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Psychological Predictors of Physical Activity in the Diabetes Prevention Program

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Abstract

Objective—To identify the baseline psychological variables before receiving a Diabetes Prevention Program (DPP) lifestyle intervention that predict physical activity levels (PALs) at baseline, 1 year, and end of study (2 to 3 years after randomization).

Design and subjects—Of the final 293 DPP lifestyle participants randomized, 274 (94%) completed validated questionnaires at baseline assessing stage of change for PAL, exercise self-efficacy, perceived stress, depression, and anxiety.

Statistical analyses performed—Correlations and stepwise multiple regression analyses.

Results—At baseline, this subset was similar to the entire DPP lifestyle cohort: mean age was 52.5 years, 65% were women, and mean PAL was 15.7 metabolic equivalent hours per week. Higher levels of baseline leisure PAL correlated with greater readiness to change PAL (r=0.44, P<0.0001), higher exercise self-efficacy (r=0.18, P=0.002), and lower levels of perceived stress (r=−0.16, P=0.009), depression (r=−0.18, P=0.003), and anxiety (r=−0.14, P=0.03), with similar correlations at 1 year and end of study. In multivariate models, being a man, lower levels of depression, and lower body mass index were independent correlates of higher baseline leisure PAL; being a man, greater baseline exercise self-efficacy, and activity level were independent correlates of greater leisure PAL levels at 1 year and end of study. Greater readiness to change PAL at baseline was also an independent correlate of greater PAL at end of study.

Conclusions—In this representative sample of DPP lifestyle participants, being a man, lower body mass index, greater readiness for change in PAL, higher exercise self-efficacy, and lower perceived stress, depression, and anxiety scores correlated with higher levels of baseline PAL with similar patterns at 1 year and end of study. These findings may help determine which patients are most likely to increase PAL in lifestyle intervention programs.

Lack of physical activity is a major risk factor for premature morbidity and mortality and contributes to the death of 200,000 Americans every year (1). Despite strong evidence for the benefits of regular physical activity (2,3), 24% of US adults engage in no recreational physical activity at all, and only 25% meet recommended physical activity levels (PALs) (4).

One of the many major health benefits of regular physical activity is the prevention of type 2 diabetes (5-7), mediated by weight control and other mechanisms (6,8,9). Given that both inactivity and obesity seem to be strongly and independently associated with diabetes and

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diabetes-related cardiovascular comorbidities (10), it is particularly crucial to understand how to promote physical activity in persons at high risk for diabetes.

Physical activity is a complex behavior that has been correlated with numerous demographic and psychological variables (11-13). However, much of the current literature focuses on the general population rather than on people at high risk for diabetes, like those with impaired glucose tolerance (IGT).

The Diabetes Prevention Program (DPP) was a randomized clinical trial comparing the efficacy of intensive lifestyle or metformin with placebo in the prevention of type 2 diabetes in persons with overweight and IGT. Subjects randomly assigned to the lifestyle intervention had goals of losing at least 7% of their body weight and achieving PALs of ≥150 minutes per week (14). The DPP lifestyle participants achieved a mean weight loss of 7.2% and a mean activity level of 208 minutes per week after 1 year of intervention, and sustained a 5% weight loss and a mean activity level of 189 minutes per week at study end after a mean study period of 2.8 years (range=1.8 to 4.8 years) (5). These changes in physical activity contributed to weight loss and a 58% reduction in the development of type 2 diabetes (5). Although weight loss was the predominant predictor of diabetes risk reduction (15), lifestyle participants with the highest levels of physical activity were more successful with long-term weight loss (16,17). Moreover, physical activity has been shown to reduce diabetes risk in subjects with an excessive body mass index (BMI) and elevated glucose levels (9).

Because of the potential benefit of increased physical activity in diabetes prevention and long-term weight-loss maintenance (16), it is important to understand the psychological determinants of exercise behavior. We hypothesized that greater readiness to exercise and greater exercise self-efficacy would be correlated with greater PALs and that perceived stress, depression, and anxiety would be correlated with lower PALs.

We examined two questions: What are the baseline psychological correlates of baseline and subsequent PALs in DPP participants assigned to the lifestyle intervention? And, what is the relative importance of these factors before participation in a lifestyle intervention in predicting activity levels in this group? A secondary question is whether or not the baseline psychological correlates of activity level differ as a function of sex or race/ethnicity.

