REVIEW ARTICLE

Enhancing Adherence to Prescribed Exercise: Structured Behavioral Interventions in Clinical Exercise Programs

C. Mark Woodard, MS, MBA, MHA; Michael J. Berry, PhD

Exercise training is an integral component in the management of many chronic, lifestyle-related diseases. Therapeutic exercise training is an accepted adjunct to medical therapy for two of the four leading causes of death—cardiovascular disease and chronic obstructive pulmonary disease (COPD)—and is considered one of the three cornerstones of treatment for diabetes mellitus. For each of these chronic conditions, the scientific literature clearly demonstrates that exercise is both beneficial and safe when applicable guidelines are followed.

For example, an expert panel convened by the Agency for Health Care Policy and Research and the National Heart, Lung, and Blood Institute conducted an extensive review of the scientific literature and concluded that patients with cardiovascular disease who participate in cardiac rehabilitation programs (CRP) realize substantial improvements in a variety of domains.[1] Moreover, the panel asserted that scientific evidence consistently demonstrates that exercise training improves exercise tolerance, morbidity, and the ability to return to work after a cardiovascular event.[2] The panel also found strong, albeit less consistent, evidence that exercise leads to improvements in cardiac symptoms, blood lipids, blood pressure, psychosocial well-being, and mortality.[2]

Exercise training also is an important component of contemporary pulmonary rehabilitation programs. A number of recent reviews have summarized the findings of research conducted over the past three decades.[3–5] A consistent finding among most of the studies reviewed is that exercise leads to improvements in physical functioning as measured by timed walks for distance (6- or 12-minute walks) and walking duration on the treadmill. Further, in one of the most comprehensive studies on pulmonary rehabilitation to date, Ries et al.[6] randomized 119 patients with COPD to either an 8-week comprehensive pulmonary rehabilitation program or an 8-week education program. After the 8-week intervention, patients in the comprehensive pulmonary rehabilitation groups realized significant improvements in exercise tolerance, symptoms of breathlessness, and walking self-efficacy compared with the education group.

Lastly, exercise plays an important role in the treatment plan of most patients with diabetes. Common benefits of exercise for these patients include reduced risk of cardiovascular disease, improvements in body weight and composition, decreased blood pressure, and, for those with type 2 diabetes, improvement in glycemic control (i.e., glycosylated hemoglobin [HbA_{1c}] levels).[7,8] In addition, exercise training may reduce anxiety and enhance mood, self-esteem, and quality of life in these patients.[9]

LONG-TERM MAINTENANCE OF EXERCISE THERAPY IS POOR

Clearly, exercise training can provoke a myriad of beneficial physiologic adaptations in patients with cardiovascular disease, COPD, and diabetes; indeed, in these clinical populations exercise can be considered "strong

From the Department of Health and Exercise Science, Wake Forest University, Winston-Salem, NC.

This work was supported by National Institutes of Health grant HL53755.

Address correspondence and reprint requests to: C. Mark Woodard, MS, MBA, MHA, PO Box 7868, Reynolda Station, Winston-Salem, NC 27109 (e-mail: woodard@wfu.edu).

medicine." This point is emphasized by Moore and Durstine,[10] who contend that exercise induces physiologic changes that

> constitute what we call the exercise response, but these physiologic changes reflect biochemical alterations in the body's control of metabolism. No modern intensive care unit can match the body's extraordinary and sophisticated system for delivery of biochemical compounds during exercise, despite the fact that some natural compounds (including hormones) are often used as prescription drugs. In this way exercise is a medicine.[10(p12)]

Exercise can be likened to medications in other ways as well. For example, the dose-response relationship is a characteristic common both to medications and to exercise. Also, patients with chronic diseases can be given prescriptions both for medications and for exercise.

In patients with chronic disease, exercise is similar to pharmacological therapy in one other very important way: exercise and medicine will produce the desired effects only if patients adhere to the prescribed treatment regimen. The general medical literature contains numerous examples of poor treatment adherence with health-related behaviors even when the risks of nonadherence are immediately life-threatening.[11,12] Further, most evidence regarding adherence to exercise as a health behavior for either health promotion or disease prevention suggests that exercise adherence is no better than for other health behaviors or treatments.[13] We recognize that some participants in clinical exercise programs continue to adhere to prescribed regimens of therapeutic exercise after formal, facility-based rehabilitation is complete; however, the scientific literature, unfortunately, supports our clinical impression that many patients with cardiovascular disease, COPD, and diabetes who participate in therapeutic exercise reconditioning programs or who receive education and instructions about exercise therapy demonstrate poor long-term exercise maintenance. That is, regular exercise training does not appear to be incorporated into the lifestyle of the majority of patients with cardiovascular disease, COPD, and diabetes for whom exercise training is indicated.

