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Long-Term Adherence to Health Behavior Change

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Abstract

The utility of lifestyle-based health promotion interventions is directly impacted by participant adherence to prescribed behavior changes. Unfortunately, poor adherence to behaviors recommended in lifestyle interventions is widespread, particularly over the long-term; thus, the “adherence problem” represents a significant challenge to the effectiveness of these interventions. The current review provides an overview of the adherence problem and describes a theoretical framework through which the factors that impact adherence can be understood. To further understand the difficulties individuals face when adhering to health behavior changes, we focus our discussion on challenges associated with adherence to lifestyle behaviors recommended for weight loss and healthy weight management (i.e., reductions in dietary intake and increases in physical activity). We describe strategies that improve long-term adherence to health behaviors related to healthy weight management, including the provision of extended care, skills training, improving social support, and strategies specific to maintaining changes in dietary intake and physical activity. Finally, we discuss difficulties involved in implementing long-term weight management programs and suggest practical solutions for providers.

Keywords

Adherence; Lifestyle Intervention; Health Behavior Change; Long-Term Maintenance

Advances in behavioral medicine over the past few decades have demonstrated the important role that behavioral health treatments can have in improving patients' health and quality of life.¹ Numerous studies have documented that patients experience clinically significant health improvements (e.g., improvements in hypertension, body weight, and disease risk) when they follow prescribed lifestyle changes.² Even the most efficacious intervention can be rendered useless, however, if the patient fails to follow treatment recommendations. Unfortunately, non-adherence to medication regimens and prescribed behavioral changes is widespread. Rates of non-adherence to chronic illness treatment regimens have been

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reported to be as high as 50 to 80%.³ Findings from the behavioral therapy literature also suggest most individuals have difficulty maintaining healthy behavior changes, with reports of premature drop-out ranging from 30 to 60%.^{4,5} Consequently, the “adherence problem” represents an important challenge across medicine and public health, especially in light of research demonstrating that individuals who are not fully adherent to health interventions experience significantly less health benefits.²

The current review depicts the nature and scope of the adherence problem. We further describe the conceptual models of treatment interventions, and review empirical support for strategies commonly used to promote long-term adherence. Due to obesity’s prominence as a major public health problem in the United States, and the fact that weight management interventions, in particular, have been plagued by low rates of long-term adherence, our overview of adherence focuses on lifestyle changes related to diet, physical activity, and weight management.

The Adherence Challenge

Non-adherence to prescribed behavior changes can substantially diminish the long-term benefits of health promotion and treatment programs. Within lifestyle interventions, a typical pattern emerges: encouraging initial responses to treatment are frequently followed by diminished adherence over time, leading to disappointing long-term outcomes. It is often said that poor adherence represents the “Achilles’ heel” of lifestyle weight management interventions in particular.⁶ Although behavioral weight management programs have been successful in producing weight losses of 8–10% of initial body weight, many participants go on to regain half of this lost weight within a year, and return to baseline weight within 3–5 years.^{7–9} Similar patterns of good initial adherence followed by gradual but steady declines in the maintenance of behavior change have also been observed in lifestyle interventions targeting diet and physical activity without weight change objectives.^{10–13}

A variety of factors affect long-term adherence to dietary and physical activity behaviors in the context of obesity treatment, including the complexity of the required changes, the number of decision points needed to carry out such changes on a daily basis, and a number of environmental, socio-cultural, and psychological influences.¹⁴ In the following sections, we review adherence challenges specific to changes in dietary intake, physical activity, and overall weight management.

Dietary Adherence

Excessive caloric intake is a significant health concern in the United States and other industrialized countries around the world.^{15,16} Despite increasingly sedentary occupations and transportation mechanisms, individuals are consuming significantly more calories than in previous years. Epidemiological studies indicate that per capita energy intake increased by approximately 300 kcal per day between the years of 1985 and 2000; prior to 1985, per capita energy intake remained fairly constant for the previous 75 years.¹⁷ Lifestyle weight management interventions typically focus initially on promoting negative energy balance through decreasing energy intake, as caloric restriction has consistently been shown to produce weight loss among overweight individuals.¹⁸ Most overweight individuals, however,

are unable to sustain weight losses achieved by reductions in energy intake;¹⁹ long-term adherence to conventional weight loss programs is notoriously poor.²⁰

