Martin Handford, *Where´s Wally?*

Abordagens Espaciais em Estudos de População:
Métodos Analíticos e Técnicas de Representação

Parte V – Relações
População – Espaço - Ambiente

Estimativas de População e relações com outras variáveis

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Antonio Miguel V. Monteiro

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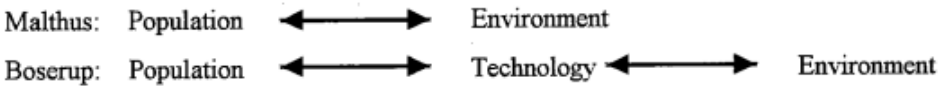
MINISTÉRIO DA CIÊNCIA E TECNOLOGIA
INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS

Abordagens Conceituais

Some Conceptual Approches to Population and Environment Relationships

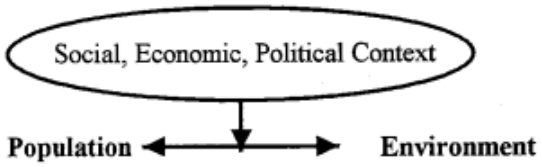
(a) Linear perspectives



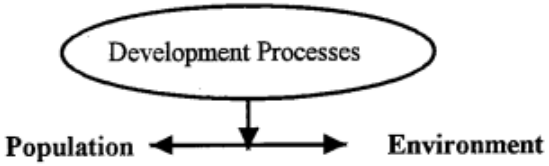
(b) Multiplicative perspective

Environment Impacts = (Population Size) (Affluence or per capita consumption) (Level of Technology)

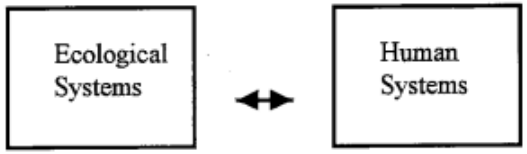
(c) Mediating perspective



(d) Development-dependency perspective



(e) Complex systems perspective



Marquette, 1997

Abordagens Conceituais

Some Conceptual Approches to Population and Environment Relationships

(a) Linear perspectives

Malthus: Population ⟷ Environment

Boserup: Population ⟷ Technology ⟷ Environment

(b) Multiplicative perspective

Environment Impacts

(c) Mediating perspective

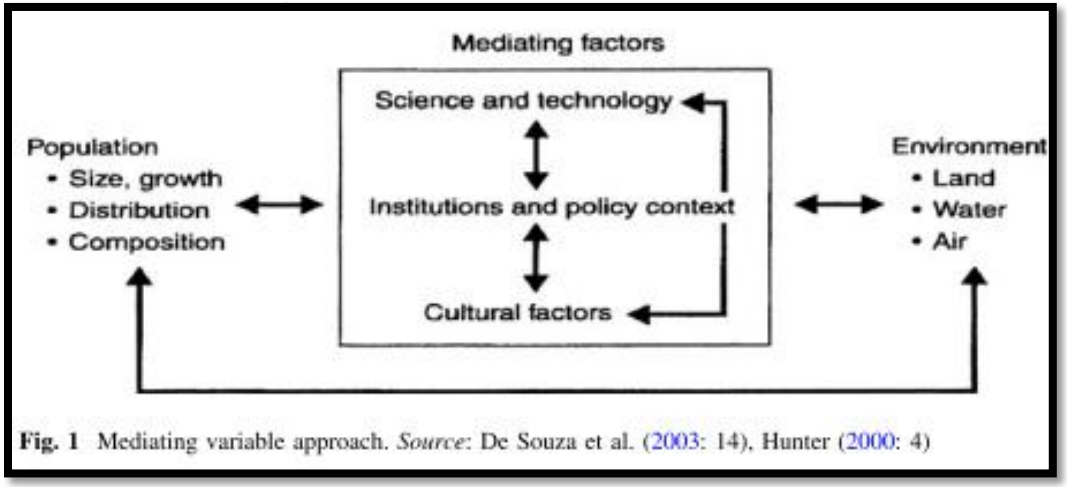
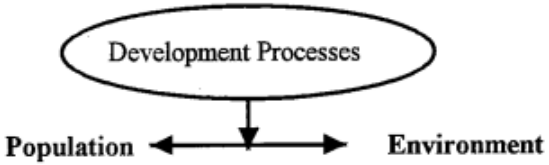


