

Solving for the Indoor Environmental Determinants of Health (IEDOH) in Asthma:

**Weatherization's Effects on Pediatric Asthma:
Evidence From a Natural Experiment**

Hosted by

U.S. Environmental Protection Agency (EPA)

Thursday, March 7, 2024

2:00–3:30 p.m. EST

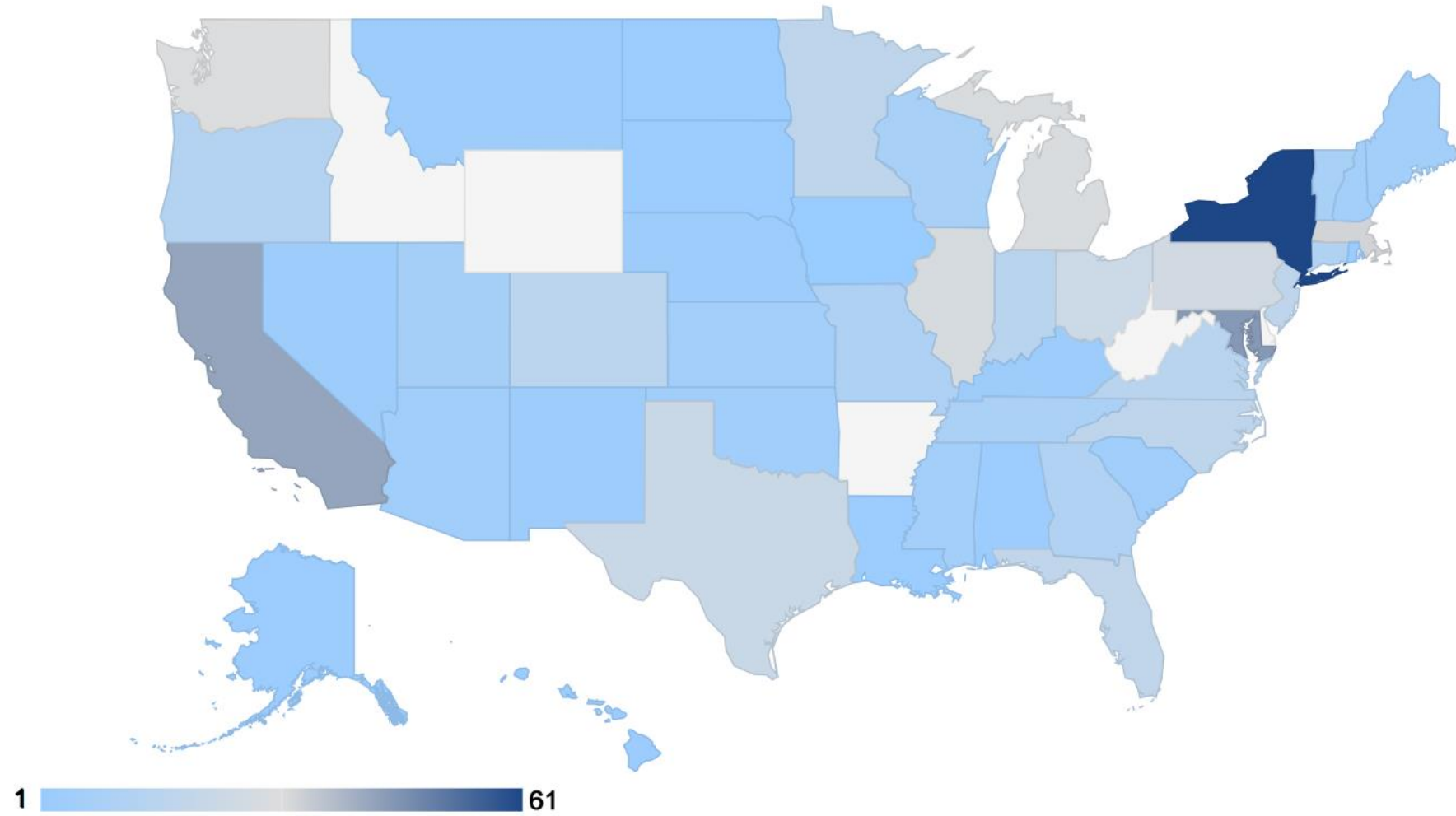


Weatherization's Effects on Pediatric Asthma: Evidence From a Natural Experiment

Today, we hope you will learn about—

- Evidence that weatherization partnerships present substantial opportunity for community asthma benefit.
- A continuum of environmental home interventions for asthma that exists—a mix of services and providers can support asthma prevention and treatment.
- How communities can layer in-home environmental actions for impact; for example, community health worker visits for children with poor asthma outcomes plus weatherization across at-risk housing for population prevention.

Who Is Here Today?

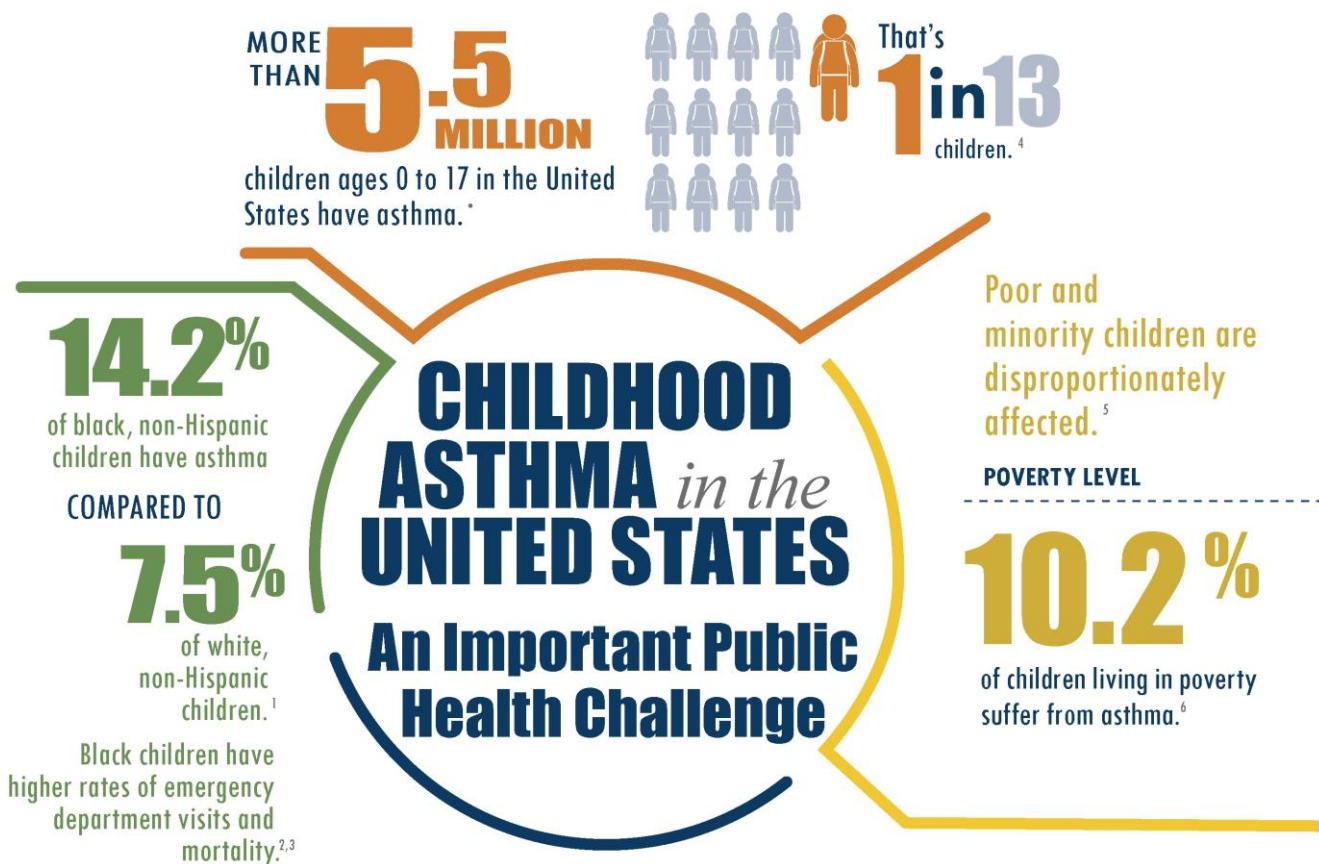


Polling Question 1

How familiar are you with weatherization as partners for indoor environmental interventions for asthma?

