Specific Efficacy Expectations Mediate Exercise Compliance in Patients with COPD

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Social learning theory has generated two different approaches for the assessment of expectancies. Bandura argues that expectancies are specific and do not generalize. Therefore, he prefers measures of specific efficacy expectations. Others endorse the role of generalized expectancies measured by locus of control scales. The present study examines specific versus generalized expectancies as mediators of changes in exercise behavior among 60 older adult patients with Chronic Obstructive Pulmonary Disease. The patients were given a prescription to increase exercise and randomly assigned to experimental groups or control groups. All groups received attention but only experimental groups received training to increase their exercise. After 3 months, groups given specific training for compliance with walking significantly increased their activity in comparison to the control group receiving only attention. These changes were mediated by changes in perceived efficacy for walking, with efficacy expectations for other behaviors changing as a function of their similarity to walking. A generalized health locus of control expectancy measure was less clearly associated with behavior change. The results are interpreted as supporting Bandura's version of social theory.

We previously reported that behavioral and cognitive-behavioral interventions are useful for helping Chronic Obstructive Pulmonary Disease (COPD) patients maintain a daily exercise program (Atkins, Kaplan, Timms, Reinsch, & Lofback, in press). In this paper, we investigate the mediation of...
behavior change using generalized (locus of control) versus specific (self-efficacy) measures. Before describing the theoretical concerns for the study, it will be necessary to review the specific behavioral problems of the study population.

Chronic Obstructive Pulmonary Disease

COPD is a condition characterized by a persistent slowing of airflow while attempting to exhale air rapidly (Pulmonary Terms and Symbols, 1976). The diseases most often categorized as COPD include chronic bronchitis, emphysema, and asthma. COPD is a very serious condition, ranking second to coronary disease as a permanent cause of disability (Brashear, 1980; Lertzman & Cherniack, 1976; Petty, Nett, Finigan, Brink, & Corsellos, 1969; West, 1977). From an economic perspective, COPD is an important public health problem. Its impact through disability, treatment, and death benefits has been estimated at 7.5 billion dollars per year (U.S. Government Task Force, 1977).

Patients suffering from COPD have been known to benefit greatly from exercise regimens (Bell & Jensen, 1977). Appropriate physical conditioning exercises can improve oxygen consumption and utilization, reduce heart rate, improve ventilation, and increase tolerance for exercise (Unger, Moser, & Hansen, 1980). Yet, motivating these patients to comply with a physical regimen is difficult. Although many COPD patients can exercise, activity may cause serious shortness of breath. It is commonly reported that shortness of breath causes fear of activity which, in turn, leaves the patient isolated from many of the activities of daily living (Mertens, Shephard, & Cavanaugh, 1978).

Interventions derived from social learning theory may be used to help COPD patients cope with their exercise regimen and to improve functioning. The present study considers several issues relevant to social learning theory. First, different versions of social learning theory embrace alternative approaches to the assessment of expectancy. These alternative approaches are evaluated using data from the COPD study. Second, one form of social learning theory known as Self-efficacy Theory (Bandura, 1982) makes specific predictions about the relationship between behavior change and cognitive change. Some of these predictions will be evaluated in this report. A brief review of each of these issues follows.

Assessment Issues

Expectancy is a central concept in social learning theory. Different social learning theorists agree that the probability that a behavior will be performed is a function of expectation that the response will lead to reward or punish-
ment. Social learning theory was first introduced by Rotter (1954) who argued that expectancies can be either specific or generalized. The generalized expectancy that reward will be contingent upon one's execution of a behavior is called internal control. External control refers to the generalized expectancy that positive or negative events are unrelated to one's behavior. Rotter argues that these differences in perceived locus of control are personality characteristics that can be measured with a personality test. Specific expectancies afford better predictions as the actor has more experiences with specific tasks. Generalized expectancies were regarded as the best predictors of novel tasks. Although Rotter made the distinction between specific and generalized expectancies, many advocates of this position focus on locus of control (generalized expectancy) as a personality characteristic. Health psychologists and educators sometimes assess generalized expectancies in order to tailor interventions for those with either internal or external personality characteristics.

