Health Psychology
2000, Vol. 19, No. 4, 354-364

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0278-6133/00/$5.00 DOI: 10.1037//0278-6133.19.4.354

Personal and Environmental Factors Associated With Physical Inactivity Among Different Racial–Ethnic Groups of U.S. Middle-Aged and Older-Aged Women

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Personal, program-based, and environmental barriers to physical activity were explored among a U.S. population-derived sample of 2,912 women 40 years of age and older. Factors significantly associated with inactivity included American Indian ethnicity, older age, less education, lack of energy, lack of hills in one's neighborhood, absence of enjoyable scenery, and infrequent observation of others exercising in one's neighborhood. For all ethnic subgroups, caregiving duties and lacking energy to exercise ranked among the top 4 most frequently reported barriers. Approximately 62% of respondents rated exercise on one's own with instruction as more appealing than undertaking exercise in an instructor-led group, regardless of ethnicity or current physical activity levels. The results underscore the importance of a multifaceted approach to understanding physical activity determinants in this understudied, high-risk population segment.

Key words: exercise, physical inactivity, determinants, women, older adults

Physical inactivity remains among the most prevalent of chronic disease risk factors in the United States and other industrialized nations (U.S. Department of Health and Human Services, 1996; World Health Organization, 1997). Although the disease prevention and health promotion benefits of regular physical activity undertaken at even a moderate intensity have been increasingly recognized (Pate et al., 1995; U.S. Department of Health and Human Services, 1996), 60% or more of Americans are not regularly active enough even at this level to receive many of these benefits (U.S. Department of Health and Human Services, 1996). Population-wide surveillance data indicate that inactivity rates are particularly prevalent among women, older adults, adults with lower educational attainment, and based on the relatively few data currently available, ethnic minorities (Jones et al., 1998; U.S. Department of Health and Human Services, 1996).

A growing physical activity determinants literature has sought to identify those variables that may be influential in promoting or impeding regular physical activity levels (Dishman & Sallis, 1994; King et al., 1992; Zunft et al., 1999). Some of these efforts have begun to target specific subgroups of adults at particular risk for inactivity (King, Rejeski, & Buchner, 1998; Taylor, Baranowski, & Young, 1998). Yet, a number of important subgroups either

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This study was funded through Centers for Disease Control and Prevention Contract U48/CCU710806 (Prevention Research Centers Program), including support from the Community Prevention Study of the National Institutes of Health Women's Health Initiative, and Public Health Service Grant AG-12358 from the National Institute on Aging.

We are grateful for the assistance of Loretta Finnegan of the Women's Health Initiative, National Institutes of Health; Patricia Riley of the Prevention Research Centers Program, Centers for Disease Control and Prevention; David Brown of the Division of Nutrition and Physical Activity, Centers for Disease Control and Prevention; and Rawls Howard of 21st Century Copernicus, Tarboro, North Carolina. We also thank Robyn Housemann and Yuh Ling-Shyu, Saint Louis University, for their assistance with data analysis.

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remain understudied (e.g., women and African American and Hispanic adults; Grassi, Gonzales, Tello, & He, 1999; Ransdell & Wells, 1998; Taylor et al., 1998) or are virtually absent from this literature (e.g., American Indian and Asian adults; Pargee, Lara-Albers, & Puckett, 1999; Taylor et al., 1998). Recently collected qualitative data on ethnic minority subgroups of women more than 40 years of age (i.e., African American, Hispanic, American Indian, Filipino, and Chinese women) suggest that lack of time due to caregiving responsibilities, health concerns, and lack of motivation to be physically active during leisure time may be important barriers to becoming more regularly physically active (Eyler et al., 1998). Yet, few efforts to systematically investigate such issues across a broader, more representative sample of women exist.

Another gap in the physical activity determinants literature concerns the paucity of variables that have been explored in certain potentially important domains of influence. Recent literature reviews, for instance, reveal that the vast majority of variables that have been studied to date reside in psychosocial and behavioral, as opposed to environmental, domains of influence (Dishman & Sallis, 1994; King et al., 1992; Sallis & Owen, 1999). Ecological models of physical activity (Sallis & Owen, 1999) emphasize the expected interplay of demographic, psychological, social, and environmental variables in influencing physical activity patterns. The potential importance of environmental factors in influencing physical activity participation was suggested in the previously mentioned qualitative data set, in which safety of the surrounding environment, availability of appropriate programs, and cost issues were noted to be barriers to physical activity among the minority women more than 40 years of age (Eyler et al., 1998). Although these environmental variables were specifically mentioned by ethnic minority women, there is substantial overlap between these variables and those believed to influence physical activity throughout the population as a whole, based on the few studies that have investigated such environmental factors (Clark, 1999; King, 1999; Sallis, Bauman, & Pratt, 1998; Sallis, Johnson, Calfas, Caparosa, & Nichols, 1997). Because such investigations, as well as relevant behavioral theory (Bandura, 1997), have suggested the potential importance of the immediate environment (e.g., one's neighborhood), in particular, in influencing physical activity, we focused on neighborhood factors in the current study. In addition, the vast majority of studies have involved convenience samples (Dishman & Sallis, 1994; King et al., 1992; U.S. Department of Health and Human Services, 1996), making it difficult to generalize results to the population at large.

