

Evaluation of Enrollment Bias in a Physical-Activity-Promotion Program for Seniors

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Health-promotion programs' success depends on their ability to enroll representative samples of the target population, particularly those who are hard to reach and those who can benefit the most from such programs. This article evaluates enrollment bias in the recruitment process, examines the usefulness of a 2-phased recruitment strategy in enrolling representative proportions of eligible individuals in a physical-activity-promotion program for older adults, and explores predictors of enrollment. Of 1,381 randomly selected Medicare HMO members, 519 were eligible. Of these, 54% attended an informational meeting and 33% enrolled in the program. Relative to the target population, a representative proportion of women was enrolled, but those who enrolled were slightly younger. Of those who were eligible, a representative proportion of sedentary participants was recruited, those who were overweight were overrepresented, and the oldest old, less educated, ethnic minorities, and precontemplators of physical activity were underrepresented. Modifiable predictors of enrollment included interest in health, previous health-class attendance, and having had a physician recommend exercise.

Key Words: older adults, physical activity

The success of public-health model programs aimed at increasing healthy behaviors depends not only on the effectiveness of the programs but also on their ability to enroll a representative sample of individuals from the target population. The extent to which an enrolled sample represents a given population is often difficult to assess because most studies do not have access to information on the target population. From a public-health perspective, it is even more important to enroll representative proportions of subgroups that (a) are typically hard to reach and (b) can benefit the most from the health-promotion program (i.e., are in need of it) but tend not to join (Blair et al., 1989; Carter, Elward, Malmgren, Martin, &

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Larson, 1991; Flay, 1986; King et al., 1992). To the extent that such programs do not attempt to reach out to these important subgroups, the programs will not meet public-health needs.

Although there is much known about general recruitment strategies, little is known about specific strategies that are effective in enrolling representative samples and underserved subgroups of individuals into health-promotion programs. In fact, many studies do not aim to recruit representative samples of a known population. Rather, they recruit a convenience sample by advertising the program in local media or through community venues. These types of strategies tend to recruit self-selected, healthy, highly motivated volunteers who are interested enough in health promotion to respond to such advertisements (Blumenthal et al., 1989; Wagner, Grothaus, Hecht, & La Croix, 1991). In contrast, a multiphase proactive recruitment strategy, in which the program actively targets individuals from a known population base, might be more effective in recruiting representative samples of the target population (King, Haskell, Taylor, Kraemer, & DeBusk, 1991; Mills et al., 1996).

Designing multiphase proactive recruitment strategies can entail social-marketing, social-influence, social-cognitive, and stages-of-change theories. The principles of social-marketing theory can facilitate reaching as broad an audience as possible by increasing the acceptability of an idea in a target group (Lefebvre & Flora, 1988). Social-influence theory emphasizes a number of factors, among them public forms of commitment and the "foot in the door" principle for persuading individuals to enroll (e.g., attending an informational meeting before committing to enrollment; Cialdini, 1985). Social-cognitive theory explains human behavior as an interaction between behavior, personal factors, and environment (Bandura, 1986). Recruitment strategies derived from social-cognitive theory can take into account outcome expectations and outcome incentives to design recruitment messages. For instance, one strategy might be to include peer recruiters or speakers to attract potential participants. Finally, the transtheoretical model, including the stages-of-change model, explains that individuals cycle back and forth through several stages of readiness to change a behavior, as follows: precontemplation (not thinking about becoming active), contemplation (considering a change), preparation (making small changes), action (currently engaging in activity), and maintenance (continuing the activity over time; Prochaska & DiClemente, 1983). Recruitment efforts can be designed to appeal to people who are in each stage.

In order to improve proactive recruitment strategies, it is also useful to understand the nature of modifiable factors that influence individuals' decision to enroll, particularly when the program requires a substantial commitment over time. Modifiable factors that might affect decisions to enroll typically fall into three broad categories: characteristics of the individual, the environment, and the program or study (King et al., 1992; Mills et al., 1996).

This article describes a proactive two-phased recruitment strategy and takes a systematic approach to account for enrollment bias at various steps throughout the recruitment process. Data from the second Community Healthy Activities Model Program for Seniors (CHAMPS II; Stewart et al., 2001) were used to evaluate our ability to enroll a representative sample, in terms of age and gender, of older adults from a defined population at each step of recruitment. From the subsample of eligible HMO members we explore (a) how well the two-phased recruitment

strategy led to enrollment of representative proportions of subgroups of older adults who are typically hard to reach and considered most in need of such programs and (b) other predictors of enrollment. This article can further help future studies by providing an example for tracking sample bias and identifying subgroups that might require more intensive recruitment efforts.

