Factors Associated With Regular Aerobic Exercise In An Elderly Population

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Abstract: ***Background:*** **Little is known regarding the characteristics of elderly persons who do not regularly exercise. This lack of knowledge limits the design and marketing of exercise programs to persons who could benefit from regular exercise.**

Methods: **We compared characteristics of regular exercisers and nonexercisers among 561 randomly selected persons aged 65 years and older who were enrollees of a health maintenance organization. Baseline data were obtained on sociodemographics, health attitudes, and medical conditions.**

Results: **Of the 561 persons studied, 192 (34 percent) were regular exercisers. Exercisers were slightly younger than nonexercisers and reported more positive health perceptions. Nonexercisers tended to report lower incomes and lower educational levels than did exercisers. Exercisers were less likely to report hypertension, arthritis, or two or more of the following medical conditions: heart disease, hypertension, arthritis, and emphysema (odds ratio 0.49; confidence interval 0.28 to 0.86). Sex differences were present. In logistic regression analysis, higher reported income, better perception of current health, and fewer than two medical conditions were associated with regular exercise status.**

Conclusions: **Specific characteristics are present in persons who regularly exercise compared with those who do not. These findings may prove useful in understanding the dynamics of exercise behavior in this age group and in designing exercise interventions for this population. (J Am Board Fam Pract 1992; 5:467-74.)**

Although more than 50 percent of older adults have no health or medically related restrictions on physical activity,[1] fewer than 20 percent regularly exercise at an intensity sufficient to improve cardiovascular fitness.[2] Such exercise has been shown to have benefits for younger persons,[3-5] and there is promising evidence that suggests benefits for the elderly as well.[6-8] Nevertheless, despite the growing interest in health promotion for older adults, and in exercise in particular, little research has been done to characterize elderly persons who perform regular aerobic exercise compared with those who do not. We therefore sought to determine the relation of selected demographic and socioeconomic factors, health attitudes, preventive health practices, and medical conditions with regular aerobic exercise in elderly persons.

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Methods

Study Site

Group Health Cooperative (GHC) is a large, closed-panel, not-for-profit health maintenance organization (HMO) with more than 350,000 members including a senior (aged 65 years and older) population of more than 45,000. The Group Health Senior Health Promotion Program, supported by research and demonstration grants from the Centers for Disease Control and the Kellogg Foundation, involves randomly sampled enrollees who are 65 years and older and who receive their care at one of three central Seattle GHC primary care clinics. The research and demonstration project includes a randomized controlled trial to evaluate this senior health promotion program, which consists of a 60- to 90-minute nurse visit in which health risks are discussed and specially designed follow-up inter-

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ventions are undertaken. The goals of the program are to reduce the occurrence or progression of disability among ambulatory older adults and to integrate health promotion and disease prevention activities for seniors into the primary care system.

Study Population

The study population consisted of 561 enrollees aged 65 years and older who responded to a mailed questionnaire regarding health attitudes, medical conditions, preventive health behaviors, socioeconomic status, and demographic information and who underwent an exercise evaluation as part of the Senior Health Promotion Program. The program had initially selected individuals at random from the computerized enrollment lists of GHC clinics; 6328 names were selected, organized by primary care practice, and reviewed by their primary care physician. The physician identified subjects who were seriously ill, cognitively impaired, or otherwise unfit for a health promotion trial; 483 persons (8 percent) were thus excluded. The remaining 5845 were sent an introductory letter, followed by a mailed program description and baseline questionnaire. Eight hundred twenty-six (13 percent) refused participation; the most frequent reasons given for refusal were "too busy" or poor health. A random telephone survey of those refusing indicated that many of them were very active and functional and were not likely to be candidates for the health promotion intervention. An additional 105 (2 percent) were not eligible to participate because they were institutionalized, seriously ill, or out of the area. Two thousand two hundred eighty-nine (39 percent) returned completed consent forms and questionnaires, while 2625 (45 percent) failed to respond despite repeated attempts to elicit a mailed response.

