PHYSICIAN-BASED PHYSICAL ACTIVITY COUNSELING FOR MIDDLE-AGED AND OLDER ADULTS: A RANDOMIZED TRIAL[1,2]

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ABSTRACT

Sedentary behavior among older adults increases risk for chronic diseases. Physicians in a primary care setting can play an important role in promoting physical activity adoption among their older patients. The Physically Active for Life (PAL) project was a randomized, controlled trial comparing the efficacy of brief physician-delivered physical activity counseling to usual care on self-reported physical activity levels. The physical activity counseling was based on the Transtheoretical Model of Change and social learning theory. Twenty-four community-based primary care medical practices were recruited into the study; 12 were randomized to the Intervention condition and 12 to the Control condition. Physicians in the Intervention practices received training in the delivery of brief physical activity counseling. Subjects in the Intervention practices (n = 181) received brief activity counseling matched to their stage of motivational readiness for physical activity, a patient manual, a follow-up appointment with their physician to discuss activity counseling, and newsletter mailings. Subjects in the Control practices (n = 174) received standard care. Measures of motivational readiness for physical activity and the Physical Activity Scale for the Elderly (PASE) were administered to subjects in both conditions at baseline, 6 weeks following their initial appointment, and at 8 months. Results showed that at the 6-week follow-up, subjects in the Intervention condition were more likely to be in more advanced stages of motivational readiness for physical activity than subjects in the Control condition. This effect was not maintained at the 8 month follow-up and the intervention did not produce significant changes in PASE scores. Results suggest that more intensive, sustained interventions may be necessary to promote the adoption of physical activity among sedentary, middle-aged, and older adults in primary care medical practices.

(Ann Behav Med 1999, *21*(1):40–47)

INTRODUCTION

Over the last two decades, convincing evidence has accumulated linking physical inactivity to increased morbidity and mortality for at least six chronic conditions: coronary heart disease, hypertension, obesity, diabetes, osteoporosis, and mental health

[1] Preparation of this manuscript was supported in part by funding from the National Institute of Aging (RO1 AG12025) to the PAL project and Dr. Goldstein.

[2] Thanks to Paula Pistocco, R.N., M.A., Janine Costa-Grigelevich, B.A., Kalene Hafey, B.S., Lisa Kopel, B.A., and Michael Vaughan, M.D., for assisting with the implementation of the study. We thank Barbara Doll for manuscript preparation. Thanks also to Steven Blair, P.E.D., Karen Calfas, Ph.D., Allen Dietrich, M.D., Charles Eaton, M.D., Thomas Kottke, M.D., Barbara Long, M.D., and Richard Washburn, Ph.D. for reviewing the patient and physician intervention materials, and to Daniel Forman, M.D., for consultation during the trial. We acknowledge the assistance of physicians and office staffs that participated in the PAL project and Bristol-Myers Squibb for providing meals for the physician-training sessions.

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disorders (1). Regular physical activity substantially reduces the risk for these conditions, even when these activities are initiated later in life (2–5). Moreover, many benefits of physical activity can be gained by performing moderate-intensity activities, leading a Centers for Disease Control and Prevention (CDCP) and American College of Sports Medicine (ACSM) panel in 1995 (4) and a National Institutes of Health Consensus Panel in 1996 to recommend that all individuals accumulate at least 30 minutes of moderate-intensity physical activity on most, and preferably all, days of the week (6). Despite increasing evidence of the benefits of physical activity, data from the Behavioral Risk Factor Surveillance System (BRFSS) showed that 59% of the U.S. population (aged $\geq$ 55 years) are sedentary (irregular or no leisure time activity) (7).

Physicians and other health care providers have the potential to play a vital role in effecting change in the levels of physical activity of their patients, with 70% of adults reporting at least one physician contact each year (8). However, the rate of physical activity counseling by physicians is generally quite low. Barriers to physical activity counseling in primary care settings include increased time demands, provider uncertainty about how to provide counseling, skepticism about the efficacy of counseling, insufficient reimbursement, and lack of organizational system support (1). To date, only a few studies have tested whether physician counseling can improve patients' activity levels. Physical activity counseling delivered in the context of a multiple risk factor, physician-delivered intervention led to an increase in beginning regular physical activity (9). Another controlled trial of brief physician advice reported an increase in self-reported minutes of exercise among subjects who reported receiving physician advice, but the frequency of physical activity was not increased and follow-up was limited to one month (10). In Project PACE (Provider-Based Assessment and Counseling for Exercise), 12 physicians provided 3 to 5 minutes of physical activity counseling followed by a brief booster phone call by a health educator 2 weeks later (11). Ten control physicians were trained in hepatitis B detection. Self-reported physical activity and motivational readiness for physical activity were collected at baseline and at a 4- to 6-week follow-up. Patients in the Intervention condition reported significantly increased walking (+37 minutes per week versus +7 minutes per week in the Control group) and increased readiness to adopt activity when compared to control subjects (11). Objective activity monitoring (Caltrac electronic accelerometers) on a subsample of subjects showed a significant treatment effect (11). However, the PACE trial used a nonrandomized design, relatively young patients (mean age = 39 years), and a relatively short follow-up period.

