

New and Emerging Weight Management Strategies for Busy Ambulatory Settings

A Scientific Statement From the American Heart Association

Endorsed by the Society of Behavioral Medicine

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Recent data from the Centers for Disease Control and Prevention show that a staggering 68% of American adults are either overweight or obese, and 34% are obese.¹ Although there is evidence that its prevalence is stabilizing, obesity remains an extremely serious public health problem. It is a major risk factor for a wide range of medical (eg, type 2 diabetes mellitus), social (eg, discrimination in employment and education settings), and psychological (eg, depression) conditions.²

Although the effectiveness of different obesity treatments has been evaluated systematically,³ rational, safe, and effective treatments from which the majority of overweight and obese patients can benefit remain elusive. New medications are emerging, but their impact on weight loss has been modest, and their long-term adverse effects are uncertain.⁴ Bariatric surgery is effective but expensive and is appropriate only for a small proportion of patients in whom the benefits outweigh the risks. Effective and safe commercial and non-commercial behavior modification programs are scarce. Changes in public policy and the “built environment”⁵ may curb obesity, but such changes take a long time to bring about, and the magnitude of their impact has yet to be established clearly. A recent review, for example, concluded

that soft drink taxes have only a small impact on a population’s average body mass index (BMI).⁶

It is widely acknowledged that no single strategy will solve the obesity problem and that effective public health initiatives to prevent and treat obesity will require the involvement of multiple stakeholders, including patients, employers, health plans, governments at all levels, the food and beverage industries, and healthcare providers.^{7,8} Among these healthcare providers are those who deliver care in busy ambulatory settings, including primary care physicians, nurse practitioners, nurses, registered dietitians, and others. Screening and counseling for obesity in such settings is widely recommended.^{9,10} Unfortunately, there is ample evidence that physicians and other healthcare professionals are poorly equipped to tackle the problem. A survey conducted in 2006 revealed, for example, that only 65% of obese patients were advised to lose weight by their physicians.¹¹ A lack of knowledge, skills, and practical tools have all been identified repeatedly as barriers to the identification and management of obesity by healthcare professionals.^{12–14}

The purpose of this statement is to provide an overview of new and emerging tools and strategies for discussing weight and assisting overweight and obese patients. Only tools and

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strategies that can be used practically in busy ambulatory settings are included. The goal is to provide clinicians with evidence-based strategies to tackle the problem of obesity in settings in which patients are seen for a wide variety of problems. Before using such strategies, of course, it is important to assess patients for overweight and obesity, a critical step that is addressed in another pending American Heart Association scientific statement on assessment of adiposity.^{14a} On the basis of our literature review, we have divided strategies into 3 categories: (1) appropriate ways of discussing body weight with patients (including readiness to change); (2) approaches that involve multidisciplinary collaboration among healthcare professionals; and (3) strategies that make use of information technology to deliver weight management programs. Although many weight management approaches that make use of technology have not been evaluated in busy ambulatory settings, we believe technological approaches should be included in the present statement because they have the potential to impact large numbers of participants and are relatively easy to recommend, administer, or refer to in such settings.

1. Discussing Weight With Patients

Overview

This section includes a review of existing evidence about (1) acceptable methods for raising and discussing the issue of weight, (2) practical methods of assessing readiness to change and motivation for attaining a healthier weight, and (3) practical strategies for assessment of eating and physical activity behaviors in busy settings.

Search Strategy

We searched for articles that explicitly described strategies for discussing weight with patients. Search terms including “physician-patient relations” OR “primary care” etc AND “communication” OR “counseling” etc were used in combination with “obesity” OR “weight loss” to identify relevant studies in the following databases: PubMed, EMBASE, CINAHL, PsycINFO, Cochrane CENTRAL, and the New York Academy of Medicine Grey Literature Collection. We searched only for reports published from 2002 through November 2010.

Results

We retrieved 157 unique citations from PubMed and 59 from EMBASE, with no other unique citations identified in the other databases. The vast majority of these reports were not relevant. Citations not reviewed included descriptive studies of the perspectives and practices of providers (eg, perceived barriers to weight management in primary care, patients’ recall about receiving weight management advice). Other reports not reviewed described strategies for discussing weight that we considered too time consuming and impractical for busy clinical settings. We reviewed 23 reports in depth (Table 1).

Raising and Discussing Weight: Studies of Patient Preferences

Several studies reported patient preferences for discussing weight management. Patients described the need for empathy, nonjudgmental interactions, and specific personalized recommendations.^{15,18,23,31} A descriptive survey of 25 female family medicine clinic patients found that when physicians demonstrated more empathy, as rated by 2 independent coders on a scale of 1 (low) to 7 (high), patients were significantly more likely to report changing their exercise behaviors 1 month later.²³ In general, published reports emphasized the need for communication between the provider and patient to be nonjudgmental to avoid feelings of blame and stigma.¹⁸ Some patients associate even the word “obese” with discrimination.³¹ A survey of patients seeking weight loss treatment asked respondents to rate the desirability of 12 terms to describe excess weight.³² Physicians were asked to report which of the terms they most often used during clinical encounters. Patients rated “weight” as the most desirable term, and “fatness” as the most undesirable term. Fortunately, physicians were most likely to use “weight” and least likely to use “fatness.” Dutton et al³² concluded that the use of desirable and respectful terms and the avoidance of terms known to be offensive improves the quality of communication about obesity and weight loss. Patients also express a preference for clinicians taking time to deliver weight loss counseling, rather than offering weight loss advice as an afterthought as they leave the room.³¹ The importance of verbally recognizing patients’ small weight losses as well as their unsuccessful weight management efforts was also noted, because nonrecognition by providers was seen as a judgment that the patient did not care or was not making an effort toward weight loss.³¹

Patients expressed an interest in hearing about how their weight was affecting their specific medical conditions (or risk for conditions) and an interest in receiving specific recommendations from the individual provider on how to lose weight rather than just broad statements about the need to lose weight.^{15,18,31} Finally, physician recommendations related to diet and physical activity were more effective (ie, associated with greater likelihood of patient behavior change) if patients were given the chance to reflect on causes of their overweight during counseling visits and their own perceptions about weight management were incorporated into the recommendations.²⁹

Studies Describing Specific Strategies for Discussing Weight

Beginning a conversation about weight is challenging. The discussion may be especially difficult if there are no readily available and affordable resources for patients genuinely interested in losing weight. The US Preventive Services Task Force recommends a framework for counseling known as the 5 A’s (ask, advise, assess, assist, and arrange) to assist physicians in primary care to effectively begin the conversation about health behavior change and provide assistance.³³ Use of this paradigm by physicians has been shown to improve patient outcomes in smoking cessation in part by noting the behavior as a health risk and advising that the

Table 1. Studies Included in Section 1: Discussing Weight With Patients

Study/Design/Description	Sample	Independent Variables	Outcome Measures	Results for Assessment, Discussing Weight or Readiness to Change
Blixen et al, 2006 ¹⁵ Descriptive survey to examine perceptions of obesity and weight-management preference among black and white general internal medicine female clinic patients	N=480 Surveys mailed: 240 to white and 240 to black female patients; 256 surveys returned (55% response rate); only blacks and whites included in the study (n=229) 100% Female 36% White 54% Black 11% Other Age: 51.5±14.1 y (white); 49.8±14.9 y (black) BMI 37.6±7.9 kg/m ² (white); 42.2±9.4 kg/m ² (black) All with ICD-9 diagnosis of obesity	Black and white races	18-item questionnaire developed from 5 themes that arose from focus group data: (1) perceptions and attitudes about weight; (2) aspects of life that weight affects; (3) weight associated medical knowledge; (4) past weight loss attempts and associated factors; and (5) help with losing weight that women want from their PCP	Compared with white women, black women expressed a greater need for a physician's help with weight loss strategies in the following areas: One-on-one assistance from PCP (<i>P</i> <0.001); group meeting with PCP, dietician, and other women (<i>P</i> =0.007); referral from PCP to dietician (<i>P</i> =0.031); prescribe medication for weight loss (<i>P</i> =0.006); individual counseling by PCP (<i>P</i> =0.015); take part in weight loss classes in PCP's practice (<i>P</i> =0.011); PCP to review adverse outcomes and dangers of weight gain (<i>P</i> <0.001); and PCP to firmly discuss need for weight loss (<i>P</i> <0.003).
Bolognesi et al, 2006 ¹⁶ RCT to examine the effect of a GP-administered physical activity counseling intervention on BMI, waist circumference, and physical activity stage of change	Usual-care control group n=55 (48 completed); PACE intervention group n=55 (48 completed) 72.9% Age 41–70 y 53.1% Female 83.3% Married All were overweight or obese patients from 8 practices in Emilia Romagna, Italy, for whom physical activity was not contraindicated.	Intervention group: PACE protocol for physical activity counseling included a baseline assessment of stage of change followed by a standard procedure for the stage that required 2–5 min of interaction between GP and patient. A 2- to 3-wk follow-up via mail or telephone reinforced the stage-specific themes of the protocol. Usual-care control group: general discussion and recommendations for a healthy lifestyle provided by GP for 2–5 min	BMI: change (in kg/m ²) at 5- to 6-mo follow-up Waist circumference: change (in cm) at 5- to 6-mo follow-up Stage of change for physical activity: change in stage level self-reported by intervention group as their stage of readiness for physical activity during leisure time	ANCOVA analyses that controlled for baseline BMI and waist circumference revealed a significant difference between the intervention and control groups at 5- to 6-mo follow-up; the intervention group decreased in BMI and waist circumference, whereas the control group increased in both (<i>P</i> <0.01). Within the intervention group, 60% of precontemplators moved to contemplation or preparation at follow-up; 51.4% who were contemplators or preparers at baseline moved to action or maintenance stage.
Boudreaux et al, 2003 ¹⁷ Cross-sectional descriptive study to investigate relationships of decisional balance and self-efficacy with stage of change for avoiding dietary fat and engaging in exercise regularly	N=515 Adult patients in 4 public primary care clinics 60% Black 81% Women 43% Married 71% Uninsured Age 45±14 y Monthly household income: \$490±\$453	Exercise self-efficacy: 5-item, 5-point Likert scale (1=not at all confident to 5=extremely confident) assessing confidence in ability to exercise in various circumstances Exercise decisional balance: 16-item, 5-point Likert scale (1=not important to 5=extremely important) assessing the degree of positive or negative feelings derived from exercise Dietary fat self-efficacy: 12-item tool assessing confidence for avoiding dietary fat on a 5-point Likert scale (1=not at all likely to 5=extremely likely) Dietary fat decisional balance: 8-item, 5-point Likert scale (1=not important to 5=extremely important) assessing the degree of positive or negative feelings derived from reducing dietary fat	Readiness to exercise: classified as precontemplation, contemplation, preparation, action, or maintenance for engaging in and maintaining a regular exercise routine (on a weekly basis, at least 3 exercise sessions of ≥20 min) Readiness to decrease dietary fat: classified as precontemplation, contemplation, preparation, action, or maintenance in response to question, "Do you consistently avoid eating high fat foods?" Followed up with 5 yes/no questions about actual low- or no-fat eating behaviors.	Stage of change for avoiding dietary fat was significantly related to stage of change for exercise; <i>P</i> <0.001. 27.4% of the study population was stage congruent for exercise and avoiding dietary fat; 37.3% was 1 stage apart (eg, contemplation for dietary fat, preparation for exercise); 35.3% was >1 stage apart (eg, precontemplation for dietary fat, preparation for exercise). The majority of the sample was stage incongruent, which suggests that intervention efforts of providers should be tailored to the stage of change for each behavior.
Brown et al, 2006 ¹⁸ Qualitative study using semistructured interviews to explore the experiences and perceptions of support among obese primary care patients	N=28 Adult patients from 5 general medicine practices in Sheffield, United Kingdom Mean age 56 y (range 19–77 y) Mean BMI 35.6 kg/m ² (range 29.4–61.5 kg/m ²) Female 64%	N/A	Experiences and perceptions of obese patients related to support and care	Themes emerged about level of support for weight loss, with disappointment related to being told about the need to lose weight with no practical advice or support for how to do so. Patients expressed dissatisfaction with hurried office visits that provided limited resources for weight loss efforts and desired specific support services that were available through their practitioner's office.

