Promoting Physical Activity in Rural Communities
Walking Trail Access, Use, and Effects

Ross C. Brownson, PhD, Robyn A. Housemann, MPH, David R. Brown, PhD,
Jeannette Jackson-Thompson, PhD, MSPH, Abby C. King, PhD, Bernard R. Malone, MPA, James F. Sallis, PhD

Introduction: Environmental and policy approaches to promote physical activity, such as walking trail construction and promotion, are being widely recommended, yet sparse data exist on their effectiveness. In conjunction with ongoing community-intervention projects in Missouri, walking trails are being built, promoted, and evaluated. Objectives include determining: (1) patterns and correlates of walking, (2) the availability of places to walk and perform other forms of physical activity, (3) the extent of walking trail use and possible effects on rates of physical activity, and (4) attitudes toward the trails and their uses.

Methods: In 12 rural counties in Missouri we used a cross-sectional telephone survey to ask a population-based sample of residents aged >18 years (n = 1269) some standard and specially developed questions about walking behaviors, knowledge, and attitudes.

Results: Only 19.5% of respondents were classified as regular walkers. About one third of respondents (36.5%) reported having access to walking trails in their area, and 50.3% reported having access to indoor facilities for exercise. Among persons with access to walking trails, 38.8% had used the trails. Groups who were more likely to have used the walking trails included women, persons with more education, those making $35,000 or more per year, and regular walkers. Among persons who had used the trails, 55.2% reported they had increased their amount of walking since they began using the trail. Women and persons with a high school education or less were more than twice as likely to have increased the amount of walking since they began using the walking trails.

Conclusions: Walking trails may be beneficial in promoting physical activity among segments of the population at highest risk for inactivity, in particular women and persons in lower socioeconomic groups.

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Introduction

The health benefits of physical activity are now well-established. Physical activity contributes to a lower risk of coronary heart disease, as well as a variety of other chronic diseases including hypertension, non-insulin dependent diabetes (Type 2), colon cancer, osteoarthritis, and osteoporosis.[1] Substantial health benefits appear to occur when going from a completely sedentary lifestyle to introducing modest amounts of physical activity.[1] As with vigorous physical activity, light to moderate-intensity activity, such as walking, provides many health benefits. Positive outcomes of walking include maintaining weight loss longer,[2] increasing high-density lipoprotein,[3,4] reducing blood pressure,[5] and decreasing the risk of death from cardiovascular disease and cancer[6,7] while incurring a lower risk of injury and sudden death.[8] Walking is the most common physical activity among the general population and in major subpopulations such as older persons and racial/ethnic minorities.[8] It is especially promising as a focus of public health interventions because of its acceptability and accessibility, particularly among populations with a low prevalence of physical activity.[8,9] The current public health recommendation is for adults to accumulate at least 30 minutes of

From the Department of Community Health and Prevention Research Center, School of Public Health, Saint Louis University (Brownson, Houseman), St. Louis, Missouri; Division of Nutrition and Physical Activity, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention (Brown), Atlanta, Georgia; Division of Chronic Disease Prevention and Health Promotion, Missouri Department of Health (Jackson-Thompson, Malone), Columbia, Missouri; Departments of Health Research and Policy and Medicine, Stanford University School of Medicine (King), Palo Alto, California; Department of Psychology, San Diego State University (Sallis), San Diego, California

Address correspondence and reprint requests to: Dr. Brownson, PhD, Department of Community Health and Prevention Research Center, School of Public Health, Saint Louis University, 3663 Lindell Boulevad, St. Louis, MO 63108-3342. E-mail: brownson@slu.edu.