Another approach to social learning theory, championed by Bandura, Mischel, and others (Bandura, 1977a,b; Bandura & Walters, 1963; Mischel, 1973, 1979) differs in its approach to assessment. These social learning theorists argue that expectancies are very specific to situations and are not generalized personality characteristics.

One of the most important statements of the alternative approach to social learning theory is in Bandura's Self-efficacy Theory. According to the efficacy theory, perceived internal control embraces two very different attributions: (1) the belief that the recommended behavior will lead to a favorable outcome (outcome expectation); and (2) the belief that the behavior required to produce the outcome can be executed (efficacy expectation). According to Bandura (1977b), efficacy and outcome expectations need to be differentiated because "individuals can come to believe that a particular course of action will result in certain outcomes but question whether they can perform those actions" (p. 79).

Self-efficacy Theory is an extension of Bandura's Social Learning Theory. According to the model, successful experiences provide new evidence for justifying changes in self-efficacy. For example, Ewart, Taylor, Reese, and DeBusk (1983) found that efficacy expectation for treadmill exercise tolerance increased after a group of heart attack victims was trained to exercise on a treadmill. As the theory predicted, these cognitive changes did not become generalized expectancies for performing well in dissimilar situations.

In summary, Self-efficacy Theory suggests that assessment should be direct estimates of performance in specific situations. Alternative conceptualizations of social learning theory utilize more global personality measures such as locus of control scales. The present study uses both approaches.
Self-efficacy Predictors

One of the advantages of Self-efficacy Theory is that it makes specific predictions about the relationships between changes in behavior and changes in cognition. Physicians typically advise COPD patients to exercise. Yet, as Bandura (1982) has noted, "People avoid activities that they believe exceed their coping capabilities. . . . Judgments of self-efficacy also determine how much effort people will expend and how long they will persist in the face of obstacles or aversive experiences. When beset with difficulties, people who entertain serious doubts about their capabilities slacken their efforts or give up altogether, whereas those who have a strong sense of efficacy exert greater effort to master the challenges" (p. 123).

Several aspects of Self-efficacy Theory can be evaluated using data from the COPD experiment. Bandura argues that there are both behavioral and cognitive influences upon perceived self-efficacy. Enactive attainments are the best source of self-efficacy, whereas vicarious experiences and verbal persuasions may be less effective in producing these changes. We previously reported that cognitive-behavioral interventions were most effective for increasing walking (enactive attainment) followed by behavioral, cognitive, and attention interventions respectively. According to the theory, changes in efficacy should mirror these performance changes.

A second prediction from the theory is that changes in efficacy expectation should be specific to changes in actual performance attainment. Thus, efficacy changes should be largest for scales describing the actual behavior that changed. As the scales describe behavior that is increasingly dissimilar to the target or training behavior, efficacy changes should diminish.

A third issue is the association between efficacy expectations and performance before and after training. At the beginning of the program, most of the participants were inactive. With little recent experience in the situation, there would be little personal evidence upon which to base an efficacy judgment and efficacy-performance correlations should be low. However, the theory would predict that efficacy judgments should become more similar to actual performance following experience performing the relevant behaviors. All three of these issues were evaluated in the present study.

METHOD

Subjects

Subjects were 22 male and 38 female moderate to severe COPD patients who experienced progressive loss of pulmonary function. The specific criteria for inclusion in the program included: (1) diagnosis of emphysema,
chronic bronchitis, and/or asthma; (2) absence of other significant pulmonary disease (i.e., TB, fibrosis or neoplasm); (3) freedom from chronic disabling nonpulmonary disease that would hinder participation (i.e., arthritis, retardation, etc.); (4) absence of an acute cardiac disorder (i.e., myocardial infarction within the past 3 months); and (5) ability to stand and walk unaided for at least 100 yards without complaint of severe dyspnea. The mean age was 64.79 years (S.D. = 7.86 years).