Of the 2289 persons who returned questionnaires, 1868 (82 percent) were eligible for the trial because they were not institutionalized, did not report difficulties with activities of daily living, and were planning to remain in the Seattle area. Six hundred thirty-three persons were randomly assigned to the program, which included an exercise evaluation performed by a trained health nurse assessor using published criteria including those developed by the American College of Sports Medicine.[9] Sixty-one persons did not attend this assessment; analysis of age, sex, and the number of medicines used for chronic diseases (chronic disease score[10]) did not reveal significant differences from those who attended.[11] One person died before attending the assessment, and data on the exercise evaluation were missing for 10 persons. The remaining 561 (89 percent of those randomized) received the physical activity assessment and were classified as (1) regular aerobic exercisers — persons exercising a minimum of three times a week for at least 15 minutes per session, in a manner thought to be sufficient to raise their heart rates to a level for cardiovascular fitness; or (2) nonaerobic exercisers — persons exercising fewer than three times a week, exercising less than 15 minutes per session, or exercising without attaining a heart rate sufficient to improve cardiovascular fitness. Our intent was not necessarily to determine which persons were achieving a full training effect, but rather to determine who were regularly exercising in a manner likely to maintain some level of enhanced cardiovascular fitness. We later compared this classification with a version of the Paffenbarger index,[5] which was completed during the baseline questionnaire. The exercisers' mean index value was 47 ± 21 kcal/kg/d, and the nonexercisers' mean index value was 33 ± 15 kcal/kg/d. Using a cutoff of 2500 kcal/d,[5] there was 80 percent agreement between the assessors' classification of persons as nonexercisers and the Paffenbarger classification.

Generation of Hypotheses

Based on previous work with the Health Belief Model[12] and Multiattribute Utility Theory,[13] we hypothesized that regular aerobic exercise would be associated with higher perceptions of current health status and a positive outlook on personal health. Second, exercise could have a strong social component in older persons, and greater social participation might be associated with regular exercise. Third, because regular exercise is a preventive health behavior, we expected regular exercise to be associated with the practice of other preventive health behaviors, such as influenza immunization, screening fecal occult blood testing, and screening mammography in the past year, plans for mammography during the next year, seatbelt use, and performance of monthly breast self-examination. Fourth, socioeconomic

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status was expected to correlate with regular aerobic exercise. We believed that persons with higher socioeconomic status might view exercise more as a leisure activity, whereas those from lower socioeconomic strata might tend to view exercise as work. In addition, high socioeconomic status has been associated previously with the practice of other preventive health behaviors.[14-16]

Analysis

The dependent variable was regular exercise status as determined from a personal interview by the nurse assessor. Independent variables were drawn from the baseline questionnaire items, including measures of health perceptions developed in the Rand Health Insurance Experiment[17,18] and the Perceived Quality of Life Scales designed by Patrick, et al.[19] Dichotomous variables were analyzed using the chi-square method. Continuous or ordered variables were examined with t-tests or the Mann-Whitney U test as appropriate. For those variables that demonstrated significant associations ($P < 0.05$), dichotomous variables were then created using the median values as cutoffs. These variables were then entered into a logistic regression analysis, and odds ratios were calculated using beta coefficients from the regression. SPSS[20] and the EGRET[21] program for logistic regression were used. Because of the number of missing variables for some items, the number of subjects available for the regression analysis varied.[22] Several models were studied with different variables, and the final regression equation was determined based on the largest number of significant variables given the largest number of subjects in the equation.[23]

Results

Of the 561 persons undergoing the assessment, 192 (34 percent) were regular exercisers and 369 (66 percent) were classified as nonaerobic exercisers.

Demographic and Social Characteristics

Regular exercisers were 1.4 years younger than nonexercisers; only 25 percent of those more than 75 years old were regular aerobic exercisers. Regular aerobic exercisers also reported significantly higher incomes and higher educational levels, and they were more likely to be married than were nonexercisers (Table 1).

Table 1. Sociodemographic Characteristics of Exercisers and Nonexercisers.

Characteristic	Exercisers n = 192	Nonexercisers n = 369
Age > 75 years (%)*	25	34
Average age (years)*	71.3 ± 4.3	72.8 ± 5.6
Income > $15,000 (%)*	74	60
College graduate (%)*	32	23
Married (%)*	66	53
Women (%)	54	62
White (%)	97	92

*$P < 0.05$.

Health Attitudes

Significant differences in health attitudes were present between the two groups. Regular exercisers tended to have more positive perceptions of their health but were no more likely to worry about their health (Table 2).

Medical Conditions

Of the medical conditions listed in the questionnaire, hypertension and arthritis were reported less often by aerobic exercisers. Aerobic exercisers were also less apt to report two or more of the following conditions: hypertension, heart disease, arthritis, and emphysema. Only 22 percent of

Table 2. Health Attitudes and Regular Aerobic Exercise.

