Neighborhoods As Drivers of Asthma Disparities

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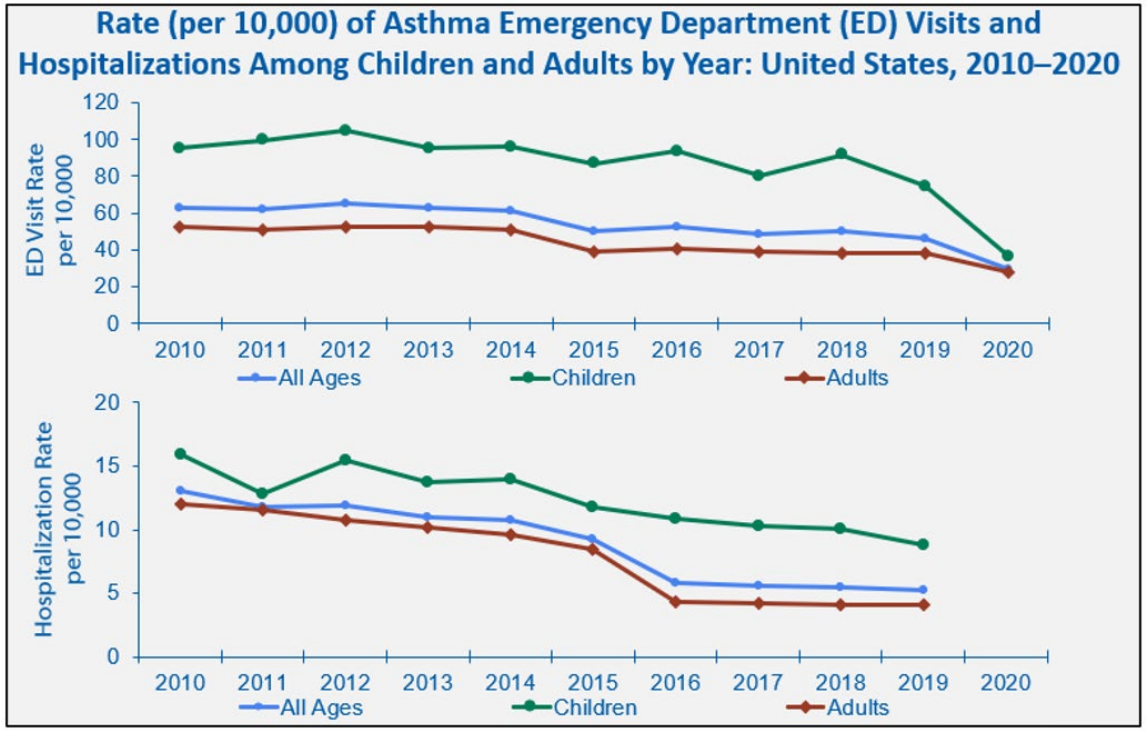
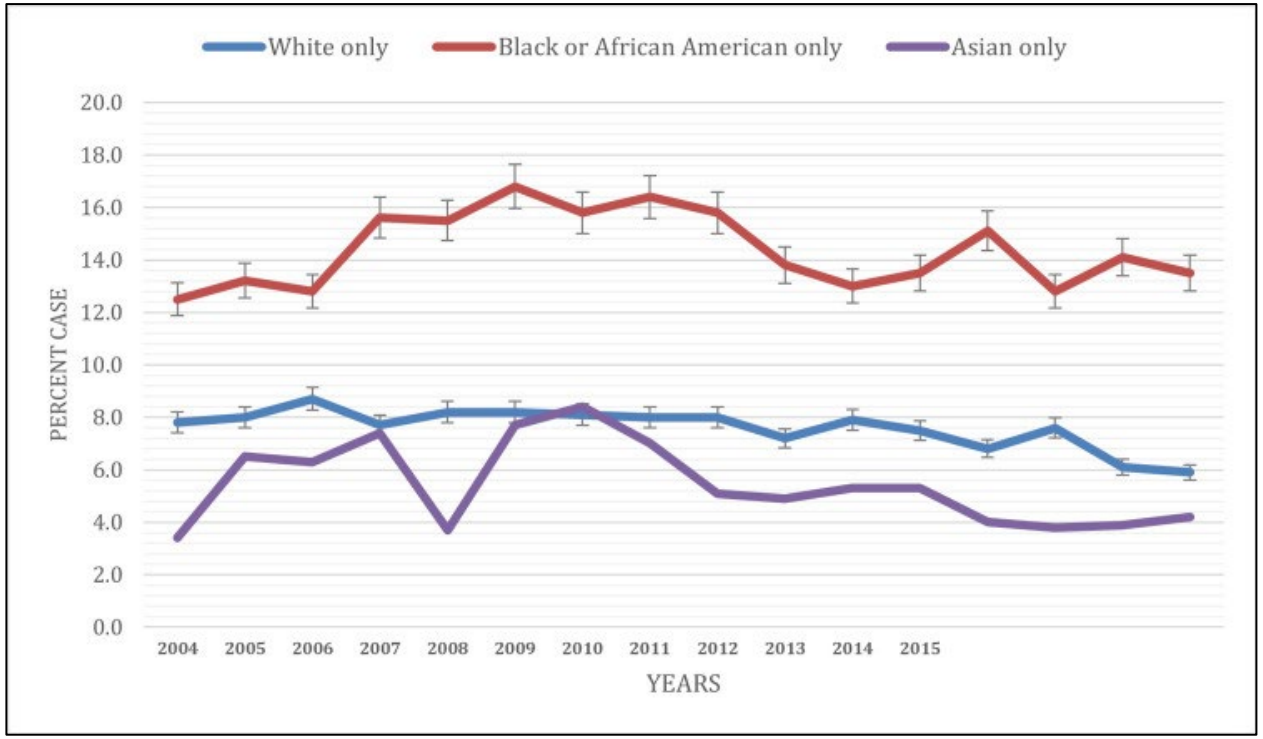
Director, Center for Health and Environment: Education and Research

Associate Dean for Faculty Academic Affairs

UT Austin Dell Medical School

Asthma prevalence and morbidity have decreased……but disparities have persisted

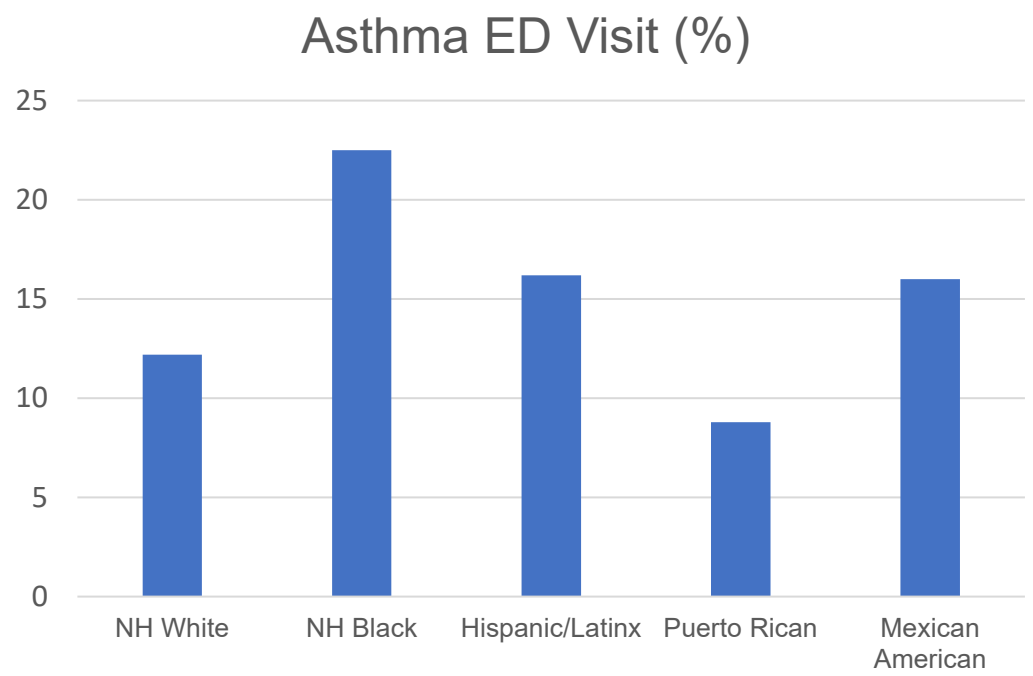


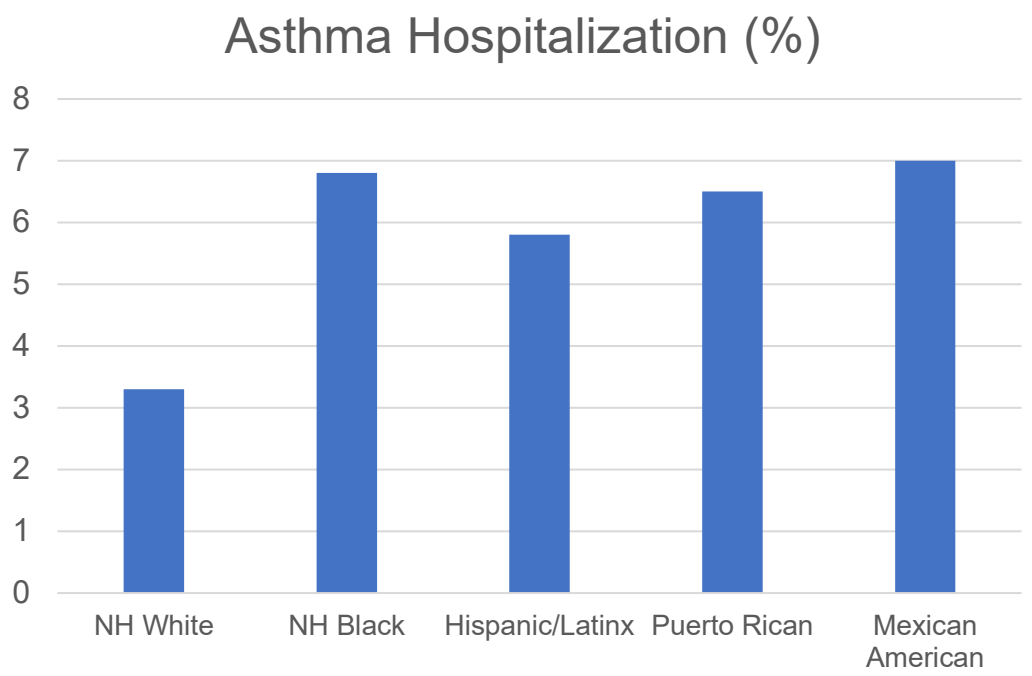


CDC

Ojo RO et al. Epidemiology of Current Asthma in Children Under 18: A Two-Decade Overview Using National Center for Health Statistics (NCHS) Data. Cureus. 2023 Nov 22;15(11):e49229.

Racial & ethnic childhood asthma disparities



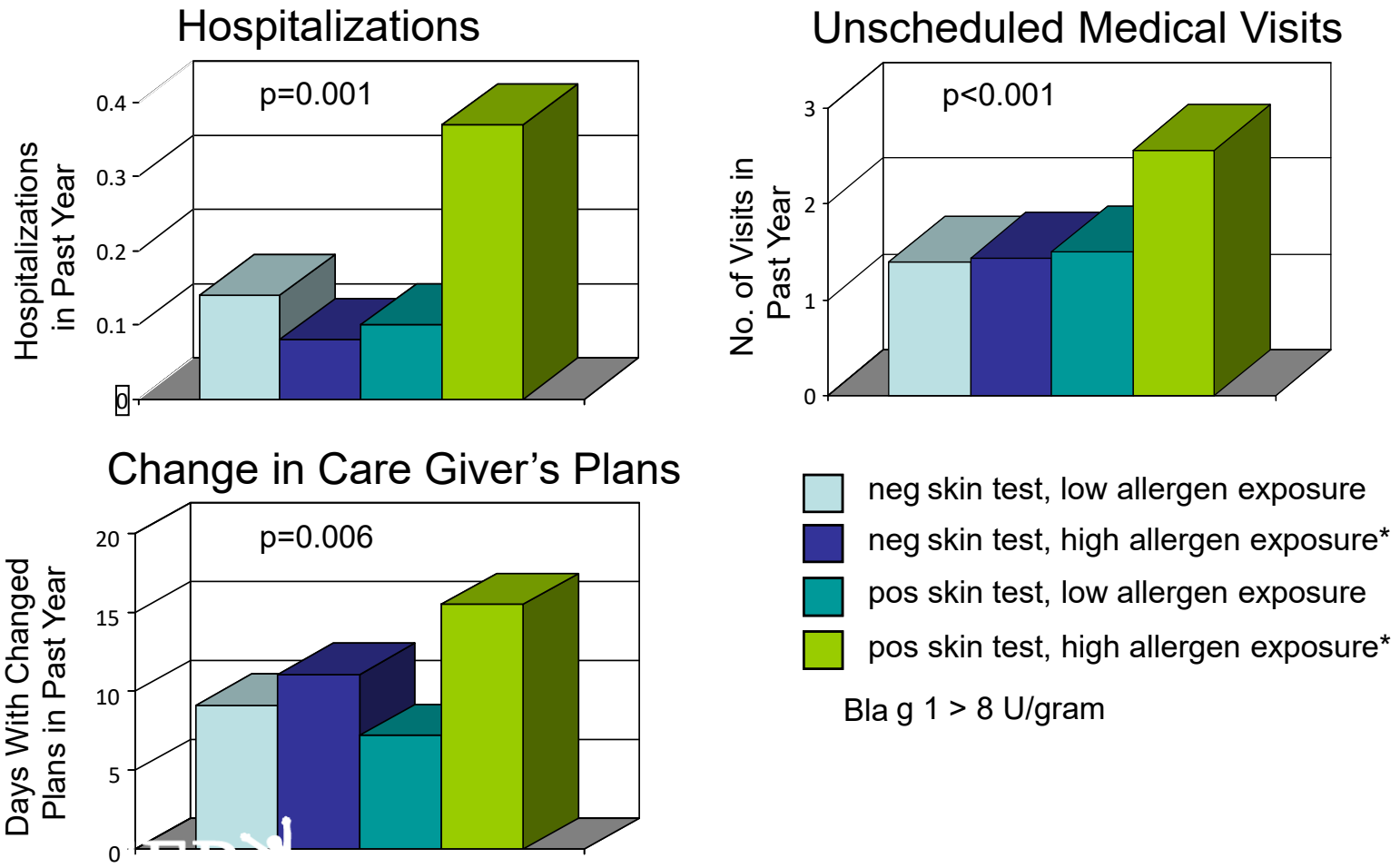


Zahran HS et al. Vital Signs: Asthma in Children - United States, 2001-2016. MMWR Morb Mortal Wkly Rep. 2018 Feb 9;67(5):149-155.

