

Efficacy of Commercial Weight-Loss Programs

An Updated Systematic Review

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Background: Commercial and proprietary weight-loss programs are popular obesity treatment options, but their efficacy is unclear.

Purpose: To compare weight loss, adherence, and harms of commercial or proprietary weight-loss programs versus control/education (no intervention, printed materials only, health education curriculum, or <3 sessions with a provider) or behavioral counseling among overweight and obese adults.

Data Sources: MEDLINE and the Cochrane Database of Systematic Reviews from inception to November 2014; references identified by program staff.

Study Selection: Randomized, controlled trials (RCTs) of at least 12 weeks' duration; prospective case series of at least 12 months' duration (harms only).

Data Extraction: Two reviewers extracted information on study design, population characteristics, interventions, and mean percentage of weight change and assessed risk of bias.

Data Synthesis: We included 45 studies, 39 of which were RCTs. At 12 months, Weight Watchers participants achieved at least 2.6% greater weight loss than those assigned to control/education. Jenny Craig resulted in at least 4.9% greater weight loss at 12 months than control/education and counseling. Nutri-

system resulted in at least 3.8% greater weight loss at 3 months than control/education and counseling. Very-low-calorie programs (Health Management Resources, Medifast, and OPTIFAST) resulted in at least 4.0% greater short-term weight loss than counseling, but some attenuation of effect occurred beyond 6 months when reported. Atkins resulted in 0.1% to 2.9% greater weight loss at 12 months than counseling. Results for SlimFast were mixed. We found limited evidence to evaluate adherence or harms for all programs and weight outcomes for other commercial programs.

Limitation: Many trials were short (<12 months), had high attrition, and lacked blinding.

Conclusion: Clinicians could consider referring overweight or obese patients to Weight Watchers or Jenny Craig. Other popular programs, such as Nutrisystem, show promising weight-loss results; however, additional studies evaluating long-term outcomes are needed.

Primary Funding Source: None. (PROSPERO: CRD4201-4007155)

Ann Intern Med. 2015;162:501-512. doi:10.7326/M14-2238 www.annals.org
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Two thirds of U.S. adults are overweight or obese (1), and excess body weight increases the risk for hypertension and type 2 diabetes mellitus (2). Losing weight can prevent the development or lead to improved control of these chronic conditions (3, 4). Most Americans (63%) have seriously attempted to lose weight at some point in their lives, and 29% report currently trying to lose weight (5). In 2014, Americans were expected to spend \$2.5 billion on commercial or proprietary weight-loss services, with Weight Watchers (45%), Nutrisystem (14%), and Jenny Craig (13%) dominating the market share (6). Weight-loss services' revenues were expected to increase by 3.2% in 2014 and continue to grow in the coming years (6) because the industry anticipates increased referrals from clinicians, given the provisions covering obesity screening in the 2010 Patient Protection and Affordable Care Act (ACA).

Once fully implemented, the ACA will likely cover 25 million uninsured Americans through the exchanges (organizations that facilitate health insurance purchases) and Medicaid expansion (7). Americans who obtain health insurance through the exchanges receive coverage for all preventive services receiving grade A or B recommendations from the U.S. Preventive Services Task Force (USPSTF) (8), including obesity screening and counseling. The ACA also provides new incentives (in the form of federal matching funds) for states

to cover all recommended USPSTF services for Medicaid beneficiaries. Previously, coverage of obesity services for Medicaid beneficiaries varied across states (9, 10). The obesity counseling interventions recommended by the USPSTF are high-intensity and comprehensive, incorporating nutrition, physical activity, self-monitoring, goal setting, and group or individual sessions (11). Although some commercial or proprietary weight-loss programs also offer comprehensive programs of high intensity, insurance coverage for these programs varies by state or health insurance type. Some state Medicaid programs have piloted programs that provide Weight Watchers for their beneficiaries (12, 13).

A 2005 systematic review of the efficacy of commercial and proprietary weight-loss programs concluded that Weight Watchers was the only program with demonstrated efficacy in achieving modest weight

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loss on the basis of results from 3 randomized, controlled trials (RCTs), one of which included only breast cancer survivors (14). Scant evidence existed for all other commercial weight-loss programs. Since then, additional RCTs examining various weight-loss programs have been published. An updated review incorporating this new evidence may aid clinicians in determining the efficacy of commercial or proprietary weight-loss programs. Our objective was to examine the benefits, adherence, and harms of commercial or proprietary weight-loss programs compared with control/education or behavioral counseling among overweight and obese persons.

METHODS

Identification and Selection of Weight-Loss Programs

We generated a list of 141 commercial and proprietary weight-loss programs from several sources: obesity experts, U.S. News & World Report rankings, and Internet searches (Google and Bing) (Table 1 of the Supplement, available at www.annals.org). Using information provided on the programs' Web sites, we characterized each program with respect to weight-loss focus, dietary change, meal replacements, physical activity, behavioral and social support (for example, coaching or online forums), delivery location (residential or online), medication or supplement use, and availability in the United States (information is available from the authors on request).

We included programs that emphasized nutrition (dietary change, meal replacements, or both) and behavioral counseling or social support components with or without physical activity because dietary change and support are essential components in effective weight-loss programs (15). We excluded programs that focused on components other than weight loss (for example, wellness or food addiction), promoted medications or supplements, were not available across the United States, or were residential programs. Thirty-two commercial or proprietary weight-loss programs met our criteria.

Protocol and Registration

We updated a 2005 systematic review (14). We developed a study protocol before data collection, which was registered and made publicly available online by PROSPERO (CRD42014007155).

Data Sources and Search Strategy

We used 3 data sources to identify citations: MEDLINE, the Cochrane Database of Systematic Reviews, and the weight-loss programs themselves.

We used the same strategy as the prior review (14) to search MEDLINE for articles published from October 2002 through November 2014, which allowed for the recommended 1-year overlap with the prior review (16). We screened all articles included in the prior review, which searched MEDLINE from inception through October 2003 (14). We also searched MEDLINE from inception through November 2014 by combining the name of each included weight-loss program with the

terms *weight loss* and *commercial* or *proprietary*. We searched the Cochrane Database of Systematic Reviews from inception to November 2014 using a strategy similar to that for our MEDLINE search. Terms used in both of these searches are listed in Table 2 of the Supplement. We reviewed the reference lists of each included article, relevant review articles, and related systematic reviews to cull additional citations for screening. Finally, we contacted all included weight-loss programs to request bibliographies of published studies that used their program and any unpublished trial results. We received responses from 11 of the 32 programs. In November 2014, we also reviewed the Web site of each included weight-loss program and culled scientific articles listed for screening.