In cardiovascular disease, exercise adherence is low despite the fact that exercise improves the short-term clinical outcome of patients with the disease. Oldridge[14] found that approximately half of all cardiac rehabilitation program participants drop out of the program within the first year. More recent studies have reported similar findings. For example, Cannistra et al.[15] in a prospective study of 225 consecutive patients enrolled in a community-based CRP found attendance rates of 51% and 63% for women and men, respectively. Further, in the Training Levels Comparison Trial (a clinical study to evaluate the effects of high- versus low-intensity training in patients with cardiovascular disease) exercise attendance during the first year averaged 64% in the low-intensity exercise group and 55.5% in the high-intensity exercise group.[16] Lastly, Moore et al.[17] reported that, in a sample of 40 women with myocardial infarction or coronary artery bypass surgery who completed a phase II CRP, only 50% continued to exercise 3 months after exiting the program. Moreover, during the 3-month post-CRP study period, the women in this study exercised within their target exercise heart rate range an average of only 5.2 sessions.[17]

Data regarding exercise adherence in COPD patients have not been published in the scientific literature. In an article published in 1995, Emery[18] noted that "no population-based data have been collected to assess the degree to which patients in pulmonary rehabilitation adhere to exercise and other components of rehabilitation,"[18(p421)] a fact that remains true today. However, it is reasonable to assume that exercise adherence in COPD patients is no better than that of patients with cardiovascular disease. Indeed, adherence in this clinical population probably is worse than in cardiovascular disease owing to the debilitating nature of the disease. The interaction among many factors, including ventilatory impairments, symptoms of breathlessness (dyspnea), reduced exercise capacity, inspiratory muscle fatigue, and malnutrition, contributes to a marked and prohibitive exercise intolerance in patients with COPD.[19]

Lastly, Kelly[20] succinctly summarizes the impact of poor treatment adherence on clinical outcomes in patients with diabetes:

> Poor patient adherence to prescribed treatments, diets, and exercise plans is still the single greatest barrier to controlling diabetes and preventing the serious long-term complications of the disease.[20(p20)]

Although leading sports medicine and diabetes organizations recommend that exercise be included in the treatment regimen of most patients with diabetes,[8] these patients report poor adherence to prescribed exercise regimens. Schneider et al.[21] report that participation in a lifestyle modification program that included education, nutrition counseling, and exercise training remained high over the first 6 weeks of the program, but the attrition rates at 3 months and 1 year were approximately 50% and 90%, respectively. Data from a survey of 570 patients with type 1 or type 2 diabetes attending an outpatient clinic in Japan revealed that only 43% implemented a prescribed exercise regimen "regularly."[22] Swift et al.,[23] in an examination of beliefs and attitudes about exercise among patients with type 2 diabetes who had completed an outpatient counseling program, reported that 52% of their sample exercised 3 or more days per week. Finally, Krug et al.[24] reported a number of findings from a survey of diabetic patients and their significant others, including: (a) most patients with diabetes discuss exercise with a healthcare profes-

sional, but only one in four receive specific exercise recommendations, and (b) the exercise relapse rate of patients with diabetes is approximately 80%.

IMPROVING ADHERENCE TO PRESCRIBED EXERCISE IS IMPORTANT

Whereas scientific evidence supports the beneficial role of exercise training in cardiovascular disease, COPD, and diabetes, it also reveals that exercise is a behavior that is difficult for patients with lifestyle-related chronic diseases to maintain over time. Although scientific evidence is lacking, long-term (i.e., > 18–24 months) physical functioning, quality of life, and mortality outcomes may be worse among patients with cardiovascular disease, COPD, and diabetes who fail to adhere to therapeutic exercise training regimens. Burke et al[25] also note that nonadherence in research settings may cause a number of undesirable effects, including underestimation of the efficacy of an experimental intervention, reduced statistical power to detect treatment effects, and increased cost due to expanded recruitment efforts to enroll additional subjects. These authors also note that nonadherence "is a formidable problem impacting on the failure of risk-reduction therapies, on patient morbidity, and on health care costs."[25(p259)]

Clearly, poor exercise adherence in clinical populations is an important issue not only to individuals with cardiovascular disease, COPD, and diabetes but also to healthcare providers, insurance companies, researchers, and health economists, to name a few. But is the time-consuming research and implementation of novel strategies to enhance exercise adherence in these clinical populations worthwhile? The answer to this question is best provided by Oldridge,[26] who proposes that three criteria must be met before research and development of adherence-enhancing strategies for specific interventions or therapies is undertaken:

1. The chronic disease in question causes significant mortality and premature disability.
2. The intervention or therapy reduces mortality and premature disability associated with the chronic disease.
3. Adherence to the intervention or therapy is poor.

Based on these three criteria, efforts to enhance exercise adherence in patients with cardiovascular disease, COPD, and diabetes are justified and warranted.

