

Demographic and Environmental Disparities in Asthma Prevalence

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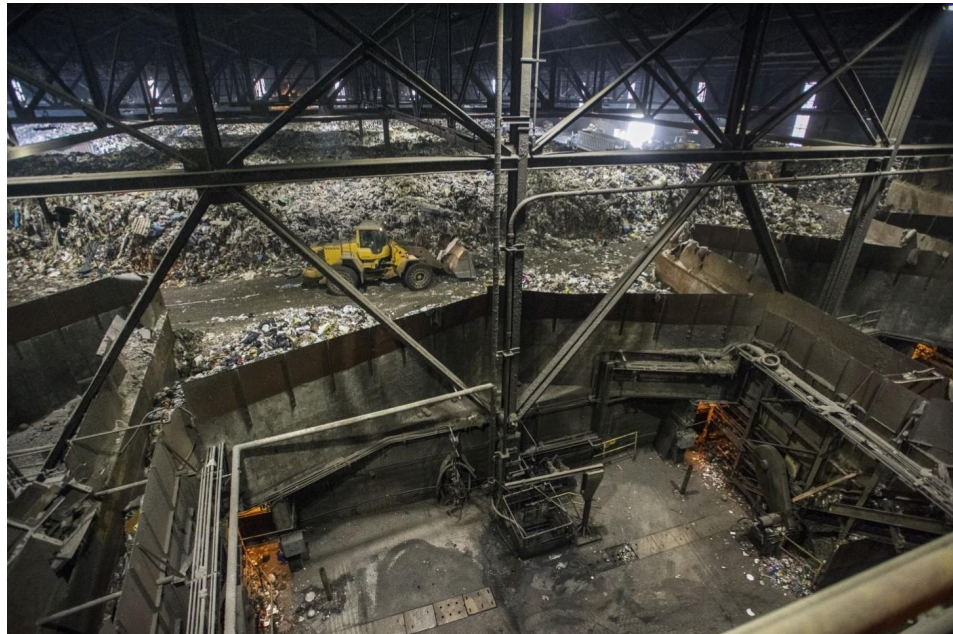
Asthma Disparities are a Problem in the US

- ◆ **≈ 26 million people in the US have asthma**
- ◆ **Black and female adults are more likely to have asthma**
- ◆ **Environmental factors can have an impact**
- ◆ **Often, asthma patients are recommended to:**
 - **Use mattress or pillow covers**
 - **Keep pets outside of their bedrooms**
 - **Maintain clean and allergen-free spaces**
- ◆ **Exacerbations: shortness of breath, coughing, wheezing, etc.**
- ◆ **Active Asthma Status: recent (within the last year) occurrence of asthma episodes with related exacerbations**



Why this Problem Matters to Me

- ◆ **Chester, PA: Covanta trash incinerators**
- ◆ **Childhood asthma prevalence is 4x the national average**



To determine which demographic and environmental factors are associated with active asthma status.

Hypotheses

1. Women have higher rates of active asthma than men.

2. Black people and other POC have higher rates of active asthma than white people.

3. People with active asthma are more likely to adjust their environment.

Study Population

- ◆ **Behavioral Risk Factor Surveillance System (BRFSS)**
 - **Established in 1984**
 - **Annual phone survey**
 - **Data from all 50 states**

- ◆ **Asthma Call-back Survey (ACBS)**
 - **BRFSS participants who have asthma → ACBS**
 - **Annual phone survey**
 - **Data from 28 states included**
 - **Separation between active and inactive**

Study Population

Characteristic	active, N = 9,002 ¹	inactive, N = 2,681 ¹	p-value ²
race			<0.001
white	6,904 (78%)	1,976 (75%)	
AAPI	34 (0.4%)	9 (0.3%)	
Asian	101 (1.1%)	68 (2.6%)	
black	493 (5.6%)	132 (5.0%)	
Hispanic	832 (9.4%)	317 (12%)	
Multi	295 (3.3%)	93 (3.5%)	
Native American	144 (1.6%)	24 (0.9%)	
Other	65 (0.7%)	22 (0.8%)	
Unknown	134	40	
sex			<0.001
male	2,867 (32%)	1,326 (49%)	
female	6,135 (68%)	1,355 (51%)	
bmi			<0.001
normal	1,975 (23%)	765 (30%)	
obese	3,763 (45%)	895 (35%)	
overweight	2,574 (31%)	849 (33%)	
underweight	121 (1.4%)	35 (1.4%)	
Unknown	569	137	
employment			<0.001
employed	3,748 (42%)	1,406 (53%)	
homemaker	355 (4.0%)	116 (4.4%)	