For the Physically Active for Life Project (PAL), we developed a medical office-based physical activity counseling intervention for adults aged 50 and above, using a patient-centered model of counseling (12) based on the principles of the Transtheoretical Model of Change (TTM) (13), social–cognitive theory (14), and health education theory (15). The PAL intervention also drew on information about the health behavior of middle-aged and older adults to help tailor the content of messages delivered by providers and the content of printed materials for the patients. A detailed description of the integrated approach utilized in PAL is provided elsewhere (16,17). Results of a pilot study of the PAL intervention, using a nonrandomized design, indicated that the counseling was both feasible for the physicians and produced increases in middle-aged and older adults' physical activity levels at 6 weeks over baseline levels (18).

This article reports the results of a randomized controlled trial of the PAL medical office-based physical activity counseling intervention conducted in 24 community-based primary care office practices. The specific aims of the PAL project were: (a) to experimentally evaluate the efficacy of a brief medical office-based intervention to increase the physical activity level of sedentary middle-aged and older adults compared to usual care and (b) to assess the degree to which changes in physical activity levels are maintained over 8 months of follow-up.

METHOD

Design

In this trial of physical activity counseling in community-based primary care physican office practices, half the sample of participating practices were randomly assigned to the Intervention condition and the other half were assigned to the Control condition. We conducted randomization by practices and not by patients, primarily to prevent carry-over effects of the intervention to Control subjects. At baseline, at 6 weeks, and at 8 months following the initial office visit, patients were interviewed via telephone to obtain data on level of physical activity, quality of life, and psychosocial factors relevant to physical activity. At 6 weeks and at the 8-month follow-up assessment, patient evaluations of the intervention components were also obtained (these data are reported elsewhere; 19). Physicians, after meeting eligibility requirements, completed a brief preintervention questionnaire on their counseling practices and again, after completion of patient follow-up visits (postintervention). The study received approval from the Institutional Review Boards of the participating institutions.

Subjects

Thirty-four physicians from 24 practices were recruited from Folio lists (20) of primary care practices (i.e. general internal medicine, family medicine) from southeastern Massachusetts and from personal contacts of the Principal Investigator. Practices were matched on whether they were solo or group practices; one practice in each pair of solo/group practices was randomized into the Intervention condition and the other into the Control condition. Of the 24 practices that participated, 12 were solo practices and 12 were group practices. Randomization of the practices produced 17 physicians in the Control condition and 17 physicians in the Intervention condition. See Table 1 for demographic characteristics of the participant physicians.

All physicians and their office staff provided investigators with a list of eligible patients with appointments during the intervention window. Office staff at all practices attended a half-hour administrative session. If randomized to the Intervention condition, physicians attended a one-hour training session on physical activity counseling and provided physical activity counseling during a routine initial office visit and at a follow-up appointment scheduled within 4 weeks of the initial appointment. Physicians in the Control practices were not provided physical activity counseling training and were not expected to schedule patients for a follow-up visit for physical activity counseling. All practices were reimbursed $400 for participation. Physicians in the Intervention condition were reimbursed an additional $100 for attending the training session and $40 for each patient seen for a follow-up visit. We elected to provide reimbursement for the patient follow-up visit because currently there is no specific reimbursement for physical activity counseling.

TABLE 1
Demographic Characteristics of PAL Physicians

	Sample (N = 34)	Control Doctors (N = 17)	Intervention Doctors (N = 17)
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)
Age in years	44.1 (8.2)	43.7 (7.3)	44.6 (9.8)
Years in practice (*SD*)	9.2 (8.8)	7.5 (8.1)	11.0 (9.4)
	Percentage (Frequency)	Percentage (Frequency)	Percentage (Frequency)
Men	76% (26)	76% (13)	76% (13)
Type of practice			
General medicine	6% (2)	6% (1)	6% (1)
Family medicine	26% (9)	18% (3)	35% (6)
Internal medicine	68% (23)	76% (13)	59% (10)
Race			
White	84% (26)	88% (14)	80% (12)
Vigorous exercisers	53% (17)	65% (11)	40% (6)
Moderate exercisers	23% (3)	33% (2)	14% (1)
Smoking status			
Never smoked	75% (24)	76% (13)	73% (11)
Ex-smokers	25% (8)	24% (4)	27% (44)
Report counseling all patients on exercise	63% (20)	71% (12)	53% (8)

