

JANUARY 2022



The University of Texas at Austin
Center for Health and Environment,
Education and Research
Dell Medical School

STRUCTURAL RACISM, UNHEALTHY HOUSING, AND ASTHMA DISPARITIES

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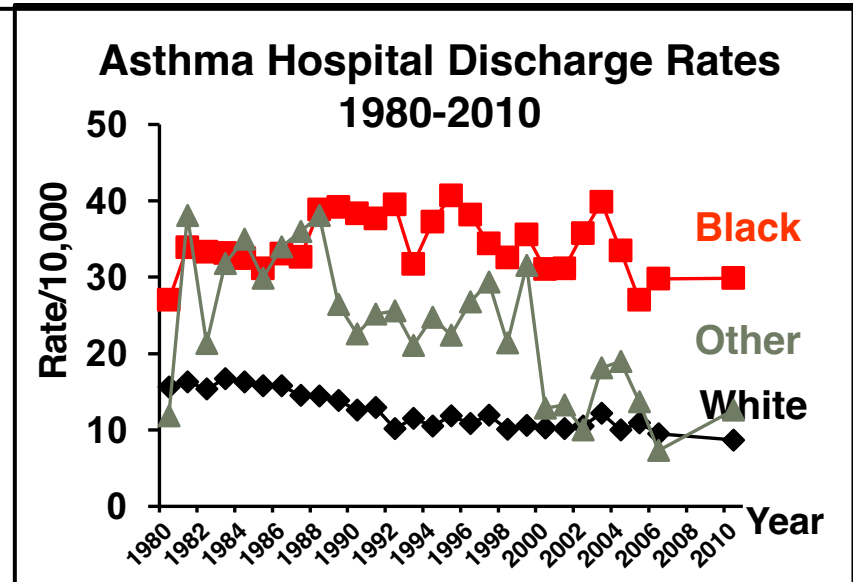
Associate Director, Health Transformation Research Institute

Associate Chair of Research, Department of Population Health

Dell Medical School, The University of Texas at Austin

“Inner-city” Childhood Asthma

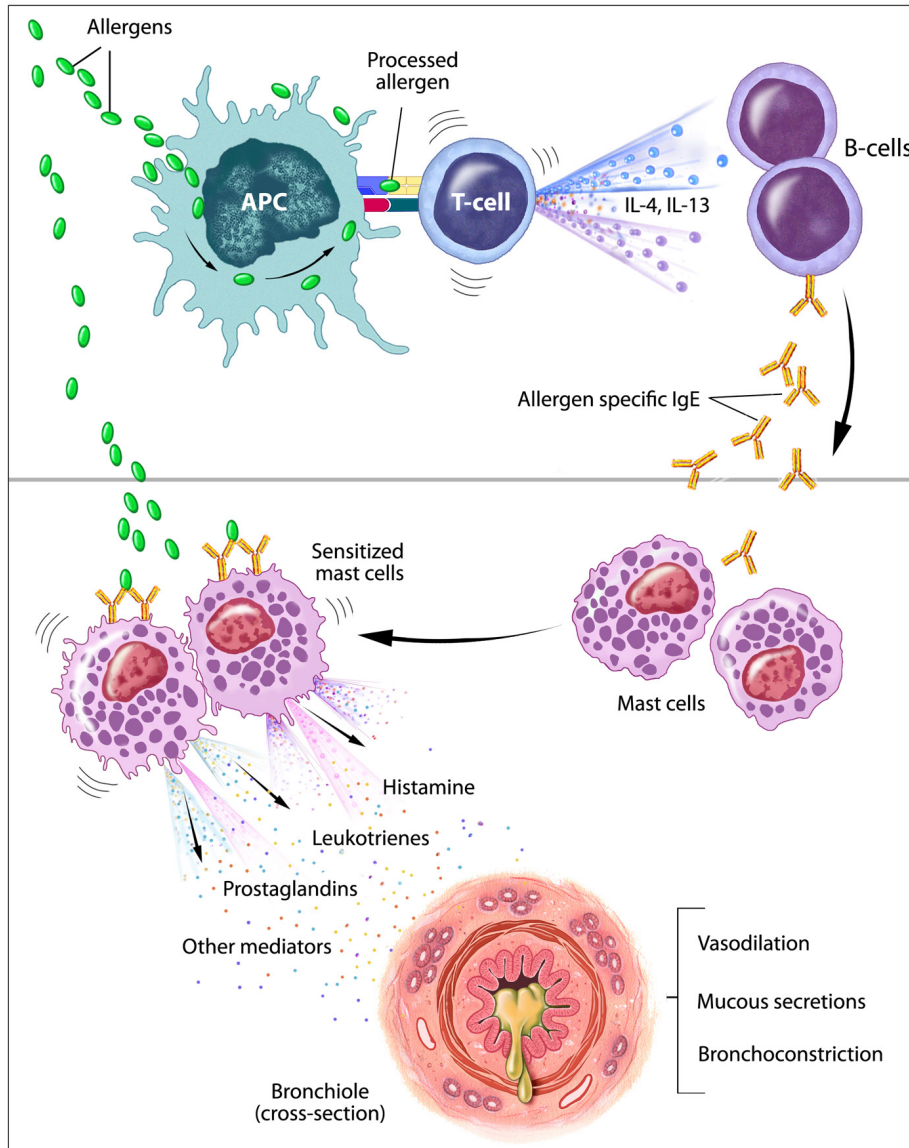
- Inner cities are low-income areas in the center of cities
- Racial/ethnic minoritized people often comprise majority of residents
- Asthma prevalence rates 25-28% in some low income, urban neighborhoods



Source: National Hospital Discharge Survey, CDC National Center for Health Statistics, * First-listed diagnosis, # Age-adjusted to 2000 U.S. population

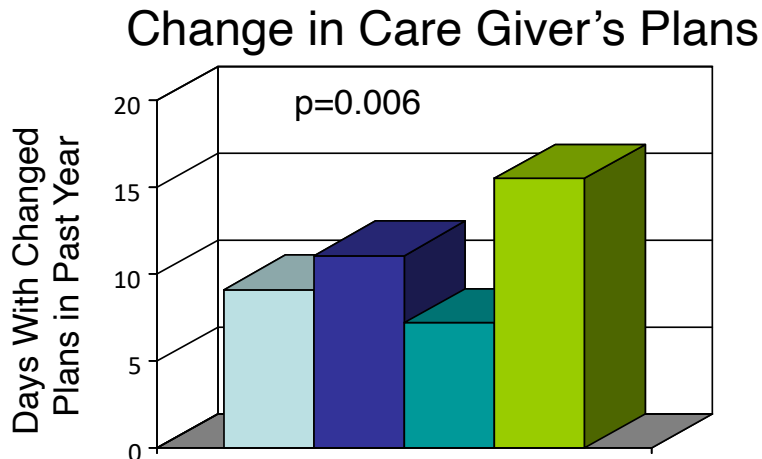
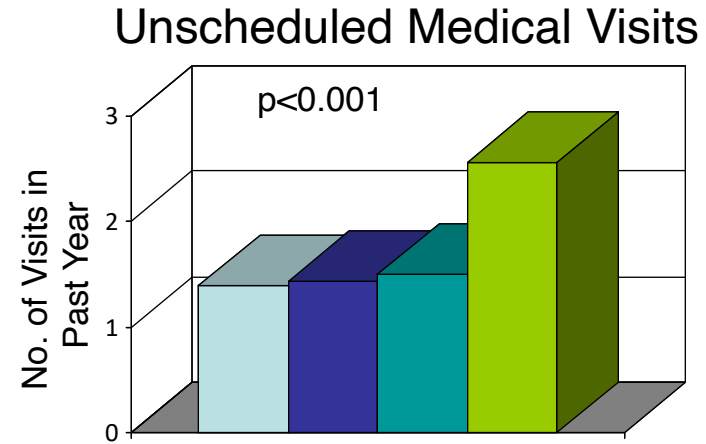
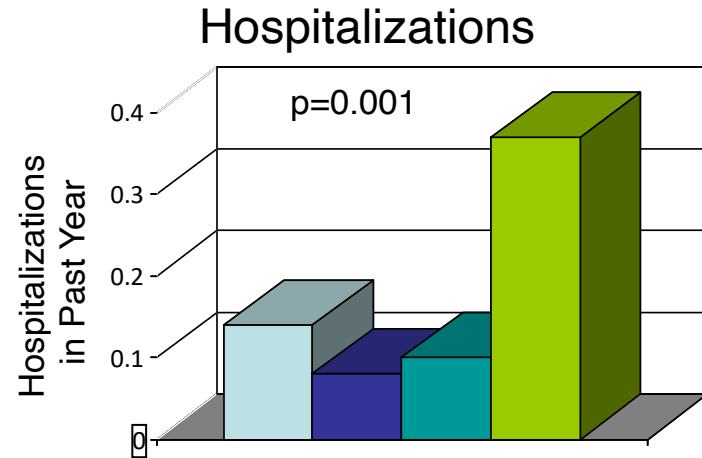
The Built Environment in Low-income Neighborhoods in Baltimore





