

# The Impact of Community on Childhood Asthma Prevalence in Chicago

**Ruchi S. Gupta, MD MPH**  
Assistant Professor of Pediatrics

*Children's Memorial Hospital &  
Northwestern University Feinberg School of Medicine*



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### Disclosure of Conflict of Interest Information:

*I have no conflict of interest to disclose*



# Background

- > 9 million children have asthma in US
- Disparities on the rise
  - Asthma rates disproportionately higher among Black vs. White children
- Urban environment often implicated
  - Little attention paid to contributions at the community level within the inner-city



# Objectives

1. Determine *variability* of asthma within Chicago
2. Identify *positive community factors* associated with variability
3. Identify *negative community factors* associated with variability



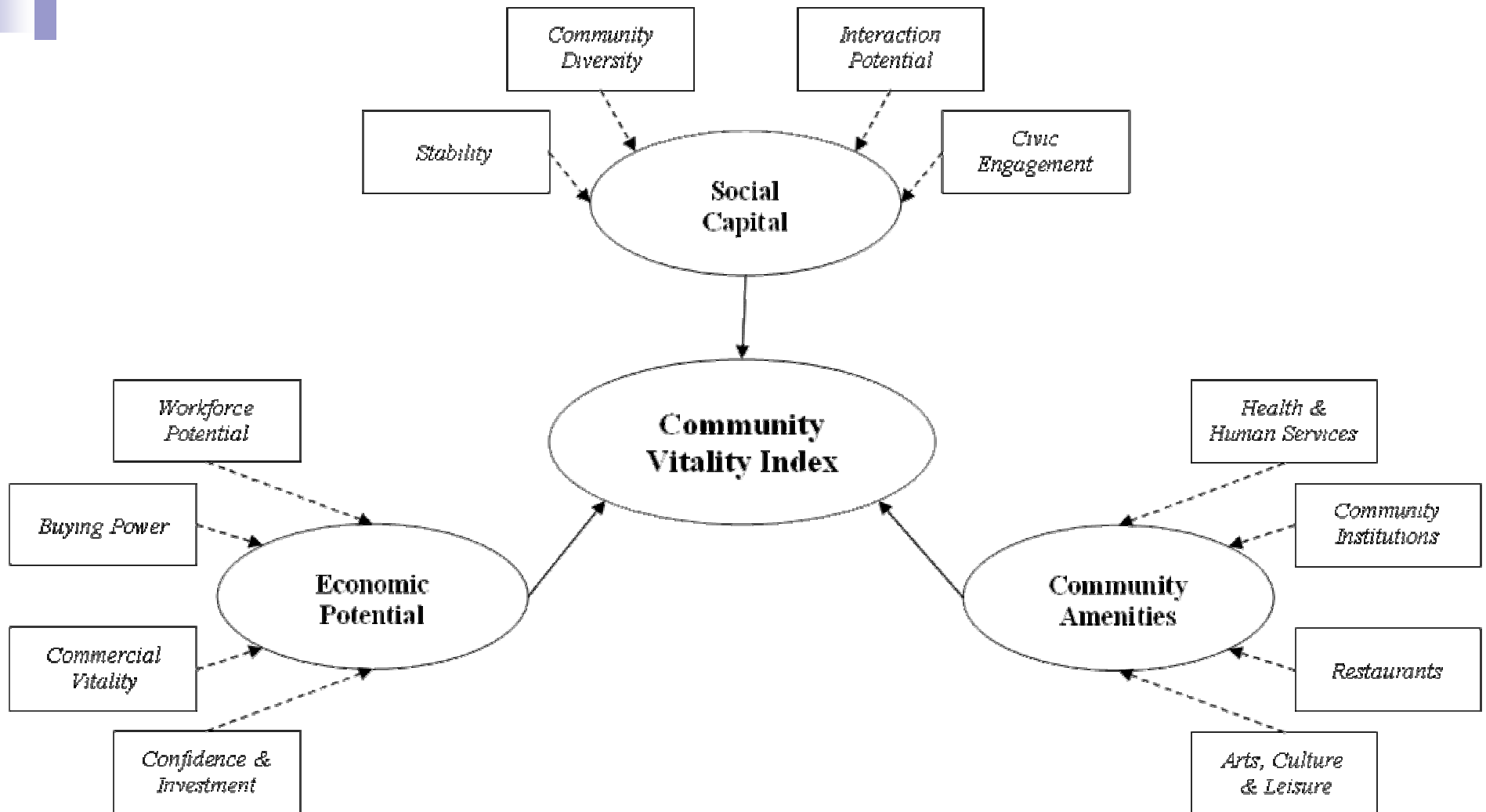
# Methods: Data Collection

- Asthma screening conducted among *50,000 children* in Chicago K-8 schools from 2003-2005
  - Part of the Chicago Initiative to Raise Asthma Health Equity (CHIRAH) study: <http://chirah.cchil.org/>
  - Individual data collected: race, age, gender & household member with asthma
- Sample geocoded into Chicago neighborhoods via Human Development in Chicago Neighborhoods (PHDCN) guidelines: <http://www.icpsr.umich.edu/PHDCN/sampling.html#neighborhood>
- Neighborhoods selected to be:
  - Ecologically meaningful
  - Geographically contiguous on census tracts
  - Internally homogenous on key census indicators

# Methods: Community Variables

- Neighborhood information obtained from census data
  - Race
  - Education
  - Income
- Positive community factors assessed using the Metro Chicago Information Center's Community Vitality Index:  
<http://info.mcfol.org/web/datainfo/cvi/methodology.asp>
  - Social capital
  - Economic potential
  - Community amenities
- Crime data obtained from the Chicago Department of Police
  - Property damage
  - Drug-trafficking
  - Violent crime
- Performed bivariate analysis and logistic regression analysis

# Methods: A Note on Positive Factors



## Explanation of Community Vitality Index descriptors:

<b>Social Capital Component (33%)</b>		
<i>Descriptor of connections between people that allow communities to work together</i>		
<b>Sub-Index</b>	<b>Variable</b>	<b>Definition</b>
Interaction Potential (25%)	Neighborhood Interaction <sup>1</sup>	% households not linguistically isolated
	Social Support <sup>1</sup>	% households not comprised of a single person living alone
	Availability <sup>1</sup>	% households with at least 1 adult not in the labor force