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Table 1. Continued

Study/Design/Description	Sample	Independent Variables	Outcome Measures	Results for Assessment, Discussing Weight or Readiness to Change
Counterweight Project Team, 2008 ¹⁹ Prospective assessment of a comprehensive program to manage obesity in primary care practices	65 General medical practices from 7 regions in the United Kingdom agreed to participate; 56 participated N=1906 patients enrolled n=1419 at 12-mo follow-up n=825 at 24-mo follow-up Age 49.4±13.5 y BMI 37.1±6.9 kg/m ² Female 77%	Intervention: registered dietitians trained GPs and PNs on screening and treatment pathways for Counterweight program. PNs delivered the patient education and intervention based on patients' stage of readiness to lose weight. Those in contemplation or action stages were asked to participate. Patients who were not ready to change were given information about the health benefits of 5%–10% weight loss and advised to think about weight loss. Patients committed to 9 appointments over 12 mo.	Primary outcomes: weight change at 12 and 24 mo Percentage of patients losing and maintaining ≥5% at 12 and 24 mo	Mean 12-mo weight change for 642 attendees: -2.96 kg (95% CI -3.47 to -2.44) 30.7% of attendees maintained ≥5% weight loss Mean 24-mo weight change for 357 attendees: -2.3 kg (95% CI -3.2 to 1.4) 31.9% of attendees maintained ≥5% weight loss
Greenwood et al, 2008 ²⁰ Pilot and cross-sectional studies to develop and assess an eating behavior clinical screening tool for use with primary care patients	Phase 1 (pilot) N=48 adult patients from 2 family medicine clinics in the Utah Health Research Network Age 42.6±12.1 y Female 54% White 77% Phase 2 (cross-sectional) N=261 adult patients from same 2 family medicine clinics Age 38.4±11.7 y Female 58% White 80% Education 15.7±3.4 y BMI 27.7±7.2 kg/m ²	Phase 1: Two versions of screening questionnaire for physical activity and eating behaviors of consumption of restaurant food, large portion sizes, sugar-added beverages, fruits and vegetables, and breakfast Phase 2: BMI, overweight, obese status as factors related to reported eating behaviors; BMI objectively measured using weight in kilograms divided by height in meters squared: Overweight: 24.5 to 29.45 kg/m ² Obese: ≥29.5 kg/m ²	Phase 1: Participants' perceptions of the questions in terms of ease of understanding, response accuracy, and actual representativeness of the behavior Phase 2: Self-reported eating behaviors and physical activity from 14-item final version of the questionnaire	Phase 1: Reporting of behaviors from the previous day was said to be less representative of the behavior than reporting of typical behaviors over a period of time; final version had 14 questions about specific eating behaviors, including 1-d and 1-wk recall, as well as typical behavior. Phase 2: Each additional sugar-added beverage typically consumed in a day was associated with a 0.61-unit increase in BMI (P=0.006). Every 1-day increase in moderate physical activity was associated with a 0.91-unit decrease in BMI (P<0.001). The odds of being classified as obese were 1.47 higher (P=0.002) for each unit increase in the frequency of consuming a full-size portion of a restaurant meal compared with never consuming a full-size portion of a restaurant meal.
Huang et al, 2004 ²¹ Cross-sectional, descriptive study using exit interviews to evaluate patients' recollection of physicians' recommendations for weight loss and the effect of MD weight loss counseling on patients' understanding of, motivation toward, and behaviors for weight loss	N=210 convenience sample of adult primary care clinic patients with a BMI ≥25 kg/m ² for whom English was their first language Mean age 52 y (range 18–82 y) Mean BMI 39 kg/m ² (range 26–65 kg/m ²) Female 74% Black 76% Insurance status: free care or self-pay 66%	Analyses were adjusted for age, race, sex, and literacy level	Topics of patient interview questions: (1) understanding of association between weight and health (2) effect of 10% weight loss (3) specific weight loss advice of the MD (4) weight loss motivation (5) past and current weight loss efforts (6) readiness for weight loss	79% recalled being advised to lose weight; of these, 28% recalled receiving specific recommendations for weight loss. 5% recalled being advised to combine dietary and exercise strategies for weight loss. Patients who recalled being counseled to lose weight were more likely to be in contemplation, preparation, action, or maintenance stages of change for weight loss (versus precontemplative stage) (χ ² =19.24, P=0.001).
Paxton et al, 2010 ²² Secondary data analysis to examine the feasibility, validity, and sensitivity to change of the STC brief dietary screening tool	N=463 Age 58.4±9.2 y Female 49.8% White 72% BMI 38.4±6.5 kg/m ²	Analyses controlled for baseline age and Hispanic ethnicity	8-Item STC tool compared with the NCI Percent Energy From Fat screener at baseline and 4 mo	Individual STC items significantly correlated with summary score (r=0.39–0.59, P<0.05). STC summary score significantly correlated with NCI fat screener measurement of fat intake (r=0.39, P<0.05). STC summary score change significantly correlated with decrease in fat intake at 4 mo (r=0.22, P<0.05).

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Table 1. Continued

Study/Design/Description	Sample	Independent Variables	Outcome Measures	Results for Assessment, Discussing Weight or Readiness to Change
Pollak et al, 2007 ²³ Descriptive study of how weight loss is discussed between physicians and female family practice clinic patients who were overweight or obese using baseline surveys, audiotaped patient visits, and 1-mo follow-up surveys	N=25 patients Age 59±11 y Female 100% White 50% BMI 37±11 kg/m ² N=7 physicians Age 43±10 y Female 57% White 57% BMI 22±3 kg/m ²	MI: Two coders evaluated MI strategies used by MDs for empathy, MI spirit, MI-adherent actions (MD advice given with patient permission, affirming and supportive statements emphasizing patient control), and MI-nonadherent actions (MD advice given without patient permission)	Patient self-reported self-efficacy and readiness to lose weight immediately after office visit and at 1-mo follow-up. Patient self-reported attempts to lose weight by altering dietary intake, exercise habits, or both at 1-mo follow-up.	Patients more likely to report changing their exercise habits at 1 mo when MDs displayed higher levels of empathy ($r=0.50$, $P=0.02$). Patients were more likely to report attempting to lose weight at 1 mo when MDs used more MI-adherent techniques ($r=0.42$, $P=0.08$).
Simkin-Silverman et al, 2005 ²⁴ Descriptive study of baseline data from the Primary Care Weight Control Project regarding the prevalence of previous MD-administered weight loss advice and predictors of identification of obese patients, as well as predictors of weight loss advice	N=255 adult patients Age 48.4±10.8 y Female 75.1% White 83.3% BMI 34.9±5.6 kg/m ² N=18 PCPs Age 38.1±5.5 y Female 61% White 72% BMI 34.9±5.6 kg/m ²	BMI (objectively measured) Waist circumference Level of physical activity Dietary intake Mood Readiness for weight management, dichotomized as precontemplation/contemplation and preparation/action/maintenance Percentage of previous office visits with PCP Medical history (patient self-report) Sociodemographic variables	Patient self-report of previous MD-administered weight loss advice Chart review of documentation indicating PCP had discussed weight or physical activity with patient Obesity diagnosis per chart review	Stage of change for weight control was a significant predictor of patient-reported, MD-administered weight loss advice (OR 0.36, 95% CI 0.15–0.88) and chart-documented, MD-administered weight loss advice (OR 0.37, 95% CI 0.20–0.69) in multivariate analyses.
Segal-Isaacson et al, 2004 ²⁵ Descriptive study to validate the REAP-S in combination with nutrition education for first-year medical students by correlating responses with the Block FFQ	N=110 First-year medical students Age 24.2±3.8 y Female 44% White 65% BMI 23.4±5.0 kg/m ²	Block 1998 FFQ	Correlations of scores from REAP-S and Block FFQ on vegetable, fruit, dairy, added fat, and meat servings, as well as estimated nutrient intake on fiber, sugar, total fat, and cholesterol	The REAP-S was significantly correlated with all Block FFQ variables except (1) meat servings ($P=0.51$), (2) fiber intake associated with high-fiber starch and whole grain foods ($P=0.08$), and (3) total fat intake from fish, poultry, or meat ($P=0.68$).
Scott et al, 2004 ²⁶ Descriptive study: Obesity is epidemic in the United States and other industrialized countries and contributes significantly to population morbidity and mortality. PCPs see a substantial portion of the obese population, yet rarely counsel patients to lose weight	Weight counseling (n=39) Adults >20 y: 12% Children ≥2 and ≤20 y: 8.2% Female 12.3% White 9.3% No weight counseling (n=337) Adults >20 y: 88% Children ≥2 and ≤20 y: 91.8% Female 87.7% White 90.7%	Frequency of weight loss counseling in primary care visits	Descriptive field notes of outpatient visits collected as part of a multimethod comparative case study were used to study patterns of physician-patient communication about weight control in 633 encounters in family practices in a Midwestern state	68% of adults and 35% of children were overweight. Excess weight was mentioned in 17% of encounters with overweight patients, whereas weight loss counseling occurred with 11% of overweight adults and 8% of overweight children. In weight loss counseling encounters, patients formulated weight as a problem by making it a reason for the visit or explicitly or implicitly asking for help with weight loss. Clinicians did so by framing weight as a medical problem in itself or as an exacerbating factor for another medical problem.
Jay et al, 2009 ²⁷ Nonrandomized, wait-list/control design to assess the impact of an obesity counseling curriculum for residents: 5-hour multimodal obesity counseling curriculum based on the 5 A's (assess, advise, agree, assist, arrange) using didactics, role-playing, and standardized patients	Control group (n=74) Mean age 43.50±13.45 y Female 73% Black 68% BMI 34.50±4.61 kg/m ² Intervention group (n=78) Mean age 46.11±13.73 y Female 71% Black 78% BMI 33.83±3.86 kg/m ²	BMI, health status, and number of comorbidities of the patient	Patient report of physician's use of the 5 A's was assessed by a structured interview survey. Main outcomes were whether obese patients were counseled about diet, exercise, or weight loss (rate of counseling) and the quality of counseling provided (percentage of 5 A's skills performed during the visit). Univariate statistics (t tests) were used to compare the rate and quality of counseling in the 2 resident groups. Logistic and linear regression were used to isolate the impact of the curriculum after controlling for patient, physician, and visit characteristics.	A large percentage of patients seen by both groups of residents received counseling about their weight, diet, and/or exercise (>70%), but the quality of counseling was low in both the curriculum and no curriculum groups (mean 36.6% versus 31.2% of 19 possible 5 A's counseling strategies, $P=0.21$). This difference was not significant. However, after controlling for patient, physician and visit characteristics, residents in the curriculum group appeared to provide significantly higher-quality counseling than those in the control group (standardized β coefficient=0.18; R^2 change=2.9%, $P<0.05$).

