Large Real Time Asthma Event Monitoring: Civic Tech and Public Policy

June 23, 2017

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AIR LOUISVILLE

Robert Wood Johnson Foundation

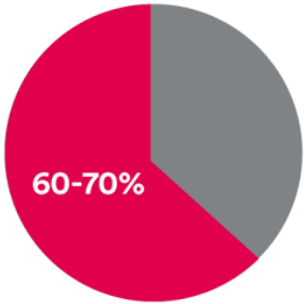
INSTITUTE FOR HEALTHY AIR WATER & SOIL

Propeller

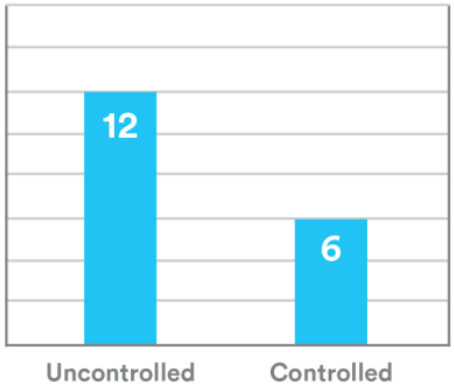
Asthma impacts daily lives and cost

> $26.2m spent on asthma hospitalizations in 2015 in Jefferson County

60-70 percent of people with asthma are uncontrolled



Missed work days/year due to asthma



5.2%

Productivity decline when working with asthma symptoms

Dean et al. The Impact of Uncontrolled Asthma on Absenteeism and Health-Related Quality of Life. Journal of Asthma; 2009, 46(9): 861-866.
R Zeiger et al. Asthma costs and utilization in a managed care organization. J Allergy Clin Immunol 2008, 121:885-92.

The Backstory

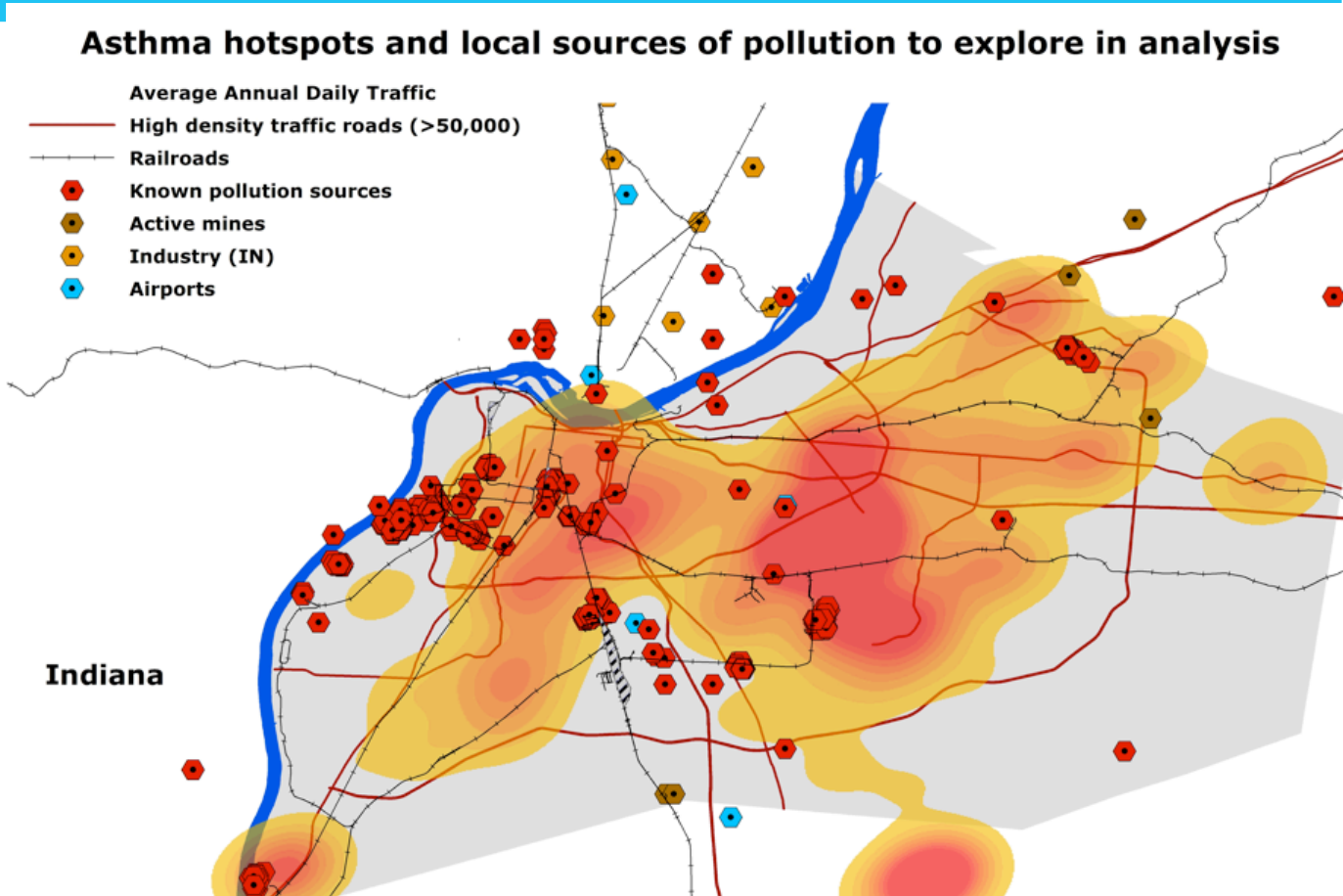
July 2011 – Why is Louisville consistently ranked as one of the worst places to live for people with breathing disorders?

Answer:

203,000 square miles

Is There a New Way to See Asthma and Inform Policy?

2012-13 – Local Philanthropy, City Innovation Office, and Propeller Health deploy 300 smart inhaler units for 18 months.