Methods

SETTING AND PARTICIPANTS

The CHAMPS II physical-activity-promotion program was offered to adults age 65 years and older who were members of one of two Medicare HMOs obtaining health care at a multispecialty medical clinic in northern California. Eligibility criteria included (a) being underactive (i.e., not engaging in moderate-intensity physical activity at least three times weekly, for at least 20 min per session, and for at least 3 months); (b) living in one of three communities near the medical clinic; (c) not planning to move from the area in the next 2 years; (d) being English speaking and cognitively intact; (e) having no serious medical conditions that could limit participation in light to moderate physical activity, including unstable angina, uncontrolled hypertension, Type-I diabetes, or having been diagnosed with chest pain, heart attack, or heart surgery during the preceding 6 months; and (f) having no extreme functional impairment as a result of multiple medical illnesses or psychiatric disease. Only one person per household was eligible.

TWO-PHASED PROACTIVE RECRUITMENT PROCESS

Before initiating recruitment, we took several steps to enhance its success, including conducting focus groups of community seniors, to obtain feedback regarding the content of the initial contact letter and telephone call, and publishing an article in the medical center's monthly newsletter. An initial contact letter was sent from a prominent geriatrician of the provider group to randomly selected HMO members to inform them that they would be contacted by telephone to complete a short interview and that they may be eligible for a new program for older adults. Within 2 weeks, these individuals were called and invited to complete a 15- to 20-min telephone interview. The purpose of the interview was to enumerate the population and determine preliminary eligibility.

Phase I. Eligible respondents were invited to attend one of several informational meetings in order to learn more about a new physical-activity-promotion program for seniors from which they would likely benefit. Techniques derived from motivational interviewing (Miller & Rollnick, 1991) were used to invite eligible individuals to the informational meeting (McLellan et al., 1997). Phase I was in effect for 5 months.

Phase II. The informational meeting highlighted the benefits of being physically active, described the program, and described the study requirements. The program was described as being for virtually everyone, even those with health problems. We explained that the program would be tailored to each individual's needs and health issues, that it would be free, and that it would include the following: a personal planning session, physical-activity-related information, self-monitoring

tools, regular telephone follow-up calls and newsletters, and support and feedback. Potential participants were then encouraged to join CHAMPS II. In an attempt to recruit those who were sedentary or not yet thinking about becoming physically active, we indicated that they were welcome even if they felt that they were not yet ready to increase their level of physical activity.

Requirements for enrollment included a 1-year commitment to the project, participation in an individual enrollment meeting, willingness to be randomized to either an intervention group or a 1-year wait-list control group, and completion of questionnaires and physical-performance assessments at baseline, 6 months, and 1 year, as well as daily-activity logs for 2 weeks of each month of the year. Those in the wait-list control group were asked to maintain their usual activities for 1 year, at which time they could participate in the 1-year program. At the close of the meeting, respondents were asked to indicate whether they were definitely, possibly, or definitely not interested. Those who were definitely interested scheduled a baseline assessment, after which they attended an individual enrollment meeting at which they completed the informed consent and were randomized. Trained interviewers contacted those who were possibly interested to discuss their concerns about the program. Some of these individuals then scheduled a baseline assessment and proceeded through the same steps of enrollment.

MEASURES

Data on age and gender for each enrollee of the entire HMO population were provided by the medical group, along with the names and telephone numbers. From the telephone interviews, we obtained measures of other demographics including education, income, and race/ethnicity; major health conditions; physical health (physical functioning; Stewart & Kamberg, 1992); pain (Stewart, Hays, & Ware, 1988); energy/fatigue (Stewart, Hays, & Ware, 1992); self-rated health (U.S. Department of Commerce Bureau of the Census, 1991); psychological well-being (Stewart, Ware, Sherbourne, & Wells, 1992); health knowledge and attitudes including interest in various health topics, knowledge of exercise, satisfaction with physical activity (Stewart & Kamberg), attendance at previous health-education and other classes at their medical clinic, stage of motivational readiness for exercise change (Marcus & Simkin, 1993), and health behaviors and risks including body weight, height, smoking status, and physical activity level. Environmental factors were also assessed, including transportation availability, marital status, role demands (work and/or caregiver), social support, social contacts, and whether a physician had ever recommended exercise to the participant. The definitions and response coding for these variables are presented in Appendix A. On the refusal survey that was administered to those who were definitely not interested in enrolling, we asked their reason(s) for not wanting to take part in the program and categorized the responses.

STATISTICAL ANALYSIS

In order to evaluate enrollment bias throughout each step of recruitment, *t* tests were conducted on age and gender of the entire population to compare those who continued through each step with those who did not.

For those who completed the survey and were eligible for the study, *t* tests were first conducted on 20 variables obtained from the telephone interview to compare characteristics of those who enrolled with those who did not. The hard-to-reach subgroups included the oldest old, less educated, racial and ethnic minorities, and precontemplators of physical activity (people not thinking about becoming physically active). Individuals in need of such a program included those who were sedentary, had more health problems, or were overweight. Other potential individual and environmental predictors of enrollment were tested, such as driving one's own car and having ever had a physician recommend exercise.

A multiple-logistic regression analysis was then conducted to determine the independence of each variable included in the univariate analyses. All variables from the univariate analysis were included except satisfaction with physical ability, social support, and social contacts in order to meet sample size per variable constraints. These particular variables were excluded because the constructs they measure were to some extent represented by other variables.