One factor that may directly impact long-term adherence to dietary changes is the current “toxic” food environment in the United States, which is rich in easily-accessible, inexpensive, and tasty high-fat, high-calorie foods.²¹ This environment in which healthy dietary choices are limited can increase the challenge of maintaining dietary changes over the long-term.²² Physiological changes experienced while dieting may further interact with this toxic environment; when dieting, people often experience a heightened sensitivity to palatable food,²³ specifically sweet and salty substances.²⁴ Additional evidence indicates that obese individuals have greater sensitivity to the sensory processing of food intake,²⁵ which is of concern because sensitivity to the rewarding properties of taste and smell are related to overeating and preference for foods high in fat and sugar.²⁶ The interaction of these physiological changes in combination with constant exposure to an unhealthy food environment virtually guarantees occasional lapses in dietary control.^{22,27-28}

Exercise Adherence

Similar to the individual and environmental challenges that make it difficult to sustain healthy dietary changes, a multitude of internal and external barriers affect an individual’s engagement in regular exercise. Following technological innovation in agricultural and industrial markets, jobs in the United States and other developed countries have become increasingly sedentary, with workers typically spending 6–8 hours (or more) sitting at desks.²⁹ In order to compensate for the reduction in energy expended throughout the working day, individuals must spend more of their leisure time in active pursuits to meet national activity guidelines (for adults, at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity aerobic activity per week³⁰).

Attempts to fit planned activity into limited leisure time, along with competition from other lifestyle activities, leads to a perceived barrier of time commitment for many individuals.³¹ Considering not only the time required to be active, but also the time involved in preparation and transportation to recreational facilities, individuals who complete shift work, have more than one job, live far from facilities, or rely on public transportation may be even more influenced by barriers of perceived lack of time.³²

Another commonly described barrier to regular physical activity includes perceived stress. Many individuals report feeling “too tired” for activity upon returning home from a stressful day at work.³³ This barrier may seem somewhat paradoxical as many people self-report that exercise decreases stress and increases energy.³⁴ However, individuals may not be able to recognize these potential future benefits prior to engaging in regular physical activity.

Finally, environmental limitations represent another significant barrier for the maintenance of changes in physical activity. Individuals may have difficulty accessing places to be physically active, as many neighborhoods, especially those in low-income areas, do not have adequate sidewalks, bike paths, or other recreational facilities.^{35,36} Individuals are much more likely to be active in areas where useable sidewalks and public facilities such as parks and tennis courts are located nearby.^{35,36} These barriers can compound, as individuals who

believe that they have little time for activity would likely be further discouraged if they have to travel far distances to access adequate facilities.

Weight Management Adherence Challenges

Regarding weight management, complex interactions between behavioral, environmental, and physiological mechanisms have been demonstrated to play a role in long-term adherence.^{26,37,38} In addition to the behavioral and environmental influences mentioned previously, recent studies indicate that physiological changes due to weight loss can make it difficult to maintain this weight loss over the long term. Following weight loss, resting metabolic rate decreases beyond the level expected from the loss of body mass alone,³⁸ which means that to maintain a calorie deficit, individuals would need to continuously eat fewer calories as they lose more weight; this would likely become progressively more challenging over time.

In addition to changes in metabolic rate, the body has several compensatory neuroendocrine mechanisms that occur following calorie restriction and weight loss to increase food intake and decrease energy expenditure.^{39–41} These mechanisms, such as decreased leptin response after meals (a protein hormone that signals satiety) and an increased ghrelin response (a gut peptide associated with the sensation of hunger), tend to promote weight regain following weight loss, and these physiological changes appear to remain present until an individual has returned to their baseline weight.^{42,43} As a result, individuals desiring to maintain a reduced body weight would have to consume fewer calories than suggested through the signals received from the brain and periphery.⁴⁴ Unfortunately, these strong neuroendocrine signals to increase food intake and decrease energy expenditure following weight reduction do not appear to decrease over time, and thus remain present until the defended weight is reached (i.e., the lost weight is regained).⁴⁵

