

US EPA ARCHIVE DOCUMENT

Measuring Specific Features of Neighborhood Environments and Estimating their Contribution to Health Disparities

Mahasin S. Mujahid, PhD MS
 Assistant Professor of Epidemiology
 University of California, Berkeley

Collaborators: Ana Diex Roux, Jeffrey Morenoff, Trivellore Ragunathan, Deepthiman Gowda, Brisa Sanchez, Steven Shea, David Jacobs, Sharon Jackson



Outline

1. Approaches to measuring and validating features of neighborhood environments
2. Neighborhoods and obesity

Background

- Exponential increase in epidemiologic studies examining neighborhood environments in relation to health
- Census-derived indicators of neighborhood socioeconomic position are often used as neighborhood measures of interest
- There is a need for direct measurement of specific features of neighborhood environments

Measuring and Validating Neighborhood Measures

Step #1

What are the relevant neighborhood features?

Step #2

How do we obtain information on these features?

Step #3

How do we create and validate neighborhood measures?

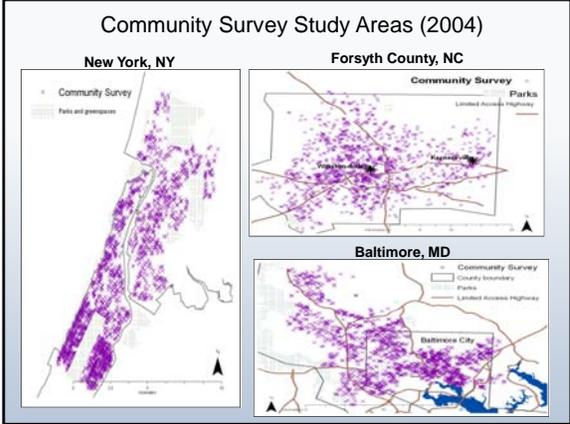
Step 1: Relevant Neighborhood Features



Diex Roux (2003), Journal of Urban Health

Step 2: Obtaining Data

1. Other administrative data sources
 - Feasibility
2. Systematic social observation
 - Labor intensive; Social environment
3. Survey of health study participants
 - Same source bias
4. **Survey of area residents**
 - **"informants"**



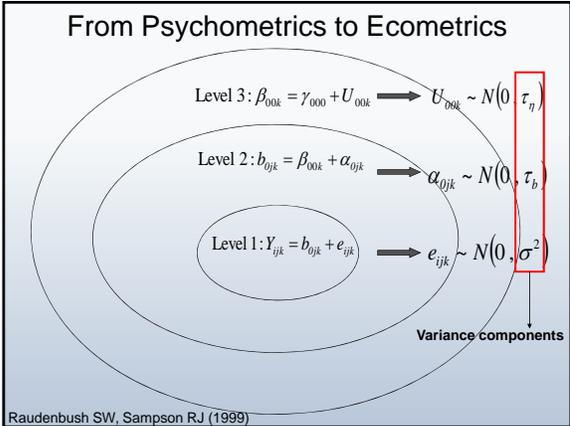
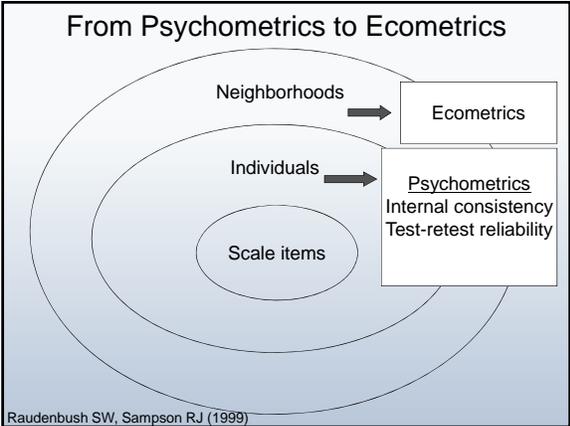
Sample Characteristics (N=5988)