Fig. 1 Mediating variable approach. *Source*: De Souza et al. (2003: 14), Hunter (2000: 4)

(d) Development-dependency perspective



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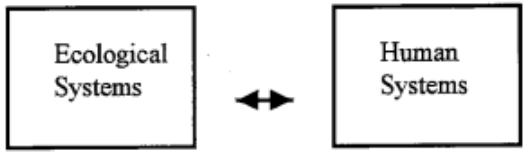

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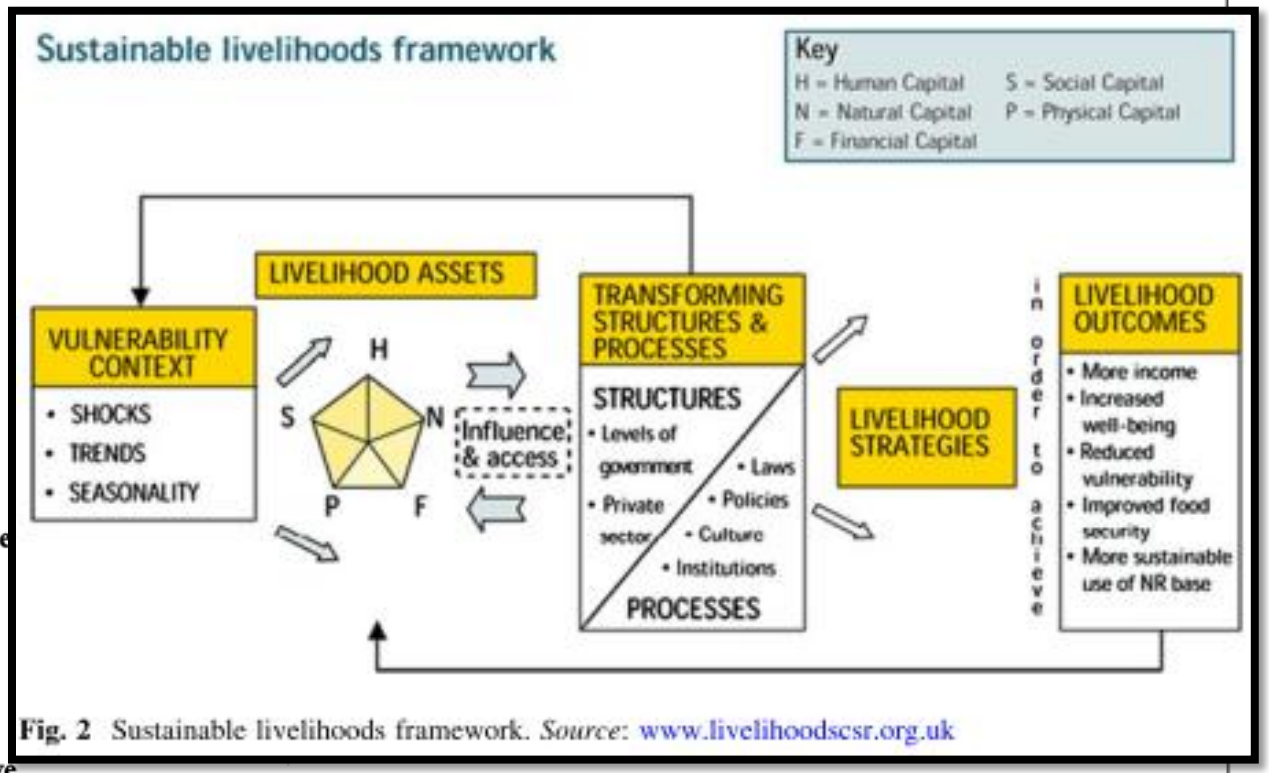
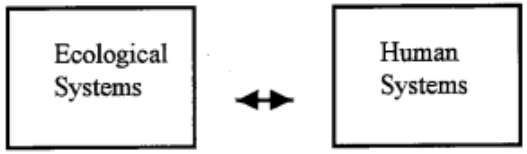


