



Spatial Analysis of Neighborhood Crime on the Body Mass Index of Urban Adolescents

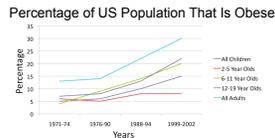
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BACKGROUND

ADOLESCENT OBESITY: A PUBLIC HEALTH PRIORITY

- Adolescent obesity is a significant problem because of its immediate and long-term health risks and because of its rapidly increasing prevalence.
- Health risks of obesity among adolescents include hypertension, type 2 diabetes, asthma, coronary heart disease, and certain cancers.
- Trend data indicate that obesity has dramatically increased among adolescents.



NEIGHBORHOOD CRIME AND OBESITY RISK: IS THERE A LINK?



- Neighborhood crime has been postulated to be implicated in adolescent obesity risk (albeit existing studies have yielded inconsistent findings).
- Potential reasons for these inconsistencies include *most* studies fail to rigorously consider the neighborhood definitions used; to consider the type of crime in associations; to examine associations by population subgroups, and to account for spatial autocorrelation in regression models.
- Studies are needed to build on and address the limitations of earlier studies.

SPECIFIC AIMS

- To examine associations between neighborhood crime and BMI z-score by different neighborhood definitions (i.e. 400-meter and 800-meter circular and street network buffers), and consider gender and race/ethnicity as potential effect modifiers.

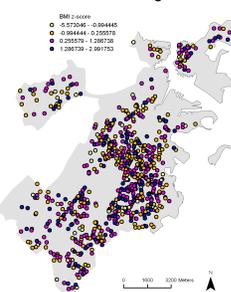
METHODS

STUDY DESIGN AND SAMPLE

- 2008 Boston Youth Survey
 - Survey of high school students in Boston Public Schools
 - 22 (of 32) Boston public high schools participated
 - Administered Spring of 2008 during class periods
- Sample
 - Georeferenced residential information
 - Complete and valid data to compute BMI-zscore
 - N= 1,034 adolescents

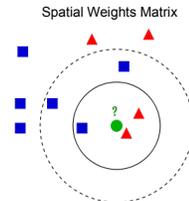
STUDY VARIABLES

- Neighborhood Crime (i.e. 2007 geocoded incident crime data)
 - Total Crime** (combination of violent & property crime)
 - Violent Crime** (i.e. aggravated assault, criminal homicide, robbery, forcible rape)
 - Property Crime** (i.e. burglary, larceny-theft, motor vehicle theft, arson)
- Normalized by total population and expressed as crime per 1,000
- BMI z-score
 - Accounts for age and gender
 - Based on 2000 CDC growth charts
- Individual-level Covariates
 - Gender
 - Race/ethnicity
 - Age
 - Nativity
 - Siblings
- Neighborhood-level Covariates
 - Percent Black
 - Percent Hispanic
 - Percent household poverty
 - Percent foreign born



SPATIAL ANALYSES

- Exploratory Spatial Data Analyses**
 - Geovisualization to map key study variables, i.e. exposures and outcomes.
 - Cluster Detection: Global Moran's I assessed via Monte Carlo simulation of 999 random replications to evaluate whether there is spatial autocorrelation for the key study variables.
- Regression Analyses**
 - Standard Regression Model, i.e. Ordinary Least Squares Regression
 - Spatial Regression Model, i.e. Spatial Error Model, if needed (e.g. if the residuals of the OLS are significant for spatial autocorrelation)
 - Evaluated Spatial Autocorrelation in OLS Residuals via Global Moran's I and Lagrange Multiplier



RESULTS

Table 1. Spatial Autocorrelation in Neighborhood Crime and BMI z-score by Neighborhood Definition

Neighborhood Definition	Global Moran's I / Statistic	Pseudo p-value
400-meter Circular Buffer Neighborhood		
Crime Rate per 1,000 population	0.65	0.001
Violent Crime Rate per 1,000 population	0.89	0.001
Property Crime Rate per 1,000 population	0.55	0.001
400-meter Network Buffer Neighborhood		
Crime Rate per 1,000 population	0.49	0.001
Violent Crime Rate per 1,000 population	0.83	0.001
Property Crime Rate per 1,000 population	0.39	0.001
800-meter Circular Buffer Neighborhood		
Crime Rate per 1,000 population	0.93	0.001
Violent Crime Rate per 1,000 population	0.97	0.001
Property Crime Rate per 1,000 population	0.91	0.001
800-meter Network Buffer Neighborhood		
Crime Rate per 1,000 population	0.85	0.001
Violent Crime Rate per 1,000 population	0.92	0.001
Property Crime Rate per 1,000 population	0.83	0.001
Adiposity		
BMI z-score	0.07	0.258

Table 2. Spatial Error Model Estimation of the Association Between Neighborhood Crime and BMI z-score: Comparison of 400-meter Circular and Street Network Buffers

	Multivariate		
	(A) Total Crime	(B) Violent Crime	(C) Property Crime
	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)
Model 1			
Crime: Total Sample	0.001 (0.001)	0.007 (0.006)	0.001 (0.002)
Model 2			
Crime: Male	0.003 (0.002)	0.009 (0.007)	0.003 (0.002)
Crime X Female	-0.004 (0.003)	-0.004 (0.008)	-0.006* (0.003)
Model 3			
Crime: White	0.003 (0.002)	0.021 (0.016)	0.004 (0.003)
Crime X Black	-0.001 (0.003)	-0.011 (0.017)	-0.001 (0.005)
Crime X Hispanic	-0.002 (0.004)	-0.015 (0.018)	-0.002 (0.004)
Crime X Asian	-0.008* (0.004)	-0.032* (0.019)	-0.011* (0.005)
Crime X Other	-0.006 (0.009)	-0.010 (0.022)	-0.017 (0.014)
	400-meter Network Buffer Neighborhood		
	(A) Total Crime	(B) Violent Crime	(C) Property Crime
	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)
Model 1			
Crime: Total Sample	0.002 (0.001)	0.011* (0.005)	0.002 (0.001)
Model 2			
Crime: Male	0.003* (0.001)	0.014* (0.006)	0.003* (0.002)
Crime X Female	-0.003 (0.002)	-0.006 (0.007)	-0.004 (0.003)
Model 3			
Crime: White	0.002 (0.001)	0.014 (0.011)	0.002 (0.002)
Crime X Black	0.003 (0.003)	0.002 (0.012)	0.003 (0.004)
Crime X Hispanic	0.001 (0.003)	-0.004 (0.013)	0.001 (0.003)
Crime X Asian	-0.008* (0.004)	-0.021 (0.016)	-0.011* (0.005)
Crime X Other	-0.004 (0.007)	-0.004 (0.017)	-0.011 (0.011)

SE= Standard Error
 * p < 0.10; ** p < 0.05 (bold); *** p < 0.01 (bold)

- Spatial autocorrelation in neighborhood crime, but not BMI z-score
- Crime associated with higher BMI at small neighborhood scale (especially violent crime among boys)
- Possible inverse association among Asians and girls

STRENGTHS AND LIMITATIONS

- Strengths**
 - Spatial modeling strategy
 - Socially meaningful neighborhoods
 - Understand modifiable areal unit problem
 - Gender and race/ethnicity as effect modifiers
- Limitations**
 - Cross-sectional design
 - Self-reported height and weight data
 - Residual confounding
 - Generalizability

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