“Inner-city” 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

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



Rosenstreich et al., N Eng J Med, 1997

Mouse allergen highest in homes in disadvantaged, urban neighborhoods

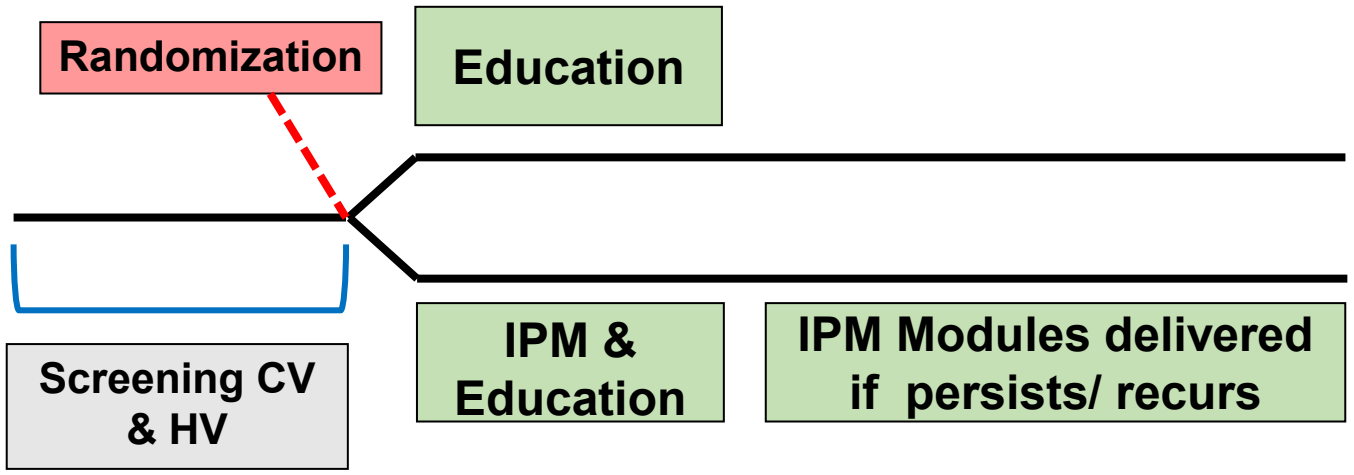
	Median Kitchen Mus m 1 (µg/g)
Suburban Maryland	0.007
US sample (Cohn JACI 2004)	0.36
NCICAS (Phipatanakul JACI 2000)	1.6
Inner-city Baltimore	14.7

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

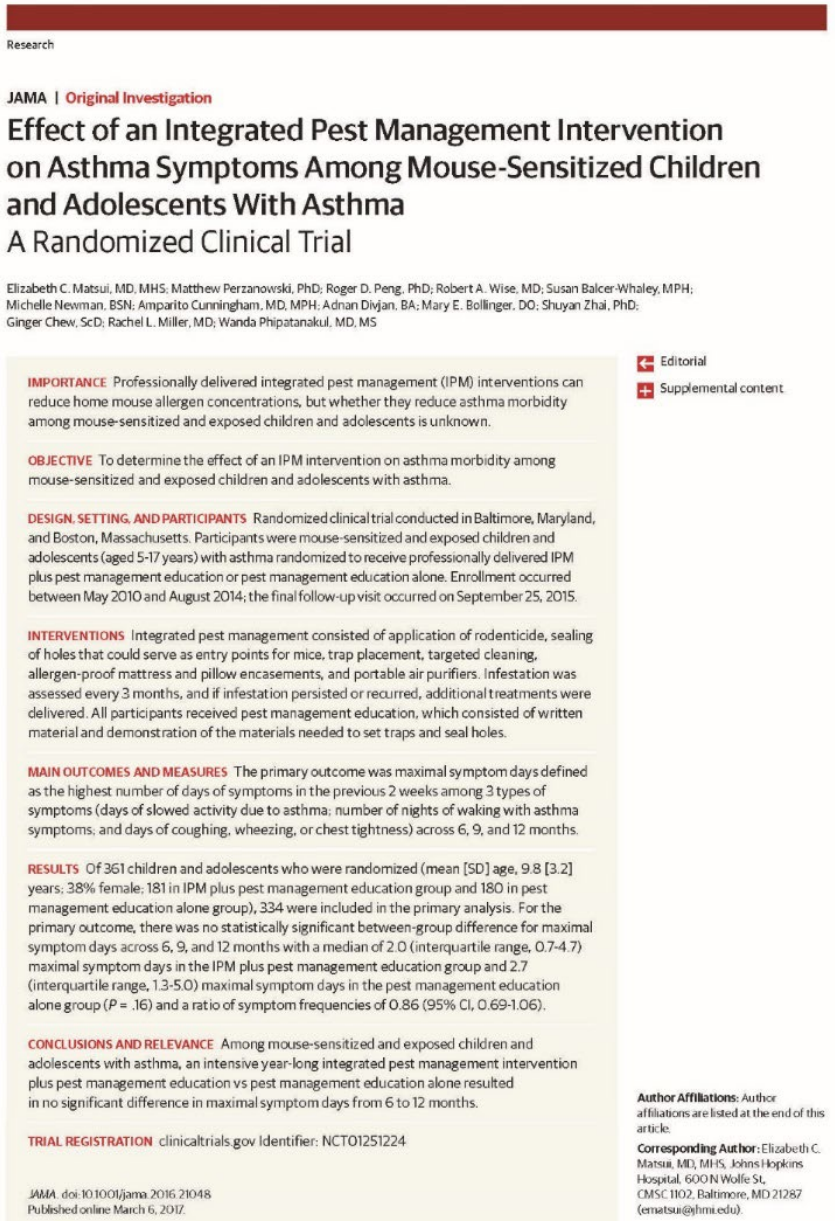
Matsui JACI 2004; Matsui JACI 2005; Matsui JACI 2007

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)



NIAID-funded through U01
Clinical Site/Core Leaders: Matt Perzanowski; Wanda Phipatanakul



Research

JAMA | Original Investigation

Effect of an Integrated Pest Management Intervention on Asthma Symptoms Among Mouse-Sensitized Children and Adolescents With Asthma

A Randomized Clinical Trial

Elizabeth C. Matsui, MD, MHS; Matthew Perzanowski, PhD; Roger D. Peng, PhD; Robert A. Wise, MD; Susan Balcer-Whaley, MPH; Michelle Newman, BSN; Amparito Cunningham, MD, MPH; Adnan Divjan, BA; Mary E. Bollinger, DO; Shuyan Zhai, PhD; Ginger Chew, ScD; Rachel L. Miller, MD; Wanda Phipatanakul, MD, MS

IMPORTANCE Professionally delivered integrated pest management (IPM) interventions can reduce home mouse allergen concentrations, but whether they reduce asthma morbidity among mouse-sensitized and exposed children and adolescents is unknown.

OBJECTIVE To determine the effect of an IPM intervention on asthma morbidity among mouse-sensitized and exposed children and adolescents with asthma.

DESIGN, SETTING, AND PARTICIPANTS Randomized clinical trial conducted in Baltimore, Maryland, and Boston, Massachusetts. Participants were mouse-sensitized and exposed children and adolescents (aged 5-17 years) with asthma randomized to receive professionally delivered IPM plus pest management education or pest management education alone. Enrollment occurred between May 2010 and August 2014; the final follow-up visit occurred on September 25, 2015.

INTERVENTIONS Integrated pest management consisted of application of rodenticide, sealing of holes that could serve as entry points for mice, trap placement, targeted cleaning, allergen-proof mattress and pillow encasements, and portable air purifiers. Infestation was assessed every 3 months, and if infestation persisted or recurred, additional treatments were delivered. All participants received pest management education, which consisted of written material and demonstration of the materials needed to set traps and seal holes.

MAIN OUTCOMES AND MEASURES The primary outcome was maximal symptom days defined as the highest number of days of symptoms in the previous 2 weeks among 3 types of symptoms (days of slowed activity due to asthma; number of nights of waking with asthma symptoms; and days of coughing, wheezing, or chest tightness) across 6, 9, and 12 months.

RESULTS Of 361 children and adolescents who were randomized (mean [SD] age, 9.8 [3.2] years; 38% female; 181 in IPM plus pest management education group and 180 in pest management education alone group), 334 were included in the primary analysis. For the primary outcome, there was no statistically significant between-group difference for maximal symptom days across 6, 9, and 12 months with a median of 2.0 (interquartile range, 0.7-4.7) maximal symptom days in the IPM plus pest management education group and 2.7 (interquartile range, 1.3-5.0) maximal symptom days in the pest management education alone group ($P = .16$) and a ratio of symptom frequencies of 0.86 (95% CI, 0.69-1.06).

CONCLUSIONS AND RELEVANCE Among mouse-sensitized and exposed children and adolescents with asthma, an intensive year-long integrated pest management intervention plus pest management education vs pest management education alone resulted in no significant difference in maximal symptom days from 6 to 12 months.

TRIAL REGISTRATION clinicaltrials.gov Identifier: NCT01251224

Editorial

Supplemental content

Author Affiliations: Author affiliations are listed at the end of this article.

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JAMA. doi:10.1001/jama.2016.21048
Published online March 6, 2017.

- 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
- >40% of participants still had mouse allergen concentrations known to be associated with asthma morbidity

Effectiveness of indoor allergen reduction in asthma management: A systematic review.

Leas BF[1], D'Anci KE[2], Apter AJ[3], Bryant-Stephens T[4], Lynch MP[2], Kaczmarek JL[2], Umscheid CA[5].

JACI 2018

“lack of conclusive, consistent, high-or-moderate strength evidence"

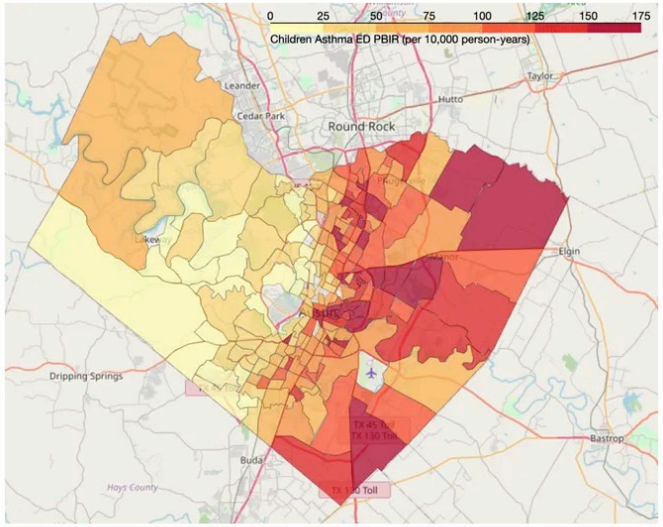
HEALTHCARE

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

Nicole Villalpando Austin American-Statesman

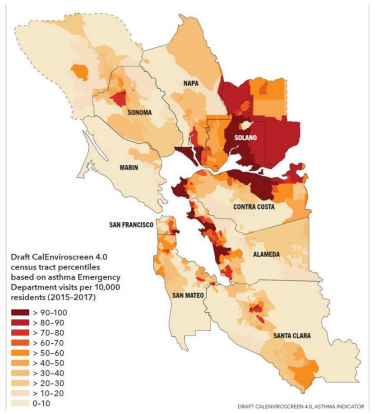
Published 7:00 a.m. CT Oct. 26, 2021

View Comments

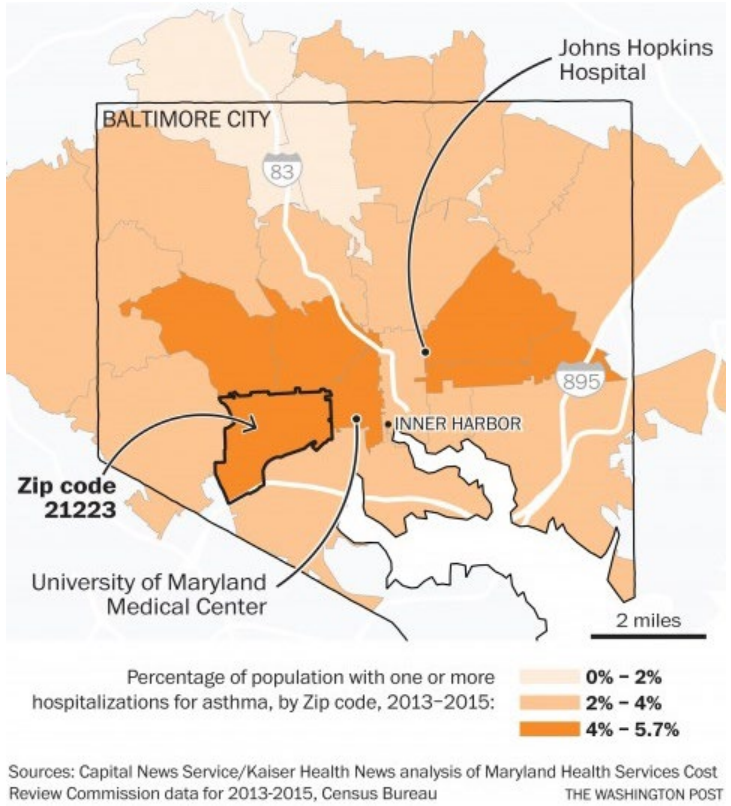


In Dell Medical School's asthma study, the concentration of emergency room and hospital visits for asthma-related incidents can be seen along census tract lines, with red having the highest concentrations and yellow being the least concentrations. *Contributed By Dell Medical School*

Bay Area Asthma Rates



https://twitter.com/AirDistrict/status/1425245706063781891?s=20



Sources: Capital News Service/Kaiser Health News analysis of Maryland Health Services Cost Review Commission data for 2013-2015, Census Bureau

THE WASHINGTON POST

Does neighborhood matter more than the household?