The purpose of the current investigation was to explore personal and environmental barriers to physical activity among a U.S. population-derived sample of women 40 years of age and older. This segment of the population was specifically targeted in light of the substantial prevalence of inactivity and the dearth of data related to physical activity determinants in these groups (U.S. Department of Health and Human Services, 1996). The chosen variables were based on domains derived from social cognitive theory that have received consistent empirical support in the physical activity literature (Dishman & Sallis, 1994; King et al., 1992) or, as in the case of the environmental variables, have been suggested to be influential in the few studies that have specifically evaluated such variables (King, 1999; Sallis et al., 1998). We had two major objectives: (a) to provide descriptive information related to potential physical activity barriers for the sample as a whole as well as for each of the targeted ethnic subgroups and (b) to explore the unique correlations between these potential barriers and physical activity level for the entire sample as well as for each ethnic subgroup. In particular, we were interested in examining a wider range of environmental variables than has typically been studied in this field while evaluating the extent to which psychosocial and behavioral determinants identified from investigations of other population segments generalize to a population-derived sample of middle- and older-aged women. In light of the prevalence of sedentary patterns of behavior among U.S. women, particularly older women (U.S. Department of Health and Human Services, 1996), as well as the fact that those who are most sedentary have the most to gain, from a health perspective, by increasing their activity to recommended levels (Pate et al., 1995), we were particularly interested in exploring barriers in the most sedentary portion of the sample.

Method

Overview of the Population Survey

The data used in this investigation were collected as part of a large-scale, cross-sectional survey of physical activity in middle- and older-aged women referred to as the U.S. Women's Determinants Study (Brownson et al., 1999). Data were collected by telephone, through a modified version of the sampling plan of the Behavioral Risk Factor Surveillance Survey (BRFSS; Gentry et al., 1985; Remington et al., 1988; Waksberg, 1978). These methods have been described in detail elsewhere (Brownson et al., 1999) and are briefly summarized here. As a means of obtaining a nationally representative sample of minority women 40 years of age and older in a cost-efficient manner, zip codes were selected with 20% or more of each of the following racial–ethnic categories: African American, American Indian–Alaskan Native, and Hispanic (Brownson et al., 2000). For comparison purposes, a group of White women 40 years of age and older was also surveyed via standard BRFSS random-digit-dialing techniques (Brownson et al., 1999). Inclusion of a representative sample of Asian–Pacific Island women had been planned originally, but difficulties during pilot testing in reaching sufficient numbers of that population segment via telephone, owing to language difficulties and other apparent cultural barriers (e.g., men tended to answer the phone and make the decision concerning survey participation on the part of the woman), resulted in their having to be excluded from the sampling frame (Brownson et al., 1999). The identified zip codes were then computer matched with telephone prefixes, and a standard multi-stage cluster technique for random telephone numbers was subsequently applied as in the standard BRFSS (Brownson et al., 1999). A zip code screening question was included at the start of the survey for verification purposes.

The survey instrument was developed through a combination of questions from the BRFSS, the National Health Interview Survey, and other surveys (Adams & Marano, 1995; Brownson et al., 1997; Centers for Disease Control and Prevention, 1997; Gentry et al., 1985; Hovell, Hofstetter, Sallis, Rauh, & Barrington, 1992; Remington et al., 1988; Sallis, Grossman, Pinski, Patterson, & Nader, 1987; Sallis et al., 1990). Every effort was made to use valid and reliable scales intact, when they were available (Brownson et al., 1999). The final survey instrument consisted of 92 questions that required an average of 29 min to administer. Questions on physical activity behavior focused on leisure-time physical activity, occupational activity, and physical activity occurring around the home (Brownson et al., 1999).

The data were collected over a 1-year period (from July 1996 through June 1997) to mitigate the effects of seasonal variations in physical activity (Brownson et al., 1999). The interviews were conducted by experienced interviewers who completed 8 or more hours of training specific to the

project survey. The survey response rate (87.3%) was calculated according to the method of the Council of American Survey Research Organizations (CASRO) and was based on the ratio of completed interviews to the sum of completed interviews, refusals, and a standard percentage of telephone numbers that were active but were either not answered or busy after multiple attempts (CASRO Task Force on Completion Rates, 1982).

Survey Items Analyzed in the Current Investigation

Dependent variable. The dependent variable in the current investigation was level of leisure-time or household-related physical activity engaged in over the past 2 weeks, collected through the items and methods of the National Health Interview Survey and the BRFSS, two of the major national health surveys collecting physical activity information in the United States (Gentry et al., 1985; U.S. Bureau of the Census, 1985). Self-report measures of physical activity of the type used in this study are used extensively in epidemiological research in this field and are predictive of mortality and morbidity (Folsom et al., 1985; Leon, Connett, Jacobs, & Rauramaa, 1987; Paffenbarger et al., 1993). Physical activity level was divided into three categories: *sedentary,* defined as no sports or exercise reported in the past 2 weeks or no increase in heart rate reported from any activities engaged in; *underactive,* defined as not meeting the criteria for either the sedentary or the active category; and *active,* defined as either three or more sessions per week, for at least 20 min per session, of jogging–running, hiking, biking, swimming, or dance resulting in a medium to large increase in reported heart rate or five or more sessions per week, for at least 30 min per session, of any physical activities (including walking, gardening or yard work, calisthenics, etc.) that resulted in at least some increase in reported heart rate. This definition of "active" is commensurate with the current national physical activity recommendations (Pate et al., 1995). These three physical activity categories were used in light of previous evidence suggesting that they may have differential determinants (Young, King, & Oka, 1995).

Independent variables. Variables that were evaluated as correlates of physical activity level were chosen because they represented factors derived from social cognitive theory that had been previously found to be associated with physical activity in adults or had been proposed as potentially important factors influencing physical activity levels (Dishman & Sallis, 1994; King et al., 1995; Sallis et al., 1997). The variables can be divided into five conceptual domains (King et al., 1992): sociodemographic, health related, psychosocial, program based, and environmental.