General Assessment

All patients were invited to the Scripps Clinic and Research Foundation (La Jolla, California) for initial assessment. During this assessment, the patient was interviewed and completed a Quality of Well-being scale. The scale was designed to express diminished quality of life attributable to illness or disability. The reliability and validity of the index are evaluated in several publications (Kaplan & Bush, 1982; Kaplan, Bush, & Berry, 1976, 1978, 1979). In addition, the patient was given a spirometric examination to determine Forced Vital Capacity (FVC) and Forced Expiratory Volume in one second (FEV\(_1\)). The FVC is the total amount of air that can be exhaled. We express it as a percentage of the volume expected for someone of the same height, sex, and age. The mean percentage for our participants was 59.62 (± 19.44). FEV\(_1\) is the amount of air that can be expired in one second and is also expressed as a percentage of predicted. Patients with COPD have obstructive problems, and thus, have abnormal FEV\(_1\) values. The mean percentage of predicted FEV\(_1\) for our participants was 36.09 (± 24.02).

After the spirometric exam, the patient was placed on a treadmill with bipolar ECG leads to monitor cardiac frequency and rhythm and an ear oximeter to monitor oxygen saturation during exercise. Each exercise test was supervised by a nurse with certification for exercise testing or a respiratory therapist. A physician was always within 25 yards and available for emergencies. Exercise tests began at .6 miles per hour, at 0% grade. Each minute the speed was increased by .2 miles per hour. The patient was encouraged to exercise as long as he or she could and still recover. The endpoint of the exercise test was reached when any of the following occurred: (1) the patient reached 85% of a predicted maximum heart rate; (2) the patient reported being exhausted or severely short of breath. Shortness of breath was the most common cause of stopping the treadmill.

Each patient was assigned an exercise prescription based upon the maximum miles per hour he or she obtained on the treadmill. All assignments were made in terms of walking at defined speeds. The number of steps per minute the patient should take were calculated and treadmill training was given at the assigned walking speed. The steps were counted and recorded so that the appropriate pace could be replicated during the home program. In addition,
each patient was given information concerning the appropriate distance he or she could expect to cover in 5 minutes walking at the prescribed pace. Each patient was given a walking log to record walks. Patients were asked to record the time, total number of minutes spent walking, the approximate distance, and a resting exercise pulse rate for each of the two prescribed daily walks.

Efficacy Expectation

Self-efficacy expectations were assessed after each patient had been given his or her walking prescription and again at the 3 month follow-up. A set of six self-efficacy scales were adapted from those used by Ewart, Taylor, Reese, and DeBusk (1983). Within each scale, the patient was presented with a series of progressively more difficult performance requirements within a specified domain of activity. For example, the scale for walking included: walk 1 block (approximately 5 minutes), walk 2 blocks (10 minutes), walk 3 blocks (15 minutes) . . . walk 3 miles (90 minutes). In sum, the walking scale had nine items representing increasing gradations (in nonequal intervals) of difficulty. For each item, the patient indicated whether the behavior could be performed. Then, for the items selected, the patients were asked to rate the strength of their expectation to perform the activity on a 100-point probability scale, ranging in 10-point intervals from high uncertainty, through moderate certainty, to complete certainty (Bandura, 1977).

The seven scales selected for the study represented activities progressively more dissimilar to the target behavior of walking. These scales are summarized as follows:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td>1 block to 3 miles</td>
</tr>
<tr>
<td>General exertion</td>
<td>very light to extremely hard</td>
</tr>
<tr>
<td>Moving things</td>
<td>light object to heavy object</td>
</tr>
<tr>
<td>Lifting</td>
<td>10 lbs. to 175 lbs.</td>
</tr>
<tr>
<td>Climbing stairs</td>
<td>several steps to four flights</td>
</tr>
<tr>
<td>Tolerate stress</td>
<td>mild to a great deal</td>
</tr>
<tr>
<td>Tolerate anger</td>
<td>mild to a great deal</td>
</tr>
</tbody>
</table>

Unfortunately, it is difficult to evaluate the reliability of self-efficacy scales in traditional psychometric terms. Internal consistency estimates of reliability are based upon average intercorrelation between items (Kaplan & Saccuzzo, 1982). However, each specific efficacy scale is a single item. Applying the psychometric models would be difficult and might be considered analogous to studying the internal consistency of a one-time test. Test-retest reliability might not be appropriate because efficacy is considered to be a dynamic characteristic that fluctuates over the course of time. Some indirect
evidence for the reliability of self-efficacy scales comes from their substantial correlations with external variables (See Bandura, 1982). These validity correlations would be expected to be low if efficacy scores represented only random error.