Similar univariate and multiple-logistic regression methods were used to explore the same questions across each of the two phases of recruitment. All 20 variables were included in the Phase-I analyses. Some variables were excluded from the Phase-II multiple-logistic regression analysis to meet power assumptions, based on a priori relevance. These included the physical health index, psychological well-being index, correct exercise knowledge, satisfaction with physical ability, smoking status, role demands, social support, and social contacts.

Results

SUBJECTS

Of the adults 65 years and older who were members of one of two Medicare HMOs, 1,381 were randomly sampled to receive the initial telephone contact in order to determine their eligibility for the physical activity program. The average age of these individuals was 75.5 years (*SD* = 7.3, range = 65–95), and 64% were women.

EVALUATION OF ENROLLMENT BIAS

As shown in Table 1, comparing age of those who continued through each step of recruitment with those who did not revealed that at almost every step, those who continued were significantly younger than those who did not continue; one exception was that those who were eligible for the study were older than those who were ineligible. For five of the steps, there were few gender differences between those who continued through each step of recruitment and those who did not continue; however, women were significantly more likely to be eligible for the physical activity program and significantly less likely to attend the informational meeting.

In sum, the 173 individuals who enrolled were about 2 years younger (mean age = 73.6 years) than the remainder of the random sample of HMO members who did not enroll (mean age = 76.6 years, $p < .01$; Table 1). There were no overall differences in gender.

Table 1 Enrollment Bias in Terms of Age and Gender at Each Phase of Recruitment

	Age (years)		Women (%)	
Of total sample (<i>N</i> = 1,381): contacted vs. not contacted (all reasons)	Contacted: 75.0 (6.9), <i>n</i> = 1,134	Not contacted: 77.9 (8.4) [†] , <i>n</i> = 247	Contacted: 64.2	Not contacted: 62.2
Of those contacted (<i>n</i> = 1,134): Eligible vs. ineligible for survey ^a	Eligible: 74.7 (6.7), <i>n</i> = 1,053	Not eligible: 78.7 (8.4) [†] , <i>n</i> = 81	Eligible: 63.8	Not eligible: 69.1
Of those eligible for survey (<i>n</i> = 1,053): Completed full survey vs. did not complete	Completed: 74.3 (6.4), <i>n</i> = 893	Did not complete: 77.2 (7.5) [†] , <i>n</i> = 160	Completed: 63.0	Did not complete: 68.1
Of those who completed full telephone survey (<i>n</i> = 893): Eligible vs. ineligible for study ^b	Eligible: 75.5 (6.7), <i>n</i> = 519	Not eligible: 72.7 (5.8) [†] , <i>n</i> = 374	Eligible: 68.6	Not eligible: 55.3 [†]
Of those eligible for the study (<i>n</i> = 519): Attended informational meeting vs. did not attend	Attended: 74.8 (6.5), <i>n</i> = 282	Did not attend: 76.2 (6.8) [*] , <i>n</i> = 237	Attended: 63.5	Did not attend: 74.7 ^{**}
Of those who attended informational meeting (<i>n</i> = 282): Enrolled in program vs. did not enroll	Enrolled: 73.6 (5.9), <i>n</i> = 173	Not enrolled: 76.8 (6.9) [†] , <i>n</i> = 109	Enrolled: 66.5	Not enrolled: 58.7
<i>Summary: of total sample (N = 1,381) completed full survey vs. remaining HMO members enrolled in program vs. did not enroll</i>	Completed: 74.3 (6.4), <i>n</i> = 893	Did not complete: 77.8 (8.1) [†] , <i>n</i> = 488	Completed: 63.0	Did not complete: 65.3
	Enrolled: 73.6 (5.9), <i>n</i> = 173	Not enrolled: 75.8 (7.4), <i>n</i> = 1,208	Enrolled: 66.5	Not enrolled: 63.5
<i>Summary: of eligible for study (n = 519) enrolled in program vs. did not enroll</i>	Enrolled: 73.6 (5.9), <i>n</i> = 173	Not enrolled: 76.4 (6.8) [†] , <i>n</i> = 346	Enrolled: 66.5	Not enrolled: 69.7

^aExclusion criteria for the survey included no longer being a member of the HMO and not being able to communicate with the interviewer because of language or cognitive problems. ^bExclusion criteria for the study are summarized in the Setting and Participants section of the article. **p* < .05. ***p* < .01. [†]*p* < .001.

ENROLLMENT OF THOSE WHO WERE ELIGIBLE

Eligible respondents included 519 Medicare HMO members. Their mean age was 75.5 years (range = 65–95 years, $SD = 6.7$) and mean years of education was 14.5 ($SD = 2.6$), 68.6% were women, 48.4% were married, and 15.5% were members of a racial or ethnic minority group (Table 2).