Innovative, state-of-the-art interventions that improve long-term exercise adherence in patients with cardiovascular disease, COPD, and diabetes may help reduce physical disability, improve long-term outcomes, and reduce healthcare costs. Therefore, healthcare professionals who work in therapeutic exercise settings should possess both a basic knowledge of the principles underlying behavioral change and a familiarity with past and current exercise compliance research and its applications.

BEHAVIORAL SCIENCE HOLDS THE KEY

Enhancing Exercise Compliance in Clinical Populations

Buckworth and Dishman[27] note that several factors may predict physical activity behaviors. These determinants of physical activity may be categorized broadly as personal attributes (demographics, cognitive variables, behaviors) and environmental factors (social environment, physical environment, and characteristics of the physical activity). Similarly, in clinical populations, patient attributes and environmental factors may predict long-term adherence to therapeutic exercise regimens[27–29] (Figure 1). Interestingly, no study to date has determined if these patient attributes and environmental factors vary across different clinical populations; therefore, the variables in Figure 1 are listed without respect to specific disease state. Fortunately, there are a number of strategies that can be used to enhance adherence, and these strategies appear to be robust across different therapeutic interventions (e.g., exercise, nutrition, medication use, etc.) and clinical populations.[25] Based on data from studies that have been conducted in supervised exercise settings, the factors most likely to influence physical activity behav-

- Poor exercise self-efficacy
- Poor sense of control over exercise behaviors
- Unfavorable self-concept
- Failure to exercise in the past
- Anxiety
- Low fitness level/poor cardiorespiratory endurance
- Physical environment not conducive to exercise
- Poor sense of control over scheduling exercise
- Insufficient knowledge about exercise/lack of exercise skills
- Perceived time barriers or limitations
- Low educational level
- Perceived physical frailty or poor health
- Transportation problems
- Limited financial resources
- Lack of interpersonal/social support
- Low valuation of exercise benefits
- Discomfort associated with physical exertion
- Fear of adverse events (cardiac symptoms, dyspnea, hypoglycemia, etc.)

Figure 1. Factors that may predict poor compliance with therapeutic exercise training.

iors/exercise compliance are perceived barriers to exercise, benefit expectation, self-efficacy, self-motivation, past activity level/program participation, exercise group cohesion, social support from family, and actual and perceived access to exercise facilities.[27]

In the past, healthcare professionals have operated under the assumption that educating patients about the health benefits of exercise will provide sufficient motivation to modify behavior. However, it is now widely accepted that cognition is only one component in the dynamic process of behavior modification:

> Education, which was once thought to be the panacea for behavioral change, has proved to be otherwise. Instead, behavior change seems to involve an intrinsic process that dramatically alters the way clients view the necessary changes expected of them.[30(p73)]

The behavioral science literature supports the use of cognitive-behavioral approaches, which are predicated on the belief that an individual responds to his or her perceptions about the environment or situation rather than directly to the environment itself,[31] to encourage long-term exercise adherence. Cognitive-behavioral therapy includes both cognitive and behavioral components and its applications in rehabilitative exercise/physical activity settings have been studied extensively. According to cognitive theory, maladaptive behavior is the product of faulty, or irrational, thinking[31]; cognitive approaches to behavior change are designed to modify how an individual thinks about or perceives a situation. Behavioral therapy is based on the idea that new and constructive behaviors can be learned through teaching and reinforcement. Under such models, specific techniques can be used to teach patients how to identify, monitor, and achieve valued long-term outcomes that are associated with therapeutic exercise training.

Several theoretical frameworks or models of behavior change have received the bulk of attention in the scientific literature. These theoretical frameworks, which are complimentary and provide a basis for developing practical and effective interventions to enhance exercise adherence in patients with disease, include Bandura's social cognitive behavior model, the health belief model, and Prochaska's transtheoretical (i.e., stages of change) model. Although many other models of health behavior change exist (e.g., Pender's health promotion model, theory of reasoned action, etc.), these theoretical frameworks, which are briefly described below, have been studied and applied in exercise settings more extensively than others and provide the foundation on which many contemporary exercise behavior interventions are based.

Social Cognitive Theory

An important component of Bandura's social cognitive theory of behavior is the concept of self-efficacy. Self-efficacy is an individual's confidence in his or her ability to perform a given task[32] and is the product of both efficacy expectations (an individual's perception of his or her ability to achieve a specific level of performance) and outcome expectations (an individual's evaluation of the probable consequences of a specific behavior).[33]

Healthcare professionals in therapeutic exercise settings can increase exercise self-efficacy by developing interventions to enhance efficacy expectations. Efficacy expectations are derived from four different sources: performance mastery, vicarious experience, verbal persuasion, and physiological states. Although interventions designed to improve performance mastery generally are the most effective means of building patient self-efficacy, healthcare professionals also can develop strategies specific to the other sources of efficacy expectations. Likewise, self-regulatory skills become increasingly important for long-term exercise maintenance and can be enhanced in several ways.