Poverty, Ethnic Composition, and Asthma ED Visit Rates

- ED visit rates, compared to White children
  - >8-fold higher among Black children
  - >2.5 fold higher among Latinx/Hispanic children

Data source: Texas Health Care Information Collection (THCIC)

Zárate RA et al, JACI under revision

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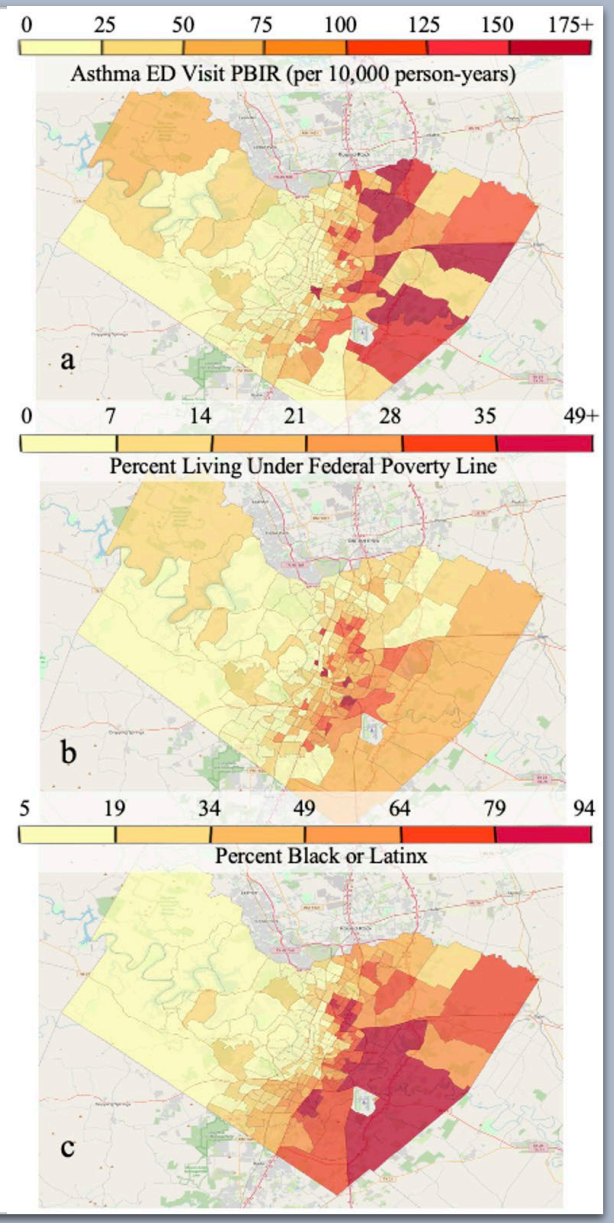
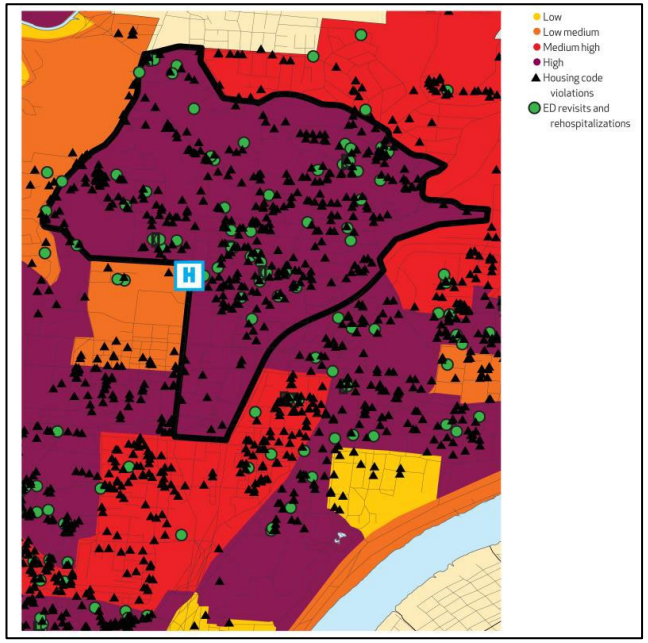


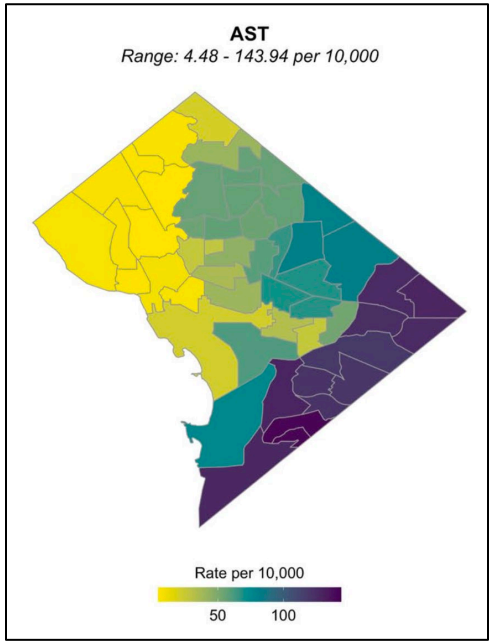
Neighborhood environment and asthma

HOUSING CODE VIOLATIONS



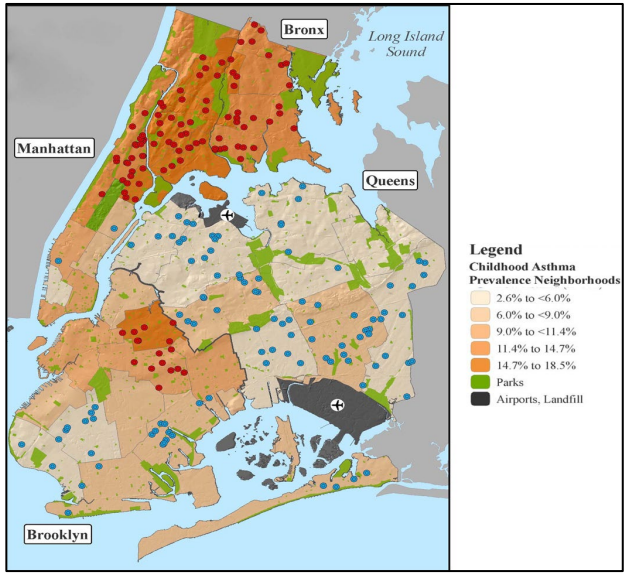
Beck AF, et al. *Health Aff (Millwood)*. 2014

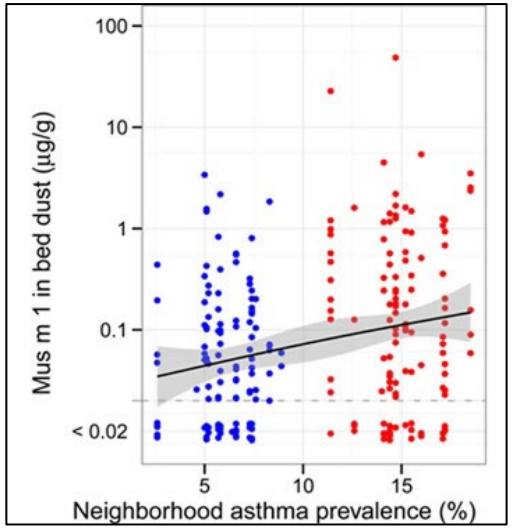
PM 2.5



Castillo MD, et al.*Geohealth*. 2021.

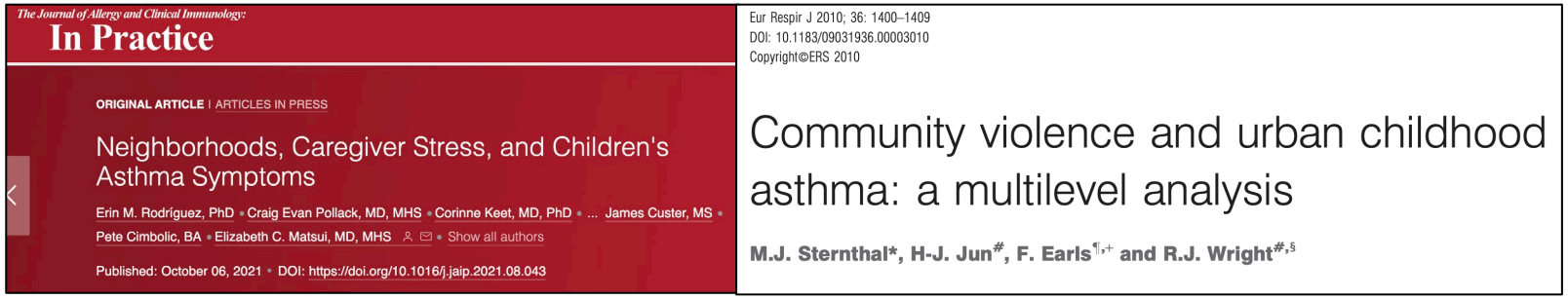
PEST ALLERGENS





Olmedo et al. *JACI*. 2011.

NEIGHBORHOOD SAFETY



The Journal of Allergy and Clinical Immunology: In Practice

ORIGINAL ARTICLE | ARTICLES IN PRESS

Neighborhoods, Caregiver Stress, and Children's Asthma Symptoms

Erin M. Rodríguez, PhD • Craig Evan Pollack, MD, MHS • Corinne Keet, MD, PhD • ... James Custer, MS • Pete Cimbolic, BA • Elizabeth C. Matsui, MD, MHS • Show all authors

Published: October 06, 2021 • DOI: https://doi.org/10.1016/j.jaip.2021.08.043

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DOI: 10.1183/09031936.00003010
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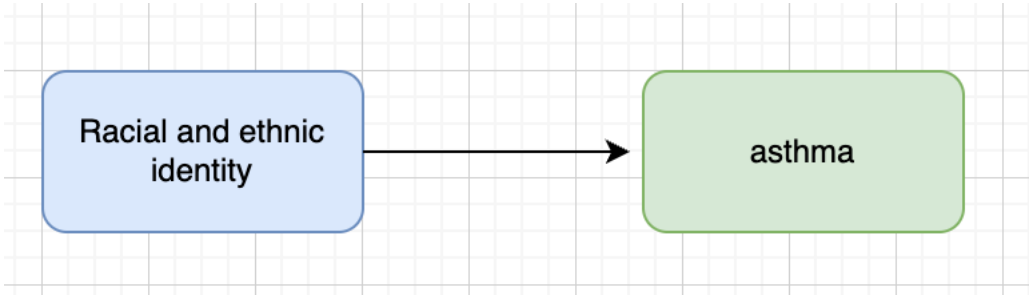
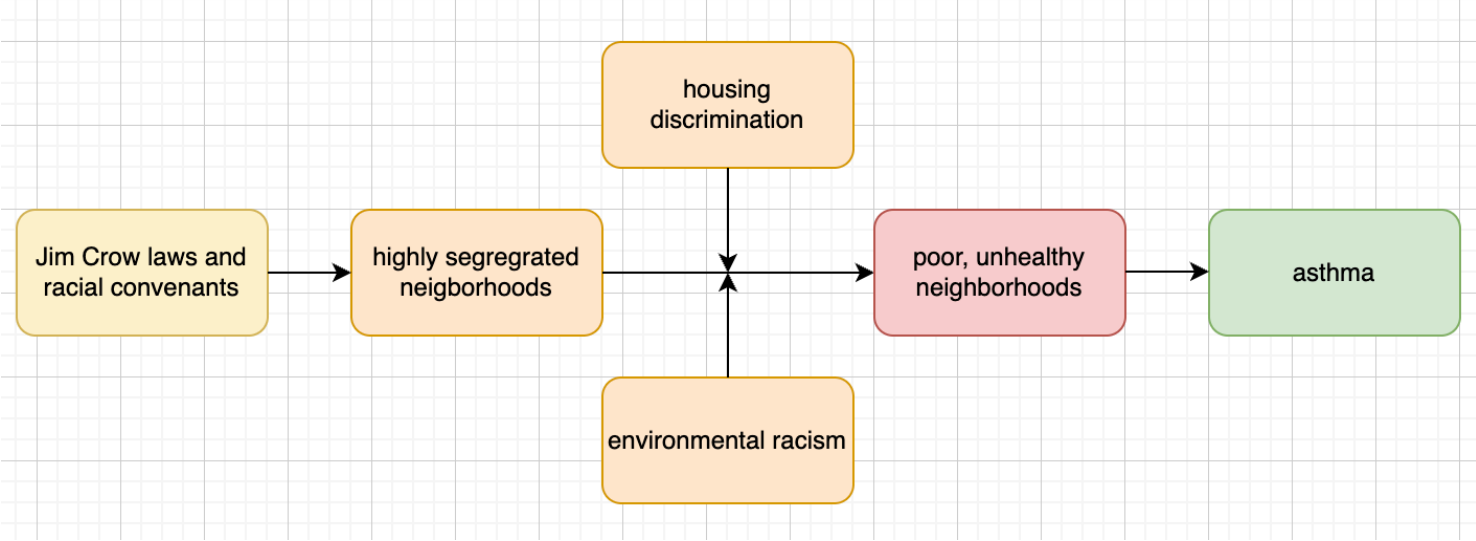
Community violence and urban childhood asthma: a multilevel analysis

M.J. Sternthal*, H-J. Jun#, F. Earls¶,+ and R.J. Wright#,§

Why are there spatial correlations between asthma, racial and ethnic neighborhood composition, and environmental features?