METHODS

Study Participants and Procedures

This DPP substudy was conducted between 1998 and 2001. Written informed consent was obtained from 274 of the last 293 (94%) lifestyle participants randomized; 18 of 27 DPP centers agreed to participate and obtained approval from their Institutional Review Boards. Of the nine centers that did not participate in this substudy, two were not invited because they had already randomized almost all of their center cohorts and the other seven (four of which were American Indian centers) declined to participate to minimize participant burden as they had elected to participate in other ancillary studies. Eligibility criteria and baseline characteristics of the DPP cohort have been previously described (14,18). Participants had IGT, BMI ≥24 (≥22 for non-Hispanic Asian Americans), and were at least 25 years old (18).

The lifestyle intervention has been described in detail (5,14,19). In brief, lifestyle participants and coaches met individually during the first 24 weeks to review a 16-session core curriculum that focused on diet, physical activity, and behavior modification strategies. Walking was the most common leisure physical activity chosen. After this 24-week core program, lifestyle coaches tailored individual sessions to the needs of each participant. They also offered classes and campaigns three times per year targeted at improving activity levels and weight loss (19).

Measures

After randomization to the lifestyle intervention, DPP participants in this substudy were asked to complete self-administered questionnaires assessing stage of change for physical activity, exercise self-efficacy, and perceived stress. These questionnaires were readministered at 6 months, 1 year, and end of study (2 to 3 years after randomization).

The Stage of Change for Exercise (20) is a five-item validated measure designed to classify subjects into the precontemplation, contemplation, preparation, action, or maintenance stage of exercise behavior. Subjects are asked to indicate the stage that "best describes [their] current exercise behavior," including whether or not they plan to begin exercising within the next 6 months.

The Exercise Self-Efficacy Scale (21) consists of five items designed to measure confidence in one's ability to persist with exercise in various situations representing the areas of negative affect, resisting relapse, and making time for exercise. A seven-point scale is used to rate each item (1=not at all confident to 7=very confident). This scale has been shown to have adequate internal consistency, test–retest reliability, and concurrent validity indexes (21).

The Perceived Stress Questionnaire (22) is a 30-item questionnaire intended to provide a sensitive measure of ongoing stress and pressure related to life events. Scores are moderately but significantly associated with stressful life events, and the scale has been reported to show an association between psychological factors and objective evidence of disease (22).

All DPP participants also completed the Beck Depression and Anxiety Inventory (23,24) and the Modifiable Activity Questionnaire (MAQ) (25) annually. The Beck Depression Inventory is a validated 21-item self-report rating inventory measuring characteristic attitudes and symptoms of depression. The Beck Anxiety Inventory is a validated 21-item self-report inventory that reliably measures symptoms of anxiety and discriminates anxiety from depression. The MAQ assesses both leisure and occupational activity during the past year. The leisure section of the questionnaire asks participants to identify their specific activities during the past year from a list of nonoccupational activities common to the entire DPP cohort (developed via pilot testing), and to estimate the frequency and duration for each activity. Leisure activity estimates were calculated separately as hours per week averaged over the past year. Each activity was also weighted by its relative metabolic cost (in metabolic units) to derive a final unit of metabolic equivalent (MET) hours per week.

Lifestyle participants also reported minutes of activity per week in lifestyle logs weekly during the first 6 months and at least 1 week per month thereafter. Specially trained staff measured body weight and height according to a standardized protocol. BMI was calculated as kg/m^2.

Statistical Analysis

The primary aim of this study was to examine the associations between baseline demographic and psychological variables and leisure-time physical activity at baseline, 1 year, and end of study. Spearman correlation coefficients were determined to assess the association between baseline variables and leisure physical activity at each time point and to examine the correlations between baseline stage of change, exercise self-efficacy, perceived stress, depression, and anxiety and leisure-time physical activity. Baseline comparisons between groups were made using *t* tests for continuous variables and χ^2 tests for categorical variables.

To determine the relative importance of the variables, stepwise multivariate regression was used with continuous leisure physical activity (measured by MAQ in MET hours per week) as the dependent variable to assess the association of these factors with physical activity at baseline, 1 year, and end of study. $P<0.15$ was required for entry into the model and $P=0.05$

to stay in the model. Stage of change at baseline was not considered as a candidate variable for the baseline model because the wording of the question closely approximated leisure physical activity (the dependent variable). However, stage-of-change at baseline was considered a candidate variable for 1-year and end-of-study physical activity models. Because the participants were grouped by study site, generalized estimating equations were used to account for the clustering of participant responses within sites.

