Associations of Perceived Social and Physical Environmental Supports With Physical Activity and Walking Behavior

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We evaluated perceived social and environmental supports for physical activity and walking using multivariable modeling. Perceptions were obtained on a sample of households in a southeastern county. Respondents were classified according to physical activity levels and walking behaviors. Respondents who had good street lighting; trusted their neighbors; and used private recreational facilities, parks, playgrounds, and sports fields were more likely to be regularly active. Perceiving neighbors as being active, having access to sidewalks, and using malls were associated with regular walking.

The beneficial effect of physical activity on reducing chronic disease is well established,[1–3] but most of the US population is not regularly active.[1,4] A social ecological perspective of health[5–7] suggests that social and environmental factors play an important role in increasing physical activity.[8–13] In this study, we use a multivariable approach to evaluate how perceptions of social and physical environmental supports contribute to predicting physical activity and walking behavior.

METHODS

Data were collected from a sample of households in a predominantly rural southeastern county. Households were selected

within each census tract of the county to guarantee a balance in racial and geographic distributions. Respondents aged 18 years or older were randomly selected from all adults living in each household. Based on 1194 telephone interviews, the survey response rate was 54%.

The interview assessed demographic characteristics, social and physical environmental perceptions, and physical activity and walking behavior. Survey items were developed from an extensive literature review,[8,10,14,15] expert input, and community focus groups.[16]

Thirteen items addressed perceived supports and barriers of physical activity in the neighborhood, defined as a 0.5-mile radius or 10-minute walk from the respondent's home. Supports for physical activity were sidewalks, public recreation facilities, streetlights, having a pleasant neighborhood for walking, and physically active neighbors. Barriers to physical activity included traffic volume, unattended dogs, crime, and perception of neighbors being untrustworthy.

Thirteen items related to perceived supports and barriers of physical activity in the community, defined as a 10-mile radius or 20-minute drive from the residence. Supports included walking/bike trails, swimming pools, recreation facilities, parks, playgrounds, sports fields, schools, malls, places of worship, and waterways. Barriers included crime and safety concerns associated with recreation facilities. Test–retest reliabilities ranged from .42 to .74 for neighborhood variables and from .28 to .56 for community variables, with modest κ coefficients between perceptions and objective data.[17]

Physical activity was measured using the 2001 Behavioral Risk Factor Surveillance System physical activity module[18–20] to classify respondents as active (30 minutes or more of moderate physical activity 5 or more days per week, or 20 or more minutes of vigorous physical activity 3 or more days per week), insufficiently active (lower levels of physical activity than active), or inactive (no moderate or vigorous physical activity). Respondents also were classified as regular walkers (30 or more minutes 5 or more days per week), irregular walkers (lower levels than regular walkers), or nonwalkers (no walking for 10 minutes or more at a time).

Analysis weights were constructed to adjust for numbers of adults and voice telephone lines in each household and for the differential sampling and response rates. All statistical analyses incorporated these weights using SUDAAN Version 80 (Research Triangle Institute, Research Triangle Park, NC). Generalized logistic regression allowed for 3 levels of the dependent variables, with inactive and nonwalker categories used as referent levels for classifying physical activity and walking behavior. An odds ratio greater than unity reflects an increased likelihood of physical activity or walking at the specified level. The associations of demographic, neighborhood, and community variables with physical activity and walking were assessed to develop multivariable models.

RESULTS

The sample demographics are presented in Table 1. Multivariable modeling demonstrated that younger age; better street lighting; trust of neighbors; and use of private recreation facilities, parks, playgrounds, sports fields, schools, and worship facilities were associated with increased physical activity (Table 2). Younger age, more education, having physically active neighbors, having sidewalks available in the neighborhood, and using a mall for walking were associated with increased walking behaviors.

TABLE 1—Demographic Characteristics and Physical Activity Behaviors

Variable	n	Weighted %
Age, y		
18–34	256	35.6
35–54	456	36.2
≥ 55	482	28.2
Race		
African American	477	41.0
White	687	59.0
Other/data missing	30	. . .
Gender		
Male	473	43.7
Female	721	56.3
Education		
Some college or technical school	630	54.3
High school diploma or less	551	45.7
Data missing	13	. . .
Physical activity		
Regularly active	395	37.6
Irregularly active	555	44.6
Inactive	234	17.8
Data missing	10	. . .
Walking behavior		
Regular walking	420	39.5
Irregular walking	438	34.8
Nonwalker	320	25.7
Data missing	16	. . .