All office practices provided the names of patients (aged ≥ 50 years and ambulatory) who were scheduled for routine visits (nonacute care) with the participating physician over the intervention period (4–7 weeks). Potential subjects were contacted on the telephone to determine eligibility, obtain informed consent, and gather baseline information. We excluded patients who were too active (moderate exercise for ≥30 minutes at least 5 days each week or vigorous exercise for ≥20 minutes on at least 3 days per week), were not ambulatory, and those unable to provide information on the telephone. Written informed consent and final patient enrollment took place at the initial visit at the office practice. The research staff enrolled patients at each pair of office practices over 4–7 weeks.

Patients

Recruitment: We obtained a total of 2,674 patient names from participating practices: 2,145 patients were contacted and 529 could not be reached. Data on demographics and exercise participation were obtained from 1,702 patients; 443 patients refused to provide information. Of the 1,702, 858 patients were too active to participate, 400 did not meet the other eligibility criteria (e.g. ambulatory status, ability to complete the interview), and 444 were eligible for participation. Of the 444 patients who met eligibility criteria, 89 refused to participate (20%) and 355 were enrolled in the study (80% of the eligible sample, 13% of the 2,674 names received).

Intervention: The intervention was based on the TTM which considers the individual's performance of the desired behavior and the intention to maintain or change this pattern of behavior (13). When applied to physical activity, there are five stages of change: Precontemplation (individuals who are not physically active and do not intend to start); Contemplation (individuals who are not physically active but intend to start in the next 6 months); Preparation (individuals who participate in physical activity irregularly, that is <5 days per week for at least 30 minutes each day); Action (individuals who participate in regular physical activity, that is, engage in physical activity ≥5 days per week, for at least 30 minutes each day, for less than 6 months); and Maintenance (those who have participated in regular physical activity for 6 months or longer). Principles of social learning theory and health education theory (14,15) were incorporated into the PAL intervention, which was also tailored to meet the needs of older adults.

For the PAL Project, we integrated the principles of the TTM (13) with a patient-centered counseling approach which emphasizes interviewing skills that permit tailoring of the counseling message (12,16,17). Assessment includes patients' previous experience with physical activity, knowledge and beliefs about physical activity, stage of motivational readiness for physical activity, and barriers and facilitators to change. The counseling strategy utilizes the "5 As" (address the agenda, assess, advise, assist, and arrange follow-up) which were adapted from a physician-delivered counseling strategy developed by the Smoking, Tobacco and Cancer Program, Division of Cancer Prevention and Control, National Cancer Institute (21).

Physician Training: Physicians were provided with a 28-page manual, a desk prompt with summary information on counseling, and an office poster on physical activity promotion. An earlier version of the manual had been previously tested for acceptability in our pilot study (18). The manual on physical activity counseling was written by the research team and reviewed by experts in the field. It included a glossary of exercise terminology, a review of the health benefits of physical activity, and information on risk assessment prior to developing an exercise prescription. The manual also described principles of behavior change and the stages of motivational readiness as applied to physical activity counseling, gave specific instructions and examples on how to write an exercise prescription, and offered suggestions on how to help patients overcome roadblocks to participation in physical activity. The manual also provided a list of community resources on physical activity programs.

Physicians in the Intervention group attended a one-hour training session in their offices where the information included in the manual was reviewed, and the research protocol was explained. Role play scenarios were used to give the physicians an opportunity to practice their counseling techniques with feedback from members of the research team.

The acceptability, usefulness, and feasibility of the physician manual and physician training are reported separately (19). Physicians favorably endorsed the training and the support materials, and training produced significant improvements in confidence in delivering physical activity counseling in Intervention physicians (19).

Office Implementation: At the patient's initial appointment, a member of the research staff explained the study and obtained written informed consent. Each patient was then interviewed briefly (average interview time was 5.8 minutes) prior to seeing the physician to obtain information on stage of motivational readiness for physical activity, physical activity preferences, and barriers to becoming physically active. Patients in the Control practices saw their physician for usual care. In the Intervention practices only, the information collected by the research staff was placed on the patient's chart and used by the physician to guide his/her counseling to be appropriate to the patient's stage of readiness. As part of the study protocol, the physician was asked to counsel the patient for about 5 minutes and give him/her a written exercise prescription (using a preprinted form) and a manual with instructions to

read the section in the manual appropriate to the patient's stage of motivational readiness for physical activity (see below for description of the patient manual). If the patient was willing to commit to becoming physically active, the physician noted the type of physical activity, frequency, intensity, and duration of activity on the exercise prescription. During training, the ACSM/CDCP recommendations for physical activity (4) were reviewed, although physicians were encouraged to tailor the prescription to the patient's motivational readiness. For example, an appropriate initial physical activity prescription for a Contemplator might be walking at a slow pace for 10 minutes, 3 times per week. Subjects who were not willing to start becoming physically active were asked to read the first section of the manual (appropriate to individuals in Precontemplation) as a component of their exercise prescription. Subjects were also encouraged to read subsequent sections of the manual when they felt ready to move on. The research staff later collected a copy of the completed exercise prescription.