Variable	Odds Ratio*	Confidence Interval	Coefficient	*P* Value
Current health† (score > 16)	1.8	1.3–2.6	0.6	0.001
Outlook on health† (score > 15)	1.6	1.2–2.3	0.47	0.01
Perception of health as excellent or very good†	1.9	1.3–2.7	0.66	< 0.001
Worry about health† (score > 12)	0.85	0.58–1.3	−0.15	0.44
Satisfaction with health of body‡ (score > 30)	1.7	1.3–2.8	0.57	0.01

*Unadjusted odds of being a regular exerciser.
†Variables from the Rand Health Insurance Experiment.[17,18]
‡Patrick.[19]
Note: scores are cut at median values.

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those reporting two or more of these four conditions were regular aerobic exercisers compared with 40 percent of nonexercisers (Table 3).

Sex Differences

Although not statistically significant, men were more likely to be regular exercisers. When the data were examined separately for men and women, different patterns emerged. In men (Table 4), regular aerobic exercise was associated with better perceptions of current health, more positive health outlook, and more positive self-reported health status. All of these measures were highly intercorrelated, with correlation coefficients of 0.45 or greater. The simple rating of health as excellent, very good, good, fair, or poor was the variable most strongly associated with regular aerobic exercise for men.

Women aerobic exercisers demonstrated a different pattern (Table 5). Like men, they had more positive perceptions of their current health and the health of their bodies; however, they were younger and reported higher incomes, higher educational levels, and fewer medical conditions. They also were more likely to have received screening mammograms in the past year. These four factors were also intercorrelated, correlation coefficients ranging from $r = 0.3$ to 0.6.

Logistic Regression Model

Finally, we constructed a logistic regression model for regular aerobic exercise status. The model showed that aerobic exercisers tended to have better perceptions of current health and were almost twice as likely to report incomes greater than $15,000, but they also had one-half the odds of reporting two or more of the medical conditions: hypertension, heart disease, arthritis, or emphysema. Based on multivariate linear regression analysis, the value of R^2 for the final model was 0.15 (Table 6).

Table 3. Medical Conditions Associated with Exercise Status.

Medical Condition	Odds Ratio*	Confidence Interval	Coefficient	*P* Value
Hypertension	0.64	0.41–0.97	−0.45	0.04
Arthritis	0.7	0.48–1.00	−0.36	0.05
⩾ 2 medical conditions (hypertension, heart disease arthritis, emphysema)	0.49	0.28–0.86	−0.69	0.01

*Unadjusted odds ratios according to likelihood of regular aerobic exercise status.

Table 4. Factors Associated with Regular Aerobic Exercise in Men.

Variables	Odds Ratio*	Confidence Interval	Coefficient
Current health† (score > 16)	2.27	1.28–3.9	0.82
Health outlook† (score > 15)	2.48	1.4–4.4	0.91
Self-reported health† (excellent/very good)	2.78	1.6–4.9	1.02

*Odds of being a regular aerobic exerciser, adjusted for age.
†From the Rand Health Insurance Experiment.[17,18]
Note: Score cutoffs taken at median values.

Discussion

Limitations of the Study

Our study group was drawn from an HMO population that has traditionally had a special emphasis on health promotion. Consequently, we cannot rule out an effect of this emphasis on exercise behavior. While we would expect this emphasis to result in higher numbers of persons who regularly exercise, it should not affect our ability to determine important factors for those who were not regularly exercising. In addition, the variables for which we have found significant associations seem unlikely to be affected by enrollment in a health maintenance organization. Nonetheless, this population was interested in health promotion and chose to respond. Thus our population is in this way a select one.

Table 5. Regular Aerobic Exercise in Women.

Variables	Odds Ratio*	Confidence Interval	Coefficient
Age > 75 years	0.58	0.34–0.98	−0.54
Income > $15,000	1.8	1.07–3.1	0.59
College graduate	1.8	1.05–3.0	0.58
Current health† (score > 16)	1.6	1.1–2.7	0.5
Satisfied with health of body‡ (score > 30)	1.7	1.1–2.4	0.53
⩾ 2 medical conditions§	0.49	0.34–0.90	0.82
Screening mammography in past year	1.7	1.1–2.8	0.55

*Unadjusted odds of being a regular aerobic exerciser.
†Rand Health Insurance Experiment.[17,18]
‡Life Satisfaction Scale.[19]
§Hypertension, heart disease, emphysema, arthritis.
Note: Cutoffs made at median values.

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Table 6. Logistic Regression Model for Regular Aerobic Exercise Status (n = 482).