Stability (25%)	Mobility <sup>1</sup>	% households that resided in same home 5 yrs earlier
	Immigration <sup>1</sup>	Inversely ranked % foreign born residents who entered given tract within 5 yrs
Community Diversity (25%)	Ethnic Diversity <sup>1</sup>	Inversely ranked % tract population of largest single racial/ethnic group
	Age Distribution <sup>1</sup>	Inversely ranked % tract population in any single age group (0-24; 25-44; 45+)
	Income Mix <sup>1</sup>	% households in any single income group (\$0-34,999; \$35,000-74,999; \$75,000+)
Civic Engagement(25%)	Voting Rate <sup>2</sup>	% registered voters who voted in Nov 2002 election
<b>Economic Potential Component (33%)</b>		
<i>Descriptor of features considered important in community development and assets with potential leverage for community change</i>		
<b>Sub-Index</b>	<b>Variable</b>	<b>Definition</b>
Commercial Vitality (25%)	Business Density <sup>3</sup>	# businesses per square mile
	Small Business Loans <sup>4</sup>	Aggregate amount of small business loans (<1 million)
Buying Power (25%)	Aggregate Income <sup>1</sup>	Total income for all people in given census tract
	Shelter Cost Burden <sup>1</sup>	Inversely ranked % households spending ≥ 30% monthly income on housing
Neighborhood Confidence & Investment (25%)	Home Investment <sup>5</sup>	# mortgages originated per dwelling unit
	Home Improvement <sup>5</sup>	# home improvement loans originated per occupied dwelling unit
	Owner Occupancy <sup>1</sup>	% occupied dwelling units
Workforce Potential (25%)	Educational Attainment <sup>1</sup>	% population > 25 yrs old with at least some college education
	Wage Earners <sup>1</sup>	# wage earners age 16-64 per square mile
	Employment Rate <sup>1</sup>	% labor force employed
<b>Community Amenities Component (33%)</b>		
<i>Descriptor of the impact of cultural and social amenities on the growth of social capital and community development</i>		
<b>Sub-Index</b>	<b>Definition</b>	
Arts, Culture, and Leisure (25%) <sup>6,7</sup>	# of 3-mile buffers around each artistic, cultural and entertainment facility that include the center of each tract divided by the population density	
Restaurants (25%) <sup>6</sup>	# of 1-mile buffers around each restaurant that include the center of each tract divided by the population density	
Health and Human Services (25%) <sup>8</sup>	# of 3-mile buffers around each agency that include the center of each tract divided by the population density	
Community Institutions (25%) <sup>9</sup>	# of 2-mile buffers around each institution that include the center of each tract divided by the population density	