Health Locus of Control

The Health Locus of Control Scale is an 11 item measure of expectancies regarding locus of control specific to health-related behavior. It was developed for the prediction of health related behavior (Wallston, Wallston, Kaplan, & Maides, 1976). Subjects respond to each item using a 6-point, Likert-type format from strongly disagree (1) to strongly agree (6). The alpha reliability of the 11 item scale is reported to range from .40 to .72 (Wallston et al., 1976). In addition, two studies by Wallston et al. (1976) have demonstrated the discriminant validity for using the Health Locus of Control Scale over Rotter's Internal-External Locus of Control Scale for predicting health related behaviors (Rotter, 1966).

Treatments

After the initial assessment, the patients were randomly assigned to one of four groups: behavior modification, cognitive modification, cognitive behavior modification, or attention control. In all groups, the patients participated in six sessions. Details of the treatment procedures are given elsewhere (Atkins et al., in press).

The behavior modification treatment included goal setting, functional analysis of reinforcers mediating walking, a behavioral contract, contingency management, and two sessions of relaxation training. In the cognitive treatment, subjects experienced didactic interactions in which they learned to identify negative self-statements and to replace them with positive thoughts, to identify specific cues for prompting positive self-talk, and so on. The experimenter attempted to challenge irrational beliefs about walking whenever possible. The cognitive behavioral group experienced many of the same positive self-talk exercises. However, they also received training in contingency management and two relaxation sessions. The attention control group received attention but did not have training specifically directed toward increasing compliance. During six sessions, they completed a variety of questionnaires including the MMPI, a life stress questionnaire (Holmes & Rahe, 1967), and the Trailmaker test from the Halstead-Reitan Battery (Reitan, 1958). The results of these tests and their relationship to lung disease were discussed during the sessions. A more detailed description of the treatments is given in Atkins et al. (in press).
The first four sessions were held weekly during the month following the initial interview. Sessions were held biweekly the second month. Three months following the initial assessment, patients were reevaluated on all measures in the clinic.

RESULTS

Experimental Comparisons

Comparisons between groups for the physiological, locus of control, efficacy, and exercise variables were made for data obtained prior to treatment. Analysis of variance tests showed that the groups did not differ significantly for any of these variables in this initial assessment.

In a previous paper, we reported that the experimental interventions promoted beneficial changes for a variety of measures, including health status, exercise tolerance, and exercise compliance (Atkins et al., in press). The focus of this paper is on expectancy variables that mediate these changes. Both experimental and correlational evidence will be considered.

Self-efficacy

Within each category of the efficacy measure, behaviors are rank-ordered in terms of difficulty. For example, within the category "lifting objects," the subject was presented with "lift a 10 pound object," "lift a 20 pound object," "lift a 175 pound object." For scoring, the least difficult item within each category was assigned the score 1, the second least difficult item assigned a score 2, and so on. The subject's score was the number associated with the most difficult task for which 100% confidence in being able to perform was expressed. Thus, high scores indicated greater perceived efficacy. Changes in efficacy ratings served as the unit of analysis. Change scores were created by subtracting the efficacy rating obtained at the original visit from the efficacy rating obtained at the 3 month follow-up. The Health Locus of Control measure was scored such that lower scores indicated greater internality and higher scores were associated with more externality.