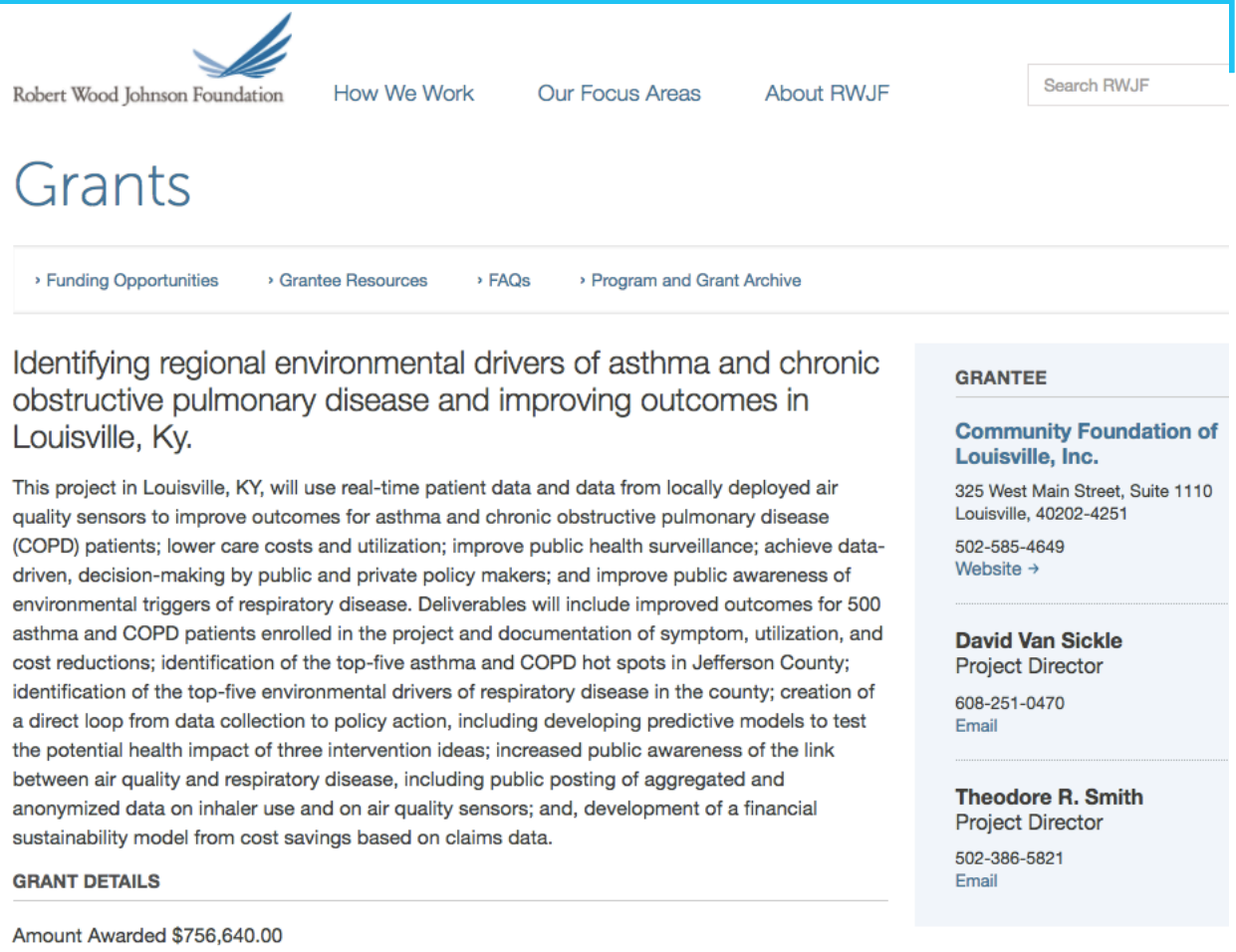


Let's Power It Up for Policy!

2014-2017 – RWJF Pioneer Fund enables a comprehensive two year study of over 1,100 residents of Louisville, KY.

Goal: gather data to inform public policy for pop health.

Focus: Connection to geo, temporal spatial factors



Robert Wood Johnson Foundation How We Work Our Focus Areas About RWJF Search RWJF

Grants

› Funding Opportunities › Grantee Resources › FAQs › Program and Grant Archive

Identifying regional environmental drivers of asthma and chronic obstructive pulmonary disease and improving outcomes in Louisville, Ky.

This project in Louisville, KY, will use real-time patient data and data from locally deployed air quality sensors to improve outcomes for asthma and chronic obstructive pulmonary disease (COPD) patients; lower care costs and utilization; improve public health surveillance; achieve data-driven, decision-making by public and private policy makers; and improve public awareness of environmental triggers of respiratory disease. Deliverables will include improved outcomes for 500 asthma and COPD patients enrolled in the project and documentation of symptom, utilization, and cost reductions; identification of the top-five asthma and COPD hot spots in Jefferson County; identification of the top-five environmental drivers of respiratory disease in the county; creation of a direct loop from data collection to policy action, including developing predictive models to test the potential health impact of three intervention ideas; increased public awareness of the link between air quality and respiratory disease, including public posting of aggregated and anonymized data on inhaler use and on air quality sensors; and, development of a financial sustainability model from cost savings based on claims data.

GRANT DETAILS

Amount Awarded $756,640.00

GRANTEE

Community Foundation of Louisville, Inc.

325 West Main Street, Suite 1110
Louisville, 40202-4251

502-585-4649
Website →

David Van Sickle
Project Director

608-251-0470
Email

Theodore R. Smith
Project Director

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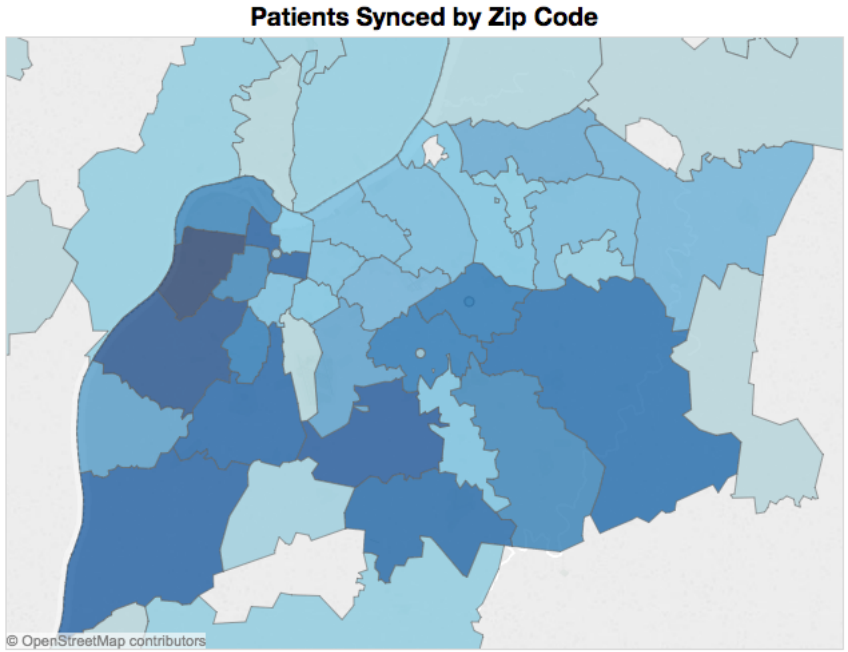
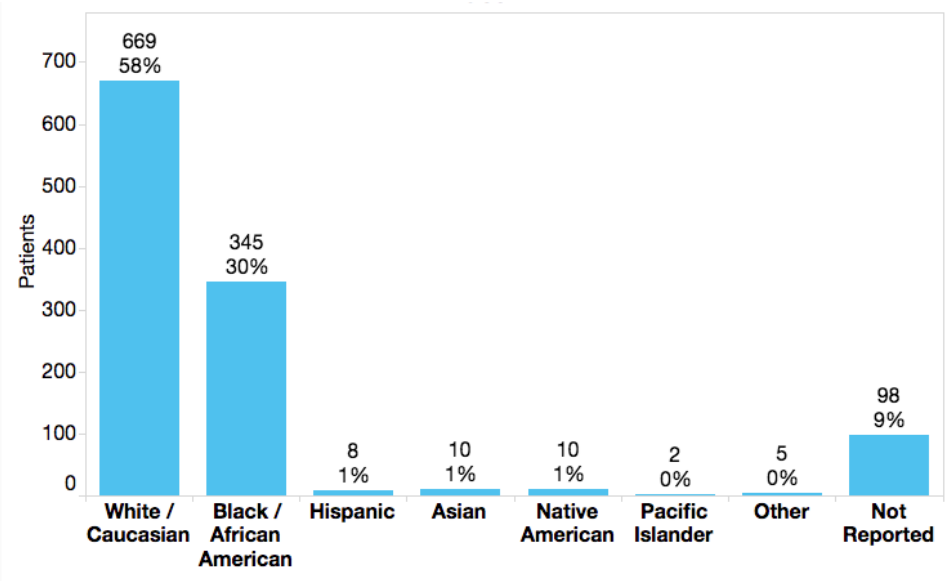
Email

Unique public-private partnership

1,147 participants - 115% of our goal

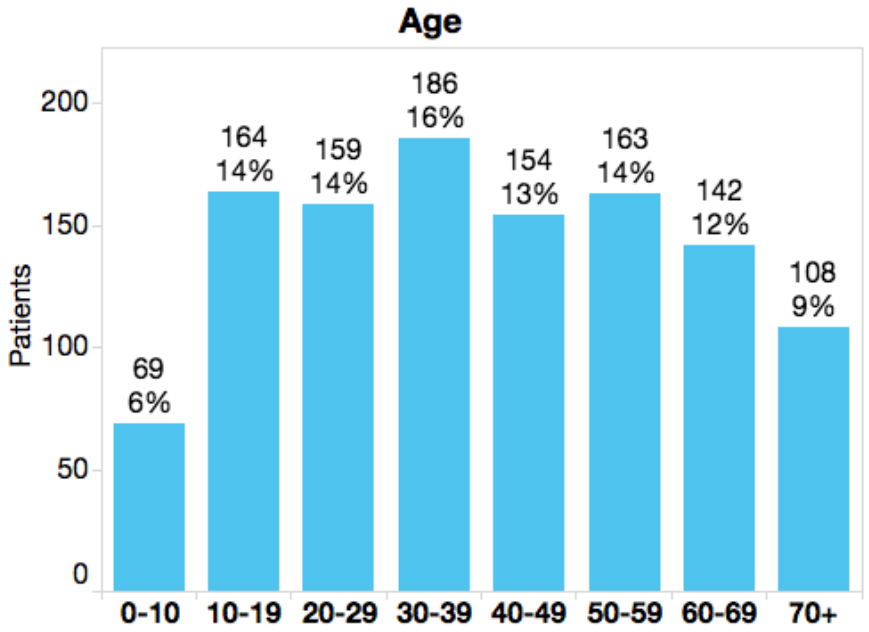
We aimed to capture a signal that is representative of asthma in Metro Louisville by neighborhood, race, SES, and disease severity.