As a consequence of these behavioral, environmental, and physiological factors, most individuals experience some weight regain following weight loss.⁸ This weight gain typically occurs after the end of initial treatment, a time when there is the least amount of contact with treatment providers. After the end of intervention, most individuals no longer have contact with providers and/or group members for social reinforcement, which may be needed as steady weight loss tends to slow after completion of treatment. As a result, the behavioral “costs” of continued dietary control can seem too high in comparison to the diminished “benefits” of weight loss, decreasing motivation to maintain behavioral changes. Without further assistance, an individual may begin to feel hopeless, as even a small weight regain may lead to attributions of personal ineffectiveness, negative emotions, and eventual abandonment of weight management efforts.^{46–49}

With the current physical and social environment supporting unhealthy dietary practices and sedentary behavior, it is not surprising that initial success in lifestyle programs is commonly followed by a return to pre-treatment patterns of eating and physical activity.^{8,26} Indeed, the potency of environmental challenges often initiates a behavioral “cascade” wherein initial lapses in the maintenance of behavioral changes undermine the individual’s confidence in their self-management skills and thereby lead to poor long-term adherence and the eventual abandonment of the entire behavior change effort.^{46,47}

To further understand factors that contribute to poor adherence, theoretical models of behavior change models may be helpful. In particular, social cognitive theory can be used to provide a framework for understanding the complex interactions that can occur between individuals and their environment during the behavior change process. The next section will focus on understanding adherence within the context of social cognitive theory.

A Theoretical Perspective on Adherence

As a theoretical basis for many current lifestyle interventions, social cognitive theory provides a framework through which the factors that influence initiation and maintenance of behavior change can be understood. Social cognitive theory describes how personal factors (i.e., cognitions, emotions) and aspects of the social and physical environment influence behavior and how a person's behavior, in turn, may have a reciprocal influence on these personal and environmental factors.⁵⁰ From a social cognitive theory perspective, the initiation and maintenance of behavioral changes involve four sets of constructs. These include: *health knowledge*, which focuses on an individual's awareness of how their behaviors affect their health; *self-efficacy beliefs and outcome expectancies*, which focus on an individual's perception of his or her ability to perform a particular behavior in a specific situation, and further the belief that performing this behavior will have a specific outcome; *self-regulatory skills*, which include the skills that allow an individual to exert control over his or her behavior, cognitions, and environment; and finally, *barriers to change*, which include an individual's perceived personal or environmental obstacles to performing a behavior.

Lifestyle interventions target all four of these key constructs. Health-related knowledge is increased by providing information regarding the influence of diet and physical activity on weight and risk for disease. Self-efficacy beliefs and outcome expectancies are enhanced through the use of short-term, achievable goals that provide a series of successful experiences in changing eating and exercise behavior. Self-regulatory skills are improved through the use of goal setting, written self-monitoring, self-reinforcement, stimulus control, and cognitive restructuring strategies. Finally, the ability to overcome barriers to change is addressed through in-session problem solving and direct training in problem-solving skills. In the following section, we will review some of these intervention techniques as they apply to long-term program adherence.

Promoting Long-Term Adherence

Health care professionals play a critical role in facilitating healthy long-term behavior changes in patients. The provision of behavior-based weight management interventions to individuals at high-risk for weight gain or weight-related chronic illness (e.g., hypertension, CVD, or type 2 diabetes) as early as possible can prevent disease progression and help individuals to make long-term behavior changes. Additionally, health care providers can improve program implementation by understanding individual factors that contribute to a patient's behaviors, such as home environment, behavior patterns (e.g., physical inactivity, frequent consumption of fast food), and related knowledge/skills.

Motivational interviewing (MI) can help providers assess a patient's willingness to change and, if ready, assist in preparations to initiate change.⁵¹ MI is a goal-directed, patient-centered counseling style originally developed for use with patients seeking treatment for substance abuse; however, it is applicable to promoting initial change and adherence to a variety of health behaviors. The use of MI allows for providers to assist in improving an individual's health knowledge and increasing his or her self-efficacy for behavior change (constructs discussed within the social cognitive theory section) in a non-confrontational and non-prescriptive way. The first step involves assessing a patient's specific barriers to adherence. For example, a patient may explain that he or she finds that the "costs" of exercising (time, cost of gym membership, uncomfortable physical feelings) to exceed the "benefits" (improved health). The provider can then lead the patient in brainstorming other benefits of exercise behavior (e.g., increased energy, improved mood, weight maintenance) that may encourage the patient to consider exercising. An important note is that providers should provide guidance on the process of listing benefits and costs but should not lecture the patient on the reasons they believe the patient should change his or her behavior; individuals are influenced more by ideas and goals that are self-generated compared to those provided by outside influences. Overall, the goal of this approach is to increase the patient's motivation for behavior change by helping him or her recognize the importance of benefits obtained from a healthy lifestyle change while minimizing the perceived costs.