Sociodemographic. Sociodemographic variables included self-identified race–ethnicity (White, African American, American Indian–Alaskan Native, or Hispanic), age (continuous variable; no upper age limit), employment status (coded as full-time employment vs. other), marital status (coded as married vs. other), educational level (less than high school degree, high school degree, some college, or college degree), and residence (urban, rural, or other). Educational level was chosen as the primary indicator of socioeconomic status in light of its typically strong correlation with other socioeconomic indicators (e.g., in the current sample, the correlation between educational level and annual household income was .54) and the fact that, in the current sample, there were higher test–retest reliability coefficients and fewer missing values for education (0.2%) than for annual income (16.2%; Brownson et al., 1999).

Health related. General health and functioning were represented by two variables: whether the individual was limited in activities because of any impairment or health problem (yes or no) and number of days during the past 30 days in which the person's physical health was impaired. Because the latter variable was skewed given that many individuals reported a zero in response to this item, it was dichotomized for purposes of analysis (0 = no days of impairment, 1 = 1 or more days of impairment).

Psychosocial. The psychosocial variables consisted of ratings of 10 often-reported personal barriers to physical activity among middle- and older-aged adults (Dishman & Sallis, 1994; King et al., 1992, 1998; Shephard, 1994). The perceived barriers were the presence of others who discouraged physical activity, self-consciousness about physical appearance, fear of injury, lack of time, feeling too tired to be physically active, lacking a safe place to exercise, caregiving duties, poor weather, health problems, and lacking the energy to exercise. The frequency with which each barrier occurred was rated on a 5-point scale (1 = *never,* 5 = *very often;* Castro, Sallis, Hickmann, Lee, & Chen, 1999; Hovell et al., 1991).

Program based. The program-based variable of interest consisted of a question asking the type of physical activity program format that was more appealing: exercising in a group with an exercise leader or exercising on one's own with some instruction (King et al., 1997; King, Taylor, Haskell, & DeBusk, 1990; Wilcox, King, Brassington, & Ahn, 1999). An additional response choice was "don't know/not sure/refused to answer."

Environmental. The environmental variables, identified through previous research (Sallis et al., 1997), consisted of ratings of whether the following eight conditions were present in the participant's neighborhood: sidewalks, heavy traffic, hills, streetlights, unattended dogs, enjoyable scenery, frequent observation of others exercising, and high levels of crime. In a separate question, respondents were asked to rate how safe it was to walk or jog alone in their neighborhood during the day (1 = *very unsafe,* 5 = *very safe*).

Statistical Analyses

All data were cleaned and edited according to standard BRFSS quality control procedures (Gentry et al., 1985; Remington et al., 1988). All analyses were conducted with the Statistical Package for the Social Sciences (SPSS); alpha levels were set at .05. Descriptive statistics were obtained on the sample as a whole, as well as by ethnic subgroup and by physical activity category. Pearson product–moment correlations were conducted to evaluate collinearity among the independent variables. The correlations were generally sufficiently low ($rs < .35$) to allow for entry of all variables into multivariate regression models. Exceptions were two sets of perceived barriers: lack of energy and feeling too tired to exercise ($r = .51$) and lack of energy and not being in good health ($r = .40$). Given that these levels of correlation still allow for a substantial amount of unique variance across these variables, they were retained for analysis. Age and employment status also were moderately correlated ($r = .62$); however, given that each has been found to be independently related to physical activity levels in other populations, and relatively few investigations of their relationships with physical activity levels among minority women have been reported (Dishman & Sallis, 1994; King et al., 1992), both were retained for analysis.

A series of logistic regression analyses (with all independent variables entered simultaneously) were subsequently undertaken to explore the unique associations of the independent variables with physical activity level. For all logistic regression analyses, the following independent variables were entered into the model simultaneously: race–ethnicity (entered into the model for the analysis conducted on the total sample only and coded as 0 = African American, 1 = other [first ethnic comparison]; 0 = American Indian, 1 = other [second ethnic comparison]; and 0 = Hispanic, 1 = other [third ethnic comparison]; age (continuous variable), employment (0 = full-time employment, 1 = other), marital status (0 = married, 1 = other), education (1 = less than high school degree, 2 = high school degree, 3 = some technical school or college, 4 = college degree), urban residence (0 = other, 1 = urban), rural residence (0 = other, 1 = rural), the 10 perceived barriers items (mean rating for each on a 5-point Likert-type scale), rated safety of walking or jogging alone in one's neighborhood during the day (5-point Likert-type scale), the eight environmental characteristics (each entered separately; 0 = absent, 1 = present), number of days in which physical health was impaired (0 = none, 1 = 1 or more days), limitations in physical activity because of health (0 = no, 1 = yes), and whether exercising in a group or on one's own was more appealing (0 = on one's own, 1 = group preference).

Physical activity level served as the dependent variable in all regression analyses. Because of the relatively small number of women placed in the

active category for physical activity (sample sizes for the racial–ethnic subgroups ranged from 41 to 83), the underactive and active categories were combined in the major logistic regression analyses (dependent variable: sedentary vs. underactive–active). The physical activity values were coded as 0 (inactive) and 1 (underactive–active).

An overall logistic regression analysis was first conducted with ethnicity included as an independent variable to evaluate the association of ethnicity with physical activity level independent of the other variables of interest. Separate logistic regression analyses were undertaken for each racial–ethnic subgroup to explore potentially unique patterns of association with respect to the independent variables and physical activity level for each subgroup.