Prior to the patient's follow-up appointment, the research staff provided the Intervention practices with exercise prescriptions which were to be placed in the patient's chart. At the follow-up appointment, the physician was expected to provide activity counseling and complete a new exercise prescription for the patient. The physician was also asked to give the patient an attractive poster (provided by the PAL project) with tips on adoption and maintenance of physical activity. Practices were reimbursed $40 for each follow-up appointment, and hence patients did not have to pay for the follow-up visit. Copies of the completed follow-up prescription were mailed to the research staff for reimbursement purposes. Research staff were not present during the follow-up visit and verification of patient receipt of an exercise prescription was not obtained.

Patient Manual: A manual for the adoption and maintenance of physical activity was developed by the research staff. The manual consisted of five color-coded sections, one for each stage of physical activity adoption. The manual provided guidance on health benefits of physical activity, benefits and barriers to physical activity, enhancing confidence to become and remain active, and tips on becoming and staying physically active. The content was based on behavioral and social–cognitive concepts (e.g. social support, cues and prompts for physical activity) and stage-specific processes (for example, patients in Precontemplation and Contemplation were given information on the health benefits of physical activity, while patients in Preparation were given information on planning regular physical activities). An earlier version of this manual had been previously tested for acceptability in our pilot study (18) and was a modification of manuals shown to be effective in community (22) and worksite settings (23). The manual, as well as other printed materials, were formatted to enhance readability (i.e. use of large fonts) and age-appropriate graphics and examples were utilized throughout.

Additional Mailings to Patients: After the follow-up appointment with their primary care physician, the patients in the Intervention practices received five monthly mailings including another copy of the manual and four newsletters which provided information on specific types of moderate activities (e.g. walking, gardening, dancing), tips for those thinking about becoming physically active and for those who were physically active, as well as local resources and quizzes about physical activity. At Month 1, patients received a newsletter on the health benefits of physical activity; at Month 2, they received a newsletter on walking; at Month 3 they received another copy of the patient manual; at Month 4, they received a newsletter on dancing; and finally, at Month 5, they received a newsletter on biking and gardening.

Evaluation

Patient Assessments: At baseline, 6 weeks, and 8 months, trained staff interviewed each subject by telephone and the following instruments were administered: Stage of motivational readiness for physical activity (modified for moderate activity) (24), Physical Activity Scale for the Elderly (PASE) (25), quality of life (SF-36) (26), and psychological constructs relevant to physical activity adoption and maintenance (processes of change for physical activity adoption, self-efficacy for physical activity, pros and cons of physical activity) (24,27,28). In this article, we present data on the main outcomes of the PAL study: motivational readiness for physical activity and PASE scores.

Stage of Motivational Readiness for Physical Activity: Seven questions assessed current stage of motivational readiness for physical activity. This instrument was a modified version of a standardized questionnaire to assess stage for vigorous exercise. Previous studies have demonstrated the reliability (kappa index over a 2-week period of .78) (28) and concurrent validity of the stages of motivational readiness instrument for vigorous exercise (29). The current instrument was modified to address the criteria for moderate physical activity as defined by the CDCP and ACSM (4). The five stages of motivational readiness are: (a) Precontemplation; (b) Contemplation; (c) Preparation; (d) Action; and (e) Maintenance. See the Intervention section for operational definitions of each stage.

Physical Activity Scale for the Elderly (PASE): The PASE is an 11-item self-report measure of physical activity designed for use with older adults (25). Physical activity is defined in terms of three dimensions: leisure time, household, and occupational activity performed within the past week. The PASE is administered by trained telephone interviewers. Subjects are asked to recall the frequency, duration, and type of leisure time activity they engaged in over the past 7 days (e.g. "Over the past 7 days, how often did you take a walk outside your home or yard for any reason?"). For household activity, subjects are asked to indicate whether or not they engaged in light or heavy housework, home repairs, lawn work, gardening, or caregiving activity. Occupational activity is defined in terms of the occurrence, duration, and type of volunteer or paid work (e.g. "sitting or standing with some walking"). Acceptable concurrent validity and test–retest reliability have been demonstrated with elderly samples (25). PASE scores are significantly associated with grip strength ($r = .37$), static balance ($r = .32$), quadriceps strength ($r = .27$), and Caltrac activity monitoring ($r = .29$). Test–retest reliability over 3–7 weeks has been established at $r = .75$ (25).

