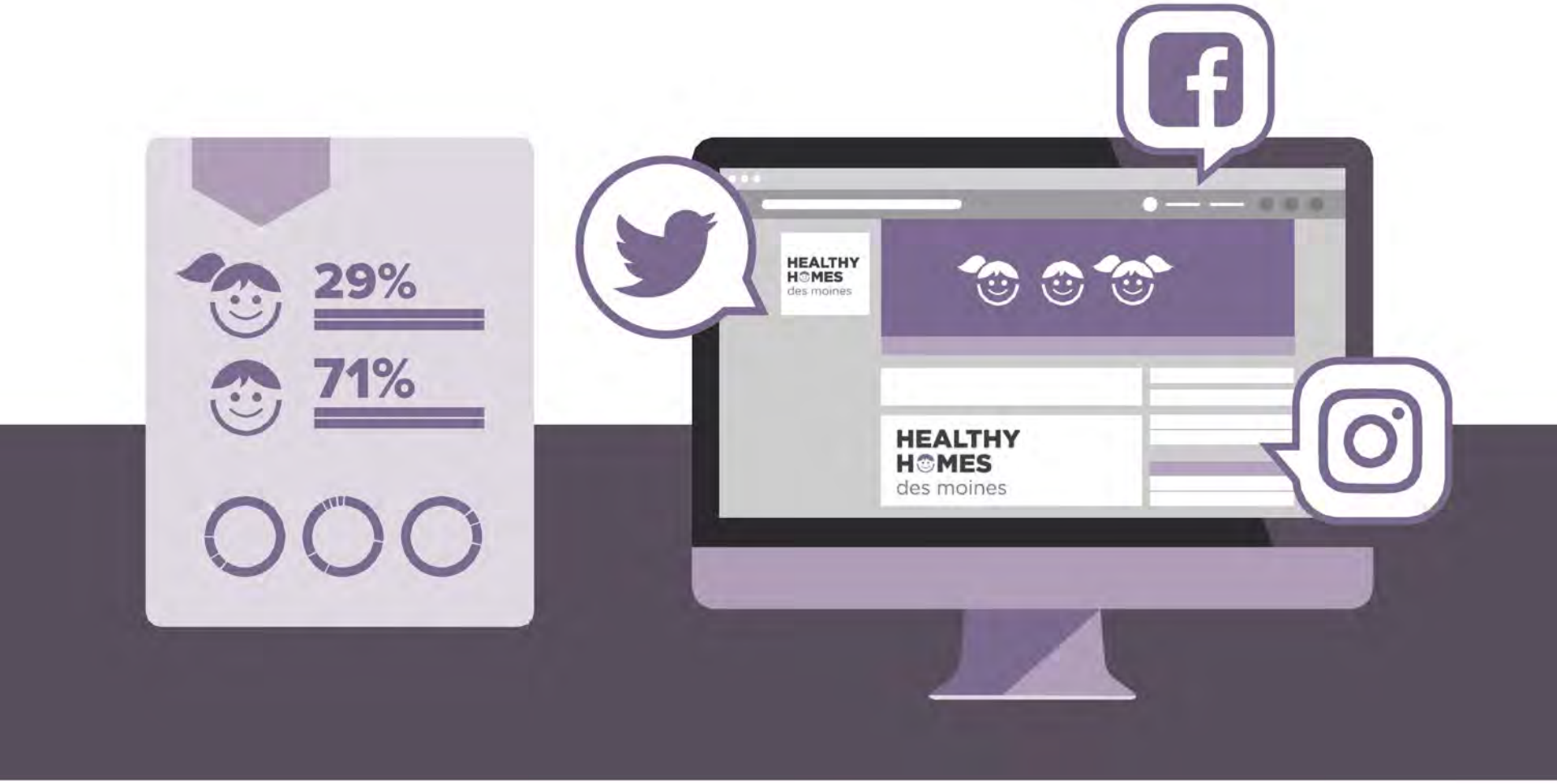




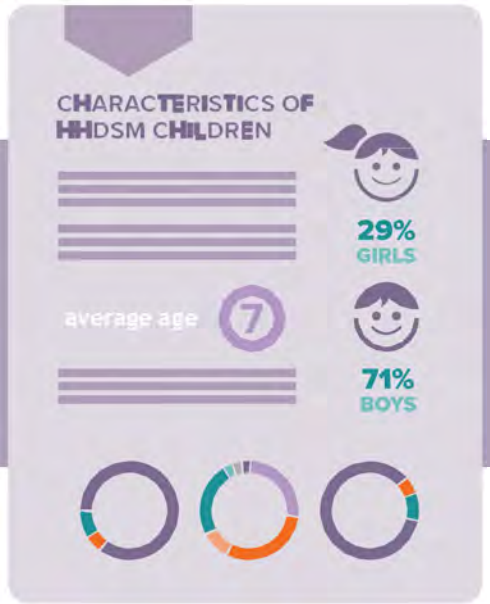
DATA **ANALYSIS**

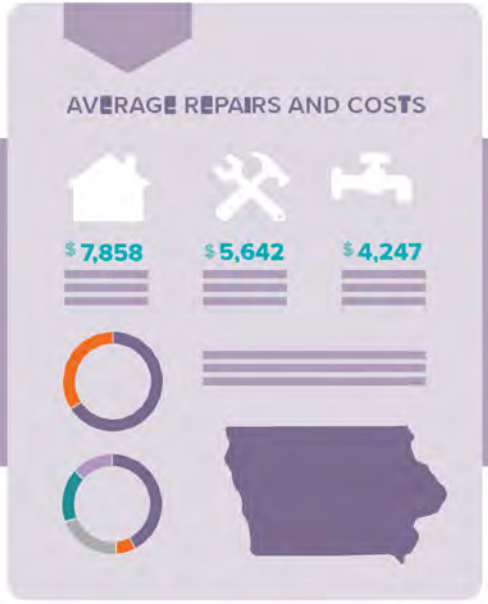


DATA **SHARING**

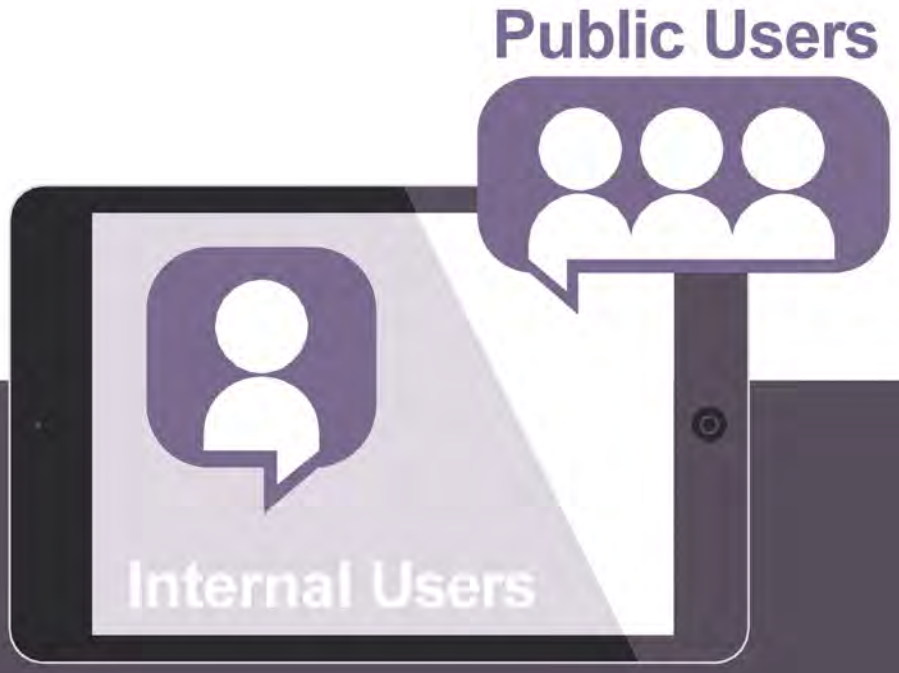


DATA **VISUALIZATION**





INTENDED **AUDIENCES**



CHALLENGES **EXPERIENCED + LEARNINGS**

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- Evaluation
- A resource list, slides, and recording will be available