Fig. 2 Sustainable livelihoods framework. *Source*: www.livelihoodscsr.org.uk



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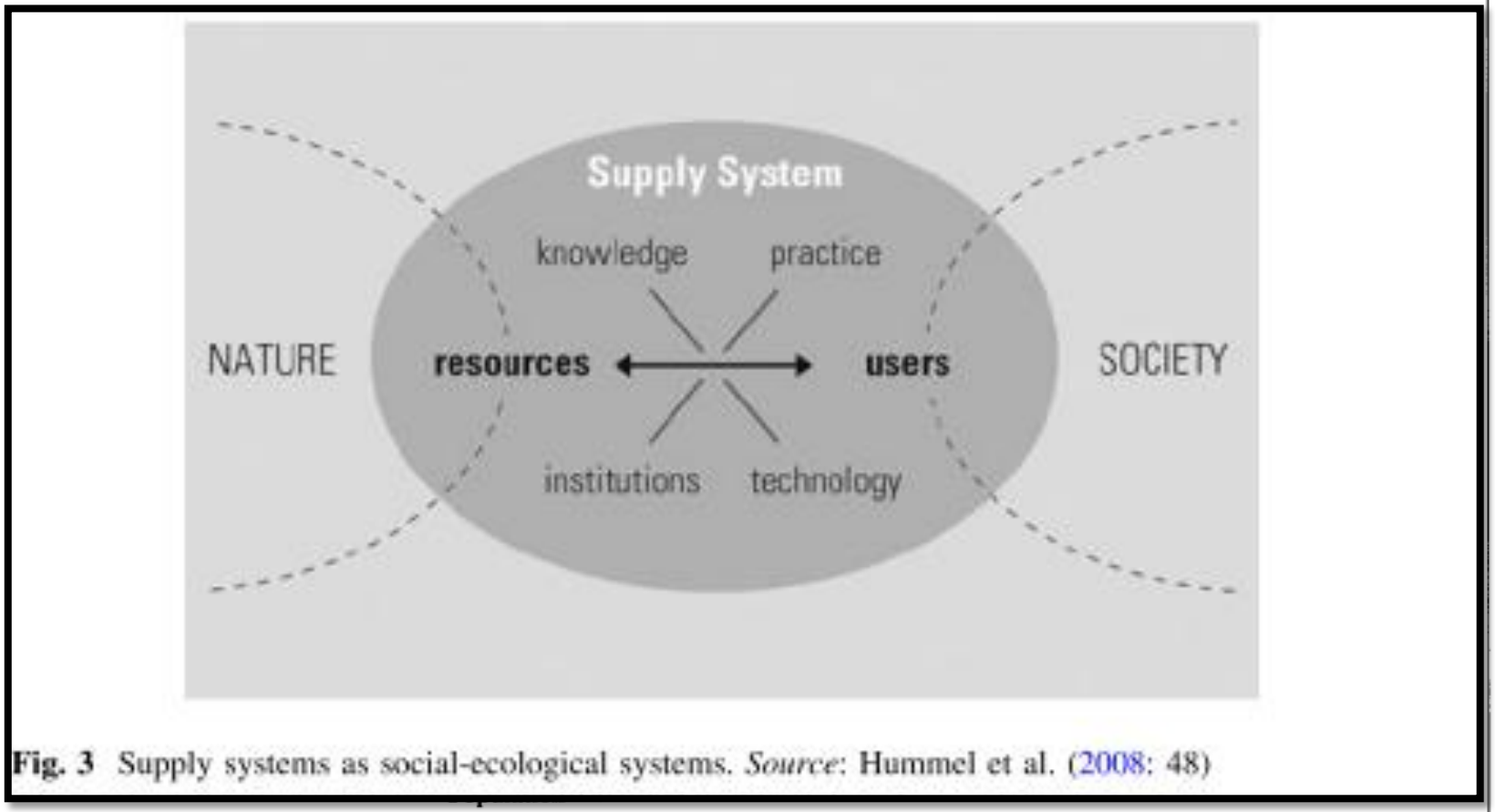
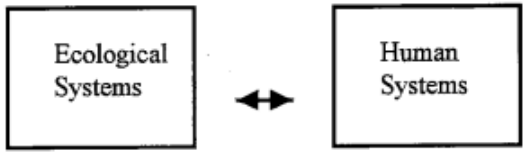


Fig. 3 Supply systems as social-ecological systems. *Source*: Hummel et al. (2008: 48)