Table 1 summarizes mean changes for efficacy ratings of walking and changes in Locus of Control obtained from the three experimental groups and the attention control group. Analysis of variance showed that there was a significant difference between groups for changes in walking self-efficacy ($F_{3/56} = 6.04, p < .01$), with the experimental groups gaining more in walking efficacy judgment than the attention control group ($F_{1/56} = 16.08, p < .001$). Post-hoc tests using the Duncan procedure showed that the three
TABLE 1
Group Changes in Walking Efficacy and Locus of Control

<table>
<thead>
<tr>
<th>Group</th>
<th>Efficacy</th>
<th></th>
<th>Locus of Control</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive-behavioral</td>
<td>1.21</td>
<td>2.01</td>
<td>-.07</td>
<td>4.69</td>
</tr>
<tr>
<td>Behavioral</td>
<td>.78</td>
<td>2.11</td>
<td>1.25</td>
<td>4.59</td>
</tr>
<tr>
<td>Cognitive</td>
<td>.20</td>
<td>1.56</td>
<td>-.33</td>
<td>6.35</td>
</tr>
<tr>
<td>Attention control</td>
<td>-1.57</td>
<td>1.74</td>
<td>2.80</td>
<td>9.27</td>
</tr>
</tbody>
</table>

ANOVA

Ominus F

\[ F_{3/56} = 6.04, \ p < .01 \]

Planned comparison: treated vs. control

\[ F_{1/56} = 16.08, \ p < .001 \]

Mastery of Specific Skills

Bandura's Self-efficacy Theory maintains that changes in self-efficacy should be specific to mastery of specific skills. In order to test this proposition, the difference between the average across three experimental groups
and the attention control group was assessed for a variety of efficacy judgments including walking, general exertion, pushing or moving things, climbing stairs, tolerance of emotional tension and stress, and tolerance of anger arousal. Walking was the target behavior for which patients were being trained in the experimental groups, and we would expect the most change in self-efficacy for walking. General exertion and climbing stairs are somewhat similar to walking, and changes in walking habits were expected to generalize to tolerance of exertion and to stair climbing. Patients were also asked to rate their ability to push or move objects and to lift. Again, these are both activities that require some exertion, and we might expect some change in efficacy, however, not as much for walking, general exertion, or climbing. Finally, patients were asked to rate their efficacy for tolerance of emotional stress and for tolerance of anger arousal. Since both of these activities are dissimilar to the target behavior, we would expect very little change in patient efficacy to tolerate stress and anger.

An analysis of variance for pre- and post-efficacy changes was performed separately for each type of efficacy. An $F$ to $r$ transformation was used to express the experimental versus attention control contrast as a correlation-like index for each type of judgment. The $r$ value for each type of efficacy is shown in Fig. 1. The figure illustrates that as the judgment becomes more similar to the target behavior, which, in this case is walking, more variance is

![SPECIFIC EFFICACY EXPECTATIONS](image)

**FIG. 1** Correlations (times 100) between experimental vs control differences and efficacy measures.
accounted for. Self-efficacy Theory would predict that the more similar the efficacy judgment is to the target behavior, the more variance it should explain. This prediction is confirmed by the data. Locus of Control obtains a coefficient just above midway between the highest and the lowest efficacy scales.

The generalized expectancy version of social learning theory actually predicts interactions between personality characteristics and interventions rather than main effects. Thus, they might predict that internals and externals may respond differentially to treatments. To investigate this prediction, we divided our groups by median split on the Health Locus of Control Scale and performed a $2 \times 4$ analysis of variance (locus of control $\times$ condition). A similar analysis was performed for a median split on self-efficacy judgments for walking. The dependent variables for separate analyses were walking compliance (total minutes walked over 3 months), changes in exercise tolerance, changes in health status, and changes in lung function as measured by FEV$^1$. There were main effects of condition for each variable except FEV$^1$. However, there were no significant interactions for analyses involving median splits for either locus of control or self-efficacy (all $p$'s $>.05$).

Correlational Studies

In the preceding section, it was suggested that experimental interventions can produce changes in self-efficacy and compliance. However, within each condition there was considerable variability for each mediating and outcome measure. In this section, we consider correlational data independent of treatment conditions.