Study Selection

Two study team members independently reviewed and screened articles against prespecified inclusion and exclusion criteria (Table 3 of the Supplement). We included RCTs of overweight or obese adults that compared a commercial or proprietary weight-loss program versus control/education or behavioral counseling. We defined the comparator as "control/education" if participants received no intervention, printed materials only, or a health education curriculum or engaged in fewer than 3 sessions with a provider during the study, and we defined it as "behavioral counseling" if participants had 3 or more consultations with a provider. We included RCTs of at least 12 weeks' duration. We also assessed adverse events in prospective case series studies and RCTs without a relevant comparator group that were at least 12 months in duration.

Data Extraction and Risk-of-Bias Assessment

Two team members serially extracted data on study design, setting, population characteristics, and intervention characteristics. Our primary weight outcome was the mean percentage of weight change. Our secondary weight outcome was the percentage of participants achieving a clinically significant weight loss of at least 5%. We considered long-term outcomes as those at 12 months or later. Investigator-defined outcomes included program adherence or engagement, serious adverse events, and attrition (that is, the percentage of participants unavailable for weight measurement at that time point in the trial). Other adverse events included program withdrawal due to adverse events, biliary disorders, joint pain, alopecia, constipation, and eating disorders.

Two reviewers independently assessed the risk of bias (ROB) for each included study by using the Cochrane Collaboration's tool (17). We designated a trial's overall ROB at a time point as "low" if all of the following were low: selection bias based on inadequate generation of a randomized sequence, detection bias based on lack of outcome assessor blinding, and attrition bias. We designated the trial's ROB as "high" if any domain was high, "unclear" if all domains were unclear, and "moderate" otherwise. We characterized the ROB for each program's body of evidence by examining the overall ROB for relevant trials. For each program, we

Table 1. Components and Costs of Included Commercial or Proprietary Weight-Loss Programs With Eligible RCTs*

Program	Intensity†	Nutrition	Physical Activity	Behavioral Strategies	Support	Monthly Costs, \$\$	USPSTF Criteria§
Weight Watchers	High	Low-calorie conventional foods Points tracking	Activity tracking	Self-monitoring	Group sessions Online coaching Online community forum	43	Yes
Jenny Craig	High	Low-calorie meal replacements	Encourages increased activity	Goal setting Self-monitoring	1-on-1 counseling	570	Yes
Nutrisystem	High	Low-calorie meal replacements	Exercise plans	Self-monitoring	1-on-1 counseling Online community forum	280	Yes
HMR	High	Very-low-calorie or low-calorie meal replacements	Encourages increased activity	Goal setting	Group sessions Telephone coaching Medical supervision	682	Yes
Medifast	High	Very-low-calorie or low-calorie meal replacements	Encourages increased activity	Self-monitoring	1-on-1 counseling Online coaching	424	Yes
OPTIFAST	High	Very-low-calorie or low-calorie meal replacements	Encourages increased activity	Problem solving	1-on-1 counseling Group support Medical supervision	665	Yes
Atkins	Self-directed	Low-carbohydrate conventional foods or meal replacements	Encourages increased activity	Self-monitoring	Online community forum	10 for book	No
The Biggest Loser Club	Self-directed	Low-calorie meal plans	Exercise plans	Self-monitoring	Online community forum	20	No
eDiets	Self-directed	Low-calorie meal plans	Activity tracking	-	Online nutrition support Online community forum	10	No
Lose It!	Self-directed	Calorie tracking	Activity tracking	Self-monitoring	Online community forum	Free	No
SlimFast	Self-directed	Low-calorie meal replacements	-	Self-weighing	Online nutrition support Coaching text messages	70	No

HMR = Health Management Resources; RCT = randomized, controlled trial; USPSTF = U.S. Preventive Services Task Force.

* Information was abstracted from program Web sites available in December 2014 and materials provided by some programs.

† High-intensity programs recommend >12 sessions per year; low-intensity programs recommend <12 sessions per year or are self-directed.

‡ Data obtained from prices listed on program Web sites and/or prices quoted during telephone contact with program centers. Monthly costs may be estimated based on daily or weekly rates. Costs are rounded to the nearest dollar. Actual costs to patients may vary.

§ Assessment of whether a program may meet USPSTF criteria for intensive behavioral counseling for obesity; however, this assessment does not reflect actual coverage of these programs under these guidelines.

|| Some health insurance companies or employers offer discounts for this program. Participants may also be eligible to use a flexible spending account, health reimbursement account, or health savings account to cover costs.

rated the ROB across trials as “low” if most studies were low, “high” if most were high, and “moderate” otherwise.

Data Synthesis and Analysis

For all comparisons, we report the qualitative synthesis of data by calculating and displaying the between-group mean differences with 95% CIs (if calculable) for individual RCTs grouped by comparison. We denote analysis type (intention-to-treat [ITT] or completers') for each result reported. We did not perform meta-analyses given the heterogeneous study populations, varying analysis types, and failure to report variance estimates for difference-in-differences.

Role of the Funding Source

This study received no funding.

RESULTS

Of the 4212 citations evaluated, we included 45 trials reported in 62 articles (Appendix Figure, available at www.annals.org) that represented 11 programs out of the 32 that were eligible. Table 1 characterizes the components and costs of each program with an eligible study. Overall, participants' mean age ranged from 37 to 57 years and the majority were female in most trials.

Race varied across trials (Table 2). Most studies were done in an urban setting, and many received financial support from the commercial program they were investigating. Table 4 of the Supplement provides details on study and population characteristics and ROB ratings for each trial. Data on our secondary outcome of the percentage of participants achieving weight loss of at least 5% are displayed in the Figure of the Supplement.

Leading Market Share Programs: Weight Watchers, Jenny Craig, and Nutrisystem

Six RCTs compared Weight Watchers with control/education (18–27); 2 of these reported only completers' analyses. Compared with control/education, Weight Watchers resulted in at least 2.6% greater weight loss at 12 months in ITT analyses (moderate ROB) (Figure 1). Attrition varied across trials, and adherence was reported variably (Table 5 of the Supplement). Three trials reported on serious adverse events, but none occurred (18, 19, 26, 27, 36) (Table 6 of the Supplement). Two RCTs compared Weight Watchers and behavioral counseling (21, 22, 30). Results were mixed (Figure 1), which may have been due to the difference in counseling providers (primary care provider

Table 2. Population Characteristics and Risk of Bias Among Included RCTs, by Program and Comparator

