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Ego-centered neighborhood socioeconomic characteristics and obesity: revisiting the analyses in the RECORD Cohort Study using propensity score matching techniques

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RECORD

Introduction

- Raising prevalence of obesity in France
- Obesity and environmental changes
- Unequal socio-spatial distribution
- Many studies around the world identified many neighborhood predictors, but specially with cross-sectional designs
- Neighborhood socioeconomic effects adjusted for individual socioeconomic characteristics: valid inference?

Introduction

- Propensity score matching technique
  - Mimic experimental design
  - Alternative to standard multivariable adjustment
  - To ensure that adjustment of regression models for individual self-selection factors is not based on excessive extrapolations
  - To be able to compare “exchangeable” participants having a comparable probability of exposure to different socioeconomic environments based on their individual socioeconomic characteristics

Objectives

- Study the relationships between neighborhood socioeconomic characteristics and obesity outcomes
  - Ego-centered neighborhood socioeconomic variables
  - Spatial-scale analyses
  - Traditional approach and an alternative one, using propensity score matching (PSM)
  - Compare results obtained from these two different approaches

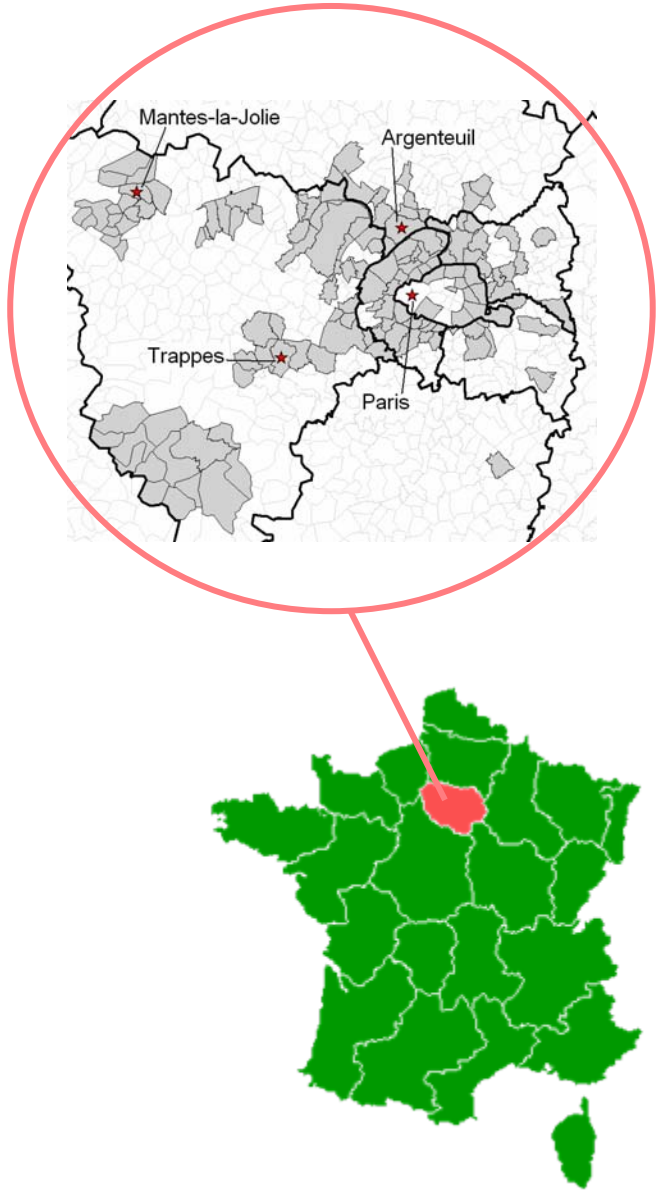
Methods

- **RECORD Cohort Study**:

1st wave (2007-2008)

  - 7292 participants living in 111 municipalities from Paris region and 10 districts from Paris.
  - 1915 neighborhoods
  - Sample:

30 - 79 years old adults



Methods

- **Data source:**

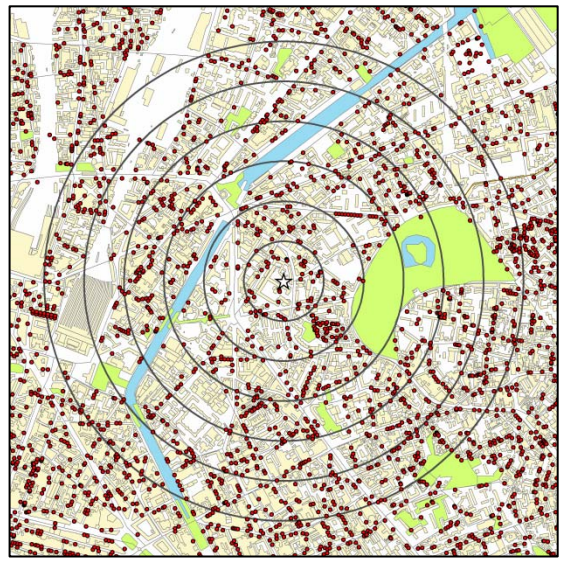
- Medical examinations: Body Mass Index (BMI) and Waist Circumference (WC)

- Individual demographic data:
  - Age
  - Gender
  - Human Development Index of the country of birth
  - Individual and maternal education
  - Individual income
  - Employment status

Methods

- **Data source:**

- Census data geocoded at the building level
- Neighborhood socioeconomic variables
  - Education level (Insee data)
  - Income (Insee data)
  - Estate prices (Notary data)
- Geographic Information Systems
  - Buffers: 100, 250, 500,1000, 5000, and 10000m around each participant's residence



Methods

- **Analytic strategy:**
  - Linear multilevel models

- **Propensity score matching:**
  - Modeling the odds of living in the lowest quartile of socioeconomic neighborhood status as a function of *age, gender, income, education, mother education, employment status, and Human Development Index (HDI) of the country of birth* (propensity score).
  - Matching of high and low socioeconomic neighborhood residents using the propensity score
  - Regression models to estimate differences in BMI and WC between lowest and highest socioeconomic status neighborhoods were rerun using the propensity score matched pairs table

Results

Results

- **Sensitivity scale analyses for BMI (in kg/m^2)**

Level	100m buffer AIC = 40528.6		250m buffer AIC = 40514.8		500m buffer **AIC = 40511.4**	
	BMI	**CI**	**BMI**	**CI**	**BMI**	**CI**
High	0.00	–	0.00	–	0.00	–
M-high	-0.09	-0.35 – 0.17	0.25	-0.01 – 0.53	0.20	-0.07 – 0.47
M-low	0.35	0.07 – 0.63	0.36	0.08 – 0.64	0.39	0.10 – 0.68
Low	**1.05**	0.74 – 1.35	**1.32**	1.01 – 1.63	**1.35**	1.04 – 1.66

Level	1000m buffer AIC = 40533.2		5000 buffer AIC = 40547.1		10000 buffer AIC = 40564.0	
	BMI	**CI**	**BMI**	**CI**	**BMI**	**CI**
High	0.00	–	0.00	–	0.00	–
M-high	0.15	-0.12 – 0.44	0.11	-0.17 – 0.40	-0.10	-0.40 – 0.18
M-low	0.43	0.14 – 0.72	0.47	0.17 – 0.77	0.14	-0.15 – 0.43
Low	**1.16**	0.85 – 1.48	**1.01**	0.68 – 1.32	**0.68**	0.36 – 0.99

Models adjusted for age, age squared, gender, center of examination, HDI of the country of birth, individual education level, and maternal education level.