Results

Descriptive Information

Demographic characteristics. Demographic characteristics for the sample as a whole (N = 2,912) are shown in Table 1. Each of the four racial–ethnic subgroups targeted constituted approximately one quarter of those sampled. Approximately 58% of the women sampled reported a high school education or less, and 60% reported household incomes of less than $35,000 per year.

Physical activity levels. The percentages of women designated as inactive, underactive, and active for the sample as a whole and for each racial–ethnic subgroup are shown in Table 2. The American Indian–Alaskan Native and African American subgroups had the largest percentages of women falling within the inactive category (59% and 57%, respectively) and the smallest percentages of women falling within the active category (8% and 6%, respectively), $\chi^2(6, N = 2{,}912) = 43.94$, $p < .001$. These levels of inactivity–activity for different ethnic groups of women are similar to those previously reported in population-based samples of women (U.S. Department of Health and Human Services, 1996).

Perceived barriers to physical activity. The prevalences of perceived personal barriers to physical activity for the sample as a whole and for each racial–ethnic subgroup are shown in Table 3, along with relative rankings within each subgroup. It is important to note that the rankings are for descriptive purposes only and should be interpreted with caution, given that differences between rankings were, in some cases, small. For the sample as a whole and across each racial–ethnic subgroup, caregiving duties and lacking energy to exercise ranked among the top four most frequently reported barriers to being physically active. In addition, lack of time and feeling too tired to be physically active ranked among the top four barriers for three of the four racial–ethnic subgroups. Lacking a safe place to exercise was the top-ranked barrier for the African American subgroup, and self-consciousness about physical appearance was ranked second for the Hispanic subgroup.

Physical activity program format preferences. Across the sample as a whole, 62% of respondents rated exercise on one's own with some instruction as more appealing than undertaking physical activity in a group with an exercise instructor (34%). Only 4% of respondents chose the "don't know/not sure/refused" response. A similar percentage preferring to exercise on one's own with some instruction was found across the four racial–ethnic subgroups (range: 62.4%–65.4%; *ns*) and across the three physical activity categories (range: 63.1%–66.2%; *ns*). These results are comparable to those that have been reported in regional surveys of middle-aged and older women in which population-based survey methods were applied (King et al., 1990; Wilcox et al., 1999).

Table 1
Demographic Characteristics of Participants in the U.S. Women's Determinants Study, 1996–1997 (N = 2,912)

Characteristic	%	*n*
Race–ethnicity		
White	26.4	769
Black	25.6	745
American Indian–Alaskan Native	25.3	738
Hispanic	22.7	660
Age group (years)		
40–49	38.5	1,121
50–59	26.1	760
60–69	20.3	592
≥70	15.1	439
Marital status		
Married	56.9	1,655
Divorced	14.8	430
Widowed	18.5	538
Separated	4.2	121
Never married	5.5	161
Other–missing	0.2	7
Employment		
Full time	37.4	1,088
Part time	6.8	199
Self-employed	4.4	129
Unemployed less than 1 year	3.4	98
Unemployed more than 1 year	2.3	68
Homemaker	12.9	375
Retired	25.3	737
Disabled and unable to work	7.0	204
Education		
Less than high school degree	27.1	788
High school degree	30.8	897
Some college or technical school	21.2	616
College degree	14.0	409
Postcollege graduate work	6.7	197
Unknown–missing	0.2	5
Annual income (thousands of dollars)		
<10	19.2	560
10–19	21.0	610
20–34	19.8	575
35–49	13.5	394
≥50	10.3	300
Unknown–missing	16.2	473
Residence		
Urban	37.6	1,096
Rural	42.7	1,242
Other	16.7	574
Missing	3.0	87

Environmental characteristics. The prevalences of environmental characteristics of potential relevance to physical activity are shown in Table 4 for the sample as a whole and for each racial–ethnic subgroup. More than 80% of respondents across all four racial–ethnic subgroups reported enjoyable scenery in their neighborhoods. However, approximately half of African American and American Indian–Alaskan Native respondents reported the presence of unattended dogs in their neighborhoods (relative to approximately one third of White and Hispanic respondents) and reported heavy neighborhood traffic (relative to one third or less of White and Hispanic respondents). In addition, 81% of American Indian–Alaskan Native respondents reported a lack of neighborhood sidewalks (range across other ethnic groups: 41%–54%), and 64% of respondents from this ethnic subgroup reported that their

Table 2
Percentages of the Total Sample and of Each Racial–Ethnic Subgroup Categorized as Inactive, Underactive, or Active

	White		Black		American Indian–Alaskan Native		Hispanic		Total sample	
Category	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*
Inactive	46.7	359	56.6	422	58.7	433	48.5	320	52.7	1,534
Underactive	42.5	327	37.4	278	33.3	246	38.6	255	38.0	1,106
Active	10.8	83	6.0	45	8.0	59	12.9	85	9.3	272
Total	100	769	100	745	100	738	100	660	100	2,912

Note. Physical activity groups were defined as follows: inactive, no sports or exercise in past 2 weeks or no increase in heart rate from activities; underactive, neither inactive nor active; and active, 3 or more sessions per week, at least 20 min per session, with medium to large increase in reported heart rate, of jogging, hiking, biking, swimming, and dance or 5+ sessions per week, at least 30 min per session, with at least a small increase in heart rate for all physical activity items.

neighborhoods lacked streetlights (range across other ethnic subgroups: 36%–40%). Frequently observing others exercising in the neighborhood was reported most often by Hispanic respondents (72%) and least often by American Indian–Alaskan Native respondents (52%). High neighborhood crime rates were reported most frequently by African Americans (25%; range across other racial–ethnic subgroups: 16%–20%). Similarly, although the vast majority of respondents across the sample as a whole rated their neighborhood as "safe" or "very safe" with respect to walking or jogging alone in their neighborhood during the day, the percentages of those rating their neighborhood as either "very unsafe" or "unsafe" ranged from 10% and 12% for Whites and Hispanics, respectively, to approximately 19% for the African American and American Indian subgroups.