For the hard to reach, according to the univariate analyses (Table 3, Columns 1 and 2), we underrepresented the oldest old, less educated, racial and ethnic minorities, and precontemplators of physical activity. Regarding those most in need, we recruited a representative proportion of those who were sedentary and overrepresented overweight individuals. Level of health on three measures did not differ between those who enrolled and those who did not. Results from the multiple-logistic regression analysis are shown in Column 1 of Table 4. After accounting for all other variables in the model, we still underrepresented the oldest old, less educated, and racial and ethnic minority groups. Regarding those who were most in need of such a program, multivariate results were similar to the univariate findings.

Of those who were eligible, the following were significant modifiable predictors of enrollment in the univariate analysis (Table 3): being interested in more health topics, having previously attended any class at the medical facility,

Table 2 Description of Eligible Individuals ($n = 519$)

Age (years)	75.5 (± 6.7)
Oldest old: 85 years and older (%)	11.2
Education (years)	14.5 (± 2.6)
Less educated: high school or less (%)	28.7
Racial/ethnic minority (%)	15.5
Female (%)	68.6
Married (%)	48.4
Precontemplator of physical activity (%)	13.9
Sedentary: underactive and did not set aside time for exercise (%)	40.8
Count of 5 chronic conditions (count)	1.2 (± 1.1)
Physical Health Index (score)	15.2 (± 3.2)
Psychological Well-Being Index (score)	4.2 (± 0.8)
Overweight (%)	22.9
Number of health topics interested in (count)	2.1 (± 2.0)
Attended any class at medical clinic (%)	21.0
Correct exercise knowledge (%)	37.0
Satisfaction with physical ability (score)	4.2 (± 1.1)
Smokes (%)	8.7
Drives own car (%)	83.2
Role demands (%)	22.4
Social-Support Index (score)	3.8 (± 1.1)
Number of weekly social contacts (count)	2.8 (± 1.0)
MD ever recommended exercise (%)	53.2

Table 3 Univariate *t* Tests of Those Enrolling vs. Not Enrolling (of Those Eligible), Those Attending vs. Not Attending the Informational Meeting (of Those Eligible), and Those Enrolling vs. Not Enrolling (of Those Attending the Meeting)

	Phase-Specific Results					
	Of Those Eligible (<i>n</i> = 519):		Of Those Eligible (<i>n</i> = 519):		Of Those Who Attended Meeting (<i>n</i> = 282)	
	Enrolled (<i>n</i> = 173)	Not enrolled (<i>n</i> = 346)	Attended (<i>n</i> = 282)	Did not attend (<i>n</i> = 237)	Enrolled (<i>n</i> = 173)	Not enrolled (<i>n</i> = 109)
<i>Hard to reach</i>						
oldest old: 85 years and older (%)	10.4	19.9**	9.2	13.9	4.0	17.4†
less educated: high school and less (%)	19.1	33.5†	23.8	34.6**	19.1	31.2*
racial/ethnic minority (%)	9.2	18.8**	11.7	20.3**	9.2	15.6
precontemplator of physical activity (%)	9.8	15.9*	10.6	17.7*	9.8	11.9
<i>In need of such programs</i>						
sedentary (%)	43.9	39.3	42.4	39.2	43.9	39.4
count of 5 chronic conditions (count)	1.3 (1.2)	1.2 (1.0)	1.3 (1.1)	1.2 (1.0)	1.3 (1.2)	1.2 (1.0)
Physical Health Index (score)	15.3 (3.3)	15.1 (3.2)	15.4 (3.2)	14.9 (3.2)	15.3 (3.3)	15.5 (3.1)
Psychological Well-Being Index (score)	4.2 (0.8)	4.2 (0.8)	4.2 (0.8)	4.2 (0.8)	4.2 (0.8)	4.1 (0.8)
overweight (%)	30.6	19.0**	24.8	20.5	30.6	15.6**
<i>Other potential predictors</i>						
number of health topics interested in (count)	2.6 (2.1)	1.8 (2.0) †	2.4 (2.0)	1.6 (2.0) †	2.6 (2.1)	2.1 (1.9)*
attended any class at medical clinic (%)	31.2	15.9**	28.7	11.8†	31.2	24.8
correct exercise knowledge (%)	46.8	32.1**	43.2	29.5**	46.8	37.6
satisfaction with physical ability (score)	4.2 (1.2)	4.2 (1.1)	4.2 (1.1)	4.1 (1.1)	4.2 (1.1)	4.2 (1.1)
smokes (%)	5.2	10.4	7.8	9.7	5.2	11.9
drives own car (%)	89.6	80.1**	87.2	78.5**	89.6	83.5
role demands (%)	23.7	21.7	76.6	78.9	23.7	22.9
Social-Support Index (score)	3.9 (1.1)	3.8 (1.1)	3.9 (1.1)	3.8 (1.1)	3.9 (1.1)	3.8 (1.2)
married (%)	55.5	44.8*	51.8	44.3	55.5	45.9
number of weekly social contacts (count)	2.9 (1.0)	2.8 (1.1)	2.8 (1.0)	2.8 (1.1)	2.9 (1.0)	2.8 (1.1)
MD ever recommended exercise (%)	65.3	47.0†	61.3	43.5	65.3	55.0

p* < .05. *p* < .01. †*p* < .001.