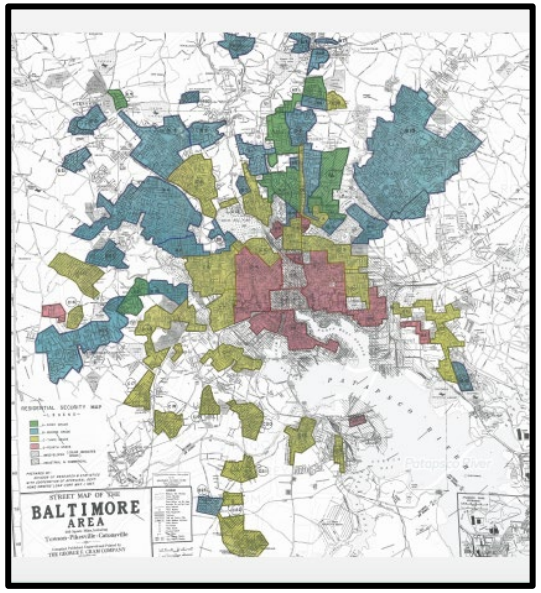
Housing Discrimination & Asthma: Baltimore

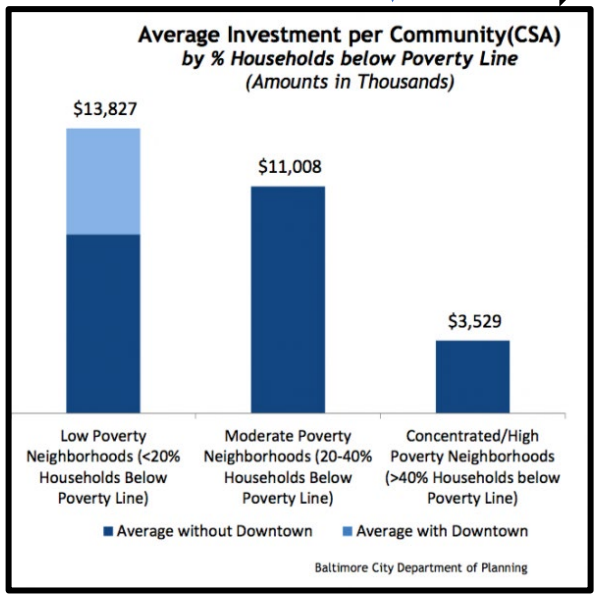
THE NEW YORK TIMES. SUNDAY. DECEMBER 25, 1910.

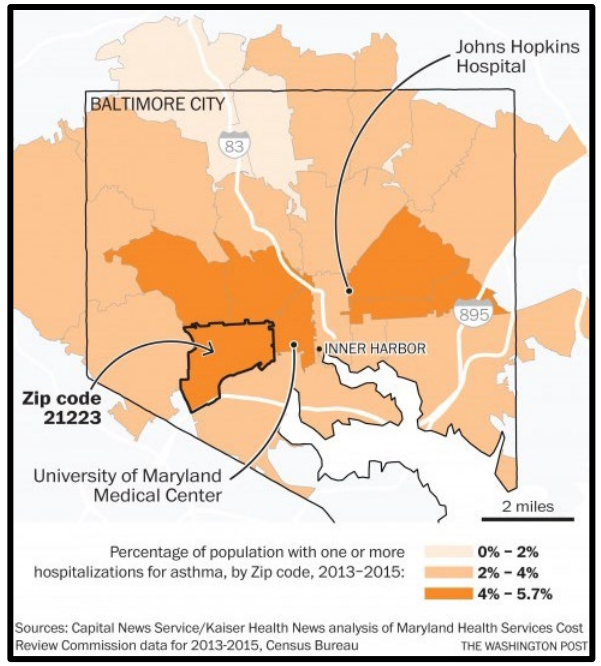
BALTIMORE TRIES DRASTIC PLAN OF RACE SEGREGATION

Strange Situation Which Led the Oriole City to Adopt the Most Pronounced "Jim Crow" Measure on Record.

1910 1930s-1960s 2017







Housing Discrimination in Austin-Travis County

1928

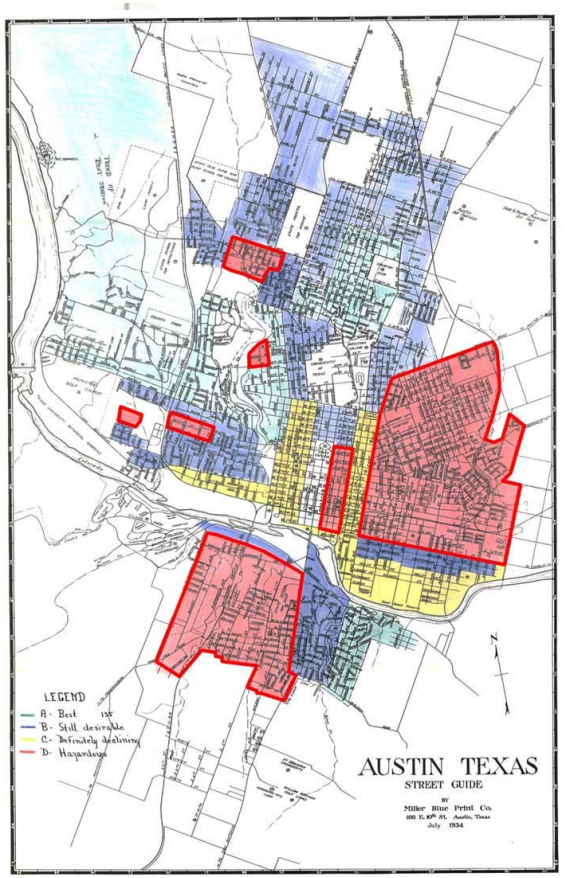
Evolution of a 'Negro District'

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/

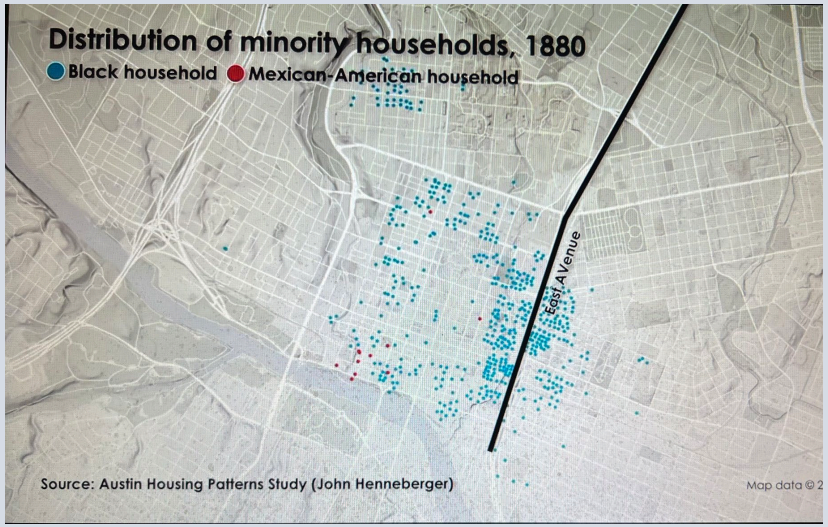
Redlining

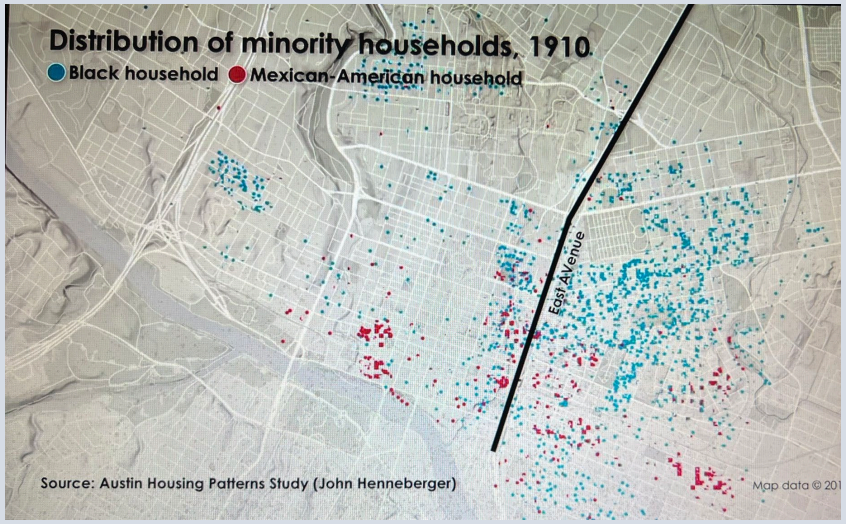


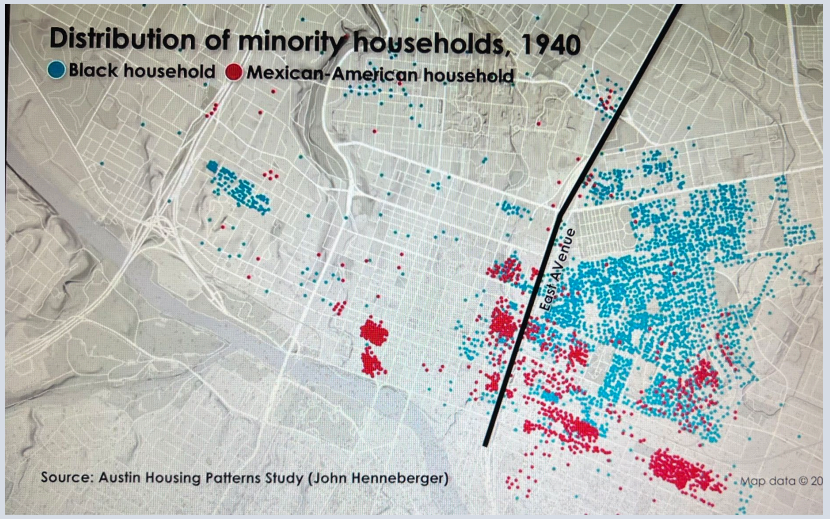
Housing discrimination targets all racialized people

- Austin built the country's first development to receive allocations from US Housing Authority (HUD) (1939)
  - In East Austin
  - Stated intent was to provide low-cost housing to the Latinx/Hispanic population
    - who had been living in pockets scattered across the Austin metropolitan area
- Even though Latinx/Hispanics were considered "white," discriminatory language in racial covenants shifted from "no people of African descent" to "Caucasian only", thereby racializing Latinx/Hispanic residents.
- Residential discrimination thus led East Austin to become home to the majority of Austin's Black and Latinx/Hispanic residents.