Correlates of Physical Activity Level: Total Sample

In the logistic regression analysis undertaken with the entire sample, 11 of the independent variables entered into the model achieved statistical significance: overall model, $\chi^2(31, N = 2{,}633) = 207.0$, $p < .0001$. These 11 variables are summarized in Table 5, along with the relevant odds ratios. In this table, each variable is adjusted for all others shown. The 11 variables were race–ethnicity, with American Indian women found to be less active than those in the other racial–ethnic subgroups ($p < .08$ for African American women comparison); age (older age associated with less activity); education (less education associated with less activity); self-consciousness about physical appearance (higher rating associated with more activity); being too tired (higher rating associated with less activity); not being in good health (higher rating associated with less activity); lacking energy (higher rating associated with less activity); hills in the neighborhood (presence of hills associated with more activity); enjoyable scenery (presence associated with more activity); unattended dogs (presence associated with more rather than less activity); and frequently observing others exercising in one's neighborhood, with endorsement of this variable associated with more activity.

Correlates of Physical Activity Level by Racial–Ethnic Subgroup

Logistic regression analyses were subsequently undertaken for each of the four racial–ethnic subgroups to explore the pattern of

Table 3
Most Frequently Reported Perceived Barriers, Along With Relative Rankings, for the Sample as a Whole (N = 2,912) and for Each Racial–Ethnic Subgroup

Perceived barrier	% total sample	Overall rank	% White (rank)	% Black (rank)	% American Indian–Alaskan Native (rank)	% Hispanic (rank)
Lack of time	22.3	1 (tie)	24.6 (1)	17.0 (5)	24.8 (2)	22.5 (3)
Caregiving duties	22.3	1 (tie)	20.7 (2)	20.2 (3)	23.6 (4)	25.6 (1)
Lack energy	21.7	3	19.9 (4)	21.1 (2)	25.1 (1)	20.3 (4)
Too tired	20.7	4	20.4 (3)	19.0 (4)	24.5 (3)	18.9 (5)
Lack safe place to exercise	20.1	5	16.5 (6)	22.9 (1)	23.0 (5)	17.6 (6)
Self-conscious about physical appearance	19.6	6	18.9 (5)	15.1 (7)	20.6 (6)	23.8 (2)
Not in good health	16.2	7	13.6 (7)	16.8 (6)	19.2 (8)	15.2 (8)
Afraid of injury	15.3	8	11.0 (9)	14.9 (8)	19.4 (7)	16.3 (7)
Bad weather	10.4	9	12.4 (8)	8.8 (9)	11.2 (9)	8.8 (9)
Others discourage me	5.6	10	3.4 (10)	6.2 (10)	7.1 (10)	5.3 (10)

Table 4
Environmental (Neighborhood) Characteristics Reported for the Sample as a Whole and for Each Racial–Ethnic Subgroup

	Total sample (%)		White (%)		Black (%)		American Indian–Alaskan Native (%)		Hispanic (%)	
Neighborhood characteristic	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Feel safe walking–jogging[a]	76.0	15.0	81	10	71	18	72	18	79	12
Sidewalks	43.8	56.2	53	47	46	54	19	81	59	41
Heavy traffic	39.1	60.9	36	64	45	55	43	57	32	68
Hills	27.5	72.5	31	69	30	70	25	75	24	76
Streetlights	55.4	44.6	60	40	63	37	36	64	64	36
Unattended dogs	44.7	55.3	38	62	46	54	56	44	39	61
Enjoyable scenery	85.3	14.7	86	14	82	18	89	11	85	15
Frequently see others exercise	63.1	36.9	67	33	62	38	52	48	72	28
High crime	19.6	80.4	16	84	25	75	19	81	20	80

[a] Remaining respondents chose the "neutral" response category.

barriers specific to each group. The results of these four regression analyses are summarized in Table 6.

White subgroup. Four of the variables entered into the model for the White subgroup (age, education, presence of hills, and lack of energy) achieved statistical significance and showed the same direction of effect described for the total sample: overall model, $\chi^2(28, N = 712) = 76.7, p < .0001$.

African American subgroup. Three of the variables entered into the regression model for the African American subgroup achieved statistical significance: overall model, $\chi^2(28, N = 646) = 70.2, p < .0001$. These three variables consisted of frequently observing others exercising in one's neighborhood (greater frequency associated with being more active), caregiving duties (higher rating associated with being less active), and the presence of unattended dogs in one's neighborhood (presence of dogs associated with being more active).

American Indian–Alaskan Native subgroup. Three of the variables entered into the regression model for the American Indian–Alaskan Native subgroup achieved statistical significance: overall model, $\chi^2(28, N = 653) = 60.6, p < .0003$. These three variables were education (lower level associated with being less active), self-consciousness about physical appearance (higher rating associated with being more active), and not being in good health (higher rating associated with being less active).

Hispanic subgroup. Four of the variables entered into the regression model for the Hispanic subgroup achieved statistical significance: overall model, $\chi^2(28, N = 622) = 64.8, p < .0001$. These four variables were education (lower level associated with being less active), discouragement from others about exercise (higher rating associated with being more active), being too tired to exercise (higher rating associated with being less active), and presence of hills in one's neighborhood (associated with being more active).