(e) Complex systems perspective



Marquette, 1997

Relações POPULAÇÃO - ESPAÇO - AMBIENTE

THE SCIENCE OF HEALTH PROMOTION

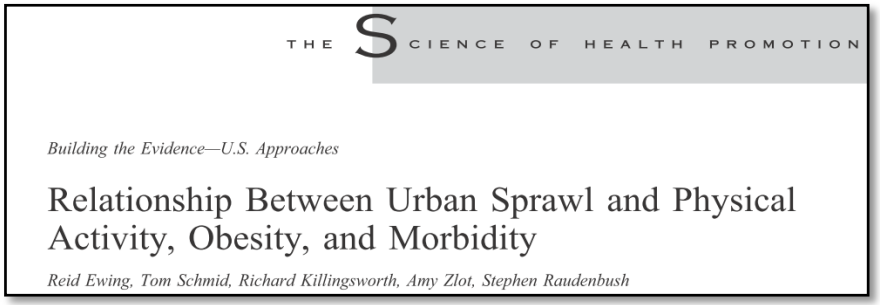
Building the Evidence—U.S. Approaches

Relationship Between Urban Sprawl and Physical Activity, Obesity, and Morbidity

Reid Ewing, Tom Schmid, Richard Killingsworth, Amy Zlot, Stephen Raudenbush

American Journal of Health Promotion, September/October 2003, Vol. 18, No. 1

Purpose. To determine the relationship between urban sprawl, health, and health-related behaviors.



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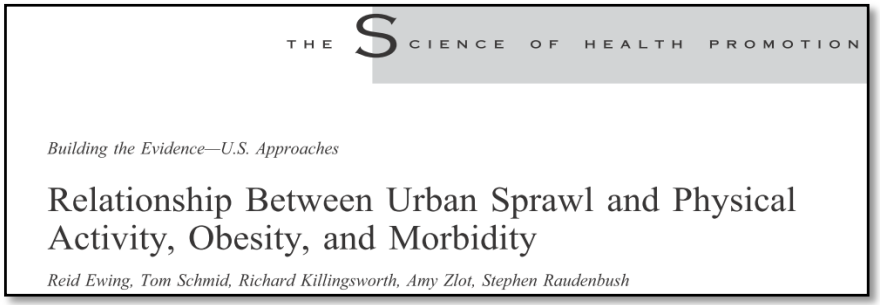
Working **hypotheses**, based on the planning and public health literature, were that:

residents of sprawling places would
(1) walk less,
(2) weigh more, and
(3) have higher prevalence of health problems linked to physical inactivity
than those living in more compact places.

These hypotheses were tested using data from the Behavioral Risk Factor Surveillance System (BRFSS) for 1998 to 2000.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Methods – Design cross-sectional and ecologic

- The degree of **sprawl** within counties or metropolitan areas was related to **levels of physical activity, obesity, body mass index (BMI), hypertension, diabetes, and coronary heart disease (CHD)** for BRFSS respondents from these particular counties or metropolitan areas.

- Hierarchical linear and nonlinear modeling (HLM) methods were used to control for covariates, such as age, race/ethnicity, and education, at the individual level while examining the effects of sprawl at the population level.

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Behavioral and health status variables extracted from BRFSS

Table 1

Sample Sizes (n), Means, and Standard Deviations (SD) for Health Behavior and Health Status Variables, 1998 to 2000*

	n for County Models With All Covariates (N = 206,992)†	n for Metropolitan Models With All Covariates (N = 175,609)	Means (SD) for County Models	Means (SD) for Metropolitan Models
Any physical activity‡	149,835	126,893	0.730 (0.444)	0.733 (0.442)
Recommended physical activity§	135,344	115,006	0.268 (0.443)	0.273 (0.445)
Minutes walked‖	147,305	124,764	247.8 (493.3)	251.2 (499.6)
Body mass index (BMI, kg/m^2)	137,263‡‡	116,779‡‡	26.06 (5.15)	26.03 (5.15)
Obesity¶	137,409‡‡	116,913‡‡	0.181 (0.385)	0.181 (0.385)
Hypertension#	85,465	68,927	0.239 (0.426)	0.235 (0.424)
Diabetes**	142,685‡‡	121,292‡‡	0.056 (0.230)	0.055 (0.228)
Coronary heart disease††	40,651	31,563	0.042 (0.201)	0.041 (0.197)

* For exact wording of Behavioral Risk Factor Surveillance System (BRFSS) questions and to see how calculated variables were determined, go to http://www.cdc.gov/brfss/calcvars.htm.