Environmental Exposures and Asthma

German Cockroach Allergen Exposure & Asthma Morbidity in Children in Low-income, Urban Neighborhoods



- neg skin test, low allergen exposure
- neg skin test, high allergen exposure*
- pos skin test, low allergen exposure
- pos skin test, high allergen exposure*

Bla g 1 > 8 U/gram

Mouse Allergen Highest in Homes in Low-income, Urban Neighborhoods

	Median Kitchen Mus m 1 ($\mu\text{g/g}$)
Suburban Maryland	0.007
US sample (Cohn JACI 2004)	0.36
NCICAS (Phipatanakul JACI 2000)	1.6
High poverty, highly segregated neighborhoods in Baltimore	14.7

- Detectable in air of 80-90% of bedrooms
- 25% homes with levels similar to occupational levels
- ~50% with significant asthma sensitized to mouse

SCIENCE

83 Things That Blew Our Minds in 2018

The most extreme, most sobering, and zaniest facts that *The Atlantic's* science, technology, and health reporters learned this year

THE ATLANTIC SCIENCE DESK DEC 30, 2018



Mouse allergen exposure & sensitization associated with:

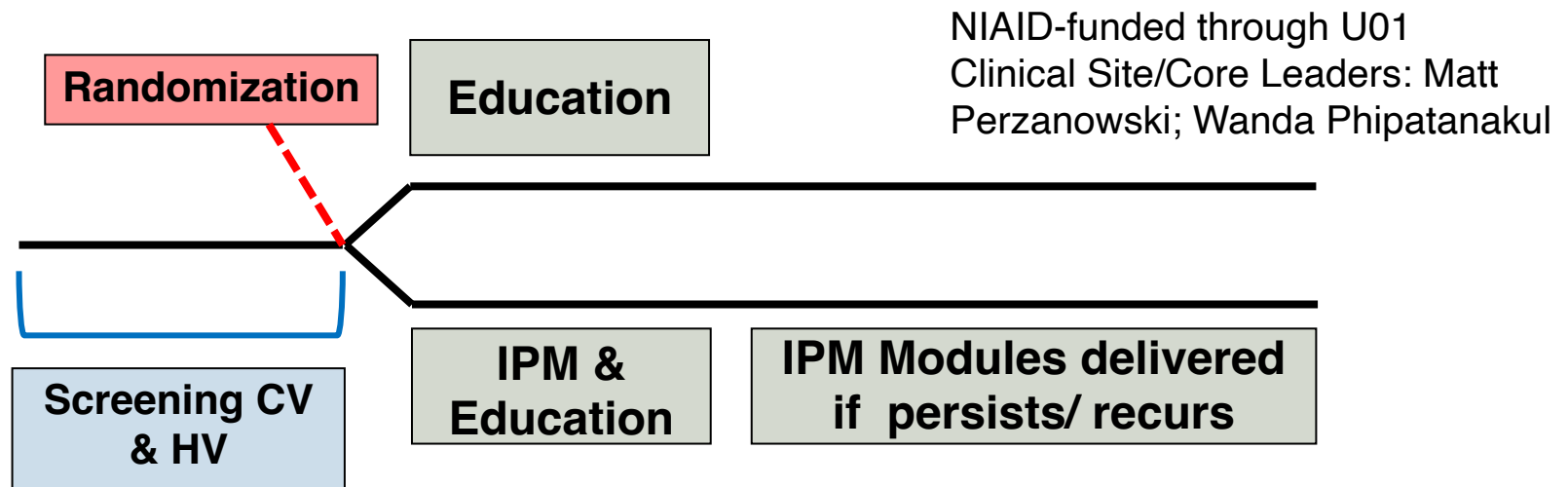
- asthma morbidity in Baltimore preschool children
Matsui Annals Asthma Allergy Immunol 2006
- symptoms, hospitalization in multi-center study of children living in low-income urban neighborhoods
Pongracic et al Annals Asthma Allergy Immunol 2008

78. Mouse urine is a major cause of asthma for poor kids in Baltimore.



Mouse Allergen and Asthma Intervention Trial

- 1 yr RCT
- Intensive professionally delivered mouse integrated pest management
- 5-17 yo in Baltimore or Boston
- Persistent asthma with recent exacerbation
- Sensitized to mouse
- Highly exposed (dust concentration of mouse allergen)



- Both IPM & Education Groups had reductions in symptoms, morbidity
- No difference between groups in clinical outcomes or mouse allergen exposure measures
- Both had ~70% reductions in home mouse allergen levels

EC Matsui and coauthors

Effect of an Integrated Pest Management Intervention on Asthma Symptoms Among Mouse-Sensitized Children and Adolescents With Asthma: A Randomized Clinical Trial

Published online March 6, 2017

Available at jama.com and on The JAMA Network Reader at mobile.jamanetwork.com

Effects of Mouse Allergen Exposure Reduction on Asthma

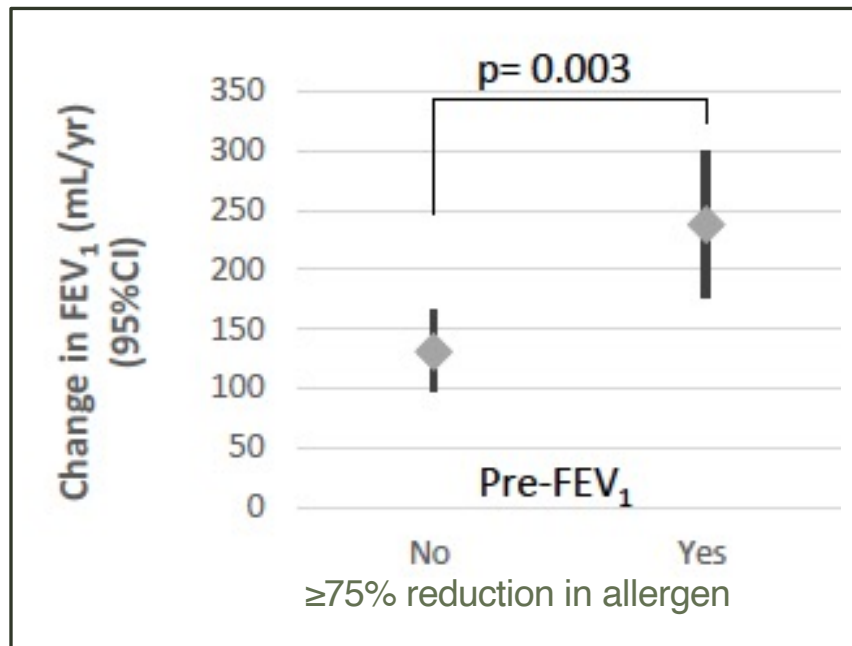
Predicted Change in Asthma Symptoms and Morbidity for 90% Reduction in Mouse Allergen[‡]

	no. per person-year (95% CI)
Acute visits	-0.82 (-1.13, -0.48)
ED visits	-0.42 (-0.60, -0.15)
Hospitalizations	-0.07 (-0.14, 0.02)