The Health Belief Model

Another theory-based model that has practical implications for enhancing long-term exercise adherence in clinical populations is the health belief model. According to the health belief model, an individual will adopt a given health behavior if the individual believes the behavior will help ward off a perceived health threat.[34] The health belief model focuses on the individual's subjective perceptions of health status rather than objective or clinical measures of health and suggests that three broad factors interact to affect behavior: motivation to act, perceived costs and benefits of action, and cues to action.[35]

Motivation to act is determined both by perceived severity of disease and perceived susceptibility to the disease and its sequellae. That is, individuals who perceive a threat of disease and believe they are susceptible to negative consequences of the disease will have greater motivation to act. Also, an individual will act to reduce the threat of disease or its negative consequences if the perceived benefits of the health behavior are valued more highly than the costs of the behavior, and a cue to action (e.g., the presence of disease symptoms) increases awareness of the presence or possible consequences of the disease.[35]

A modification of the health belief model is the exercise behavior model.[36] This theory-based model has been used to evaluate exercise attitudes and beliefs in patients with diabetes,[23] and may be useful in assessing exercise behavior in various clinical populations. The exercise belief model suggests that exercise behavior is influenced by four factors: perceived control over exercise behaviors, attitude toward exercise, self-concept, and values related to exercise.[36]

Transtheoretical (Stages of Change) Model

A concept originally developed to help understand behavior related to smoking cessation and now broadly

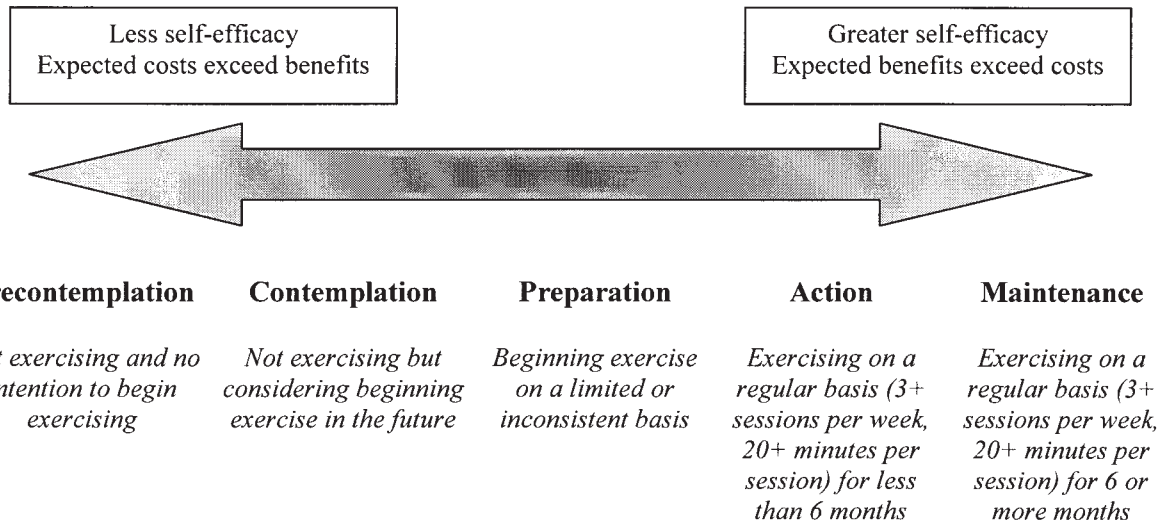

Figure 2. Transtheoretical model of behavior change. Data from Hellman EA. Use of the stages of change in exercise adherence model among older adults with a cardiac diagnosis. *J Cardiopulm Rehabil.* 1997;17(3):145–155.

studied and applied in health promotion and physical activity/exercise settings, the stages of change model suggests that health behaviors vary among individuals based on cognitive and performance factors.[37] Individuals can be staged along a continuum consisting of five different levels: precontemplation, contemplation, preparation, action (adoption), and maintenance (Figure 2). Greater self-efficacy and more perceived benefits relative to costs are associated with the adoption and maintenance of exercise.[38] In addition, the processes of change (the covert and overt activities used to progress through the stages of change) vary across the five stages of the transtheoretical model.[39] According to Prochaska and Velicer,[39] movement through the later stages of change (i.e., from preparation to action and action to maintenance) is facilitated by such processes as contingency management, helping relationships, counter-conditioning, and stimulus control (Table 1). Whereas clinical exercise professionals at one time may have concentrated on transforming sedentary individuals to active individuals, contemporary healthcare professionals in therapeutic exercise settings now focus their efforts on moving individuals along the continuum by designing stage- and process-specific interventions.[40]

FROM THEORY TO PRACTICE

Conceptual Models May Prove Useful in Improving Long-term Exercise Maintenance

Past experience (success or failure at a given task) affects an individual's perceptions of what he or she can achieve. Successful performance of a specific task increases efficacy expectations, whereas failed performance reduces efficacy expectations. Clearly, building a "base of success" early in a therapeutic exercise training program is essential to improving exercise maintenance over the long term. We believe that structured interventions to enhance long-term exercise adherence in clinical populations should be integrated into the traditional, short-term (2 or 3 months) rehabilitative programs offered to patients with cardiovascular disease, COPD, and diabetes.