1. Very familiar. I participate in weatherization and asthma efforts.
2. Somewhat familiar. I know weatherization can be a partner but have no experience.
3. A little. I can imagine weatherization benefitting asthma but do not know how to partner.
4. Not familiar. What do you mean by “weatherization”?

Solving for IEDOH in Asthma



Asthma disparities bring into focus the critical role of **in-home environmental interventions** in pediatric asthma care.

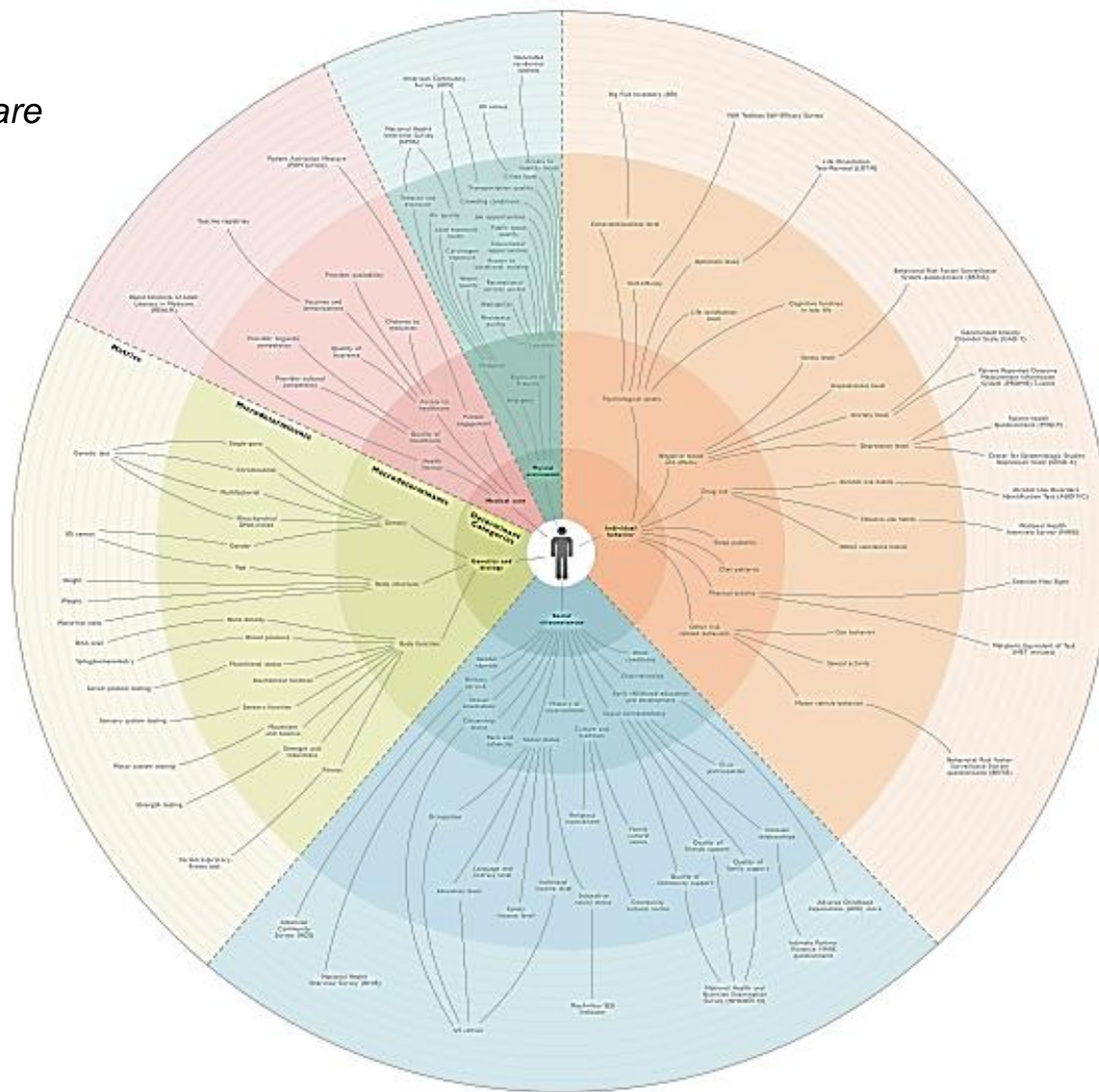
EPA's Indoor Environments Division (IED) spreads **solutions for the IEDOH**, the indoor environmental determinants of health.

Physical Environment

Medical Care

Individual Behavior

Genetics & Biology

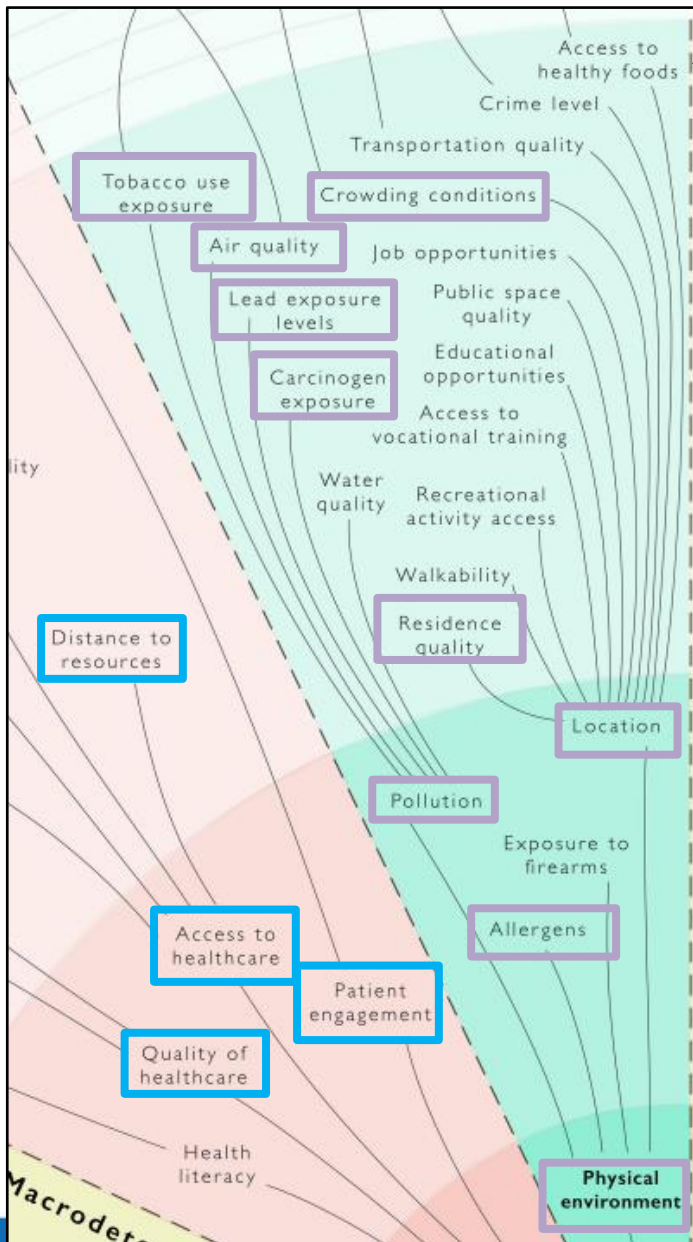


The **social determinants of health (SDOH)** are conditions in environments where people are born, live, work, play, and age that affect health, functioning, and quality-of-life outcomes and risks.