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Table 1. Continued

Study/Design/Description	Sample	Independent Variables	Outcome Measures	Results for Assessment, Discussing Weight or Readiness to Change
Carels et al, 2005 ²⁸ This investigation was designed to improve BWLP treatment outcomes by providing SC to individuals experiencing difficulties with weight loss during treatment	BWLP+SC (n=23) Female 85.2% White 92.9% BWLP only (n=23) Female 88.5% White 92.3%	Weight, physical activity/fitness, and dietary intake	Changes in weight, cardiorespiratory fitness, self-reported physical activity, and diet (ie, calories, percentage daily intake of fat, protein, and carbohydrates) in response to treatment were assessed. Fifty-five obese, sedentary adults were randomly assigned to a BWLP+SC or a BWLP.	Participants significantly decreased their weight, increased physical activity/fitness, and improved dietary intake ($P<0.05$). BWLP+SC (MI) participants lost more weight and engaged in greater weekly exercise than BWLP (SC matched) participants who did not receive MI ($P<0.05$).
Heintze et al, 2010 ²⁹ Cross-sectional study: The aim of this study was to assess GPs' and patients' practices and attitudes about overweight encountered during preventive counseling talks	N=51 Age, y: 35-50: 21.1% 51-60: 36.5% >75: 40.3% (1 patient w/no age specification) Female 17% BMI, kg/m ² : 25.0-29.9: 38.5% 30.0-34.9: 40.4% 35.0-39.9: 13.7% >40: 5.8%	N/A	Twelve GPs audiotaped their preventive counseling talks with overweight patients, including the assessment of individual risk profiles and further medical recommendations. Fifty-two dialogues were transcribed and submitted for qualitative content analysis.	Dietary advice and increased physical activity were discussed most often during talks. Recommendations appeared to be more individual if patients were given the chance to reflect on causes of their overweight during counseling talks.
Burke et al, 2010 ³⁰ 24-mo RCT of behavioral intervention, examining effect of 3 approaches to SM on weight loss and SM adherence	N=210 PDA (n=68→64) 85.3% Women 80.9 % White Age 46.7±9.2 y BMI 34.9±4.6 kg/m ² 94.1% Retention at 6 mo PDA plus daily FB (n=70→65) 84.3% Women 78.6 % White Age 46.4±9.5 y BMI 34.8±4.6 kg/m ² 92.9% Retention at 6 mo Paper diary (n=72→63) 84.7% Women 76.4 % White Age 47.4±8.5 y BMI 33.4±4.5 kg/m ² 87.5% Retention at 6 mo	All subjects received a 24-mo behavioral weight loss program. Paper diary: Use paper diary for SM diet and exercise. PDA: Use PDA with dietary and exercise software. PDA includes date and time stamp to measure adherence to SM. PDA+FB: Use PDA for SM, automated message delivered daily and tailored to diary entries.	Δ % Weight loss at 6 mo	Intention-to-treat analysis: 6-mo weight change: Paper diary: 5.3%±5.9% PDA: 5.5%±7.0% PDA+FB: 7.3%±6.6% ($P<0.12$) Proportion of each group that achieved 5% weight loss (compared with PDA+FB 63%) Paper record: 46% ($P<0.05$) PDA 49% ($P<0.05$) Median % adherence to SM: Paper record 55% PDA 80% PDA+FB 90% ($P<0.01$)
Ward et al, 2009 ³¹ Qualitative study to understand how obese black patients perceive the physician's role in the treatment of obesity and to identify specific provider behaviors that may motivate or hinder attempts at weight loss	N=43 Women: 63% Age: 30-64 y (median 50 y) BMI: 30.2-57.7 kg/m ²	N/A	Qualitative study involving 8 focus groups	Physicians must be cognizant of the potential unintended consequences of the techniques they use to educate and counsel black men and women on obesity, particularly those that may be perceived as negative and that act to further alienate obese patients from seeking the care they need.
Dutton et al, 2004 ³² Cross-sectional, nonrandom sampling study to determine how patients prefer physicians to communicate about the topic of obesity	N=143 Women: 89.5% White: 64.5% Age: 46.8±12.5 y BMI: 36.9±7.4 kg/m ²	Descriptor terms used to describe weight	Cross-sectional, nonrandom sampling study; patients who were seeking treatment for weight loss rated the desirability of 12 terms to describe excess weight, and physicians rated the likelihood with which they would use those terms during clinical encounters. Participants rated terms on a 5-point scale.	Physicians generally reported that they used terminology that patients had rated more favorably, and they tended to avoid terms that patients may find undesirable.

(Continued)

Table 1. Continued

Study/Design/Description	Sample	Independent Variables	Outcome Measures	Results for Assessment, Discussing Weight or Readiness to Change
Whitlock et al, 2002 ³³ Evidence-based approach. Promote broader appreciation of the importance of behavioral counseling interventions in clinical care and the context for their delivery.	N/A	N/A	N/A	Behavioral counseling interventions in clinical settings are an important means of addressing prevalent health-related behaviors, such as lack of physical activity, poor diet, substance (tobacco, alcohol, and illicit drug) use and dependence, and risky sexual behavior, that underlie a substantial proportion of preventable morbidity and mortality in the United States.
Unrod et al, 2007 ³⁴ Evaluation of the effectiveness of a computer-tailored intervention designed to increase smoking cessation counseling by PCPs	N=518 Intervention: n=270 58% Women 61% White Age 43.5±14.7 y Control: n=248 64% Women 63% White Age 42.8±14.2 y	Physician implementation of the 5 A's, quit rate, length of quit attempts, number of quit attempts, and stage-of-change progression	Physicians and their patients were randomized to either intervention or control conditions. In addition to brief smoking cessation training, intervention physicians and patients received a 1-page report that characterized the patients' smoking habits.	The use of a brief computer-tailored report improved physicians' implementation of the 5 A's and had a modest effect on patients' smoking behaviors 6 mo after intervention.
Quinn et al, 2005 ³⁵ Survey study	N=4207 63.8% Women 70% White 31.1% Age 25–40 y 42.8% Age 41–54 y 26.1% Age ≥55 y	Demographics, health status, outpatient utilizations, smoking history, and reports of tobacco services received at healthcare visits during the past 12 mo	Survey mailed to 64 764 members 25–75 y of age, or 9 nonprofit HMOs participating in the NCI-funded Cancer Research Network. Smokers were asked about tobacco cessation treatments received during primary care visits in the past year.	Substantial clinician compliance with the first 2 steps (ask and advise). Greater efforts are needed in providing the more effective tobacco treatments (assist and arrange). Compliance with the guideline is associated with greater patient satisfaction.
Jakicic et al, 2008 ³⁶ Study examined the effect of exercise of varying duration and intensity on weight loss and fitness in overweight adult women during a 24-mo period		Physical activity energy expenditure and intensity	Participants were assigned to 1 of 4 behavioral weight loss intervention groups. They were randomly assigned to groups based on physical activity energy expenditure and intensity. Participants were told to reduce caloric intake to 1200–1500 kcal/d. A combination of in-person conversations and telephone calls were conducted during the 24-mo study period.	The addition of 275 min/wk of physical activity, in combination with a reduction in energy intake, was important in allowing overweight women to sustain a weight loss of >10%.
Soroudi et al, 2004 ³⁷ Addressed the development of the Quick WAVE Screener, a tool that can be used in primary care settings and schools to quickly assess weight, activity, variety, and excess	111 First-year medical students, mean age 24 y, as part of their vertically integrated curriculum	N/A	Examined existing questionnaires that could provide clinically useful information to guide a brief intervention related to the WAVE themes	Formative evaluation by medical students revealed that focusing on themes of weight, activity, variety, and excess was easy to remember.

BMI indicates body mass index; *ICD-9*, *International Classification of Diseases, 9th Revision*; PCP, primary care physician; RCT, randomized controlled trial; GP, general practitioner; PACE, Patient-centered Assessment and Counseling for Exercise; ANCOVA, analysis of covariance; N/A, not applicable; PN, practice nurse; CI, confidence interval; MD, medical doctor; STC, Starting the Conversation; NCI, National Cancer Institute; MI, motivational interviewing; OR, odds ratio; REAP-S, Rapid Eating Assessment for Participants–Short Version; FFQ, Food Frequency Questionnaire; BWLP, behavioral weight loss program; SC, stepped care; SM, self-monitoring; PDA, personal digital assistant; FB, feedback; HMO, health maintenance organization; and WAVE, weight, activity, variety, and excess.

patient take action to stop smoking.³⁴ An adaptation of the 5 A's for obese patients includes assessment of patient health risk, assessment of current behavior and readiness to change, advising the patient to change specific behaviors, agreeing about the behaviors and collaboratively setting goals, assisting patients in addressing barriers and securing support, and arranging for follow-up.^{27,33} In a recently published randomized controlled trial (RCT), internal medicine residents were randomized either to receive training in the 5 A's obesity counseling curriculum or not and then to utilize the strategy with obese patients.³³ Results revealed that the majority of obese patients of residents who received training acknowledged that they had been coun-

seled. Evaluation of the counseling provided, however, revealed that residents in the intervention group did not address most of the 5 A's. Furthermore, there were no actually significant differences in obesity counseling rates between residents in the intervention and control groups. This result may indicate the impracticality of the 5 A's when implemented in a manner that relies entirely on physicians without infrastructure supports or help from other professionals. Counseling about obesity is likely more complex and time-consuming than smoking cessation counseling. Even among studies that demonstrate the effectiveness of the 5 A's paradigm for smoking cessation counseling by primary care physicians, physicians were

more likely to complete the “ask” and “advise” steps and less likely to complete the remaining steps.³⁵

A descriptive study by Scott et al²⁶ supported the usefulness of encouraging patients themselves to make weight management a priority with their physicians. In 633 clinical encounters, excess weight was mentioned in 17% of visits with overweight and obese adults, and weight loss counseling occurred with 11% of overweight and obese adults. In encounters that included counseling, patients formulated weight management as a problem by making it a reason for the visit or explicitly or implicitly asking for help with the weight loss, or physicians framed weight as a medical problem itself or one that contributed to another existing medical problem. The authors concluded that strategies that increase the likelihood of patients themselves identifying weight as a problem or that provide clinicians with a way to “medicalize” the patient’s weight are most likely to increase the frequency of weight loss counseling in primary care visits.

Assessing Readiness to Change and Motivation

A qualitative study of 43 obese blacks revealed that patients believe providers should ask whether they want to lose weight and whether they believe they are ready to make changes to promote weight loss.³¹ Methods for assessing patients’ readiness to address weight management behaviors were described in several studies^{16,17,19,21,23,24} and were based on Prochaska and DiClemente’s stages of change: precontemplation, contemplation, preparation, action, and maintenance.³⁸ A simple 5-item questionnaire was used in a descriptive study of 210 patients attending 2 primary care clinics in Louisiana, in which patients were asked to choose which of 5 statements best described their readiness for weight loss: “I have not really thought about it” (precontemplation), “I mean to lose weight but I don’t actually get around to it” (contemplation), “From time to time, I go on a diet/exercise, but then I stop after a few days” (preparation), “I have been working on losing weight for the past 6 months” (action), or “I have been working on losing weight for over 6 months, or I have kept my weight I lost off for over 6 months” (maintenance).²¹ Patients who were in the latter 4 stages of readiness were more likely to recall having received counseling for weight loss than those in the precontemplation stage. Similar results have been found by Simkin-Silverman and colleagues.²⁴ These findings suggest that although assessing readiness to change adds an extra step in caring for overweight and obese adults, it is a useful indicator of whether any accompanying weight loss counseling will be recalled by the patient. A patient who at least recalls weight loss counseling is better equipped to take steps toward weight loss than one who does not.