[‡]effects estimated from random effects models of relationships between log₂(mouse allergen) and asthma symptoms and morbidity; statistically significant findings indicated in bold

Childhood Asthma Management Program: budesonide associated with 0.1 fewer urgent care visits, and 0.02 fewer hospitalizations per person-yr

Reducing mouse allergen associated with improved lung growth



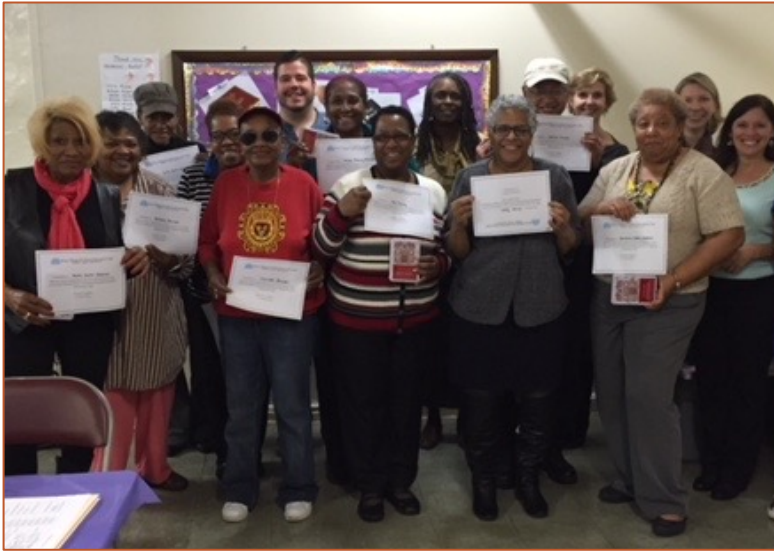
- ~75% of children with asthma have abnormal lung function when they reach adulthood
- ~10% meet criteria for chronic obstructive lung disease

CAMP, McGeachie NEJM 2016

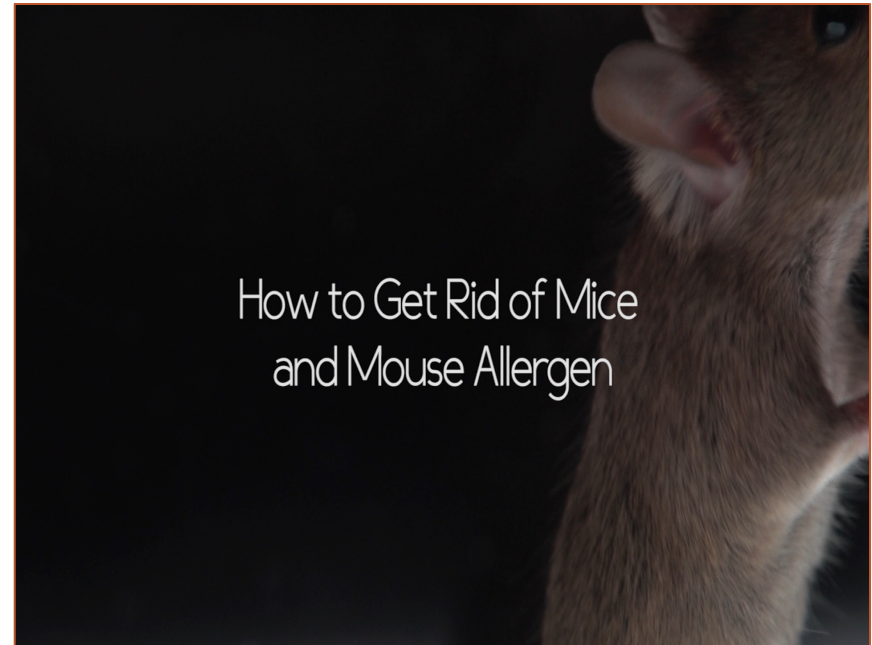
Children who have reduction in mouse allergen exposure have 75-100ml mls greater lung function growth (FEV1)

Grant T et al, JACI 2020

Disseminating Results: Mouse IPM Educational Video



Community Advisory Board



Produced and directed by Jessica Crowell

<https://youtu.be/CFC06uGzY40>

What Have We Learned?

A large reduction in indoor allergen levels is feasible & likely necessary to achieve significant clinical benefit

- Control, morbidity
- Long term outcomes, including lung function growth

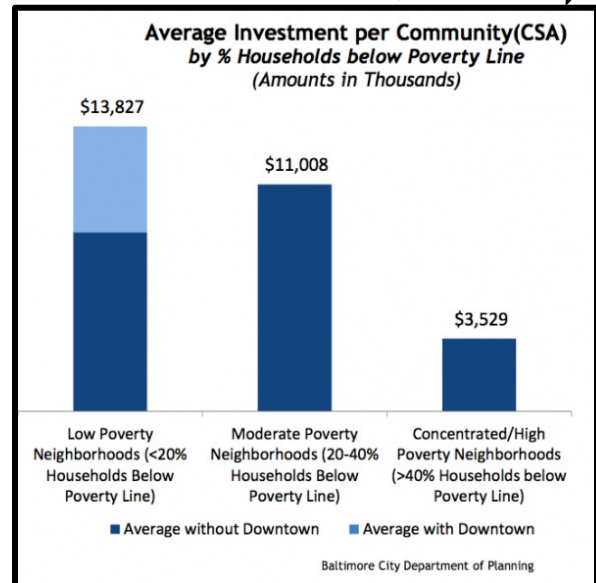
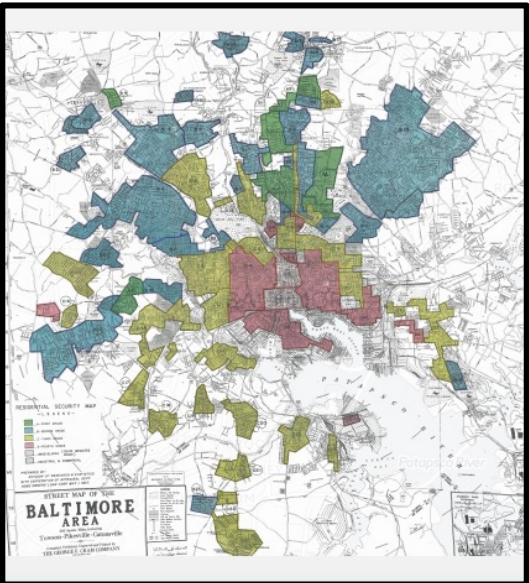
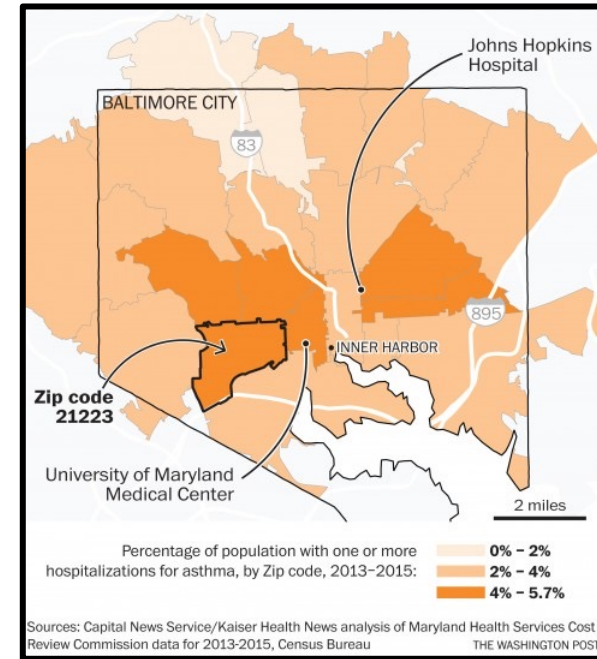
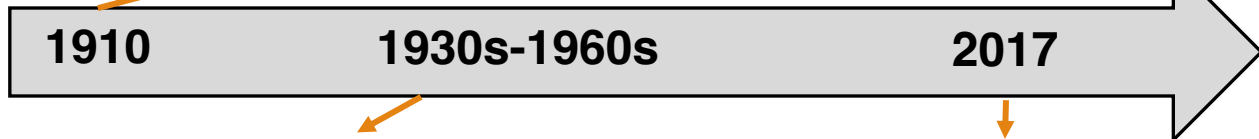
Targeting a single allergen is promising