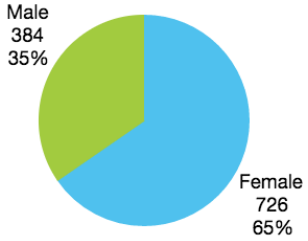


Age, gender and technology access

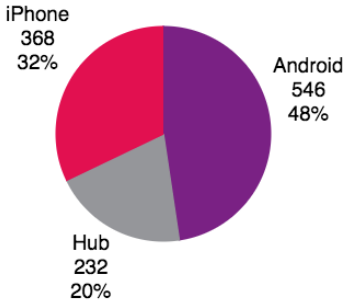
Enrollment across age groups



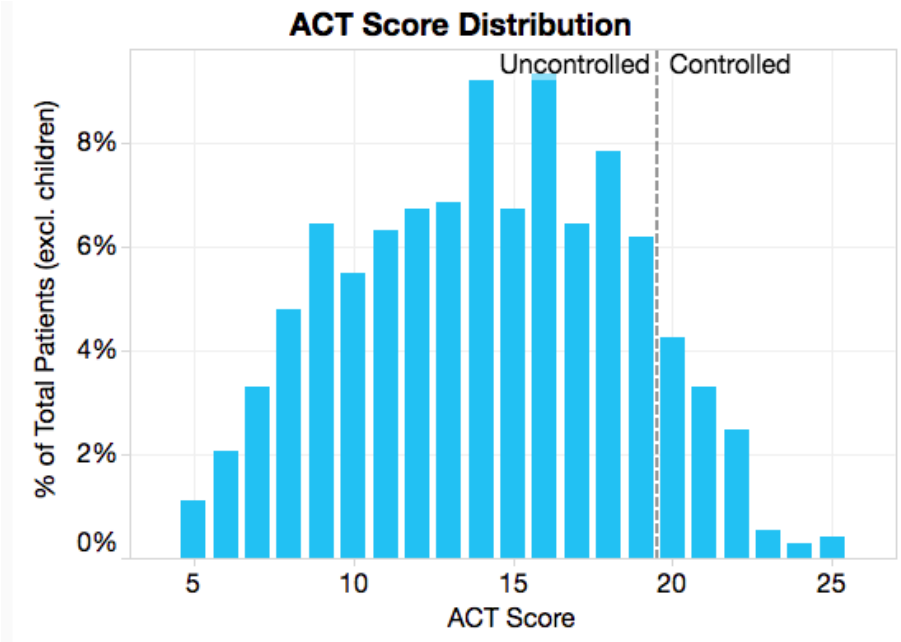
65% of participants are female



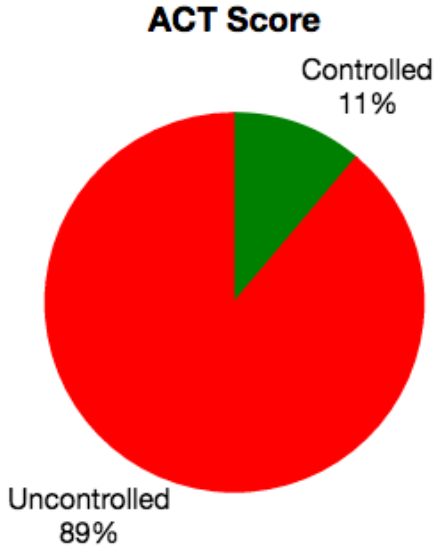
80% of participants use smartphones



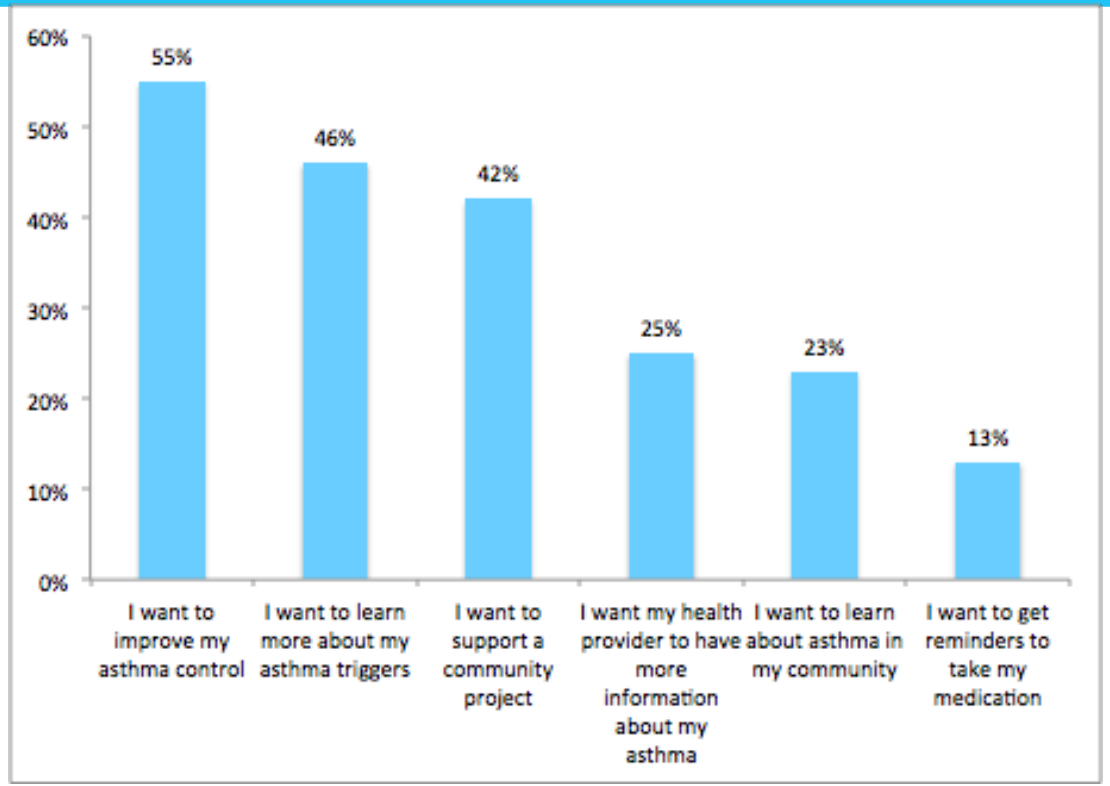
AIR Louisville participants were largely uncontrolled



89% of patients were uncontrolled based on the Asthma Control Test™ at the time of enrollment