Variable	Odds Ratio*	Coefficient	Significance
Age >75 years	0.68 (0.44–1.13)	−0.35	0.15
Income > $15,000	1.7 (1.12–2.38)	0.41	0.05
Current health score > 16 (median)	1.7 (1.15–2.64)	0.56	0.009
⩾ 2 medical conditions (hypertension, arthritis, heart disease, emphysema)	0.52 (0.27–0.99)	−0.65	0.047

*Odds of being a regular exerciser, ± confidence interval.

Selection bias is especially important in studies of persons aged 65 years and older because this age group has greater heterogeneity in health status and disease burden than in any other.[24] Our study used reliable addresses and contact methods of this HMO population to avoid the more common types of selection bias. Respondent bias has been a concern in every study involving questionnaire data, and it could be a potential source of bias in this study as well. Elderly persons are known to demonstrate lower response rates to questionnaires, although participation rates in clinical studies compare favorably with those of younger persons.[25] The study's nonrespondent rate was high, but compares favorably with previous rates reported in this age group.[25] In contrast to other research in the elderly, information on the study's subgroups was available as part of the study design and is presented in Table 7. There were no significant differences between respondents and nonrespondents with respect to age, sex, and the number of medications taken for major chronic diseases (chronic disease score).[9,10,26] The participation rate for the exercise evaluation (89 percent), however, is to our knowledge the highest ever reported in an elderly population.[25]

Potential misclassification of persons as regular or nonregular exercisers is possible, because we did not have direct observational data with which to corroborate their reports. All self-report measurements have this potential source of error, including the Paffenbarger index,[5] which is based on report of exercise activity. Comparison of assessors' classifications with Paffenbarger scores recorded separately on the baseline questionnaire (and not available to our assessors) indicated acceptable levels of agreement. That personal interviews with trained health personnel could be more accurate is speculation in the absence of an independent reference standard.

Because the study population was 95 percent white, the findings might not be generalizable to a more ethnically diverse group. Self-reported income and educational levels were not corroborated with objective data; therefore, the degree of influence of particular levels of income and education cannot be determined. Our questionnaire did not allow us to assess severity of illness with respect to any of the reported medical conditions. We cannot rule out some effect that variability in illness might have had, but other measures of overall disability (e.g., number of days in bed, the degree to which respondents reported limitations in activity in the recent past) were not significantly different between the two groups. Lastly, this data set was not originally formulated to address our specific hypotheses. A questionnaire directed specifically at these areas might be able to provide more in-depth information.

Implications

This study examined the factors associated with regular aerobic exercise behavior in elderly enrollees of an established health maintenance organization. We found that attitudes regarding health, the absence of reported chronic disease, and socioeconomic factors were important in exercise behavior. We cannot imply causation simply from associations with exercise behavior, and the precise interaction of exercise activity with other factors could not be tested with this study.

Table 7. Age, Sex, and Chronic Disease Score (CDS) among Subgroups in the Group Health Senior Health Promotion Project.

Subgroup	No.	Mean Age in Years (± SD)	Percent Women	Mean CDS (± SD)
Respondents	2289	72.4 (5.7)	59.9	2.22 (2.58)
Nonrespondents	2625	72.9 (6.3)	58.6	2.25 (2.62)
Physician review	483	77.4 (7.7)	61.3	4.05 (3.29)
Subject refusal	826	74.8 (6.9)	65.1	2.62 (2.78)
Ineligible	105	77.2 (8.8)	58.1	3.80 (3.08)
Study group	561	72.3 (5.3)	59.5	2.12 (2.52)

SD = standard deviation.

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When viewed in context with previous research, however, our study has several implications for promotion of exercise in this age group.

Certain groups of persons may not exercise regularly: persons of lower socioeconomic status and those who report more medical conditions. It seems doubtful, however, that financial or educational status as such directly deters patients from exercising, particularly in this HMO population that has essentially equal access to services. More likely, Mechanic and Cleary[15] and Green[16] have argued that positive health behaviors are part of a wider life orientation that includes a sense of psychological and physical well-being and a sense of the importance of personal health maintenance that is not as well integrated into these persons' experiences. An understanding of how these factors specifically influence exercise behavior in older age groups is not known, however. We speculate that group activities that are part of other social functions or clubs might serve to lessen misperceptions of many poor elderly that exercise interferes with leisure, or alternatively, they could promote the adoption of exercise into the social culture. These hypotheses deserve further investigation.