- *Population-based interventions*

But

- For mouse, many children (~40%) still had allergen levels associated with morbidity
 - **WHY?**

Structural Racism, Environmental Equity & Asthma



Mobility Asthma Project



Background

- 1995 lawsuit (*Thompson v. HUD*) found that HUD had violated fair housing laws
- Settlement set aside special housing vouchers for assisted housing to help families move to non-poor areas

Prospective cohort study of children with asthma enrolled in the Baltimore Housing Mobility Program

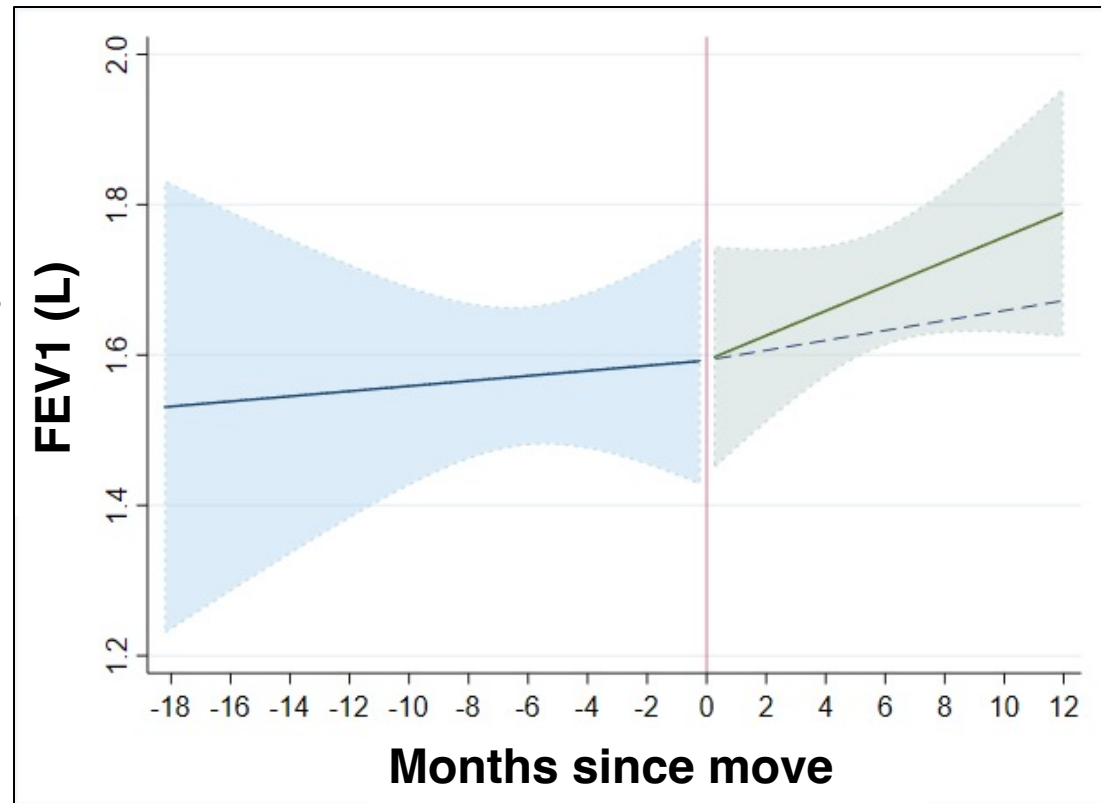
- To determine the effect of moving from a high poverty to a low poverty neighborhood on indoor environmental exposures and asthma morbidity

Potentially more potent intervention with health care payment and housing policy implications

Co-PIs: Craig Pollack & Corinne Keet
Sponsor: NIEHS

Association between moving to an ‘opportunity’ neighborhood and lung function growth

- Moving associated with improvements in symptoms and reductions in pest allergen levels
- Moving associated with 66mLs greater increase in FEV1
- FEV1 reaches peak in early adulthood, loss of 25mLs per year
- FEV1 is predictor of
 - COPD
 - mortality



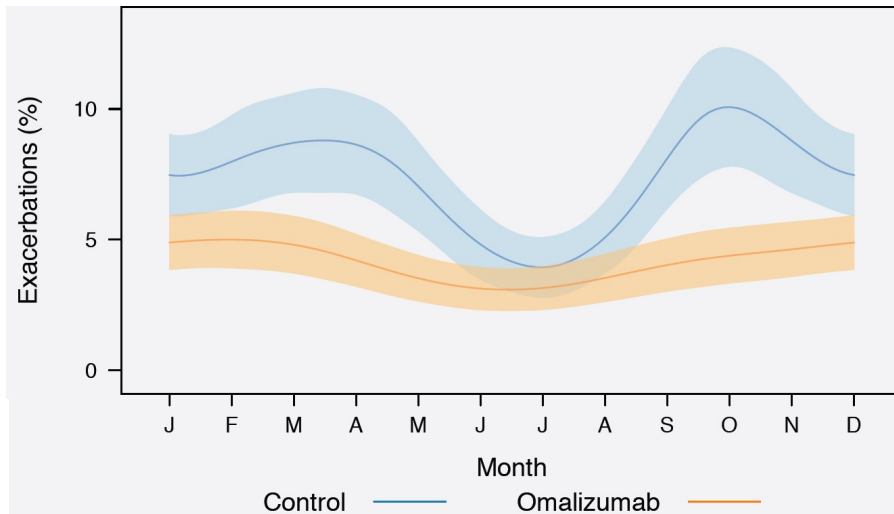
...But Inhaled Corticosteroids Work Well

ICS Benefits

- Highly effective
- At low doses, reasonable side effect profile

ICS Limitations

- Don't alter natural history of asthma
- Risk of significant side effects at high doses
- Don't appear to have significant *in vivo* effects on IgE



Busse et al NEJM 2011

But....

medications don't have to be cost effective – why do we hold non-drug management approaches to a different standard?