A variety of strategies have been investigated to address the challenge of sustaining long-term adherence within interventions, including the use of extended-care treatment regimens, skills training, and social support. In the following sections, we briefly describe each of these approaches and provide information about their utility; see Table 1 for a summary of the available evidence for each of these approaches.

Extended Care

Within lifestyle-based weight management interventions, increasing the length of treatment improves adherence and thus treatment outcome.⁵² Specifically, longer initial treatments produce greater weight losses than briefer treatments,⁵² and providing participants with programs of extended care following initial treatment increases the maintenance of lost weight.^{7,53} Several clinical trials have demonstrated that extended care in the form of additional contacts with treatment providers (typically once or twice per month during the year following initial treatment) improves adherence to the behaviors needed to maintain lost weight.^{54,55–57} A recent meta-analysis of randomized controlled trials including extended care demonstrated that the provision of care leads to, on average, the maintenance of an additional 3.2 kg of weight loss over 17.6 months compared to control.⁵³

One drawback associated with lengthening interventions through the inclusion of additional face-to-face treatment sessions, however, is the increased cost of additional treatment. Consequently, alternative modalities for treatment delivery have been investigated, including the use of extended care delivered via telephone⁵⁴ or the internet.^{58,59} The literature on phone-based delivery shows that using telephone contact simply as a means of prompting adherence has not been effective.⁶⁰ However, using the telephone to provide additional counseling appears to be as effective as face-to-face counseling for maintaining adherence.⁵⁴

Further, contact via telephone rather than in person can be delivered at a substantially lower cost. For example, the Treatment of Obesity in Underserved Rural Settings (TOURS) trial demonstrated that, compared to a mail-only extended-care condition, providing participants with biweekly extended-care sessions delivered either in-person or via telephone-based led to significant improvements in adherence to behavioral changes and maintenance of lost weight.⁵⁴

The results of initial research focused on using the internet to maintain behavior changes were mixed.^{55,59} Specifically, while Wing and colleagues⁵⁵ found that internet-based support led to significantly less weight regain compared to control, Harvey-Berino and colleagues⁵⁹ found that internet-based support was not as effective as face-to-face support. More recently, another study by Harvey-Berino and colleagues⁵⁸ found that internet-based extended care, when combined with counseling, may be capable of producing benefits comparable to face-to-face counseling. In this study, researchers found no significant difference in weight loss over an 18 month period for participants randomized to an internet-support group (7.6 kg) compared to participants randomized to either a minimal or frequent in-person contact condition (5.5 kg and 5.1 kg, respectively).

Another possibility to improving treatment outcome involves the combination of some of these options (e.g., phone plus internet support). Appel and colleagues⁶¹ demonstrated effectiveness of providing remote support through a combination of telephone-contact, a study-specific Web site, and e-mail. At 24-months, there was no difference in change from baseline weight between participants in this condition compared to a condition wherein participants received the remote support plus in-person support (during 3 monthly group and 6 bimonthly individual sessions); weight changes were -4.6 kg for participants receiving only remote support compared to -5.1 kg for participants receiving remote plus in-person support.

Skills Training

The transition from initiation to long-term maintenance of lifestyle changes can be difficult for participants due to a myriad of often-unanticipated obstacles (identified as “barriers to change” within the context of social cognitive theory). Consequently, skills-training approaches have been used to enhance individuals’ ability to negotiate the various unexpected challenges to maintaining adherence. We will focus on two such strategies below: relapse-prevention and problem-solving skills training.