We do not know whether exercisers have a more positive outlook because they exercise, or whether they exercise because they have a more positive attitude. Study of nonexercisers has, however, suggested that some improvements in self-image and mood do accrue to previously sedentary persons who take up exercise.[27,28] In addition, exercise has been shown to improve functional ability as well as perceptions of personal health.[29-32] Our study raises a different issue: which specific health perceptions are truly important? Longitudinal studies of sufficient rigor are needed to answer this question definitively, but our data suggest that a desire to improve or at least maintain functional ability has an important role.

Previous research in persons with coronary artery disease suggested that medical problems were given as important factors for dropout in cardiac rehabilitation programs but that dropout did not correlate well with objective indicators of severity of illness as determined from hospital and clinic records.[33] In fact, persons who experienced intercurrent coronary artery bypass or myocardial infarction did not have an increased rate of dropout. This finding supports an important role for health perceptions in exercise behavior. Nonetheless, certain medical conditions, such as arthritis, can adversely affect the type of activities that an elderly person can find enjoyable and easy to perform.[34,35]

Only mammography screening was related to regular exercise for women for whom, in this HMO setting, financial barriers did not exist. There was no correlation between exercise and other individual preventive health behaviors or in the total number of behaviors in the entire group. Exercise could be a preventive health behavior with determinants different from the more provider-oriented behaviors, such as influenza immunization and fecal occult blood testing, and could require greater personal commitment than seat belt use or breast self-examination.

Our study suggests issues to be addressed when counseling elderly patients who are not regularly exercising. Physicians would do well to address carefully seniors' perceptions of their health and of their need for exercise. Many programs emphasize training or endurance, concepts that might not be attractive or meaningful to seniors.[36] An alternative would be to place emphasis on the ability of exercise to improve or maintain the functional capacity of the elderly person and to lessen the impact of intercurrent illnesses in everyday activities.[6] Indeed, the dysfunction involved with all the medical conditions associated with not exercising can be improved in many patients with the appropriate form of exercise (e.g., water aerobics for those with severe arthritis).

Conclusions

In this population of elderly enrollees of an established health maintenance organization, regular aerobic exercise status was associated with higher perceptions of current health and a more positive outlook on personal health; exercisers reported fewer medical conditions, particularly those that might directly influence cardiopulmonary and exercise abilities. Exercisers also reported higher socioeconomic status. We did not find an association between regular exercise and the practice of other preventive health behaviors. We believe this lack of association relates to the different nature of exercise compared with receiving influenza immunizations or mammograms. Sex differences were present. Regular aerobic exercise in

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men seemed to be predominantly associated with health perceptions, whereas in women the relative contribution of socioeconomic factors was greater. Finally, the dynamics involved in regular exercise behavior are complex. There is interaction between health attitudes and socioeconomic characteristics, but the manner and the degree to which this interaction operates remain to be elucidated. Further research is needed to formulate a conceptual model for exercise behavior in this age group.