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moderate-intensity physical activity on most, and preferably all, days of the week.[10] This guideline is generally consistent with the recommendation from the U.S. Surgeon General.[1] Despite the positive effects of physical activity, more than one quarter of the American population remains completely inactive and the prevalence of inactivity is highest in rural areas of the United States.[11]

To promote physical activity, more environmental and policy strategies are needed to change the physical and sociopolitical environments.[12] Environmental and policy approaches may be especially indicated as a complement to more frequently used individual behavior and lifestyle modification strategies because they can benefit all people exposed to the environment rather than focusing on changing the behavior of one person at a time.[12–15] Strategies often include providing facilities and programs that are not currently available to the population. Examples of environmental and policy approaches to increase physical activity include walking and bicycle trails, liability legislation, zoning and land use, mall walking programs, building construction that encourages physical activity, policies and incentives promoting physical activity during the workday, and policies requiring comprehensive school physical health education programs.[14,15] Among these, establishing walking trails is a relatively low-cost intervention that may facilitate walking by reducing barriers related to convenience and accessibility and encouraging ongoing physical activity maintenance because trails become a permanent fixture in the community. Although such environmental and policy interventions to promote physical activity are being promoted widely,[16,17] there are sparse data on the uses and effects of these approaches on a community-wide basis.[1,14,15] For example, in a recent review of the effectiveness of environmental and policy interventions in promoting physical activity, Sallis et al.[15] identified only seven published, English-language studies.

To assess physical activity patterns and correlates, in particular walking trail uses and usefulness, we recently conducted a study of walking-related behaviors and attitudes. Its purposes were four-fold: (1) to describe the patterns and correlates of walking in the community, (2) to assess the availability of places to walk and perform other physical activities, (3) to determine the extent of walking trail use and possible effects on rates of physical activity, and (4) to describe attitudes toward the trails and their uses that may serve as barriers or enablers.

Methods

Intervention Activities

Environmental and policy interventions are being conducted in two community-based intervention projects (i.e., the Bootheel and Ozark Heart Health projects) in 12 rural, southeastern Missouri counties, comprising a population of approximately 280,000. These projects are collaborations between the Missouri Department of Health and the Prevention Research Center at Saint Louis University. Compared with the rest of Missouri and the United States, this region has significantly more poverty, is medically underserved, and has lower educational levels.[18] These projects are described in detail elsewhere.[19–22] In brief, each project is targeting change in behavioral risk factors for heart disease—physical inactivity, cigarette smoking, and poor diet. Interventions are delivered largely by community volunteers via organized coalitions. Examples of intervention activities include enactment of policies for smoke-free churches and schools, nutrition and tobacco education programs for children and adults, community fun-walks, procurement of exercise equipment for various sites (e.g., nutrition centers, community centers, sheriff's offices), and using schools and churches for physical activity programs. In addition, a major recent focus of the coalitions has been on the construction of new walking trails and enhancement of existing trails. Walking trails have been a priority because of the lack of places to walk in these rural areas (e.g., few sidewalks and no shopping malls in the 12-county region). There are currently 13 walking trails in the Ozark counties and 8 in the Bootheel communities. The majority of trails are located in residential park areas within city limits. They are generally asphalt (44%), gravel (44%), or wood chip covered (11%). Trails sometimes loop around ball playing fields or playgrounds. The trail lengths vary from 0.13 miles to 2.38 miles (mean = 0.68 miles). The duration of the existence of the trails varied from 6 months to 5 years (mean = 1.53 years).

Survey Design

A special risk factor survey was conducted using the methods of the Missouri Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS provides a flexible, state health agency–based surveillance system to assist in planning, implementing, and evaluating health promotion and disease prevention programs. It is extensive, both in content areas covered and sample size.[25] Missouri began conducting statewide BRFSS surveys in 1986. The cross-sectional risk factor survey used a two-stage, random-digit-dialing technique to collect data.[24,26]

Sample

From April through December 1998, computer-assisted telephone interviews were conducted with 1269 adults, aged 18 years and older. Study subjects were randomly selected from residents of 17 communities in 12 southeast Missouri counties. Eight communities were chosen

specifically because of the existence of a walking trail in the local area. Proportion-to-size sampling[27] was used to estimate the sample size from each community. The communities sampled ranged in size from 616 to 22,494. The response rate among eligible households, determined by standard methods of the American Association for Public Opinion Research,[28] was 73%.