Commercial Program and Comparators	Eligible/ Total RCTs, n/N	RCTs in an Urban Location*, n	Range of Overall Baseline Population Characteristics					Risk of Bias†	RCTs With Commercial Program Support, n	
			Study Duration, mo	Mean Age, y	Women, %	White Patients, %	Black Patients, %			Mean BMI, kg/m ²
Market leaders										
Weight Watchers										
Control/education	6/1850	2‡	3-24	36-51	72-100	74-89‡	4-13‡	31-34‡	High	4
Counseling	2/265	2	11-12	49-51	67-90	27-90	5-6‡	33-36	Moderate	1
Jenny Craig										
Control/education	1/70	1	12	40-42	100	57	3-17	34	Moderate	1
Counseling	2/669	2	12-24	44-57	47-100	68-82	3-11	34-36	High	2
Nutrisystem										
Control/education	1/69	1	3	52-53	68-74	37-44	44-60	39	Moderate	1
Counseling	2/127	1	3-6	54-56	58-100	32-40‡	54-64‡	33-36	High	2
Very-low-calorie and low-calorie meal-replacement programs										
HMR										
Control/education	3/128	0	3-6	37-52	63-82	91-93‡	NR	32-35	High	3
Counseling	1/38	1	6	45-51	75-78	91-94	6-9	35-36	High	0
Medifast										
Control/education	0/0	-	-	-	-	-	-	-	-	-
Counseling	1/90	NR	9	43-45	33-76	42-60	36-56	38-39	High	1
OPTIFAST										
Control/education	0/0	-	-	-	-	-	-	-	-	-
Counseling	4/246	4	5-15	38-52	63-100	64‡	35‡	33-40	High	0
Self-directed programs										
Atkins										
Control/education	1/118	NR	12	41	74-75	NR	NR	31-32	High	0
Counseling	7/1026	3	5-24	40-54	9-100	14-79‡	3-66‡	31-37	High	3
The Biggest Loser Club										
Control/education	1/203	NR	3	42	58-59	NR	NR	32	Low	1
Counseling	0/0	-	-	-	-	-	-	-	-	-
eDiets										
Control/education	0/0	-	-	-	-	-	-	-	-	-
Counseling	1/47	1	12	43-44	100	NR	NR	33-34	Unclear	0
Lose It!										
Control/education	0/0	-	-	-	-	-	-	-	-	-
Counseling	1/35	1	6	43-45	78-88	NR	41-72	34-35	High	0
SlimFast										
Control/education	4/362	1‡	6-51	39-70	35-82‡	82-86‡	9-14‡	32-35	High	3
Counseling	4/297	3	3-12	37-59	33-100‡	NR	NR	29-34	High	4

BMI = body mass index; HMR = Health Management Resources; NR = not reported; RCT = randomized, controlled trial.

* City with a population >250 000.

† Rated as low, unclear, or high across studies if most trials in that group were individually rated as low, unclear, or high overall, respectively, at the first reported time point; rated as moderate across studies otherwise.

‡ Results from trials reporting this characteristic.

[21, 22] vs. psychologist [30]). Harms were not reported.

One RCT compared Jenny Craig with control/education (28), and 2 compared Jenny Craig with behavioral counseling (31-33). Jenny Craig resulted in at least 4.9% greater weight loss at 12 months than both control/education and counseling in ITT analyses (moderate and high ROB, respectively) (Figure 1), regardless of program delivery (in-person vs. telephone), program version (traditional vs. low-carbohydrate), or study population (general vs. patients with diabetes). Attrition was less than 20% in all trials. Adherence was not reported, and harms occurred rarely (Table 6 of the Supplement).

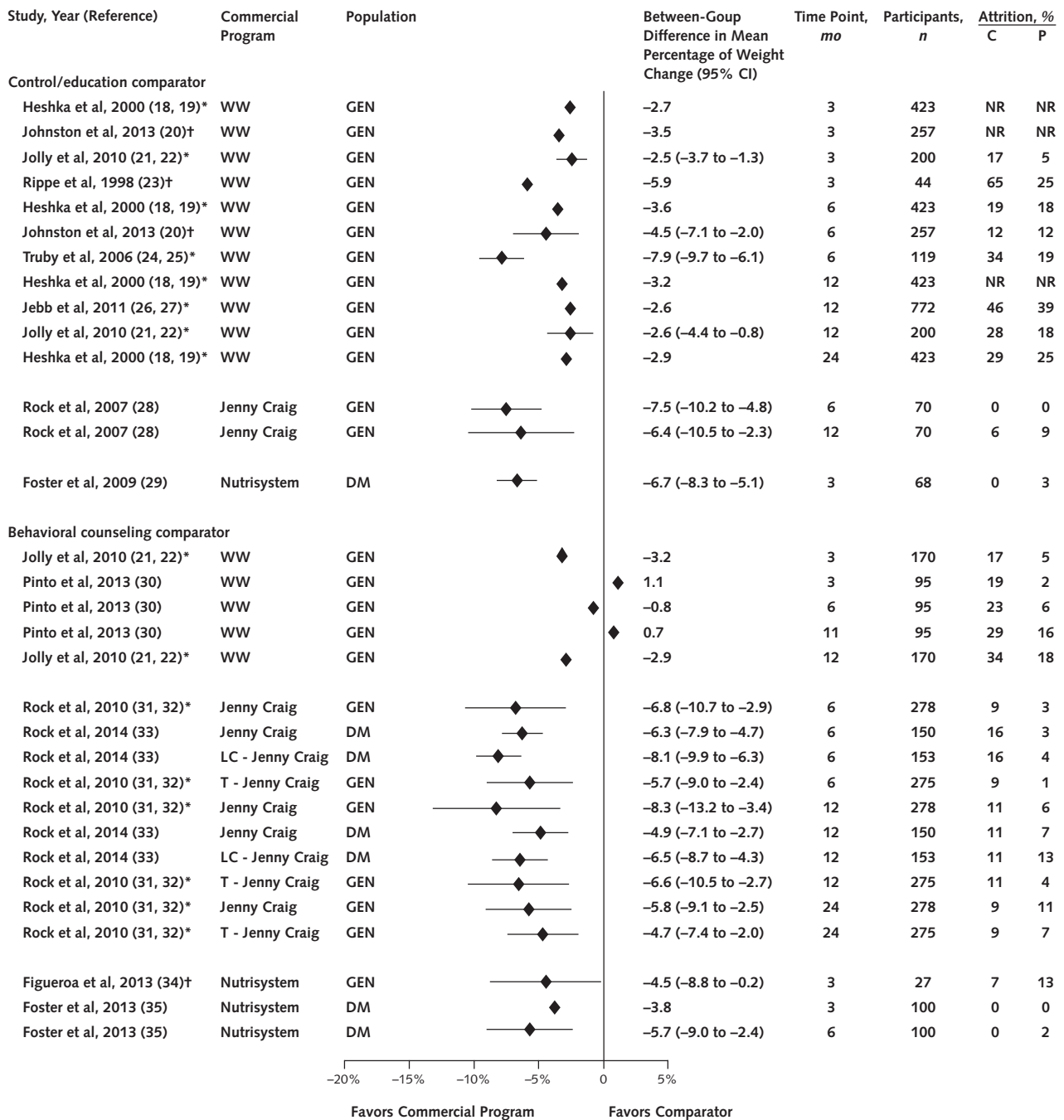
One RCT compared Nutrisystem with control/education (29), and 2 compared Nutrisystem with behav-

ioral counseling (34, 35). One reported only completers' analyses. Regardless of analysis type or study population, Nutrisystem resulted in at least 3.8% greater weight loss than both control/education and counseling at 3 months (moderate and high ROB, respectively) (Figure 1). No trials continued to 12 months. Attrition was less than 20% in all trials. Adherence was not reported and harms, when reported, were rare (Table 6 of the Supplement).