<sup>1</sup>Data Source: 2000 US Census; <sup>2</sup>Data Source: County Board of Elections, Chicago Board of Elections by precinct; <sup>3</sup>Data Source: 2002 commercial listing of all businesses with telephones; <sup>4</sup>Data Source: 1999 Community Reinvestment Act data; <sup>5</sup>Data Source: 1999 Home Mortgage Disclosure Act; <sup>6</sup>Data Source: Commercial database of businesses with telephones; <sup>7</sup>Data Source: Database of non-profit arts/culture organizations; <sup>8</sup>Data Source: 2001 United Way Blue Book; <sup>9</sup>Data Source: InfoUSA commercial business database



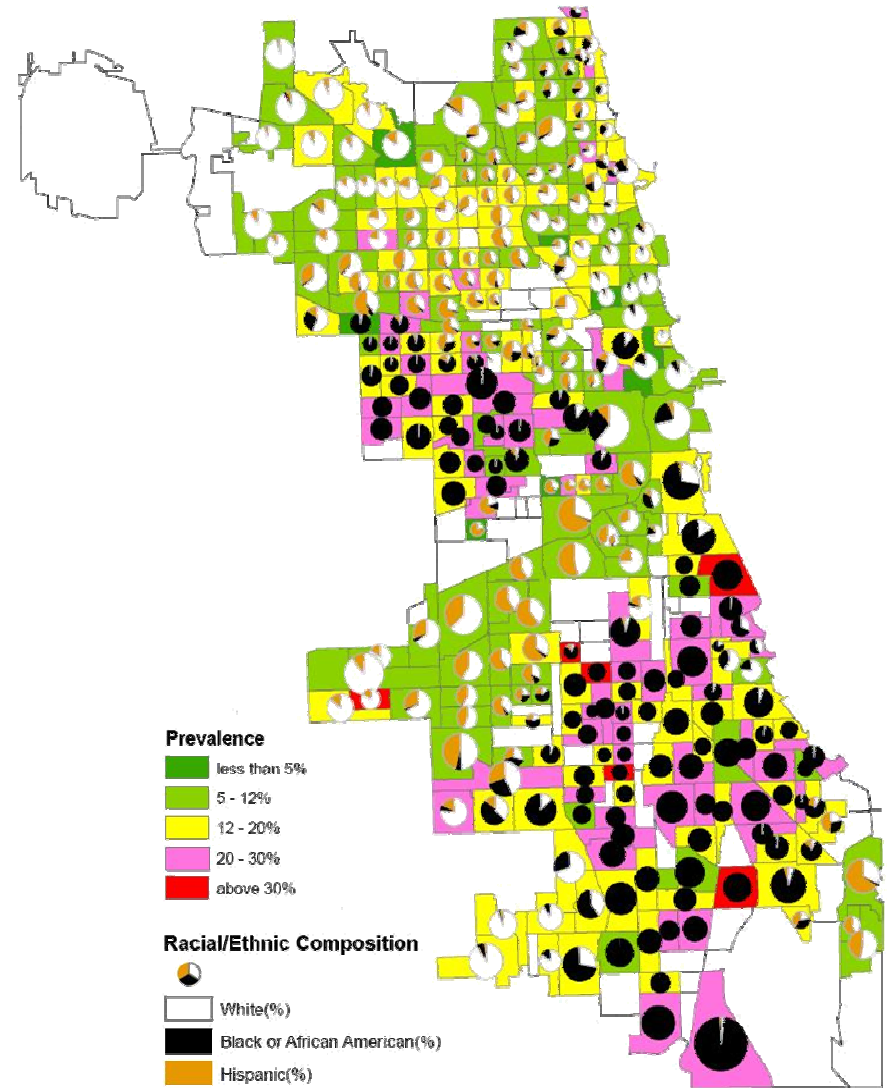
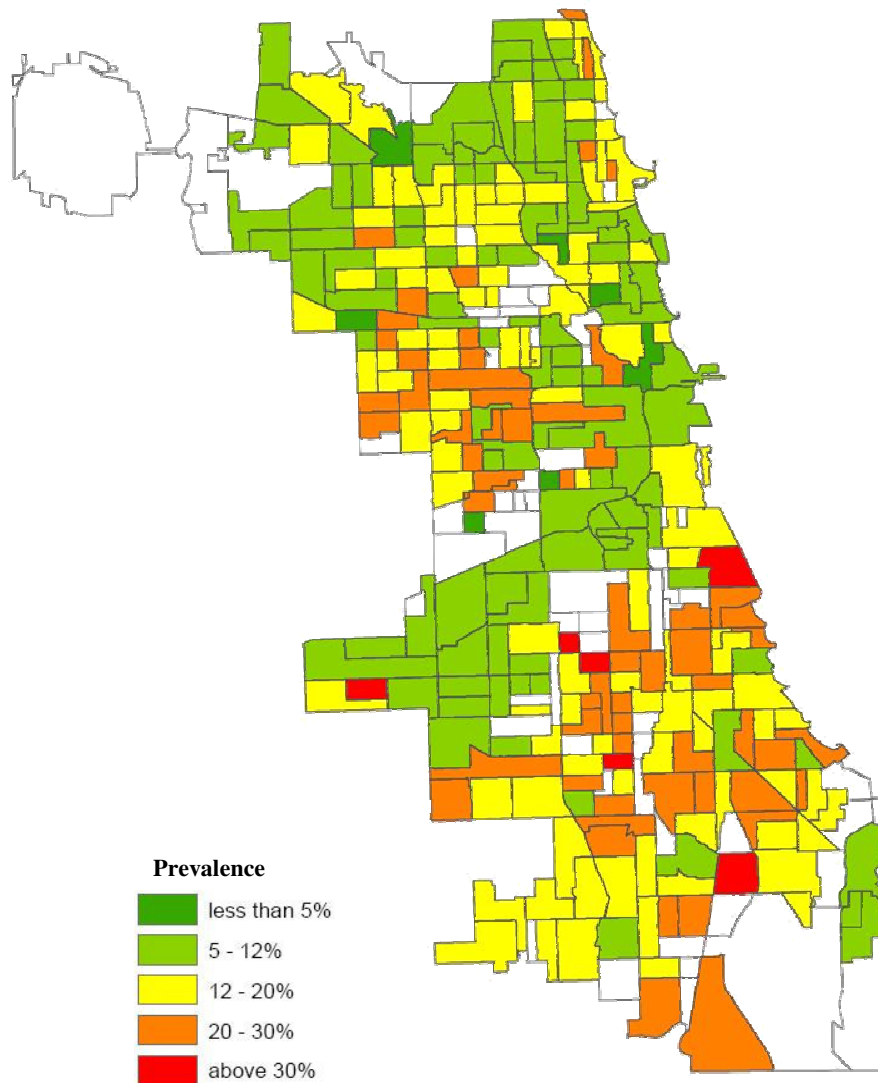
# Questions

