Environmental sprawl and weight status: The paradox of obesity in the food desert.

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Abstract

Restricted access to healthy foods, including fresh fruits and vegetables (FFV), is a primary factor in the development of obesity. One previously underexplored measure of access is sprawl, which incorporates complex components of an area's overall accessibility. This cross-sectional study employed secondary data analysis to quantitatively examine the role of sprawl on obesity and FFV consumption as measured by Body Mass Index (BMI) among a nationally representative sample (n=122,265). Obesity and FFV intake differed significantly by race, education, income, and perceptions of food security. Mutivariate analyses demonstrated that residents of more sprawling areas had significantly higher obesity rates and consumed significantly less FFV than residents of less sprawling areas. Given that low-income populations experience greater barriers to healthful foods and experience a disparate burden of obesity, future research should further explore causal linkages between the environment, BMI, and FFV access.

Literature Review

Barriers to healthy food access include having few or no grocery stores that stock FFV, inundation of fast food outlets or corner stores as the only locations to purchase food, transportation disadvantages (no personal vehicle or public transit system available), or limited incomes (Cotterill & Franklin, 1995; Glanz, Sallis, Saelens & Frank, 2007; Hendrickson, Smith & Eikenberry, 2006; Jetter & Cassady, 2006; Moore & Diez-Roux, 2006). Minority, poor, and otherwise under-resourced communities share a disproportionate burden of lack of access to FFV as well as increased rates of obesity (Glanz et al., 2007; Giang, Karpyn, Laurison, Hillier, & Perry, 2008; Lewis, Sloane, Nascimento, Diamant, Guinyard, Yancey, et al., 2005). Literature exploring the effects of the food environment on obesity and FFV intake, particularly with poor and minority populations, includes diverse measurement strategies, including using geospatial analysis to measure proximity or density of retailers, in-store audits to assess food selection, variety, quality, and price, or respondent-based methods to measure residents' perceptions of their food environment (Caspi et al., 2012). While available studies have gleaned valuable insight into the relationship between the food environment and FFV, these studies often examine single dimensions of areas, such as miles from home to grocery store or store density, which may not consider peoples' complex decision-making processes about purchasing fresh fruits and vegetables (Caspi et al., 2012; Charreire et al., 2010). The construct of sprawl, used in this study, incorporates more complex components of an area's overall accessibility (Ewing et al., 2006).

Methods

The cross-sectional design employed secondary data analysis to quantitatively examine the role of sprawl on obesity and FFV. The analyses included descriptive measures and regression models to estimate the hypothesized predictive effect of sprawl on BMI and FFV. The study utilized the Behavioral Risk Factor Surveillance System for BMI, FFV, and demographic variables merged with Ewing's County Sprawl Index as a measure of sprawl (n=122,265).

Results

BMI and FFV intake differed significantly by education, race, and income. Those with less education, lower incomes, and minorities had higher BMIs and consumed less FFVs.

Category	BMI Median	BMI Mean	S.E. Mean	S.D.
Total Sample	**26.5**	**27.3**	**.058**	**5.83**
Educational Level				
Not H.S. Grad	27.5	28.4	.208	6.35
H.S. Grad	26.9	27.8	.126	6.14
Some College	26.6	27.8	.121	6.17
College Grad	25.8	26.6	.080	5.18
F (2756, 100940568) = 3978.16, p = .000 [1]				
Race/Ethnicity				
White (non-Hispanic)	26.1	27.0	.071	5.58
Black (non-Hispanic)	28.0	29.0	.187	6.52
Other race (non-Hisp)	24.4	25.2	.186	4.90
Multi-racial (non-Hisp)	26.6	28.2	.559	7.01
Hispanic	27.4	28.1	.144	6.01
F (2756, 100940568) = 4517.95, p = .000 [2]				
Annual Income				
Less than $10,000	26.8	28.3	.365	8.05
$10,001- 14,999	26.6	28.0	.326	7.03
$15,000 - $19,999	27.3	28.1	.263	6.63
$20,000 - $24,999	26.9	27.9	.226	6.18
$25,000 - $34,000	26.6	27.7	.190	5.95
$35,000 - $49,999	26.6	27.5	.158	5.78
$50,000 - $74,000	26.6	27.5	.144	5.69
More than $75,000	25.8	26.7	.081	5.04
F (2756, 100940568) = 4717.81, p = .000 [3]				