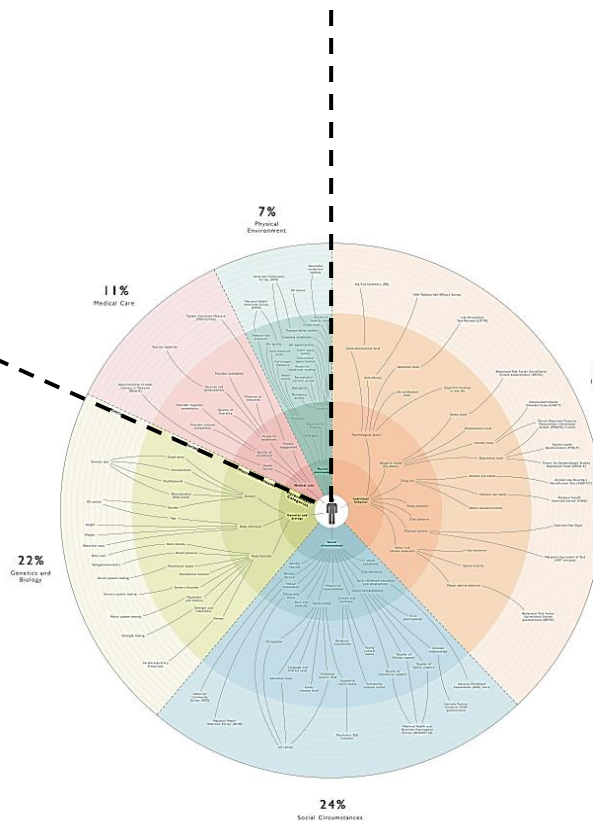
GoInvo infographic:
www.goinvo.com/vision/determinants-of-health/?utm_source=determinant

Social Circumstances

Solving for IEDOH in Asthma



IEDOH are a subset of SDOH clustered in the physical environment that **covary with housing quality and access to quality medical care.**



IEDOH are **modifiable environmental factors indoors**—such as household air pollution, thermal comfort, presence of pests, mold and moisture, chemicals, and irritants—that **influence risk and experience of disease.**



Weatherization's Effects on Pediatric Asthma: Evidence From a Natural Experiment

- Addressing IEDOH in asthma often requires partners who can get indoors.
- Some IEDOH are structural—such as house leakiness, temperature variability, or cracks and holes in the foundation or roof.
- Weatherization is a structural environmental intervention, including air sealing, duct sealing, insulation, and window replacement—different environmental interventions than most asthma home-visiting programs deliver.
- Weatherization-eligible homes are likely to covary with disproportionate IEDOH-burdened homes, a catchment with disproportionate asthma risk.

Solving for IEDOH in Asthma:

Weatherization's Effects on Pediatric Asthma: Evidence From a Natural Experiment



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Solving for the Indoor Environmental Determinants of Health (IEDOH) in Asthma:

Weatherization's Effects on Pediatric Asthma: Evidence From a Natural Experiment

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University of Missouri–Kansas City

Headline Summary: Quantifying Health Benefits From Weatherization

- We find a **39% reduction in acute asthma exacerbation encounters** following energy efficiency enhancements.
 - Results are for the pediatric population in Kansas City, Missouri
 - Finding consistent across model specifications
 - Incorporates patient-level confounders and accounts for some variation among houses
- **Weatherization produces tangible health benefits.**
 - Supports upstream interventions to address chronic asthma
- We take advantage of a **natural experiment** involving a federally funded energy efficiency program and our novel housing and health data repository.
 - **Address level and health encounter/patient-level analysis**
- Opportunity to **extend this analysis** in meaningful ways.
 - Unobserved heterogeneity among housing complicates our interpretation
 - *Many* programs are waiting to be analyzed
- We should include health effects in the benefit/cost calculations of weatherization activity.



Metropolitan
ENERGY CENTER



**The Impact of a Weatherization
Program on the Health Outcomes for
Children with Asthma**

*A Preliminary Study Commissioned by
the City of Kansas City, Missouri, and
Metropolitan Energy Center*

*Neal Wilson PhD, UMKC CEI; Claude Aloumon, UMKC CEI;
Linwood Tauheed PhD, UMKC CEI; Kevin Kennedy, MPH,
Children's Mercy Kansas City*

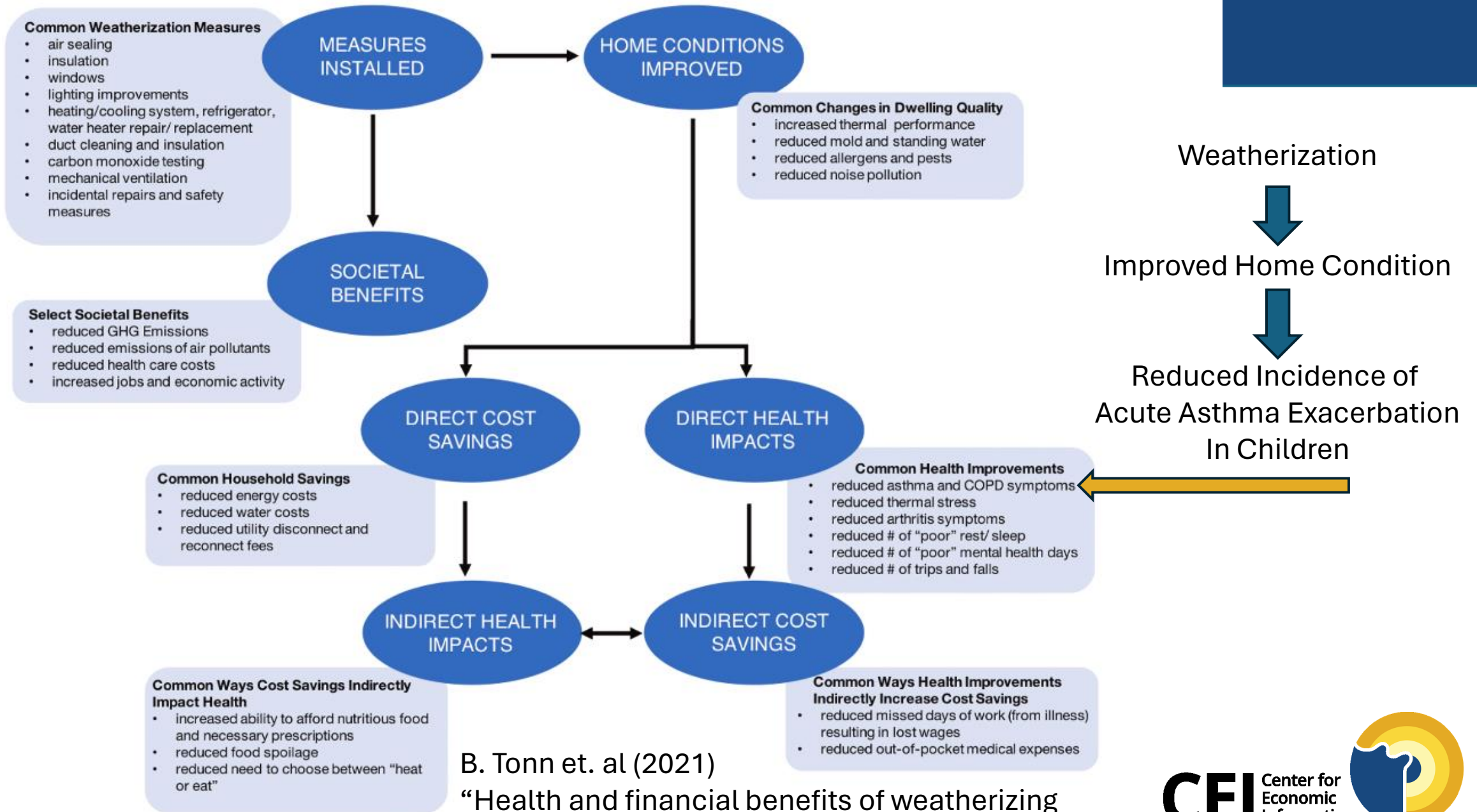
June 2023

- Results reported today are an update of our report for MEC published online.
 - Specified age differently (0–16 v. 2–18)
 - More complete medical payment information
 - Updated Model Specification (negative binomial)
- Slightly larger impact from weatherization
39% (not 34%) reduction