Very-Low-Calorie and Low-Calorie Meal-Replacement Programs: Health Management Resources, Medifast, and OPTIFAST

Three RCTs (1 of which reported only completers' analyses) compared Health Management Resources

Figure 1. Difference in mean percentage of weight change between commercial programs that dominate the market share (Weight Watchers, Jenny Craig, and Nutrisystem) and comparators, displayed by time point.



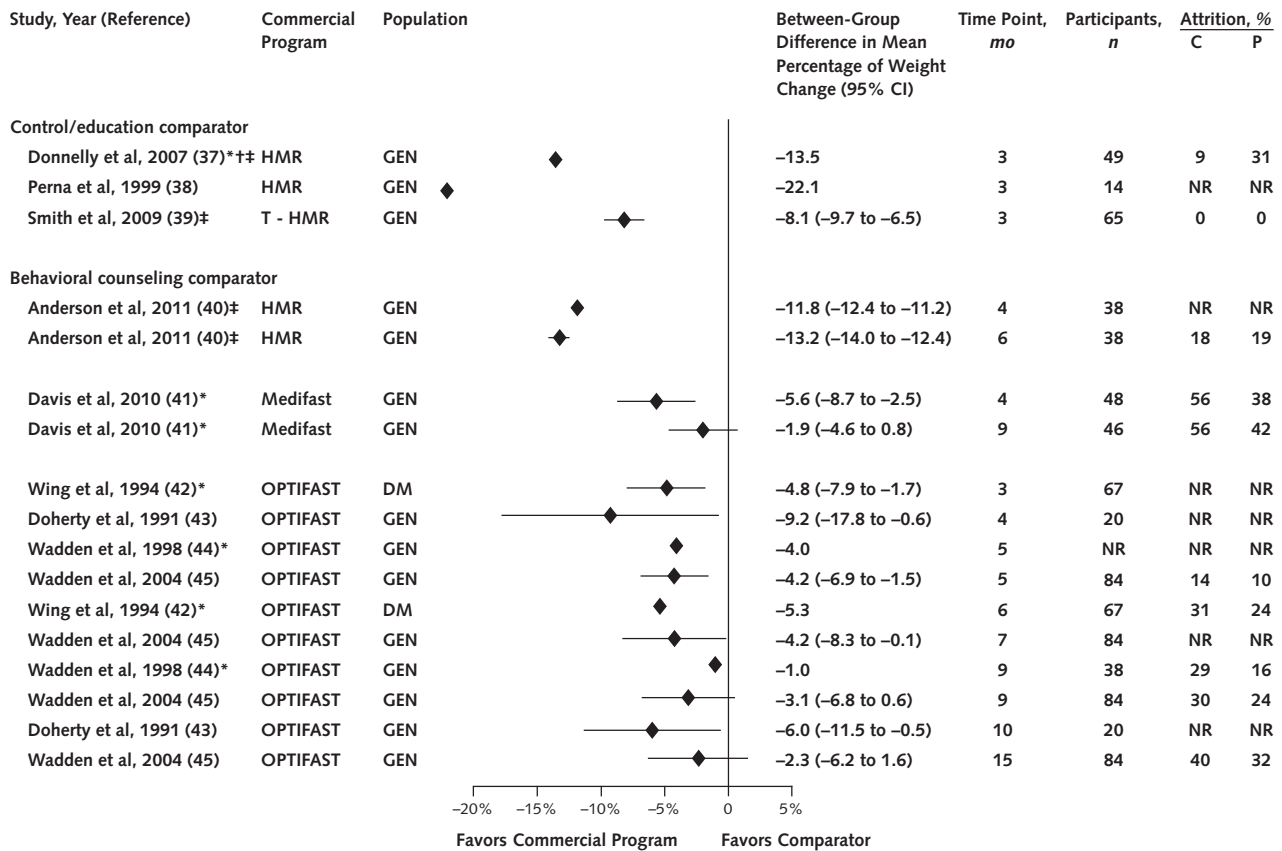
Diamond size is standardized across trials and does not reflect the sample size analyzed. "Attrition" reflects the percentage of participants unavailable for weight measurement at that time point in the trial. C = comparator group; DM = overweight or obese patients with diabetes mellitus; GEN = general population of overweight and obese patients; LC = low-carbohydrate version of program; NR = not reported; P = commercial program group; T = telephone-based program; WW = Weight Watchers.

* Results reported in >1 article.
 † Results from completers' analysis.

(HMR) with control/education (37-39), and 1 compared HMR with behavioral counseling (40). No trials continued to 12 months. At 3 months, HMR resulted in greater weight loss than control/education (high

ROB) (Figure 2). The magnitude was diminished when HMR was delivered remotely (39). In addition, HMR resulted in 13.2% greater weight loss than counseling at 6 months (high ROB) (Figure 2). Attrition was variable

Figure 2. Difference in mean percentage of weight change between commercial programs that use very-low-calorie or low-calorie meal replacements (HMR, Medifast, and OPTIFAST) and comparators, displayed by time point.



Diamond size is standardized across trials and does not reflect the sample size analyzed. "Attrition" reflects the percentage of participants unavailable for weight measurement at that time point in the trial. C = comparator group; DM = overweight or obese patients with diabetes mellitus; GEN = general population of overweight and obese patients; HMR = Health Management Resources; NR = not reported; P = commercial program group; T = telephone-based program.

* Results from completers' analysis.

† Trial reported median percentage of difference in weight change rather than mean.

‡ Intervention was low-calorie (1200 to 1500 calories daily) during weight loss phase.

and program adherence was high when reported (Table 5 of the Supplement). HMR participants reported constipation (Table 6 of the Supplement) (46, 47).

One RCT reported completers' analyses comparing Medifast with behavioral counseling (41). Medifast achieved a 5.6% greater weight loss than counseling at 4 months (high ROB). The difference was not statistically significant at 9 months (Figure 2). Attrition was high (38% to 56%). Adherence was not reported, and no serious harms occurred (Table 6 of the Supplement).