Motivational interviewing is a brief, evidence-based intervention derived from a social cognitive theoretical framework. It is designed to increase a patient’s motivation to change problematic and often long-standing health behaviors. Motivational interviewing strategies have been adapted for use in healthcare settings and are designed to work with the stages-of-change framework.^{39,40} There is evidence for the

efficacy of motivational interviewing in promoting weight loss.⁴¹ What follows is a general description of the strategy. Depending on a patient’s self-reported readiness to change (based on the questions above or alternatively on a 10-point scale), there are predetermined steps a clinician can take to increase motivation and encourage change. For example, the goal for a provider with a precontemplative patient is to increase the patient’s awareness of the need to change by providing personalized information and feedback about weight and health risks. An additional aim is to encourage the patient to continue to think about making some changes and, with the patient’s permission, arrange for a follow-up visit to continue the conversation. For patients in the contemplation stage, the provider’s goal is to enhance patient motivation and sense of self-efficacy about his or her efforts to change. Self-efficacy is defined as people’s beliefs about their capabilities to produce designated levels of performance that exert influence over events that affect their lives.⁴² The patient’s self-efficacy can be enhanced by eliciting perceived benefits of change, exploring concerns and fears about change, clarifying misconceptions, offering information with permission, and expressing empathy and support. Once a patient has moved into the preparation, action, or maintenance stage, recognition of their effort and success is very important, as is relating weight loss to improvements in indicators of health such as blood pressure or blood sugar.

Assessing Eating and Physical Activity Behaviors

Efficient and accurate assessment of eating and physical activity behaviors in busy clinical settings is necessary to guide weight management. Tools such as 24-hour dietary recalls, food frequency questionnaires, and food/exercise diaries have been used to assess diet and activity, especially in research studies.^{28,36,43} These tools, however, are generally not practical for fast-paced settings because they are time consuming to administer and analyze and sometimes require specially trained personnel. Greenwood and colleagues²⁰ developed a 14-item questionnaire for use in the clinical setting to screen patients’ eating and physical activity behaviors. Domains of the questionnaire relate to restaurant and fast food consumption, sugar-added beverage intake, fruit and vegetable intake, breakfast intake, restaurant meal portion size consumption, and whether physical activity (defined as at least moderate-intensity activity for ≥ 30 minutes) in the past week and a typical week took place.²⁰ The validity of the tool is supported by strong associations between specific behaviors and obesity. Among 261 majority female (54%) and white (80%) family medicine clinic patients, typical consumption of sugar-sweetened beverages was associated with a higher BMI, eating a full-size portion of a restaurant meal was associated with the likelihood of being obese, and the odds of obesity and overweight were lower with at least 30 minutes a day of moderate-intensity activity and consumption of vegetables and/or fruits >3 times a day.²⁰

Other practical tools to assess diet include the 8-item Eating Pattern Questionnaire recommended by the American Medical

Association,^{44,45} the 8-item Starting the Conversation tool,²² the 17-item Quick WAVE (Weight, Activity, Variety, and Excess) Screener,³⁷ and the 16-item Rapid Eating Assessment for Participants—Short Version (REAP-S).²⁵ The Eating Pattern Questionnaire assesses behaviors such as how an individual's food is typically prepared (eg, baked, broiled), frequency of eating outside the home, favorite snack foods, and typical daily frequency of starches, fruits, vegetables, dairy, meat, fats, and sweets.⁴⁴ The Starting the Conversation tool is a brief screening tool developed for nondietitian professionals and asks about, for example, consumption of fast foods, fruits and vegetables, regular soda, margarine or butter, and desserts over the previous few months. It correlates significantly with the National Cancer Institute's Percent Energy From Fat screener and is available in English or Spanish.²² The Quick WAVE Screener was initially developed as a pocket guide. The WAVE uses items in the Behavioral Risk Factor Surveillance System and the Paffenbarger Physical Activity Questionnaire⁴⁶ to address 4 key assessment areas (weight, physical activity, dietary variety, and excess)⁴⁷ and has evolved into a 17-item tool that can be completed in 5 to 10 minutes. The assessment of these 4 areas includes questions about, for example, where excess body weight is concentrated, sedentary and activity behaviors, the variety of healthful (eg, fruits and vegetables) and unhealthful (eg, candy bars, sugared sodas) foods consumed, and excess food consumption during stressful times.³⁷ Written at a fifth-grade reading level, the REAP-S was designed to help providers quickly assess dietary behaviors as part of the routine history and physical examination and includes items to evaluate intake of whole grains, foods high in calcium, vegetables and fruits, fat and cholesterol, sugar, sodium, and alcohol.⁴⁸ The REAP-S has been validated with the Block 1998 Food Frequency Questionnaire.⁴⁹ It is a shorter and lower literacy version of a 31-item questionnaire that also asked about physical activity.⁴⁴

Summary

1. Initial discussions about weight management with patients should be respectful, nonjudgmental, and delivered in an unhurried fashion. The term "weight" should be used rather than "obese" or objectionable terms such as "fatness." Counseling should always include a description of the medical consequences of obesity. The 5 A's paradigm for delivering counseling is simple and practical but has not yet been successfully incorporated into busy clinical settings in a way that improves the quality of counseling.
2. A patient's stage of readiness to change can be assessed with a simple 5-item questionnaire. Assessment should be accompanied by systematic motivational interviewing, the content of which is tailored for the individual patient's readiness to change.
3. Several simple tools are available for the accurate assessment of diet and physical activity behaviors that contribute to obesity. These include 8- to 17-item questionnaires that can be completed by patients in a limited amount of time.

2. Collaborative Approaches

Overview

We defined a collaborative approach as a strategy or set of strategies to help patients achieve and/or maintain a healthy weight that involve collaboration among healthcare professionals in at least 2 different disciplines (eg, physicians and dietitians) for the delivery of weight management interventions. We considered interventions that do not significantly disrupt the usual processes of health care in busy practices and that included at least 1 meaningful outcome such as change in dietary behavior or change in weight.

Search Strategy

Terms including "cooperative behavior," "collaborative intervention," and "chronic care model" in combination with the terms "obesity" or "obese" were used to search the following databases: PubMed, EMBASE, CINAHL, PsycINFO, Cochrane CENTRAL, and the New York Academy of Medicine Grey Literature. Only articles published from 2002 through November 2010 were reviewed.

Results

One hundred thirty-four citations were retrieved, the vast majority of which did not meet our inclusion criteria. Many reports described approaches that were not truly collaborative (eg, physicians simply referring to a weight management program, with no joint responsibility for providing or coordinating obesity care) or involved interventions that we considered too time consuming, expensive, and inconvenient for busy clinical settings. Only 4 reports met our criteria (Table 2).

The Counterweight Programme is a centrally planned, locally implemented primary care weight management program developed in the United Kingdom.⁵⁴ Sixty-two primary care practices were recruited initially. Seven weight management advisors facilitated implementation. The program included 4 phases: audit and needs assessment; practice support and training; patient intervention; and evaluation. General practitioners and practice nurses both received training and collaborated to deliver the program. General practitioners were responsible for raising the issue of weight, assessing motivation, and monitoring progress, as well as prescribing medications when needed. Practice nurses completed an extensive 6- to 8-hour training program that included skills in goal setting and assisting patients with self-monitoring, stimulus control, cognitive restructuring, nutrition education, and relapse management. Practice nurses were encouraged to see patients for six 10- to 30-minute appointments for the first 3 months followed by quarterly visits. A recent evaluation of the program revealed a mean weight change for participants of -3 kg after 12 months and -2.3 kg after 24 months. The cost to deliver the program was roughly \$90 per participant.⁵⁰ The program has not been systematically compared with a control intervention.

Feigenbaum et al⁵¹ described a 6-month, 3-arm program in which (A) patients received counseling by a family physician and dietician every 2 weeks along with orlistat, or (B)

Table 2. Studies Included in Section 2: Collaborative Approaches

Study/Description	Sample	Intervention/Control	Primary Outcome Measures	Analysis/Results
Trueman et al ⁵⁰ Counterweight program. Centrally planned, locally implemented primary care program in the United Kingdom	Obese patients and their physicians in 62 primary care practices	Training for physicians and practice nurses. Practice nurses provide counseling in 6 appointments in 3 mo followed by quarterly appointments. No control.	Mean weight change after 12 and 24 mo among participants; cost per participant	−3-kg and −2.3-kg weight loss among participants at 12 and 24 mo, respectively; cost per participant ≈\$90.
Feigenbaum et al ⁵¹ Randomized trial of intense multidisciplinary follow-up and orlistat in primary care practices	225 Obese patients in 3 primary care clinics in Israel	Group A: Personal diet, biweekly meetings with physician and dietician and orlistat Group B: General diet, monthly meetings with physician only, and orlistat Group C: Personal diet, monthly meetings with dietician only, and no drug therapy Study duration: 6 mo	Percent of patients in each group achieving weight loss of ≥5% of initial weight within 6 mo	51% of group A patients met weight loss goal compared with 13% and 9% in groups B and C, respectively.
Logue et al ⁵² REACH trial. Comparison of transtheoretical model–chronic disease intervention versus augmented usual care for obesity	665 Obese primary care patients in 15 practices in the United States	Augmented usual-care patients received dietary and exercise counseling every 6 mo. Asked to complete and provide dietary and exercise logs every 6 mo. Transtheoretical model–chronic disease patients received augmented usual-care intervention plus assessment for anxiety, depression, and binge eating every 6 mo; assessment of stages of change every 2 mo; and monthly telephone counseling. Study duration was 2 y.	Weight change after 2 y	No significant change in weight in either group after 2 y, nor any significant difference in mean weight change between groups.
Ely et al ⁵³ Pilot randomized trial using CCM in rural Kansas primary care practices	107 Overweight and obese patients in 3 rural practices in the United States	Usual-care group received weight loss educational materials at days 0, 90, and 180. CCM group received usual-care intervention plus CCM elements, including self-management support and telephone counseling. Study was 6 mo in duration.	Weight change and difference between groups at days 90 and 180	Mean weight change for CCM group was 2.0 kg (SD 3.5 kg) after 90 d compared with 1.1 kg (SD 3.7 kg) in usual-care group ($P=0.27$). Mean weight change for CCM group was 4.3 kg (SD 4.7 kg) after 180 d compared with 0.95 kg (SD 4.9 kg) in usual-care group ($P=0.01$).

REACH indicates Reasonable Eating and Activity to Change Health; CCM, chronic care model; and SD, standard deviation.

monthly meetings with a family physician only with orlistat treatment, or (C) monthly meetings with a dietician only with no drug treatment. Physicians received training in obesity management. All patients received a personal diet and individualized nutrition and physical activity goals at each visit. Patients in arm A met first with a family physician who described the program, then with a dietician. In follow-up sessions, the physician and dietician met jointly with each patient. Counseling by physicians was limited to discussing the use of orlistat and its side effects. Fifty-one percent of patients in arm A lost at least 5% of their starting weight compared with 13% and 9% of patients in arms B and C, respectively. Patients in arms A and B also demonstrated significant improvement in triglyceride and low-density lipoprotein cholesterol levels.

The Reasonable Eating and Activity to Change Health (REACH) trial was a 24-month, randomized 2-armed study

performed in 15 primary care practices.⁵² Participants in the augmented usual-care group were asked to provide dietary and exercise data every 6 months. They received 10 minutes of dietary counseling at each visit. Participants assigned to the transtheoretical model/chronic disease group received the same care as the augmented usual-care group together with formal assessments for anxiety, depression, and binge eating every 6 months and “stages of change” assessment of physical activity, portion control, dietary fat, and fruit and vegetable consumption every 2 months. Assessments were reviewed by a weight loss advisor who provided individualized telephone counseling monthly. Physicians received reports that summarized the progress of patients in the transtheoretical model/chronic disease group, as well as training on how to make use of the stages-of-change profiles and a stages-of-change flip chart for counseling during patients’ routine visits. After 24 months, there was no appreciable

mean weight loss in either group and no statistically significant mean change in weight between the 2 groups.