Two additional sets of models were created. The first using continuous self-reported minutes of physical activity at 1 and 2 years as the dependent variable and the second using a dichotomous outcome of whether or not subjects met the 150 minutes/week physical activity goal at 1 and 2 years as the dependent variable (stepwise logistic regression).

To further examine variables that might have an influence on physical activity, the method of Barron and Kenny (26) was used to determine if variables that correlated with leisure physical activity might mediate the association between an exogenous variable (ie, sex) and leisure physical activity.

To address whether or not sex or race/ethnicity influenced the extent to which various psychological variables influenced leisure physical activity, interaction terms were created that included each variable in the final model for baseline, 1 year, and end of study combined with either sex or race/ethnicity. A substantial interaction was considered if the interaction term had a $P<0.10$, to be as inclusive as possible and generate new hypotheses about the relationships of these variables.

RESULTS

Baseline Characteristics

The 274 lifestyle participants from 18 DPP centers in this substudy represent approximately one fourth of the total DPP lifestyle cohort (n=1,079). The American Indian centers did not participate in this substudy. This subgroup was representative of the total lifestyle group in terms of sex, initial BMI, and baseline activity level (Table 1). The group was 65% women and 38% minority; mean BMI was 33.9; 50% had completed some college and 47% had an income of $50,000/year or higher; 62% of participants were married or living with a partner and 74% were employed full- or part-time.

Physical Activity

Physical activity was measured in two ways, as leisure physical activity in MET hours per week and as self-reported minutes of activity per week. At baseline, the mean level of leisure physical activity as measured by MAQ was 15.7 MET hours per week; the median level was 8.9 MET hours per week (approximately 120 minutes per week). The mean weekly activity by self-report was 228±208 minutes and 223±184 minutes at 1 year and 2 years, respectively; 63% and 64% of these lifestyle participants met the goal of ≥150 minutes per week at 1 year and 2 years, respectively. Minutes of physical activity were moderately correlated with leisure MET hours per week at both 1 year ($r=0.41$, $P<0.0001$) and 2 years ($r=0.51$, $P<0.0001$).

Sociodemographic Correlates of Activity

Age, race/ethnicity, income, and education level were not correlated with baseline or subsequent leisure PALs. Higher baseline BMI and being a woman correlated with lower baseline, 1-year, and end-of-study leisure PALs as measured by MAQ. The pattern was similar for reported minutes of activity, except that older participants reported more minutes of activity at 1 and 2 years.

There were notable differences in baseline psychological variables and physical activity outcomes between men and women. Table 2 shows sex differences in baseline characteristics. At baseline, men were older, were at a more advanced stage of change for exercise, had significantly higher exercise self-efficacy scores, and higher leisure PALs when compared with women. In contrast, women had significantly higher BMIs and higher levels of depression, anxiety, and perceived stress than men (with perceived stress levels being statistically significant).

At all three time points, men had significantly higher levels of leisure physical activity than women. Men also reported more minutes of activity per week at both 1 year (294 minutes vs 193 minutes, $P<0.001$) and 2 years (292 minutes vs 190 minutes, $P<0.001$).

Psychological Correlates of Physical Activity

Table 3 shows the correlation of baseline psychological variables and mean leisure physical activity as determined by the MAQ at baseline, 1 year, and end of study. Table 4 shows correlations of leisure physical activity, expressed in MET hours per week, with stage of change. No participant was in the precontemplation stage of change. Most were either contemplating (28%) or preparing (41%) to become more physically active. At each time point, those in the contemplation stage had lower mean leisure PALs than those in the maintenance stage of change.

Higher baseline self-efficacy was associated with higher levels of leisure physical activity; this relationship was stronger with 1-year and end-of-study leisure physical activity than it was with baseline leisure physical activity. Higher scores for perceived stress, depression, and anxiety were associated with lower levels of leisure physical activity at each time point. The pattern was similar between reported minutes of activity at 1 and 2 years.

Self-efficacy was positively correlated with stage of change ($r=0.28$, $P<0.0001$) and negatively correlated with perceived stress ($r=-0.36$, $P<0.0001$), depression ($r=-0.14$, $P=0.02$), and anxiety ($r=-0.16$, $P=0.01$). Perceived stress was also positively correlated with depression ($r=0.50$, $P<0.0001$) and anxiety ($r=0.28$, $P<0.0001$).