† N, initial sample before any BRFSS variables entered.

‡ Reported any leisure time physical activity in the last month.

§ Met recommended level of physical activity in the last month: Recommended amount is 30 minutes of moderately intense physical activity at least 5 days per week and/or 20 minutes of vigorously intense physical activity at least 3 days per week.

‖ Minutes walked for leisure during last month.

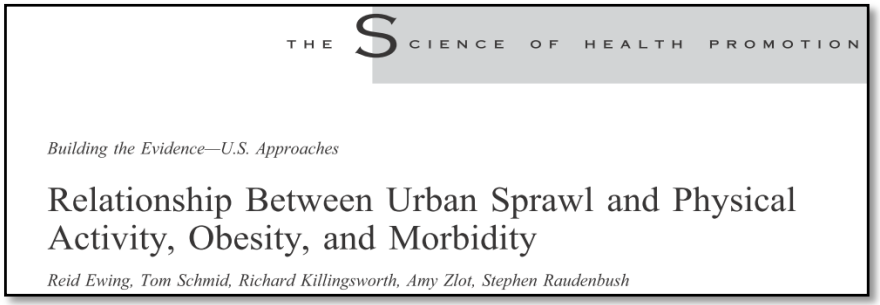
¶ BMI ≥ 30.

Ever been told had hypertension.

** Ever been told had diabetes.

†† Ever been told had coronary heart disease.

‡‡ Includes fruit and vegetable consumption as a covariate, which reduced sample size.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BRFSS

BRFSS is a population-based, random digit–dialed telephone survey administered to U.S. civilian noninstitutionalized adults aged >= 18 years. (http://www.cdc.gov/brfss/index.htm).

For the years under study, BRFSS collected data from 150,000 to 185,000 respondents in the 50 states and the District of Columbia.

Smart Growth America's metropolitan sprawl index(www.smartgrowthamerica.org).
83 metropolitan areas in the United States with a total population of more than 150 million people in 2000, over half the U.S. population, were rated in four urban form dimensions.

- *Residential density*
- *Land use mix*
- *Degree of centering*
- *Street accessibility*

The four were given equal weight in the overall index. Scores were then converted to a scale with a mean of 100 and standard deviation of 25.

The bigger the value of the index, the more compact the metropolitan region

THE SCIENCE OF HEALTH PROMOTION

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Smart Growth America's metropolitan sprawl index(www.smartgrowthamerica.org).
To a finer geographic scale ➔ a county sprawl index using a process similar to that used to develop the metropolitan sprawl index.

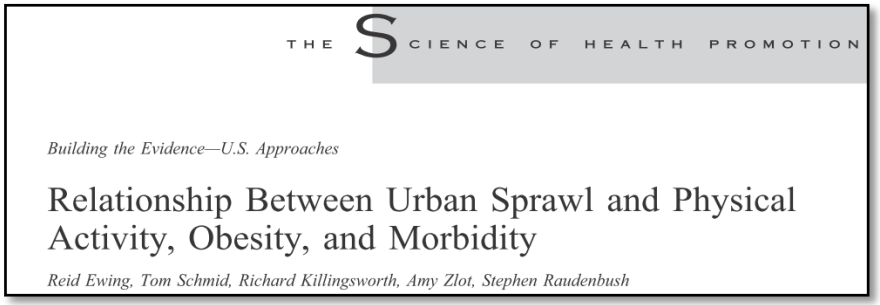
Only two of these could be measured at the county level: **low residential density** and poor street accessibility.

Table 3

County Sprawl Index Variables and Factor Loadings

Observed Variable	Factor Loading*
Gross population density in persons per square mile	0.846
% of population living at densities <1500 persons per square mile	−0.698
% of population living at densities >12,500 persons per square mile	0.846
County population divided by the amount of urban land in square miles	0.849
Average block size in square miles	−0.698
% of blocks 1/100 of a square mile or less in size (about 500 feet on a side, a traditional urban block)	0.821

* Correlation with county sprawl index.