Table 2 presents correlations between efficacy scales and a variety of criterion variables. These correlations were obtained at the initial visit and at the 3 month follow-up visit. The criterion variables included exercise tolerance, health status as measured by the Quality of Well-being scale (QWB), and the two pulmonary function measures—FEV$^1$ and FVC. The results for treadmill exercise tolerance are of particular interest. At the initial visit, none of the efficacy scales were significantly correlated with treadmill performance. However, after participating in an exercise program that required self-monitoring of activity, correlations between efficacy and actual performance began to appear. The association was greatest for walking efficacy, and the correlations with other efficacy scales appeared to be related to the similarity of the specific behavior to walking. At the 3 month follow-up, there were significant correlations ($p < .05$) between exercise tolerance and efficacy judgments for walking, climbing, lifting, and pushing. The correlation between exercise tolerance and locus of control was nonsignificant at the initial session and $.26 (p < .05)$ at the follow-up.
**TABLE 2**
Correlations Between Efficacy Scales and Criterion Measures at the Initial Assessment and Three-Month Return Visit

<table>
<thead>
<tr>
<th>Efficacy Measure</th>
<th>Exercise Tolerance</th>
<th>Health Status</th>
<th>Expiratory Volume (FEV')</th>
<th>Vital Capacity (FVC)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial</td>
<td>3-month</td>
<td>Initial</td>
<td>3-month</td>
</tr>
<tr>
<td>Walking</td>
<td>.05</td>
<td>.47*</td>
<td>.16</td>
<td>.19</td>
</tr>
<tr>
<td>General exertion</td>
<td>.00</td>
<td>.24</td>
<td>.18</td>
<td>.25*</td>
</tr>
<tr>
<td>Climbing</td>
<td>.08</td>
<td>.36*</td>
<td>.29</td>
<td>.32*</td>
</tr>
<tr>
<td>Lifting</td>
<td>.01</td>
<td>.31*</td>
<td>.22</td>
<td>.32*</td>
</tr>
<tr>
<td>Pushing</td>
<td>.09</td>
<td>.32*</td>
<td>.15</td>
<td>.25*</td>
</tr>
<tr>
<td>Tension</td>
<td>-.04</td>
<td>.11</td>
<td>-.01</td>
<td>.14</td>
</tr>
<tr>
<td>Anger</td>
<td>-.02</td>
<td>.13</td>
<td>.02</td>
<td>.07</td>
</tr>
<tr>
<td>Locus of Control</td>
<td>.16</td>
<td>.26*</td>
<td>-.25*</td>
<td>.18</td>
</tr>
</tbody>
</table>

*p < .05

**p < .01
Another interesting finding in Table 2 is the high correlations between efficacy judgments and the physiological measures at the initial assessment. This might be expected since lung status does greatly inhibit function. There were significant associations between vital capacity and walking, general exertion, climbing, and lifting. The data from the initial session suggest that perceived self-efficacy for activity is highly dependent upon lung status prior to entering the program. For example, the walking efficacy-FEV\(^1\) correlation was .44 \((p<.05)\). Whereas the walking efficacy-exercise tolerance correlation was only .05 \((p = \text{NS})\). Belief in ability to exercise was dissociated with actual performance. This may suggest that the patients had come to believe through their prior experiences and perhaps through their physicians that their lung function would determine their physical function. Actually, there are considerable performance differences within levels of lung disability. Our data merely confirm other studies on this point (Petty et al., 1969). After participating in a program, efficacy judgments came to correspond more closely with exercise tolerance \((r = .47)\) and the extent to which patients' efficacy ratings corresponded to lung function test declined.

Table 3 shows the perceived efficacy and locus of control at the 3 month follow-up assessment as a function of the self-reported time spent walking during the first 3 months of the program. As the table demonstrates, walking efficacy is a function of successfully adhering to a regular exercise program. Although to a lesser extent, walking compliance was also correlated with ef-
cacy judgments for pushing and for general exertion. Walking compliance was unrelated to efficacy judgments for tension and anger tolerance and to locus of control.