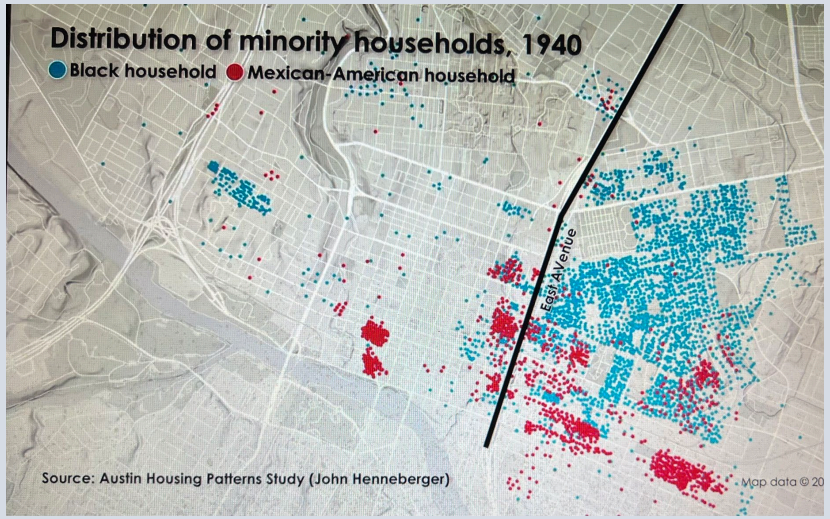
Evolution of segregation in Austin, TX

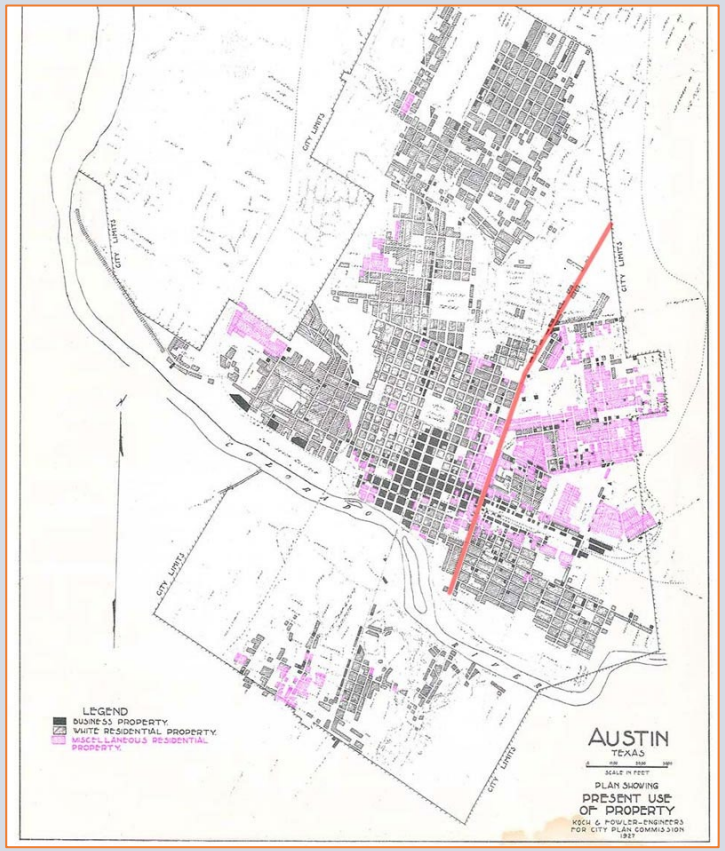


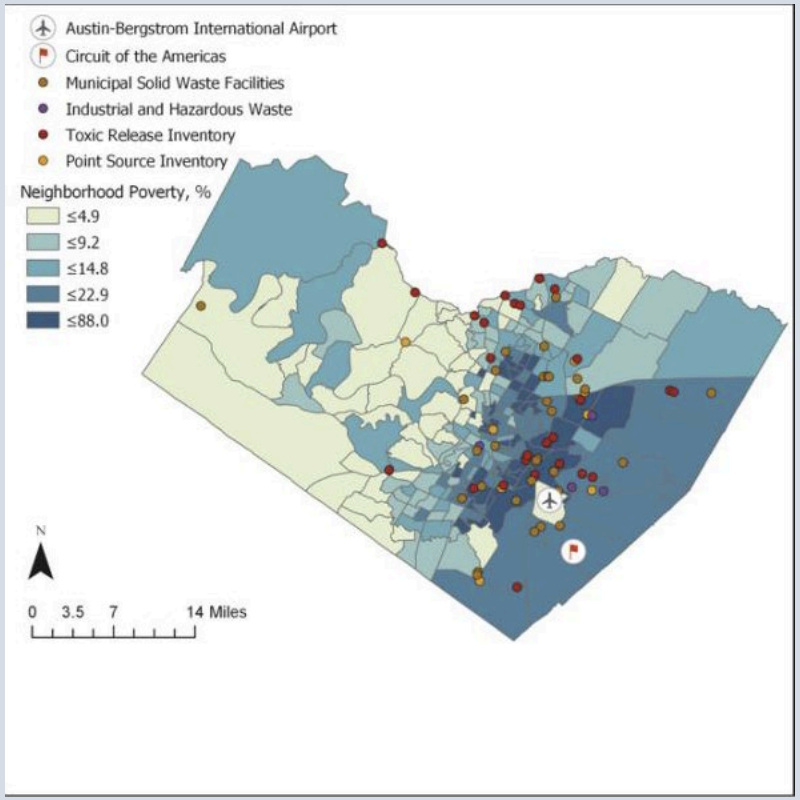




Segregation and environmental racism in Austin, TX

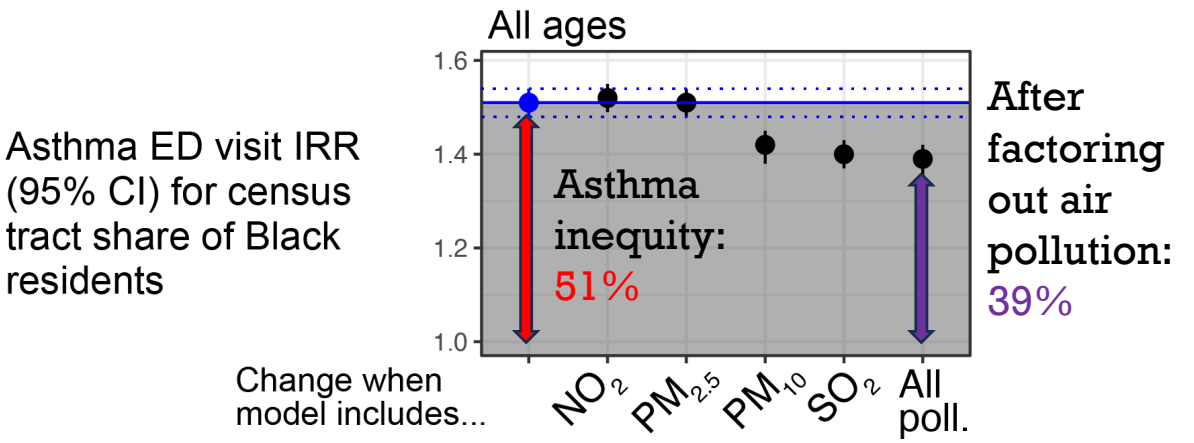


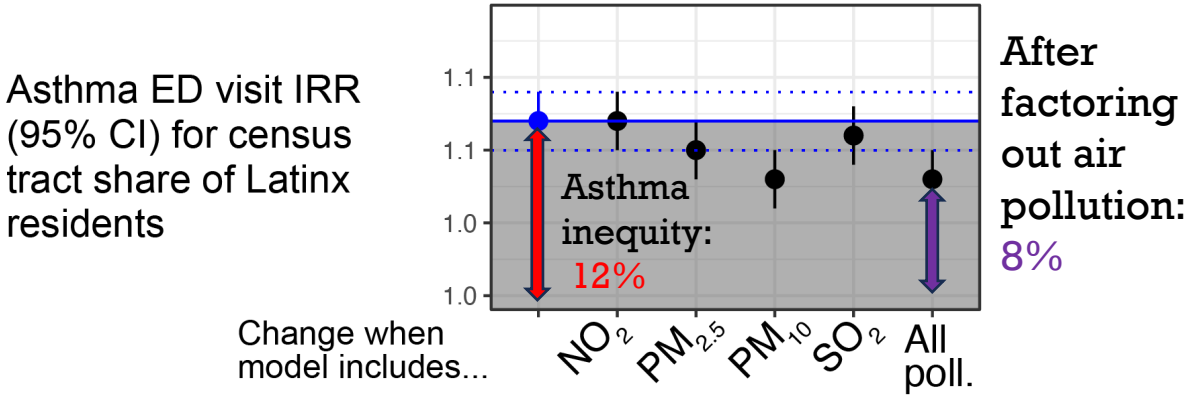




Minority neighborhoods without zoning protections

– East Avenue





Sarah Chambliss, PhD
Research Associate

- When accounting for neighborhood air pollution, association between census tract incidence rates and
  - Black resident share is attenuated by 24%
  - Latinx resident share is attenuated by 32%

Chambliss et al. AJRCCM, In Press

Intervening on Neighborhoods

- Target neighborhood
  - Urban planning, investment
    - Green spaces, tree cover
    - Vacant lot management
    - Siting of fixed and mobile air pollution sources
  - Housing policy
    - Low-income housing not concentrated
    - Mitigate gentrification
- Target individuals
  - Housing mobility

JAMA | Original Investigation

Association of a Housing Mobility Program With Childhood Asthma Symptoms and Exacerbations

Craig Evan Pollack, MD, MHS; Laken C. Roberts, PhD, MPH; Roger D. Peng, PhD; Pete Cimbolic, BA; David Judy, BA; Susan Balcer-Whaley, MPH; Torie Grant, MD, MHS; Ana Rule, PhD; Stefanie Deluca, PhD; Meghan F. Davis, PhD; Rosalind J. Wright, MD; Corinne A. Keet, MD, PhD; Elizabeth C. Matsui, MD, MHS

- Prospective cohort of 140 children with asthma enrolled in the Baltimore Regional Housing Partnership
- Started recruitment July 2016, report through start of COVID
- Inclusion: (1) 5-17 years of age, (2) persistent asthma OR having an asthma exacerbation in the past 12 months.

*No allergic sensitization eligibility criteria

JAMA. 2023;329(19):1671-1681. doi:10.1001/jama.2023.6488
Sponsor: NIEHS

Baltimore Regional Housing Partnership

- Started as result of class action lawsuit, Thompson v. HUD
- Has helped approximately 5,500 families with Housing Choice Vouchers move to opportunity areas throughout the Baltimore region
- Provides families with extensive pre-move, housing search, and post-move counseling support
- In 2018, average pre-move neighborhood poverty rate of 37%, post-move of 7.9%

Mobility Asthma Project

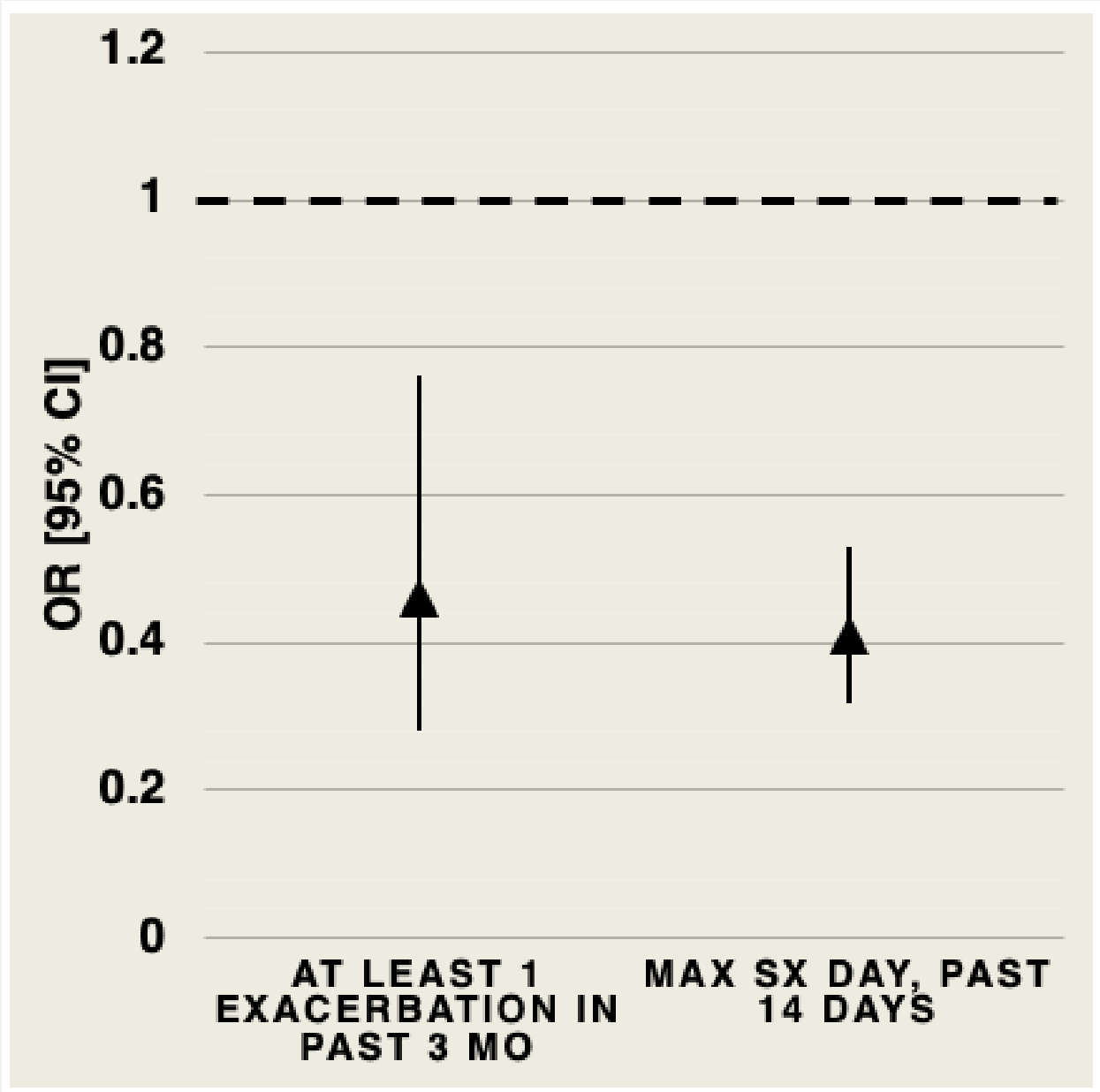
140 participants →

122 moved

followed up to 1 year post-move

Housing Mobility & Asthma

- ~50% reduction in odds of an exacerbation
- ~60% reduction in odds of a symptom day



What Happened to Indoor Allergens? Indoor Air Pollution?

Mobility Asthma Project

	Change	Mediation?
Cat	↔	No
Dog	↑	No
Dust mite	↑	No
Cockroach	↓	No
Mouse	↓	No

	Change		Mediation?
PM2.5	↓	**-25%**	No
PM10	↓	**-20%**	No
Cigarettes smoked in home	↓	**-1 cig/day**	No

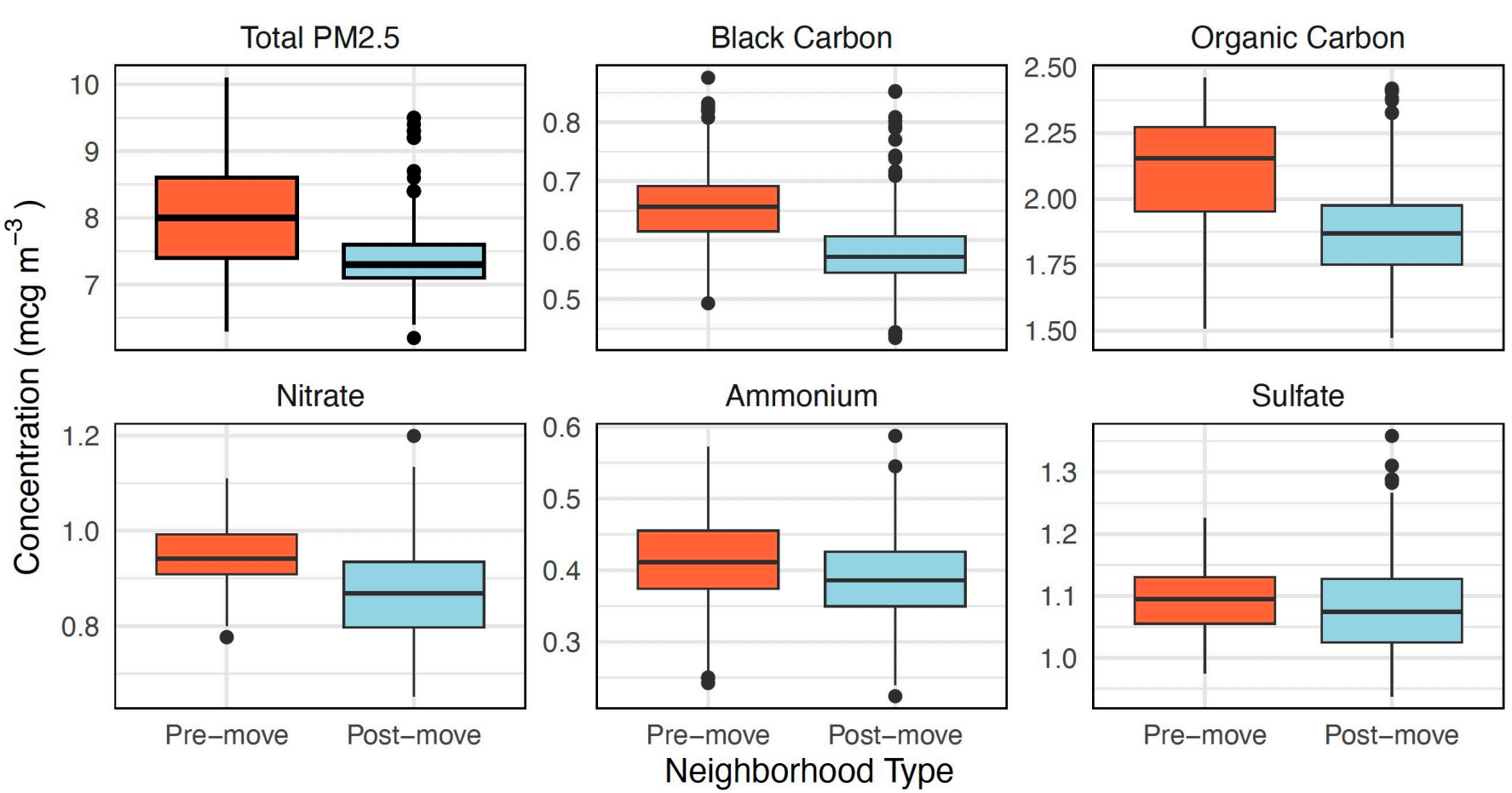
What Happened to Stressors/Stress?