Participants seeking to gain control of their asthma



Participants could select multiple answers

90% of the participants were concerned about their asthma

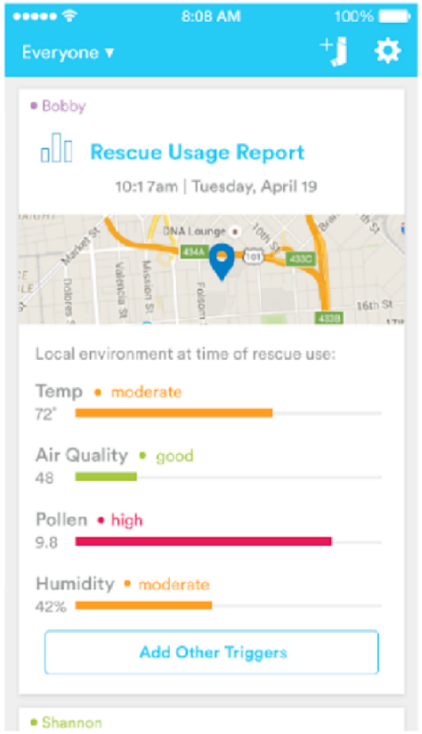
People joined to:

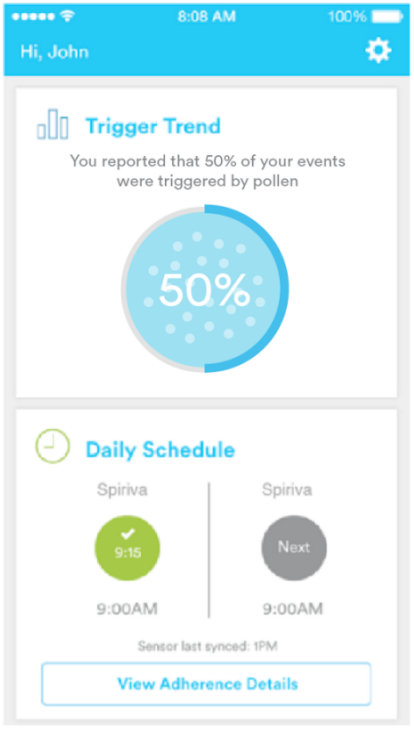
1. Improve my asthma control
2. Learn more about my asthma triggers
3. Support a community project

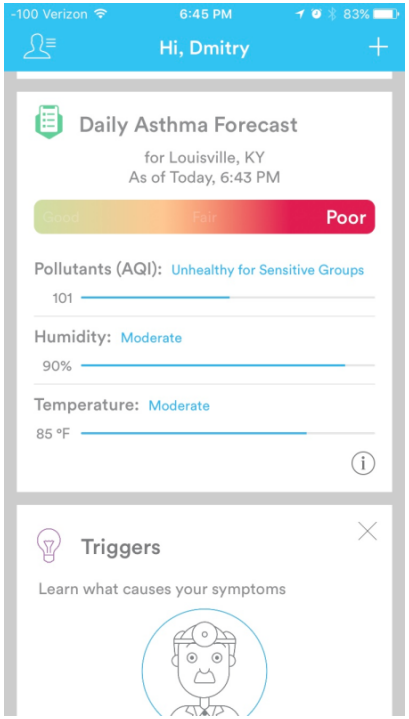
Their top goals included:

1. Feeling more in control of their asthma
2. Having fewer asthma attacks
3. Missing fewer days of work and school

Giving participants the information to take control of their asthma







What participants learned, in their own words:

“What triggers the flare up. The fact my flare ups are in the evening. The humidity levels indoors and outside a huge factor.”

“How often I use my rescue inhaler and how it relates to allergies and air quality”

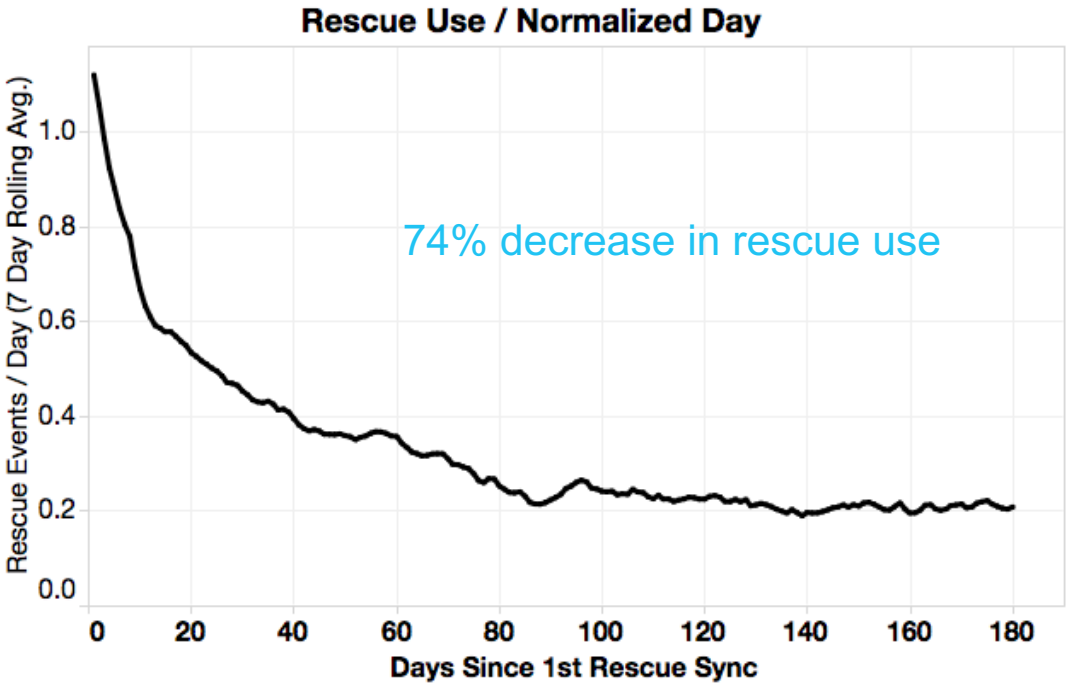
“I learned it was a lot worse than I thought and it has showed me how it’s improved since I started getting allergy shots.”

“My asthma control is directly related to remembering to take my medicine. I would not remember whether I had taken it without the Propeller tracking and reminders.”

“I'm better able to track inhaler usage to provide my doctor concrete data when I need to change something to better control my asthma. I know when my asthma is well controlled and when it isn't, which gives me great peace of mind.”

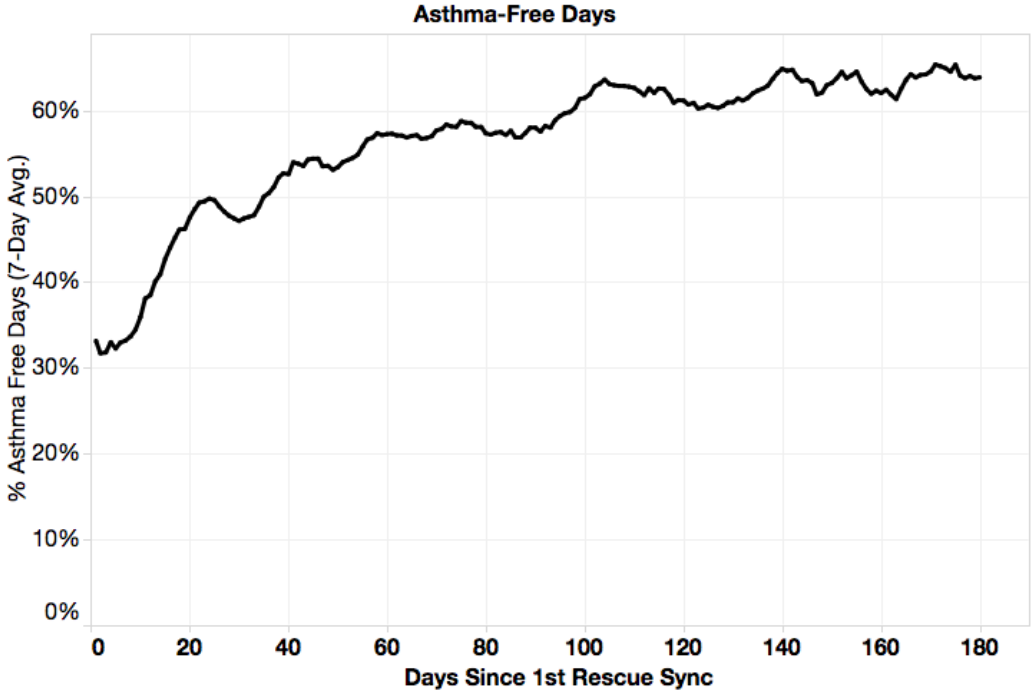
Clinical outcomes for participants

74% reduction in rescue inhaler use for asthma



The frequency of rescue inhaler use represents one of the most valuable indicators of acute worsening.