Also presented in Table 3 are dynamic correlations (see right-hand column). These dynamic correlations reflect the relationship between walking compliance and changes in expectations. Changes in efficacy judgments and locus of control were obtained by subtracting initial scores from those obtained at the 3 month follow-up. Among the measures, walking efficacy changes were significantly correlated with compliance and to a lesser (but significant) extent with changes for climbing efficacy. Interestingly, there was a significant negative relationship between walking compliance and anger tolerance. Change in locus of control was not significantly correlated with walking compliance.

A final analysis considered the correlations between efficacy and criterion variables separately for Locus of Control Internals and Externals. Some of these results are summarized in Table 4. Correlations between physical activity efficacy judgments and criterion variables tended to be significant for locus of control internals but not for externals. For example, self-efficacy judgments for walking, general exertion, and climbing were significantly correlated with exercise tolerance, health status, and pulmonary function for those with an Internal Locus of Control. However, all efficacy judgments were uncorrelated with all criterion variables for those with an External locus of control.

**DISCUSSION**

Each of the three specific predictions derived from self-efficacy theory was confirmed by the data. Increases in compliance with an exercise prescription (performance accomplishment) was associated with enhanced expectations for performing these behaviors in the future. After 3 months, these expectations were significantly associated with performance on a treadmill exercise test. Also conforming with theoretical predictions, changes in efficacy were specific to physical activity—which was the target of intervention. Efficacy expectations for the performance of other behaviors changed as a function of their similarity to walking. Finally, the correlation between efficacy expectation and treadmill performance improved after subjects gained experience self-monitoring their own walking.

Bandura's Self-efficacy Theory maintains that behavior is mediated by expectations that particular behaviors can be executed in specifically defined situations. Programs that provide mastery experiences in particular situations will enhance expectations for success in similar situations on future occasions. These expectations in turn serve to mediate future executions of the
<table>
<thead>
<tr>
<th>Locus of Control</th>
<th>Exercise Tolerance</th>
<th>Health Status</th>
<th>Expiratory Volume (FEV₁)</th>
<th>Vital Capacity (FVC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficacy Scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walking</td>
<td>.45*</td>
<td>.42*</td>
<td>.62**</td>
<td>.54**</td>
</tr>
<tr>
<td>General Exertion</td>
<td>.47**</td>
<td>.38*</td>
<td>.75**</td>
<td>.79**</td>
</tr>
<tr>
<td>Climbing</td>
<td>.46*</td>
<td>.37*</td>
<td>.43*</td>
<td>.58**</td>
</tr>
<tr>
<td>Lifting</td>
<td>.29</td>
<td>.24</td>
<td>.30</td>
<td>.46*</td>
</tr>
<tr>
<td>Pushing</td>
<td>.37*</td>
<td>.17</td>
<td>.20</td>
<td>.29</td>
</tr>
<tr>
<td>Tension</td>
<td>-.13</td>
<td>.03</td>
<td>.25</td>
<td>.22</td>
</tr>
<tr>
<td>Anger</td>
<td>.06</td>
<td>-.06</td>
<td>.17</td>
<td>.25</td>
</tr>
</tbody>
</table>

*p < .05  
**p < .01

Note: I = Internal Locus of Control  
E = External Locus of Control  
The I-E distinction was defined by median split.
behavior. Patients in our study were given an individually tailored exercise prescription. In the experimental groups, patients worked out a clearly defined strategy for implementing the walking program. As the focus remained on walking—when, how, where, how long—patients' perceived efficacy for accomplishing exercise improved. A typical answer while filling out the self-efficacy questionnaire at the 3 month follow-up was "I know I can walk three blocks because I have done it. I don't know if I can walk five blocks, but I can try."

Past experience serves as a mediating cognitive process (Bandura, 1982) and accomplishing changes in one particular behavior serves to increase expectations that specific behaviors can be executed in the future. At the end of the 3 month training period, patients indicated lesser expectancies for related exercise behavior—such as climbing stairs and moving furniture. Patients showed least improvement for capacities that were not the focus of training.