Four RCTs compared OPTIFAST with behavioral counseling (42-45), of which 2 reported only completers' analyses. OPTIFAST resulted in 4.2% to 9.2% greater weight loss than counseling at 4 to 5 months in ITT analyses (moderate ROB) (Figure 2). Only 1 trial continued beyond 12 months, and it reported no statistically significant difference. Attrition varied when reported, and adherence was not reported. Two prospective case series studies reported that fewer than

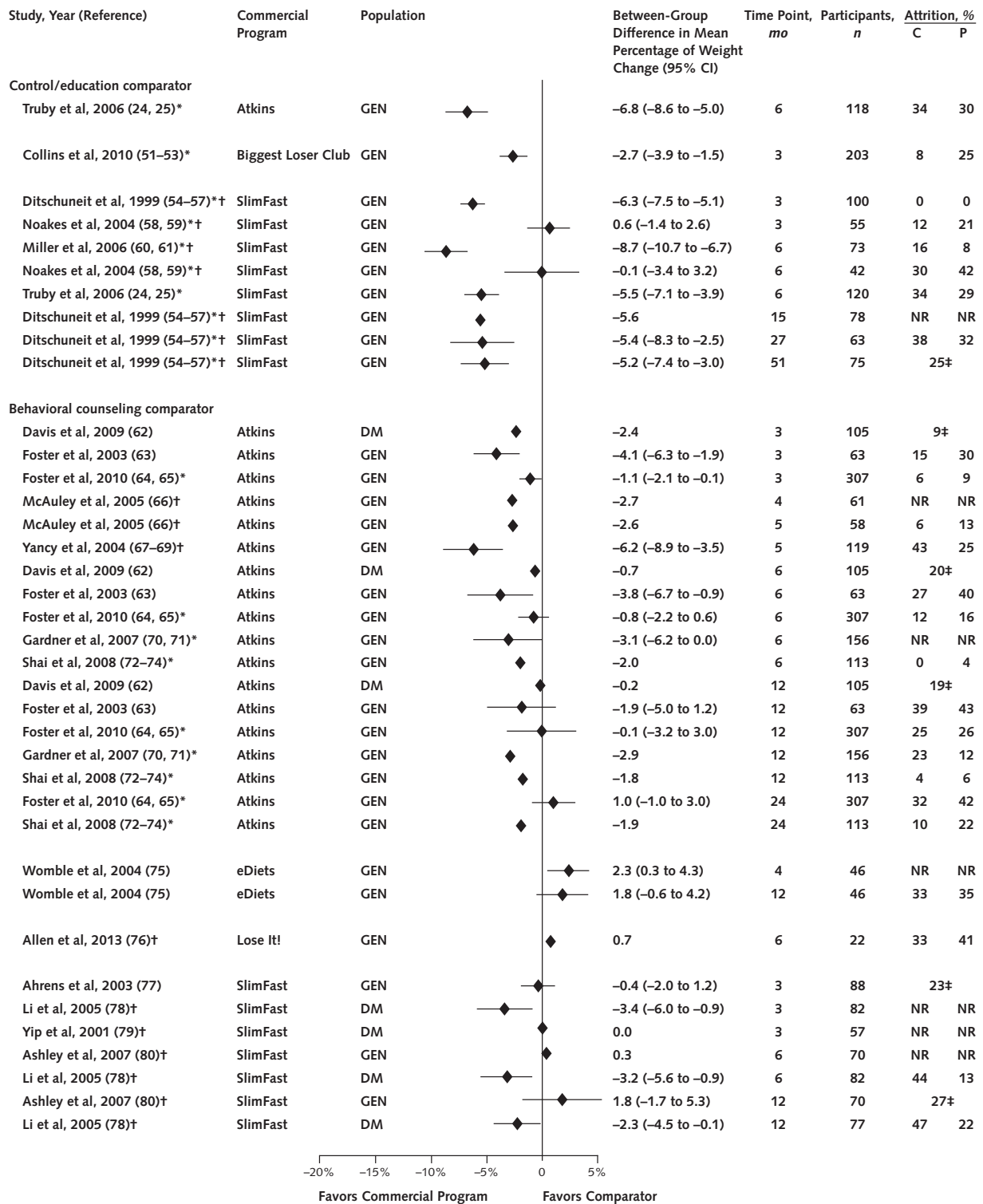
1% of OPTIFAST participants died (48, 49). Cholecystectomy, constipation, and alopecia were rare (Table 6 of the Supplement) (49, 50).

Self-Directed Programs: Atkins, The Biggest Loser Club, eDiets, Lose It!, and SlimFast

One RCT compared Atkins with control/education (24, 25). Atkins resulted in 6.8% greater weight loss than control/education at 6 months (high ROB) (Figure 3). Seven RCTs compared Atkins with behavioral counseling (62-74); 1 reported completers' analyses only. Compared with behavioral counseling, Atkins participants achieved 0.1% to 2.9% greater weight loss at 12 months in ITT analyses (moderate ROB) (Figure 3). Adherence was not reported, and Atkins participants reported constipation (Table 6 of the Supplement).

Three RCTs evaluated Internet-based programs: The Biggest Loser Club, eDiets, and Lose It!. One RCT reported that The Biggest Loser Club resulted in 2.7% greater weight loss than control/education at 3 months (low ROB) (Figure 3) (51-53). One RCT showed no sta-

Figure 3. Difference in mean percentage of weight change between self-directed commercial programs (Atkins, The Biggest Loser Club, eDiets, Lose It!, and SlimFast) and comparators, displayed by time point.



Diamond size is standardized across trials and does not reflect the sample size analyzed. "Attrition" reflects the percentage of participants unavailable for weight measurement at that time point in the trial. C = comparator group; DM = overweight or obese patients with diabetes mellitus; GEN = general population of overweight and obese patients; NR = not reported; P = commercial program group.

* Results reported in >1 article.
 † Results from completers' analysis.
 ‡ Overall attrition at time point.

tistically significant difference between eDiets and counseling at 12 months (high ROB) (Figure 3) (75). One RCT reported that Lose It! resulted in weight loss similar to that of counseling at 3 months in a completers' analysis (high ROB) (Figure 3) (76). Attrition was high, and program adherence varied when reported (Table 5 of the Supplement). No trial reported harms.

Four RCTs (2 of which reported completers' analyses) compared SlimFast with control/education (24, 25, 54-61). Results were mixed (Figure 3). One RCT that showed no between-group difference provided free food to both the control and intervention groups (58, 59), which may explain the different results compared with other trials. Four RCTs compared SlimFast with behavioral counseling (77-80), and 3 reported only completers' analyses. Results were again mixed (Figure 3), although most trials showed minimal between-group differences. Attrition and adherence were variable when reported (Table 5 of the Supplement). Harms were not reported.

DISCUSSION

Overall, the literature base examining commercial weight-loss programs has expanded since the prior review in 2005 (14). We identified 13 RCTs evaluating Weight Watchers, Nutrisystem, or Jenny Craig, which occupy a majority of the U.S. market share. We also found 9 RCTs evaluating very-low-calorie programs and 18 examining self-directed programs. We identified no RCTs for the 21 other programs that met our inclusion criteria; therefore, additional studies are still needed.

Given provisions in the ACA covering obesity screening, clinicians may be increasingly prompted to consider referring patients to commercial programs. A recent weight management guideline from the American Heart Association (AHA), the American College of Cardiology (ACC), and The Obesity Society (TOS) recommends that clinicians refer overweight and obese patients to high-intensity programs (15). However, the guideline does not provide recommendations about commercial weight-loss programs. A recent review comparing the efficacy of different diet types found that low-carbohydrate and low-fat diets resulted in the greatest weight loss at 6 and 12 months (81). This meta-analysis categorized several commercial programs into groups focused on dietary composition. It reported results for individual programs in a secondary analysis but did not include several programs in the commercial marketplace (such as OPTIFAST, SlimFast, and Lose It!). Our study complements this prior work by providing a comprehensive representation of available commercial programs. Overall, our results may help clinicians critically evaluate all commercial programs, which we outline by type in this section.