Ely et al⁵³ performed a 6-month, 2-armed trial in 3 rural practices in which a usual-care arm was compared with a strategy that included elements of the chronic care model. Chronic care model elements included clinical information systems in the form of an electronic registry that updated physicians on patients' progress and readiness to change behaviors. Physicians also received decision support in the form of National Institutes of Health obesity guidelines. Self-management support took the form of weight loss materials, pedometers, and diet/activity diaries. The primary counseling intervention used motivational interviewing and was delivered by trained counselors by telephone. Topics included relationship with food and body image, as well as dietary and physical activity behaviors. Each patient received 8 calls over 6 months. Patients in the chronic care model arm lost a mean of 4.3 kg after 180 days compared with 0.95 kg in the usual-care arm ($P=0.01$).

Summary

Only a small number of reports described practical collaborative approaches for busy settings. Strategies that included central planning and training, the chronic care model, and counseling in combination with medications demonstrated positive results.

3. Use of the Internet and Other Technologies

Overview

Great interest has emerged in technologies that have the potential to overcome the time and resource barriers that primary care clinicians face when trying to disseminate weight management interventions to large numbers of people. Few technology-supported weight loss interventions have actually been tested in the primary care setting, but there is hope that providers will one day be able to provide patients with effective weight loss interventions delivered via the Internet, mobile phone, or other devices. Our review includes published RCTs of Internet-based behavioral weight loss and weight maintenance studies. We also reviewed a small number of studies that make use of other technological tools.

Search Strategy

Our search strategy included the terms "computer assisted instruction" OR "Internet" OR "cellular phone" OR "hand-held" (among many others) in combination with "obesity" OR "obese." We searched the following databases: PubMed, CINAHL, PsycINFO, EMBASE, Cochrane CENTRAL, IEEE Xplore, and the New York Academy of Medicine Grey Literature Collection. Only papers published from 2002 to the present were reviewed.

For Internet-based and other technology-based studies, the present review was limited to RCTs that compared behavioral interventions for obesity delivered via the Internet with a control condition. Only studies that provided pretreatment and posttreatment data for ≥ 1 weight loss indices, including

change in body weight, BMI, or waist circumference, were selected for review.

Results

A total of 227 abstracts were identified. A total of 24 studies met our inclusion criteria and were included in the present review (18 weight loss trials and 6 weight maintenance trials). These studies are summarized in Table 3.

Internet-Based Studies

Of the Internet trials reviewed, intervention components included the following: (1) education about diet, physical activity, weight loss, and weight maintenance; (2) self-monitoring for a variety of health behaviors (ie, diet intake, physical activity) and outcomes (ie, body weight, BMI, and waist circumference); (3) individual goal setting for health behavior change; (4) motivation enhancement (typically facilitated online or through electronic communication by a counselor); and/or (5) peer social support.

Nine of the 18 trials^{55–57,59–58,62,70,72} reported significantly greater weight loss among participants randomized to Internet conditions than a control condition. Of these 9, however, 1 study reported findings only from participants who had fully completed the interventions (ie, not intention-to-treat analyses),⁶¹ and another reported outcomes for only 20% to 30% of participants because of extremely high attrition.⁵⁹ The 7 remaining positive trials reported that successful Internet intervention conditions contained elements of human contact (eg, e-mail or online discussion with a behavioral coach) and involved participants who were primarily obese rather than just overweight. Participants in 2 positive trials were relatively homogenous ($>80\%$ female and white),^{56,60} whereas participants in 2 others were more diverse (eg, $\approx 50\%$ male and 50% white).^{55,57} An additional 7 of the 18 trials reported no significant differences in weight loss between the Internet and control conditions,^{58,63–67,71} and the final 2 trials reported significantly greater weight loss among participants randomized to the control condition. The superior control condition was a self-directed weight loss manual in 1 study⁶⁸ and face-to-face counseling in another study.⁶⁹

With respect to the 6 trials of weight maintenance interventions, the authors of 3 trials reported no significant differences between Internet and control conditions.^{73,74,76} Results of the 3 other trials showed significantly greater weight maintenance among participants randomized to a face-to-face counseling program than those using Internet programs.^{76–78}

Our review of Internet-based studies suggests that under certain conditions, Internet interventions may be effective in facilitating weight loss among obese individuals. Several imitations were identified in the reviewed studies. First, although samples composed of at least 50% men were used in 5 trials,^{55,57,58,62,64} most studies enrolled a large majority of women. Further research is needed to determine whether weight loss and weight maintenance can be achieved via the Internet among men. Second, positive trials reported completer rather than intention-to-treat analyses.^{61,63,71,65} This compromises the value of randomization. Third, attrition

Table 3. Studies Included in Section 3: Use of the Internet and Other Technologies

Study/Description	Sample	Intervention/Control	Outcome Measures	Analysis/Results
Internet				
Bennett et al, 2010 ⁵⁵ : 12-wk RCT of Internet behavioral weight loss intervention in primary care	N=101→85 52.5% Male 50% White Age 54.4±8.1 y Weight 97.3±10.9 kg BMI 34.6±3.2 kg/m ² Systolic BP 137 mm Hg Diastolic BP 76 mm Hg Waist circumference: not reported Retention rate: 84%	Intervention: Targeted obesogenic behavior goals plus SM plus MI (baseline plus 6 wk) through Web site (n=51→43) Control: Usual care (n=50→42)	Primary outcome: Δ body weight at 12 wk Secondary outcomes: ΔBMI at 12 wk, BP, waist circumference	ITT (BOCF): Weight loss: I=-2.28±3.21 kg; C=0.28±1.87 kg (M diff=-2.56 kg; CI -3.60 to -1.53) BMI: I=-0.94±1.16 kg/m ² ; C=0.13±0.75 kg/m ² ; (M diff=-1.07 kg/m ² , CI -1.49 to -0.64; 95% CI -1.49 to -0.64) No change in BP or waist circumference
Gold et al, 2007 ⁵⁶ : 12-mo RCT of Internet behavioral weight loss intervention	N=124→88 Intervention: 77% Female 98% White Age 46.5±10.7 y Weight 92.0±15.7 kg BMI 32.3±3.9 kg/m ² Control: 86% Female 98% White Age 48.9±9.9 y Weight 90.2±14.1 kg BMI 32.5±4.2 kg/m ² Retention rate: 71%	Intervention: VTrim: Therapist-led online behavioral weight loss program (n=62→40) Control: eDiets: Online commercial weight loss self-help Web site (n=62→48)	Primary outcome: Δ Body weight at 6 and 12 mo	ITT (BOCF) and completer analysis: Δ Body weight at 6 mo: VTrim: -6.8±7.8 kg eDiets: -3.3±5.8 kg (P<0.01; ITT) Δ Body weight at 12 mo: VTrim: -5.1±7.1 kg eDiets: -2.6±5.3 kg (P<0.04; ITT)
Hunter et al, 2008 ⁵⁷ : 6-mo RCT of behavioral weight loss intervention	N=451→394 (US Air Force) 50% Female Intervention: Age 33.5±7.4 y 58% White Weight 87.4±15.6 kg BMI 29.4±3 kg/m ² Retention: 190 of 227 (84%) Control: Age 34.4±7.2 y 53% White Weight 86.6±14.7 kg BMI 29.3±3.0 kg/m ² Retention: 204 of 224 (91%) Overall retention rate: 87%	Intervention: 6-mo behavioral Internet therapy. Internet diaries, weekly feedback, MI (n=227→190) Control: Usual-care annual visit with primary care, access to services on the base (n=224→204)	Primary outcomes: Δ Body weight at 6 mo Secondary outcomes: Δ BMI, Δ % body fat, Δ waist circumference	ITT (BOCF): Δ body weight at 6 mo: I=-1.0±3.7 kg C=0.5±3.1 kg (I>C, P<0.01) Completer analysis: BMI: I=-0.5±1.4 kg/m ² C=0.2±1.1 kg/m ² (I>C, P<0.01) % Body fat: I=-0.4±3.1% C=0.6±2.9% (I>C, P<0.01) Waist circumference: I=-2.1±4.3 cm C=-0.4±3.8 cm (I>C, P<0.01)
Morgan et al, 2009 ⁵⁸ : 6-mo RCT of Internet behavioral weight loss intervention	N=65→44 100% Male Race: not reported Age 35.9±11.1 y BMI 30.6±2.8 kg/m ² Weight 99.1±12.8 kg Retention rate: 68%	Intervention: One in-person meeting with booklet and online resources through CalorieKing Web site (n=34→22) Control: One in-person meeting with booklet with weight loss advice (n=31→22)	Primary outcome: Δ Body weight at 3 and 6 mo	ITT (BOCF): Δ Body weight at 3 mo: I=-4.8 kg (CI -6.4 to -3.3) C=-3.0 kg (CI -4.5 to -1.4) (I=C, P=NS) Δ Body weight at 6 mo: I=-5.3 kg (CI -7.3 to -3.3) C=-3.5 kg (CI -5.5 to -1.4) (I=C, P=NS) Per-protocol analysis: Δ Body weight at 6 mo: Completers: -9.1 kg (CI -11.8 to -6.5) Noncompleters: -2.7 kg (CI -5.3 to -0.01) (Completers>Noncompleters, P<0.01)
Rother et al, 2006 ⁵⁹ : 6-wk RCT of Internet behavioral weight loss intervention	N=2862→585 Intervention: 83% Female 57% White Age 45.6±12.1 y Weight 92.2±14.4 kg BMI 33.0±3.8 kg/m ² Control: 83% Female 56% White Age 45.2±12.0 y BMI 31.1±3.9 kg Weight 92.5±14.3 kg/m ² Retention rate: 30% at 3-mo follow-up; 20% at 6-mo follow-up	Intervention: 6-wk Internet behavioral weight loss intervention plus peer social support plus expanded online materials (n=1475→306) Control: Web-based weight management information (n=1387→279)	Primary outcome: % Weight lost at 3 and 6 mo	LOCF: % Weight lost at 3 mo (response rate=30%): I=0.8±0.1% C=0.4±0.1% (I>C, P<0.01) % Weight lost at 6 mo (response rate=20%): I=0.9±0.1% C=0.4±0.1% (I>C, P<0.01)

(Continued)