Enhancing task-specific performance efficacy (i.e., confidence in the ability to use proper exercise techniques and adhere to the exercise protocol) increases the likelihood of successful exercise adoption during the early phase of a clinical exercise program. In a recent article, Schlicht et al.[41] suggest several methods to enhance self-efficacy that are applicable to the clinical exercise setting, including: careful instruction about and observation of exercise technique, intensity regulation, and use of adjunct therapies such as inhaler or oxygen use; modeling of exercise behaviors using peers having similar attributes; positive evaluative feedback that emphasizes self-improvement and gains in clinical indicators or function; and correcting participants' misinterpretations about somatic perceptions or bodily states (e.g., fatigue, weakness, shortness of breath, etc.) It is important to note that individuals may perceive different barriers to exercise; therefore, to a certain extent, attempts to strengthen self-efficacy should be individualized with respect to both the clinical population and the participants within a given program. For example, patients with diabetes have reported several barriers to exercise, including physical discomfort, fear of hypoglycemia, excessive body weight, and lack of social support.[23] Clearly, some of these barriers are relevant only for patients with diabetes, whereas others may be applicable across several populations. Further, some patients with diabetes may perceive certain

Table 1 • CHANGE PROCESSES ASSOCIATED WITH EXERCISE ADOPTION AND MAINTENANCE*

Process	Definition	Examples
Contingency management	Promote the adoption of a healthy behavior by controlling the consequences of the behavior	Use contracts that detail rewards for achievement of specific exercise goals; provide verbal encouragement and/or public recognition.
Helping relationships	Develop interpersonal relationships that promote the adoption and maintenance of healthy behaviors	Use exercise role models and buddy systems; encourage spouse participation; promote identification through group affiliation; contact exercise participants frequently.
Counter-conditioning	Substitute a learned healthy behavior for an unhealthy behavior	Encourage walking rather than smoking to counter stress; relaxation therapy to counter anxiety.
Stimulus control	Remove environmental cues that provoke unhealthy behaviors, or add cues that promote or encourage healthy behaviors	Post behavioral contract in visible area of home; ask participants to keep exercise clothing and shoes in convenient, and preferably visible, area at home; send participants e-mail messages or postcards with photographs or informative articles.

*Data from Prochaska JO, Velicer WF.[39]

barriers to be more significant than others, as in the example of a tightly controlled diabetic patient on supplemental insulin who fears the possibility of nocturnal exercise-induced hypoglycemia versus a diabetic patient on oral medications for whom hypoglycemia may be only a mild concern. An understanding of a participant's perceived barriers to exercise is necessary to develop a personalized plan to enhance exercise adoption in the short term and exercise maintenance in the long term.

Participation in a structured, facility-based therapeutic exercise program (e.g., cardiopulmonary rehabilitation program or diabetes exercise program) allows patients to translate beliefs about the benefits of exercise into action. During the initial adoption phase, healthcare professionals can use a variety of methods to enhance efficacy and outcome expectations, strengthen the motivation to exercise, and identify and provide solutions to perceived barriers to exercise among participants with cardiovascular disease, COPD, and diabetes. However, the transition to a home- or community-based exercise setting is complicated by a different set of barriers and obstacles than that encountered in the facility-based setting.

Long-term exercise maintenance becomes a high-demand situation because the individual assumes greater responsibility for his or her behavior in the home- or community-based setting.[42] Efficacy beliefs that are critical to success in short-term, structured exercise programs are different from those needed to maintain exercise over the long term. That is, performance self-efficacy is more important in the early (adoption) phase of a clinical exercise program, whereas self-regulatory skills are more important in the maintenance phase. Bandura[43] succinctly highlights this distinction between performance efficacy and the ability to self-regulate exercise behaviors outside of the clinical setting when he writes:

> The role played by efficacy beliefs in sustaining adherence to regular exercise has received a great deal of attention. The aspect of perceived efficacy that is most relevant is not whether one can execute the physical skills, which are readily mastered, but the self-regulatory efficacy to mobilize oneself to exercise regularly in the face of a variety of personal, social, and situational impediments.[43(p410)]

Healthcare professionals in clinical exercise settings can improve the likelihood that participants will maintain beneficial exercise behaviors by carefully structuring interventions that incorporate several techniques to enhance self-regulatory capabilities: instruction on self-monitoring of exercise behaviors, proximal goal setting, and supportive feedback (Figure 3).