Multivariate models (Table 5) showed that being a man ($\beta=9.68\pm2.7$, $P=0.003$), lower depression scores ($\beta=-0.64\pm0.32$, $P=0.03$), and lower BMI ($\beta=-0.30\pm0.14$, $P=0.0495$) at baseline were significant predictors of more baseline leisure physical activity ($R^2=0.08$). Similarly, at 1 year, being a man, greater baseline self-efficacy, and higher baseline leisure physical activity were significant predictors of more leisure physical activity. At the end of the study, all of the same baseline variables were significant predictors and so was baseline stage of change. These baseline predictors explained 33% of the variance in leisure PAL at 1 year and end of study. At both 1 year and 2 years sex, baseline stage of change, and self-efficacy were significant independent predictors of total minutes of exercise reported.

At 1 year, age, sex, and baseline stage of change (for maintenance vs contemplation) were significant independent predictors of meeting the physical activity goal of 150 minutes per week with older subjects, men, and those in the maintenance stage of change at baseline being more likely to succeed (Table 5). At 2 years, age and baseline self-efficacy were the significant independent factors predicting achievement of 150 minutes of physical activity per week.

When examining the potential interactions between sex and other significant predictors of leisure physical activity, we found that higher depression scores at baseline were significant predictors of leisure physical activity for men but not for women. At 1 year, baseline leisure physical activity was a significant predictor for men but again not significant for women. At end of study, baseline leisure physical activity was a significant predictor for both men and

women, but the effect size was larger in men. At both 1 year and at end of study, baseline self-efficacy was a significant predictor for both men and women, but the effect size was larger in men. Interaction terms for race/ethnicity were not examined because race/ethnicity was not a predictor of leisure physical activity at any of the three time points.

Associations among Sex, Psychological Variables, and Physical Activity

Because sex was a strong predictor of physical activity, we examined the correlations between sex, BMI, and psychological variables to see if BMI, self-efficacy, perceived stress, depression, or anxiety mediated the association between sex and leisure physical activity. Although several of these variables were significantly correlated with both sex and leisure physical activity, none of them significantly altered the association between sex and leisure physical activity at any of the three time points.

DISCUSSION

In this representative sample of DPP lifestyle participants, being a man as well as having a lower BMI; a more advanced stage of readiness for change in PAL; higher exercise self-efficacy; and lower perceived stress, depression, and anxiety scores at baseline correlated with higher levels of baseline leisure physical activity. Similar patterns were found at 1 year and at end of study. Multivariate models showed being a man, having lower BMI, and having lower levels of depression were all significant independent factors associated with higher baseline leisure PALs. At 1 year, being a man, baseline self-efficacy, and physical activity were independent predictors of activity level. At end of study, we found that all of the 1-year baseline predictors were still significant, as was baseline stage of change. Models that used participants' self-reported minutes of activity as a continuous variable produced similar results.

To date, very little research on psychosocial predictors of physical activity has been reported in persons at high risk for type 2 diabetes mellitus. It is possible that people in high-risk populations have different determinants of physical activity and it is crucial to understand these to successfully promote physical activity. Our results are consistent with previous findings in a non-IGT population that show that men are more physically active than women (4), less overweight (16,17), and have a more advanced stage of change for exercise, greater exercise self-efficacy, and less perceived stress, all of which are correlated with higher PALs (13). In a study of Native Hawaiians with or at high risk for diabetes, stage of change was found to be significantly associated with exercise behavior (27). Our study adds to the small body of literature on psychosocial research in persons at high risk for diabetes by confirming this finding in an ethnically diverse group with IGT.

These results are consistent with observations in the entire DPP study group showing that depression scores were not associated with meeting the 150-minute physical activity goal, but older age and being a man were (28). Our study adds to the previously published findings of the DPP group by including additional psychological variables that reflect general mental well-being (ie, perceived stress and anxiety) as well as attitudes toward physical activity (ie, stage of change and exercise self-efficacy). Contrary to other studies (13), our results demonstrate that older age was an independent predictor of achieving the goal of 150 minutes of physical activity at 1 year and 2 years. Lifestyle participants aged ≥60 years achieved greater minutes of physical activity and also achieved greater percent weight losses and greater risk reductions for developing diabetes (71% risk reduction compared with 48% risk reduction in persons aged 25 to 44 years) (5).

The findings of this study must be interpreted with several limitations in mind. First, because DPP participants underwent a rigorous screening process before inclusion and needed to be willing to accept random assignment to lifestyle intervention, they are different than a general

population of patients with IGT. This is apparent by the fact that none of our participants indicated being in the precontemplation stage of change for physical activity and only 28% were in the contemplation stage of change, whereas in other populations, the majority of patients report being in the precontemplation or contemplation stage of change (21,29). Anxiety and depression tend to be less common in clinical trial participants, and levels were quite low in this sample and in the entire DPP cohort (30), which may diminish the likelihood of finding significant associations with leisure physical activity. However, although 90% of our sample had a Beck depression score ≤10 (normal range), it seems that even scores in the upper range of normal are an important independent correlate of baseline leisure PAL, in men more than women. Also, although our study included five important psychosocial variables, numerous other variables were not measured and may be important determinants of physical activity.