Measures

The questionnaire used standard items from the Missouri BRFSS, items from other surveys, and items developed specifically for this project. Interviews averaged 17 minutes. Nine sets of questions formed the dependent variables of primary interest in the current study. These included: (1) walking behavior in the past month; (2) regular walking, such as walking >5 times per week and >30 minutes per occasion (the algorithm commonly used to determine compliance with current public health recommendations for moderate-intensity physical activity[10]); (3) access to walking trails (defined by the question: "Are there any walking trails or paths in your area, not including those in state parks or national forests?"); (4) access to indoor exercise facilities (defined by the question: "Do you have access to an indoor facility where you can exercise when you don't want to or can't use the trail?"); (5) use of walking trails; (6) whether exercise behavior had changed due to walking trail use; (7) perceptions of safety when using trails; (8) how respondents found out about the trails; and (9) aspects of the trails most liked.

Analysis

Following data collection, risk factor data were cleaned and edited using standard BRFSS quality-control procedures.[23] After editing, data were weighted to compensate for post-stratification by age, gender, and race. Because telephone surveys tend to over-sample certain subpopulations (e.g., older persons) and nonresponse tends to be unequal across subpopulations (e.g., income and education groups), weighted prevalence estimates provide a better representation of the overall population prevalence. Prevalence odds ratios (POR) and 95% confidence intervals (CI) were calculated to compare the differences in behavior, knowledge, and attitudes within various subgroups. Reference categories are defined in footnotes to each table.

Results

The sociodemographic characteristics of the study population are shown in Table 1. The sample was generally representative of the overall population of the region, although it slightly underrepresented younger persons, males, and African Americans.

Overall, 44.9% of respondents had walked in the past month for exercise and 19.5% had walked at a level of five or more times per week and 30 minutes or more per occasion ("regular" walking). These variables were also examined within sociodemographic strata (Table 2). Subpopulations that were more likely to have walked in the past month included persons aged 60 years or older, women, and persons with more education. Persons who were divorced or separated were less likely to have walked in the past month. Respondents who were more likely to be regular walkers included those age 60 years or older, widowers, those with more education, and persons with incomes of $35,000 or higher. It is noted that some of the confidence intervals for the observed associations bordered on statistical significance (i.e., 1.0 as the upper or lower limit) and therefore, some caution in their interpretation is warranted.

About one third of respondents (36.5%) reported having access to walking trails in their area. A larger proportion (50.3%) reported that they had access to indoor facilities for exercise (e.g., a gymnasium). For the most part, sociodemographic patterns in access were similar for walking trails and indoor exercise facilities (Table 3). Persons who were widowed were less likely to have access to either walking trails or indoor facilities. Conversely, persons with more education and earning higher incomes were more likely to have access to walking trails and to indoor places to exercise. In addition, persons aged 60 year or older were less likely

Table 1. Characteristics of walking survey participants in Bootheel and Ozark regions, Missouri, 1998

Characteristic	No.	%
Age group		
18–39	376	29.6
40–59	462	36.4
60+	426	33.6
Unknown/missing	5	0.4
Total	1269	
Gender		
Men	438	34.5
Women	829	65.3
Unknown/missing	2	0.2
Race/ethnic group		
Caucasian	1152	90.8
African American	99	7.8
Other/missing	18	1.4
Marital status		
Married/unmarried couple	761	60.0
Divorced/separated	194	15.3
Widowed	211	16.6
Never married	103	8.1
Education		
High school or less	887	70.0
Some college or college graduate	381	30.0
Unknown/missing	1	0.1
Annual household income, $ (thousands)		
Less than 15	504	39.7
15–35	370	29.2
35 or more	254	20.0
Unknown/missing	141	11.1