Relapse-prevention training centers on the identification of “high-risk” situations that are likely to trigger “lapses” in adherence,⁶² with the idea that training individuals to avoid or successfully cope with high-risk situations may help them avoid full-blown “relapse” (i.e., return to baseline behaviors). Moreover, individuals are instructed in the use of positive coping strategies to implement following lapses or relapses, to prevent abandonment of behavior change efforts. Empirical findings regarding the efficacy of relapse prevention training have been mixed. Simply providing such training during the course of initial treatment is not sufficient to prevent post-treatment lapses.⁶³ Combining relapse prevention training with extended care regimens, however, appears to be effective in promoting long-term adherence and weight maintenance.^{63,64} In a study by Perri and colleagues,⁶³

participants in a behavioral weight management intervention who were assigned to receive relapse-prevention training but no extended care regained 6.0 kg from post-test to 12 month follow-up, while participants who were assigned to receive relapse-prevention training an extended care lost an additional .71 kg during this same time period. Similarly, Baum and colleagues⁶⁴ demonstrated that participants randomized to a relapse-prevention based extended-care condition continued to lose weight or maintain their lost weight following the end of a weight management intervention, while participants randomized to a minimal-contact control condition regained a significant amount of weight.

Problem-solving skills training⁶⁵ is an approach to addressing barriers to change that is appropriate for both initial change and long-term maintenance. Problem-solving counseling includes the development of five skills: (a) positive problem orientation (e.g., developing the perspective that problems are “normal” and can be managed effectively); (b) problem identification and definition (e.g., recognizing the existence of a problem and objectively detailing contributing factors); (c) generation of alternatives (e.g., brainstorming an array of potential solutions); (d) decision making (e.g., anticipating the likely positive and negative consequences of potential solutions and selecting the best alternative); and (e) implementation and evaluation (e.g., trying out the solution plan and evaluating its effectiveness). Research has shown that incorporating problem solving into extended care leads to improved long-term weight losses.⁶⁶ Specifically, Perri and colleagues⁶⁶ demonstrated that participants randomized to a problem-solving based extended-care condition continued to lose an additional 1.5 kg in the year following initial treatment, compared to a regain of 5.4 kg experienced by participants in a no-further-contact control condition.

The MI approach discussed earlier can also be used to enhance skills training. In particular, the focus on guiding individuals, as opposed to prescribing changes, and additionally encouraging individuals to develop their own goals and solutions to barriers may help facilitate behavioral change. Individuals are more likely to be persuaded by their own ideas and arguments than by what they are told to do by others (i.e., an individual offering “walking after work” as an idea when problem solving how to increase physical activity, rather than a provider giving a list of activity options and times to select from). Thus, providers should encourage patients to develop individualized solutions to health challenges and barriers rather than directly providing solutions or telling patients what they should do. If a patient is struggling with developing solutions, providers may offer assistance, but should first ask permission to offer suggestions (e.g., “You just said that you are having trouble thinking of new ways to fit in activity after work. Can I suggest things that have worked for other patients in the past?”).

Social Support

Research has demonstrated that social support is significantly associated with adherence to health behavior change, and further the absence of social support has been associated with poorer outcomes.⁶⁷ For example, DiMatteo and colleagues⁶⁷ found that the relative risk of non-adherence was twice as high for participants who did not have practical social support (e.g., support from others to complete tasks) compared to those who did. Thus, helping

participants improve social support may have a beneficial impact on adherence. Wing and Jeffery⁶⁸ demonstrated that, among participants recruited alone (i.e., not recruited along with friends or family members) for a weight management intervention, training participants to improve social support for weight management led to 0.8 kg less weight regain from posttreatment to 6-month follow-up compared to participants who did not receive this training. Another promising approach is to recruit friends or family members who are also interested in making changes along with the patient. Wing and Jeffery⁶⁸ demonstrated that participants who were recruited along with friends or family members regained only 0.1 kg from post-treatment to a 6-month follow-up, while participants recruited alone regained 1.6 kg.

Another method of improving social support for patients includes conducting lifestyle interventions in a group. Research suggests that group interventions produce superior outcomes to individual treatment, even for individuals who report preferring individual treatment before the start of intervention.⁶⁹ Participants in group-based lifestyle programs often comment on the value of social support and the importance of being a group member. Group cohesion appears to enhance the effectiveness of treatment,^{70,71} and the social- and task-related functions of group treatment may have direct effects on a participant's eating and physical activity patterns.^{70,72} In addition, some research suggests that the social support provided by group participation enhances individuals' perceived ability to adhere to lifestyle changes and to cope with barriers to long-term change.⁷² Similar to individual-based MI counseling, when leading group-based interventions, providers should allow group members to provide health knowledge when appropriate and generate potential solutions during problem solving.