Earlier Findings on Health Effects of Energy Efficiency Improvements

Review from **Occupant Health Benefits of Residential Energy Efficiency (2016)**

- 12% reduction in asthma-related emergency department (ED) use
- *A predicted six-fold reduction in the likelihood of visiting an ED after weatherization due to asthma symptoms, based on regression modeling*
- Greater than \$400 decline in annual Medicaid costs and fewer Medicaid claims (for homes receiving energy efficiency improvements (EE), EE plus health repairs, or healthy homes repairs)
- A trend toward a 20% reduction in use of asthma “rescue” medicines (Tonn et al. 2014; Rose et al. 2015; Wilson et al. 2014)
- A **large New Zealand study with a robust control group** (over 1,000 people and 3,000 homes) targeting low-income individuals with a history of respiratory risks demonstrated over a 50% reduction in the odds of being admitted to the hospital due to respiratory issues when compared to similar individuals living in homes that did not receive the EE (**Howden-Chapman et al. 2007**)
- Improvements in respiratory health are strongest among vulnerable groups (Rose et al. 2015; Tonn et al. 2014; Wilson et al. 2014; Howden-Chapman et al. 2007; Breysse et al. 2014)



B. Tonn et. al (2021)
 "Health and financial benefits of weatherizing low-income homes in the southeastern United States"

Hypothesized Mechanisms Improving Health

1. Weatherization may create a more effective separation between exterior asthma triggers and interior spaces, effectively isolating the child from their asthma triggers.
2. Weatherization may increase thermal control. stabilize the interior environment, reducing the use of the furnace and air conditioner. This lowers the hot/cold swing, which could trigger an attack inside the house. Additionally, a reduction in the use of forced air HVAC could reduce the amount of dust and molds distributed by internal air currents.
3. Weatherization could reduce moisture intrusion into the home, thus lowering the presence of mold.
4. Weatherization could reduce the costs of heating and cooling the home, thus allowing the family to shift spending toward asthma prevention (medication, other preventative treatments, etc.)

The actual mechanism is unclear. Thus, we can think of this investigation as a hypothesis-generating exercise.

Introducing the Energy Efficiency Enhancement Programs

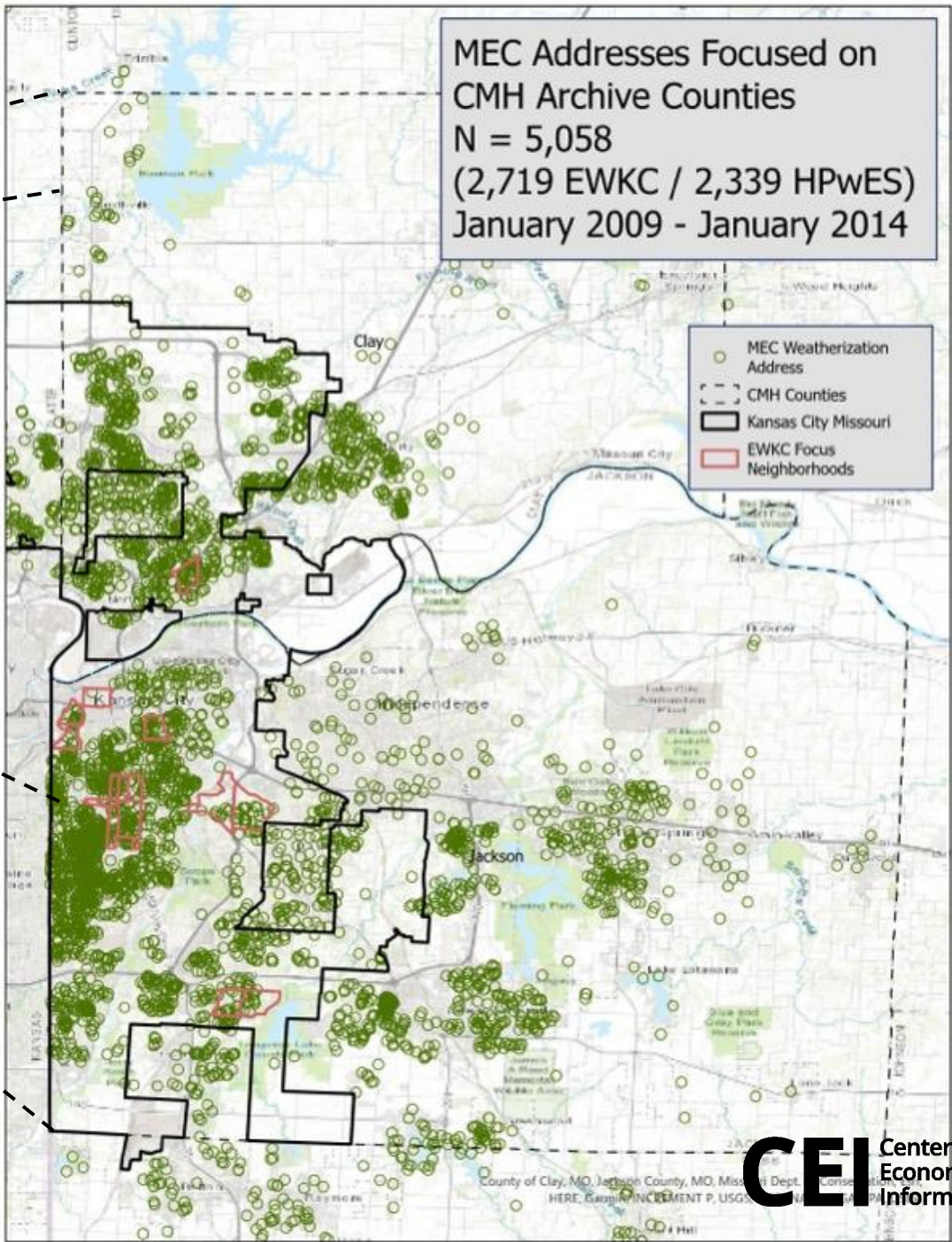
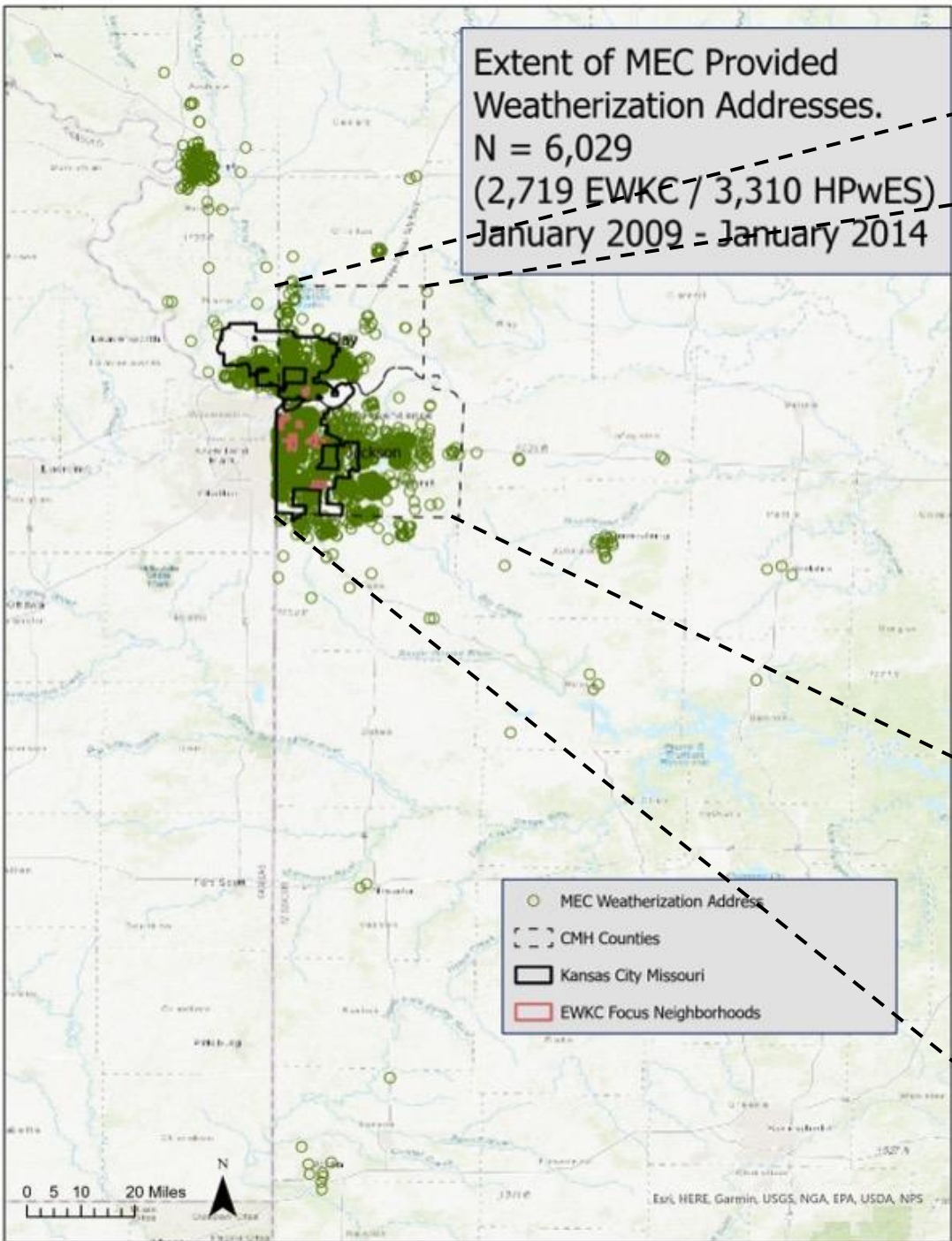
- The 2009 American Recovery and Reinvestment Act (ARRA, or Recovery Act) contained funding for the U.S. Department of Energy's (DOE) Better Buildings Neighborhood Program.
- The 41 ARRA grant participants were selected on a competitive basis from communities across the country.
- The ARRA had several component aims:
 - Improve access to information
 - Establish financing structures
 - Development of a skilled workforce
 - Generate “green entrepreneurs”
- The weatherization activities supported by the ARRA were not undertaken to address asthma triggers or treat pediatric asthma.
- Kansas City Program—**Energy Works Kansas City (EWKC)**—administered by the Metropolitan Energy Center (MEC).
 - MEC administers a second program: Home Performance with Energy Star (HPwES)