References

1. McPherson BD. Sport, health, well-being and aging. In: McPherson BD, editor. Sport and aging. Champaign, IL: Human Kinetics, 1986.
2. Thornberry OT. Health promotion and disease prevention: provisional data from the National Health Interview Survey. United States, January-June 1985. Hyattsville, MD: US Dept. of Health and Human Services, Public Health Service, 1986.
3. deVries HA. Physiological benefits of an exercise training regimen on men aged 52 to 88. J Gerontol 1970; 25:325-36.
4. Paffenbarger RS Jr, Hyde RT. Exercise in the prevention of coronary heart disease. Prev Med 1984; 13:3-22.
5. Paffenbarger RS Jr, Wing AL, Hyde RT. Physical activity as an index of heart attack risk in college alumni. Am J Epidemiol 1978; 108:161-75.
6. Larson EB, Bruce RA. Health benefits of exercise in an aging society. Arch Intern Med 1987; 147:353-6.
7. Ades PA, Hanson JS, Gunther PG, Tonino RP. Exercise conditioning in the elderly coronary patient. J Am Geriatr Soc 1987; 35:121-4.
8. Elward KS, Larson EB. Benefits of exercise for older adults: a review of existing evidence and recommendations for the general population. Clin Geriatr Med 1992; 8:35-50.
9. American College of Sports Medicine. Position statement on the recommended quantity and quality of exercise for developing and maintaining fitness in healthy adults. Med Sci Sports 1978; 10:vii-x.
10. vonKorff M, Wagner EH, Saunders K. A chronic disease score from automated pharmacy data. J Clin Epidemiol 1992; 45:197-203.
11. Wagner EH, Grothaus LC, Hecht JA, LaCroix AZ. Factors associated with participation in a senior health promotion program. Am J Health Promotion (in press).
12. Rosenstock IM. Historical origins of the health belief model. Health Educ Monogr 1974; 2:328-35.
13. Carter WB, Beach LR, Inui TS. The Flushot Study: using multiattribute utility theory to design a vaccination intervention. Organiz Behav Human Decision Proc 1986; 38:378-91.
14. United States Public Health Service. Adult use of tobacco — 1975. Atlanta: Centers for Disease Control, June 1976.
15. Mechanic D, Cleary PD. Factors associated with the maintenance of positive health behavior. Prev Med 1980; 9:805-14.
16. Green LW. Status identity and preventive health behavior. Berkeley, CA: School of Public Health, University of California, Pacific Health Education Reports No. 1, 1970.
17. Stewart AL, Hays RD, Ware JE Jr. The MOS short-form general health survey: reliability and validity in a patient population. Med Care 1988; 26:724-35.
18. Ware JE Jr, Johnston SA, Davies-Avery A, Brook RH. Conceptualization and measurement of mental health for adults in the Health Insurance Study. Vol. 3. Mental Health Report — 1987/3HEW. Santa Monica, CA: Rand, 1979.
19. Patrick DL, Danis M, Southerland LI, Hong G. Quality of life following intensive care. J Gen Intern Med 1988; 3:218-23.
20. SPSS advanced guide to statistics. Chicago: SPSS, Inc. 1990.
21. EGRET statistical package. Seattle: Epidemiological Research Group (SERC), 1989.
22. Kleinbaum DG, Kupper LL, Muller KE, editors. Applied regression analysis and other multivariate methods. 2nd ed. Boston: PWS-Kent Pub. Co., 1988.
23. Kleinbaum DG, Kupper LL, Morgenstern H. Epidemiologic research: principles and quantitative methods. Belmont, CA: Lifetime Learning Publications, 1982.
24. Zimmer AW, Calkins E, Hadley E, Ostfeld AM, Kaye JM, Kaye D. Conducting clinical research in geriatric populations. Ann Intern Med 1985; 103:276-83.
25. Carter WB, Elward KS, Malmgren J, Martin ML, Larson EB. Participation of older adults in health programs and research: a critical review of the literature. Gerontologist 1991; 31:584-92.
26. Wagner EH, Passmore M, Scholes D, Grothaus L, Omenn GS. A randomized trial to prevent disability in the well elderly. Presented at Prevention 90 Conference, Atlanta, GA, 19-22 April 1990.
27. Molloy DW, Beerschoten DA, Borrie MJ, Crilly RG, Cape RD. Acute effects of exercise on neuropsychological function in elderly subjects. J Am Geriatr Soc 1988; 36:29-33.
28. Dustman RE, Ruhling RO, Russell EM, Shearer DE, Bonekat HW, Shigeoka JW, et al. Aerobic exercise training and improved neuropsychological function of older individuals. Neurobiol Aging 1984; 5:35-42.
29. Hopkins DR, Murrah B, Hoeger WWK, Rhodes RC. Effect of low-impact aerobic dance on the functional fitness of elderly women. Gerontologist 1990; 30:189-92.
30. Fiatarone MA, Marks EC, Ryan ND, Meredith CN, Lipsitz LA, Evans WJ. High intensity strength training in nonagenarians. Effects on skeletal muscle JAMA 1990; 263:3029-34.

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31. Morey MC, Cowper PA, Feussner JR, DiPasquale RC, Crowley GM, Kitzman DW. Evaluation of a supervised exercise program in a geriatric population. J Am Geriatr Soc 1989; 37:348-54.
32. Morey MC, Cowper PA, Feussner JR, DiPasquale RC, Crowley GM, Sullivan RJ Jr. Two year trends in physical performance following supervised exercise among community-dwelling older veterans. J Am Geriatr Soc 1991; 39:549-54.
33. Bruce EH, Frederick R, Bruce RA, Fisher LD. Comparison of active participants and dropouts in CAPRI cardiopulmonary rehabilitation programs. Am J Cardiol 1976; 37:53-60.
34. Green LW. Modifying and developing health behavior. Ann Rev Public Health 1984; 5:215-36.
35. Oldridge NB. Compliance and exercise in primary and secondary prevention of coronary heart disease: a review. Prev Med 1982; 11:56-70.
36. Shephard RJ, Berridge M, Montelpare W, Daniel JV, Flowers JF. Exercise compliance of elderly volunteers. J Sports Med Phys Fitness 1987; 27:10-8.

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