Table 3. Continued

Study/Description	Sample	Intervention/Control	Outcome Measures	Analysis/Results
Tate et al, 2001 ⁶⁰ : 6-mo RCT of Internet behavioral weight loss intervention	N=91→65 89% Female Age 40.9±10.6 y BMI 29.0±3 kg/m ² Intervention: Weight 77.4±9.4 kg Waist circumference 98.5±9.4 cm Control: Weight 78.8±11.6 kg Waist circumference 98.4±10.2 cm Retention rate: 71%	Intervention: Internet behavioral weight loss including weekly online SM plus questions to therapist with tailored information and feedback plus peer social support (n=46→33) Control: Internet education plus online SM plus calorie restriction plus physical activity recommendations (n=45→32)	Primary outcomes: Δ Body weight and waist circumference at 3 and 6 mo Secondary outcomes: Change in physical activity and dietary intake	ITT (BOCF): Δ Body weight at 3 mo: I=-3.2±2.9 kg C=-1.0±2.4 kg (I>C, P<0.001) Δ Body weight at 6 mo: I=-2.9±4.4 kg C=-1.3±3.0 kg (I>C, P<0.04) Δ Waist circumference at 3 mo: I=-5.3±4.9 cm C=-2.1±3.9 cm (I>C, P<0.001) Δ Waist circumference at 6 mo: I=-4.6±5.5 cm C=-2.3±3.9 cm (I>C, P<0.02)
Turner-McGrievy et al, 2009 ⁶¹ : 12-wk RCT of Internet behavioral weight loss intervention	N=94→77 Intervention: 68% Female 85% White Age 37.7±11.8 y Weight 91.9±15.0 kg BMI 31.8±3.2 kg/m ² Control: 81% Female 78% White Age 39.6±12.2 y Weight 89±13.6 kg BMI 31.4±4.1 kg/m ² Retention rate: 82%	Intervention: Enhanced podcast based on user control theory (n=48→41) Control: Control podcast (n=46→36)	Primary outcomes: Δ Body weight at 12 wk Secondary outcomes: Δ BMI at 12 wk; change in physical activity and dietary intake	Completer analysis: Δ Body weight at 12 wk: I=-2.9±3.5 kg C=-0.3±2.1 kg (I>C, P<0.001) Δ BMI at 12 wk: I=-1.0±1.2 kg/m ² C=-0.1±0.7 kg/m ² (I>C, P<0.001) Change in physical activity (↑ vigorous activity): I=0.8±0.9 d/wk C=-0.4±1.4 (I>C, P<0.01) Diet (↑ vegetable intake): I=0.4±0.7 servings C=0.01±0.4 servings (P<0.05) Diet (↑ fruit intake) I=0.2±0.9 servings C=-0.2±0.7 servings (P<0.05)
Van Wier et al, 2009 ⁶² : ALIFE @ Work: 6-mo RCT of behavioral weight loss intervention	N=1386→982 67% Male Age 43±8.6 y BMI 29.6±3.5 kg/m ² Intervention I1: Weight 92.8±14.3 kg Waist circumference 101.5±10.3 cm Intervention I2: Weight 93.4±14.1 kg Waist circumference 102.6±10.0 cm Control: Weight 92.9±13.6 kg Waist circumference 101.5±9.8 cm Retention rate: 71%	Intervention: I1: 6-mo Internet intervention including 10 modules on diet and physical activity plus counselor e-mail feedback (n=464→329) I2: 6-mo telephone intervention; 10 telephone-based modules for diet and physical activity plus counselor sessions every 2 wk (n=462→332) Control: Information control group receiving free diet and physical activity brochures (n=460→321)	Primary outcomes: Δ Body weight at 6 mo Secondary outcomes: Δ Waist circumference	Imputed data sets: Δ Body weight at 6 mo: I1=-0.6 kg (CI -1.3 to -0.01 kg) I2=-1.5 kg (CI -2.2 to -0.8 kg) C=not reported (I1 and I2>C, P<0.05) Completers: Δ Body weight at 6 mo: I1=-1.1 kg (CI -1.7 to -0.5 kg) I2=-1.6 kg (CI -2.2 to -1.0 kg) C=not reported (I1 and I2>C, P<0.01) Δ Waist circumference at 6 mo: I1 (n=235)=-1.2 cm (CI -2.1 to -0.4 cm) I2 (n=236)=-1.9 cm (CI -2.7 to -1.0 cm) C (n=231)=not reported (I1 and I2>C, P<0.01)
Booth et al, 2008 ⁶³ : 12-wk RCT of Internet behavioral weight loss intervention	N=73→53 80% Female 81% White Intervention: Age 46.4±12.5 y BMI 29.0±2.3 kg/m ² Weight 80.5±8.6 kg Waist circumference 95.6±8.4 cm Control: Age 46.2±9.2 y BMI 29.9±2.7 kg/m ² Weight 84.3±11.3 kg Waist circumference 96.9±10.0 cm Retention rate: 73%	All participants received 1 face-to-face session for behavioral weight loss, then were randomized to 1 of 2 conditions: Intervention: Online program with diet plus physical activity advice and goal setting (n=40→27) Control: Online program with physical activity advice and goal setting (n=33→26)	Primary outcome: Δ Body weight at 12 wk Secondary outcomes: Δ BMI at 12 wk; Δ waist circumference at 12 wk; Δ physical activity; Δ dietary intake	Completer analysis: Δ Body weight at 12 wk: I=-0.7±2.0 kg C=-1.9±3.1 kg (I=C, P=NS) Δ BMI at 12 wk: I=-0.3±0.75 kg/m ² C=-0.67±1.1 kg/m ² (I=C, P=NS) Δ Waist circumference at 12 wk: I=-3.2±2.9 cm C=-4.5±4.5 cm (I=C, P=NS) Δ Physical activity at 12 wk: I=+3526±3010 steps/d C=+3148±4214 steps/d (I=C, P=NS) Δ Dietary intake at 12 wk: I=-1813±730 kJ C=+131±760 kJ (I=C, P<NS)
Lubans et al, 2009 ⁶⁴ : 6-mo RCT of Internet behavioral weight loss intervention	N=65→54 Males only Race: not reported Age 35.9±11.1 y Weight 99.1±12.8 kg BMI 30.6±2.8 kg/m ² Retention rate: 83%	Intervention: In-person meeting with booklet plus CalorieKing Web site access (n=34→not reported) Control: In-person meeting with booklet with weight loss advice (no further support) (n=31→not reported)	Primary outcome: Body weight at 6 mo	ITT (LOCF): I=93.1±15.2 kg C=95.1±13.8 kg (I=C, P=NS)

(Continued)

Table 3. Continued

Study/Description	Sample	Intervention/Control	Outcome Measures	Analysis/Results
McConnon et al, 2007 ⁶⁵ : 12-mo RCT of Internet behavioral weight loss intervention	N=221→131 77% Female 95% White Age 45.8±10.6 y Weight 98.4±17.4 kg BMI 34.4 (31.9–38.7) kg/m ² Retention rate: 59%	Intervention: Internet Web site with tools, advice and support (n=111→54) Control: Usual care (n=110→77)	Primary outcome: Δ BMI at 12 mo Secondary outcome: Change in lifestyle behaviors	Completer analysis: (also had LOCF and BOCF results to substantiate completer analysis) Δ BMI at 12 mo: I=−5.9 to +3.8 kg/m ² C=−8.1 to +3.5 kg/m ² M difference=0.3 kg/m ² (CI −0.5 to 1.0 kg/m ² , P=NS) Δ Physical activity: I=not reported C=not reported Mean group difference=0.1 (CI −0.3 to 0.4, P=NS) Lifestyle and dietary habits: I=C (P=NS)
Micco et al, 2007 ⁶⁶ : 12-mo RCT of Internet behavioral weight loss intervention	N=123→77 Intervention: 89% Female 100% White Age 47.1±11.1 y BMI 31.0±4.1 kg/m ² Weight 86.1±12.8 kg Control: 77% Female 98% White Age 46.5±10.7 y BMI 32.3±3.9 kg/m ² Weight 92.0±15.7 kg Retention rate: 63%	Intervention: Internet behavioral weight loss program plus minimal in-person support (n=61→38) Control: Internet behavioral weight loss only (n=62→39)	Primary outcome: Δ Body weight at 6 and 12 mo	ITT (BOCF): Δ Body weight at 6 mo: I=−5.1±4.8 kg C=−6.8±7.8 kg (I=C, P=NS) Δ Body weight at 12 mo: I=−3.5±5.1 kg C=−5.1±7.1 kg (I=C, P=NS)
Webber et al 2008 ⁶⁷ : 16-wk RCT of Internet behavioral weight loss intervention	N=66→66 100% Female 86% White Age 50±9.9 y Intervention: Weight 82.1±13.6 kg BMI 30.8±4.0 kg/m ² Control: Weight 82.5±8.4 kg BMI 31.4±3.3 kg/m ² Retention rate: 100%	Intervention: In-person session plus 16-wk access to Internet program based on DPP plus weekly Web chat plus weekly online motivational group meetings (n=33) Control: In-person session plus 16-wk access to Internet program based on DPP plus SM diary plus monitored weight weekly plus information (n=33)	Primary outcome: Body weight at 16 wk Secondary outcomes: Change in physical activity and dietary intake	Body weight at 16 wk: I=−3.7±4.5 kg C=−5.2±4.72 kg (I=C, P=NS) Δ Physical activity (↑ caloric expenditure): I=1585±1691 kcal/d C=1087±2389 kcal/d (I=C, P=NS) Diet (↓ caloric intake): I=253±1034 kcal/d C=488±484 kcal/d (I=C, P=NS)
Womble et al, 2004 ⁶⁸ : 12-mo RCT of Internet behavioral weight loss intervention	N=47→31 100% female Age 43.7±10.2 y BMI 33.5±3.1 kg/m ² Intervention: Weight 93.4±12.6 kg Control: Weight 87.9±10.8 kg Retention rate: 66%	Intervention: 12-mo membership to eDiets.com. Provides customized grocery lists plus social support via message boards plus e-mail with other users plus tailored activity recommendations plus meal plans. Asked to log on daily. (n=23→15) Control: Weight loss manual. Encouraged to keep daily diary. (n=24→16)	Primary outcome: Δ Body weight at 4 and 12 mo Secondary outcomes: Change in dietary intake	LOCF: Δ Body weight at 4 mo: I=−0.7±2.7 kg C=−3.0±3.1 kg (I<C, P<0.02) Δ Body weight at 12 mo: I=−0.8±3.6 kg C=−3.3±4.1 kg (I<C, P<0.04) Eating behavior (restraint, disinhibition, hunger) (I=C, P=NS)
Harvey-Berino et al, 2010 ⁶⁹ : 6-mo RCT of Internet behavioral weight loss intervention	N=481→ 462 93% Female 28% black Age 46.6±9.9 y Weight 97.0±17.7 kg BMI 35.7±5.6 kg/m ² Retention rate: 96%	Intervention: 6-mo behavioral weight loss program (in-person, online, or hybrid formats) containing educational material, SM of diet intake and physical activity, graded goals for physical activity. I1: In-person (n=158→150) I2: Internet (n=161→159) I3: Hybrid (n=162→153)	Primary outcome: Δ Body weight at 6 mo Secondary outcome: Percent achieving 5% and 7% weight loss	ITT (BOCF): Δ Body weight at 6 mo: I1=−7.6±6.2 kg I2=−5.5±5.6 kg I3=−5.7±5.5 kg (I1>I2 or I3, P<0.01) 5% Weight loss: I1=62.0% I2=52.2% I3=55.6% (I1=I2=I3, P=NS) 7% Weight loss: I1=53.2% I2=37.3% I3=42.0% (I1>I2, P<0.01)

(Continued)