Mobility Asthma Project

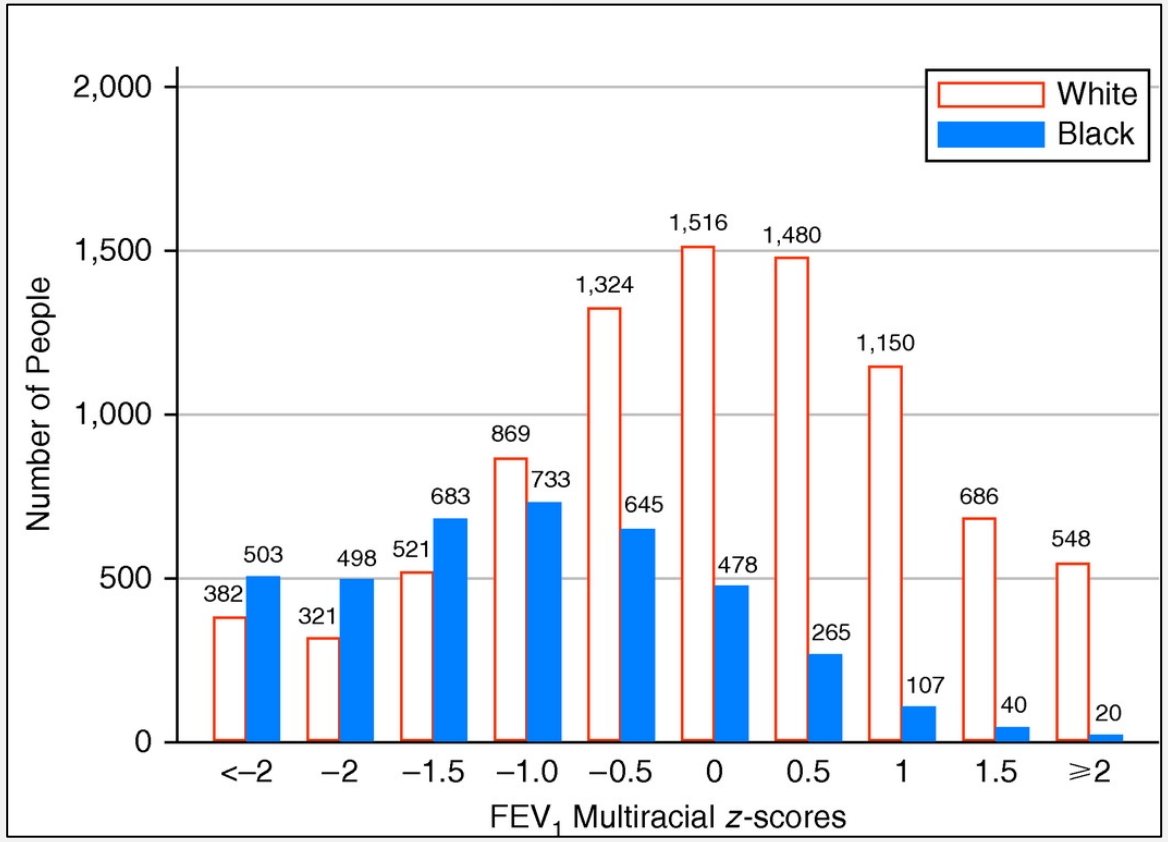
	Change	Mediation?
Neighborhood factors		
Social cohesion	↑	**Yes**
Safety	↑	**Yes**
Parent/caregiver stress		
Depression	↓	No
Urban stress	↓	**Yes**
Discrimination	↓	No

What Happened to Outdoor Air Pollution?

Mobility Asthma Project

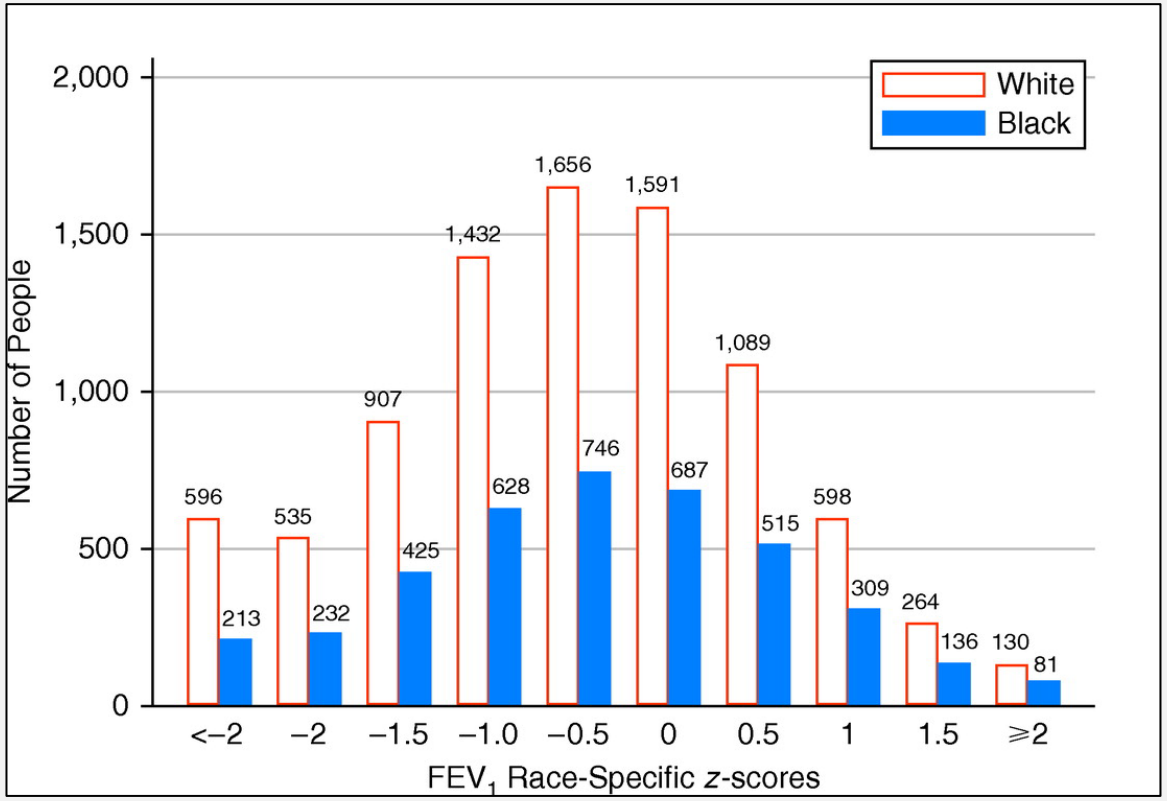


Does Neighborhood Explain Lung Function Disparities?

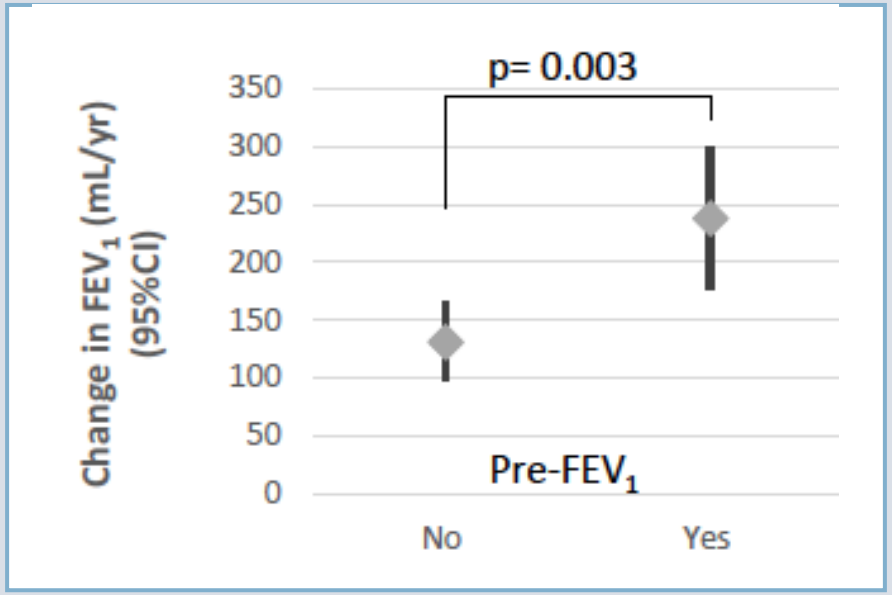


Adults: Black adults have, on average, FEV1 that is 500mLs lower than White adults

Children: Black children, have on average, FEV1 that is 10% lower than White children



McCormack et al. Am J Respir Crit Care Med, 2022
https://www.atsjournals.org/doi/abs/10.1164/rccm.202104-0822LE



Chronic Effects: 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

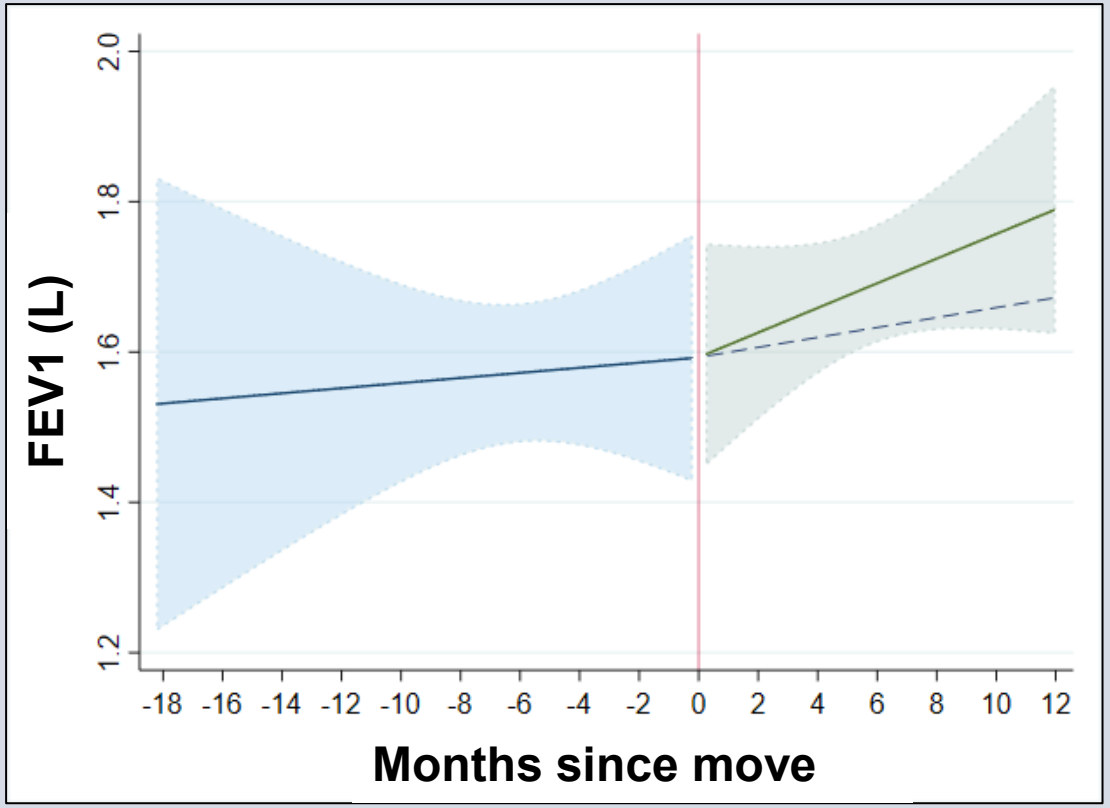
Children who have reduction in mouse allergen exposure have 75-100ml mls greater lung function growth (FEV1)

Grant T et al, JACI 2020

Mobility Asthma Project

Association between moving to a low-poverty neighborhood and lung function growth

- Moving associated with improvements in symptoms and reductions in pest allergen levels
- Moving associated with ~45mLs greater increase in FEV1
- FEV1 reaches peak in early adulthood, loss of 25mLs per year
- FEV1 is predictor of
  - COPD
  - mortality



Does neighborhood explain respiratory virus infection disparities?

Darlene Bhavnani, PhD
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KL2 Awardee
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Do upper respiratory viruses contribute to racial and ethnic disparities in emergency department visits for asthma?

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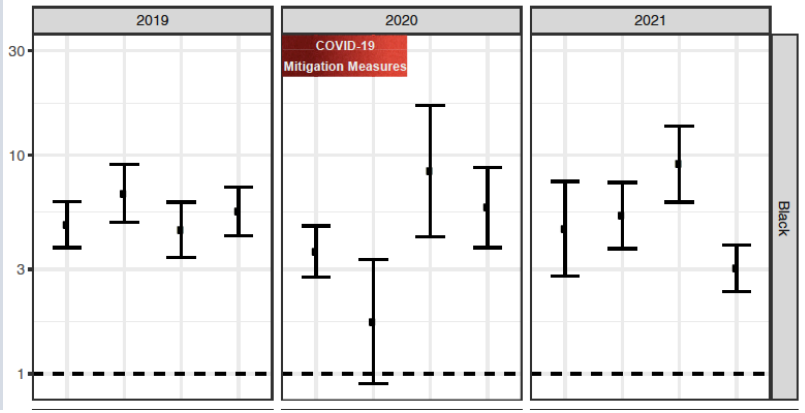
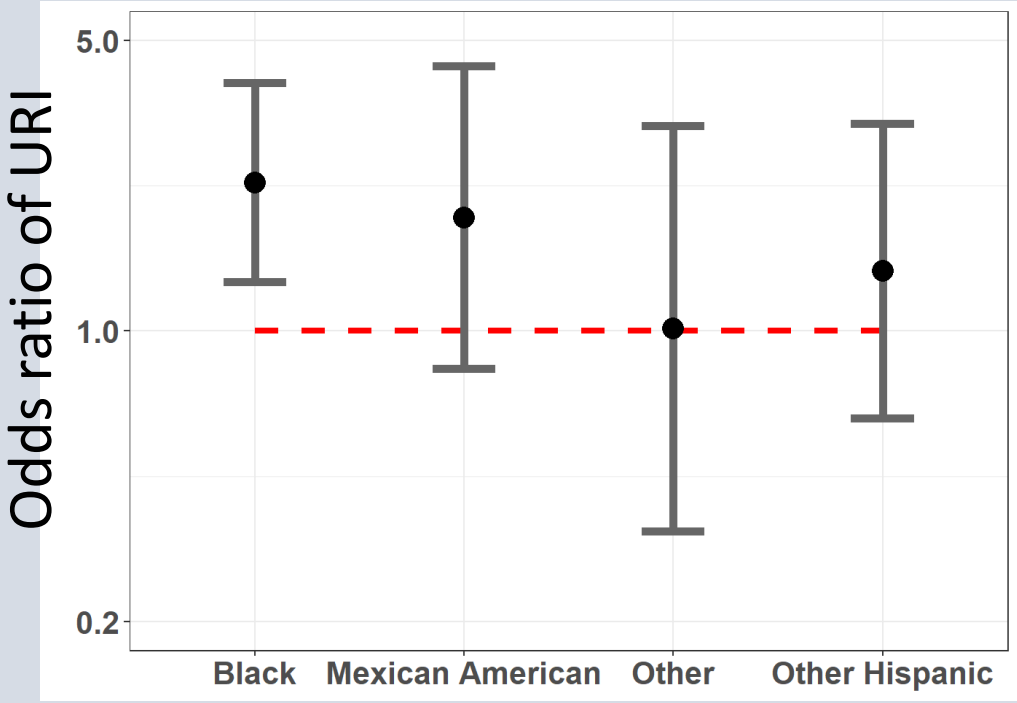


FIG 2. IRRs of ED visits comparing Black children with asthma with White children with asthma (*black*) and Latinx children with asthma with White children with asthma (*gray*) and 95% CIs by season and year, displayed on a $\log_{10}$ scale. Community-wide COVID-19 infection measures went into effect beginning on March 6, 2020 (winter 2020). A phased relaxation of these measures began on May 1, 2020 (spring 2020).