retired	2,664 (30%)	619 (23%)
student	264 (2.9%)	130 (4.9%)
unable to work	1,304 (15%)	166 (6.2%)
unemployed	619 (6.9%)	228 (8.6%)
Unknown	48	16
education		0.5
college and above	6,448 (72%)	1,941 (72%)
never completed college	2,539 (28%)	738 (28%)
Unknown	15	2
income		<0.001
\$75,000 or more	2,389 (31%)	820 (36%)
\$25,000-\$75,000	2,921 (38%)	968 (42%)
Less than \$25,000	2,459 (32%)	512 (22%)
Unknown	1,233	381
health_coverage		<0.001
private	400 (40%)	198 (58%)
Medicaid/State	131 (13%)	21 (6.1%)
Medicare	374 (38%)	102 (30%)
none	3 (0.3%)	1 (0.3%)
other	84 (8.5%)	20 (5.8%)
Unknown	8,010	2,339
last_smoked		
never	6 (0.2%)	4 (0.6%)
1 month	50 (1.9%)	35 (4.8%)
1 year	120 (4.6%)	42 (5.8%)
10 years	277 (11%)	84 (12%)
10+ years	1,767 (68%)	414 (57%)
5 years	337 (13%)	131 (18%)
last year	41 (1.6%)	13 (1.8%)