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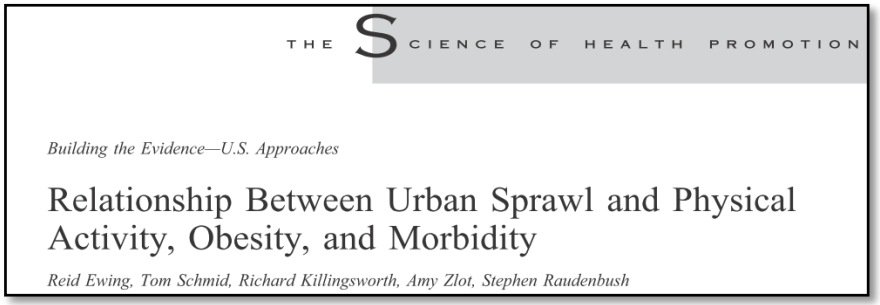
Only two of these could be measured at the county level: low residential density and **poor street accessibility**.

Data reflecting street accessibility for each county were obtained from the U.S. Census, based on information concerning block size.

For each county, we calculated (1) average block size and (2) percentage of blocks with areas less than 1/100 square mile, the size of a typical traditional urban block bounded by sides just over 500 feet in length.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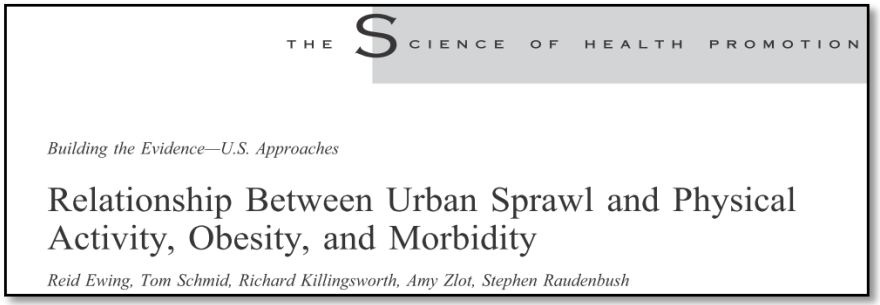
Only two of these could be measured at the county level: low residential density and **poor street accessibility**.

The six variables were combined into one factor representing degree of sprawl within the county, via **principal components analysis**.

To derive a county sprawl index, we transformed the principal component, which had a mean of 0 and standard deviation of 1, to a scale with a mean of 100 and standard deviation of 25.
This transformation produced a more familiar metric (like an IQ scale) and ensured that all values would be positive, thereby enhancing our ability to test nonlinear relationships.

The bigger the value of the index, the more compact the county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Hierarchical Linear and Nonlinear Modeling - pairs of linked statistical models.

At the first level, respondent health status or behavior were modeled within each place as a function of respondent characteristics plus a random error.

Thus, each place had a place-specific regression equation that described the association between respondent characteristics and respondent health status or behavior within that place.

At the second level, the place-specific intercept and coefficients were conceived as outcomes and were modeled in terms of place characteristics plus random effects.

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The likelihood of getting recommended levels of physical activity was related to the county index.
Residents of more compact places reporting more leisure time walking than residents of more sprawling places.

County-level Analysis - Physical Activity Outcomes.

Table 4

Relationship Between Individual Characteristics, County Sprawl Index, and Leisure Time Physical Activity, 1998 to 2000 (With Coefficients, *t*-ratios, and Significance Levels)

	Any Physical Activity			Recommended Physical Activity			Minutes Walked		
	Coefficient	*t*	*p*	Coefficient	*t*	*p*	Coefficient	*t*	*p*
Male	0.246	12.1	<0.001	0.087	4.44	<0.001	−82.5	−22.1	<0.001
Age 30 to 44	−0.396	−14.7	<0.001	−0.228	−8.17	<0.001	39.4	7.95	<0.001
Age 45 to 64	−0.596	−17.5	<0.001	−0.159	−5.68	<0.001	102.2	14.9	<0.001
Age 65 to 74	−0.639	−13.6	<0.001	0.054	1.38	0.167	139.7	16.4	<0.001
Age 75+	−1.067	−26.7	<0.001	0.187	4.78	<0.001	74.1	6.65	<0.001
Black non-Hispanic	−0.322	−10.9	<0.001	−0.176	−4.96	<0.001	4.24	0.62	0.537
Hispanic	−0.625	−14.7	<0.001	−0.217	−6.15	<0.001	−27.6	−3.58	0.001
Other race	−0.553	−9.43	<0.001	−0.276	−4.49	<0.001	−37.8	−3.26	0.001
Some college	−0.417	−13.3	<0.001	−0.226	−10.3	<0.001	−8.33	−1.66	0.097
High school graduate	−0.854	−31.8	<0.001	−0.525	−21.1	<0.001	−19.8	−3.74	<0.001
Less than high school	−1.353	−39.6	<0.001	−0.946	−20.9	<0.001	−65.3	−9.24	<0.001
Currently smoke	−0.357	−15.7	<0.001	−0.273	−11.0	<0.001	−5.65	−1.16	0.245
County sprawl index	0.000552	1.01	0.313	0.000872	1.94	0.052	0.275	2.95	0.004