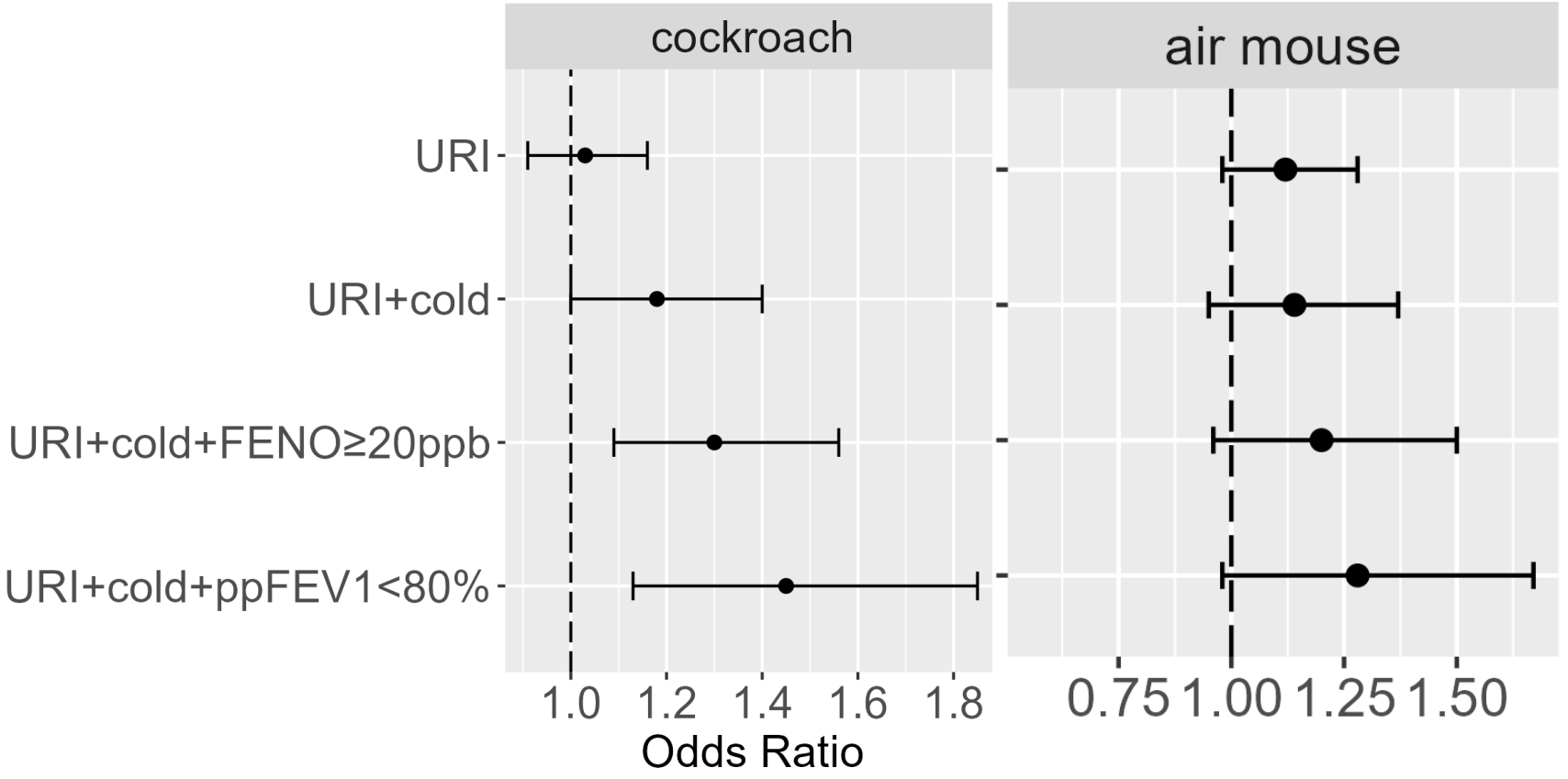
J Allergy Clin Immunol
Selected as Editor's Choice



Bhavnani et al JID 2024

Pest allergen exposure and URI outcomes

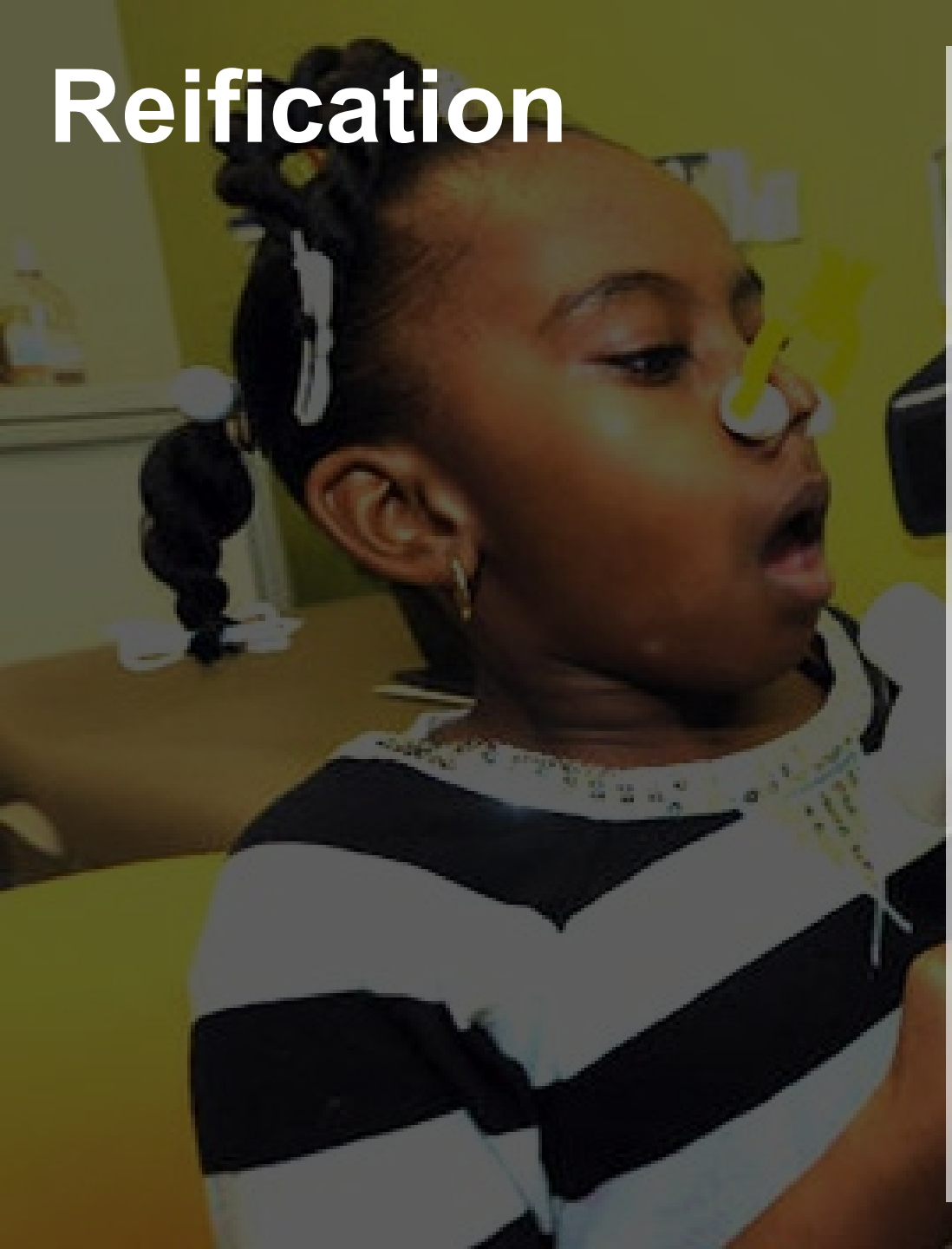
A two-fold increase in pest allergen levels associated with increased odds of a URI-with colds and with lower respiratory tract symptoms



Take home messages

- Historical and ongoing structural racism that have shaped and continue to shape neighborhoods likely underpin racial and ethnic disparities in asthma morbidity
- Housing mobility programs, designed to counter housing discrimination, are a promising strategy to meaningfully shrink asthma disparities
- Perhaps neighborhood also plays an important role in:
  - Lung function disparities
  - URI disparities
  - Asthma prevalence disparities

Reification



"Some social scientists have a term — "reification" — for the process by which the effects of a political arrangement of power and resources start to seem like objective, inevitable facts about the world.

In medicine, examples of reification are so abundant that sociologists have a special term for it: "medicalization," or the process by which something gets framed as primarily a medical problem.

Medicalization shifts the terms in which we try to figure out what caused a problem, and what can be done to fix it.

Often, it puts the focus on the individual as a biological body, at the expense of factoring in systemic and infrastructural conditions."

Dr. Danielle Carr, https://www.nytimes.com/2022/09/20/opinion/us-mental-health-politics.html

It Takes a Village

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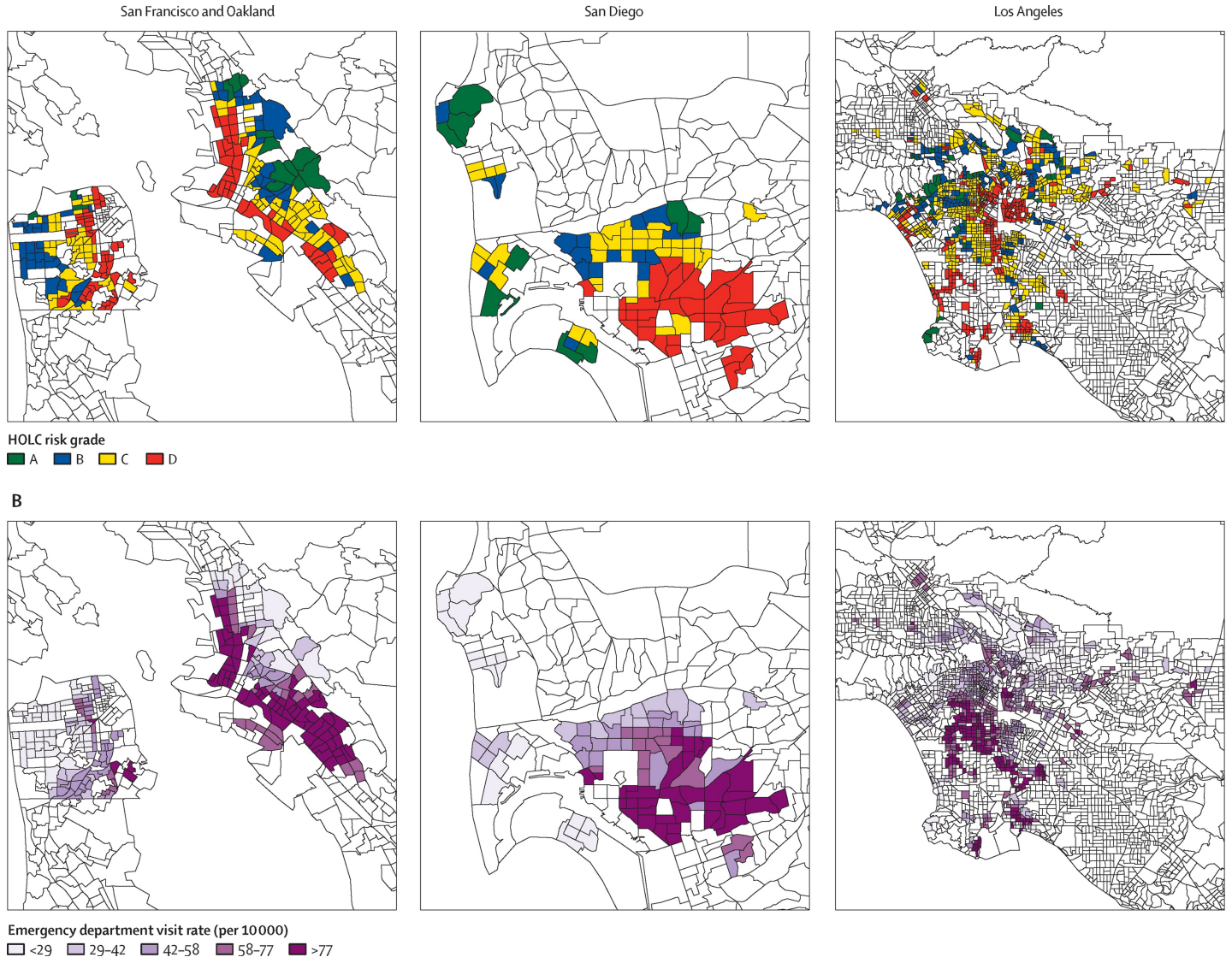
  - Bob Wise
  - Craig Pollack
  - Wanda Phipatanakul, Matt Perzanowski
  - Cory Zigler, Catherine Cubbin, Liz Mueller, Paul Rathouz, Roger Peng, Kerry Kinney
  - RA Zárate, Dan Katz, Emily Croce, Darlene Bhavnani, Sarah Chambliss
- **Research team**
  - Marissa Alviar, Lizzy Keiger, Luis Alamo-Rivera, Divia Kallattil, Christian Vallejo, Ian Chiu, Emily Hall, Sabrina Rosario
  - Susan Balcer-Whaley, Michelle Newman
- **Sponsors**: NIAID, NIEHS, NHLBI