Table 2. Walking behavior in rural communities by sociodemographic subgroup, Missouri, 1998

Category	Walked for exercise in past month			Regular walking[a]		
	%	POR[b]	95% CI[c]	%	POR	95% CI
Age group						
18–39[d]	41.2	1.0		17.3	1.0	
40–59	45.3	1.2	0.9, 1.6	17.1	1.0	0.7, 1.4
60 and older	47.8	1.3	1.0, 1.7	24.2	1.5	1.1, 2.2
Gender						
Men[d]	37.0	1.0		19.8	1.0	
Women	49.3	1.7	1.3, 2.1	19.4	1.0	0.7, 1.3
Race/ethnic group						
Caucasian[d]	45.2	1.0		19.9	1.0	
African American	44.4	1.0	0.6, 1.5	15.2	0.7	0.4, 1.3
Other	41.2	0.9	0.3, 2.4	23.5	1.2	0.4, 3.8
Marital status						
Married/unmarried couple[d]	46.8	1.0		18.3	1.0	
Divorced/separated	38.6	0.7	0.5, 1.0	17.0	0.9	0.6, 1.4
Widowed	45.5	1.0	0.7. 1.3	23.7	1.4	1.0, 2.0
Never married	43.7	0.9	0.6, 1.3	25.2	1.5	0.9., 2.5
Education						
High school or less[d]	43.1	1.0		18.4	1.0	
Some college or college graduate	49.5	1.3	1.0, 1.6	22.3	1.3	1.0, 1.7
Income, $ (thousands)						
Less than 15[d]	42.9	1.0		17.1	1.0	
15–35	46.8	1.2	0.9, 1.6	20.3	1.2	0.9, 1.7
35 or more	47.8	1.2	0.9, 1.7	22.4	1.4	1.0, 2.1

[a]Regular walking is defined as walking 5 or more times per week and 30 minutes or more per occasion.
[b]Prevalence odds ratio.
[c]Confidence interval.
[d]Reference category.

to have access to walking trails and indoor facilities. Persons who were regular walkers were more likely to have access to indoor exercise facilities.

We also examined use of the walking trails and whether respondents perceived that such use had influenced behavior. Among persons with access to walking trails, 38.8% had used the trails. Groups who were more likely to have used the walking trails included women, persons with more education, those making $35,000 or more per year, regular walkers, people from mid-sized (>5,500 to <10,000 persons) communities, and users of asphalt trails (Table 3). Among persons who had used the trails, 55.2% reported that they had increased their amount of walking since they began using the trail. Women were more than twice as likely as men to report that they had increased the amount of walking since they began using the walking trails. Nearly 62% of persons with a high school education or less reported increasing walking—this was statistically different from persons with a college education (45.5%). Similarly, lower-income groups were more likely to have increased walking due to trail use than were higher income persons. Persons using longer trails (>0.25 miles) were more likely to report an increase in physical activity. Travel distance to walking trails appeared to have a slight perceived effect on walking. However, it is notable that nearly half of respondents (43%) had to travel 15 miles or more to the trail.

Among users of the trails, we also assessed perceived level of safety (data not shown). Concerns about safety did not appear to be a barrier to use as 86.9% of trail users felt very safe when using the trails. Only 1.1% of users felt unsafe when exercising on the trails. Trail users found out about the trails through a variety of methods, including happening to see it one day (35.3%), reading about the trail in a newspaper (12.4%), hearing from a friend (10.6%), and hearing about it from a relative (8.8%). Among trail users, the aspects of the trails most liked were their scenic beauty (19.4%), availability as a free place to exercise (18.2%), convenient location (15.9%), safe surface (10.0%), and lighting (5.3%).