CONCLUSIONS

Our findings emphasize important connections among sex, BMI, psychological factors, and current and future PALs and have important implications for dietetics professionals. Our results suggest that programs that focus on improving motivational readiness for physical activity and self-efficacy will be critically important. Tailored exercise programs for women who are overweight who are less ready for change, have lower exercise self-efficacy, and higher levels of perceived stress could be of great value in improving physical activity outcomes in women. In the DPP, as part of the lifestyle intervention, participants were offered two supervised activity sessions per week for 45 to 60 minutes. The women-only fitness programs that have started in the United States seem to target some of the potential exercise barriers for women because they provide an accessible environment for women who are overweight to exercise comfortably, which may increase the motivation to engage in physical activity and the self-efficacy to do so.

We have identified baseline patient profiles that might require additional or different strategies to achieve physical activity goals. Future plans will evaluate the extent to which the DPP lifestyle program influenced the modifiable predictors (ie, BMI and psychological variables) and how changes in these predictors affected physical activity outcomes.

At the outset, dietetics professionals should seek to identify and reduce potential modifiable demographic (ie, BMI) and psychological barriers (ie, perceived stress, depression, and anxiety) to increasing physical activity and increase the positive modifiable predictors (ie, stage of change and exercise self-efficacy).

- With patients who are in the precontemplation or contemplation stage of change for increasing physical activity, dietetics professionals can focus on the benefits of increasing physical activity on blood glucose control, weight management, and other related health factors as well as on strategies to minimize the effects of stress, depression, and anxiety, which were found to be negative predictors of physical activity.
- Dietetics professionals can also refer patients to other qualified professionals or programs to help manage stress, depression, and anxiety and thereby minimize their potential interference with the goal of improving activity.
- Dietetics professionals can help patients improve their exercise self-efficacy (ie, self-confidence in ability to persist with exercise in various situations representing the areas of negative affect, resisting relapse, and making time for exercise) by helping patients set gradual, stepwise, achievable physical activity goals and by modeling active problem solving to reduce barriers to physical activity in individual or group sessions.

- Dietetics professionals can discuss with patients the extent to which their BMI influences their physical and emotional ability to engage in increased physical activity and then collaborate on a tailored problem-solving approach to minimize the barriers. A women-only fitness center or a personal trainer may be alternatives for those who are uncomfortable exercising in front of others, whereas others may need a stronger focus on weight loss first with a modified or delayed activity program until weight loss progresses and physical ability and mobility improve.

Our findings could help dietetics professionals assess and determine which patients are most likely to increase PALs, tailor lifestyle programs, and utilize resources most effectively and efficiently.

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Table 1

Baseline characteristics of ancillary study (18 centers, n=274) and full lifestyle Diabetes Prevention Program (DPP) (27 centers, n=1,079) cohorts

Characteristic	**DPP lifestyle cohort**		**Ancillary study cohort**	
Age (y, mean±SD[a])	50.6±11.3		52.5±12.1*	
	n	*%*	*n*	*%*
Sex				
Female	734	68	177	65
Male	345	32	97	35
Race/ethnicity				
Non-Hispanic white	580	54	171	62
Non-Hispanic African American	204	19	54	20
Hispanic	178	17	38	14
Non-Hispanic American Indian	60	6	0	0
Non-Hispanic Asian	57	5	11	4**
Body mass index (mean±SD)	33.9±6.8		33.9±6.9	
<25	38	3	8	3
25-29.9	320	30	80	29
≥30	721	67	186	68
Leisure physical activity (MET[b] h/wk mean±SD)	15.5±22.1		15.7±21.6	

[a] SD=standard deviation.

[b] MET=metabolic equivalent.

* P=0.012, calculated using t test for continuous variables and $\chi 2$ test for categorical variables.

** P=0.0005 vs full cohort, calculated using t test for continuous variables and $\chi 2$ test for categorical variables.