Category	FFV Median	FFV Mean	S.D	S.E. Mean
Total Sample	**3.43**	**3.74**	**1.99**	**.020**
Educational Level				
Not H.S. Grad	3.00	3.38	2.11	.073
H.S. Grad	3.08	3.40	1.95	.041
Some College	3.32	3.66	1.97	.040
College Grad	3.75	4.05	1.95	.031
F (1024, 95304439) = 6126.59, p = .000				
Race/Ethnicity				
White (non-Hispanic)	3.50	3.80	1.94	.025
Black (non-Hispanic)	3.21	3.59	2.13	.063
Other race (non-Hisp)	3.86	3.98	1.97	.078
Multi-racial (non-Hisp)	3.57	3.86	2.06	.170
Hispanic	3.10	3.49	2.04	.051
F (1024, 95304439) = 4339.21, p = .000				
Annual Income				
Less than $10,000	2.96	3.40	2.19	.104
$10,001- 14,999	2.96	3.34	2.08	.100
$15,000 - $19,999	3.17	3.56	2.12	.088
$20,000 - $24,999	3.21	3.56	2.02	.076
$25,000 - $34,000	3.29	3.54	1.99	.066
$35,000 - $49,999	3.37	3.67	1.97	.055
$50,000 - $74,000	3.43	3.74	1.91	.049
More than $75,000	3.64	3.95	1.94	.032
F (1024, 95304439) = 5353.85, p = .000				

Sprawl emerged as a significant predictor of obesity and FFV, net of other variables.

		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	29.35	.628		4672.616	.000
	Pacific	-.943	.605	-.063	-156.145	.000
	Mountain	-.898	.666	-.036	-133.713	.000
	W.N. Central	-.418	.683	-.016	-61.245	.000
	E. N. Central	-.459	.613	-.025	-75.000	.000
	Mid-Atlantic	-1.115	.617	-.059	-180.887	.000
	New England	-.991	.737	-.031	-134.613	.000
	South Atlantic	-.858	.607	-.049	-141.455	.000
	West South Central	-.421	.622	-.022	-67.776	.000
	Physical Activity	-1.220	.202	-.095	-605.343	.000
	Less than $10,000	.032	.408	.001	8.047	.000
	$10,001- $14,999	-.076	.407	-.003	-18.772	.000
	$20,000 - $24,999	.258	.370	.013	69.872	.000
	$25,000 - $34,000	-.060	.349	-.003	-17.212	.000
	$35,000 - $49,999	-.145	.325	-.009	-44.611	.000
	> $50,000	.036	.312	.002	11.572	.000
	Some College	.105	.222	.008	47.489	.000
	Didn't Graduate H.S.	.352	.295	.021	119.810	.000
	Other Race	-1.690	.483	-.056	-349.902	.000
	Multi Racial	1.373	.783	.027	175.305	.000
	Hispanic	.570	.270	.039	211.105	.000
	Black	1.42	.293	.082	487.692	.000
	FFV Daily	-.000	.000	-.030	-190.253	.000
	Sprawl	-.975	.004	-.047	-260.038	.000

The predictor variables do not explain a large proportion of variance in BMI scores individually or when considered together. While the results indicate a weak inverse relationship between sprawl and BMI scores (lower the sprawl score, the higher the BMI score) and a weak positive relationship between sprawl and number of FFV servings consumed daily (as sprawl score increases, fruit and vegetable consumption increases), the mechanisms through which these relationships occur cannot be answered with these data.

Conclusion

This study contributes to the current knowledge base by identifying sprawl as a significant predictor of BMI and FFV consumption net of demographic and economic covariates. Future research should incorporate more sophisticated multi-level modeling techniques to examine how multiple characteristics in an individual's environment simultaneously may influence obesity and fresh fruit and vegetable consumption.

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