The likelihood of engaging in any leisure time physical activity in the past **month was greater for males** than females **and for white non-Hispanics** than other races/ethnicities.
The likelihood **declined with age and increased with educational attainment**

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The county index was related to BMI in the expected direction and at a highly significant level.
Residents of a more compact county, one standard deviation above the mean county index, would be expected to have BMIs 0.17 kg/m^2 lower than residents of a more sprawling county, one standard deviation below the mean

County-level Analysis - Weight-related Outcomes

Table 5

Relationship Between Individual Characteristics, County Sprawl Index, and Weight, 1998 to 2000 (With Coefficients, *t*-ratios, and Significance Levels)

	Body Mass Index			Obesity		
	Coefficient	*t*	*p*	Coefficient	*t*	*p*
Male	1.190	22.4	<0.001	0.0535	2.07	0.038
Age 30 to 44	1.696	27.7	<0.001	0.578	16.0	<0.001
Age 45 to 64	2.547	43.0	<0.001	0.852	24.2	<0.001
Age 65 to 74	1.995	23.5	<0.001	0.574	12.3	<0.001
Age 75+	0.517	6.29	<0.001	0.0542	0.98	0.327
Black non-Hispanic	1.604	20.1	<0.001	0.563	17.5	<0.001
Hispanic	0.744	8.71	<0.001	0.308	6.45	<0.001
Other race	−1.075	−10.2	<0.001	−0.448	−7.32	<0.001
Some college	0.818	14.7	<0.001	0.397	13.7	<0.001
High school graduate	1.102	17.9	<0.001	0.520	17.0	<0.001
Less than high school	1.693	19.7	<0.001	0.758	17.4	<0.001
Currently smoke	−0.985	−16.6	<0.001	−0.381	−11.4	<0.001
Fruit/vegetable consumption	−0.327	−7.54	<0.001	−0.154	−5.94	<0.001
County sprawl index	−0.00344	−2.84	0.005	−0.00212	−4.24	<0.001

BMI was **higher for males** than females; **increased with age up to middle age** (45 to 64 years), and then declined; was **higher for blacks and Hispanics** than for whites and lower for other races (primarily Asian); was **higher for the less educated** relative to the college educated; **was lower for smokers** than nonsmokers; and was **lower for those who consume three or more servings of fruits and vegetables daily**

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Metropolitan-level Analysis

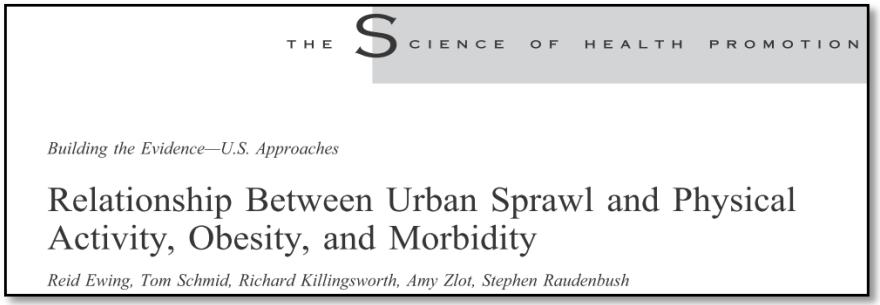
The metropolitan sprawl index proved significantly related to only one outcome variable, **minutes walked** as a leisure time activity

Table 9

Comparison of Relationships of County and Metropolitan Sprawl Indices to Leisure Time Physical Activity, Obesity, and Morbidity Outcomes, 1998 to 2000*