Locus of Control Versus Self-efficacy

Internality and externality, as measured by the Health Locus of Control Scale (HLC) were not as clearly associated with changes on the major dependent variables. These findings are consistent with other research on coronary disease risk factors that show the health locus of control variables unrelated to the long-term modification of unhealthy behaviors such as smoking and overeating (Matarazzo, Connor, Fey, Carmody, Pierce, Brischetto, Baker, Connor, & Sexton, 1981).

The nature of the interventions should be considered in interpreting the data. The interventions involving behavior modification were specifically designed to increase self-efficacy. Thus, improved efficacy in patients exposed to interventions with a behavioral component were as the theory would predict. However, the interventions were not clearly designed to impact upon locus of control and changes in locus of control are not as obviously predicted from theory. It might be argued that the cognitive treatments may have had more relevance to health locus of control beliefs—at least to the extent that they dealt with internal self-statements. It is interesting that there is a trend toward increased internality for patients exposed to the cognitive treatments.

Of greater interest, however, is the finding that correlations between efficacy judgments and criterion variables tended to be significant for those with an Internal Locus of Control and to be nonsignificant for those with an External Locus of Control. This suggests that the relationship between self-efficacy judgments and behavior may be stronger for those who hold the general belief that there is a relationship between their behavior and their health. Bandura might have predicted this finding since behavior depends on both outcome and efficacy expectations. We think this is a very exciting finding that should be evaluated in future research.
Unfortunately, our data do not provide a strong test of the Health Locus of Control concept. Our data suggest that the test-retest reliability of the Health Locus of Control Scale is only .49. In addition, there were complaints by patients that they did not “understand” the meaning of the questions on the Health Locus of Control Scale. The authors of the Health Locus of Control Scale (Wallston et al., 1976) suggest that their instrument is a generalized measure of health expectancy as opposed to a questionnaire about specific behaviors. Our data suggest that a more specific instrument would lead to better predictions about particular behaviors.

Our research was initiated several years ago. Since this time, the Health Locus of Control Scale has been revised to be more specific. The developers of the Health Locus of Control Scale now use a multidimensional scale with components for internality, chance externality, and powerful others externality (Wallston, Wallston, & DeVellis, 1978). In addition, there has been a deemphasis on internality as a “trait.” Instead, Health Locus of Control is viewed as a belief about the relationship between one’s behavior and one’s health. The stability of these beliefs may vary depending upon one’s health and health circumstances. It must be emphasized that Rotter (1979) has always acknowledged the need for specificity as reflected in the following quotation:

“Measurement in a specific area is enhanced by devising tests limited to that specific area, particularly if the specific area is one in which the individual has a great deal of experience” (p. 265). This statement gives recognition to the validity of specific expectancy measures—particularly in relation to situations individuals have experienced. Nevertheless, generalized locus of control measures remain a most popular research tool in current research. In other words, the assessment approach remains fundamentally different from that taken by advocates of Bandura’s Social Learning Theory. Although some convergence is developing, considerably more work will be required to delineate the advantages and disadvantages of the contrasting approaches to assessment.

It is worth noting that the self-efficacy model does not imply a direction of causation. Most theoretical models of health behavior suggest a unidirectional causal sequence from cognitions to behaviors. The Health Belief Model (Becker, 1976) assumes that cognitions or belief cause behavior. Other social psychological models, such as self-perception theory, assume that behaviors cause cognitions (Bem, 1972). Behavioral models hold that environments cause behaviors (Martin, 1979). Our results support the social learning theory position that determinants of behavior are not unidirectional. The direction of causation may be bi-directional or a reciprocal causal model. Efficacy and performance attainments may affect each other in a reciprocal fashion.
CONCLUSIONS

Our data suggest that specific rather than generalized expectancies mediate behavior changes. Training that enables subjects to accomplish a new behavior leads to the expectation that the action can be replicated in the future. These changed expectations then become the mediators of behavior change. Self-efficacy gained through the accomplishment of one new behavior does not generalize to dissimilar behaviors without additional training. However, the relationship between efficacy and a variety of criterion variables is stronger for those with an Internal Locus of Control than for those with External control beliefs. These results are consistent with current social learning theory (Bandura, 1982).

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