1. *Variability*: How does asthma prevalence vary within and between Chicago neighborhoods?
2. *Positive Factors*: Does a community's social capital, economic potential, and/or community amenities explain a significant degree of variability?
3. *Negative Factors*: Does the incidence of property damage, drug-trafficking, and/or violent crime in a community explain a significant degree of variability?

# Results: Variability

- Average childhood asthma rate → 13%
  - 12% for White children
  - 20% for Black children
  - 12% for Hispanic children
- Asthma rates vary widely among neighborhoods from 0% to 44%
  - Black neighborhoods range from 4%-44%
  - White neighborhoods range from 2%-30%
  - Hispanic neighborhoods range from 0%-29%
- After controlling for individual/community demographics:
  - Gender, age, household members w/asthma and neighborhood income significantly associated with asthma but did NOT explain differences by neighborhood
  - Race explained significant proportion (80%), but NOT all variation

# Childhood asthma variability in Chicago:



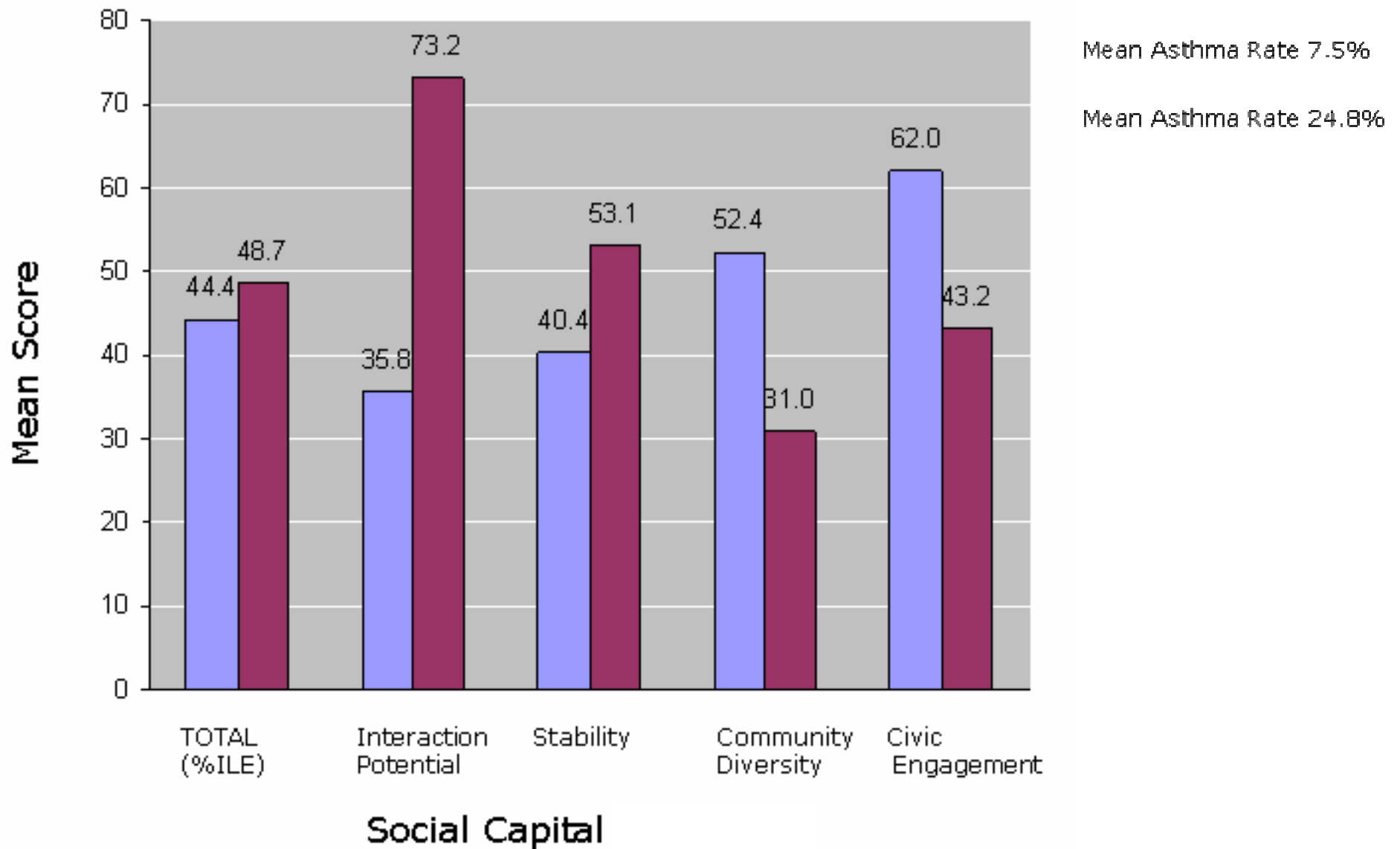
Source: Gupta RS, Zhang X, Sharp LK, Shannon JJ, Weiss KB. Geographic variability in childhood asthma prevalence in Chicago. *The Journal of Allergy and Clinical Immunology*. 2008 Mar;121(3):639-45 e1