Discussion

Researchers and practitioners recommend the building of walking trails as a useful environmental and policy intervention to promote physical activity.[15,16] To the best of our knowledge, this is the first U.S. study to systematically examine the descriptive characteristics, correlates, and possible effects of walking-trail development. As such, there is little literature with which to compare our results. Earlier cross-sectional studies have shown that numerous environmental variables are correlated with physical activity behavior. For example, three studies[29–31] have shown associations between the number of pieces of exercise equipment in the home

Table 3. Access to places to exercise and uses and effects of walking trails in rural communities by sociodemographic subgroup, Missouri, 1998

Category	Walking trails in area?		Access to indoor exercise facilities?		Used walking trails?[c]		Increased walking since using trail?[c]	
	%	POR[a] (95% CI[b])	%	POR (95% CI)	%	POR (95% CI)	%	POR (95% CI)
Age group								
18–39[d]	42.9	1.0	54.3	1.0	44.3	1.0	60.3	1.0
40–59	38.4	0.8 (0.6, 1.1)	49.9	0.8 (0.6, 1.1)	37.1	0.7 (0.5, 1.2)	52.5	0.7 (0.4, 1.5)
60 and older	28.8	0.5 (0.4, 0.7)	47.0	0.8 (0.6, 1.0)	34.2	0.7 (0.4, 1.1)	52.6	0.7 (0.3, 1.7)
Gender								
Men[d]	35.2	1.0	52.2	1.0	29.8	1.0	41.0	1.0
Women	37.2	1.1 (0.9, 1.4)	49.4	0.8 (0.7, 1.1)	43.6	1.8 (1.2, 2.8)	59.7	2.1 (1.0, 4.4)
Race/ethnic group								
Caucasian[d]	36.8	1.0	50.3	1.0	39.7	1.0	55.0	1.0
African American	30.3	0.8 (0.5, 1.2)	51.5	1.1 (0.7, 1.6)	34.5	0.8 (0.4, 1.8)	70.0	1.9 (0.5, 7.7)
Other	52.9	1.9 (0.7, 5.1)	47.1	0.9 (0.3, 2.3)	22.2	0.4 (0.1, 2.1)	0.0	
Marital status								
Married/unmarried couple[d]	38.7	1.0	50.4	1.0	40.6	1.0	55.0	1.0
Divorced/separated	32.8	0.8 (0.6, 1.1)	56.0	1.3 (0.9, 1.7)	29.5	0.6 (0.3, 1.1)	43.8	0.6 (0.2, 1.8)
Widowed	27.9	0.6 (0.4, 0.9)	40.2	0.7 (0.5, 0.9)	36.8	0.9 (0.5, 1.5)	75.0	2.5 (0.8, 7.2)
Never married	44.6	1.3 (0.8, 1.9)	60.2	1.5 (1.0, 2.3)	44.4	1.2 (0.6, 2.2)	44.4	0.7 (0.2, 1.8)
Education								
High school or less[d]	33.9	1.0	47.9	1.0	36.1	1.0	61.9	1.0
Some college or college graduate	42.5	1.4 (1.1, 1.8)	55.8	1.4 (1.1, 1.7)	44.5	1.4 (1.0, 2.1)	45.5	0.5 (0.3, 1.0)
Income, $ (thousands)								
Less than 15[d]	32.7	1.0	42.3	1.0	31.6	1.0	64.4	1.0
15–35	37.6	1.2 (0.9, 1.7)	54.1	1.6 (1.2, 2.1)	38.2	1.3 (0.8, 2.2)	61.5	0.9 (0.4, 2.0)
35 or more	41.7	1.5 (1.1, 2.0)	59.5	2.0 (1.5, 2.7)	44.2	1.7 (1.0, 2.9)	42.9	0.4 (0.2, 1.0)
Regular walking								
No[d]	36.4	1.0	49.2	1.0	36.5	1.0	57.7	1.0
Yes	36.7	1.0 (0.8, 1.4)	55.1	1.3 (1.0, 1.7)	48.9	1.7 (1.0, 2.7)	47.5	0.7 (0.3, 1.4)
Population								
≤5,500[d]					33.3	1.0	78.6	1.0
>5,500 to <10,000					51.1	2.1 (1.0, 4.2)	59.0	0.4 (0.1, 1.6)
≥10,000					32.9	1.0 (0.5, 2.1)	34.6	0.1 (0.0, 0.6)
Trail length								
≤¼ mile[d]					32.5	1.0	34.6	1.0
>¼ to <½ mile					50.3	2.1 (1.2, 3.7)	59.7	2.8 (1.1, 7.2)
≥½ mile					29.6	0.9 (0.3, 2.2)	87.5	13.2 (1.4, 124.6)
Trail surface								
Asphalt[d]					49.1	1.0	63.0	1.0
Chat					31.4	0.5 (0.3, 0.8)	37.0	0.3 (0.1, 0.9)
Wood chips					16.7	0.2 (0.0, 1.8)	—	
Distance to trail								
1 to 4 miles[d]							59.5	1.0
5 to 10 miles							54.5	0.8 (0.4, 1.9)
11 to 29 miles							53.6	0.8 (0.3, 2.1)
more than 30 miles							52.4	0.7 (0.3, 1.8)