Results

- **Sensitivity scale analyses for WC**

Level	100m buffer AIC = 53365.0		250m buffer AIC = 53359.3		500m buffer **AIC = 53356.7**	
	WC	**CI**	**WC**	**CI**	**WC**	**CI**
High	0.00	–	0.00	–	0.00	–
MH	0.01	-0.70 – 0.73	0.38	-0.34 – 1.11	0.32	-0.42 – 1.06
ML	0.86	0.11 – 1.60	0.72	-0.03 – 1.47	0.67	-0.09 – 1.43
Low	**2.80**	1.99 – 3.62	**3.09**	2.26 – 3.91	**3.14**	2.31 – 3.97

Level	1000m buffer AIC = 53370.8		5000 buffer AIC = 53388.4		10000 buffer AIC = 53407.4	
	WC	**CI**	**WC**	**CI**	**WC**	**CI**
High	0.00	–	0.00	–	0.00	–
MH	-0.09	-0.84 – 0.65	0.38	-0.38 – 1.14	-0.03	-0.81 – 0.74
ML	0.68	-0.08 – 1.45	1.14	0.36 – 1.92	0.11	-0.66 – 0.89
Low	**2.65**	1.81 – 3.49	**2.37**	1.53 – 3.21	**1.39**	0.56 – 2.22

Models adjusted for age, age squared, gender, center of examination, HDI of the country of birth, individual education level, and maternal education level.

Results

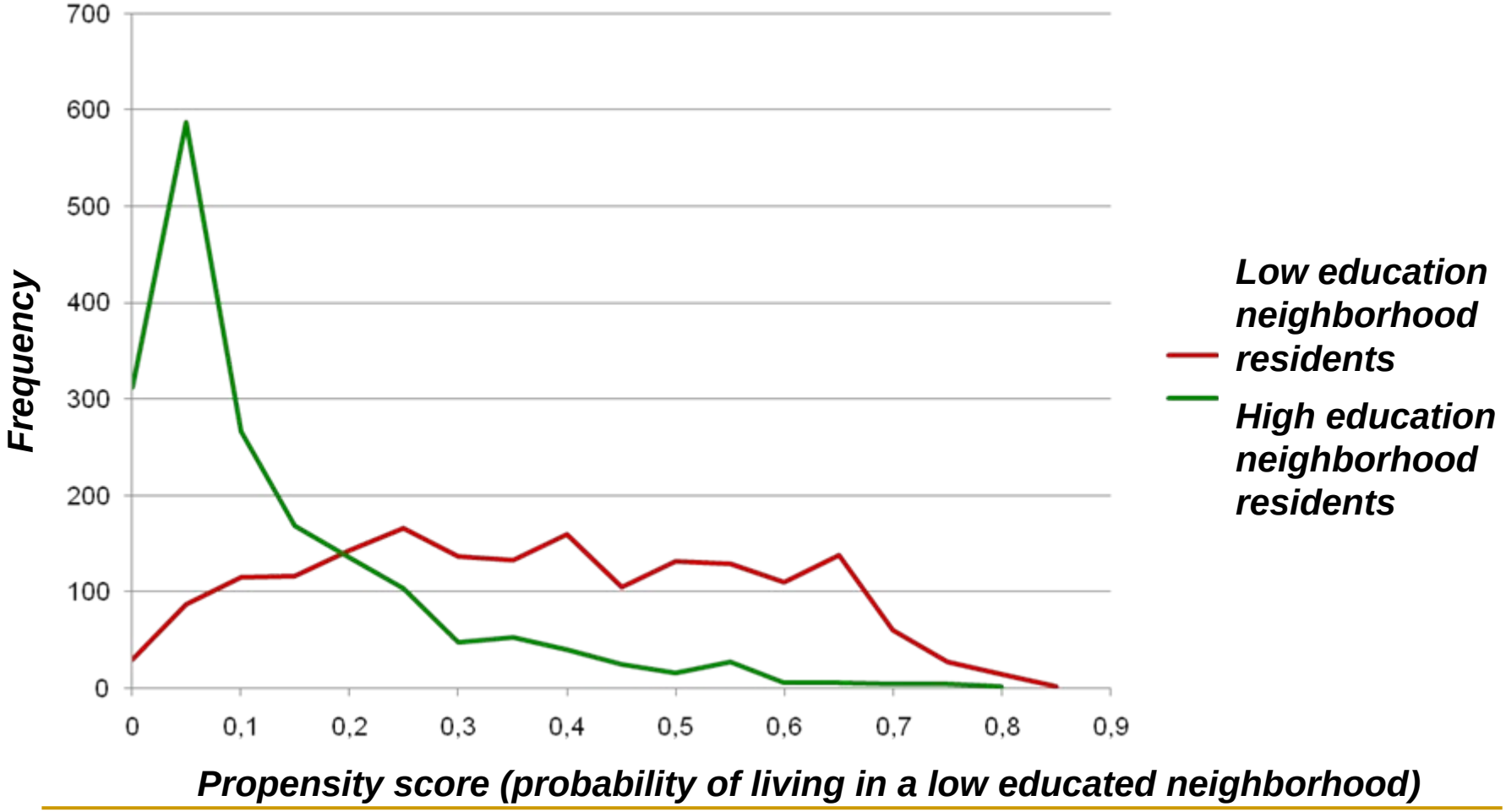
- **Multilevel linear models for BMI and WC (500m buffer variables)**

