

More Active Living-oriented County and Municipal Zoning is Associated with Increased Adult Physical Activity—United States, 2011

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BACKGROUND

The *Community Guide* recommends the following environmental and policy approaches to increase physical activity

Environmental Policy Approach	Strategies
Enhanced School-based Physical Education	Increase # of minutes spent in MVPA
Community-Scale and Urban Design Land Use Policies	Mixed use, street connectivity, aesthetics and safety
Street-Scale Urban Design Land Use Policies	Roadway design standards, traffic calming, safe street crossings, street lighting
Transportation and Travel Design Policies and Practices	Facilitating walking, biking, public transportation use, reducing car use

Zoning and its relationship to public health

- Zoning/land use laws are exercises of the states' police powers under the 10th Amendment
 - States grant authority to county/municipal governments to promote the health, safety, morals, and general welfare of their citizenry
- Zoning/land use laws can **include provisions for structural improvements to increase opportunities for physical activity** such as provisions requiring:
 - Sidewalks; bicycle infrastructure (lanes, parking, signage); trails; open space/parks; mixed use; street connectivity

Zoning Code Reforms

- Potential policy strategy for reducing sprawl, reliance on cars, and increasing physical activity (PA) opportunities.¹⁻³
- Seek to create pedestrian-friendly neighborhoods
 - Increased street connectivity, mixed-use and higher density, open space, transportation infrastructure, and a traditional neighborhood structure.¹⁻³

(1) Schilling J, Linton LS. The public health roots of zoning: In search of active living's legal genealogy. *Am J Prev Med.* 2005;28:96-104.

(2) Schilling J, Mishkovsky N. *Creating a Regulatory Blueprint for Healthy Community Design: A Local Government Guide to Reforming Zoning and Land Development Codes.* E-43346. 2005. Washington, D.C., ICMA.

(3) American Planning Association. *Planning and Urban Design Standards.* 1st ed. Hoboken, NJ: John Wiley & Sons, Inc., 2006.



Code Reform Examples

- Form-based codes (FBC)
 - Development by “right”
 - Focus on pedestrian accessibility; legalize compact, mixed-use and walkable dev. (compared to traditional Euclidian zoning)
 - **SmartCode** (Duany & Plater-Zyberk, 2005)—the *Transect*—a type of FBC
- Traditional neighborhood dev. (TND)
- Pedestrian-oriented dev./districts (POD)
- Transit-oriented districts (TOD)

Study Objective



- To examine whether population-level exposure to zoning code reforms and/or active living-oriented zoning provisions is associated with adult physical activity (PA) behaviors:
 - Biking
 - Vigorous biking
 - Walking
 - Running/jogging
 - Vigorous running/jogging

METHODS

Zoning Code Collection and Coding

- Zoning codes compiled via Internet/teleph. FU
 - 96 most populous US counties** (covering ~40% US population)
 - 1,274 municipal jurisdictions** located in those counties that represented at least 0.5% of the given county population
- Zoning codes evaluated by trained MUPP coders using an in-depth coding tool developed by the study team for this study

ZONING DISTRICT CATEGORIES PRESENT		Yes	No	Community Districts Coded								
1. CODE REFORM CATEGORY		1	0									
2. COMMERCIAL DISTRICTS CATEG		Category Present?										
3. MIXED USE DISTRICTS CATEGORY		Y	N									
4. PARK, REC, OPEN SPACE DISTRICT												
5. PLANNED UNIT DEVELOPMENT (P												
6. PUBLIC, CIVIC, GOV'T DISTRICTS C												
7. RESIDENTIAL DISTRICTS CATEGOR												
8. GENERAL ZONING PROVISIONS												
				Addressed?		Strength			Type of Use			
				Yes	No	Req	Enc	No	Mixed	Allow	Prohib	None
1. Code Reform Category												
A. Sidewalks				1	0	2	1	0	-	-	-	-
B. Crosswalks				1	0	2	1	0	-	-	-	-
C. Bike-Pedestrian Connectivity				1	0	2	1	0	-	-	-	-
D. Street Connectivity				1	0	2	1	0	-	-	-	-
E. Bike Lanes				1	0	2	1	0	-	-	-	-
F. Bike Parking				1	0	2	1	0	-	-	-	-
G. Bike-Pedestrian Trails-Paths				1	0	2	1	0	-	1	-	0
H. Other Walkability				1	0	2	1	0	-	-	-	-
I. Mixed Use				1	0	2	1	0	2	1	-1	0
J. Active Recreation				1	0	2	1	0	-	1	-	0
K. Passive Recreation				1	0	2	1	0	-	1	-	0

 Districts
 Markers 

Zoning Markers/Variables

- Code reform zoning OR
- Zoning code **requirements** for (each is a separate measure):
 - Sidewalks
 - Crosswalks
 - Bike-ped connectivity
 - Street connectivity
 - Bike lanes
 - Bike parking
 - Bike-ped trails/paths
 - Other walkability
 - Mixed use
 - Active recreation
 - Passive recreation