Austin-Travis County, TX

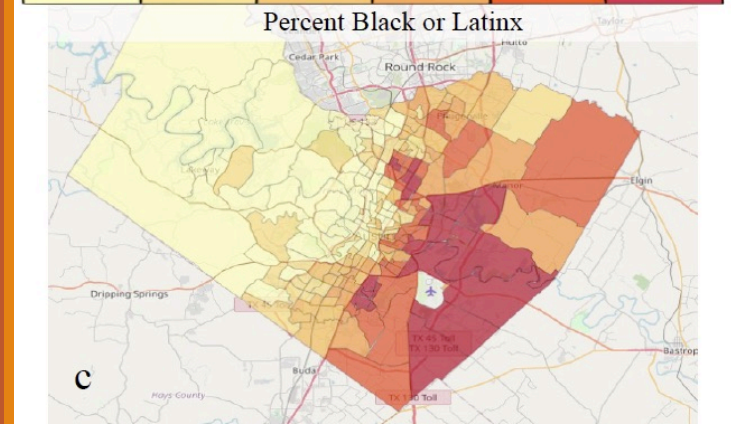
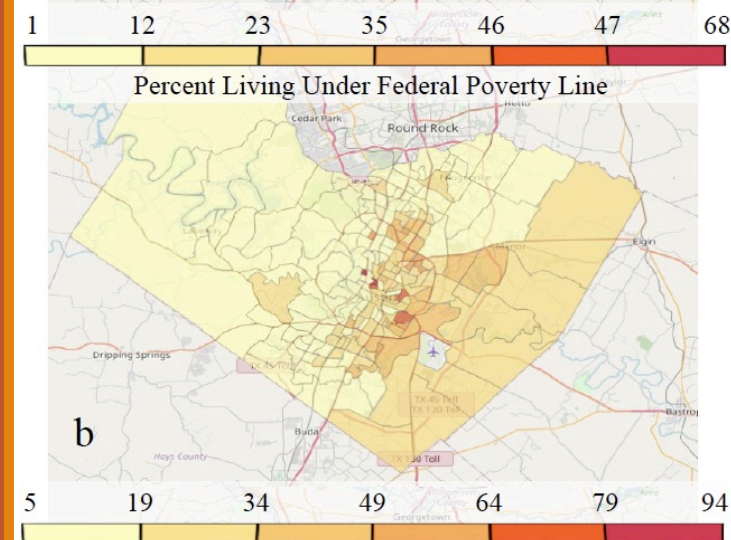
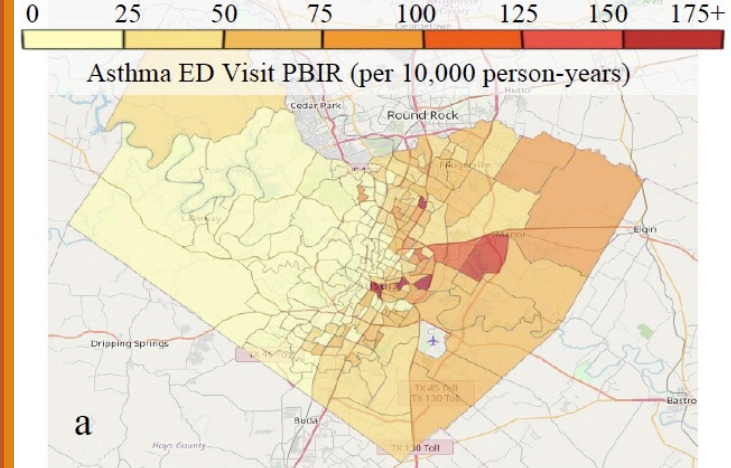


Children in Austin-Travis County are more likely to be hospitalized for asthma than US children

Asthma-Related ED Visit and Hospitalization Rates (per 10000 py) PBIR [95% CI]		
	US*	Travis County (2016)
Emergency Department Visits	74.3 [47.8, 100.8]	82.0 [78.4, 85.7]
Hospitalizations	10.7	19.2 [17.5, 21.1]
<p>Akinbami LJ, et al. Trends in racial disparities for asthma outcomes among children 0 to 17 years, 2001-2010. <i>J Allergy Clin Immunol.</i> 2014;134(3):547-553.e5. doi:10.1016/j.jaci.2014.05.037</p> <p>Zahran HS, et al. Vital Signs: Asthma in Children - United States, 2001-2016. <i>MMWR Morb Mortal Wkly Rep.</i> 2018;67(5):149-155.</p>		

Poverty, Ethnic Composition, and Asthma ED Visit Rates

- Asthma ED visits, population-based incidence rates
- Expressed per 10,000 person-years
- Data source: THCIC
- National PBIR ~55 per 10,000 py



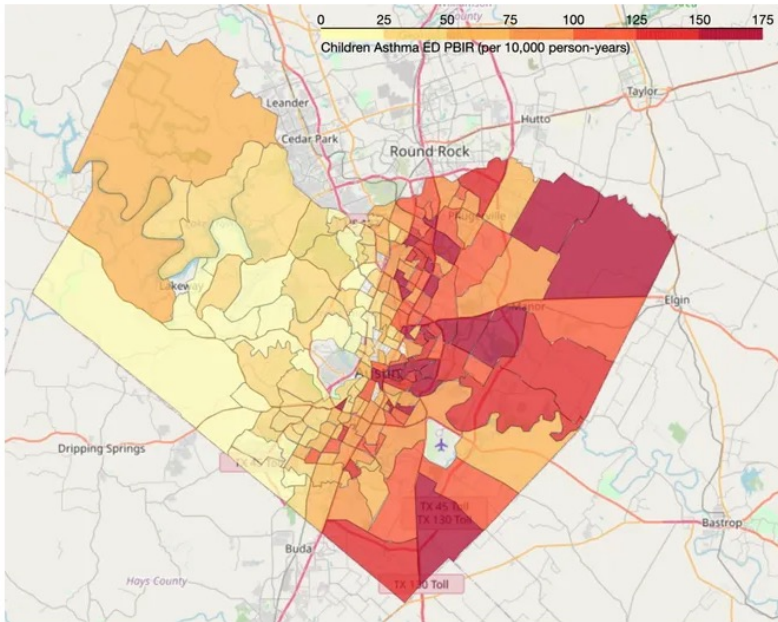
HEALTHCARE

Kids in Travis County have 60% higher rates of asthma events, Dell Medical School study finds

Nicole Villalpando Austin American-Statesman

Published 7:00 a.m. CT Oct. 26, 2021

[View Comments](#)



In Dell Medical School's asthma study, the concentration of emergency room and hospital visits for asthma-related incidents can be seen along census tract lines, with red having the highest concentrations and yellow being the least concentrations. Contributed By Dell Medical School

TRAVIS COUNTY

Children with asthma in Travis County hospitalized more than children nationwide, study shows



A hospital bed (Nexstar, file)

by: KXAN staff

Posted: Oct 21, 2021 / 03:28 PM CDT / Updated: Oct 21, 2021 / 03:28 PM CDT

Structural Racism in Austin-Travis County

1928

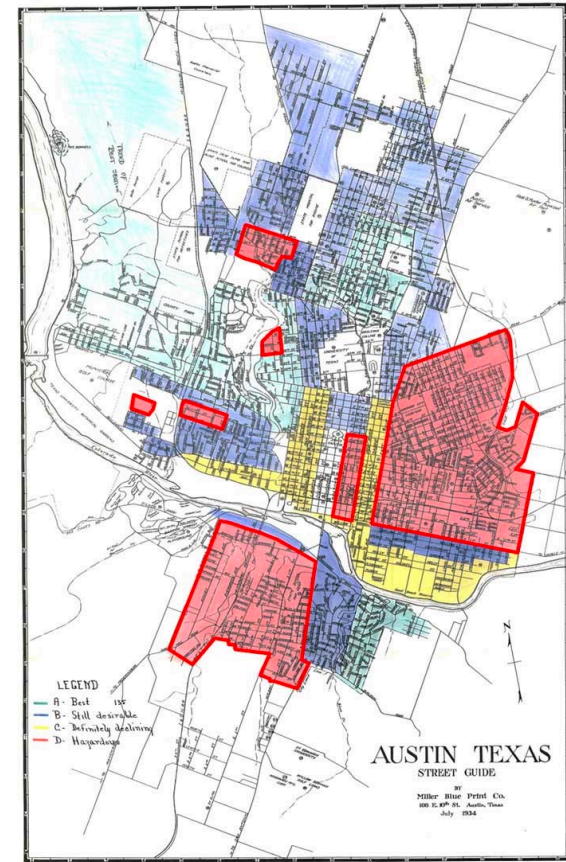
Evolution of a ‘Negro District’

In Austin, the strategy to isolate minorities came in the form of the Koch and Fowler city plan, which in 1928 proposed the creation of a “Negro District” — making it the only part of the city where African-Americans could access schools and other public services.