Introducing the Energy Efficiency Enhancement Programs (2)

- MEC provided information about 6,029 weatherized homes.
 - Address, date, costs, work performed, contractors, energy company identifiers, percent change in air flow, etc.
 - January 2009 – January 2014
- EWKC was limited to Kansas City, Missouri, with extra outreach in six “target neighborhoods.”
- Improvements were funded by utility company rebates of up to \$2,000 total, and a subsidy of up to \$500 for a home energy audit to guide weatherization activity. Participants were also eligible for zero-interest loans up to \$15,000 (each figure is for a single-family home).
- HPwES program observation:
 - Existing DoE-funded rebate program, limited to Missouri
 - Andrew County in the north to Newton County in the south (~200 miles), Platte County in the west to Pettis County in the east (~90 miles)
- Both programs were “open enrollment” for residential homeowners with a clean title, current on their taxes, current on their mortgage, and no liens to their property.

Extent of MEC Provided Weatherization Addresses.
N = 6,029
(2,719 EWKC / 3,310 HPwES)
January 2009 - January 2014

MEC Addresses Focused on CMH Archive Counties
N = 5,058
(2,719 EWKC / 2,339 HPwES)
January 2009 - January 2014



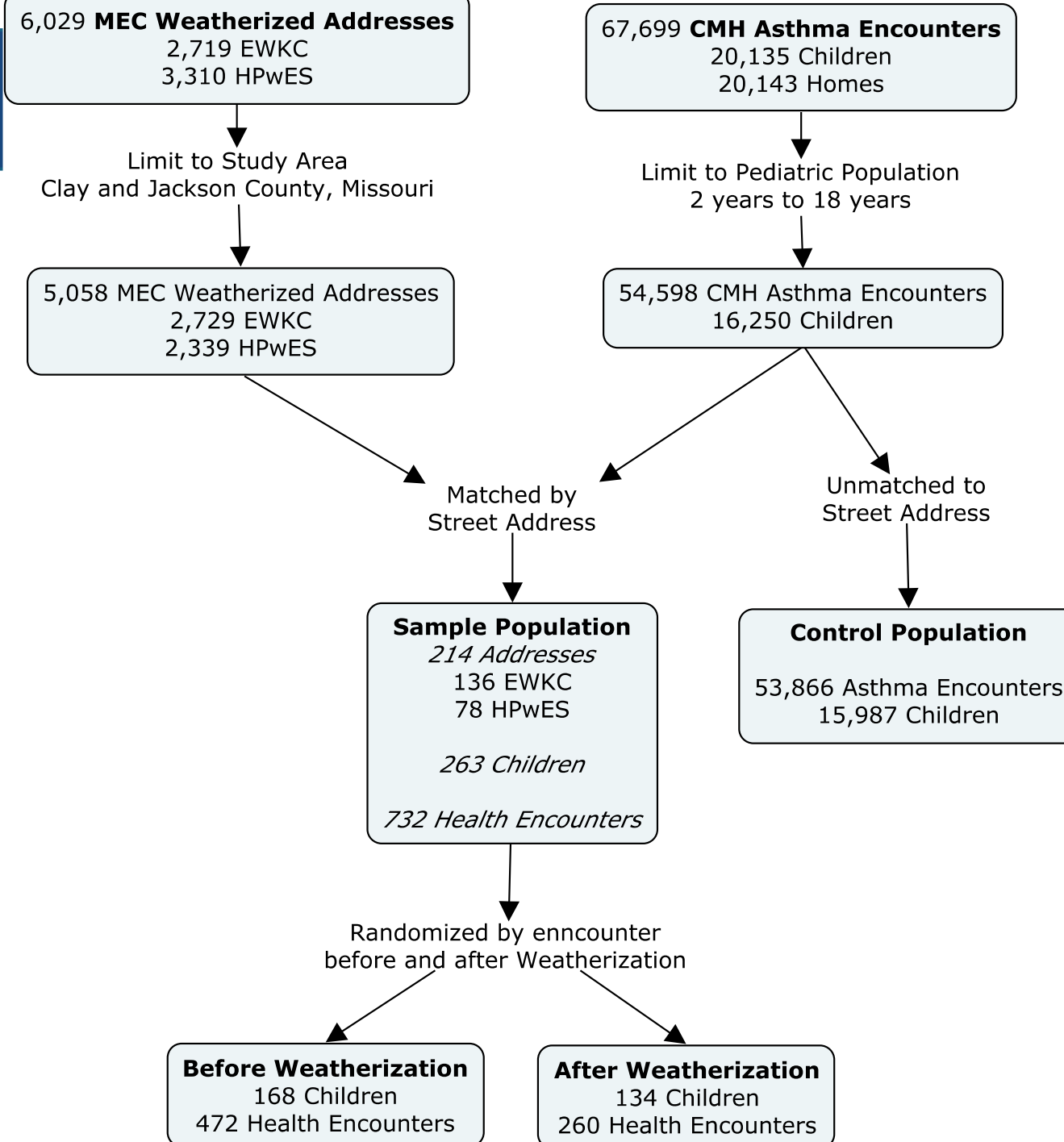
Housing and Health Repository

- Governed by Children's Mercy Kansas City (CMKC) institutional review board; structures and rules for accessing and using the repository.
- Established in 2013 as part of a HUD Lead Tech Study.
From 2000, authorized to extend through 2023
- Encounter level data by diagnosis code from CMKC:
International Classification of Diseases, 9th revision (ICD-9) for the years 2000–2015,
ICD-9 and ICD-10 for the years 2015–2017 (inclusive)
ICD-10 for 2018–2023, as well as related CPT and E codes where relevant.
Plus, MRN, address, ZIP, city, state, account number, admit date, discharge date, sequence ID
- Demographic record:
MRN, birthday, sex, race, ethnic group
- Visit characteristic:
Financial class, patient class, location name, discharge, DRG code, DRG description
- Children's Mercy health outcomes:
Pediatric asthma, pediatric injuries (poisonings, fractures, sprains, punctures, and contusions)
Control variables: Well-child visits, car accidents, and gunshot wounds.