Discussion

The current results provide an in-depth evaluation of correlates of physical inactivity among middle- and older-aged U.S. women

Table 5
Simultaneous Logistic Regression: Correlates of Being Sedentary Versus Underactive–Active (n = 2,633)

Correlate	Odds ratio	95% CI
Race–ethnicity		
African American vs. other	0.81	0.64–1.03
American Indian–Alaskan Native vs. other	0.67**	0.52–0.86
Hispanic vs. other	0.93	0.74–1.17
Age	0.98***	0.97–0.99
Employment	0.97	0.80–1.19
Marital status	0.88	0.74–1.04
Education	1.18***	1.09–1.28
Location		
Urban	1.12	0.88–1.42
Rural	1.11	0.87–1.41
Neighborhood characteristics		
Feel safe walking–jogging	1.02	0.94–1.11
Sidewalks	1.08	0.87–1.34
Heavy traffic	0.92	0.77–1.09
Hills	1.46***	1.22–1.75
Streetlights	1.02	0.84–1.24
Unattended dogs	1.20*	1.01–1.42
Enjoyable scenery	1.42**	1.12–1.79
Frequently see others exercise	1.26**	1.06–1.50
High crime	0.99	0.84–1.18
Days physical health was not good	1.04	0.87–1.24
Limited in activities owing to health	0.86	0.69–1.07
Preference for home-based exercise	1.00	0.84–1.18
Personal barriers		
Others discourage me from exercising	1.07	0.98–1.17
Self-conscious about physical appearance	1.08*	1.01–1.14
Afraid of injury	1.05	0.98–1.13
Lack of time	0.95	0.89–1.02
Too tired	0.92*	0.85–0.99
Lack safe place to exercise	0.98	0.93–1.05
Caregiving duties	0.95	0.90–1.01
Bad weather	1.00	0.93–1.08
Not in good health	0.93*	0.86–0.99
Lack energy	0.90**	0.84–0.97

Note. CI = confidence interval.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 6
Simultaneous Logistic Regression: Correlates of Being Sedentary Versus Underactive–Active by Racial–Ethnic Subgroup

Correlate	White (n = 712)		African American (n = 646)		Hispanic (n = 622)		American Indian–Alaskan Native (n = 653)	
	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
Age	0.98**	0.96–0.99	0.99	0.97–1.01	0.98	0.96–1.00	0.99	0.97–1.01
Employment	1.08	0.73–1.61	0.83	0.54–1.29	0.84	0.55–1.28	0.99	0.66–1.48
Marital status	0.86	0.60–1.23	1.00	0.71–1.42	0.70	0.49–1.00	0.93	0.65–1.33
Education	1.28**	1.08–1.52	1.04	0.88–1.24	1.29**	1.07–1.55	1.21*	1.02–1.44
Location								
Urban	1.27	0.81–2.00	1.10	0.65–1.86	0.98	0.63–1.51	1.13	0.43–2.96
Rural	1.09	0.69–1.72	1.25	0.71–2.20	1.14	0.66–1.97	0.95	0.57–1.60
Neighborhood characteristics								
Feel safe walking–jogging	1.14	0.97–1.33	0.88	0.74–1.03	1.00	0.84–1.19	1.11	0.94–1.31
Sidewalks	1.01	0.66–1.56	1.51	0.98–2.32	1.00	0.66–1.53	1.08	0.64–1.82
Heavy traffic	0.83	0.59–1.17	0.82	0.57–1.17	1.18	0.80–1.74	1.00	0.70–1.45
Hills	1.48*	1.04–2.10	1.14	0.77–1.70	1.89**	1.21–2.93	1.29	0.87–1.91
Streetlights	1.02	0.68–1.54	1.04	0.67–1.62	0.86	0.59–1.26	1.19	0.81–1.75
Unattended dogs	1.06	0.75–1.49	1.51*	1.06–2.15	1.12	0.77–1.63	1.13	0.79–1.62
Enjoyable scenery	1.46	0.91–2.35	1.47	0.92–2.34	1.16	0.71–1.91	1.39	0.78–2.46
Frequently see others exercise	0.95	0.65–1.37	2.08***	1.45–2.98	1.05	0.69–1.59	1.32	0.94–1.85
High crime	0.79	0.50–1.26	0.91	0.58–1.42	0.99	0.63–1.55	1.26	0.80–1.98
Days physical health was not good	1.03	0.73–1.46	1.11	0.77–1.60	1.16	0.80–1.68	0.92	0.64–1.32
Limited in activities owing to health	0.77	0.50–1.18	0.76	0.49–1.19	0.88	0.53–1.45	1.09	0.70–1.72
Preference for home-based exercise	0.86	0.62–1.20	1.31	0.93–1.85	1.12	0.78–1.60	0.81	0.56–1.16
Personal barrier								
Others discourage me from exercising	1.02	0.83–1.25	1.04	0.88–1.23	1.25*	1.03–1.51	1.02	0.86–1.20
Self-conscious about physical appearance	1.04	0.92–1.17	1.09	0.96–1.24	1.03	0.90–1.17	1.19**	1.05–1.34
Afraid of injury	1.03	0.87–1.19	1.07	0.92–1.25	1.14	0.98–1.33	0.99	0.86–1.14
Lack of time	0.90	0.79–1.03	1.00	0.87–1.16	0.90	0.79–1.03	0.96	0.84–1.10
Too tired	1.14	0.96–1.35	0.91	0.78–1.06	0.78**	0.66–0.92	0.88	0.76–1.03
Lack safe place to exercise	1.00	0.89–1.14	0.96	0.85–1.09	1.01	0.88–1.15	1.00	0.87–1.14
Caregiving duties	1.06	0.94–1.19	0.84**	0.74–0.96	0.89	0.79–1.01	1.02	0.91–1.15
Bad weather	0.87	0.76–1.01	1.11	0.95–1.31	1.03	0.88–1.22	1.04	0.89–1.23
Not in good health	1.06	0.91–1.23	0.87	0.74–1.03	0.94	0.80–1.10	0.83*	0.70–0.97
Lack energy	0.78**	0.67–0.92	0.94	0.80–1.10	0.96	0.82–1.13	0.88	0.76–1.02