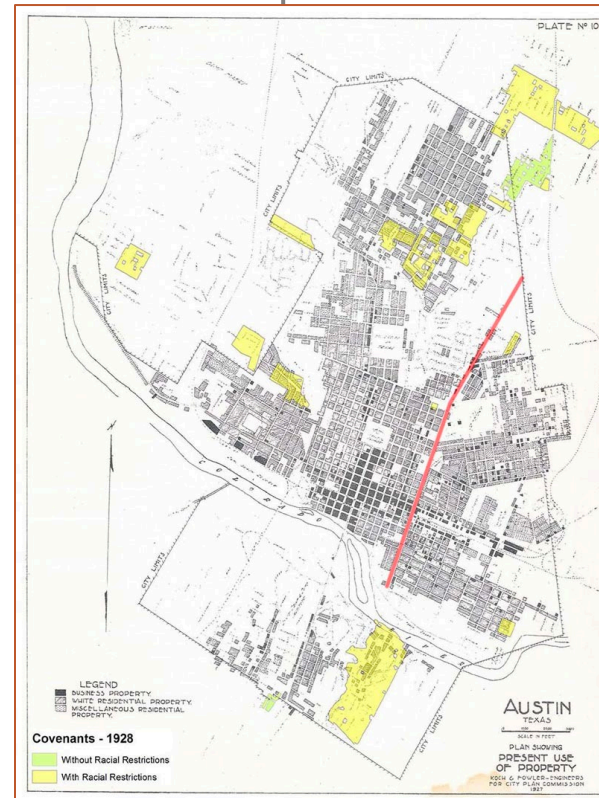
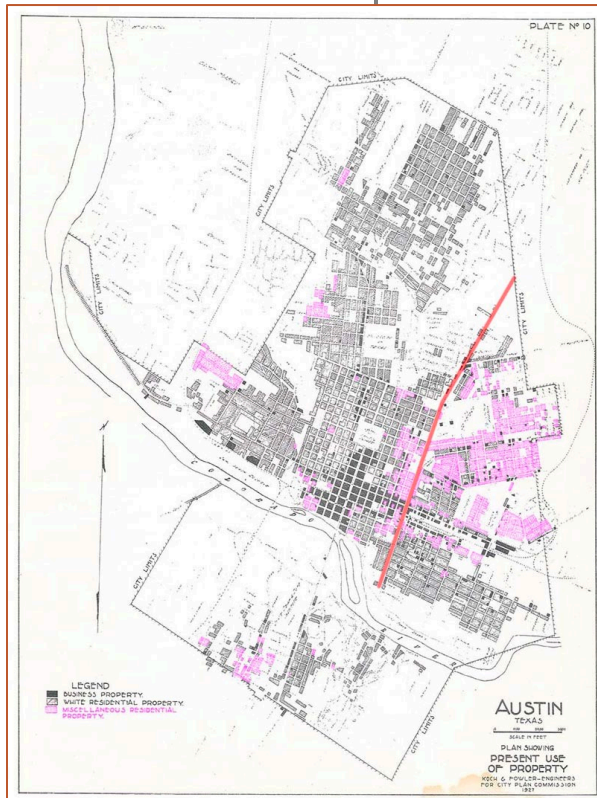
Koch and Fowler also proposed that the district have the city’s weakest zoning restrictions, allowing the development of “a number of slightly objectionable industrial uses” — essentially, any use that wasn’t specifically outlawed.

<https://projects.statesman.com/news/economic-mobility/>

Redlining



Structural Racism in Austin-Travis County cont.



- Anglo neighborhoods with zoning protections
- Minority neighborhoods without zoning protections
- East Avenue

Latinx Communities and Air Pollution Sources are Co-located in Central Texas

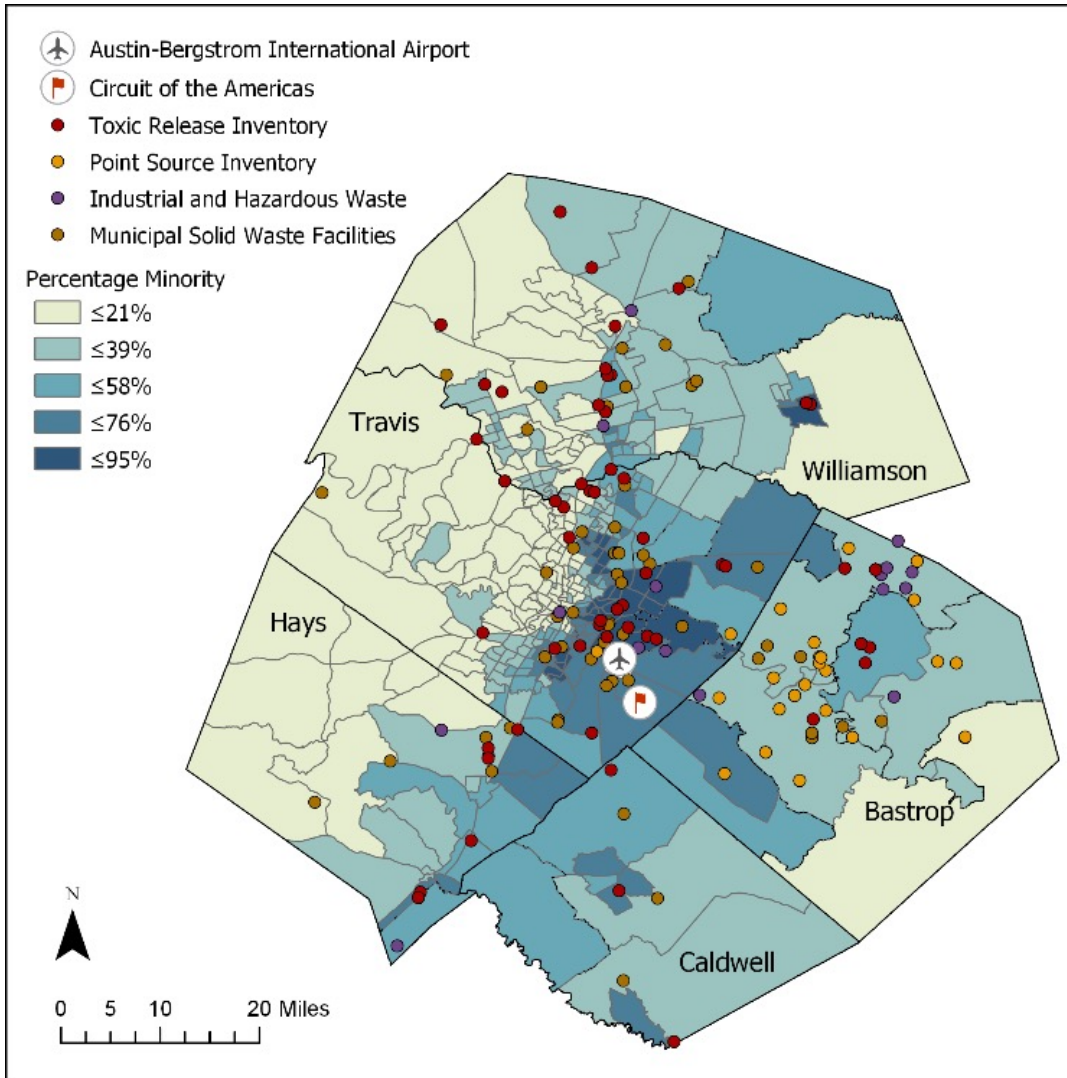
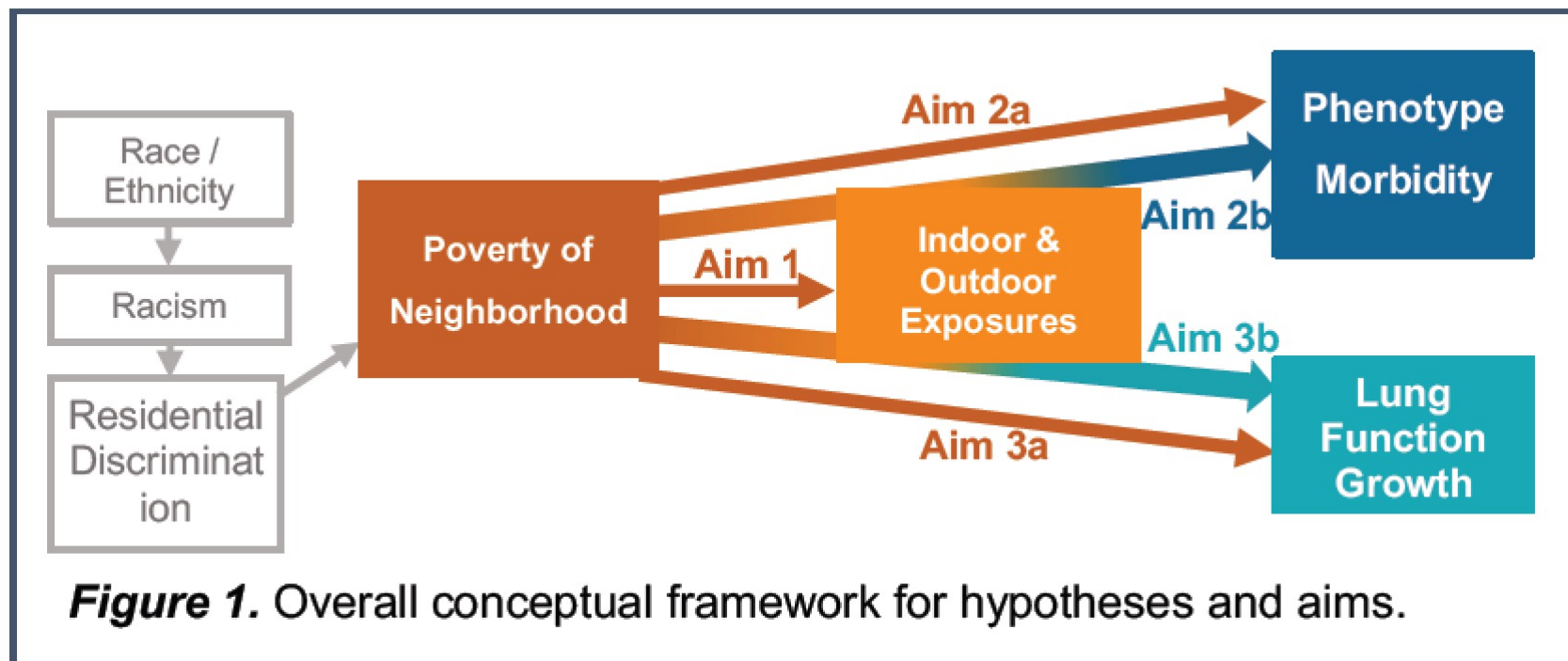