Housing and Health Repository (2)

- From Kansas City, Missouri Health Department:
 - All observations of Pediatric BLL 2000–2019 (8,000–14,000 observations per year)
 - Unique ID (not MRN), age and sex, but no race/ethnicity and no medical coverage
- Observations of Housing Conditions and Housing Intervention
 - CEI’s Neighborhood Housing Conditions Survey
 - (370,000 parcels, 25 observations/parcel, 5-level ratings of 15 areas grouped into 5 housing conditions, 5 grounds conditions, 5 infrastructure)
 - 2000–2023
 - Kansas City, Missouri Health Department Lead-Safe Housing Interventions.
 - ~2,000 observations of home interventions
 - 1997–2021
 - Children’s Mercy Healthy Home inspection,
 - ~800 home inspections
 - 2004–~2020

Natural Experiment and Process



- Which asthmatic children received the treatment (and when they received it) was, in effect, random.
 - People did not enroll for asthma-related services
 - ‘Double randomization’
- Housing and health repository contains 93% of the asthma encounters at the MEC addresses (Children’s Mercy Market Research).
- Natural Experiment allows us to make causal claims about weatherization’s effect on pediatric asthma.

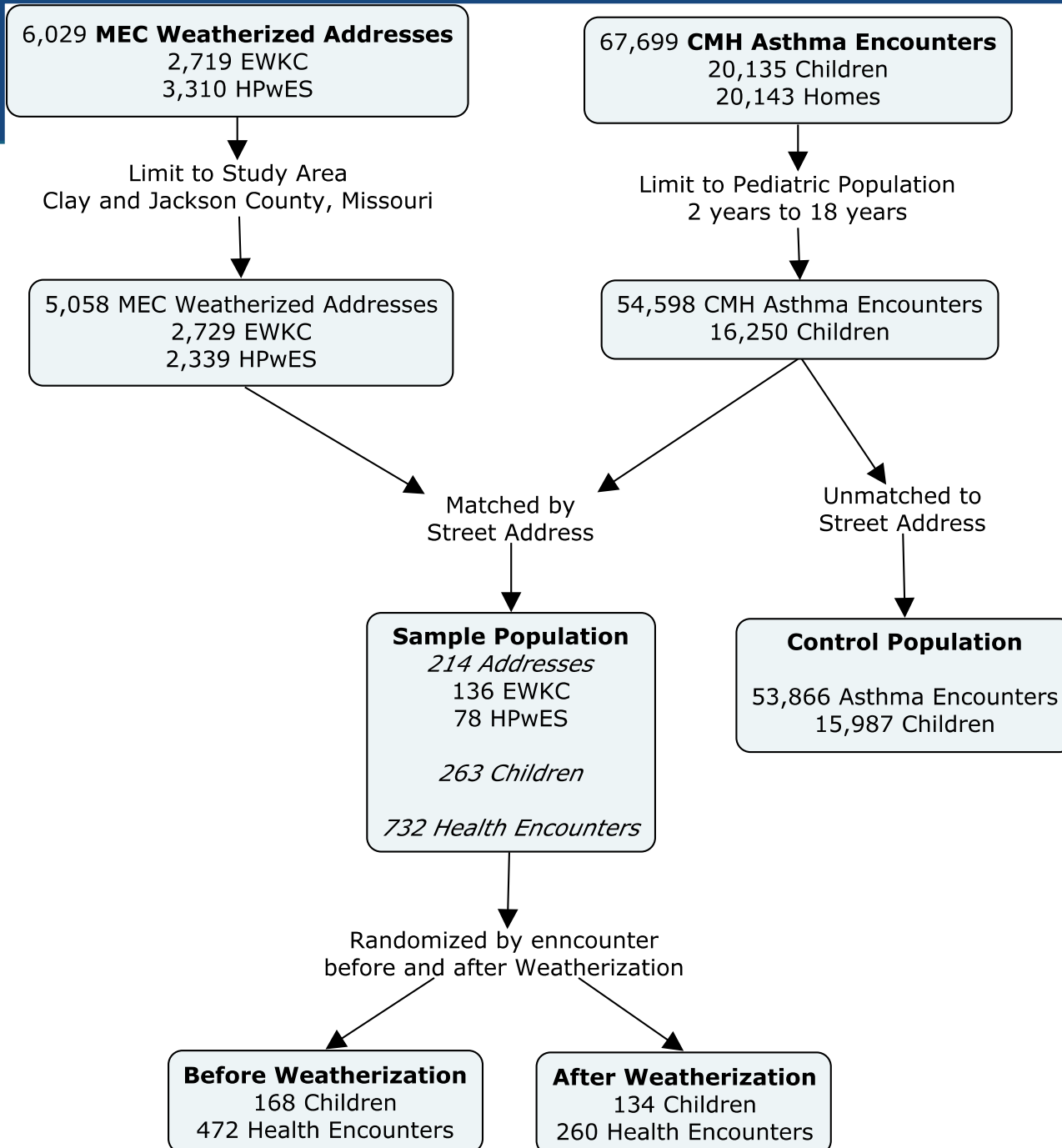
Three Groups\Four Sample Populations

Groups:

1. Home address (MEC or Asthma)
2. Children with asthma
3. Pediatric asthma health encounters

Study Sample Populations:

1. Asthmatic children at MEC address after weatherization.
2. Asthmatic children at MEC address before weatherization.
3. Asthmatic children who do not live at an MEC address.
4. Asthmatic children at MEC address with observations before and after the weatherization event.



Patient Information

Pediatric Asthma (2 - 18 Years) Encounters by Dataset

	All Pediatric Asthma Encounters (N = 54,598)	Pediatric Asthma Encounters at MEC Addresses (N = 732)
Sex		
Female	22,515 (41.2%)	330 (45.1%)
Male	32,083 (58.8%)	402 (54.9%)
Age		
2- 6 years	24,217 (44.4%)	359 (49.0%)
7 - 10 years	14,052 (25.7%)	188 (25.7%)
11 - 14 years	10,463 (19.2%)	128 (17.5%)
15 - 18 years	5,866 (10.7%)	57 (7.8%)
Race and Ethnicity		
American Indian or Alaska Native	88 (0.2%)	NA
Asian	496 (0.9%)	8 (1.1%)
Black or African American	28,781 (52.7%)	402 (54.9%)
Latinx	6,267 (11.5%)	39 (5.3%)
Multiracial	1,737 (3.2%)	12 (1.6%)
Native Hawaiian or Pacific Islander	105 (0.2%)	NA
White	13,412 (24.6%)	217 (29.6%)
Unknown	3712 (6.8%)	54 (7.4%)
Medical Coverage		
Medicaid	37,201 (68.1%)	371 (50.7%)
Commercial	13,748 (25.2%)	303 (41.4%)
Self Pay	3,649 (6.7%)	58 (7.9%)

- Race and ethnicity are consolidated from separate columns.
- Medical coverage consolidated from comprehensive listing of insurance providers.