Table 4 Multiple-Logistic Regression Analysis Predicting Those Enrolled of Those Eligible, Those Attending the Informational Meeting (of Those Eligible), and Those Enrolled (of Those Attending the Meeting), Odds Ratio (95% CI)

Variable label	Phase-Specific Results		
	Of eligible: enrolled vs. did not enroll	Of eligible: attended meeting vs. did not attend	Of attended meeting: enrolled vs. did not enroll
Hard to reach			
oldest old (85 years and older)	0.29 (0.12, 0.70)**	0.97 (0.50, 1.89)	0.19 (0.07, 0.51)†
less educated (high school or less)	0.57 (0.34, 0.94)*	0.79 (0.49, 1.27)	0.48 (0.25, 0.91)*
racial/ethnic minority	0.36 (0.19, 0.68)**	0.40 (0.23, 0.71)**	0.48 (0.21, 1.09)
precontemplator of physical activity	0.82 (0.40, 1.71)	0.67 (0.34, 1.32)	1.05 (0.40, 2.73)
In need of such programs			
sedentary	1.16 (0.72, 1.88)	1.31 (0.81, 2.13)	0.96 (0.52, 1.77)
count of 5 chronic conditions	1.11 (0.90, 1.37)	1.17 (0.95, 1.44)	1.02 (0.80, 1.30)
Physical Health Index	1.05 (0.97, 1.14)	1.10 (1.00, 1.20)	not included
Psychological Well- Being Index	1.02 (0.76, 1.37)	0.87 (0.65, 1.16)	not included
overweight	1.68 (1.02, 2.76)*	0.96 (0.58, 1.57)	2.61 (1.28, 5.29)**
Other potential predictors			
number of health topics interested in	1.26 (1.13, 1.40)†	1.26 (1.13, 1.40)†	1.19 (1.03, 1.36)*
attended any class at medical clinic	2.23 (1.38, 3.62)**	2.52 (1.51, 4.20)†	1.52 (0.84, 2.75)
correct exercise knowledge	1.18 (0.76, 1.82)	1.30 (0.85, 2.00)	not included
satisfaction with physical ability	not included	1.11 (0.86, 1.45)	not included
smokes	0.56 (0.24, 1.26)	0.81 (0.40, 1.65)	not included
drives own car	1.40 (0.74, 2.63)	1.25 (0.71, 2.21)	1.24 (0.56, 2.75)
role demands	0.93 (0.56, 1.52)	0.90 (0.55, 1.46)	not included
Social-Support Index	not included	0.98 (0.81, 1.18)	not included
married	1.34 (0.86, 2.08)	1.21 (0.77, 1.88)	not included
number of weekly social contacts	not included	1.05 (0.86, 1.29)	not included
MD ever recom- mended exercise	1.58 (1.01, 2.47)*	1.87 (1.22, 2.86)**	1.19 (0.68, 2.08)

Note. 95% CI = $e^{\beta \pm 1.96 SE(\beta)}$.

* $p < .05$. ** $p < .01$. † $p < .001$.

having correct knowledge about exercise, being a nonsmoker, driving one's own car for transportation, and having ever had a physician recommend exercise. Factors that remained as significant predictors in the multivariate model (Table 4) included expressing interest in a greater number of health topics, previous attendance at a class at the medical facility, and having ever had a physician recommend exercise.

PHASE-SPECIFIC PREDICTORS

Of the 519 eligible individuals, 282 attended the informational meeting (54%). Of those who attended the meeting, 173 enrolled in the CHAMPS II program (61%). Columns 2–4 of Table 3 present the univariate results for each of the two phases of recruitment, and Columns 2–4 of Table 4 present the multivariate results. We highlight here the multivariate results for variables that were significant at either of the two phases.

Multivariate analyses indicated that, of those who were eligible, a representative proportion of the oldest old and the less educated attended the informational meeting, but once they attended the meeting these groups were less likely to join. Conversely, racial and ethnic minorities were underrepresented at the meeting, but of those who attended, a representative proportion enrolled in the study. Finally, although a representative proportion of overweight individuals attended the informational meeting, they were overrepresented in the study.

Of the potential modifiable predictors, having ever had a physician recommend exercise and previous attendance at any class at the clinic were predictive of attending the meeting but not of subsequently joining the program once they had attended the meeting. Expressing an interest in more health topics was predictive at both phases.

REASONS FOR REFUSING AFTER ATTENDING THE INFORMATIONAL MEETING

Of the individuals who decided not to join CHAMPS II after attending the informational meeting ($N = 109$), 71 refused either immediately after the meeting or during a telephone recontact. Of those individuals, 62 completed the refusal survey (87%), with a total of 95 responses. Primary reasons for refusing enrollment included not being interested in the program ($n = 42$; 44%), being too busy ($n = 26$; 27%), having health problems ($n = 13$; 14%), and having family problems ($n = 5$; 5%).