County-level Zoning Measure Construction

- For each municipal jurisdiction and zoning variable, created population-weighted measure: **zoning measure (0/1) * %age county population**
- County-aggregated zoning measure: **\sum pop. weighted municipal zoning measure (for each zoning measure)**
 - Continuous measure ranging from 0-1 (1=all localities in the county exposed to the measure; 0.5=50% of the localities in the county exposed to measure)
- For example, city A is located in county B
 - City A's population represents 10% of county B's population
 - City A had code reform zoning (=1)
 - City A code reform variable coding (=1) * 0.10=0.10 for code reform variable
 - Population-weighted muni code reform variables summed across county B to derive a population-weighted county-aggregated measure of code reform zoning within the county

Adult PA and Contextual Data

- **Individual-level adult PA behaviors** obtained from the 2011 Behavioral Risk Factor Surveillance System (BRFSS)
 - Included **57,585 adults** residing in the 96 counties of interest and with individual controls
 - PA measures constructed from self-reported measures of “minutes” of doing each of the following: **biking, vigorous biking, walking, run/jog, vigorous run/jog**
- **Self-reported individual (BRFSS) controls:** Race/ethnicity, gender, marital status, children present in home, age squared, education, income categorization, BMI
- **County controls (ACS 2008-2012 5-year estimates):** % families with children living in poverty, % NH White, % NH Black, % Hispanic, MHH income, median age, region, walkability scale

Analyses

- Zoning data lagged onto BRFSS data for analyses
- Linked using state and county geocodes
- Multivariate logistic regression models, controlling for individual and county controls, clustered on county with robust standard errors to predict odds of PA behaviors
- All analyses conducted using STATA SE v. 13.0.1

RESULTS AND IMPLICATIONS

Sample Characteristics (n=57,585)

(survey-weighted)

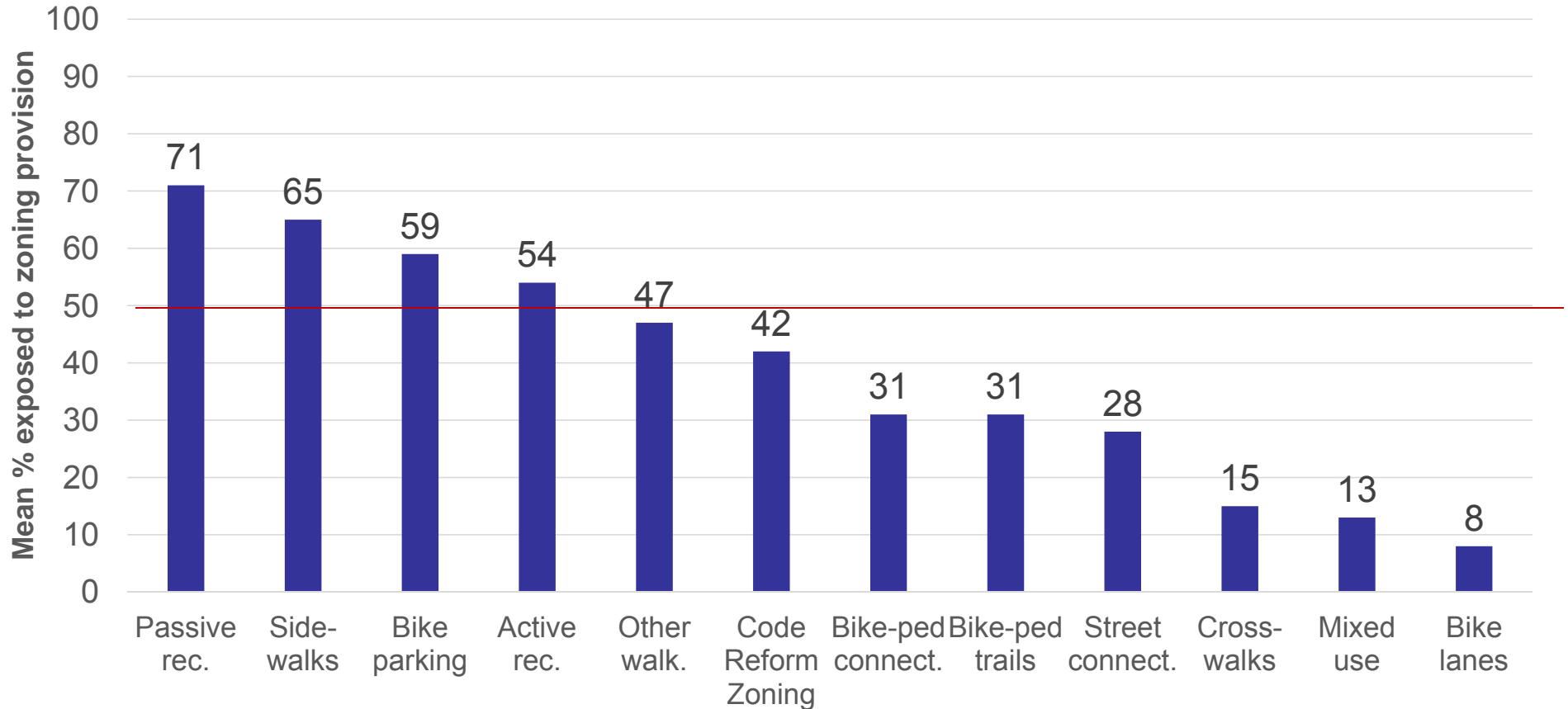
Characteristic	Mean (SD)	Characteristic	Mean (SD)
Hispanic	0.24 (0.43)	Income: \$20,000-\$24,999	0.08 (0.28)
Female	0.48 (0.50)	Income: \$25,000-\$34,999	0.10 (0.30)
Age-squared	1897 (1043)	Income: \$35,000-49,999	0.12 (0.32)
Never married	0.28 (0.45)	Income: \$50,000-\$74,999	0.14 (0.35)
Widow/separated/divorced	0.15 (0.36)	Income: \$75,000+	0.35 (0.48)
Child present in the home	0.47 (0.50)	Black	0.17 (0.37)
High school education	0.23 (0.42)	Asian	0.08 (0.27)
Some college education	0.31 (0.46)	Other Race	0.06 (0.23)
College education	0.33 (0.47)	BMI	27.53 (5.87)
Employed	0.68 (0.47)	Note: Except for age-squared and BMI, all are proportions)	