Table 3. Continued

Study/Description	Sample	Intervention/Control	Outcome Measures	Analysis/Results
Tate et al, 2006 ⁷⁰ : 6-mo RCT of Internet behavioral weight loss intervention	N=192→155 84% Female Age 49.2±9.8 y BMI 32.7±3.5 kg/m ² Intervention: Automatic feedback: 90% White Weight 89.0±13.2 kg Human e-mail feedback: 87% White Weight 89.0±13.0 kg Control: 91% White Weight 88.3±13.9 kg Retention rate: 81%	All participants received 1 face-to-face session for weight loss, then were randomized to 1 of 3 conditions Interventions: I1: Automatic feedback generated by computer (n=61→44) I2: Human e-mail feedback (n=64→52) Control: No further contact (n=67→59)	Primary outcomes: Δ Body weight at 3 and 6 mo Secondary outcomes: Changes in physical activity and dietary intake	BOCF plus completer analysis: Δ Body weight at 3 mo: I1=-4.1±4.3 kg I2=-5.3±4.2 kg C=-2.3±3.4 kg (I1 and I2>C, P<0.01) Δ Body weight at 6 mo: I1=-3.5±5.4 kg I2=-5.9±6.2 kg C=-2.3 kg±5.4 kg (I2>C, P<0.001) Completer analysis: Δ Physical activity at 3 mo: I1=+314 kcal/wk I2=+253 kcal/wk C=+147 kcal/wk (I1=I2=C, P=NS) Δ Physical activity at 6 mo: I1=+124 kcal/wk I2=+93 kcal/wk C=-124 kcal/wk (Note: Physical activity increased across groups at 3 mo, but decreased by 6 mo; P<0.01) Δ Dietary intake (% fat from calories) at 6 mo: I1=-3.5 %/d I2=-5.7 %/d C=-1.1 %/d (I2>C, P<0.01)
Carr et al, 2008 ⁷¹ : 4-mo RCT of Internet lifestyle intervention	N=67→32 77% Female Race: not reported Intervention: Age 41.4±3.7 y BMI 32.3±1.3 kg/m ² Weight 91.1±5.0 kg Waist circumference 100.6±2.4 cm Control: Age 49.4±1.7 y BMI 30.6±0.8 kg/m ² Weight 83.3±6.6 kg Waist circumference 99.2±2.2 cm Retention rate: 48%	Intervention: 4-mo self-guided Internet lifestyle intervention including SM of behaviors, stimulus control, social support (with virtual partner), reinforcement strategies. (n=37→14) Control: Wait-list control (n=30→18)	Primary outcome: Change in physical activity at 4 mo Secondary outcome: Change in waist circumference at 4 mo	Completer analysis: Change in physical activity at 4 mo: I=+1384 steps/d C=+816 steps/d (I=C, P=NS) Change in waist circumference at 4 mo: I=96.6±2.7 cm C=99.8±2.1 cm (I=C, P=NS)
Tate et al, 2003 ⁷² : 12-mo RCT of Internet behavioral weight loss	N=92→77 89% Female Age 48.5±9.4 y Intervention: 89% White BMI 32.5±3.8 kg/m ² Weight 86.2±14.3 kg Waist circumference 108±12.4 cm Control: 89% White BMI 33.7±3.7 kg/m ² Weight 89.4±12.6 kg Waist circumference 111±11.7 cm Retention rate: 84%	All participants received a 1-h face-to-face session of behavioral weight loss strategies Intervention: 12-mo Internet behavioral weight loss intervention including SM of weight, tutorials, weight loss resources plus e-counseling with interventionist (n=46→38) Control: 12-mo access to Internet weight loss resources (as described above) (n=46→39)	Primary outcome: Change in weight at 12 mo Secondary outcome: Change in waist circumference at 12 mo	BOCF: Change in weight at 12 mo: I=-4.4±6.2 kg C=-2.0±5.7 kg (I>C, P<0.05) Change in waist circumference at 12 mo: I=-7.2±7.5 cm C=-4.4±5.7 cm (I>C, P=0.05)
Cussler et al, 2008 ⁷³ : 12-mo RCT of Internet weight maintenance intervention	N=135→111 100% Female Race: Not reported Age 48.2±4.4 y Weight 83.7±11.8 kg BMI 30.7±3.6 kg/m ² Energy expenditure: 128±124 kcal/d Energy intake: 1952±506 kcal/d Retention rate: 82%	All participants completed a 16-wk behavioral weight loss intervention, then were randomized to 1 of 2 conditions. Intervention: Internet SM of weight, diet, and physical activity (n=66→52) Control: Self-directed weight maintenance without further contact or resources (n=69→59)	Primary outcome: Δ Body weight at 12 mo Secondary outcomes: Δ BMI at 12 mo; energy expenditure at 12 mo; energy intake at 12 mo	BOCF: Δ Body weight at 12 mo: I=+0.4±5.0 kg C=+0.6±4.0 kg (I=C, P=NS) Δ BMI at 12 mo: I=1.3±1.8 kg/m ² C=-0.9±1.9 kg/m ² (I=C, P=NS) Δ Energy expenditure at 12 mo: I=+55±301 kcal/d C=+62±279 kcal/d (I=C, P=NS) Δ Energy intake at 12 mo: I=123±390 kcal/d C=171±399 kcal/d (I=C, P=NS)

(Continued)

Table 3. Continued

Study/Description	Sample	Intervention/Control	Outcome Measures	Analysis/Results
Harvey-Berino et al, 2004 ⁷⁴ : 12-mo RCT of behavioral weight maintenance intervention	N=232→176 82% Female 100% White Age 45.8±8.9 y BMI 31.8±4.1 kg/m ² Retention rate: 76%	Intervention: 6-mo interactive television weight loss program, then randomized to 1 of 3 maintenance conditions: M1: Frequent in-person support (n=77→61) M2: Minimal in-person support (n=78→63) M3: Internet support (n=77→52)	Primary outcomes: Δ Body weight at 6, 12, and 18 mo	ITT (BOCF): Δ Body weight at 6 mo M1=-7.6±5.0 kg M2=-7.6±4.9 kg M3=-8.4±6.1 kg (I1=I2=I3, P=NS) Δ Body weight at 12 mo: not reported Δ Body weight at 18 mo M1=-5.1±6.5 kg M2=-5.5±8.9 kg M3=-7.6±7.3 kg (M1=M2=M3, P=NS)
Harvey-Berino et al, 2002 ⁷⁵ : 22-wk pilot RCT of behavioral weight maintenance	N=44→41 80% Female 100% White Age 46±7.4 y Weight 95.8±16.5 kg BMI 33.7±4.6 kg/m ² Retention rate: 93%	Intervention: 15-wk behavioral weight loss program, then randomized to 1 of 3 conditions. Maintenance conditions: M1: In-person therapist (n=14→14) M2: Internet therapist (n=15→13) Control: No further treatment (n=15→14)	Primary outcome: Δ Body weight at 22 wk	Completer analysis: Δ Body weight at 22 wk: M=-1.6 kg across all groups (mean difference NS)
Harvey-Berino et al, 2002 ⁷⁶ : 12-mo RCT of Internet weight maintenance intervention	N=122→90 85% Female BMI 32.2±4.5 kg/m ² Age 48.4±9.6 y Intervention-M1: 100% White Weight 86.5±10.1 kg Intervention-M2: 97.4% White Weight 90.2±13.9 kg Intervention-M3: 96.7% White Weight 89.3±15.3 kg Retention rate: 82% at 6 mo 74% at 18 mo	Intervention: 6-mo behavioral weight loss program plus 12-mo maintenance (in-person versus Internet) Maintenance conditions: M1: Frequent in-person support (n=41→32) M2: Minimal in-person support (n=41→28) M3: Internet support only (n=40→30)	Primary outcomes: Δ Body weight at 6 and 12 mo Secondary outcomes: Δ Energy intake; Δ energy expenditure	ITT and completer analysis (no difference in results); results presented as completer. Δ Body weight at 6 mo M1=0.0±4.0 kg M2=not reported M3=2.2±3.8 kg (M1>M3, P<0.05) Δ Body weight at 12 mo M1=-10.4±6.3 kg M2=-10.4±9.3 kg M3=-5.7±5.9 kg (M3<M1 or M2, P<0.05) Δ Energy intake at 6 mo M=-2189±2691 kJ/d (M1=M2=M3, P=NS) Δ Energy expenditure at 6 mo: M=3951±8150 kJ/wk (M1=M2=M3, P=NS)
Wing et al, 2006 ⁷⁷ : 18-mo RCT of Internet behavioral intervention for weight maintenance	N=314→291 Race: not reported Internet: 81% Female Age 50.9±9.3 y Weight 76.0±16.4 kg BMI 28.1±4.6 kg/m ² Weight loss from highest weight in prior 2 y 19.2±11.1 kg Face-to-face: 80% Female Age 51.0±10.3 y Weight 78.6±17.1 kg BMI 28.7±4.7 kg/m ² Weight loss from highest weight in prior 2 y 20.0±11.6 kg Control: 83% Female Age 52.0±10.8 y Weight 78.8±14.8 kg BMI 29.1±5.0 kg/m ² Weight loss from highest weight in prior 2 y 18.6±10.3 kg Retention rate: 93%	Internet: M1: 18 mo of Internet-based SM of weight plus problem solving of diet intake and physical activity (n=104→101) Face-to-face M2: 18 mo of in-person SM of weight plus problem solving of diet intake and physical activity (n=105→92) Control: Assessment only at 6, 12, and 18 mo (n=105→98)	Primary outcomes: Δ Body weight at 6, 12, and 18 mo	ITT: Δ Body weight at 6 mo M1=1.2±4.2 kg M2=-0.02±4.3 kg C=1.5±3.6 kg (M2>C, P<0.05) Δ Body weight at 12 mo M1=3.1±7.5 kg M2=1.3±6.0 kg C=3.0±5.7 kg (M1=M2=C, P=NS) Δ Body weight at 18 mo M1=4.7±8.6 kg M2=2.5±6.7 kg C=4.9±6.5 kg (M2>C, P<0.05)

(Continued)

Table 3. Continued

Study/Description	Sample	Intervention/Control	Outcome Measures	Analysis/Results
Svetkey et al, 2008 ⁷⁸	N=1032→964 63% Female 38% Black Age 55.6±8.7 y Weight 96.7±16.6 BMI 34.1±4.8 Retention rate: 93%	Intervention: 6-mo group-based behavioral intervention plus 30-mo maintenance (personal contact, Internet, or self-directed), then randomized to 1 of 3 maintenance conditions: M1: unlimited access to interactive Web site (348→323) M2: personal contact (telephone and face-to-face) with an interventionist (342→321) Control: Printed lifestyle guidelines and recommendations (342→320)	Primary outcome: Δ Body weight at 30 mo Secondary outcomes: Total energy intake (kcal/d); moderate-vigorous physical activity (min/wk)	ITT (imputed data set): Δ Body weight at 30 mo M1=−0.3 kg (CI=1.2–0.6 kg) M2=−1.5 kg (CI=2.4–0.6 kg) C=−1.2 kg (CI=2.1–0.3 kg) (M2>M1 and C, $P<0.01$) Total energy intake M1=326 kcal/d M2=272 kcal/d C=231 kcal/d (M1=M2=C, $P=NS$) Moderate-vigorous physical activity M1=−35 min/wk M2=−33 min/wk C=−32 min/wk (M1=M2=C, $P=NS$)
Handheld devices				
Haapala et al, 2009 ⁷⁹	N=125→85 Race: Not reported Intervention: 79% Female Age 38.1±4.7 y BMI 30.6±2.7 kg/m ² 73% Retention at 12 mo Control: 76% Female Age 38.0±4.7 y BMI 30.4±2.8 kg/m ² 65% Retention at 12 mo	Intervention: Mobile telephone generating text messages, and tailored-response text message after receiving participants' messages (n=62→45) Control: On waiting list until after 12-mo study period (n=62→40)	Primary outcome: Δ % Weight loss at 12 mo	Completers analysis: Change in 12-mo weight Experimental group: 5.4±5.8% Control group: 1.3±6.5% ($P<0.01$)
Patrick et al, 2009 ⁸⁰	N=78→65 Intervention: 76% Female 76% White Age 38.1±4.7 y BMI 30.6±2.7 kg/m ² 84.6% Retention at 4 mo Control: 84% Female 75% White Age 42.4±7.5 y BMI 33.5±4.5 kg/m ² 82.1% Retention at 4 mo	Intervention: Tailored and interactive text messaging through mobile telephones, augmented and weekly reporting of weight (n=39→33) Control: Monthly mailing of printed education materials (n=39→32)	Primary outcome: Δ Weight loss at 4 mo	Change in 4-mo weight Intervention group: 3.16% Control group: 1.01% (group difference −1.97 kg, CI −0.34 to −3.60 kg; $P<0.02$)
Burke et al, 2011 ³⁰ : A 24-mo RCT of behavioral intervention examining effect of 3 approaches to SM on weight loss and SM adherence	N=210 PDA (n=68→64) 85.3% Women 80.9% White Age 46.7±9.2 y BMI 34.9±4.6 kg/m ² 94.1% Retention at 6 mo PDA plus daily feedback (n=70→65) 84.3% Women 78.6% White Age 46.4±9.5 y BMI 34.8±4.6 kg/m ² 92.9% Retention at 6 mo Paper diary (n=72→63) 84.7% Women 76.4% White Age 47.4±8.5 y BMI 33.4±4.5 kg/m ² 87.5% Retention at 6 mo	All subjects received a 24-mo behavioral weight loss program Paper diary: Use paper diary for SM diet and exercise PDA: Use PDA with dietary and exercise software; PDA includes date and time stamp to measure adherence to SM PDA plus feedback: Use PDA for SM, automated message delivered daily and tailored to diary entries	Δ % Weight loss at 6 mo	ITT analysis 6-mo weight Δ : Paper diary: 5.3±5.9% PDA: 5.5±7.0% PDA plus feedback: 7.3±6.6% ($P<0.12$) Proportion of each group that achieved 5% weight loss (compared with PDA plus feedback 63%): Paper record: 46% ($P<0.05$) PDA: 49% ($P<0.05$) Median % adherence to SM: Paper record: 55% PDA: 80% PDA plus feedback: 90% ($P<0.001$)