ANALYSES

Fisher's exact tests and Welch t-tests were used to compare differences in demographic characteristics and baseline activity counseling between Intervention and Control physicians (17 in each group) and to compare patient demographic characteristics between the two groups. PASE scores were square root transformed to correct for heteroscedasticity and non-normality. Linear mixed effects models were applied to the PASE scores while logistic mixed effects models were used for the proportion in Preparation and Action, the proportion in Action, and the proportion who met CDCP and ACSM recommendations for vigorous or

TABLE 2
Demographic Characteristics of the Patient Sample (N = 355)

	Total Sample (N = 355)	Control Group (N = 174)	Intervention Group (N = 181)
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)
Age in years	65.6 (9.1)	65.8 (9.3)	65.4 (9.0)
Education in years	12.3 (2.9)	12.3 (2.8)	12.3 (3.0)
	Percentage (Frequency)	Percentage (Frequency)	Percentage (Frequency)
Women	65 (229)	64 (112)	65 (117)
White	97 (340)	97 (168)	96 (172)
Employed	36 (126)	38 (66)	33 (60)
Marital status			
Married	66 (233)	65 (113)	67 (120)
Income			
<10K	18 (58)	15 (24)	21 (34)
10–20K	27 (90)	27 (45)	28 (45)
>20K	55 (179)	58 (96)	51 (83)
Stage of Adoption of Physical Activity			
Precontemplation	15 (52)	17 (29)	13 (23)
Contemplation	32 (115)	33 (58)	31 (57)
Preparation	53 (188)	50 (87)	56 (101)

moderate exercise (4,30). The models were fitted using the SAS GLIMMIX Macro (31) with physician practice entered as a random effect nested within Group in accordance with the experimental design. The intervention effect was assessed for the 6 weeks and 8 months physical activity outcomes individually and also in longitudinal models taking the effect of repeated measurements into account. Age, gender, number of medical conditions, time since baseline, and baseline response were entered as covariates in all the models.

RESULTS

Demographic Characteristics of Participating Physicians

As seen in Table 1, the mean age of participating physicians was 44.1 years (*SD* = 8.2), 68% practiced internal medicine. The sample had been in practice for a mean of 9.2 years (*SD* = 8.8). A majority (63%) reported that they provided exercise counseling to all patients prior to their participation in the study. There were no significant differences in demographic characteristics between physicians in the Intervention and Control practices. Physicians in the Control practices were more likely to be vigorous exercisers than physicians in the Intervention practices (65% versus 40%), but this difference was not significant (p = .29).

Demographic Characteristics of the Patients

Three hundred and fifty-five patients were enrolled in the study (181 in the Intervention practices and 174 in the Control practices). The mean age of the sample was 65.6 years, a majority were women (65%), and most participants were married (66%). The sample was largely White (97%) and in the middle income range. A minority of the participants were employed (36%). There were no significant differences between subjects in the Intervention and Control groups on demographic characteristics. See Table 2 for the demographic characteristics of the patient sample.

Corroboration of Physician-Delivered Activity Counseling

At the initial appointment, physicians in the Intervention condition provided activity counseling to virtually all of the subjects. This was corroborated by copies of exercise prescriptions obtained by research staff from Intervention offices for 99% of the patients in the Intervention condition. Exercise prescriptions obtained from the practices after follow-up visits indicated that 139 patients received follow-up physical activity counseling (77%) and suggested that there were difficulties in arranging and providing follow-up counseling for some subjects.

At the follow-up interviews, patients were asked a series of questions about the physical activity counseling that they may have received. Data from these responses have been published elsewhere (19). In brief, 93% (141/151) of the patients in the Intervention group who provided data at 6 weeks reported receiving physical activity counseling from their physician during the initial visit. However, only 67% of the patients in the Intervention condition recalled receiving the written exercise prescription from their physician at the initial visit. Only two patients in the Control condition reported receiving an exercise prescription.

Changes in Motivational Readiness for Physical Activity

At 6 weeks, 89% of the Intervention group were in Preparation or Action versus 74% in the Control group ($p < .001$, OR = 3.56, 95% CI 1.79–7.08) (see Table 3). At 6 weeks, 49% of the Intervention group had moved to Action versus 42% in the Control group (p = .13, OR = 1.47, 95% CI 0.88–2.43). Among the subgroup of patients in Precontemplation/Contemplation at baseline, 84% (n = 62) of the subjects in this subgroup in the Intervention condition at baseline moved into Preparation or Action at 6 weeks versus 68% of patients in Precontemplation/Contemplation at baseline in the Control group (n = 55) (p = .01, OR = 3.27, 95% CI 1.32–8.07) (see Figure 1). Of note, within the Intervention Group, subjects in Precontemplation or Contemplation at baseline were equally likely to move into Preparation/Action at 6 weeks (83% versus 84%), while within the Control group, subjects in Precontemplation at baseline were less likely to move into Preparation/Action at 6 weeks (44%) than those in Contemplation at baseline (80%).