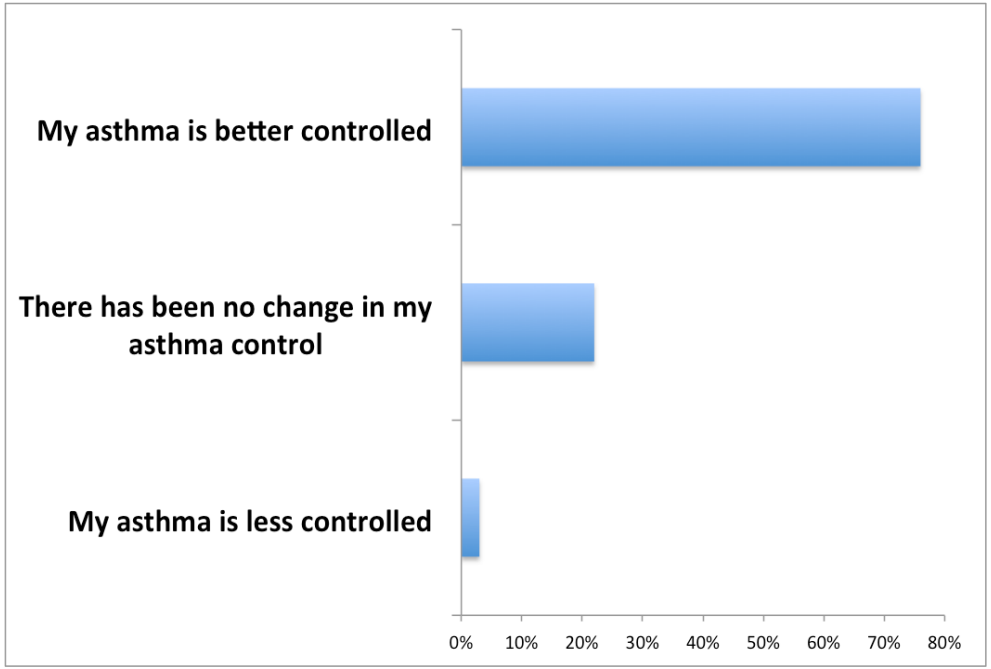
> 2x increase in asthma-free days



Participants experienced more than double the number of healthier days - free from the burden of asthma symptoms

Participants reported feeling more in control

Since joining AIR Louisville...



N=37

75% of respondents reported that their asthma is **better controlled**

84% reported they **now understand their asthma** either “very well” or “well”

78% reported feeling “very confident” or “confident in **being able to avoid a bad asthma attack**”

Respondents made progress on these goals:

1) Knowing more about my asthma triggers (62%)
2) Having fewer attacks (59%)
3) Feeling more control of my asthma (59%)
4) Feeling more confident in taking medication on time (40%)
5) Not having to go to the ER (32%)

Community Health Benefit

AIR Louisville: Unprecedented Data Collection

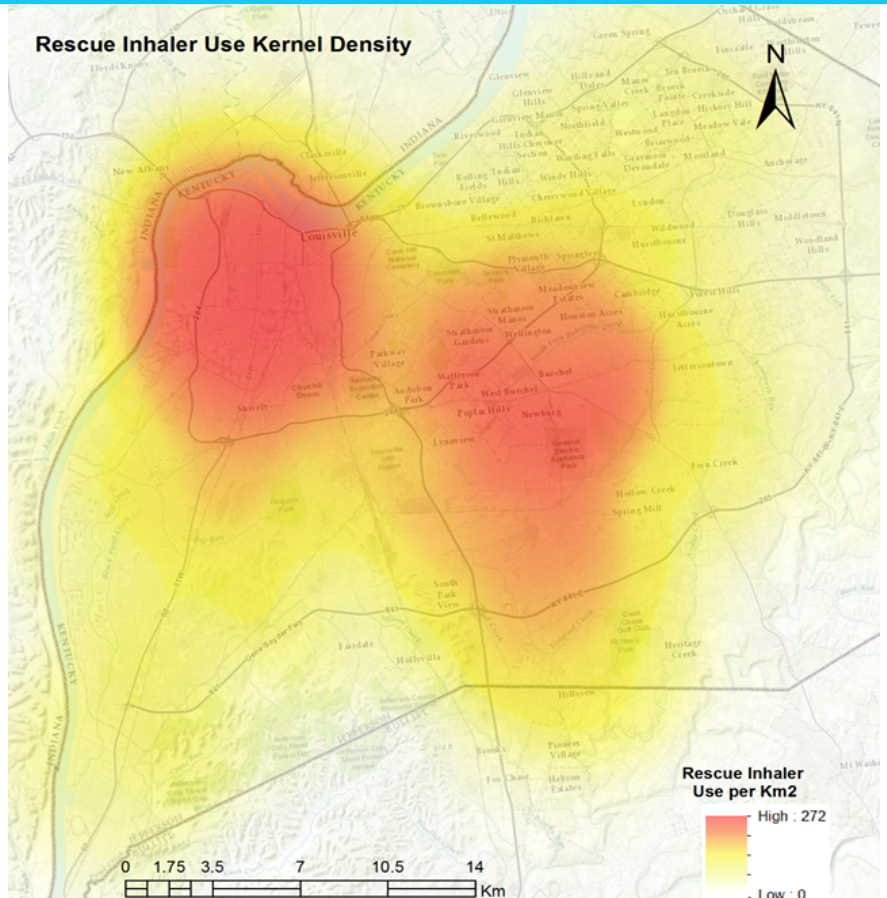
>1.16m data points collected, including 251,379 medication use events (rescue and controller)

- Date and time
- Medication
- Number of doses
- Location

5.4m environmental data points including:

- Air pollutants: NO_2, $PM_{2.5}$, Ozone, SO_2
- Pollen Count
- Temperature, Humidity, Wind speed/direction
- Land use (zoning, tree cover, impervious surface)
- Distance to emission sources
- Major roadways and highways

Density of rescue inhaler use (2012 - 2016)



Environmental triggers associated with increased asthma

Temperature***

NO_2 (traffic related air pollution)***

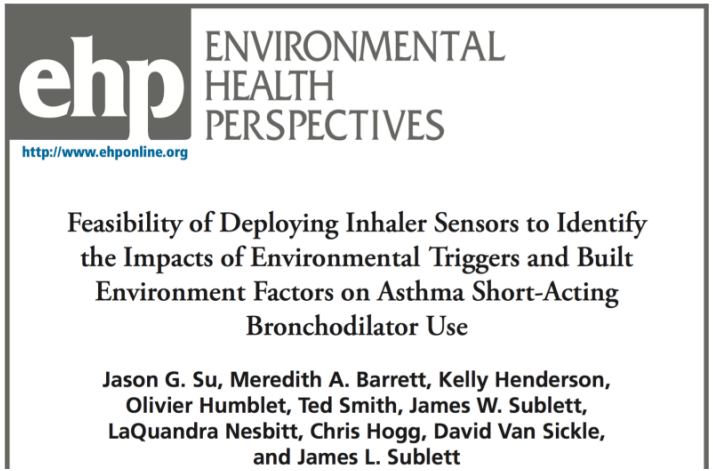
Weed pollen***

Smoking rate**

$PM_{2.5}$ (traffic related air pollution)***

Grass pollen*

(controls for neighborhood income, race/ethnicity composition, and participant time spent in neighborhoods)



1. Su et al. *Environmental Health Perspectives*.2016.
2. Smith et al. 2014. APHA.
3. Van Sickle, et al. 2014. APHA.
4. Barrett et al. 2014. APHA.
5. Nesbitt, L. 2014. APHA.