[a]Prevalence odds ratio.
[b]Confidence interval.
[c]Limited to persons who reported having access to walking trails.
[d]Reference category.

and rates of physical activity. Objectively measured density of exercise facilities around homes has been correlated with exercise rates, even after adjustment for demographic variables.[32] Qualitative data from Australia suggest that people believe they are more likely to exercise when they have access to both free and pay facilities.[33] Yet at least one recent experimental study suggests that actually providing free access to convenient facilities may not itself lead to increases in physical activity levels.[34]

As reported elsewhere,[1] a relatively small percentage of the population we surveyed is meeting current public health recommendations for moderate-intensity physical activity such as walking (i.e., more than 80% of persons surveyed were not regular walkers). An important and promising finding of our study is that women and persons in lower socioeconomic (SES) groups were more likely to report an increase in walking since using the walking trails. This is especially promising for women, since they were also found to be more likely

than men to use the walking trails. Conversely, persons with higher incomes were more likely to use the trails than persons with lower incomes. If this finding holds true in future research, it may provide one important avenue for reaching high-risk populations. Walking trails may assist persons in lower SES groups to initiate and increase their activity. Persons of higher SES may use trails to maintain, but not necessarily increase, their activity. Longitudinal studies will be needed to ascertain whether walking trails have a maintenance effect on walking behavior. Our study also suggests that persons who are more sedentary may be more likely to benefit from walking trails. Although not statistically different, persons who were not regular walkers (57.7%) were more likely to report increased activity due to trail use than were regular walkers (47.5%). This suggests that a "ceiling" effect may exist in which regular walkers may be using the trails to maintain but not increase an already adequate level of walking activity. Nevertheless, since the relationship between physical activity and disease outcomes is believed to be an inverse, continuous gradient,[35] moving sedentary individuals to any level of activity is likely to confer benefits.

Another recent study from five states[36] found that perceived neighborhood safety may have a direct relationship with rates of physical activity. Among older adults, physical activity rates were more than two-fold higher among persons perceiving their neighborhoods to be safe. In our study in rural Missouri, lack of neighborhood safety did not appear to be an important barrier among trail users (only 1% of users perceived unsafe conditions). Perceived safety may vary considerably in urban versus rural environments and perceived safety among non-users of trails needs examination. Some important enabling factors identified in our study that may help others who are constructing walking trails include the scenic beauty of the trails and their availability as free and convenient places to exercise.

There are several limitations of our study that deserve mention. First, we relied on self-reported telephone survey data, for which there are several potential biases (e.g., possible underrepresentation of lower SES segments of the population).[37,38] According to 1990 census information for the counties we sampled, telephone coverage was reasonably high (range: 81.4% to 92.2%). Second, although BRFSS questions on physical activity behavior have been tested for reliability,[39,40] other items in our survey (e.g., perceived access to trails and indoor facilities) have not been similarly examined. Our information on access to walking trails is general and we do not have data on why people who had access did not use the trails. And fourth, because our data are cross-sectional, causal relationships cannot be inferred.