Discussion

Through the two-phased recruitment process, we enrolled one third of the eligible older adult HMO members who completed the telephone interview. This recruitment rate is higher than other health promotion studies that require an extensive commitment over time, whose rates have ranged from 2% to 26% (King, Harris, & Haskell, 1988; Mills et al., 1996; Vogt, Ireland, Black, Camel, & Hughes, 1986).

We found no overall enrollment bias in terms of gender, but there was an overall age bias (those who enrolled were younger by about 2 years than those in the rest of the sampling frame) that appeared at most steps of recruitment. This might be because increased age is related to several other factors potentially associated with either being ineligible and/or refusing such programs, such as severe medical problems and increased barriers to participating in programs or time-intensive research studies. Given these findings, the effectiveness of the CHAMPS II physical activity program should be generalizable to other men and women in the HMO but might not be generalizable to the older members of the HMO group (although the magnitude of this bias is small). Furthermore, although the inclusion of a specific population of Medicare HMO members is a strength because of our ability to

employ proactive methods and enumerate the population, the generalization of these recruitment results might be limited to individuals with clear access to medical care. This particular HMO setting also had a relatively low proportion of ethnic-minority and low-socioeconomic-status individuals. We were able to evaluate enrollment bias only in terms of age and gender at each step of recruitment. Future studies might, however, attempt to obtain demographic information other than age and gender on the target population. The depth of descriptive information one can obtain on target populations for such comparisons, however, typically depends on the administrative policies of the particular agency.

Phase-specific analyses allowed us to identify factors associated with each step—attending the informational meeting and enrolling in the program. Results indicated that different recruitment efforts might be needed at each phase in order to attract the hard-to-reach subgroups. Findings that the oldest old and least educated were represented at the informational meeting but were less likely to enroll in the program indicate that additional strategies are needed to enhance the effectiveness of the informational meeting in making the program more appealing to these subgroups of older adults. In terms of the oldest old, one could emphasize that it is never too late to improve fitness and that physical activity is especially beneficial for these individuals, while showing examples of individuals in this age group being physically active. To appeal to the less educated, it is essential to ensure that all messages at such meetings are clear and understandable. Given the initial interest of those who were least educated, future research can explore correlates of being less educated that might affect these individuals' decision to not enroll.

Findings that racial and ethnic minorities were underrepresented at the informational meeting indicate that further efforts need to be made to attract minority groups to the informational meeting, such as tailoring initial contacts to be more culturally sensitive and appealing to ethnic minority groups. Having ethnically matched staff members involved in recruitment might also increase the proportion of ethnic minorities who express interest in attending the meeting. More formative research is needed to refine recruitment strategies that address the concerns and issues of these groups. For instance, previous studies have suggested that involving members of the selected population in the early stages of program planning enhances program involvement and improves outcomes (Shopland, 1993). Future studies can evaluate whether this same approach can enhance recruitment. Using a two-phased recruitment strategy can also be useful for other types of health promotion programs, to evaluate at which phases methods need to be improved in order to attract hard-to-reach and in-need individuals.

Our evaluation of behavioral, personal, and environmental predictors of enrollment (based on social-cognitive theory) offered valuable information regarding specific factors that can be addressed to enhance overall enrollment. Our finding that being interested in a greater number of health topics, previous attendance at a health education class at the medical facility, and having had a physician recommend being more physically active were predictive of overall enrollment is useful, given that these three variables are modifiable. One approach would be to increase the salience of relevant health topics to the targeted individuals. For example, displaying informational posters and providing general materials such as newsletters on health topics to the targeted population before recruitment could increase awareness and interest in such studies. Advertising new health promotion programs through other classes in the facility might also be useful.

Our finding that having had a physician recommend exercise was predictive of enrollment is consistent with one previous study (Eakin & Glasgow, 1997). This suggests that encouraging physicians to recommend exercise to their older patients might enhance recruitment rates for such programs (Damush, Stewart, Mills, King, & Ritter, 1999). For example, a brief bulletin summarizing evidence of the benefits of physical activity for older patients could be distributed to physicians. Such bulletins could highlight for the physicians the power of such simple recommendations. Our recruitment rates might also have been improved by having each potential participant's primary care physician, as opposed to a local geriatrician, sign the initial contact letter. This latter point would need to be tested in future research.

Using social-influence theory helped us design the two-phased approach, which appears to have been reasonably successful. Through the use of strategies suggested by social-marketing theory, social-cognitive theory, and the transtheoretical model in the two-phased recruitment strategy, we were successful in terms of enrolling those in need of a physical activity program (even overrepresenting overweight individuals) but not in terms of enrolling the hard to reach. Overall enrollment of a representative proportion of eligible individuals who were sedentary is an improvement from the first CHAMPS study, in which those who were sedentary were less likely to join the program (Mills et al., 1996). Of particular interest, level of health was not predictive of enrollment. Because individuals were excluded from the study for health reasons only if they had a severe and unstable health problem, these findings indicate that variations in health were not influential in people's decisions. This could be attributed to our emphasis during the informational meeting that exercise is especially beneficial for those with health problems and that there was some type of appropriate exercise for virtually everyone, regardless of health problems. Our inability to represent the hard to reach indicates that much more planning is needed to reach these groups. The one exception is that by taking into account the stages of change in our recruitment strategies, we were successful in enrolling representative proportions of precontemplators of physical activity (of those who were eligible).