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* p <0.01
** p <0.001
*** p < 0.0001

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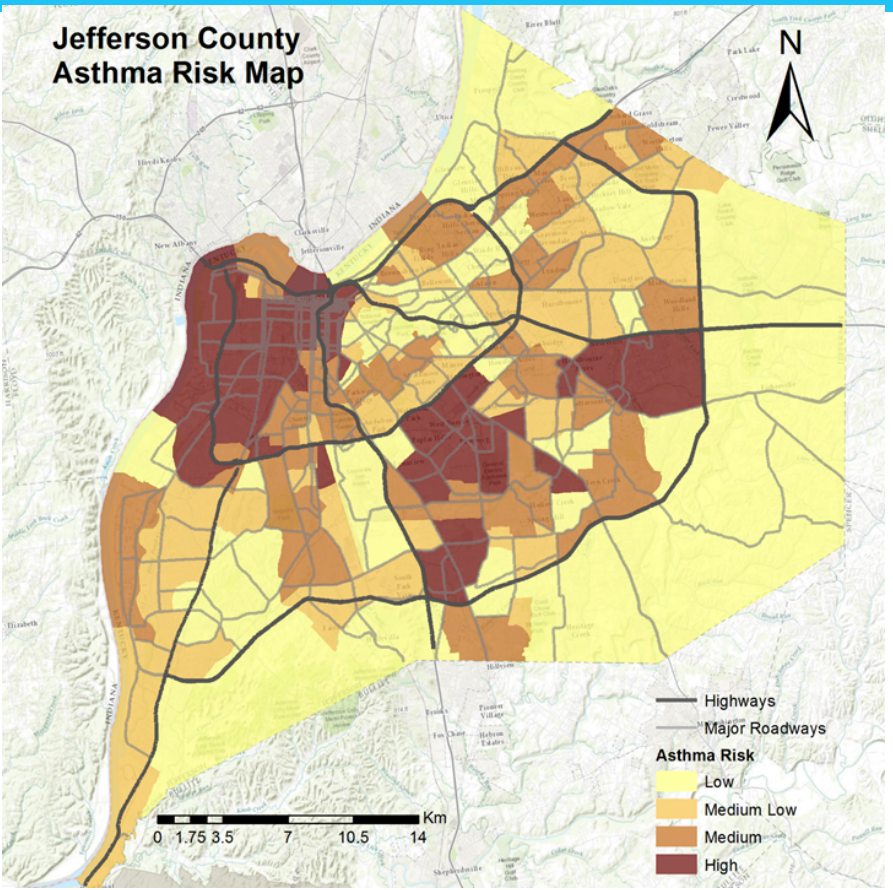
Asthma risk assessment of Louisville neighborhoods



Represents asthma risk per census tract as a function of:

- NO_2 concentrations (annual mean)
- $PM_{2.5}$ concentrations (annual mean)
- Smoking rate
- Temperature (annual mean)
- Underlying asthma prevalence
- Underlying race/ethnicity
- Pollen exposure due to grass & weeds

What is the cost of air pollution?

Imagine a day in spring, with temperatures reaching 85, with the grass and weed pollen out. If nitrogen dioxide and PM2.5 exceeded their EPA standards,* we would expect to see....

an **additional** 5,046 rescue inhaler uses across Jefferson County, with an associated **extra cost** of $39,278 on just that day.

High risk areas would be 40% more likely to bear the brunt of these symptoms.

*(53ppb, 35 ug/m^3)

How many people could be at risk?

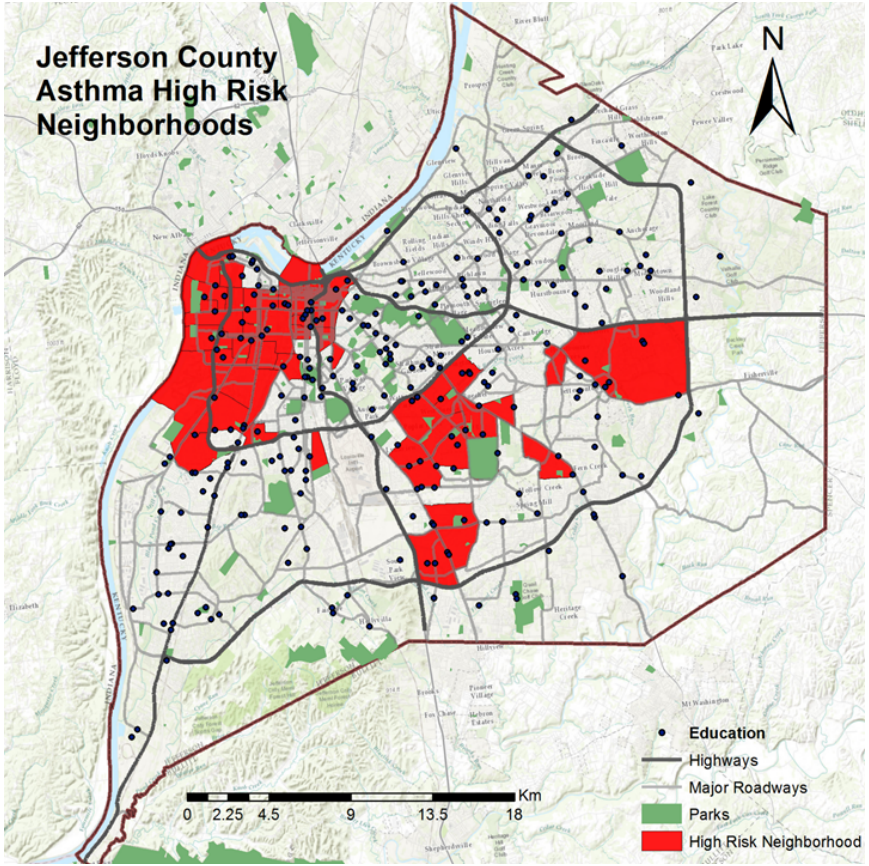
23% of the general population lives within high risk areas