Although most clinical exercise programs currently do not possess the innovative mind-set necessary to develop or implement a structured approach to increase exercise adherence over the long term, a few programs are developing interventions that may serve as models in the future. For example, Baptist Memorial Hospital in Memphis, Tennessee uses scheduled follow-up to encourage the maintenance of behavioral changes in its CRP participants. After facility-based cardiac rehabilitation has ended, a standardized protocol specifies the type of data collected during periodic follow-up visits (i.e., self-reported exercise, diet diary, evaluation of submaximal walking performance on the treadmill) as well as the time points at which the data are collected.[44] In addition, the follow-up visits are offered on a no-fee basis and are considered to be a mandatory part of the CRP at Baptist Memorial.[44] Devised in response to managed care's increasing emphasis on documenting long-term outcomes and cost effectiveness, the follow-up program suggests that relatively simple and inexpensive interventions can enhance compliance with medical

Encourage participants to self-monitor exercise behaviors by having them:

- Maintain a record of objective and subjective exercise data such as date, time of exercise, duration, type of activity, heart rate, rating of perceived exertion, and/or rating of perceived dyspnea
- Identify barriers to home- or community-based exercise through use of an exercise diary or journal
- Recognize pre- and postexercise mood states and mood state during exercise lapses
- Identify environmental cues that discourage exercise
- Monitor time constraints and apply appropriate time-management strategies

Teach participants to establish exercise goals by having them:

- Develop objectives that are specific, realistic, and adhere to an established timetable
- Devise sub-goals with specified incentives or rewards
- Develop relapse prevention and contingency management plans
- Establish monitoring strategies to assess progress toward goals

Help participants develop a system to provide supportive feedback by having them:

- Develop a social support network to promote exercise maintenance
- Establish a timeline for periodic clinic-based assessments
- Maintain regular periodic contact with clinical exercise program staff and health care providers

Figure 3. Strategies to enhance self-regulatory efficacy. Data from Bandura.[43]

therapy, including adjunct therapies such as rehabilitative exercise training. According to Hall[45]:

> Long-term follow-up using telephone, group, and face-to-face counseling to increase compliance in these interventions is an integral part of these models. Managed care has, as a primary objective, the managing of the health of the enrollee to reduce hospitalizations, interventions, and healthcare utilization; this is accomplished by compliance to a healthy lifestyle over time. Compliance is improved when there is good follow-up.[45(p44)]

Prospective research studies also are needed to determine if the traditional therapeutic exercise training model can be modified to enhance long-term exercise maintenance in clinical populations. For example, future investigations might (a) identify the best methods to increase participants' confidence to perform target exercise behaviors (i.e., maintain long-term exercise) and use self-regulatory skills to integrate physical activity into their lifestyles, (b) determine if long-term exercise maintenance can be enhanced by gradually weaning exercise program participants from a facility-based setting to the home- or community-based setting, and/or (c) evaluate the various effects of structured behavioral interventions, including components such as self-monitoring of exercise behavior, relapse prevention, and environmental reengineering, on long-term exercise maintenance and clinical outcomes.

ENHANCING EXERCISE MAINTENANCE IS WORTHWHILE

The cost-effectiveness of therapeutic exercise in different clinical populations has not been widely studied. To date, multidisciplinary cardiac rehabilitation has received the most attention in the scientific literature and appears to be a cost-effective use of medical care resources.[1] In addition, we are unaware of any studies specifically examining the effect of exercise maintenance on long-term physical functioning, quality of life, or morbidity and mortality outcomes in any clinical population, including cardiovascular disease. Indeed, in the case of COPD, some healthcare providers might claim that long-term exercise maintenance is a moot point considering the argument that pulmonary rehabilitation is not an effective treatment for COPD.[46] In the case of type 2 diabetes, "the relative complexity of dietary and metabolic control components of the diabetes regimen may cause exercise to be underemphasized by healthcare professionals" as well as patients.[23(p533)]

In some clinical exercise program participants, lifestyle habits and perceived barriers to exercise may be so entrenched that the long-term maintenance of positive behavioral changes, including exercise, is unlikely. On the other hand, we believe that structured, theory-based interventions grounded on factual findings in the behavioral and exercise science research may enhance exercise maintenance and long-term outcomes in the majority of participants enrolled in clinical exercise programs. Further, the cost-cutting mentality rampant in the healthcare delivery system can be applied to such interventions to ensure that resources are used, and costs maintained, at existing levels. Indeed, Boyle et al.[47] have implied that health maintenance organizations (HMOs) and other care providers may benefit from behavioral interventions offered within the context of clinical exercise programs:

> The stage of change distribution of HMO members with chronic conditions suggests that members at highest risk of adverse health outcomes have the greatest readiness to change behavioral risk factors. Based on these observations, targeted, stage-specific efforts to support behavior change are likely to be both acceptable and effective in HMO members with chronic conditions.[47(p170)]

Taken as a whole, the scientific literature supports the valuable role of exercise in patients with cardiovascular

disease, COPD, and diabetes. Although the association between long-term exercise maintenance and health outcomes in these clinical populations is yet to be studied with scientific rigor, it is reasonable to expect that the cumulative effect of repeated exercise bouts conducted over many years is a beneficial one. Although we know what strategies may be successful in improving adherence to therapeutic exercise[25] in general, we have failed to integrate these strategies into our programs.