Variables	BMI (kg/m²)	*CI*	WC (cm)	*CI*
Neighborhood education level				
High	0.00	-	0.00	-
Medium-high	+0.20	(-0.07; +0.47)	+0.32	(-0.42; +1.06)
Medium-low	+0.39	(+0.10; +0.68)	+0.67	(-0.09; +1.43)
Low	+1.35	(+1.04; +1.66)	+3.14	(+2.31; +3.97)
Neighborhood estate prices				
High	0.00	-	0.00	-
Medium-high	+0.01	(-0.27; +0.29)	-0.01	(-0.76; +0.74)
Medium-low	+0.22	(-0.06; +0.52)	+0.71	(-0.05; +1.49)
Low	+0.59	(+0.28; +0.89)	+1.18	(+0.36; +2.00)
Neighborhood median income				
High	0.00	-	0.00	-
Medium-high	-0.10	(-0.18; +0.38)	-0.07	(-0.83; +0.67)
Medium-low	+0.28	(-0.01; +0.57)	+0.59	(-0.17; +1.37)
Low	+0.86	(+0.54; +1.17)	+1.76	(+0.93; +2.59)

Models adjusted for age, age squared, gender, center of examination, HDI of the country of birth, individual education level, and maternal education level.

Results

- The overlap in our sample in terms of PS for living in a low education neighborhood: low vs. high neighborhoods



Results

- Using PSM, in our French population, the sample was reduced by 40-50%, and comparable coefficients were observed

Linear multilevel models for BMI and WC, comparing the results using traditional and PSM method approach.

Variables	BMI (kg/m²)	*CI*	WC (cm)	*CI*
Neighborhood education level				
Traditional approach				
High	0.00	-	0.00	-
Low	**+1.36**	(+1.04; +1.66)	+3.14	(+2.31; +3.97)
Propensity score matching				
High	0.00	-	0.00	-
Low	**+1.58**	(+1.14; +2.02)	+3.12	(+1.99; +4.25)

Models adjusted for age, age squared, gender, center of examination, HDI of the country of birth, individual education level, and maternal education level.

Discussion

- A buffer scale around 500m was the best in reflecting associations between neighborhood factors and BMI/WC.
- Living in a disadvantaged neighborhood was associated with an increased BMI and WC even after adjustment for individual socioeconomic characteristics.
- Neighborhood education level showed the strongest associations with obesity outcomes compared with income and estate prices.

Discussion

- Propensity score matching techniques is an useful approach
  - Reducing selection bias in cross-sectional studies
  - Run analyses among exchangeable participants
  - “On-support” inference : based on real data

- Limits
  - Choice of variables used for constructing the PS
  - Do not solve residual confounding issues

Ongoing work

- Incorporate other dimensions of neighborhood environments
  - Data: Services, physical and social characteristics

Number of supermarkets
Number of grocery stores
Number of fruit/vegetables stores
Total number of restaurants
Number of fast-foods
Total number of sports equipments
Diversity of equipments
Number of services
Number of transport lines
Number of medical offices
Number of pharmacies

Building volume
Alpha index
Gamma index
Connectivity
Density of intersections
Street density
Number of historical monuments
Surface proportion covered by water
Surface proportion with parks or green spaces

Social cohesion
Insecurity
Stigmatization
Social disorder

Leal, C; Chaix, B. Obesity Reviews (2010)

Thank you

Merci

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