# Results: Positive Factors

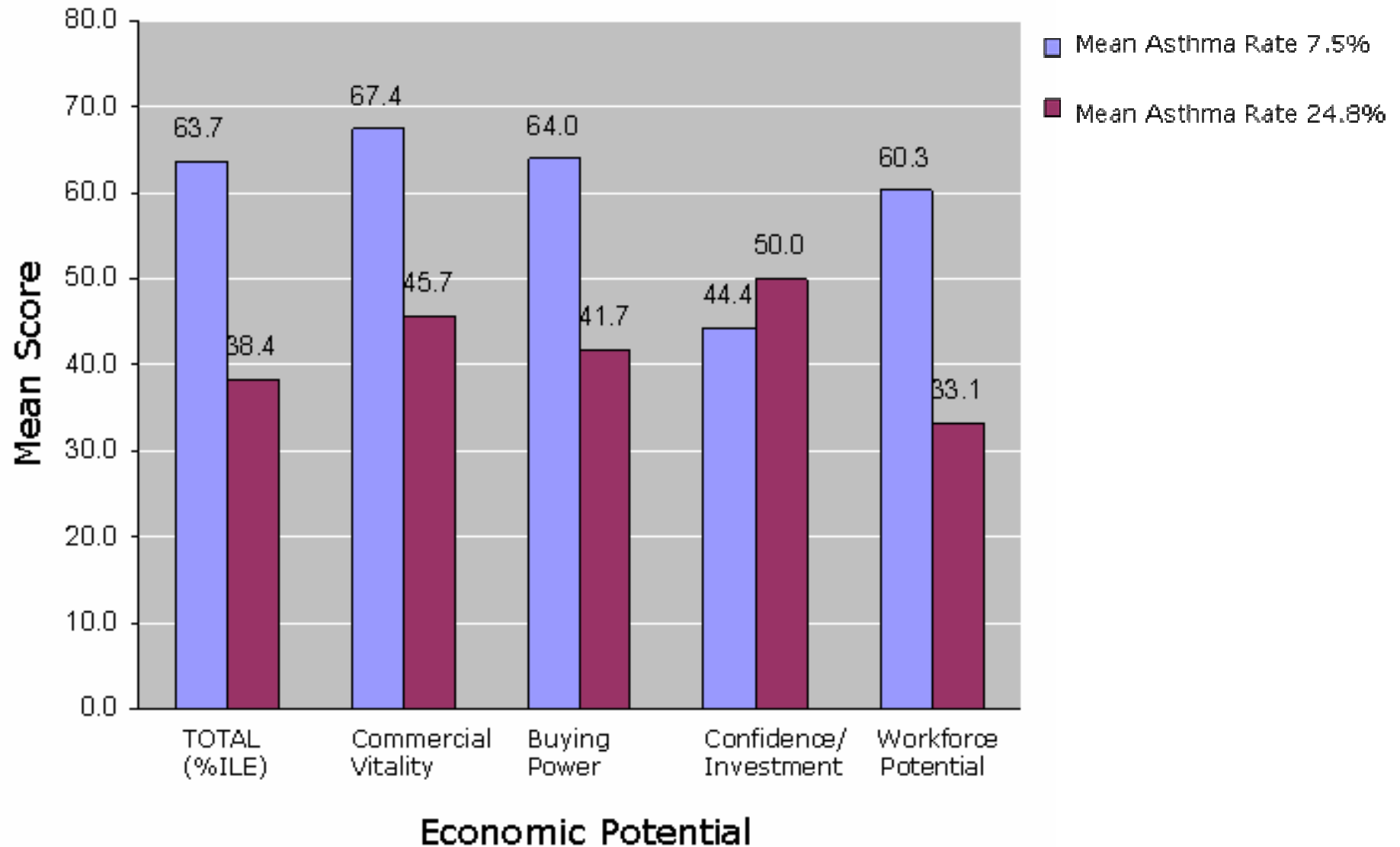
- Community vitality significantly higher in neighborhoods with low asthma prevalence
  - 54% vs. 44% (Low vs. High Asthma),  $p < 0.0001$
- Economic potential significantly higher in neighborhoods with low asthma prevalence
  - 64% vs. 38% (Low vs. High Asthma),  $p < 0.0001$
- Sub-indices of social capital significantly higher in neighborhoods with high asthma prevalence
  - **Neighborhood interaction:** 36% vs. 73% (Low vs. High Asthma),  $p < 0.0001$
  - **Stability:** 40% vs. 53% (Low vs. High Asthma),  $p < 0.0001$

Source: Gupta RS, Zhang X, Sharp LK, Shannon JJ, Weiss KB. The protective effect of community on childhood asthma. The Journal of Allergy and Clinical Immunology. In press.