As the traditional healthcare delivery system continues to transform itself, so too should traditional therapeutic exercise training programs. Increasingly, healthcare consumers are being encouraged to become actively involved in managing their health and are being given the tools (education, different treatment options, etc.) to improve health outcomes. In much the same way, healthcare professionals should provide participants enrolled in clinical exercise programs the tools to maintain meaningful lifestyle changes after the formal, facility-based phase of training is completed. In the end, the behavioral sciences may provide the key to enhancing exercise maintenance in clinical populations, but healthcare professionals will have to open the door.

References

1. Wenger NK, Froelicher ES, Smith LK, et al. *Cardiac Rehabilitation. Clinical Practice Guideline No. 17.* Rockville, MD: US Department of Health and Human Services, Public Health Service, Agency for Health Care Policy and Research, the National Heart, Lung, and Blood Institute; 1995. AHCPR publication no. 96-0672.
2. Wenger NK, Froelicher ES, Smith LK, et al. *Cardiac Rehabilitation as Secondary Prevention. Clinical Practice Guideline. Quick Reference Guide for Clinicians, No. 17.* Rockville, MD: US Department of Health and Human Services, Public Health Service, Agency for Health Care Policy and Research, the National Heart, Lung, and Blood Institute; 1995. AHCPR publication no. 96-0673.
3. Berry MJ, Walschlager SA. Exercise training and chronic obstructive pulmonary disease: past and future research directions. *J Cardiopulm Rehabil.* 1998;18:181–191.
4. Casaburi R. Exercise training in chronic obstructive lung disease. In: Casaburi R, Petty TL, eds. *Principles and Practices of Pulmonary Rehabilitation.* Philadelphia: WB Saunders Company; 1993: 204–224.
5. Lacasse Y, Wong E, Guyatt GH, King D, Cook DJ, Goldstein RS. Meta-analysis of respiratory rehabilitation in chronic obstructive pulmonary disease. *Lancet.* 1996;348:1115–1119.
6. Ries AL, Kaplan RM, Limberg TM, Prewitt LM. Effects of pulmonary rehabilitation on physiologic and psychosocial outcomes in patients with chronic obstructive pulmonary disease. *Ann Intern Med.* 1995; 122:823–832.
7. Maynard T. Exercise: part I. Physiological response to exercise in diabetes mellitus. *The Diabetes Educator.* 1991;17:196–204.
8. American College of Sports Medicine and American Diabetes Association. Joint position statement: diabetes mellitus and exercise. *Med Sci Sports Exerc.* 1997;29(12):i–vi.
9. American Diabetes Association. *Vital Statistics.* Alexandria, Va: American Diabetes Association; 1991.
10. Moore GE, Durstine JL. Framework. In: Durstine JL, ed. *ACSM's Exercise Management for Persons With Chronic Diseases and Disabilities.* Champaign, Ill: Human Kinetics; 1997:6–16.
11. Kravitz RL, Hays RD, Sherbourne CD, et al. Recall of recommendations and adherence to advice among patients with chronic medical conditions. *Arch Intern Med.* 1993;153:1869–1878.
12. Rand CS. Measuring adherence with therapy for chronic diseases: implications for the treatment of heterozygous familial hypercholesterolemia. *Am J Cardiol.* 1993;72(10):68D–74D.
13. Dishman RK. *Exercise Adherence: Its Impact on Public Health.* Champaign, Ill: Human Kinetics; 1988.
14. Oldridge NB. Compliance and dropout in cardiac exercise rehabilitation. *J Cardiopulm Rehabil.* 1984;4:166–177.
15. Cannistra LB, Balady GJ, O'Malley CJ, Weiner DA, Ryan TJ. Comparison of the clinical profile and outcome of women and men in cardiac rehabilitation. *Am J Cardiol.* 1992;69:1274–1279.
16. Lee JY, Jensen BE, Oberman A, Fletcher GF, Fletcher BJ, Raczynski JM. Adherence in the training levels comparison trial. *Med Sci Sports Exerc.* 1996;28:47–52.
17. Moore SM, Ruland CM, Pashkow FJ, Blackburn GG. Women's patterns of exercise following cardiac rehabilitation. *Nurs Res.* 1998;47:318–324.
18. Emery CF. Adherence in cardiac and pulmonary rehabilitation. *J Cardiopulm Rehabil.* 1995;15:420–423.
19. Olopade CO, Beck KC, Viggiano RW, Staats BA. Exercise limitation and chronic obstructive pulmonary disease. *Mayo Clin Proc.* 1992;67:144–157.
20. Kelly K. Patient compliance: the final frontier of diabetes care. *Practical Diabetology.* 1995;14:20–23.
21. Schneider SH, Khachadurian AK, Amorosa LF, Clemow L, Ruderman NB. Ten-year experience with an exercise-based outpatient life-style modification program in the treatment of diabetes mellitus. *Diabetes Care.* 1992;15:1800–1810.
22. Kamiya A, Ohsawa I, Fujii T, et al. A clinical survey on the compliance of exercise therapy for diabetic outpatients. *Diabetes Res Clin Pract.* 1995;27:141–145.
23. Swift CS, Armstrong JE, Beerman KA, Campbell RK, Pond-Smith D. Attitudes and beliefs about exercise among persons with non-insulin-dependent diabetes. *The Diabetes Educator.* 1995;21:533-540.
24. Krug LM, Haire-Joshu D, Heady SA. Exercise habits and exercise relapse in persons with non-insulin dependent diabetes mellitus. *The Diabetes Educator.* 1991;17:185–188.
25. Burke LE, Dunbar-Jacob JM, Hill MN. Compliance with cardiovascular disease prevention strategies: a review of the research. *Ann Behav Med.* 1997;19:239–263.
26. Oldridge NB. Cardiac rehabilitation exercise programmes. Compliance and compliance-enhancing strategies. *Sports Med.* 1988;6:42–55.
27. Buckworth J, Dishman RK. Determinants of physical activity: from research to application. In: Rippe JM, ed. *Lifestyle Medicine.* Malden, Mass: Blackwell Science, Inc.; 1999:1016–1027.
28. Franklin B, ed. *ACSM's Guidelines for Exercise Testing and Prescription.* 6th ed. Philadelphia, Pa: Lippincott Williams & Wilkins; 2000:239.
29. Schneider SH. Long-term exercise programs. In: Ruderman N, Devlin JT, eds. *The Health Professional's Guide to Diabetes and Exercise.* Alexandria, Va: American Diabetes Association; 1995: 125–132.
30. Sullivan ED, Joseph DH. Struggling with behavior changes: a special case for clients with diabetes. *The Diabetes Educator.* 1998;24:72–77.
31. Ellis A. *Reason and Emotion in Psychotherapy.* New York: Lyle Stuart; 1962.
32. Bandura A. Self-efficacy: Toward a unifying theory of behavioral change. *Psychol Rev.* 1977;84:191–215.
33. Bandura A. *Social Foundations of Thought and Action.* Englewood Cliffs, NJ: Prentice-Hall; 1986.
34. Shepard RJ. Factors influencing exercise behavior of patients. *Sports Med.* 1985;2:348–366.