Housing Information (1)

Weatherization Details by Dataset

	All MEC Addresses					MEC Addresses w/ Asthmatic Children				
	Observations	Min	Median	Mean	Max	Observations	Min	Median	Mean	Max
Amount Spent Per Home	4,983	\$250.00	\$1,600.00	\$2,343.13	\$60,777.00	214	\$250.00	\$1,497.50	\$2,202.22	\$20,994.00
% Airflow Improvement	4,825	0.00%	22.23%	22.16%	93.28%	181	0.00%	24.90%	24.05%	59.03%

Housing Characteristics by Dataset

	All Homes w/ Asthmatic Children (n = 20,143)	MEC Homes w/ Asthmatic Children (n = 214)
Built before 1980*		
Before 1980	14,982 (74.4%)	145 (67.8%)
After 1980	4,232 (21.0%)	59 (27.6%)
Within City Limits		
Outside of Kansas City	7,264 (36.1%)	43 (20.1%)
Kansas City	12,879 (63.9%)	171 (79.9%)

*Does not sum to sample size due to missing values

Weatherization Intervention (Housing 2)

	All MEC Homes (N = 6,029)	MEC Homes w/ Asthmatic Children (N = 214)
AIR SEALING; INSULATION	2270	86
AIR SEALING (only)	1315	66
INSULATION (only)	1179	29
AIR SEALING; INSULATION; WINDOW(s)	184	12
WINDOW(s) (only)	477	7
AIR SEALING; WINDOW(s)	89	4
AIR SEALING; INSULATION; DUCT SEALING	58	2
DUCT SEALING (only)	91	2
INSULATION; WINDOW(s)	56	2
AIR SEALING; DUCT SEALING	43	1
AIR SEALING; INSULATION; DOOR(s)	19	1
AIR SEALING; INSULATION; WINDOW(s); DOOR(s)	18	1
AIR SEALING; WINDOW(s); DOOR(s)	12	1
AIR SEALING; DOOR(s)	19	0
DOOR(s) (only)	45	0
DOOR(s); AIR SEALING	1	0
HEAT PUMP (only)	1	0
INSULATION; DOOR(s)	5	0
INSULATION; DUCT SEALING	5	0
INSULATION; WINDOW(s); DOOR(s)	11	0
WINDOW(s); AIR SEALING	3	0
WINDOW(s); AIR SEALING; INSULATION	1	0
WINDOW(s); DOOR(s)	103	0
NA	24	0

Consolidated data.

- Door(s), window(s)
- Order of multi-intervention listing has been standardized.

Table 5: Distribution of Asthma Encounters by Dataset

	<u>All Asthma</u>		<u>Before Weatherization</u>		<u>After Weatherization</u>	
	Observations	Percentage	Observations	Percentage	Observations	Percentage
Total Encounters	54,598		472		260	
Encounter Level 1	24,848	46%	184	39%	135	52%
Encounter Level 2	29,750	54%	288	61%	125	48%

Table 16: Severity Level because of Diagnosis Code

Diagnosis Code	Diagnosis Name
Severity Level 1	
493	EXTRINSIC ASTHMA, NOS
493.1	INTRINSIC ASTHMA, NOS
493.2	CHRONIC OBSTRUCTIVE ASTHMA, NOS
493.82	COUGH VARIANT ASTHMA
493.9	ASTHMA, UNSPECIFIED
Severity Level 2	
493.02	EXTRINSIC ASTHMA, W (ACUTE) EXACERBATION
493.12	INTRINSIC ASTHMA, W (ACUTE) EXACERBATION
493.22	CHRONIC OBSTRUCTIVE ASTHMA, W (ACUTE) EXACERBATION
493.81	EXERCISE INDUCED BRONCHOSPASM
493.92	ASTHMA, UNSPECIFIED, W (ACUTE) EXACERBATION
493.01	EXT ASTHMA W STATUS ASTH
493.11	INT ASTHMA W STATUS ASTH
493.21	ASTHMA, CHRONIC OBSTRUCTIVE W ASTHMATICUS
493.91	ASTHMA W STATUS ASTHMAT

The higher value from Diagnosis Code or Patient Class determines Encounter severity level: controlled or acute exacerbation.

Table 17: Asthma Severity because of Patient Class

Severity Level 1	
	CLIENT REFERRED
	OUTPATIENT
	DIAGNOSTIC/TREATMENT REFERRED
Severity Level 2	
	EMERGENCY
	SAME DAY CLINIC
	INPATIENT CHAMPUS
	INPATIENTS
	INPATIENTS WITH KS MEDICAID
	OBSERVATION CHAMPUS
	OBSERVATION KS MEDICAID
	OBSERVATION PATIENTS

Lots of Regressions

We use a negative binomial regression model to estimate the change in the rate of acute asthma exacerbation following weatherization.

Incident rate ratio (IRR): A value under 1.00 indicates a decrease in the rate of acute asthma exacerbation.

We run lots of regressions as a diagnostic check on the sample selection and the sensitivity of the weatherization variable.

Incidence Rate:

$$\frac{\text{Count of acute asthma exacerbation}}{\text{Time at risk}}$$

Incidence Rate Ratio:

$$\frac{\text{Incident Rate After Weatherization}}{\text{Incident Rate Un-Weatherized and Control}}$$

Regressions 1: Comparison of different samples

	<u>MEC and Controls</u>		<u>Only MEC</u>		<u>No Weatherization</u>		<u>Only observations before and after weatherization</u>	
	IRR*	95% CI*	IRR	95% CI	IRR	95% CI	IRR	95% CI
Weatherization	0.6	0.47 - 0.76	0.48	0.36 - 0.64	-	-	0.28	0.15 - 0.50
Before Weatherization					1.26	1.04 - 1.52		
	MRN = 16,250		MRN = 263		MRN = 16,155		MRN = 39	

* IRR = Incidence Rate Ratio, CI = Confidence Interval

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	MRN = 16,250		MRN = 263		MRN = 16,155		MRN = 39	

*IRR = Incidence Rate Ratio, CI = Confidence Interval

Regressions (2)

	Model 1		Model 2	
	IRR*	95% CI*	IRR	95% CI
Weatherization	0.6	0.47 - 0.76	0.6	0.47 - 0.76
Kansas City			1.07	1.03, 1.11

* IRR = Incidence Rate Ratio, CI = Confidence Interval
MRN = 16,250

	Model 3		Model 4	
	IRR	95% CI	IRR	95% CI
Weatherization	0.62	0.49 - 0.79	0.63	0.50 - 0.81
Kansas City	1.06	1.01 - 1.10	1.04	0.99 - 1.08
Post-1980 Block	0.92	0.88 - 0.97	0.96	0.92 - 1.01
Payment Type				
Medicaid			—	—
Commercial Insurance			0.88	0.84 - 0.92
Self Pay			1.19	1.10 - 1.27

	Model 5		Model 6	
	IRR	95% CI	IRR	95% CI
Weatherization	0.61	0.48 - 0.78	0.61	0.48 - 0.78
Kansas City	1.02	0.98 - 1.06	1.02	0.98 - 1.06
Post-1980 Block	0.98	0.93 - 1.02	0.97	0.93 - 1.02
Payment Type				
Medicaid			—	—
Commercial Insurance	0.9	0.86 - 0.94	0.9	0.86 - 0.94
Self Pay	1.2	1.12 - 1.29	1.2	1.12 - 1.29
Race and Ethnicity				
American Indian or Alaska Native			—	—
Asian	1.05	0.66 - 1.69	1.03	0.64 - 1.65
Black or African American	1.16	0.75 - 1.78	1.15	0.74 - 1.76
Latinx	1.18	0.76 - 1.81	1.16	0.75 - 1.79
Multiracial	1.33	0.86 - 2.07	1.32	0.85 - 2.05
Native Hawaiian or Pacific Islander	1.65	0.92 - 2.99	1.62	0.90 - 2.94
Unknown	0.42	0.27 - 0.65	0.42	0.27 - 0.64
White	1.11	0.72 - 1.71	1.1	0.71 - 1.68
Sex				
Female			—	—
Male			1.07	1.03 - 1.11

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	IRR*	95% CI*	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI
Weatherization	0.6	0.47 - 0.76	0.6	0.47 - 0.76	0.62	0.49 - 0.79	0.63	0.50 - 0.81	0.61	0.48 - 0.78	0.61	0.48 - 0.78

The estimate of the impact of weatherization is remarkably stable as we add confounding variables.