At 8 months, 79% of the Intervention group were in Preparation or Action versus 88% of the Control group (p = .07, OR = 0.50, 95% CI 0.2–1.07). Examining the proportions in Action alone, 48% of the Intervention group met Action criteria at 8 months versus 43% of the Control group (p = .35, OR = 1.25, 95% CI 0.77–2.02). Among the subgroup of patients in Precontemplation/Contemplation at baseline, 83% (n = 64) in the Control group moved into Preparation/Action at 8 months versus 70% of the subjects in Precontemplation/Contemplation (n = 51) in the Intervention group (p = .16, OR = 0.41, 95% CI 0.11–1.46). Thus, the significant effects noted for the Intervention for this subgroup at 6 weeks were not sustained at 8 months.

Longitudinal analyses that take all three time points into account showed that odds of the Intervention group being in Preparation/Action was 1.29 times higher compared to the Control group (p = .28, 95% CI 0.82–2.04). Similarly, although the results were not statistically significant at the .05 level, there is some suggestion that the Intervention group was more likely to be in Action (p = .08, OR = 1.36, 95% CI 0.96–1.93).

TABLE 3
Physical Activity Participation by Group at Each Assessment

Outcome	Group	Baseline N	Baseline Mean or Proportion	Baseline Std Err	6 Weeks N	6 Weeks Mean or Proportion	6 Weeks Std Err	6 Weeks p-value*	8 Months N	8 Months Mean or Proportion	8 Months Std Err	8 Months p-value*
PASE Score	Intervention	171	108.53	5.26	169	119.56	5.90	0.94	158	112.58	5.79	0.74
	Control	168	108.82	5.02	166	122.31	5.57		154	111.03	5.55	
Proportion in Preparation/Action	Intervention	181	0.56	0.04	169	0.89	0.02	0.0009	161	0.79	0.03	0.24
	Control	174	0.50	0.04	167	0.74	0.03		161	0.88	0.03	
Proportion in Action	Intervention	181	0	—	169	0.49	0.04	0.13	161	0.48	0.04	0.08
	Control	174	0	—	167	0.42	0.04		161	0.43	0.04	
Proportion meeting CDCP and ACSM goals	Intervention	175	0.15	0.03	169	0.28	0.03	0.27	159	0.28	0.04	0.27
	Control	169	0.17	0.03	166	0.21	0.03		157	0.24	0.03	

std err = standard error.
* p-value testing for Group effect after controlling for age, gender, number of medical conditions, time since baseline, and baseline response.

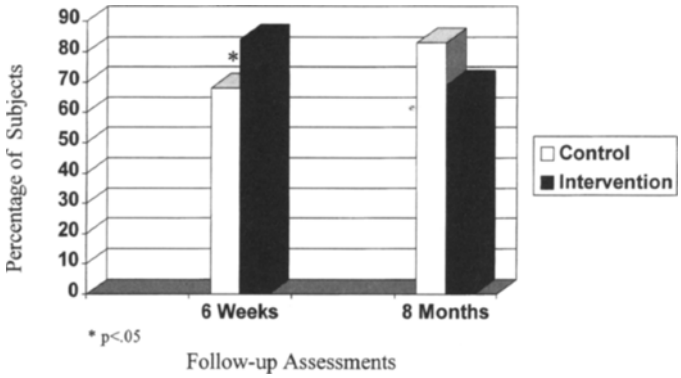

FIGURE 1: Percentage of subjects moving from Precontemplation/Contemplation at baseline to Preparation/Action at follow-up.

CDCP and ACSM Recommendations for Moderate or Vigorous Exercise

At 6 weeks, based on responses to the PASE, 27% of subjects in the Intervention group met the CDCP and ACSM recommendations for moderate exercise (30 minutes per day on at least 5 or more days per week) or vigorous exercise (20 minutes per day on at least 3 days per week) (4,30) versus 21% in the Control group (p = .27, OR = 1.37, 95% CI 0.77–2.43). At 8 months, 28% of subjects in the Intervention group met the CDCP and ACSM recommendations versus 23% in the Control group (p = .41, OR = 1.26, 95% CI 0.72–2.22). For the subgroup in Precontemplation/Contemplation at baseline, there was no significant effect of the intervention on meeting CDCP and ACSM recommendations. Longitudinal analyses showed that the odds of the Intervention group meeting CDCP and ACSM recommendations for moderate exercise or vigorous exercise was 1.30 times higher compared to the Control group, but this was not statistically significant (p = .19, 95% CI 0.88–1.92).