Figure credit: Kerry Kinney

The Texas Home Assessment of Asthma and Lung Exposures (TexHALE)



TexHALE is a cross-sectional study of children, 5-17 years of age, with asthma recruited from high poverty and low poverty neighborhoods in Travis County.

Take home messages

Mouse infestation in Baltimore (and similar cities)

- Mouse allergen is a major driver of asthma morbidity among children in Baltimore (and other similar cities).
- Mouse allergen levels can be reduced, and reduction is associated with marked improvements in asthma.
- Allergen exposure reduction linked with long-term benefits, especially lung function growth.

Housing discrimination

- Mouse infestation appears endemic, may be related to history of housing discrimination, limiting effectiveness of mouse infestation interventions.
- Housing mobility may offer an alternative approach that addresses housing discrimination as root cause.

Take home messages, cont.

Austin/Travis County, TX

- Children in Travis Co, TX have a high burden of asthma morbidity, including Latinx children who are predominantly of Mexican origin.
- Poverty, asthma ED visits, and ethnic composition all spatially correlated with each other and with air pollution sources.
 - This spatial correlation appears rooted in structural racism related to segregation and zoning ordinances.



The University of Texas at Austin
Center for Health and Environment,
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Connecting Environment to Health in Texas & Beyond

CHEER is a hub for multidisciplinary environmental health sciences research and education. Housed within the Department of Population Health at Dell Medical School, the center brings together experts from the Cockrell School of Engineering, the College of Natural Sciences, the College of Pharmacy, and the Steve Hicks School of Social Work at The University of Texas at Austin.

Director: Elizabeth Matsui, MD MHS

Steering Committee: Kate Calder, Lydia Contreras, Catherine Cubbin, Andrea Gore, Kerry Kinney, Cory Zigler

WHAT IS ENVIRONMENTAL HEALTH

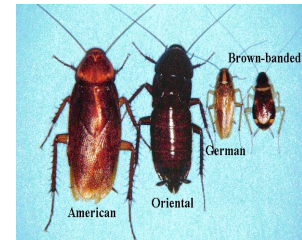
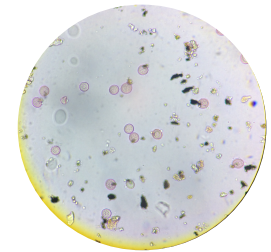
Environmental Health is a discipline that focuses on how the **environment** influences human **health** and disease.

“Environment” encompasses the natural environment, which includes air, water, soil, and climate, and the built and social environments.

CHEER: Connecting Environment to Health in Texas and Beyond

MISSION:

To improve the health of people locally and globally through research and education.



Expertise

- Statistics and Data Science
- Social Science
- Toxicology
- Endocrine disrupting chemical exposures
- Airway epithelial cell models
- Outdoor air pollution
- Built environment
- Indoor environment
- Allergens and microbial exposures
- Health disparities
- Pediatrics
- Environmental justice
- Respiratory disease
- Neurodevelopment
- Animal models
- Epidemiology
- Water systems
- Building science
- Climate change
- Unconventional oil and gas drilling exposures

Current Activities

- **Monthly seminar series**
- **DMS Medical Student Environmental Health Interest Group (EHIG)**
 - Op-eds
 - Journal club
- **Internship in Environmental Health Communication**
 - Newsletter: *Environmental Health Connections*
- **Community engagement**
 - City of Austin Office of Sustainability
 - Collaboration with CEHE, BASTA
 - Climate Change Symposium, Sierra Club of Texas
- **Sampling of research projects, underway and planned**
 - Mapping asthma ED visits
 - Estimating effects of pollen and viruses on asthma ED visits in Texas
 - HUD filter forensics: using HVAC filters to measure indoor environmental contaminants
 - Study the effects of unconventional oil and gas drilling emissions in Texas on respiratory health
 - The Texas Home Assessment of Asthma and Lung Exposures (TexHALE): Understanding the effects of neighborhood poverty on indoor and outdoor airborne exposures and asthma phenotypes
 - Developing an environmental data portal for Central Texas

Endocrine-Disrupting Chemicals and the Brain

By **Andrea C. Gore, PhD**

Professor and Vacek Chair of Pharmacology and CHEER Steering Committee
Member

Effects of the Environment on Children's Health

By **Leo Trasande, MD MPP**

Jim G. Hendrick, MD Professor and Vice Chair, Department of Pediatrics
Chief, Division of Environmental Pediatrics
Professor of Environmental Medicine & Population Health
NYU School of Medicine

Public Health Impacts of Air Pollution Regulations by Dr. Cory Zigler

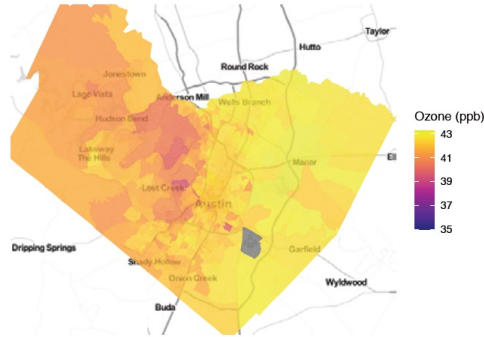
This talk outlines the relevance of air pollution regulations for public health and outlines analytic strategies that combine statistics, epidemiology, and atmospheric science towards quantifying the downstream health impacts of air quality policies.