Techniques Specific to Weight-Related Health Behaviors

Some approaches to promoting long-term adherence are specifically related to the target of behavior change. For example, in the area of dietary change, participants commonly find it easier to follow nutritionally "balanced" dietary regimens compared to those that are very low with respect to either carbohydrates or fats.⁷³ Further, studies providing participants with portion-controlled meals (free of charge) show better dietary adherence and weight loss compared to standard recommendations to reduce caloric intake.⁷⁴ When participants are required to pay for portion-controlled meals, however, few follow the advice to do so.⁶⁰

In the physical activity domain, the location, intensity, frequency, and duration of prescribed changes have particular relevance to adherence. Home-based physical activity routines are associated with better long-term adherence than center-based programs,⁷⁵ and sedentary individuals are more likely to adhere to moderate-intensity programs than vigorous-intensity regimens.⁷⁶ Moreover, some research suggests that prescribing exercise in shorter bouts (e.g., multiple bouts of 10 min per day) may boost adherence compared with prescribing a single long bout per day.⁷⁷ Furthermore, prescribing exercise at a higher frequency (5–7 vs. 3–4 days per week) does not detract from adherence and results in a greater accumulation of total minutes of exercise per week.⁷⁶

Research on long-term weight management also suggests the importance of ongoing vigilance with regard to self-monitoring. Successful long-term adherence appears to be

facilitated by ongoing monitoring of caloric intake or body weight; individuals who continue to log their food intake or weigh themselves regularly are more likely to achieve success in maintaining lost weight over time.^{78,79}

Addressing Barriers to Program Implementation

While several techniques (e.g., extended care, skills training, and improving social support) have been demonstrated to improve long-term adherence, it is sometimes difficult to implement these programs in healthcare settings. Three important factors have been identified as major barriers to program implementation: lack of time, lack of reimbursement, and patient factors.^{80,81}

Many randomized trials for weight loss include groups that are 1 to 1.5 hours in length, which can represent a significant time commitment for providers in primary care or other medical settings. Further, few physicians have received in-depth training in behavioral techniques and may feel under qualified to effectively intervene with patients. Recent research has demonstrated, however, that weight management counseling sessions as brief as 15 minutes can be effectively administered by physicians and other healthcare providers after only just minimal training.⁸² Specifically, Davis Martin and colleagues⁸² demonstrated that participants randomized to a brief (15 minute), physician-delivered, behaviorally tailored intervention experienced significantly greater weight loss compare to participants randomized to standard care.

Another recently-completed randomized clinical trial by Wadden and colleagues⁸³ demonstrated an effective primary-care provider (PCP) model wherein quarterly PCP visits addressing coexisting illnesses and including 5–7 minutes of weight loss education were combined with brief (10–15 minute) monthly lifestyle counseling visits delivered by medical assistants. Participants randomized to this condition experienced a weight loss of 2.9 kg at 2 years, compared with a 1.7 kg loss experienced by participants in a usual-care condition (including only the PCP visits described above). Further, these results were enhanced further when the PCP plus lifestyle counseling condition was combined with provision of either meal replacements or weight loss medication (orlistat or sibutramine); participants in this condition experienced a 4.6 kg weight loss at 2-years, which was significantly larger than the weight losses experienced by participants in the usual care or PCP plus lifestyle counseling conditions.

An additional potential challenge to treatment delivery is lack of reimbursement for physicians' and other healthcare providers' time for intervention efforts. Although few insurance providers previously covered behaviorally oriented weight loss programs when other comorbid health conditions were not present,⁸⁴ the Affordable Care Act enacted March 23, 2010 requires all insurance policies purchased after September 23, 2010 to cover obesity screening and counseling.⁸⁵ Providers should become familiar with the services covered under this act and the categories of providers who are eligible for reimbursement. Further, more resource-efficient models for obesity treatment should be considered. Jakicic and colleagues⁸⁶ recently demonstrated that a stepped-care model, for which minimal initial intervention was supplemented with more intensive-intervention components for participants

who did not meet set weight loss goals at prescribed times. Participants assigned to the stepped-care condition lost and maintained a -6.9% change in body weight from baseline and, although participants assigned to a standard behavioral weight loss intervention lost 8.1% of their initial body weight, this program was substantially more cost-effective than standard intervention approaches (i.e., \$58 per kg lost versus \$97 per kg lost). This model offers promise as more cost-effective approach to achieving clinically-significant weight reductions.