DISCUSSION

Few investigators have used multivariable analysis to assess the influence of environmental supports on physical activity,[14] and less is known about the impact of such supports on walking behavior.[10,12,21,22] The findings in the present study are consistent with previously identified univariate associations between social and environmental supports and physical activity[10,14] and between walking behavior and access to trails.[14,23]

Overall, neighborhood variables were stronger predictors of physical activity and walking than were community variables. Consistent with social ecological models,[5–7] increasing awareness and use of environmental supports already available in neighborhoods may be cost-effective for increasing physical activity and walking. Interventions to increase environmental supports for physical activity should target proximal locations—such as private recreational facilities, parks, playgrounds, and sports fields—as well as adequate lighting and the presence of convenient, nearby opportunities for physical activity. Future research on community-based interventions should focus on expanding awareness, safety, and access to and use of places where people can engage in physical activity and walking.

This study is cross-sectional; therefore, causal inferences cannot be made. The survey was based on self-report measures of perceptions, physical activity, and walking and was conducted during the winter months in a predominantly rural, southeastern community with only 1 small metropolitan area, limiting potential generalizability.

TABLE 2—Associations With Physical Activity and Walking Behavior

Variable	Physical Activity Behavior			Walking Behavior		
	Active vs Inactive OR (95% CI)	Sufficiently Active vs Inactive OR (95% CI)	Overall *P*	Regular Walking vs No Walking OR (95% CI)	Irregular Walking vs No Walking OR (95% CI)	Overall *P*
Demographic Variables						
Age, y			0.0121			0.0002
18–34	2.17 (1.20, 3.92)	1.35 (0.76, 2.38)		3.44 (2.00, 5.93)	1.53 (0.90, 2.61)	
35–54	2.06 (1.18, 3.60)	1.92 (1.16, 3.18)		1.99 (1.17, 3.37)	1.24 (0.74, 2.06)	
≥ 55	1.00	1.00		1.00	1.00	
Education			. . .			0.0424
Some college or technical school	. . .	. . .		1.69 (1.07, 2.66)	1.69 (1.08, 2.65)	
High school or less	. . .	. . .		1.00	. . .	
Neighborhood Variables						
People active in neighborhood			. . .			0.0002
Yes	. . .	. . .		2.66 (1.67, 4.25)	1.65 (1.06, 2.60)	
No	. . .	. . .		1.00	1.00	
Sidewalks in neighborhood			. . .			0.0114
Yes	. . .	. . .		1.39 (0.77, 2.51)	2.23 (1.27, 3.92)	
No	. . .	. . .		1.00	1.00	
Street lighting in neighborhood			0.0448			. . .
Good	1.21 (0.70, 2.09)	0.84 (0.49, 1.43)		. . .	. . .	
Fair	1.28 (0.68, 2.43)	1.73 (0.96, 3.11)		. . .	. . .	
Poor	1.00	1.00		. . .	. . .	
Uses private recreation facility			< 0.0001			. . .
Yes	7.26 (3.52, 14.95)	4.36 (2.17, 8.76)		. . .	. . .	
No	1.00	1.00		. . .	. . .	
Neighbors can be trusted			0.0002			. . .
Yes	2.64 (1.32, 5.30)	3.72 (1.99, 6.95)		. . .	. . .	
No	1.00	1.00		. . .	. . .	
Community Variables						
Community parks			0.0192			. . .
Uses parks	2.20 (1.21, 3.98)	1.96 (1.10, 3.49)		. . .	. . .	
Does not use parks	0.81 (0.46, 1.43)	1.12 (0.66, 1.90)		. . .	. . .	
No parks	1.00	1.00		. . .	. . .	
Community malls for physical activity			. . .			0.0030
Uses malls	. . .	. . .		0.77 (0.40, 1.48)	1.68 (0.87, 3.24)	
Does not use malls	. . .	. . .		0.45 (0.26, 0.78)	1.03 (0.59, 1.77)	
No malls	. . .	. . .		1.00	1.00	

Note. OR = odds ratio; CI = confidence interval.

In summary, perceptions of social and physical environmental supports were positively associated with physical activity and walking behavior, especially at the neighborhood level. Increasing awareness of environmental supports, social comparison, and safety issues as well as of the importance of using opportunities for physical activity at the neighborhood level may be an effective strategy for future community-based interventions. ■

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Contributors

C.L. Addy, B.E. Ainsworth, P. Sharpe, and D. Kimsey developed the environmental supports questionnaire and designed the overall study. C.L. Addy also designed and conducted the analyses for this article. K.A. Kirtland contributed to the implementation of the study, especially the data collection and management activities. D.K. Wilson contributed to the conceptual framework. All authors contributed to the writing of this brief.

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Human Participant Protection

This study was approved by the institutional review board of the University of South Carolina.

References

1. Pate RR, Pratt M, Blair SN, et al. Physical activity and public health. A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *JAMA.* 1995;273:402–407.