Molecular Effects of Air Pollution on Airway Epithelial Cells

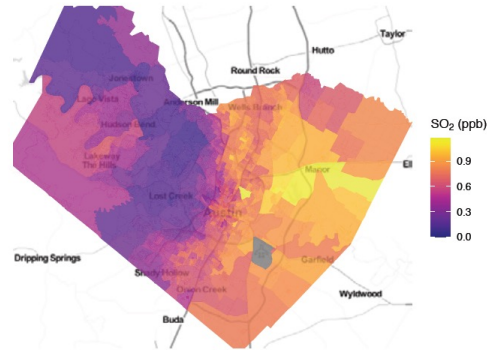
By **Lydia Contreras, PhD**

Associate Professor
Jim and Barbara Miller Endowed Faculty Fellowship in Chemical Engineering and
CHEER Steering Committee Member

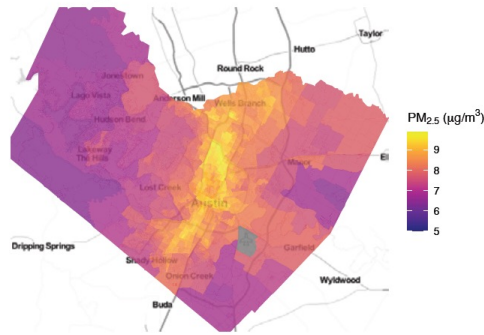
Modeled Ozone



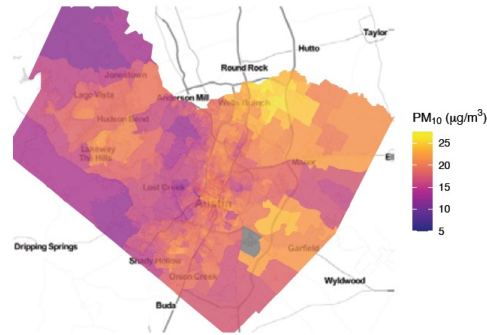
Modeled SO₂



Modeled PM_{2.5}



Modeled PM₁₀



Sarah Chambliss and Cory Zigler CACES models

Kim S.-Y.; Bechle, M.; Hankey, S.; Sheppard, L.; Szpiro, A. A.; Marshall, J. D. 2020. "Concentrations of criteria pollutants in the contiguous U.S., 1979 – 2015: Role of prediction model parsimony in integrated empirical geographic regression." PLoS ONE 15(2), e0228535. DOI: 10.1371/journal.pone.0228535

Future Activities

- We are an officially designated Organized Research Unit (ORU) –
 - Thanks to generous support from DMS, CNS, Engineering, and OVPR
- Look for expansion of our work to include activities designed to:
 - catalyze environmental health science research
 - support the development of environmental health science researcher pipeline
 - create a community of EHS researchers and educators across UT
 - engage with the Austin-Travis County community

Want to learn more?

- Sign up for our listserv - contact Rosemary Stewart
 - Newsletter
 - Seminar announcements
 - Announcements of new initiatives and opportunities to get involved
- Feel free to reach out if you'd like to talk!

Email:

cheer.health@austin.utexas.edu

Thank you

- **Study Participants**
- **Community Advisory Board**
- **Collaborators & mentees**

- Matt Perzanowski
- Wanda Phipatanakul
- Roger Peng
- Bob Wise
- Corinne Keet
- Craig Pollack
- Meredith McCormack
- Rebecca Zarate
- Cory Zigler
- Torie Grant

- CommUnityCare, Eda Baykal-Caglar, Tara Greendyk
- Courtney Mulligan, Becky Correa, Marissa Alviar, Lizzy Keiger, Luis Alamo-Rivera
- RA Zarate, Dan Katz, Emily Croce, Michelle Zhang, Torie Grant
- Susan Balcer-Whaley, Michelle Newman

Sponsors: NIAID, NIEHS

Contact Information:
email: ematsui@utexas.edu
twitter: [@elizabethmatsui](https://twitter.com/elizabethmatsui)

Podcast on Academic Life:
The Effort Report
effortreport.libsyn.com
twitter: [@theeffortreport](https://twitter.com/theeffortreport)
Co-host: Roger D. Peng

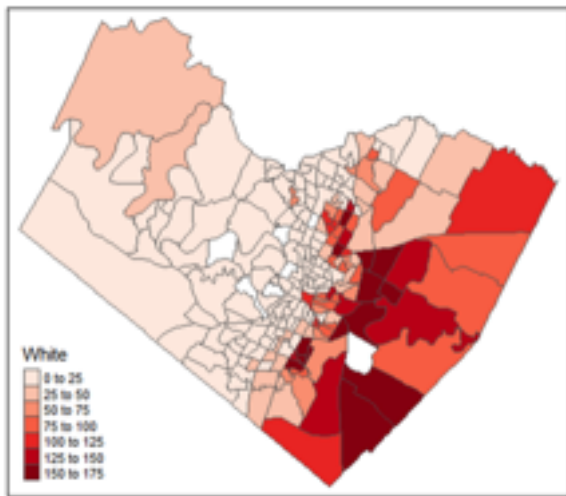


Black/African American children in Austin-Travis County may be more likely to be hospitalized for asthma than Black/African American US children

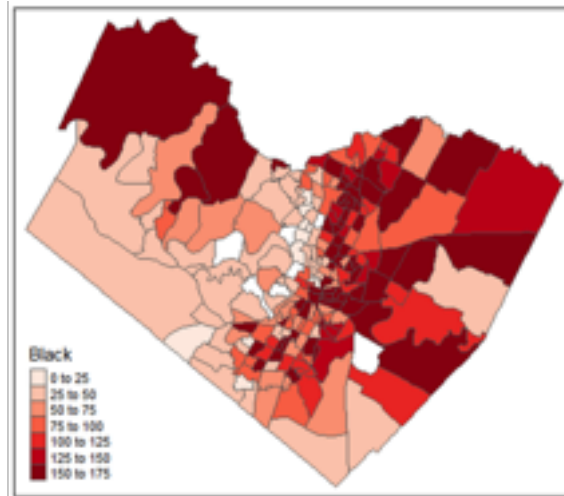
Asthma-Related ED Visit and Hospitalization Rates for Black/African American Children PBIR [95% CI]		
	US	Travis County
ED	254.4 [216.0, 292.8]	268.4 [253.7, 282.8]
Hosp	33.3 [8.0, 58.6]	44.3 [38.5, 50.8]
per 10,000 person-years		

Spatial distribution of asthma-related ED visits varies by race/ethnicity

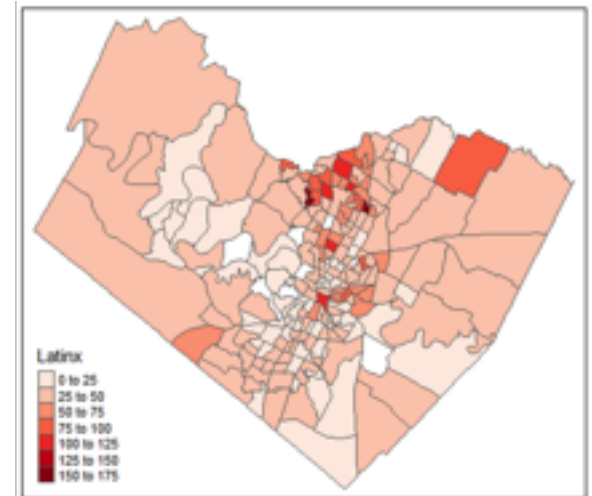
Non-Latinx White



Black



Latinx



Home environmental interventions: What about costs?

Medication Costs

- fluticasone/salmeterol
 - 500/50 = \$275/month = \$3300/y
 - 250/50 = \$215/month = \$2580/y
 - 100/50 = \$175/month = \$2100/y
- montelukast = \$125/month = \$1500/y

Cost of environmental intervention (Morgan et al NEJM): ~1500 dollars/family