Table 2

Sex differences in Diabetes Prevention Program participant characteristics at baseline

Characteristic	Men (n=97)		Women (n=177)		p^a
	← *mean±standard deviation* →				
Age (y)	56.9±12.5		50.1±11.3		<0.001
Body mass index	32.3±5.9		34.7±7.2		0.003
Leisure physical activity (MET[b] h/wk)	22.6±22.6		11.8±20.2		<0.001
Exercise efficacy	26.7±6.3		24.3±5.8		0.002
Anxiety	2.8±3.5		3.7±4.2		0.10
Depression	3.5±3.8		4.4±4.2		0.09
Perceived stress	0.29±0.14		0.34±0.16		0.004
	n	*%*		*n*	*%*
Maintenance stage of change (%)	28	29		18	10

[a] Calculated by *t* test for continuous variables and $\chi 2$ test for categorical variables.

[b] MET=metabolic equivalent.

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Table 3

Correlation of baseline psychological variables and mean leisure physical activity as determined by Modifiable Activity Questionnaire (MAQ) (25) score at baseline, 1 year, and end of study (2 to 3 years after randomization) for participants in the Diabetes Prevention Program

Psychological variable	Baseline score for psychological variables (mean±standard deviation)	Correlation with baseline physical activity (n=274)	*P* value[a]	Correlation with 1 year physical activity (n=260)	*P* value[a]	Correlation with end of study physical activity (n=256)	*P* value[a]
Exercise efficacy	25.2±6.1	0.18	0.002	0.33	<0.0001	0.30	<0.0001
Anxiety	3.38±3.96	−0.14	0.03	−0.13	0.04	−0.13	0.05
Depression	4.08±4.08	−0.18	0.003	−0.12	0.06	−0.14	0.03
Perceived stress	0.032±0.16	−0.16	0.01	−0.18	0.003	−0.17	0.007

[a]Spearman correlation coefficients for significance between exercise motivation and physical activity.

Table 4

Correlation of stage of change with leisure physical activity (metabolic equivalent hours/week) at baseline, 1 year, and end of study (2 to 3 years after randomization) for participants in the Diabetes Prevention Program

Stage of change	n	%	Baseline physical activity (mean±standard deviation)	r^a	1 Year physical activity (mean±standard deviation)	r^a	End of study physical activity (mean±standard deviation)	r^a
Precontemplation	0	0	NA[b]	0.44*	NA	0.35*	NA	0.35*
Contemplation	77	28	8.52±22.6		15.7±13.2		16.0±12.8	
Preparation	113	41	13.9±13.0		22.4±18.8		19.8±14.6	
Action	38	14	11.1±9.4		27.3±25.6		22.9±17.8	
Maintenance	46	17	35.5±31.2		42.2±34.2		40.0±29.1	

[a] Spearman correlation coefficient.

[b] NA=not applicable.

* Significant at $P<0.0001$.

Table 5

Independent baseline predictors of physical activity by Diabetes Prevention Program participants at baseline, 1 year, and end of study[a]

Model	Significant variables	Effect estimate (or AOR[b])	*P* value	R^2 for model
Baseline leisure activity (MAQ[c])	Sex	9.68	0.003	0.08
	Depression	−0.64	0.03	
	Body mass index	−0.30	0.0495	
1-year leisure activity (MAQ)	Sex	13.4	0.003	0.33
	Self-efficacy	0.73	0.009	
	Baseline activity	0.39	0.02	
End-of-study leisure activity (MAQ)	Baseline activity	0.23	0.004	0.33
	Sex	8.71	0.01	
	Stage of change	12.9	0.03	
	Self-efficacy	0.48	0.03	
1-year 150-minute goal	Stage of change	6.4	0.007	NA[d]
	Sex	1.94	0.03	
	Age	1.03	0.04	
2-year 150-minute goal	Self-efficacy	1.09	0.005	NA
	Age	1.03	0.01	
1-year continuous minutes	Stage of change	160.7	0.004	0.19
	Self-efficacy	6.42	0.009	
	Sex	57.0	0.04	
2-year continuous minutes	Self-efficacy	5.75	0.009	0.19
	Stage of change	114.9	0.01	
	Sex	65.9	0.02	

[a] Stepwise multivariate regression was used to test the independent association of baseline demographic and psychological variables with physical activity outcomes measured via the Modifiable Activity Questionnaire and self-reported minutes of activity at 1 year and 2 years. Stepwise logistic regression was used to test the independent association of baseline demographic and psychological variables with physical activity outcome of achieving the goal of 150 minutes of activity per week.

[b] AOR=adjusted odds ratio.

[c] MAQ=Modifiable Activity Questionnaire.

[d] NA=not applicable.