2. US Department of Health and Human Services. *Physical Activity and Health: A Report of the Surgeon General.* Atlanta, Ga: US Department of Health and Human, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion; 1996. Serial Number 017-023-00196-5.

3. Dunn AL, Marcus BH, Kampert JB, Garcia ME, Kohl HW III, Blair SN. Comparison of lifestyle and structured interventions to increase physical activity and cardiorespiratory fitness: a randomized trial. *JAMA.* 1999;281:327–334.

4. Jones DA, Ainsworth BE, Croft JB, Macera CA, Lloyd EE, Yusuf HR. Moderate leisure-time physical activity: who is meeting the public health recommendations? A national cross-sectional study. *Arch Fam Med.* 1998;7:285–289.

5. Sallis JF, Owen N. Ecological models. In: Glanz K, Lewis FM, Rimer BK, eds. *Health Behavior and Health Education: Theory, Research, and Practice.* 2nd ed. San Francisco, Calif: Jossey-Bass; 1997:403–424.

6. Spence JC, Lee RE. Toward a comprehensive model of physical activity. *Psychol Sport Exerc.* 2003;4:7–24.

7. Hill JO, Peters JC. Environmental contributions to the obesity epidemic. *Science.* 1998;280:1371–1374.

8. Brownson RC, Baker EA, Housemann RA, Brennan LK, Bacak SJ. Environmental and policy determinants of physical activity in the United States. *Am J Public Health.* 2001;91:1995–2003.

9. Sallis JF, Bauman A, Pratt M. Environmental and policy interventions to promote physical activity. *Am J Prev Med.* 1998;15:379–397.

10. Brownson RC, Housemann RA, Brown DR, et al. Promoting physical activity in rural communities: walking trail access, use, and effects. *Am J Prev Med.* 2000;18:235–241.

11. King AC, Castro C, Wilcox S, Eyler AA, Sallis JF, Brownson RC. Personal and environmental factors associated with physical inactivity among different racial-ethnic groups of U.S. middle-aged and older-aged women. *Health Psychol.* 2000;19:354–364.

12. Hovell MF, Sallis JF, Hofstetter CR, Spry VM, Faucher P, Caspersen CJ. Identifying correlates of walking for exercise: an epidemiologic prerequisite for physical activity promotion. *Prev Med.* 1989;18:856–866.

13. Centers for Disease Control and Prevention. Neighborhood safety and the prevalence of physical activity—selected states, 1996. *MMWR Morb Mortal Wkly Rep.* 1999;48(7):143–146.

14. Sallis JF, Johnson MF, Calfas KJ, Caparosa S, Nichols JF. Assessing perceived physical environmental variables that may influence physical activity. *Res Q Exerc Sport.* 1997;68:345–351.

15. Sallis JF, Hovell MF, Hofstetter CR, et al. Distance between homes and exercise facilities related to frequency of exercise among San Diego residents. *Public Health Rep.* 1990;105:179–185.

16. Henderson KA, Neff LJ, Sharpe PA, Greaney ML, Royce SW, Ainsworth BE. It takes a village to promote physical activity: the potential for public park and recreation departments. *J Park Recreation Adm.* 2001;19(1):23–41.

17. Kirtland KA, Porter DE, Addy CL, et al. Environmental measures of physical activity supports: perception versus reality. *Am J Prev Med.* 2003;24:323–331.

18. Ainsworth BE, Wilcox S, Henderson KA, Richter DL, Greaney ML. Environmental supports for physical activity among southern African American women [abstract]. *Med Sci Sports Exerc.* 2002;34:S11.

19. Wilcox S, Ainsworth BE, Henderson KA, Richter DL, Greaney ML. Personal barriers to physical activity in African American women [abstract]. *Med Sci Sports Exerc.* 2002;34:S11.

20. Wilcox S, Richter DL, Henderson KA, Greaney ML, Ainsworth BE. Perceptions of physical activity and personal barriers and enablers in African-American women. *Ethn Dis.* 2002;12:353–362.

21. Ball K, Bauman A, Leslie E, Owen N. Perceived environmental aesthetics and convenience and company are associated with walking for exercise among Australian adults. *Prev Med.* 2001;33:434–440.

22. Carnegie MA, Bauman A, Marshall AL, Mohsin M, Westley-Wise V, Booth ML. Perceptions of the physical environment, stage of change for physical activity, and walking among Australian adults. *Res Q Exerc Sport.* 2002;73:146–155.

23. Booth ML, Owen N, Bauman A, Clavisi O, Leslie E. Social-cognitive and perceived environmental influences associated with physical activity in older Australians. *Prev Med.* 2000;31:15–22.