It has been noted previously that promotion of walking may be an especially useful, although currently underused, tool for health promotion because of its acceptability and accessibility, especially among subpopulations at greatest risk of physical inactivity (e.g., persons of lower SES and older people).[8] Our study extends this premise and suggests that construction of walking trails may be a viable intervention strategy. Walking-trail development was relatively inexpensive (estimates from program records of $2000 to $4000 per trail in direct costs) and, in our experience, local public and private agencies are often willing to donate time and materials toward trail building and maintenance. Much more work is needed on ways to actively promote trail use and in determining whether there are longer-term effects on walking behavior among subgroups at highest risk of being sedentary. We are planing future quantitative and qualitative research that will expand on several issues: (1) methods of effective trail use promotion; (2) measurement of potential changes in walking behavior over time via use of trails; (3) reasons for trail use and nonuse; and (4) effects of trail enhancement (e.g., additional trees, exercise stations, lighting) on trail use.

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References

1. 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 Services; Centers for Disease Control and Prevention, 1996.
2. Ballor DL, Keesey RE. A meta-analysis of the factors affecting exercise-induced changes in body mass, fat mass, and fat-free mass in males and females. Int J Obesity. 1991;15:717–26.
3. 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;18:856–66.
4. Phillips WT, Pruitt LA, King AC. Lifestyle activity. Current recommendations. Sports Med 1996;22:1–7.
5. Dunn AL, Marcus BH, Kampert JB, Garcia ME, Kohl HW, Blair SN. Comparison of lifestyle and structured interventions to increase physical activity and cardiorespiratory fitness: a randomized trial. JAMA 1999;281: 327–34.
6. Hakim AA, Petrovitch H, Burchfiel CM, et al. Effects of walking on mortality among nonsmoking retired men. NE J Med 1998;338:94–9.
7. Manson JE, Hu FB, Rich-Edwards JW, et al. A prospective study of walking as compared with vigorous exercise in the prevention of coronary heart disease in women. NE J Med 1999;341:650–8.
8. Siegel P, Brackbill R, Heath G. The epidemiology of walking for exercise:

implications for promoting activity among sedentary groups. Am J Public Health. 1995;85:706–10.
9. Morris JN, Hardman AE. Walking to health. Sports Medicine. 1997;23:306–32.
10. Pate R, Pratt M, Blair S, 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.
11. Centers for Disease Control and Prevention. Self-reported physical inactivity by degree of urbanization–United States, 1996. MMWR Morb Mortal Wkly Rep 1998;47:1097–100.
12. Schmid TL, Pratt M, Howze E. Policy as intervention: environmental and policy approaches to the prevention of cardiovascular disease. Am J Public Health. 1995;85:1207–11.
13. Bauman A, Bellew B. Environmental and policy approaches to promoting physical activity. In: Commonwealth Institute, ed. Health in the Commonwealth. London: Commonwealth Institute; 1999.
14. King AC, Jeffery RW, Fridinger F, et al. Environmental and policy approaches to cardiovascular disease prevention through physical activity: issues and opportunities. Health Ed Q 1995;22:499–511.
15. Sallis JF, Bauman A, Pratt M. Environmental and policy interventions to promote physical activity. Am J Prev Med 1998;15:379–97.
16. Physical Activity Workgroup. how to promote physical activity in your community. Washington, DC: Association of State and Territorial Directors of Health Promotion and Public Health Education; 1996.
17. US Department of Health and Human Services. Promoting physical activity: a guide for community action. Champaign, IL: Human Kinetics; 1999.
18. US Dept of Commerce. 1990 census of population and housing short form. Washington, DC: US Dept of Commerce, Bureau of the Census; 1992.
19. Brownson CA, Dean C, Dabney S, Brownson RC. Cardiovascular risk reduction in rural minority communities: The Bootheel Heart Health Project. J Health Educ 1998;29:158–65.
20. Brownson RC, Smith CA, Pratt M, et al. Preventing cardiovascular disease through community-based risk reduction: the Bootheel Heart Health Project. Am J Public Health 1996;86:206–13.
21. Brownson RC, Mack NE, Meegama NI, et al. Changes in newspaper coverage of cardiovascular health issues in conjunction with a community-based intervention. Health Educ Res 1996;11:479–86.
22. Brownson RC, Mayer JP, Desseault PG, et al. Developing and evaluating a cardiovascular risk reduction project. Am J Health Beh 1997;21:333–44.
23. Gentry EM, Kalsbeek WD, Hogelin GC, et al. The behavioral risk factor surveys: II. Design, methods, and estimates from combined state data. Am J Prev Med 1985;1:9–14.
24. Remington PL, Smith MY, Williamson DF, Anda RF, Gentry EM, Hogelin GC. Design, characteristics, and usefulness of state-based behavioral risk factor surveillance: 1981–1987. Public Health Report. 1988;103:366–75.
25. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System. Available at: http://www.cdc.gov/nccdphp/brfss/. Accessed on month/day/1999.
26. Waksberg J. Sampling methods for random digit dialing. J Am Stat Assoc. 1978;73:40–46.
27. Brownson RC, Eyler AA, King AC, Shyu Y-L, Brown DR, Homan SM. Reliability of information on physical activity and other chronic disease risk factors among US women aged 40 years or older. Am J Epidem 1999;149:379–91.
28. The American Association for Public Opinion Research. standard definitions: final dispositions of case codes and outcome rates for rdd telephone surveys and in-person household surveys. Ann Arbor, MI: AAPOR; 1998.
29. Jakicic JM, Wing RR, Butler BA, Jeffery RW. The relationship between presence of exercise equipment in the home and physical activity level. Am J Health Promotion 1997;11:363–5.
30. Sallis JF, Hovell MF, Hofstetter CR, et al. A multivariate study of determinants of vigorous exercise in a community sample. Prev Med 1989;18:20–34.
31. Sallis JF, Johnson MF, Calfas KJ, Caparosa S, Nichols JF. Assessing perceived physical environmental variables that may influence physical activity. Res Q Exer Sports 1997;68:345–51.
32. 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 Reports. 1990;105:179–85.
33. Corti B, Donovan RJ, Holman CDJ. Factors influencing the use of physical activity facilities: results from qualitative research. Health Promotion J Australia. 1997;7:16–21.
34. French SA, Jeffery RW, Oliphant JA. Facility access and self-reward as methods to promote physical activity among healthy sedentary adults. Am J Health Promotion. 1994;8:257–62.
35. Blair SN, Connelly JC. How much physical activity should we do? The case for moderate amounts and intensities of physical activity. Med ScienceSports Exer 1996;67:193–205.
36. Centers for Disease Control and Prevention. Neighborhood safety and the prevalence of physical inactivity—selected states, 1996. MMWR Morb Mortal Wkly Rep 1999;48:143–6.
37. Centers for Disease Control. Using Chronic Disease Data: A handbook for public health practitioners. Atlanta, GA: Centers for Disease Control; 1992.
38. Ford ES. Characteristics of survey participants with and without a telephone: findings from the third National Health and Nutrition Examination Survey. J Clin Epidem 1998;51:55–60.
39. Stein AD, Lederman RI, Shea S. The Behavioral Risk Factor Surveillance System questionnaire: its reliability in a statewide sample. Am J Public Health. 1993;83:1768–72.
40. Shea S, Stein AD, Lantigua R, Basch CE. Reliability of the behavioral risk factor survey in a triethnic population. Am J Epidem 1991;133:489–500.