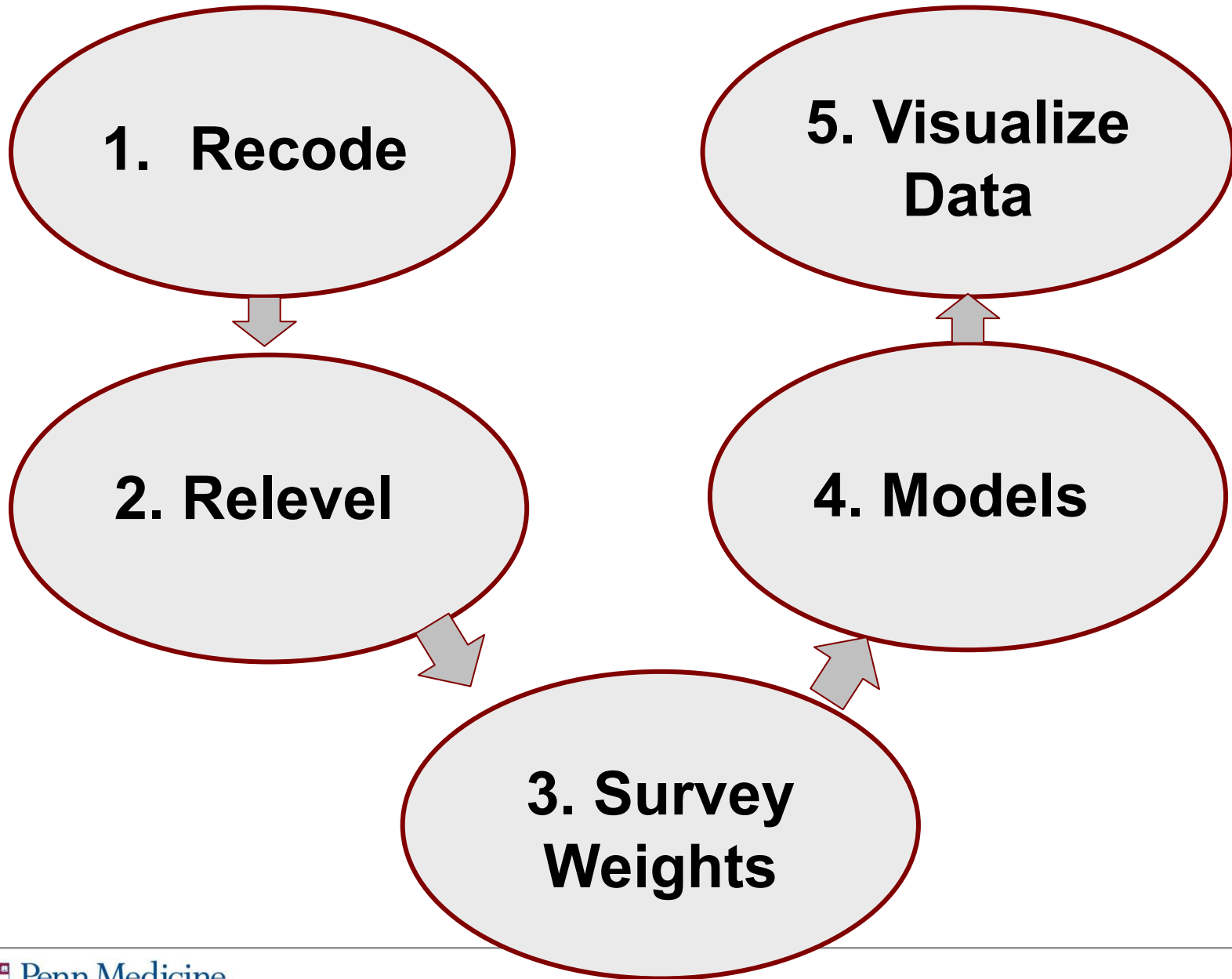
Variable Selection

- ◆ **Outcome Variables:**
 - **active asthma status**

- ◆ **Demographic Variables:**
 - **Sex**
 - **Race**
 - **Income**
 - **BMI**

- ◆ **Environmental Interventions:**
 - **Pillow Cover**
 - **Mattress Cover**
 - **Air Cleaner**
 - **Modify Environment**

Data Analysis



Demographic Risk Factors: Sex and Race

- ◆ POC did not have higher rates
- ◆ Women did have higher rates of active asthma
 - 1.83 : 1.00
- ◆ Black women are at greatest risk
 - 2.19

	[,1]	[,2]
[1,] "(Intercept)"		"2.26 (1.96, 2.60)**"
[2,] "raceAAPI"		"0.47 (0.10, 2.26)"
[3,] "raceAsian"		"0.48 (0.23, 1.00)"
[4,] "raceblack"		"0.76 (0.44, 1.32)"
[5,] "raceHispanic"		"0.70 (0.49, 1.00)*"
[6,] "raceMulti"		"0.57 (0.24, 1.35)"
[7,] "raceNative American"		"1.09 (0.45, 2.68)"
[8,] "raceOther"		"2.28 (0.53, 9.82)"
[9,] "sexfemale"		"1.83 (1.50, 2.23)**"
[10,] "raceAAPI:sexfemale"		"6.56 (0.82, 52.31)"
[11,] "raceAsian:sexfemale"		"1.84 (0.72, 4.66)"
[12,] "raceblack:sexfemale"		"2.19 (1.02, 4.70)*"
[13,] "raceHispanic:sexfemale"		"1.21 (0.76, 1.94)"
[14,] "raceMulti:sexfemale"		"2.10 (0.76, 5.80)"
[15,] "raceNative American:sexfemale"		"3.74 (1.02, 13.76)*"
[16,] "raceOther:sexfemale"		"0.43 (0.08, 2.29)"

Demographic Risk Factors: BMI and Income

- ◆ Lower income puts you at risk
 - 1.72x more likely
- ◆ Deviating from the healthy BMI correlates to an increased chance of active asthma
 - Obese = 1.97x more likely
 - Overweight = 1.26; Underweight = 2.30

```
[,1]           [,2]
[1,] "(Intercept)"      "2.72 (2.38, 3.11)**"
[2,] "income$25,000-$75,000" "0.99 (0.82, 1.20)"
[3,] "incomeLess than $25,000" "1.72 (1.37, 2.15)**"
```

```
[,1]           [,2]
[1,] "(Intercept)"      "2.18 (1.86, 2.55)**"
[2,] "bmiobese"         "1.97 (1.61, 2.42)**"
[3,] "bmioverweight"   "1.26 (1.01, 1.58)*"
[4,] "bmiunderweight"  "2.30 (1.26, 4.20)*"
```