Note. CI = confidence interval.
* $p < .05$. ** $p < .01$. *** $p < .001$.

at the population level. This population segment represents a particularly important study target given its elevated risk for having a sedentary lifestyle (King et al., 1998; U.S. Department of Health and Human Services, 1996). Furthermore, the oversampling of four different racial–ethnic subgroups provides much needed information concerning the differential relationships across multiple domains of determinants and physical activity levels in these understudied population segments. The information on the American Indian–Alaskan Native subgroup, in particular, begins to address a group that has been minimally studied with respect to physical activity–inactivity determinants. The finding that only approximately 9% of respondents across the survey as a whole met the definition of being regularly active is comparable to that of other recently reported national surveys that included middle- and older-aged women (U.S. Department of Health and Human Services, 1996). In those national surveys, which generally had lower percentages of ethnic minority women represented and included younger women (i.e., 18 years of age and older), regular physical activity rates for moderate or more vigorous activities ranged from approximately 9% to 19% (U.S. Department of Health and Human Services, 1996).

For the sample as a whole as well as for one or more of the racial–ethnic subgroups evaluated separately, being less educated or older, lacking energy to exercise, reporting a lack of hills in one's neighborhood, perceived poor health, and infrequently observing others exercising in one's neighborhood were associated with inactive lifestyles. The inclusion of study variables representing different determinants domains (e.g., sociodemographic, health related, psychosocial, program based, and environmental), along with the fact that significant correlates emerged from virtually all of these domains, underscores the importance of applying an ecological model to further understanding of influences on physical inactivity in middle-aged and older women.

The descriptive analysis of the perceived barriers items indicated that several barriers that have been frequently identified in other populations (e.g., lacking energy to exercise and perceived lack of time; Craig, Russell, Cameron, & Beaulieu, 1998; Dishman & Sallis, 1994; King et al., 1992) were also identified by women

across different racial–ethnic backgrounds in the current sample. In addition, the current sample identified caregiving duties as a prevalent barrier to physical activity participation. This finding indicates the potential impact of this increasingly frequent life role on health behaviors for women in this age group and underscores the need to identify the types of physical activity regimens that are most appropriate to the caregiving situation (King & Brassington, 1997). Caregiving duties were also identified as an important barrier to physical activity participation among women in a recently completed population-based survey of physical activity barriers among 15,239 respondents representing the 15 European Union member states (Zunft et al., 1999), as well as in a community-based physical activity intervention targeting rural Latino families (Grassi et al., 1999). The fact that caregiving duties were one of the three variables reaching statistical significance in the logistic regression analysis for the African American subgroup suggests the need to better understand the effects of that barrier particularly as it influences African American middle- and older-aged women.

Other less studied perceived barrier items that reached statistical significance in the ethnic-specific logistic regression analyses were discouragement from others about physical activity (Hispanics) and self-consciousness about physical appearance (American Indians–Pacific Islanders). Of note, both variables were associated with being more active. With respect to self-consciousness, the results suggest that appearance motives might increase interest and participation in physical activity, as has been suggested in some studies (King et al., 1992). Alternatively, it is possible that greater levels of physical activity, which often occurs in public venues or settings, lead to increased awareness that others may be noticing one's appearance or, in the case of the discouragement variable, incite more criticism from others related to choosing to spend time exercising.

Close to two thirds of respondents from all four racial–ethnic subgroups and from each of the three defined physical activity categories expressed a preference for undertaking physical activity on one's own, with some instruction, as opposed to in a group with an exercise leader. This overwhelming preference for physical activities that can be undertaken outside of group settings has been found in other random-sample surveys of middle- and older-aged women and men that have been undertaken in the United States (King et al., 1990; Wilcox et al., 1999) as well as in Australia (Lee, 1993). Notably, in the random-sample telephone survey of 286 Australian women between 50 and 64 years of age, a similar percentage of women (68%) preferred "going it alone" when given a number of physical activity alternatives to choose from (Lee, 1993). On a similar note, "no one to exercise with" and "lack of facilities" were cited as barriers by less than 10% of both women and men participating in a population-based European Union survey (Zunft et al., 1999). The preference for activities one can undertake on one's own probably reflects the roles that convenience and flexibility play in influencing people's physical activity choices, as well as subsequent participation levels (Carter-Nolan, Adams-Campbell, & Williams, 1996; King et al., 1990, 1992, 1998; Whitehorse, Manzano, Baezconde-Garbanati, & Hahn, 1999). The prevalence of such preferences, found on the population level and across different racial–ethnic subgroups, including subgroups of Asian American–Pacific Islanders (Lew et al., 1999), underscores the importance of continuing to fashion effective physical activity programs that are appealing to the two thirds of women who may not seek out participation in a community class or group.