Changes in PASE Scores

As seen in Table 3, although PASE scores increased in both groups at the 6-week assessment, they decreased at the 8-month follow-up. There were no significant differences between the Intervention and Control groups on PASE scores at 6 weeks (p = .94) or at 8 months (p = .74). The conclusions did not change when we accounted for the influence of repeated measurements in the longitudinal model or when we examined the change in PASE scores in the subgroup in Precontemplation/Contemplation at baseline.

DISCUSSION

The main purpose of this study was to evaluate the efficacy of a brief provider-based intervention (supplemented with a patient manual and newsletter mailings) on the physical activity level of sedentary, middle-aged and older adults. We found that subjects in the Intervention group moved into more advanced stages of adoption of physical activity (Preparationor or Action) at 6 weeks versus subjects in the Control group. Among the subgroup of subjects who started in Precontemplation (not thinking about becoming physically active) and Contemplation (thinking about becoming physically active), those in the Intervention condition were more likely to move into Preparation or Action at 6 weeks than those in the Control condition. Hence, the intervention enhanced motivational readiness for physical activity in this subgroup at the 6-week outcome. This finding suggests that the use of an intervention based on the TTM (13) that provides a brief message tailored to stage of adoption can promote movement to higher levels of readiness for physical activity. In addition to increases in motivational readiness for physical activity, there was a trend for achievement of CDCP and ACSM recommendations for moderate or vigorous exercise for the Intervention versus Control group.

Our results support the findings of previous studies in primary care settings which report an impact of brief physician counseling on physical activity outcomes (11,18) and also add to the findings of studies which showed a benefit of stage-matched physical activity interventions delivered in other settings (22,23,32). Though motivational readiness has been shown to correlate with the Seven Day Physical Activity Recall (29), motivational readiness is a self-report measure and the improvements noted in motivational readiness in the Intervention group at 6 weeks are limited by the absence of objective monitoring of activity levels or documentation of fitness changes. Moreover, because movement through stages of motivational readiness does not occur in an orderly manner, improvement in motivational readiness may not necessarily lead to subsequent changes in physical activity. Indeed, the significant improvement in motivational readiness noted for the Intervention condition at 6 weeks was not sustained at the 8-month follow-up.

Despite evidence for delivery of activity counseling in the Intervention group at the initial and follow-up visits, we did not find a significant effect on physical activity levels as assessed by

the PASE at 6 weeks or at the 8-month follow-up. Several factors may have contributed to our inability to detect differences in outcomes using PASE between the Intervention and Control groups. Although there were no differences at baseline between physicians in the two conditions, a majority of physicians in the Control condition (70%) reported that they regularly provided physical activity counseling to all their patients. Moreover, 65% of the Control physicians were vigorous exercisers (compared to 40% in the Intervention group). Though this difference was not statistically significant, the self-selection of interested and motivated physicians into this study may have attenuated the impact of the intervention. Additionally, the physical activity assessments conducted as part of the study may have functioned inadvertently as cues for physical activity in both Intervention and Control groups. Our findings do not appear to be due to a lack of power to detect effects on PASE since the study was powered to detect an effect size of 15% on PASE scores. However, the PASE measure has been primarily used in epidemiological studies and may not be as sensitive to change resulting from an intervention as other measures that allow for an estimation of caloric expenditure (33).