Bivariate Results of Environmental Variables

Characteristic	active, N = 9,002 ¹	inactive, N = 2,681 ¹	p-value ²
air_cleaner	2,664 (30%)	635 (24%)	<0.001
Unknown	67	35	
smoke_inside	1,017 (11%)	264 (9.9%)	0.035
Unknown	3	2	
mod_env	2,973 (33%)	533 (20%)	<0.001
Unknown	55	36	
dehumidifier	2,547 (28%)	721 (27%)	0.14
Unknown	33	6	
kitchen_fan	5,263 (59%)	1,480 (56%)	0.004
Unknown	71	30	
cook_gas	3,631 (40%)	1,110 (41%)	0.3

Unknown	14	6	
mold_home	911 (10%)	189 (7.1%)	<0.001
Unknown	51	14	
bedroom_pet			0.006
no	1,127 (21%)	272 (17%)	
some	42 (0.8%)	8 (0.5%)	
yes	4,305 (79%)	1,300 (82%)	
Unknown	3,528	1,101	
roach_home	759 (8.4%)	252 (9.4%)	0.11
Unknown	9	7	
rodent_home	865 (9.6%)	208 (7.8%)	0.004
Unknown	13	6	
mattress_cover	3,853 (44%)	806 (31%)	<0.001
Unknown	323	91	
pillow_cover	2,959 (33%)	531 (20%)	<0.001
Unknown	169	59	
carpet_bedroom	5,172 (58%)	1,531 (57%)	0.8
Unknown	8	5	

Results to Multivariable Models

- ◆ Those with active asthma are more likely to use air cleaners

- 1.31 : 1.00

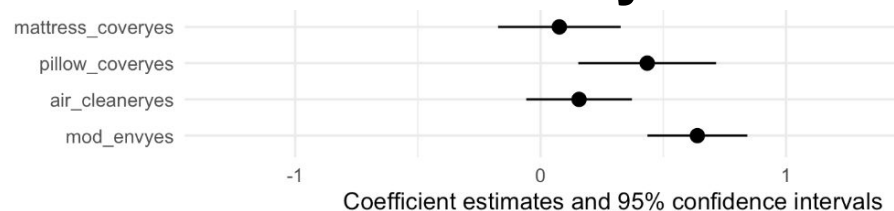
	[,1]	[,2]
[1,]	"(Intercept)"	"1.24 (0.99, 1.56)"
[2,]	"air_cleaneryes"	"1.31 (1.07, 1.61)*"
[3,]	"sexfemale"	"2.14 (1.77, 2.57)**"
[4,]	"raceAAPI"	"0.76 (0.25, 2.27)"
[5,]	"raceAsian"	"0.66 (0.38, 1.15)"
[6,]	"raceblack"	"0.82 (0.56, 1.21)"
[7,]	"raceHispanic"	"0.67 (0.50, 0.90)*"
[8,]	"raceMulti"	"0.72 (0.42, 1.24)"
[9,]	"raceNative American"	"1.58 (0.80, 3.14)"
[10,]	"raceOther"	"1.39 (0.54, 3.58)"
[11,]	"bmiobese"	"1.90 (1.51, 2.38)**"
[12,]	"bmioverweight"	"1.37 (1.07, 1.76)*"
[13,]	"bmiunderweight"	"2.95 (1.40, 6.20)*"
[14,]	"income\$25,000-\$75,000"	"0.96 (0.78, 1.18)"
[15,]	"incomeLess than \$25,000"	"1.78 (1.38, 2.31)**"

- ◆ More likely to use mattress and pillow covers

- 1.46x more likely; 1.79x more likely

- ◆ Overall, modifications are more likely with active asthma

- 2.06 : 1.00



What does that mean?

Education has an impact!

Future Plans

- ◆ **Design a survey exploring reasons for adoption of interventions**
- ◆ **Investigate Penn patient population to identify similar or emerging themes**



Research Contribution

- ◆ **Familiarized myself with the ACBS codebook and data set & chose variables**
- ◇ **Used descriptive statistics to explore connections between:**
 - **demographic and environmental variables**
 - AND**
 - **asthma prevalence**
- ◇ **Visualized data for ease in interpretation**

Lessons Learned

- ◆ **Analysis of big data**
- ◆ **Programming using R**
- ◆ **Survey weights and making comparisons to broader groups**
- ◆ **Context for personal experiences**
- ◆ **Passion for activism & giving back to my community**

Thank You!

◆ Research Mentor:

- Dr. Blanca Himes

◆ Others:

- Joanne Levy
- ChiChi Nwadiogbu
- SUMR & GEAR-UP 2023 Cohort