35. Gatchel RJ, Baum A, Krantz DS. *An Introduction to Health Psychology*. 2nd ed. New York, NY: Random House; 1989.
36. Noland MP, Feldman R. Factors related to the leisure exercise behavior of "returning" women college students. *Health Education*. 1984;15:32–36.
37. Prochaska JO, Velicer WF, Rossi JS, et al. Stages of change and decisional balance for 12 problem behaviors. *Health Psychol*. 1994;13:39–46.
38. Bandura A. Editorial: the anatomy of stages of change. *American Journal of Health Promotion*. 1997;12(1):8–10.
39. Prochaska JO, Velicer WF. The transtheoretical model of health behavior change. *American Journal of Health Promotion*. 1997:12(1):38–48.
40. Clark DO. Physical activity efficacy and effectiveness among older adults and minorities. *Diabetes Care*. 1997;20:1176–1182.
41. Schlicht J, Godin J, Camaione DC. How to help your clients stick with an exercise program: build self-efficacy to promote exercise adherence. *ACSM's Health and Fitness Journal*. 1999;3(6):27–31.
42. McAuley E. The role of efficacy cognitions in the prediction of exercise behavior in middle-aged adults. *J Behav Med*. 1992;15(1): 65–88.
43. Bandura A. *Self-efficacy: The Exercise of Control*. New York, NY: WH Freeman and Company; 1997:410–421.
44. Hall LK. Will my cardiac rehabilitation program survive in the new managed-care era? The road map will be drawn by measuring outcomes. *J Cardiopulm Rehabil*. 1998;18(1):9–16.
45. Hall LK. Health and disease management: expanding the cardiac and pulmonary rehabilitation model. *Clinical Exercise Physiology*. 1999;1(1);42–46.
46. Albert RK. Is pulmonary rehabilitation an effective treatment for chronic obstructive pulmonary disease? No. *Am J Respir Crit Care Med*. 1997;155:784–785.
47. Boyle RG, O'Connor PJ, Pronk NP, Tan A. Stages of change for physical activity, diet, and smoking among HMO members with chronic conditions. *American Journal of Health Promotion*. 1998;12(3):170–175.