27% of the asthma population lives within high risk areas

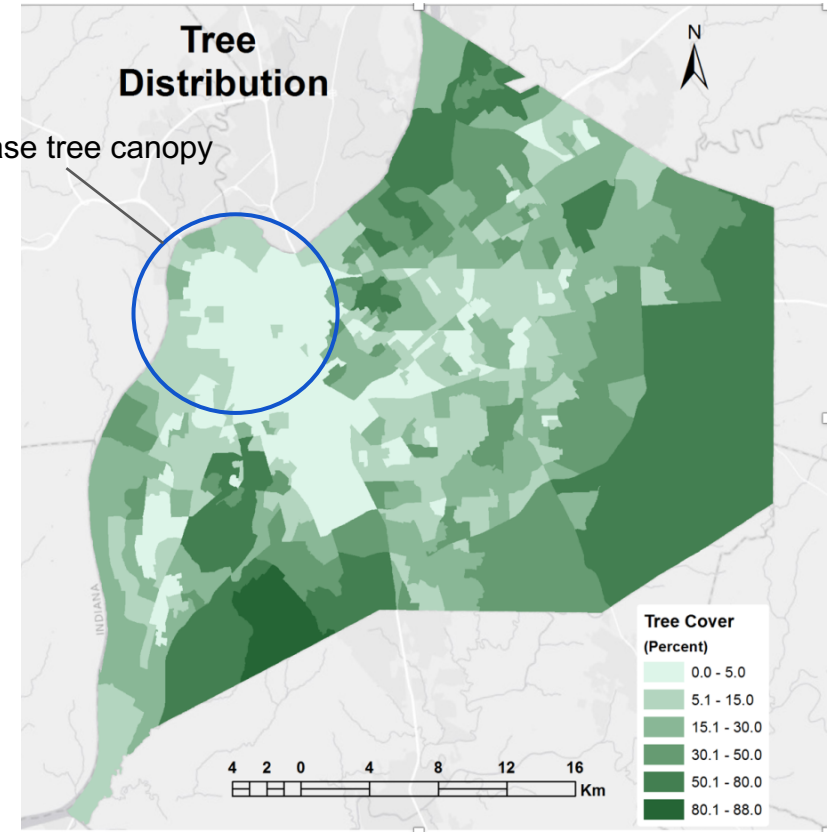
68 educational institutes/schools

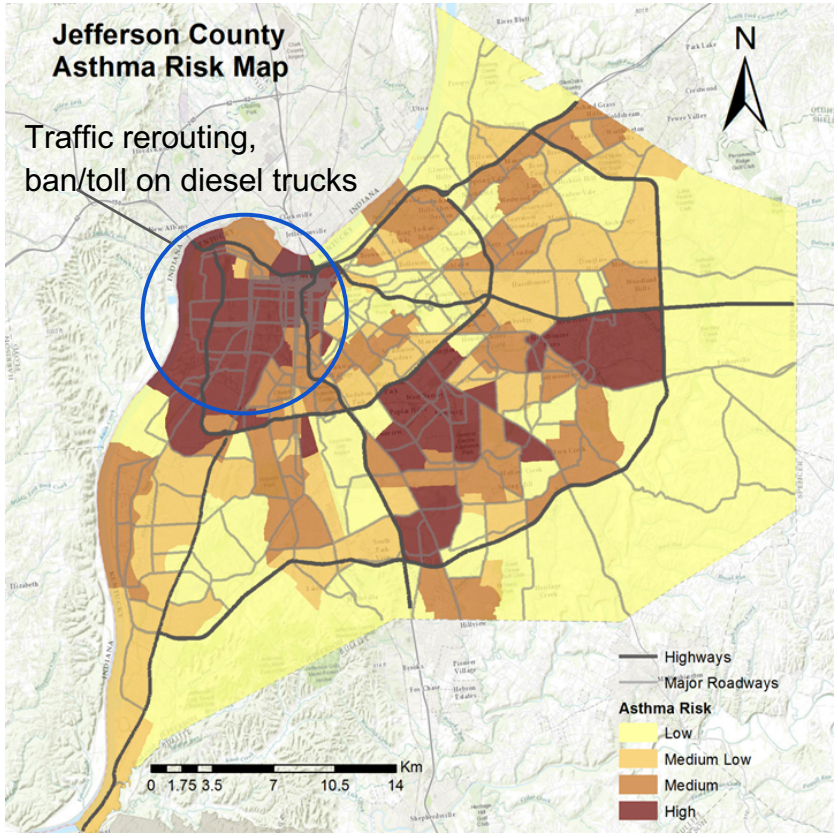
47 parks (state, county and city)

Impact on school absenteeism?



Possible interventions





Next steps

June 28 event to convene stakeholders and present final results

Final report card for participants

Report for doctors and healthcare providers

Policy recommendations for city leaders, employers, individuals

Awareness campaigns identified

Ongoing policy discussions

AIR Louisville commitment

What can we do about it?

Potential benefits of interventions due to avoided asthma-related medical costs (hospitalizations + ED visits)

Intervention type	Scenario	Reduction of Inhaler Use	% Reduction	Annual Cost Savings
Smoking reduction	Region-wide smoking rate reduction of 10%	4,744	<1%	$36,932
Tree Canopy	Region-wide increase of tree canopy from 31% to 40%	24,161	<1%	$188,079
	High risk focus: 44%, with region-wide mean still 40%	66,146	2%	$514,910
Emissions (NO_2 and $PM_{2.5}$)	Region-wide mean reduction of 20%	94,422	3%	$735,027
	High risk focus: 50% reduction, with region-wide mean reduction still 20%	156,130	5%	$1,215,393

“Compassion and data are transforming my city.”

“[AIR Louisville] is making public health resonate in our policy conversations. It’s citizen science. It’s about asthma, about air, but it’s also about rebuilding trust in government and that link to citizenship.” – Greg Fischer, Mayor of Louisville, KY

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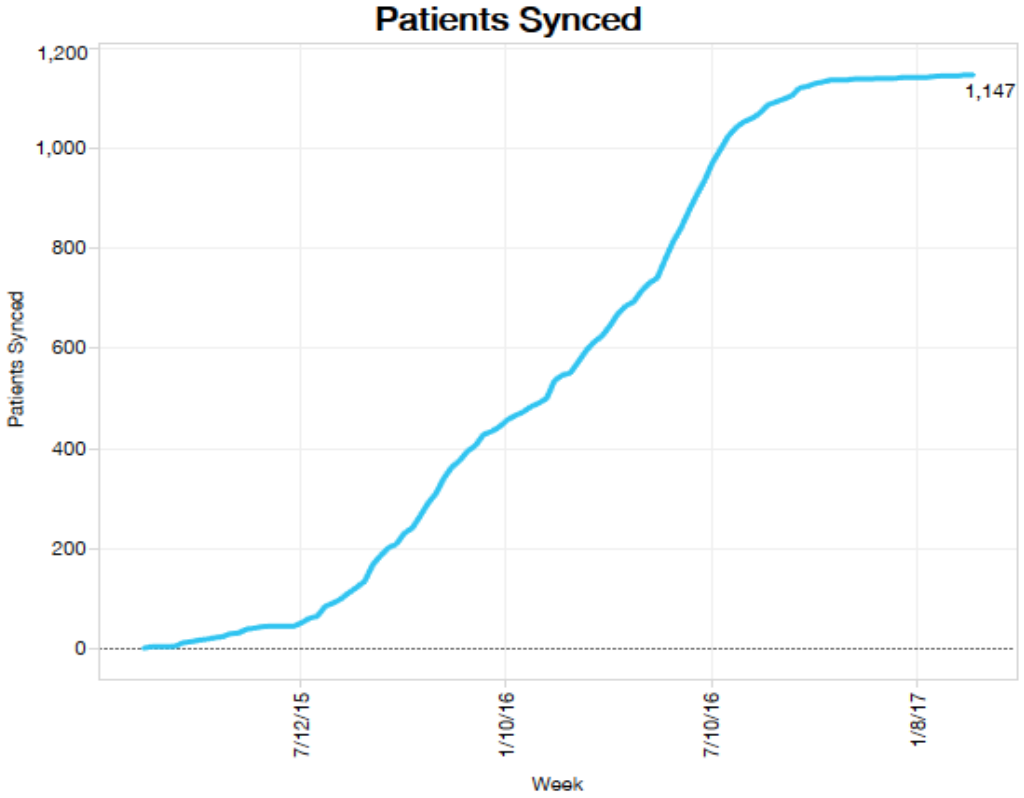
QUESTIONS?

Enrollment

1,147 Louisville metro area residents are participating in AIR Louisville (115% of goal)



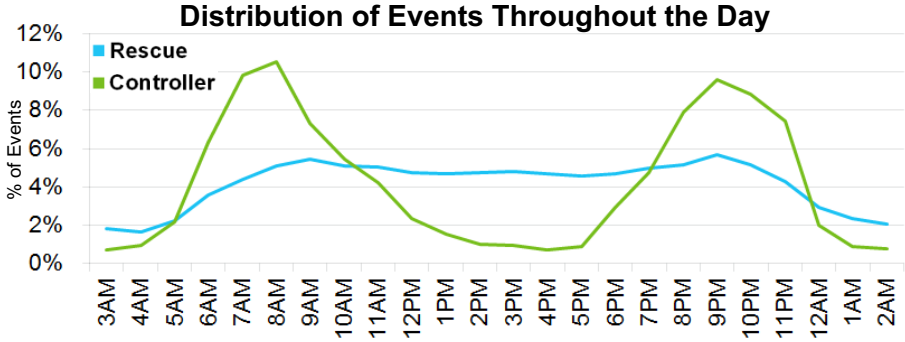
a as of
2/10/17

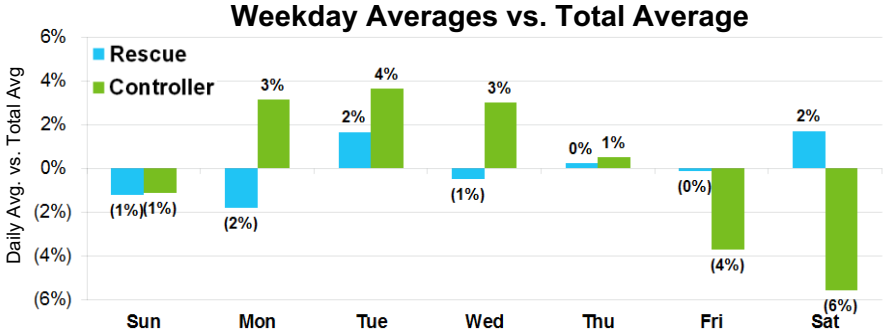
Rescue and Controller Use Patterns

Rescue use less frequent at night

Controller medication use typically occurs at morning and night

Controller adherence best Monday - Wednesday and worst on weekends





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AIR Louisville by the numbers