Podcast on Academic Life:
The Effort Report
Co-host: Roger D. Peng

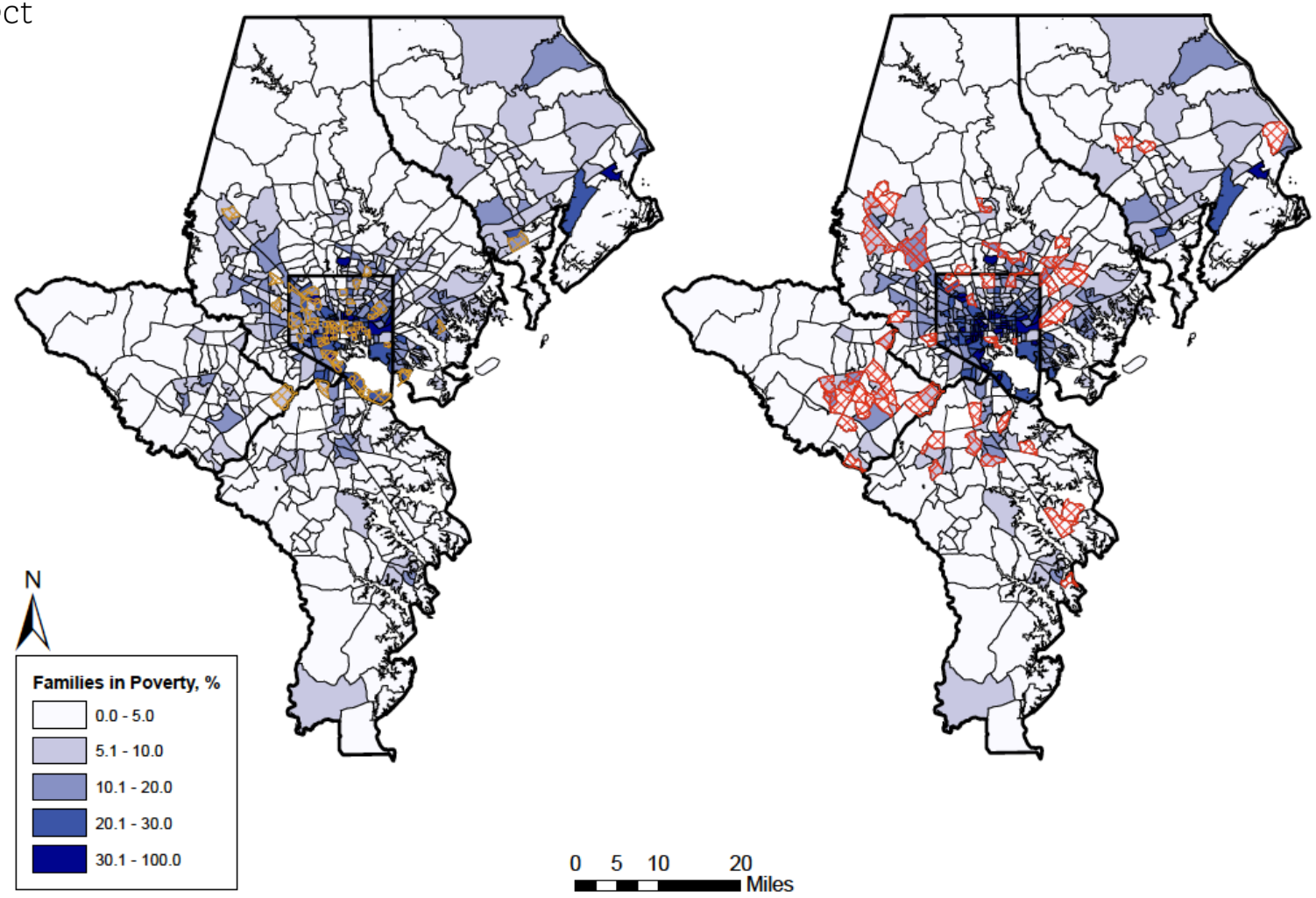
Redlining and Asthma ED Visit Rates



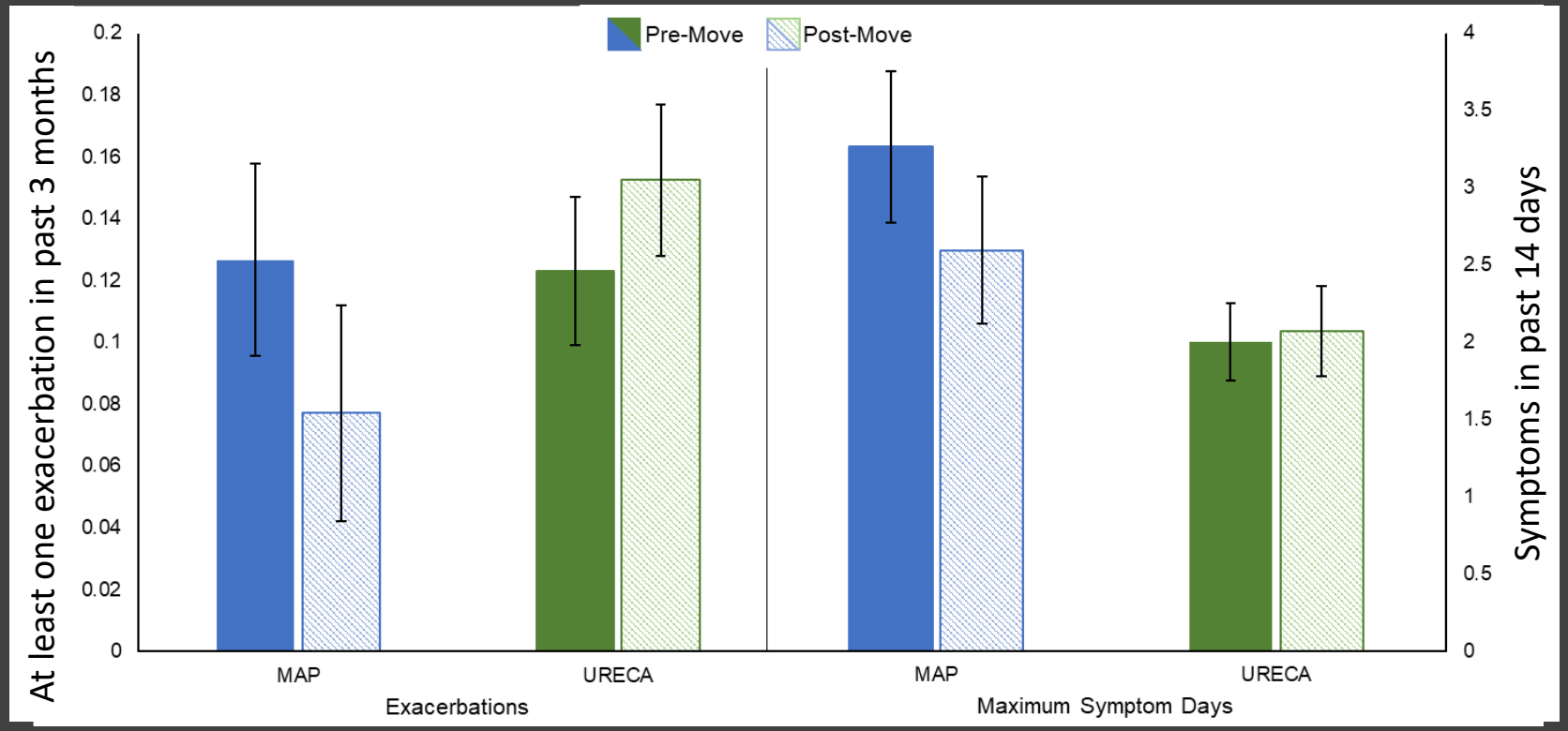
Nardone et al. The Lancet Planetary Health. Volume 4 Issue 1 Pages e24-e31 (January 2020)

Mobility Asthma Project

Census tracts of MAP participants before and after moving

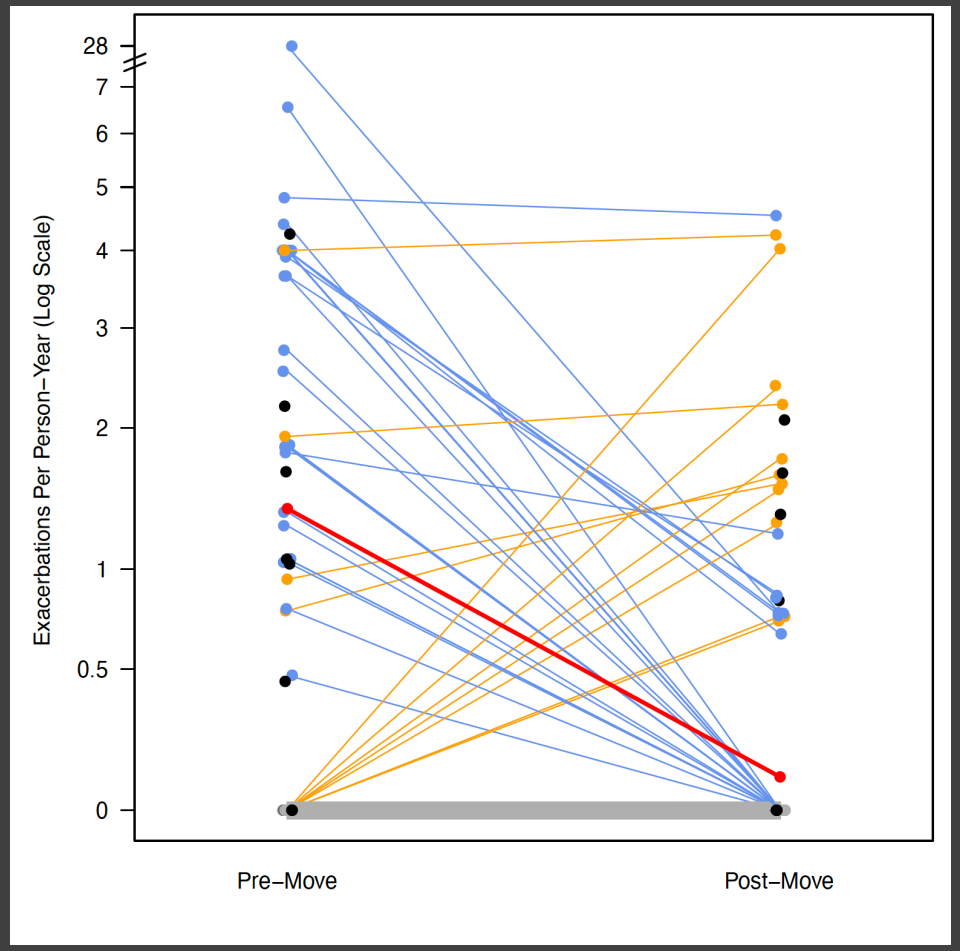


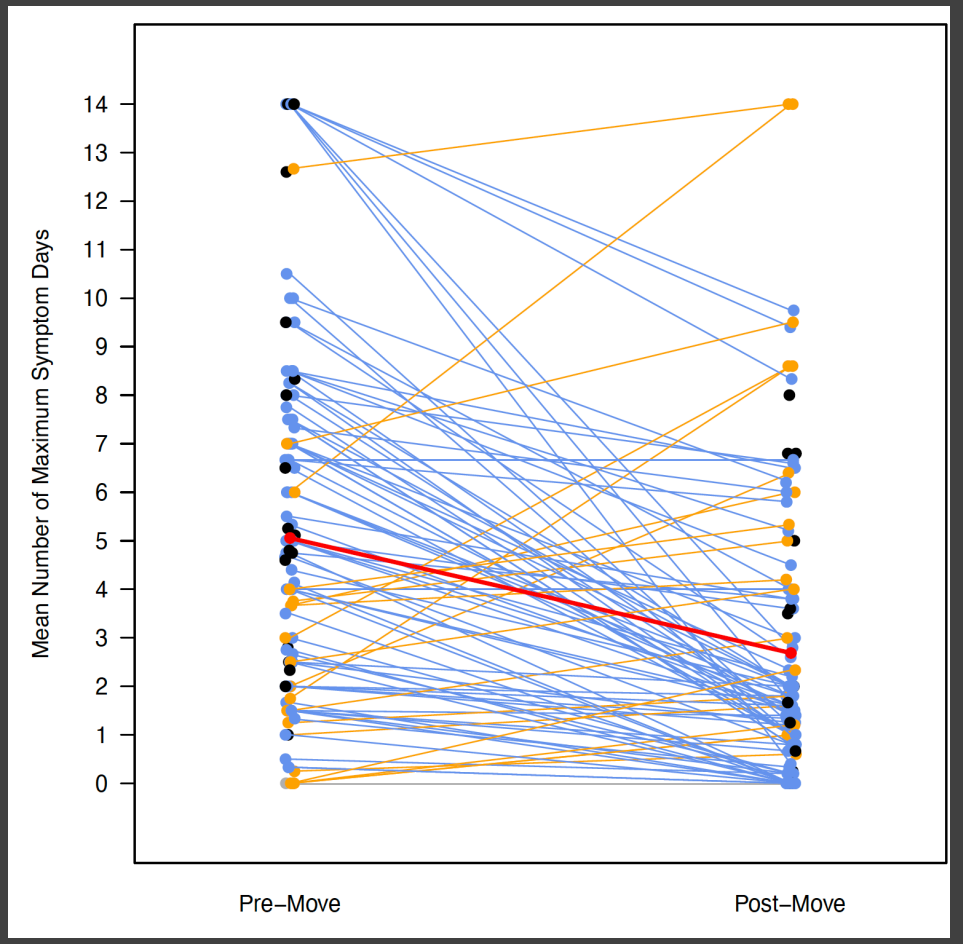
Maximum symptom days lower in MAP but not comparison group



Notes: Mobility Asthma Project (MAP); Urban Environment and Childhood Asthma (URECA). Predicted probabilities adjusted for time (months) and baseline values of child age, sex, Black race, neighborhood poverty rate, any sensitization, inhaled steroid use in previous 3 months, exacerbations in previous 3 months, and number of symptoms days and nights in past two weeks. The study×move interaction was statistically significant in the exacerbation model (p=0.009) and the maximum symptom days model (p=0.033).

Change in asthma morbidity with moving





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

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

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

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