Community Survey Sample	N	Survey (%) weighted	2000 U.S census (%)
Age (mean, 45.0 (SD=17.6])			
≤55yrs	5014	87.6	88.4
65+ yrs and older	974	12.4	11.6
Gender			
Male	2108	45.8	N/A
Female	3880	54.2	
Race/Ethnicity			
White	3140	34.9	33.5
African American	1711	30.0	33.5
Hispanic	788	26.0	28.0
Asian	127	4.2	2.8
Other	183	4.9	1.0
Education			
< H.S diploma	735	17.1	29.9
High school graduate/some college	2536	42.5	42.6
College graduate and beyond	2704	40.4	27.5
Income			
\$0-\$49,999	2991	60.7	66.0
\$50,000+	2287	39.3	34.0
Years in neighborhood*	5982	13.3 (14.0)	N/A

*Means (std)

Telephone Survey

- Asked individuals to respond the questions regarding the area 1 mile surrounding home
- Seven dimensions defined *a priori*
 - Aesthetic Quality (6 items)
 - Walking Environment (10 items)
 - Access to healthy foods (4 items)
 - Safety from Crime (3 items)
 - Violence (4 items)
 - Social Cohesion (4 items)
 - Activities with neighbors (5 items)
- Neighborhood defined as census tracts (average of 8 individuals per tract)



Ecometric Measures

- Intraneighborhood agreement (ICC)
 - % of variability in neighborhood scale items that lies between neighborhoods as opposed to within neighborhoods
 - range: (0-1)
- Neighborhood reliability
 - The accuracy of the model estimate as a measure of the true neighborhood dimension
 - range:(0-1)

$$ICC = \frac{\tau_{\eta}}{\tau_{\eta} + \tau_b}$$

$$\lambda_{00k} = \frac{\tau_{\eta}}{\tau_{\eta} + \left\{ \sum_1^J [r_b + \sigma^2 / n_{jk}]^{-1} \right\}}$$

Scales Have Good Psychometric Properties

Construct	# items	Cronbach's Alpha	Test-retest* [95% C.I.]
Aesthetic quality	5	0.75	.83 [.77, .88]
Walking environment	7	0.73	.60 [.47, .74]
Availability of healthy foods	3	0.78	.69 [.57, .77]
Safety	3	0.77	.88 [.83, .91]
Violent crime	4	0.83	.72 [.62, .80]
Social cohesion	4	0.74	.65 [.53, .74]
Activities w/neighbors	5	0.78	.73 [.63, .80]

0.60-0.88

* Test-retest reliability on reduced sample of N=120 participants
Mujahid et al. (2007)

Scales Have Good Ecometric Properties

Variance component	Aesthetic Quality	Walking Environment	Healthy Foods
Within-person variance	.81	.85	.64
Within-neighborhood variance	.25	.18	.52
Between-neighborhood variance	.26	.14	.21
Intra-neighborhood correlation	.51	.43	.28
Neighborhood reliability	.78	.73	.64

51% of the variability in aesthetic quality lies between neighborhoods

Ecometric Properties (con't)

Variance component	Safety	Violent crime	Social cohesion	Activities with Neighborhoods
Within-person variance	.64	.40	.59	.65
Within-neighborhood variance	.38	.31	.28	.39
Between-neighborhood variance	.35	.18	.14	.03
Intra-neighborhood correlation	.37	.34	.31	.06
Neighborhood reliability	.77	.72	.68	.28

Neighborhood SEP Is Only Modestly Correlated With Neighborhood Features

	Aesthetic	Walking	Healthy Foods	Safety	Violent Crime	Social cohesion	Activities with neighbors
Neighborhood predictors % poverty	-0.28 (0.01)	-0.13 (0.01)	-0.15 (0.02)	-0.30 (0.01)	0.22 (0.01)	-0.17 (0.01)	-0.02 (0.01)
Variance components							
Within person	0.80	0.86	0.54	0.62	0.40	0.58	0.63
Within neighborhood	0.24	0.18	0.50	0.38	0.29	0.27	0.38
Btwn neighborhood	0.08	0.07	0.15	0.10	0.08	0.03	0.02
Percent of variance explained							
Between neighborhoods	67.1	26.5	78	65.4	54.6	60.7	1.7

For a neighborhood to be SEP explains 66% of the healthy neighborhood assets by 15