Our findings with respect to physical activity outcomes contrast with Project PACE which reported a significant increase in physical activity among patients receiving brief physician-delivered activity counseling. Although the PAL study used a similar theoretical approach to Project PACE, there are several possible explanations for our divergent findings. First, Project PACE used a nonrandomized design in which self-selecting physicians who were interested in and motivated to provide physical activity counseling were assigned to the experimental condition, while physicians assigned to the PACE control condition were not particularly interested in delivering a physical activity counseling intervention. In contrast, the PAL project randomly assigned interested physicians into Intervention and Control conditions, providing a more rigorous test of the impact of brief physician-delivered activity counseling. Moreover, all physicians randomized into the PAL study were highly motivated to provide physical activity interventions and a majority of physicians in both Intervention and Control conditions reported that they regularly provided physical activity counseling to all their patients. This may have limited the potential of the PAL Intervention to outperform counseling provided by physicians in the PAL Control condition. Second, in Project PACE physical activity was assessed via two items taken from the National Health Interview Survey (33), items taken from the College Alumni Study (34), and the Seven Day Physical Activity Recall (35). In the current study, the PASE instrument was used to assess physical activity levels, and it is possible that the instrument was not sensitive to changes in moderate physical activity, which was the focus of the intervention. Third, PACE subjects differed from subjects in the PAL study on age (mean age of PACE subjects = 39 years versus 66 years in PAL), gender (80% of PACE subjects were women versus 65% in PAL) and employment status (67% of PACE subjects were employed versus 36% in PAL). The demographic differences in the sample studied may reflect greater barriers to physical activity in older, non-employed individuals. Finally, unlike Project PACE which reported a positive effect of physician counseling for patients in Contemplation, the PAL study also included patients in Precontemplation, Contemplation, and Preparation stages of motivational readiness for physical activity. The inclusion of subjects in Precontemplation in the PAL study presented additional challenges to obtaining an effect on physical activity levels, while inclusion of subjects in Preparation may have created a ceiling effect. The potential for a ceiling effect is reflected in the baseline responses to two PASE questions on walking duration (11.7 and 14.1 minutes of walking per day for the Intervention group and Control group, respectively). The baseline minutes of walking per day reported by PAL subjects is more than double that reported in Project PACE at their 4- to 6-week outcome (11). However, despite the differences in findings based on physical activity levels between the PACE and PAL studies, there is consistency in the significant findings at the 6-week follow-up on stage transitions in both projects. Project PACE did not report on a longer follow-up, and hence, no direct comparisons can be made between the studies for long-term follow-up.

An additional limitation of the PAL study relates to the generalizability of the findings. Although 80% of the eligible patients were recruited into the study, the participants represented only 13% of patients over age 50 scheduled for appointments with the study physicians during the intervention period. Thirty-six percent of the patients on the patient lists were either unreachable or refused to provide enough information to assess eligibility. Another 15% of patients scheduled had medical conditions which interfered with ambulation or their ability to participate in the intervention. Thus, the demands of this efficacy study may have led to the selection of patients who were more likely to respond to both the intervention and usual care conditions. This is supported by our findings of improvement in stage transitions and the high proportion of subjects that met CDCP and ACSM recommendations across both conditions over time.

Moreover, 50% of the 1,702 patients who provided baseline self-reported levels of physical activity were excluded from the trial because they did not meet our criteria for sedentary behavior, even though the criteria for being active were rather stringent and based on current recommendations for moderate or vigorous activity (4). Population-based samples of older adults report higher proportions of sedentary behavior (7), which suggests over-reporting of physical activity among the older adults targeted for the current trial. This finding underscores the importance of continuing to develop self-report instruments that more accurately reflect the actual physical activity levels of older adults. Another possible explanation for the high percentage of older adults excluded from the study because they were too active was the high percentage of physicians who, at the time of recruitment into the study, reported providing exercise counseling to all of their patients. Reimbursement of the practices for participation in the trial, for attendance at the training session, and for each follow-up visit also limits the generalizability of the findings. However, we believe that reimbursing practices to offset the time that practice staff devoted to the evaluation component of the trial is reasonable when conducting research in community-based practices. The provision of payments for each follow-up visit was included to overcome financial barriers to follow-up preventive care that presently exist in medical care settings. If subsequent studies demonstrate the efficacy of provider-based physical activity counseling, further research testing the generalizability and cost-effectiveness of the intervention will be needed.

Results of this randomized trial suggest that sedentary, middle-aged and older adults may encounter barriers to physical activity that were not fully addressed by a brief office-based intervention. Although the PAL study attempted to address existing barriers by providing provider training, office systems tools to enhance the delivery of physical activity counseling, and reimbursement for follow-up, maintenance of short-term improvements in stage of motivational readiness for physical activity and levels of physical activity among adults aged 50 and over may require more intensive and more frequent intervention efforts. It is revealing that, 6 weeks after receiving the initial PAL Intervention, only 67%

recalled receiving the written PAL exercise prescription, though copies of these prescriptions were obtained from Intervention offices for 99% of Intervention patients. This finding suggests that a more intensive intervention is needed to ensure that the counseling message is understood and retained. Given the constraints on physicians' time in primary care settings, it may be more feasible for other members of the office staff (e.g. nurse practitioners, health educators) to provide more intensive counseling and follow-up to promote physical activity among older adults. Data on the effectiveness of nurse-delivered smoking cessation counseling (36) suggest that the use of a team approach may be an effective strategy to promote the importance of physical activity adoption in primary care.

In summary, our findings suggest that a brief physician-delivered intervention to increase the physical activity of sedentary, middle-aged and older adults, based on the TTM, had a short-term impact on stage of motivational readiness for physical activity, but no long-lasting effects on either motivational readiness for physical activity or self-reported measures of physical activity. This finding suggests the need for developing more intensive interventions that can be efficiently delivered in primary care settings.

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