	County Index			Metropolitan Index		
	Coefficient	*t*	*p*	Coefficient	*t*	*p*
Any physical activity	0.000552	1.01	0.313	0.000760	0.83	0.411
Recommended physical activity	0.000872	1.94	0.052	0.00141	1.49	0.139
Minutes Walked	0.275	2.95	0.004	0.338	2.09	0.040
BMI	−0.00344	−2.84	0.005	−0.00142	−1.03	0.307
Obesity	−0.00212	−4.24	<0.001	−0.000800	−1.02	0.312
Hypertension	−0.00119	−2.37	0.018	−0.000325	−0.49	0.626
Diabetes	−0.000586	−1.32	0.187	−0.000400	−0.60	0.548
Coronary heart disease	−0.000113	−1.82	0.069	na		

* Models included gender, age, race, education, and smoking status as level-1 covariates. Models for body mass index (BMI), obesity, and diabetes also included fruit and vegetable consumption.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Discussion

This ecologic study reveals that **urban form** could be significantly associated with some forms of **physical activity and with some health outcomes**.

The **county sprawl index** had small but **significant associations** with minutes walked, obesity, BMI, and hypertension.

Those living in sprawling counties were likely to walk less, weigh more, and have greater prevalence of hypertension than those living in compact counties.

Relationships **are stronger for the county index** than for the larger scale **metropolitan** index. → The county environment might be more representative of what is actually experienced on a day-to-day basis by residents than is the overall metropolitan environment

This study is **exploratory** and subject to important **limitations** that call for additional research

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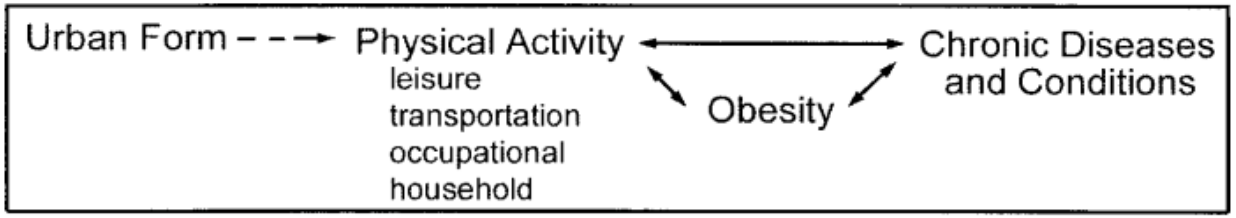
Discussion

Figure 1

Established (Solid) and Speculative (Dashed) Relationships



Combined with other research from public health and urban planning, there is moderate support for the assertion that urban form can have significant (positive or negative) influences on health and health-related behaviors.

If this assertion holds true, health practitioners **can improve public health by advocating for more compact development patterns.**

Public health researchers can **refine** their understanding of physical activity, obesity, and morbidity by including urban form variables in their analyses.

Relações POPULAÇÃO - ESPAÇO - AMBIENTE

- Segurança Alimentar
- Saúde
- Segurança (criminalidade)
- Qualidade (e expectativa)de vida

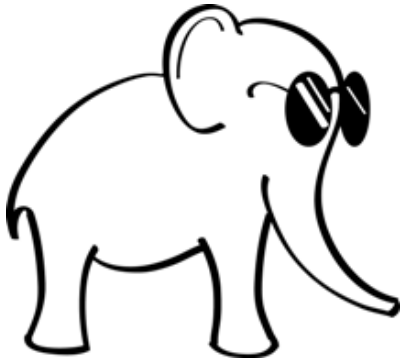
- Desigualdade e Diversidade
- Sustentabilidade (Consumo)
- Desastres

- Recursos Naturais
- Biodiversidade
- Serviços ecossistêmicos
- Mudanças Climáticas

A cadeira de Van Gogh por Vincent van Gogh

PE analysis as a “chair with four legs”:
population dynamics,
environmental dynamics,
and the **influences** of each on the other.

Frederick A.B. Meyerson, Population and Environment: Methods of Analysis
Wolfgang Lutz, Alexia Prskawetz, & Warren C. Sanderson (Eds.)
New York: Population Council, 2002. 251 pages.



https://blog.qualys.com/securitylabs/2015/09/16/blindelephant-then-and-now

P-E research remains an elephant described by a blind committee—but it is a powerful, complex beast that science and policy would be foolish to neglect or ignore

(Frederick A.B. Meyerson)

Frederick A.B. Meyerson, Population and Environment: Methods of Analysis
Wolfgang Lutz, Alexia Prskawetz, & Warren C. Sanderson (Eds.)
New York: Population Council, 2002. 251 pages.