(Continued)

Table 3. Continued

Study/Description	Sample	Intervention/Control	Outcome Measures	Analysis/Results
Study reporting use of BodyMedia arm band for exercise feedback				
Polzien et al, 2007 ⁸¹ : A 3-mo RCT of behavioral intervention testing to examine the efficacy of adding a technology-based program to an in-person behavioral weight loss intervention	N=57 98.3% Women; group-specific sex information not provided SBWP (n=19→16) 63.2 % White Age 40.2±8.0 y BMI 33.6±2.7 kg/m ² 84.2% Retention at 3 mo INT-TECH (n=19→16) 63.2 % White Age 41.3±8.3 y BMI 33.4±2.8 kg/m ² 84.2% Retention at 3 mo CON-TECH (n=19→18) 57.9 % White Age 42.6±10.0 y BMI 32.7±2.7 kg/m ² 94.7% Retention at 6 mo	SBWP: 7 Individual sessions over 12 wk, calorie and exercise goals, paper diary for diet and exercise SM INT-TECH and CON-TECH: SenseWear Pro Armband to monitor energy expenditure and an Internet-based program to monitor eating behaviors. These features were used by INT-TECH subjects during weeks 1, 5, and 9 and by CON-TECH subjects weekly throughout the intervention.	Δ Weight loss at 3 mo	ITT analysis 3-mo. weight Δ: SBWP: 4.1±2.8 kg INT-TECH: 3.4±3.4 kg CON-TECH: 6.2±4.0 kg (P<0.05)

RCT indicates randomized controlled trial; BMI, body mass index; BP, blood pressure; SM, self-monitoring; MI, motivational interviewing; C, control; M diff, mean difference; CI, confidence interval; I, intervention; ITT, intention to treat; BOCF, baseline observation carried forward; NS, not significant; LOCF, last observation carried forward; DPP, Diabetes Prevention Program; PDA, personal digital assistant; SBWP, standard in-person behavioral weight control program; INT-TECH, intermittent technology-based program; and CON-TECH, continuous technology-based program.

rates in some studies were high. Twelve trials reported attrition rates greater than 20% (ranging from 24% to 80%),^{56,58–60,62,63,65,66,68,71,74,75} which compromises the power of the studies and the certainty with which any conclusions can be drawn. Finally and most importantly, a considerable amount of heterogeneity existed among the intervention components included in these trials. The Internet is not an intervention; it is a vehicle through which behavioral interventions can be delivered. It holds considerable promise because it enables individuals to have access to empirically supported interventions that may not otherwise be available in their community. We are unable, however, to draw causal inferences from these data about the specific behavioral mechanisms that are responsible for facilitating weight loss in Internet-based interventions. Future research that is guided by relevant behavioral theory may shed light on the optimal manner in which to deliver intensive behavioral interventions via the Internet.

Handheld and Other Devices for Use in Behavioral Weight Loss Interventions

We defined handheld devices as personal digital assistants (PDAs), mobile phones, pedometers, accelerometers, and armbands that record energy expenditure. Thirteen studies were identified, and of these, 4 met our inclusion criteria (Table 3). Studies were excluded because they did not report weight loss outcomes (n=3),^{82–84} did not use a randomized controlled design (n=4),^{85–88} or the phones used were standard landline phones (n=2).^{49,89} All 4 studies enrolled primarily white women and were conducted in the community.

Two studies used mobile phones.^{79,80} One study, conducted in Finland, compared a smart phone text-messaging-delivered weight loss intervention to a control group

that received no intervention.⁷⁹ Based on a dieter’s daily weight and weight loss targets, the program sent text messages designed to promote weight loss by informing patients of weight and daily calorie goals and by providing general advice, such as limiting the consumption of high-fat foods, high-sugar foods, and alcohol and increasing physical activity. Although the experimental group lost more weight than the control group (4.5 versus 1.1 kg) over 12 months, analysis was performed only on study completers. Attrition was high at 27% and 35% of the experimental and control groups, respectively.

Patrick and colleagues⁸⁰ described a 16-week RCT that compared the provision of written material monthly with an intervention that included personalized Short Message Service and Multimedia Message Service. The Short Message Service was augmented by printed materials focused on behavioral strategies for weight loss and brief monthly phone calls from a health counselor. Tailoring of the Short Message Service messages involved adjusting the frequency and timing of message delivery according to the participants’ preferences. Adherence, measured by subject response to the messages, was 100% the first week and declined to ≈66% by week 16. At 16 weeks, the intervention group lost a statistically significant 3.16% of baseline weight compared with 1.01% in the control group.

Burke and colleagues³⁰ conducted a 24-month RCT of a standard behavior intervention for weight loss in which 210 participants (85.3% women and 80.3% white) were randomized to 1 of 3 approaches to self-monitoring: paper record, PDA with dietary and exercise software (PDA), and a PDA with the same software plus delivery of a daily message (feedback) tailored to what had been entered in the PDA (PDA plus feedback). After 6 months, 63% of PDA-plus-feedback group participants had achieved a 5% weight loss

compared with 46% of the paper record group and 49% of the PDA group. The differences between the PDA-plus-feedback and the paper and PDA groups were significant, but the differences between the PDA and paper groups were not. Adherence to self-monitoring was statistically significantly higher in the PDA groups than in the paper group. These findings suggest that mobile devices may be useful tools for self-monitoring as part of standard behavior interventions for weight loss.

We reviewed 1 study that used the SenseWear Pro Armband, a device that tracks energy expenditure.⁸¹ This 3-group, 12-week RCT of 57 subjects compared standard in-person behavior treatment with continuous or intermittent use of the armband to monitor energy expenditure, along with an Internet program to monitor energy intake. The group that used the armband continuously lost significantly more weight on average (6.2 kg) than the group that used it intermittently (3.4 kg) or the control group that received standard in person-treatment (4.1 kg). The armband device shows promise in self-monitoring and encouragement of physical activity, but it needs to be evaluated among more patients and for a longer duration as a tool for managing obesity.

With the exception of the PDA study, the studies of technologies other than the Internet were pilot or feasibility studies and thus had limited sample size and were of limited duration. Although the findings are promising, longer studies with a larger and more diverse sample are needed before definitive conclusions can be drawn. Two of the studies are being replicated on a large scale at present.^{80,81}

The use of electronic health records is becoming more widespread.⁹⁰ We did not, however, find studies that met our inclusion criteria that made explicit use of electronic health records to deliver obesity interventions.

Summary

1. The Internet shows promise as a tool to promote weight loss among obese individuals (BMI >30 kg/m²). Further research is needed to determine its relative effectiveness in other specific segments of the population, including men. The available data do not support the use of Internet interventions for weight maintenance.
2. It is premature to draw conclusions about the effectiveness of mobile phones as a weight loss tool. There is some evidence for the usefulness of mobile devices (including PDAs) to promote self-monitoring of diet and physical activity habits and weight loss. The effectiveness of both technologies in promoting weight loss needs further study.

4. Conclusions, Recommendations, and Future Directions

In general, more evidence is needed to support specific strategies for discussing weight, incorporating collaborative approaches for weight management, and using technological tools, including the Internet. We also believe in general that because many weight management interventions involve understanding and applying detailed and sometimes complex

information by patients, the health literacy of patients should be taken into account in the design and selection of interventions. Our recommendations are based on the limited evidence we found:

1. Discussions of weight should be performed in a non-judgmental, respectful, and unhurried manner.
2. Readiness and self-efficacy to change behaviors should be assessed before weight loss strategies are initiated, and this information should be factored into decisions about what type of approach to use.
3. Validated tools such as the Eating Pattern Questionnaire, the Starting the Conversation tool, and the WAVE and REAP-S tools should be used to assess behaviors that contribute to excess body weight gain.
4. Central planning and training should be incorporated into collaborative approaches that involve physicians, nurses, or other providers.
5. Studies of Internet and other technologies for weight loss have shown promise, but at this time, there is insufficient evidence to make recommendations about their use in busy clinical settings.

We have prioritized areas for future research based on significant gaps in the literature:

1. There is a need for larger studies, both those that include technologically based interventions and those that do not, that enroll a diverse spectrum of overweight and obese patients in terms of sex, race, and socioeconomic status. Latino subjects and men, in particular, are underrepresented in obesity studies to date. There is also a need to investigate the specific features of technologically based interventions (eg, content, format, device) that make such interventions successful in promoting weight loss.
2. Because attrition rates from technology-based studies are very high, there is a need to develop effective strategies to keep patients engaged in using technology tools for the long-term.
3. Further evaluation of collaborative approaches (eg, approaches involving centralized planning, approaches involving nurses in intervention delivery) in general is needed. In particular, larger studies of longer duration are needed to evaluate the effectiveness of the chronic care model as a framework for weight management interventions.
4. Use of electronic health records is increasing, and there is a need to explore the use of these valuable tools, not only for identification and assessment of obesity but also for the delivery of obesity interventions. The STOP (Strategies to Overcome and Prevent) Obesity Alliance research team has also emphasized the usefulness of electronic health records in the care of obese patients.⁹¹

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This table represents the relationships of writing group members that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all members of the writing group are required to complete and submit. A relationship is considered to be "significant" if (1) the person receives \$10 000 or more during any 12-month period, or 5% or more of the person's gross income; or (2) the person owns 5% or more of the voting stock or share of the entity, or owns \$10 000 or more of the fair market value of the entity. A relationship is considered to be "modest" if it is less than "significant" under the preceding definition.

†Significant.

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*Modest.

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KEY WORDS: AHA Scientific Statements ■ education ■ nutrition ■ obesity ■ overweight ■ primary care ■ Internet ■ technology

New and Emerging Weight Management Strategies for Busy Ambulatory Settings: A Scientific Statement From the American Heart Association Endorsed by the Society of Behavioral Medicine

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