Finally, certain patient factors may interfere with program implementation. Patients may feel embarrassed about their habits and thus may be hesitant to discuss certain health behaviors with providers.⁸⁷ Providers may address this barrier by approaching patients in a non-judgmental, collaborative manner. Using the techniques of MI and problem solving discussed earlier, the provider can guide discussion without passing judgment or condemning any particular health behavior. When adopted by providers, this communication style can make it easier for patients to be open and honest about their goals and behaviors.

Conclusions

Maintaining long-term adherence to behavior change represents a problem of enormous clinical significance. The long-term success of health promotion interventions is often compromised by the difficulties participants experience in maintaining adherence to prescribed behavioral changes. Social cognitive theory has provided a useful theoretical framework for understanding the factors that influence adherence to behavioral changes and for designing interventions that improve long-term outcomes. Table 1 contains a summary of the available evidence regarding approaches to improving long-term adherence to health behavior change. We note that this table provides supporting evidence for these strategies, but does not provide conflicting evidence. At the current time, only one study provides conflicting evidence to one of these approaches, and only in certain implementations: a study by Perri and colleagues⁶² suggests that relapse-prevention training may only be effective when combined with extended care, rather than when presented during initial intervention. The lack of available contradicting evidence may reflect the proverbial “file drawer problem;” non-supportive studies tend to not get published and, as a result, the literature (including this review) may portray the effectiveness of well-known strategies in an overly favorable manner.

Currently, the evidence suggests that the most promising approaches to promoting long-term adherence include extended-care programs, skills training, social support, and using techniques with specific utility for the target behavior, such as providing portion controlled meals for dietary adherence or recommending exercise be completed in shorter but more frequent bouts for improving adherence to physical activity. Ideally, we recommend interventions that are multifaceted and combine several of these efficacious techniques, such as group-based extended-care programs that focus on skills training and address individual barriers to long-term adherence. These programs have the potential to be implemented in a time and cost-effective manner in healthcare settings especially in light of recent changes in healthcare law that have improved funding for behavioral counseling.

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Extended Care	Providing long-term contact individually or by group, either in-person, by phone, or via the internet	Providing bi-weekly or monthly follow-up sessions	Ross Middleton, Patidar, & Perri (2011); ⁵³ Perri et al. (2008); ⁵⁴ Svetkey et al. (2008); ⁵⁷ Wing et al. (2006) ⁵⁵
Skills Training	Specific training in problem-solving skills or relapse prevention	Training participants how to address barriers that interfere with treatment adherence, such as time constraints	Marlatt & Witkiewitz (2005); ⁶² Perri et al. (2001); ⁶⁶ Baum, Clark, & Sandler (1991); ⁶⁴ Perri et al. (1984) ⁶³
Social Support	Increasing social support through skills training or recruitment of participants with friends/family	Recruiting participants with their friends and family; conducting group-based interventions rather than individual-based	Renjilian et al. (2001); ⁶⁹ Estabrooks & Carron (1999); ⁷⁰ Wing & Jeffery (1999); ⁶⁸ Spink & Carron (1992) ⁷¹
Treatment Tailoring	Making flexible treatment recommendations that can be tailored to individual preferences and schedule	Allowing individuals to choose their own methods of physical activity, and allowing multiple short bouts of physical activity rather than requiring long bouts	Perri et al. (2002); ⁷⁶ Jakicic et al. (1999); ⁷⁷ Perri et al. (1997) ⁷⁵
Self Monitoring	Having participants keep records of their adherence behaviors	Having participants weigh themselves daily to assess weight loss maintenance	Butryn et al. (2007); ⁷⁹ Wing & Phelan (2005) ⁷⁸
Multicomponent Strategies	Combining multiple strategies to promote long term adherence	Providing bi-weekly or monthly follow-up, group-based sessions that focus on skills training and continued self-monitoring	Wing et al. (2006); ⁵⁵ Perri, Sears, & Clark (1993); ⁸⁸ Perri et al. (1988) ⁵⁶ ; Perri et al. (1984) ⁸⁹