Regressions 2.3

	Model 1		Model 6	
	IRR*	95% CI*	IRR	95% CI
Weatherization	0.6	0.47 - 0.76	0.61	0.48 - 0.78
Kansas City			1.02	0.98 - 1.06
Post-1980 Block			0.97	0.93 - 1.02
Payment Type				
Medicaid			—	—
Commercial Insurance			0.9	0.86 - 0.94
Self Pay			1.2	1.12 - 1.29
Race and Ethnicity				
American Indian or Alaska Native			—	—
Asian			1.03	0.64 - 1.65
Black or African American			1.15	0.74 - 1.76
Latinx			1.16	0.75 - 1.79
Multiracial			1.32	0.85 - 2.05
Native Hawaiian or Pacific Islander			1.62	0.90 - 2.94
Unknown			0.42	0.27 - 0.64
White			1.1	0.71 - 1.68
Sex				
Female			—	—
Male			1.07	1.03 - 1.11

* IRR = Incidence Rate Ratio, CI = Confidence Interval

MRN = 16,250

There Are Issues With Every Analysis

- We do not have a complete record of asthma events, only a record of asthma events that involve the children's hospital.
- Use of the ED for primary care is coded as an exacerbation encounter.
- There are other plausible ways to specify time at risk, each of which could bias the result in a different direction.
- There is unaccounted for heterogeneity among patients.
- There is unaccounted for heterogeneity among houses
 - Differed maintenance? Furnace combustion type? Type of stove? Pets or smokers in the home?
- Variation among the interventions.
 - % change in air flow
 - Are all insulation interventions the same?

Future Extensions of This Research

Deeper dive into the program.

- Focus on the Energy Performance Analysis (pre/post analysis of air leakage)
- Differentiate between impacts of different weatherization improvements
- Follow children at these addresses to the present day
- Incorporate Children's Mercy health costs to calculate savings procedures, medicines (and the time value to the parents)
- Isolate the effect on those children who were born into a weatherized home
- Look more closely at the variation among homes
- Type of furnace, what fuel type of stove, and other characteristics of the home

Look at other historic weatherization activities.

- The 40 other ARRA programs; Children's Health Association, a nationwide consortium of children's hospitals, maintains a similar repository

Extend the analysis to the weatherization of multifamily homes.

The Inflation Reduction Act will bring additional weatherization activity.

- Establish health surveillance as part of these programs

Literature Review Citations

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Thank You!

Please, don't hesitate to get in touch with me with your thoughts and/or comments.

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	Model 1		Model 6	
	IRR*	95% CI*	IRR	95% CI
Improvement				
none	—	—	—	—
AIR SEALING	0.62	0.41 - 0.93	0.63	0.42 - 0.94
AIR SEALING; INSULATION	0.81	0.52 - 1.26	0.79	0.50 - 1.22
AIR SEALING; INSULATION, plus	0.87	0.30 - 2.28	0.81	0.28 - 2.05
INSULATION	0.39	0.24 - 0.64	0.4	0.24 - 0.66
Neither	0.51	0.21 - 1.19	0.62	0.26 - 1.40
Housing Characteristic				
Kansas City			1.02	0.98 - 1.06
Post-1980 Block			0.98	0.93 - 1.02
Payment Type				
Medicaid			—	—
Commercial Insurance			0.9	0.86 - 0.94
Self Pay			1.21	1.12 - 1.29
Race and Ethnicity				
American Indian or Alaska Native			—	—
Asian			1.03	0.64 - 1.65
Black or African American			1.15	0.74 - 1.76
Latinx			1.16	0.75 - 1.79
Multiracial			1.31	0.84 - 2.04
Native Hawaiian or Pacific Islander			1.62	0.90 - 2.94
Unknown			0.42	0.27 - 0.64
White			1.1	0.71 - 1.68
Sex				
Female			—	—
Male			1.07	1.03 - 1.11

Beginning to separate the impact by Improvement

These are weatherization activities subject to the needs of the house, not the needs of the child.

It is unlikely that insulating a home unnecessarily will have an effect on pediatric asthma.

However, it makes sense to investigate the condition of a child's home as part of a comprehensive asthma examination.

Alternative Model Specifications (Regressions 3)

Regressions: Only Encounters at MEC Addresses

	Model 1		Model 6	
	IRR*	95% CI*	IRR	95% CI
Weatherization	0.48	0.36, 0.64	0.53	0.39, 0.72
Kansas City			0.71	0.45, 1.12
Post-1980 Block			0.89	0.61, 1.31
Payment Type				
Medicaid			—	—
Commercial Insurance			0.91	0.67, 1.23
Self Pay			0.73	0.41, 1.26
Race and Ethnicity				
Asian			—	—
Black or African American			1.28	0.36, 5.16
Latinx			0.74	0.19, 3.30
Multiracial			1.39	0.26, 7.71
Unknown			0.55	0.14, 2.33
White			0.66	0.18, 2.71
Sex				
Female			—	—
Male			0.92	0.68, 1.23

* IRR = Incidence Rate Ratio, CI = Confidence Interval

MRN = 263

Regressions: Only Children w/ before and after-weatherization encounters

	Model 1		Model 6	
	IRR*	95% CI*	IRR	95% CI
Weatherization	0.28	0.15, 0.50	0.3	0.17, 0.54
Kansas City			0.4	0.10, 1.64
Post-1980 Block			0.92	0.46, 1.84
Payment Type				
Medicaid			—	—
Commercial Insurance			1.26	0.65, 2.47
Self Pay			0.78	0.27, 2.33
Race and Ethnicity				
American Indian or Alaska Native			—	—
Asian			1.43	0.23, 11.5
Black or African American			1.5	0.15, 19.3
Latinx			0.76	0.05, 11.8
Multiracial			0.54	0.06, 5.82
Native Hawaiian or Pacific Islander			0.35	0.05, 2.95
Unknown			—	—
White			—	—
Sex			0.79	0.41, 1.51
Female			—	—
Male			1.07	1.03, 1.11

* IRR = Incidence Rate Ratio, CI = Confidence Interval
MRN = 39

Regressions: Robustness Check, no after-weatherization encounters

	Model 1		Model 6	
	IRR*	95% CI*	IRR	95% CI
Pre-Weatherizat	1.26	1.04, 1.52	1.29	1.07, 1.55
Kansas City			1.02	0.97, 1.06
Post-1980 Block			0.98	0.93, 1.03
Payment Type				
Medicaid			—	—
Commercial Insurance			0.9	0.86, 0.94
Self Pay			1.21	1.12, 1.29
Race and Ethnicity				
American Indian or Alaska Native			—	—
Asian			1.04	0.64, 1.66
Black or African American			1.14	0.74, 1.75
Latinx			1.16	0.75, 1.79
Multiracial			1.31	0.84, 2.04
Native Hawaiian or Pacific Islander			1.62	0.90, 2.94
Unknown			0.42	0.27, 0.64
White			1.1	0.71, 1.69
Sex				
Female			—	—
Male			1.07	1.03, 1.11

* IRR = Incidence Rate Ratio, CI = Confidence Interval

Panel Discussion and Question-and-Answer Session



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Polling Question 2

How familiar are you with weatherization as partners for indoor environmental interventions for asthma?

1. Very familiar. I participate in weatherization and asthma efforts.
2. Somewhat familiar. I know weatherization can be a partner but have no experience.
3. A little. I can imagine weatherization benefitting asthma but do not know how to partner.
4. Not familiar. What do you mean by “weatherization”?

Where Can I Learn More?

Join the Asthma Community Network at www.asthmacommunitynetwork.org.

Three-part webinar series on Technical Solutions for Addressing the Indoor Environmental Determinants of Health!

Innovations in Financing Environmental Asthma Home Visits Within Medicaid.

Population Health Situational Awareness: Getting the Data You Need to Build Equity in Child Asthma Outcomes.

Reimagining Asthma Care, Climate Resilience and Equity in Contra Costa, California: Partnering Health Care With Weatherization to Address the Indoor Environmental Determinants of Health.