Our predictive model might have been limited because it focused on individual and environmental predictors of enrollment, although our conceptual framework also included program factors that might have affected peoples' decisions to enroll. For instance, some refusals might have been based on not finding physical activity programs appealing. Results from the refusal survey indicate that a large proportion of those who refused to join CHAMPS II after attending the meeting did not find the specific program appealing, which suggests that we need to learn more about the appeal of various program features, possibly through more qualitative research.

This article extends our work exploring predictors of enrollment from the first CHAMPS study (Mills et al., 1996). By exploring predictors of each of the two phases separately, we were able to identify factors affecting decisions at both points of recruitment. In addition, this study included some additional variables of particular interest as determinants of enrollment: whether a physician had ever recommended exercise and whether individuals were in very early stages of readiness to increase physical activity.

Our approach to examining enrollment biases provides an example that can be used by other health-promotion studies. Furthermore, by evaluating levels of

enrolling the hard to reach and those in need, as well as predictors of enrollment at two phases of the recruitment process, we were able to suggest specific strategies for improving recruitment of specific subgroups. Representing a known population in programs and research studies is the first step toward the public-health goal of improving the health and healthy behaviors of any population. Regarding enrollment of older adults into physical-activity-promotion programs, because we had some information on the general population from which we recruited, we have contributed to an area of research in which there is currently relatively little in the literature. With more studies assessing predictors of recruiting older adults, efforts to recruit those who can especially benefit from physical-activity-promotion or health-promotion programs in general are more likely to be successful.

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References

- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.
- Blair, S.N., Kohl, H.W., Paffenbarger, R.S., Clark, D.B., Cooper, K.H., & Gibbons, L.W. (1989). Physical fitness and all-cause mortality: A prospective study of healthy men and women. *Journal of the American Medical Association*, **262**, 2395-2401.
- Blumenthal, J.A., Emery, C.F., Madden, D.J., George, L.K., Coleman, E., Riddle, M.W., McKee, D.C., Reasoner, J., & Williams, R.S. (1989). Cardiovascular and behavioral effects of aerobic exercise training in healthy older men and women. *Journal of Gerontology*, **44**, M147-M157.
- Carter, W.B., Elward, K., Malmgren, J., Martin, M.L., & Larson, E. (1991). Participation of older adults in health programs and research: A critical review of the literature. *Gerontologist*, **31**, 584-592.
- Cialdini, R.B. (1985). *Influence: Science and practice*. Glenview, IL: Scott, Foresman and Co.
- Damush, T.M., Stewart, A.L., Mills, K., King, A.C., & Ritter, P.L. (1999). Prevalence and correlates of physician recommendations to exercise among older adults. *Journal of Gerontology: Medical Sciences*, **54a**, M423-M427.
- Eakin, E.G., & Glasgow, R.E. (1997). Recruitment of managed care Medicare patients for a physical activity study. *American Journal of Health Promotion*, **12**, 98-101.
- Flay, B.R. (1986). Efficacy and effectiveness trials (and other phases of research) in the development of health promotion. *Preventive Medicine*, **15**, 451-474.
- King, A.C., Blair, S.N., Bild, D.E., Dishman, R.K., Dubbert, P.M., Marcus, B.H., Olderidge, N.B., Paffenbarger, R.S., Powell, K.E., & Yeager, K.K. (1992). Determinants of physical activity and interventions in adults. *Medicine and Science in Sports and Exercise*, **24**, 221-236.