Our focus was awareness and enrollment during the first year of our community asthma program:

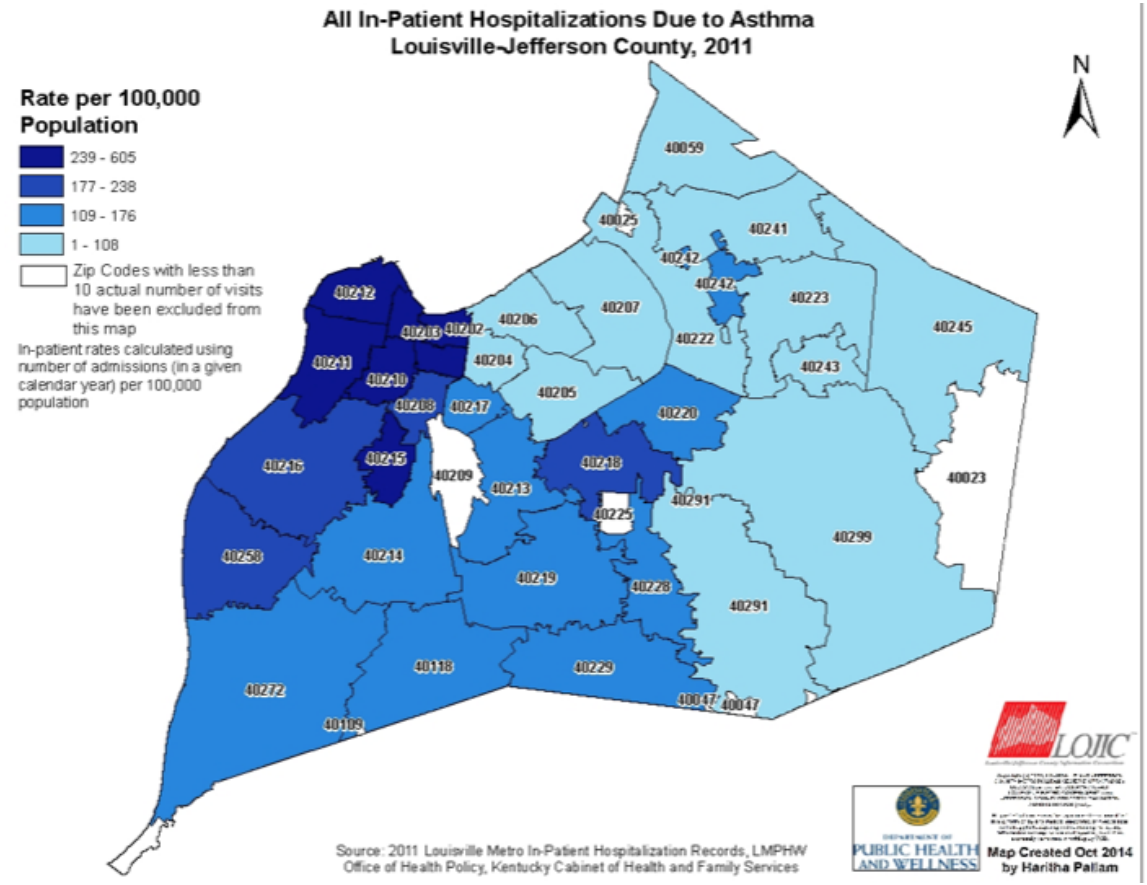
- 35 meetings with potential partners
- 24 events, including the Downtown Rotary Club, a Semple Elementary event and Humana's Bold Moves Town Hall
- 36 mentions in the press, including The Washington Post, PBS NewsHour Weekend, The Courier-Journal and MobiHealthNews
- 23 blog posts
- 1,013 likes on the AIR Louisville Facebook page

Our 12 partners include:

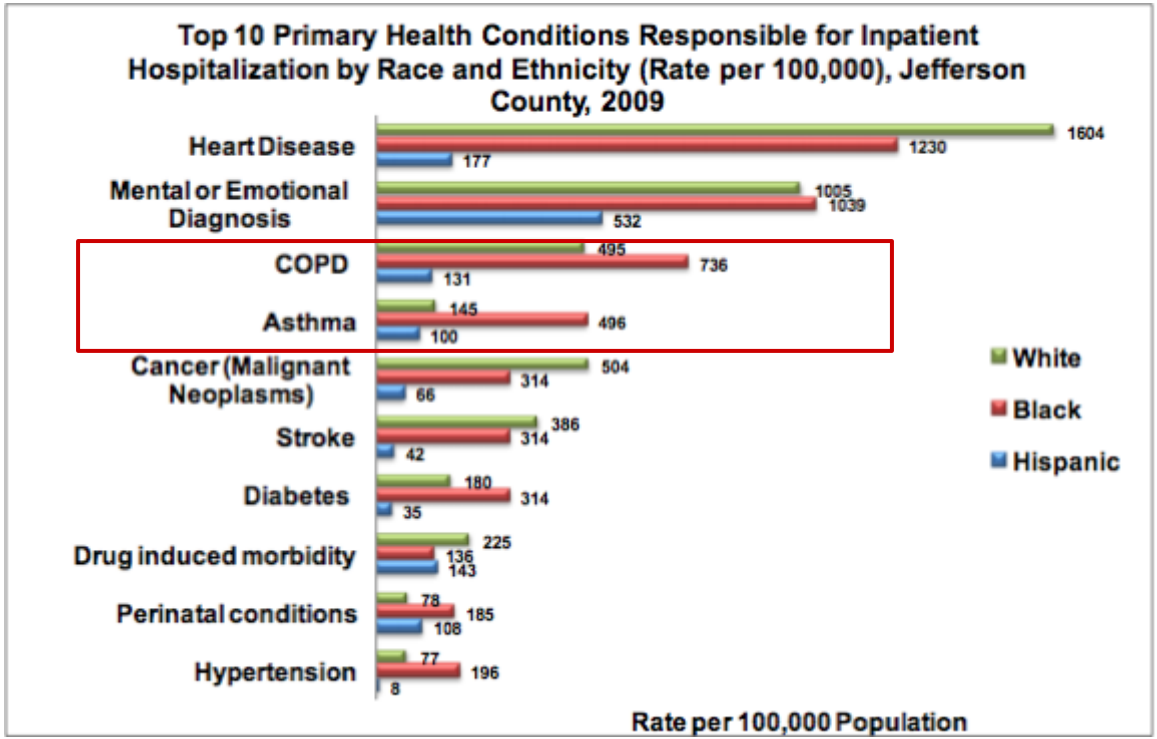
- 7 employers – Brown-Forman, Papa John's, Seven Counties, WHAS 11, Louisville Metro employees, Kindred, and Humana
- 1 health plan – Passport
- 3 providers – Family Allergy and Asthma, University of Louisville pediatrics, and JenCare
- 1 advocacy group – American Lung Association of the Midland States

Impact of Asthma in Louisville

Population	14,712 children + 60,213 adults[10]
Prevalence	10% - 15%[11,16]
Cost (national avg)	$3350 per person per year[9]
Missed work (national avg)	5 days/year[15]



Respiratory disease costly in Jefferson County



> $26.8m was spent on hospitalizations for asthma in 2012 in Jefferson County

Louisville Metro Health Status Report 2012