County Characteristics (n=96 counties)

Characteristic	Mean (SD)
% families with children living in poverty	17.29 (7.20)
% non-Hispanic White	49.22 (17.27)
% non-Hispanic Black	14.53 (11.43)
% Hispanic	25.35 (16.74)
Median household income	\$59,448 (\$13,618)
Median age	35.75 (2.72)
South region	0.26 (0.44)
Walkability scale (range: 0.74-17.97)	1.71 (2.33)

Note: With the exception of the walkability scale (constructed with GIS measures) and southern region, all items obtained from the American Community Survey 5-year estimates for 2008-2012

Zoning Code Provisions



Adult PA Behaviors (BRFSS, 2011)

Activity	Mean (SD)
Biking	0.06 (0.23)
Vigorous biking	0.04 (0.20)
Walking	0.45 (0.50)
Running/jogging	0.16 (0.36)
Vigorous running/jogging	0.05 (0.22)

N=57,585 adults

Predicting the odds of adult biking and vigorous biking by selected zoning measures

Zoning Measure ▲	BIKING		VIGOROUS BIKING	
	OR	95% CI	OR	95% CI
Code reform	1.34*	1.01-1.76	1.31*	1.01-1.71
Bike lanes	1.30	0.91-1.86	1.21	0.84-1.74
Bike parking	1.82***	1.36-2.44	1.75***	1.29-2.39
Bike-ped trails/paths	1.59***	1.22-2.06	1.54***	1.20-1.97
Mixed use	1.57*	1.10-2.23	1.45*	1.01-2.06
Active rec.	1.43*	1.03-1.98	1.45*	1.05-2.03
Passive rec.	1.55*	1.08-2.21	1.51*	1.05-2.18

▲ Results for zoning requirements for sidewalks, crosswalks, bike-ped connectivity, street connectivity. other walkability not presented for space reasons—for the most part they were not statistically associated with the outcomes

***p<.001 **p<.01 *p<.05

Predicting the odds of adult walking and running/jogging by selected zoning measures

Zoning Measure ▲	WALKING		RUN/JOG	
	OR	95% CI	OR	95% CI
Code reform	1.04	0.94-1.16	0.98	0.09-1.07
Bike lanes	1.24***	1.09-1.40	1.23*	1.03-1.46
Bike parking	1.18***	1.07-1.31	1.08	0.98-1.18
Bike-ped trails/paths	1.06	0.93-1.14	0.99	0.91-1.10
Mixed use	1.16***	1.04-1.29	1.20***	1.09-1.33
Active rec.	1.14**	1.04-1.24	1.09+	1.00-1.19
Passive rec.	1.11*	1.01-1.22	1.09*	1.01-1.19

▲ Results for zoning requirements for sidewalks, crosswalks, bike-ped connectivity, street connectivity. other walkability not presented for space reasons—for the most part they were not statistically associated with the outcomes

***p<.001 **p<.01 *p<.05 +p<.10

Study Limitations

- Only 1-year of BRFSS data
 - Applying to use 2013 data through restricted use access with CDC
- Cross-sectional analysis—associations not causation
- Proportion of county population exposed to zoning measure does not necessarily mean that individuals in the BRFSS sample within a given county are located in the local jurisdictions within the county with such provisions

Implications for Practice and Policy

- Jurisdictions nationwide are seeking to identify policy and environmental strategies for increasing adult PA.
- Implementing changes to zoning codes to be more active living-oriented may be a key strategy for improving adult population-level PA in communities.
 - **Key zoning elements:** bike lanes, bike parking, bike-pedestrian trails/paths, mixed use, active recreation, passive recreation
- PA advocates should **work with planning and zoning officials/urban planners** in the community to facilitate such changes—perhaps starting with adding goals to the community master/comprehensive plan.

For More Information

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