Currently, 3 programs dominate the weight-loss services industry: Weight Watchers, Jenny Craig, and Nutrisystem (6). These programs are high-intensity, and 2 of them rely on low-calorie meal replacements. Our findings show that Weight Watchers participants con-

sistently have greater weight loss than control/education participants and sustain it beyond 12 months. Although we conclude that Weight Watchers has weight-loss efficacy, whether it is superior to behavioral counseling is unclear. Jenny Craig participants consistently had greater sustained weight loss than both control/education and counseling participants, including those with diabetes mellitus. We identified Weight Watchers as one of the lowest-cost programs, and it has previously been shown to be the most cost-effective weight management strategy compared with other commercial programs and medications (82). Jenny Craig is more expensive than Weight Watchers, although Jenny Craig estimates include the cost of food (meal replacements), whereas Weight Watchers estimates do not. Given these findings, it may be reasonable for clinicians to refer patients to Weight Watchers or Jenny Craig, especially if they lack the time, training, or ancillary staff to deliver behavioral counseling in their practices. Clinicians should note our moderate to high ROB ratings for these trials. Finally, Nutrisystem has shown better short-term weight loss than control/education and behavioral counseling; however, we identified no long-term trial results. We conclude that Nutrisystem shows promise, but the lack of long-term RCTs precludes definitive conclusions.

We examined 3 programs (HMR, Medifast, and OPTIFAST) that promote weight loss through very-low-calorie meal replacements, with calories ranging from 800 to 1000 per day. These programs result in short-term weight-loss outcomes superior to those of control/education and behavioral counseling. However, whether they result in sustained, long-term weight loss is unclear because differences between counseling and Medifast or OPTIFAST were attenuated after 6 months (41, 44, 45). Clinicians should note our high ROB ratings for most of these trials. Many studies examining these programs were retrospective or short-term prospective case series and, therefore, did not meet our eligibility criteria. These approaches may also have risks, such as gallstones requiring cholecystectomy (49, 50). Prior studies have found the risk for gallstones to be 3 times greater with very-low-calorie diets than with a low-calorie approach (83). In addition, high program costs may make these programs unaffordable for many patients. The current AHA/ACC/TOS recommendations encourage providers to refer to very-low-calorie diets only in limited circumstances under close medical supervision within a high-intensity lifestyle intervention (15).

We also examined 5 self-directed programs, all of which offer support through the Internet. Of these programs, Atkins showed greater short-term weight loss than control/education or counseling. A recent meta-analysis reported that Atkins-like programs resulted in greater weight loss at 6 and 12 months than no diet (81). Our review included fewer Atkins trials than this meta-analysis, which incorporated trials of Atkins and similar low-carbohydrate approaches. Although Atkins seems promising, we interpret these findings cautiously because the delivery of Atkins in many trials included in

the prior meta-analysis and in this study may differ from the typical patient experience. For example, trials often relied on registered dietitians to deliver counseling and dietary guidance on Atkins. SlimFast may help patients achieve greater weight loss than control/education but does not seem to differ substantially from behavioral counseling. Given that most SlimFast RCTs only reported completers' analyses, we consider these findings preliminary. Some SlimFast trials also incorporated counseling sessions into the intervention, which probably differs from the typical patient experience. Clinicians should note our high ROB ratings for both Atkins and SlimFast trials. Finally, the 3 exclusively Internet-based programs (The Biggest Loser Club, eDiets, and Lose It!) may achieve superior short-term weight loss compared with control/education but do not seem to differ from counseling. Similarly, recent weight management guidelines have reported lower weight-loss efficacy of online comprehensive programs compared with similar programs delivered in person (15). Despite limitations, it should be noted that we typically identified the self-directed options as the most affordable.

Although our results have implications for clinical practice, we also believe that this evaluation is critical to policymakers, health insurers, and employers. Because the ACA is likely to increase obesity screening, having an actionable plan that addresses weight management is critical. Health insurers and employers may want to consider providing benefits coverage or incentives of reduced program fees to beneficiaries and employees for commercial programs with strong evidence of effectiveness. On the basis of our findings, we would identify Weight Watchers and Jenny Craig for consideration for such benefits coverage. Similarly, Medicaid administrations may want to consider covering these programs for their beneficiaries, as some states have (12, 13).

This systematic review has limitations. We excluded weight-loss outcomes reported in prospective case series studies because of the high risk of selection bias. We limited the scope to weight-loss programs that are available in the United States; however, many of the included programs are available worldwide. Other studies have examined weight-loss programs in the United Kingdom (84). Our eligibility criteria also excluded such popular programs as Ornish and Zone because the former does not focus on weight loss and the latter offers no behavioral or social support. Weight-loss results for these programs have been well-characterized (81). Publications for several commercial programs (such as South Beach and Ideal Protein) did not meet our eligibility criteria and were therefore not included in this review. Finally, we did not report any head-to-head comparisons of commercial programs.

We also identified limitations within the literature base. Some programs only had results from short-term trials, which may be of little value to clinicians trying to determine whether a program can be effective in achieving long-term weight loss. Internal validity of many trials was weak due to high or unequal attrition and inadequate handling of missing data given the use

of last-observation-carried-forward ITT or completers' analyses. In many trials, study staff assisted in program retention, and trials often covered the costs of these programs for participants. Therefore, the study results are probably better than can be expected in a real-world setting, given that a prior study of one commercial program reported retention of only 7% at 12 months (85). Studies often did not report adherence, engagement, or adverse outcomes. When described, program adherence was reported differently across trials, making comparability across studies challenging. Finally, trials frequently lacked blinding of participants and study personnel and did not report blinding of outcome assessors, raising the possibility of biased results.

Overall, we found consistent evidence supporting the long-term efficacy of Weight Watchers and Jenny Craig, whereas Nutrisystem may require 12- or 24-month RCTs reporting ITT analyses before we can be confident of its long-term effect. Very-low-calorie dietary approaches can result in substantial short-term weight loss, but enthusiasm is limited because of potential risks and the lack of evidence supporting sustained long-term weight loss. Additional RCTs are needed to investigate the efficacy of SlimFast and Internet-based commercial weight-loss programs, which are becoming increasingly popular. Clinicians might consider prioritizing referral only for those commercial programs that have a substantial body of evidence showing a consistent, long-term effect.

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Financial Support: Dr. Gudzone was supported by a career development award from the National Heart, Lung, and Blood Institute (K23HL116601). Ms. Doshi was supported by the Johns Hopkins medical student summer research program. Mr. Jacobs was supported by the medical student research program in diabetes at JHU-UMD Diabetes Research Center (National Institute of Diabetes and Digestive and Kidney Diseases grant P30DK079637). Dr. Bleich was supported by a career development award from the National Heart, Lung, and Blood Institute (1K01HL096409).