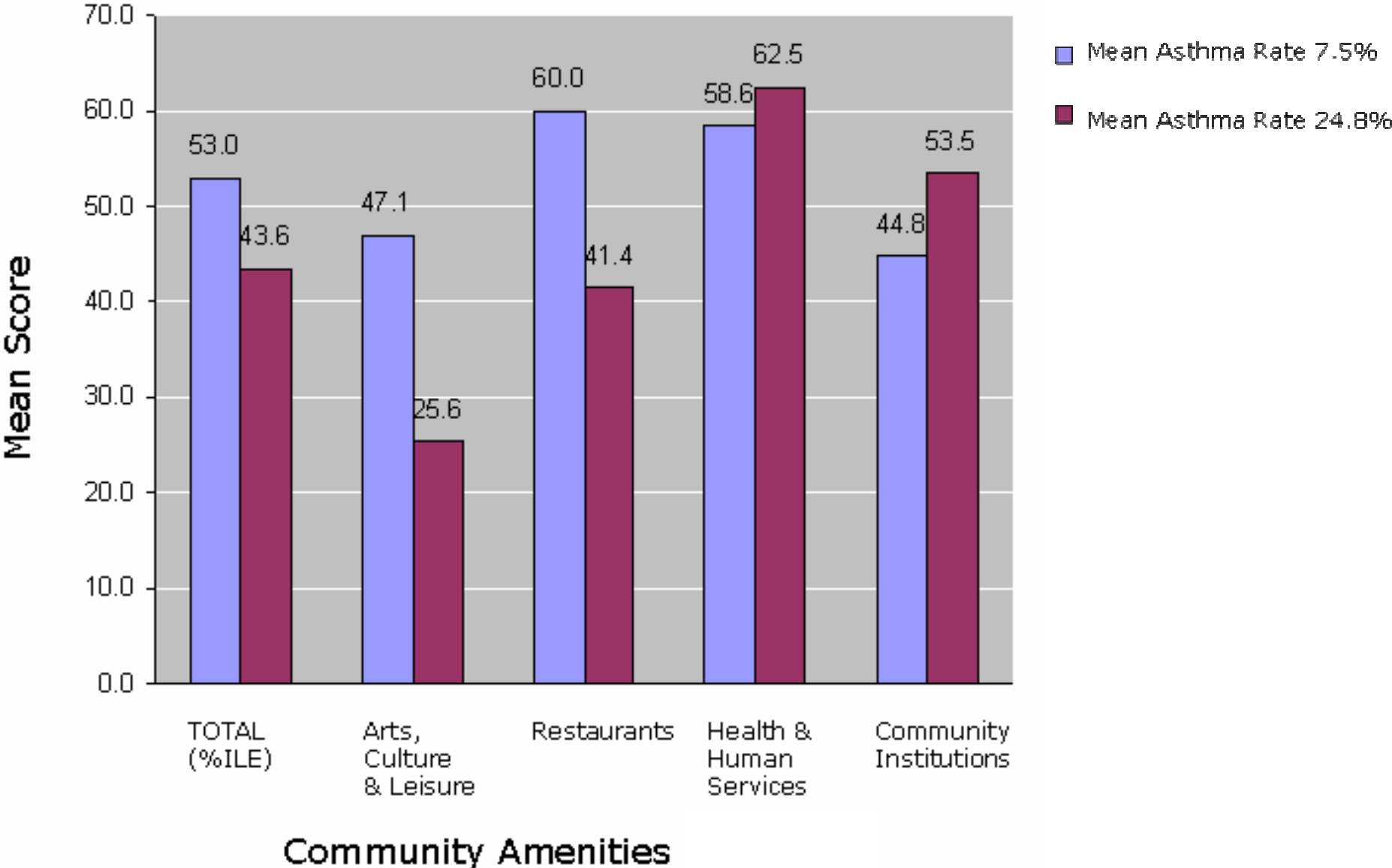
## Social capital in neighborhoods w/low and high asthma prevalence:



# Economic potential in neighborhoods w/low and high asthma prevalence:



# Community amenities in neighborhoods w/low and high asthma prevalence:





## Results: Positive Factors

- As the Black population increased in a community, so did childhood asthma
- After controlling for individual/community characteristics:
  - In Black neighborhoods, positive community factors remained significantly higher in areas with low asthma prevalence
- Alongside individual/community characteristics:
  - Overall community vitality and social capital continued to contribute significantly ( $p < 0.05$ ) to asthma variation
- Overall, positive factors explained 21% of asthma variation

# Results: Negative Factors

- Property damage over 1.5 times higher in neighborhoods with high asthma prevalence
  - Annually/100,000 people: N=2361 vs. 3921 (Low vs. High Asthma),  $p < 0.0001$
- Drug trafficking more than 6-fold higher in neighborhoods with high asthma prevalence
  - Annually/100,000 people: N=461 vs. 2921 (Low vs. High Asthma),  $p < 0.0001$
- Violent crimes more than 3-fold higher in neighborhoods with high asthma prevalence
  - Annually/100,000 people: N=448 vs. 1566 (Low vs. High Asthma),  $p < 0.0001$