- King, A.C., Harris, R.B., & Haskell, W.L. (1988). Effects of recruitment strategy on types of subjects entered into a primary prevention clinical trial [abstract]. *CVD Epidemiology Newsletter*, **43**, 38.
- King, A.C., Haskell, W.L., Taylor, C.B., Kraemer, & DeBusk, R.F. (1991). Group vs home-based exercise training in healthy older men and women: A community-based trial. *Journal of the American Medical Association*, **266**, 1535-1542.
- Lefebvre, R.C., & Flora, J.A. (1988). Social marketing and public health intervention. *Health Education Quarterly*, **15**, 299-315.
- Marcus, B.H., & Simkin, L.R. (1993). The stages of exercise behavior. *Journal of Sports Medicine and Physical Fitness*, **33**, 83-88.
- McLellan, B.Y., Stewart, A.L., Mills, K.M., Verboncoeur, C.J., Sperber, N., & Ritter, P.L. (1997). Using motivational interviewing techniques to recruit older adults into a physical activity study. *Annals of Behavioral Medicine*, **19**, S103.
- Miller, W.R., & Rollnick, S. (1991). *Motivational interviewing*. New York: Guilford Press.
- Mills, K.M., Stewart, A.L., King, A.C., Roitz, K., Sepsis, P.G., Ritter, P.L., & Bortz, W.M. II. (1996). Factors associated with enrollment of older adults into a physical activity promotion program. *Journal of Aging and Health*, **8**, 96-113.
- Prochaska, J.O., & DiClemente, C.C. (1983). Stages and processes of self-change of smoking: Toward an integrative model of change. *Journal of Consulting and Clinical Psychology*, **51**, 390-395.
- Shopland, D. (1993). Smoking control in the 1990's: A National Cancer Institute model for change. *American Journal of Public Health*, **83**, 1208-1210.
- Stewart, A.L., Hays, R.D., & Ware, J.E. (1988). The MOS short-form general health survey: Reliability and validity in a patient population. *Medical Care*, **26**, 724-735.
- Stewart, A.L., Hays, R.D., & Ware, J.E. (1992). Health perceptions, energy/fatigue, and health distress measures. In A.L. Stewart & J.E. Ware (Eds.), *Measuring functioning and well-being: The Medical Outcomes Study approach* (pp. 143-172). Durham, NC: Duke University Press.
- Stewart, A.L., & Kamberg, C.J. (1992). Physical functioning measures. In A.L. Stewart & J.E. Ware (Eds.), *Measuring functioning and well-being: The Medical Outcomes Study approach* (p. 345). Durham, NC: Duke University Press.
- Stewart, A.L., Verboncoeur, C.J., McLellan, B.Y., Gillis, D.E., Rush, S., Mills, K., King, A.C., Ritter, P., Brown, B., & Bortz, W.M. (2001). Physical activity outcomes of CHAMPS II: a physical activity promotion program for older adults. *Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, **56**, 465-470.
- Stewart, A.L., Ware, J.E., Jr., Sherbourne, C.D., & Wells, K. (1992). Psychological distress/well-being and cognitive functioning measures. In A.L. Stewart & J.E. Ware, Jr. (Eds.), *Measuring functioning and well-being: The Medical Outcomes Study approach* (pp. 102-142). Durham, NC: Duke University Press.
- U.S. Department of Commerce Bureau of the Census. (1991). *National health interview survey*. Washington, DC: Public Health Service.
- Vogt, T.M., Ireland, C.C., Black, D., Camel, G., & Hughes, G. (1986). Recruitment of elderly volunteers for a multicenter clinical trial: The SHEP pilot study. *Controlled Clinical Trials*, **7**, 118-133.
- Wagner, E.H., Grothaus, L.C., Hecht, J.A., & La Croix, A.Z. (1991). Factors associated with participation in a senior health promotion program. *Gerontologist*, **31**, 598-602.

Appendix A

MEASURES OF INDIVIDUAL AND ENVIRONMENTAL FACTORS

Measure	Definition	Scale
Hard to reach		
oldest old	Age 85 years or older.	0-1
less educated	High school education or less.	0-1
racial/ethnic minority	Non-White and/or Hispanic.	0-1
precontemplator of physical activity	Sedentary and not thinking about being physically active (based on the "stages of change" theory).	0-1
In need of such programs		
sedentary	Underactive and does not set aside time for exercise.	0-1
count of 5 chronic conditions	Count of arthritis, diabetes, hypertension, heart disease or stroke, and other serious medical condition.	0-5
Physical Health Index	Extent to which health limits everyday physical activities, bodily pain, self-rated health, and energy/fatigue (based on factor analysis). High score indicates better health (Cronbach's alpha = .76).	4-21
Psychological Well-Being Index	Extent to which bothered by emotional problems such as feeling anxious, depressed, or irritable; amount of time felt downhearted and blue. High score indicates greater well-being (Cronbach's alpha = .75).	1-5
overweight	Body mass index (BMI) > 27.0; BMI = weight (kg)/height (m) ² .	0-1
Other potential predictors		
female	Female gender.	0-1
number of health topics interested in	Number of health topics interested in learning: blood pressure, depression, exercise, nutrition, about smoking cessation, stress management, weight control, or other (write-in).	0-8
attended any class at medical clinic	Previously attended any class, lecture, or support group about health or aging at the medical clinic.	0-1
correct exercise knowledge	Correct knowledge regarding how fast heart rate and breathing rate should be to enhance heart and lungs (answer: a lot faster, but talking possible).	0-1
satisfaction with physical ability	Extent to which satisfied with physical ability to do what wants to do. Higher score indicates greater satisfaction.	1-6

smokes	Currently smokes cigarettes.	0-1
drives own car	Drives own car for transportation.	0-1
role demands	Currently a caregiver and/or working at paying job.	0-1
Social-Support Index	Extent to which has tangible and emotional support. Higher score indicates more support (Cronbach's alpha = .63).	1-5
married	Currently married.	0-1
weekly frequency of social contacts	Weekly frequency of social contact with friends. Higher score indicates more contact. Ordinal scale.	0-5
MD ever recommended exercise	Having had a physician ever recommend exercise.	0-1