Estimates in bold are statistically significant

Features of Neighborhood Environments by Racial/Ethnic Composition

	White	Black	Hispanic	Black/Hispanic	Mixed
Aesthetics					
Low	5	40	70	41	16
Medium	33	30	27	41	44
High	62	10	3	18	40
Walkability					
Low	9	49	48	36	20
Medium	24	38	35	43	32
High	67	13	17	21	48
Healthy foods					
Low	13	54	35	33	26
Medium	27	30	44	41	28
High	60	16	21	26	46
Safety					
Low	6	47	53	47	22
Medium	17	41	34	37	46
High	77	12	13	16	32
Clusters					
0	78	21	12	24	48
1-2	19	37	37	33	36
3-5	3	42	52	43	16

Summary: Measuring and Validating Neighborhood Measures

Step #1

What are the relevant neighborhood features?

- Outcome specific features and pathways

Step #2

How do we obtain information on these features?

- Survey of area residents increases feasibility and minimizes bias

Step #3

How do we create and validate neighborhood measures?

- consider psychometric and ecometric properties
- scales have good properties

Neighborhoods and Obesity

Study Population

The Multi-Ethnic Study of Atherosclerosis (MESA)

- A longitudinal study to identify risk factors for sub-clinical atherosclerosis.
 - 45-84 years
 - Diverse racial/ethnic backgrounds
 - Free from clinical CVD at baseline
- Six study sites:
 - Los Angeles, CA
 - Chicago, IL
 - Baltimore, MD
 - St. Paul, MN
 - Forsyth County, NC
 - New York, NY

Neighborhood Measures

- Factor Analysis
- Physical Environment
 - Healthy Foods
 - Walkability
- Social Environment
 - Aesthetic Quality
 - Safety
 - Violent Crime
 - Social Cohesion
- Linked to MESA participants

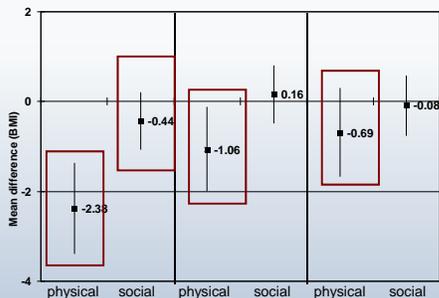
Study Measures

- Body Mass Index (BMI)
 - Height and weight measurement via examination
- Study site
- Time lived in neighborhood
- Age
- Gender
- Race/ethnicity
- Education
- Income
- Diet
- Physical Activity

Sample Characteristics

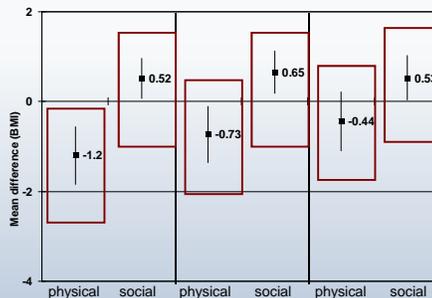
N=2865	N	Male	Female
Age	2865	63 (10)	62 (10)
Race			
Hispanic	462	16	16
Black	1205	40	44
White	1198	44	40
Education			
< H.S diploma	414	14	14
H.S diploma	584	18	23
Some college	857	26	33
College graduate+	1010	42	30
Income			
<\$24,999	584	15	25
\$25,000-\$49,999	805	24	32
\$50,000-\$74,999	871	33	28
≥\$75,000	605	28	16
BMI	2865	28.3 (4.3)	29.7 (6.3)

Neighborhood Environments and BMI in Women



Model 1: Age; Model 2: + education, income, race/ethnicity; Model 3: + diet, physical activity

Neighborhood Environments and BMI in Men



Model 1: Age; Model 2: + education, income, race/ethnicity; Model 3: + diet, physical activity

Summary

- Men and women who live in neighborhoods with better physical environments have a lower BMI, independent of sociodemographic factors
 - Mediating pathways through diet and physical activity
- Men who live in neighborhoods with worse social environments have a lower BMI, independent of sociodemographic factors and diet, and physical activity

Conclusion

- Specific features of neighborhood environments can be measured through survey approaches with good measurement properties
- Features of the physical and social environments of neighborhoods matter for health