## Asthma prevalence, racial/ethnic distribution, and incidence of crime:

Variable	Neighborhood Quartile Groups			
	1 (n=61)	2 (n=62)	3 (n=62)	4 (n=62)
<b>Asthma Prevalence (Mean %)</b>				
TOTAL	9	12	17	22
<b>Racial/Ethnic Distribution (Mean %)</b>				
White***	34	39	13	3
Black***	7	11	73	91
Hispanic***	59	51	15	6
<b>Incidence of Crime (n)<sup>1</sup></b>				
TOTAL***	2879	2710	4837	5487
Property Damage***	2361	2289	3614	3921
Drug Trafficking***	461	574	2064	2921
Violent Crimes***	448	421	1223	1566

\*p-value < 0.1

\*\*p-value < 0.05

\*\*\*p-value < 0.001

<sup>1</sup> Annually, per population of 100,000

## Role of crime as a predictor of asthma:

Variable	Likelihood of Asthma OR (95% CI)		
	Unadjusted	Adjusted <sup>1</sup>	Adjusted <sup>2</sup>
<b>TOTAL Crime<sup>3</sup></b>			
High vs. Low	1.73 (1.48, 2.03)	1.49 (1.26, 1.76)	1.16 (0.98, 1.37)
Moderate vs. Low	1.44 (1.28, 1.62)	1.33 (1.19, 1.48)	1.08 (0.96, 1.20)
<b>Property Damage<sup>4</sup></b>			
High vs. Low	1.56 (1.32, 1.84)	1.37 (1.17, 1.60)	1.09 (0.93, 1.26)
Moderate vs. Low	1.45 (1.28, 1.63)	1.32 (1.18, 1.47)	1.08 (0.97, 1.20)
<b>Drug Trafficking<sup>5</sup></b>			
High vs. Low	1.81 (1.56, 2.11)	1.51 (1.25, 1.82)	1.14 (0.96, 1.35)
Moderate vs. Low	1.32 (1.17, 1.49)	1.23 (1.08, 1.41)	0.11 (0.99, 1.24)
<b>Violent Crimes<sup>6</sup></b>			
High vs. Low	2.03 (1.76, 2.34)	1.83 (1.52, 2.20)	1.27 (1.04, 1.55)
Moderate vs. Low	1.41 (1.26, 1.57)	1.35 (1.21, 1.51)	1.15 (1.02, 1.29)

<sup>1</sup> Adjusted for age, gender, household member with asthma, and SES

<sup>2</sup> Adjusted for age, gender, household member with asthma, SES, and race/ethnicity

<sup>3</sup> Annual Incidence per population of 100,000: High > 6352; Moderate ≤ 6352 and > 3076.5; Low ≤ 3076.5

<sup>4</sup> Annual Incidence per population of 100,000: High > 4765.5; Moderate ≤ 4765.5 & > 2440; Low ≤ 2440

<sup>5</sup> Annual Incidence per population of 100,000: High > 2706.5; Moderate ≤ 2706.5 & > 344; Low ≤ 344

<sup>6</sup> Annual Incidence per population of 100,000: High > 1771.5; Moderate ≤ 1771.5 & > 451.5; Low ≤ 451.5

# Results: Negative Factors

- As the Black population increased in a community, so did childhood asthma
- After controlling for individual/community characteristics:
  - Only violent crime significantly associated with likelihood of asthma → OR(95%CI)=1.27(1.04, 1.55),  $p < 0.05$  (Low vs. High Asthma)
- Alongside individual/community characteristics:
  - The incidence of violent crime continued to contribute significantly ( $p < 0.05$ ) to asthma variation
- Violent crime explained 15% of asthma variation



## Conclusions

- Childhood asthma prevalence varies significantly by neighborhood
- Both positive and negative community factors have a strong impact on childhood asthma prevalence in Chicago
- A deeper understanding of these factors may lend insight into potential interventions to reduce childhood asthma



## Future Work

- Determine the impact of air pollution on childhood asthma prevalence
- Assess community factors in Humboldt Park, a Chicago neighborhood at high risk for asthma
- Determine the impact of community on children with and without a genetic predisposition for asthma

Thank You!



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**Questions?**