Disclosures: Authors have disclosed no conflicts of interest. Forms can be viewed at www.acponline.org/authors/icmje/ConflictOfInterestForms.do?msNum=M14-2238.

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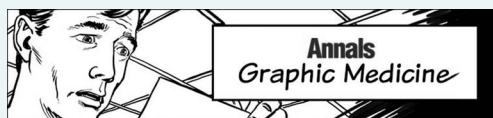
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References

- Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011-2012. *JAMA*. 2014;311:806-14. [PMID: 24570244] doi:10.1001/jama.2014.732
- Flegal KM, Graubard BI, Williamson DF, Gail MH. Cause-specific excess deaths associated with underweight, overweight, and obesity. *JAMA*. 2007;298:2028-37. [PMID: 17986696]
- Appel LJ, Champagne CM, Harsha DW, Cooper LS, Obarzanek E, Elmer PJ, et al; Writing Group of the PREMIER Collaborative Research Group. Effects of comprehensive lifestyle modification on blood pressure control: main results of the PREMIER clinical trial. *JAMA*. 2003;289:2083-93. [PMID: 12709466]
- Knowler WC, Fowler SE, Hamman RF, Christophi CA, Hoffman HJ, Brenneman AT, et al; Diabetes Prevention Program Research Group. 10-year follow-up of diabetes incidence and weight loss in the Diabetes Prevention Program Outcomes Study. *Lancet*. 2009;374:1677-86. [PMID: 19878986] doi:10.1016/S0140-6736(09)61457-4
- Saad L. To lose weight, Americans rely more on dieting than exercise. Gallup Poll Social Series: Health and Healthcare; 2011. Accessed at www.gallup.com/poll/150986/Lose-Weight-Americans-Rely-Dieting-Exercise.aspx on 27 September 2014.
- IBISWorld. Weight loss services in the U.S. industry market research report; June 2014. Los Angeles: IBISWorld; 2014. Accessed at <http://clients1.ibisworld.com/reports/us/industry/default.aspx?entid=1719> on 25 August 2014.
- Congressional Budget Office. Updated estimates of the insurance coverage provisions of the Affordable Care Act. February 2014. Accessed at www.cbo.gov/sites/default/files/cbofiles/attachments/45010-breakout-AppendixB.pdf on 17 December 2014.
- Sebelius K; U.S. Department of Health and Human Services. Report to Congress on preventive services and obesity-related services available to Medicaid enrollees. 2014. Accessed at www.medicaid.gov/medicaid-chip-program-information/by-topics/quality-of-care/downloads/rtc-preventive-obesity-related-services2014.pdf on 6 December 2014.
- Lee JS, Sheer JL, Lopez N, Rosenbaum S. Coverage of obesity treatment: a state-by-state analysis of Medicaid and state insurance laws. *Public Health Rep*. 2010;125:596-604. [PMID: 20597460]
- Kaiser Commission on Medicaid and the Uninsured. Coverage of Preventive Services for Adults in Medicaid. Washington, DC: Henry J. Kaiser Family Foundation; 2012. Accessed at <http://kaiserfamilyfoundation.files.wordpress.com/2013/01/8359.pdf> on 6 December 2014.
- U.S. Preventive Services Task Force. Obesity in Adults: Screening and Management. Rockville, MD: U.S. Preventive Services Task Force; 2012. Accessed at www.uspreventiveservicestaskforce.org/uspstf/uspsobes.htm on 6 December 2014.
- Mitchell NS, Ellison MC, Hill JO, Tsai AG. Evaluation of the effectiveness of making Weight Watchers available to Tennessee Medicaid (TennCare) recipients. *J Gen Intern Med*. 2013;28:12-7. [PMID: 22618582] doi:10.1007/s11606-012-2083-8
- Bleich SN, Herring BJ. Medicaid coverage for weight loss counseling may make 'cents' [Editorial]. *J Gen Intern Med*. 2013;28:3-5. [PMID: 22956417] doi:10.1007/s11606-012-2201-7
- Tsai AG, Wadden TA. Systematic review: an evaluation of major commercial weight loss programs in the United States. *Ann Intern Med*. 2005;142:56-66. [PMID: 15630109] doi:10.7326/0003-4819-142-1-200501040-00012
- Jensen MD, Ryan DH, Apovian CM, Ard JD, Comuzzie AG, Donato KA, et al; American College of Cardiology/American Heart Association Task Force on Practice Guidelines. 2013 AHA/ACC/TOS guideline for the management of overweight and obesity in adults: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and The Obesity Society. *Circulation*. 2014;129:S102-38. [PMID: 24222017] doi:10.1161/01.cir.0000437739.71477.ee
- Tsartsvadze A, Maglione M, Chou R, Garrity C, Coleman C, Lux L, et al. Updating Comparative Effectiveness Reviews: Current Efforts in AHRQ's Effective Health Care Program. *Methods Guide for Comparative Effectiveness Reviews*. AHRQ publication no. 11-EHC057-EF. Rockville, MD: Agency for Healthcare Research and Quality; 2011.
- Higgins JPT, Green S, eds. *Cochrane Handbook for Systematic Reviews of Interventions*, Version 5.1.0. The Cochrane Collaboration; 2011. Accessed at www.cochrane-handbook.org on 1 October 2013.
- Heshka S, Greenway F, Anderson JW, Atkinson RL, Hill JO, Phinney SD, et al. Self-help weight loss versus a structured commercial program after 26 weeks: a randomized controlled study. *Am J Med*. 2000;109:282-7. [PMID: 10996578]
- Heshka S, Anderson JW, Atkinson RL, Greenway FL, Hill JO, Phinney SD, et al. Weight loss with self-help compared with a structured commercial program: a randomized trial. *JAMA*. 2003;289:1792-8. [PMID: 12684357]
- Johnston CA, Rost S, Miller-Kovach K, Moreno JP, Foreyt JP. A randomized controlled trial of a community-based behavioral counseling program. *Am J Med*. 2013;126:1143.e19-24. [PMID: 24135513] doi:10.1016/j.amjmed.2013.04.025
- Jolly K, Daley A, Adab P, Lewis A, Denley J, Beach J, et al. A randomised controlled trial to compare a range of commercial or primary care led weight reduction programmes with a minimal intervention control for weight loss in obesity: the Lighten Up trial. *BMC Public Health*. 2010;10:439. [PMID: 20663185] doi:10.1186/1471-2458-10-439
- Jolly K, Lewis A, Beach J, Denley J, Adab P, Deeks JJ, et al. Comparison of range of commercial or primary care led weight reduction programmes with minimal intervention control for weight loss in obesity: Lighten Up randomised controlled trial. *BMJ*. 2011;343:d6500. [PMID: 22053315] doi:10.1136/bmj.d6500
- Rippe JM, Price JM, Hess SA, Kline G, DeMers KA, Damitz S, et al. Improved psychological well-being, quality of life, and health practices in moderately overweight women participating in a 12-week structured weight loss program. *Obes Res*. 1998;6:208-18. [PMID: 9618125]
- Truby H, Baic S, deLooy A, Fox KR, Livingstone MB, Logan CM, et al. Randomised controlled trial of four commercial weight loss programmes in the UK: initial findings from the BBC "Diet Trials". *BMJ*. 2006;332:1309-14. [PMID: 16720619]
- Morgan LM, Griffin BA, Millward DJ, DeLooy A, Fox KR, Baic S, et al. Comparison of the effects of four commercially available weight-loss programmes on lipid-based cardiovascular risk factors. *Public Health Nutr*. 2009;12:799-807. [PMID: 18647427] doi:10.1017/S1368980008003236
- Jebb SA, Ahern AL, Olson AD, Aston LM, Holzapfel C, Stoll J, et al. Primary care referral to a commercial provider for weight loss treatment versus standard care: a randomised controlled trial. *Lancet*. 2011;378:1485-92. [PMID: 21906798] doi:10.1016/S0140-6736(11)61344-5
- Walker CG, Holzapfel C, Loos RJ, Mander AP, Klopp N, Illig T, et al. Genetic predisposition to an adverse lipid profile limits the improvement in total cholesterol in response to weight loss. *Obesity (Silver Spring)*. 2013;21:2589-95. [PMID: 23418103] doi:10.1002/oby.20328
- Rock CL, Pakiz B, Flatt SW, Quintana EL. Randomized trial of a multifaceted commercial weight loss program. *Obesity (Silver Spring)*. 2007;15:939-49. [PMID: 17426329]
- Foster GD, Borradaile KE, Vander Veur SS, Leh Shantz K, Dilks RJ, Goldbacher EM, et al. The effects of a commercially available weight loss program among obese patients with type 2 diabetes: a randomized study. *Postgrad Med*. 2009;121:113-8. [PMID: 19820280] doi:10.3810/pgm.2009.09.2046
- Pinto AM, Fava JL, Hoffmann DA, Wing RR. Combining behavioral weight loss treatment and a commercial program: a randomized clinical trial. *Obesity (Silver Spring)*. 2013;21:673-80. [PMID: 23404824] doi:10.1002/oby.20044
- Rock CL, Flatt SW, Sherwood NE, Karanja N, Pakiz B, Thomson CA. Effect of a free prepared meal and incentivized weight loss program on weight loss and weight loss maintenance in obese and