This study represents the first effort to evaluate the relationship between neighborhood environments and levels of physical activity in a population-based sample. Characteristics of the neighborhood environment were assessed because associations with physical activity were hypothesized, but environmental characteristics are rarely investigated (Clark, 1999; Sallis & Owen, 1999). Some significant associations were documented, indicating the importance of including environment assessment in physical activity determinants studies. Among African American women, for example, frequently seeing others exercising in the neighborhood was positively related to physical activity. However, several of the associations were in unexpected directions, which poses challenges for interpretation. The positive relationships between physical activity levels and presence of both hills and unattended dogs, in the sample as a whole as well as in some racial–ethnic subgroups, were counter to our expectations because these items were originally conceptualized as barriers to physical activity (Sallis et al., 1997). The positive relationships with physical activity are unlikely to be due to a confounding with socioeconomic status, given that, in the current sample, these environmental variables were minimally correlated ($r < .10$) with all other variables entered into the multivariate models, as well as income. It is possible that hilly neighborhoods provide more interesting scenery in which to undertake physical activity. An alternate explanation is that undertaking physical activity in hilly neighborhoods increases perceived effort, making such activity more salient and thus more likely to be reported than physical activity on flat terrain (Sallis, Hovell, & Hofstetter, 1992).

Similarly, observing the presence of unattended dogs in one's neighborhood could be a marker for getting out more often in the neighborhood, when one would have a greater opportunity to observe such events. Thus, interpretations that environments affect physical activity and that physical activity can affect perceptions of the environment are both tenable. A final possibility is that both significant associations are chance findings, so replications of these associations should be attempted. The unexpected results suggest that environmental influences may be more complex than anticipated. Because environmental characteristics affect entire populations but may interact with individual-differences variables, the need to clarify environmental associations with physical activity in various population groups remains.

In contrast to recently reported BRFSS data from five states indicating that people who perceived their neighborhood to be unsafe were more likely to be physically inactive (Weinstein, Feigley, Pullen, Mann, & Redman, 1999), the current national study did not show that perceived safety was independently associated with reported physical activity level. These differences underscore the importance of additional research to further understanding of how perceived safety and other environmental factors may influence physical activity levels in different population strata.

The current study has several limitations, including reliance on data collected via telephone, which may result in undersampling of some minority and low-income groups who lack telephones (Centers for Disease Control, 1992), and use of zip codes containing 20% or more of a racial–ethnic group, which leads to overrepre-

sentation of certain types of ethnic subgroups (e.g., American Indians living on reservations; Brownson et al., 1999). However, according to 1990 census information for the zip codes that were sampled, telephone coverage was reasonably high (86.1% to 92.6%), and we were able to obtain a representative distribution of minority and low-income women (Brownson et al., 1999). Notably, however, insufficient numbers of Asian women were able to be interviewed by telephone during the survey pilot phase, resulting in their subsequent exclusion from the formal phase of the survey. This is unfortunate, given the fact that Asians are, along with Latinos, the fastest-growing ethnic minority group in the United States (Lin-Fu, 1993; U.S. Bureau of the Census, 1993) and have to date been minimally studied in the physical activity arena (Taylor et al., 1998). In addition, the telephone survey was conducted in English only, which would have excluded Spanish-speaking women who did not possess sufficient English language skills. The results are thus limited to the subgroup of Hispanic women who speak English, a subgroup that has been shown, in some national samples, to have a different (i.e., better) coronary heart disease risk factor profile than subgroups of non-English-speaking Hispanic women (Sundquist & Winkleby, 1999). An important limitation is that the current investigation was cross sectional in nature, making it impossible to evaluate the predictive utility of the variables identified on subsequent physical activity levels.

Because the prevalence of regular physical activity in this country is low among women, particularly those who are older and from ethnic minority groups (U.S. Department of Health and Human Services, 1996), the relatively low prevalence of regularly active women in the current sample was not surprising. This did, however, limit our ability to compare determinants among groups intermittently as opposed to regularly active. This limitation is mitigated somewhat by the current consensus among scientists in the field that the most important, yet most understudied, subgroup consists of those who are inactive (Pate et al., 1995; U.S. Department of Health and Human Services, 1996). The population-based epidemiological survey sampling technique, although allowing us to obtain a representative U.S. sample, also has limitations with respect to the number and type of questions that can be ascertained. The physical activity questions that were used and the classification of individuals as inactive or not inactive were based on standard survey methods and approaches that have been used in other major population-based physical activity evaluations in the United States (U.S. Department of Health and Human Services, 1996).

An additional potential limitation relates to the dearth of data on the validity of physical activity variables collected as part of the BRFSS and similar surveys (Ainsworth et al., 1999; Jones et al., 1999). Potential lack of validity may be a particular issue when the target population consists of midlife, older, and minority women (Eyler et al., 1998; Masse et al., 1998). For instance, a recently convened expert panel has suggested that currently available physical activity surveys such as the BRFSS may not adequately assess the range and patterns (e.g., intermittent or simultaneous) of physical activity undertaken by women and ethnic minority subgroups or may involve terminology that is unfamiliar to or misconstrued by these subgroups (Eyler et al., 1998; Masse et al., 1998; Whitehorse et al., 1999).

The assessment of environmental influences also involved several limitations. Only a subset of possible environmental influences was assessed in the survey, based on the few systematic investigations currently reported in the field (Eyler et al., 1998; Sallis et al., 1997). The assessment focused on the presence of variables rather than participants' perceptions that the environmental variable influenced their behavior, given the potential in the latter case for post hoc attributions on the part of respondents who were not currently active (e.g., using environmental factors as an excuse for inactivity). Because it is not clear whether the actual or perceived environment is more influential (Sallis et al., 1997), it is important for future studies to evaluate both aspects. Because self-reports of environmental characteristics may be incomplete, objective measures of theoretically important variables need to be developed and applied.

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