- overweight women: a randomized controlled trial. *JAMA*. 2010;304:1803-10. [PMID: 20935338] doi:10.1001/jama.2010.1503
32. Dow CA, Thomson CA, Flatt SW, Sherwood NE, Pakiz B, Rock CL. Predictors of improvement in cardiometabolic risk factors with weight loss in women. *J Am Heart Assoc*. 2013;2:e000152. doi:10.1161/JAHA.113.000152
33. Rock CL, Flatt SW, Pakiz B, Taylor KS, Leone AF, Brelje K, et al. Weight loss, glycemic control, and cardiovascular disease risk factors in response to differential diet composition in a weight loss program in type 2 diabetes: a randomized controlled trial. *Diabetes Care*. 2014;37:1573-80. [PMID: 24760261] doi:10.2337/dc13-2900
34. Figueroa A, Vicil F, Sanchez-Gonzalez MA, Wong A, Ormsbee MJ, Hooshmand S, et al. Effects of diet and/or low-intensity resistance exercise training on arterial stiffness, adiposity, and lean mass in obese postmenopausal women. *Am J Hypertens*. 2013;26:416-23. [PMID: 23382493] doi:10.1093/ajh/hps050
35. Foster GD, Wadden TA, Lagrotte CA, Vander Veur SS, Hesson LA, Homko CJ, et al. A randomized comparison of a commercially available portion-controlled weight-loss intervention with a diabetes self-management education program. *Nutr Diabetes*. 2013;3:e63. [PMID: 23507967] doi:10.1038/ntud.2013.3
36. Dansinger ML, Gleason JA, Griffith JL, Selker HP, Schaefer EJ. Comparison of the Atkins, Ornish, Weight Watchers, and Zone diets for weight loss and heart disease risk reduction: a randomized trial. *JAMA*. 2005;293:43-53. [PMID: 15632335]
37. Donnelly JE, Smith BK, Dunn L, Mayo MM, Jacobsen DJ, Stewart EE, et al. Comparison of a phone vs clinic approach to achieve 10% weight loss. *Int J Obes (Lond)*. 2007;31:1270-6. [PMID: 17325684]
38. Perna F, Bryner R, Donley D, Kolar M, Hornsby G, Sauers J, et al. Effect of diet and exercise on quality of life and fitness parameters among obese individuals. *J Exerc Physiol Online*. 1999;2:2.
39. Smith BK, Van Walleghen EL, Cook-Wiens G, Martin RN, Curry CR, Sullivan DK, et al. Comparison of two self-directed weight loss interventions: limited weekly support vs. no outside support. *Obes Res Clin Pract*. 2009;3:1-IV. [PMID: 24345585] doi:10.1016/j.orcp.2009.04.001
40. Anderson JW, Reynolds LR, Bush HM, Rinsky JL, Washnock C. Effect of a behavioral/nutritional intervention program on weight loss in obese adults: a randomized controlled trial. *Postgrad Med*. 2011;123:205-13. [PMID: 21904103] doi:10.3810/pgm.2011.09.2476
41. Davis LM, Coleman C, Kiel J, Rampolla J, Hutchisen T, Ford L, et al. Efficacy of a meal replacement diet plan compared to a food-based diet plan after a period of weight loss and weight maintenance: a randomized controlled trial. *Nutr J*. 2010;9:11. [PMID: 20222968] doi:10.1186/1475-2891-9-11
42. Wing RR, Blair E, Marcus M, Epstein LH, Harvey J. Year-long weight loss treatment for obese patients with type II diabetes: does including an intermittent very-low-calorie diet improve outcome? *Am J Med*. 1994;97:354-62. [PMID: 7942937]
43. Doherty JU, Wadden TA, Zuk L, Letizia KA, Foster GD, Day SC. Long-term evaluation of cardiac function in obese patients treated with a very-low-calorie diet: a controlled clinical study of patients without underlying cardiac disease. *Am J Clin Nutr*. 1991;53:854-8. [PMID: 2008863]
44. Wadden TA, Considine RV, Foster GD, Anderson DA, Sarwer DB, Caro JS. Short- and long-term changes in serum leptin dieting obese women: effects of caloric restriction and weight loss. *J Clin Endocrinol Metab*. 1998;83:214-8. [PMID: 9435444]
45. Wadden TA, Foster GD, Sarwer DB, Anderson DA, Gladis M, Sanderson RS, et al. Dieting and the development of eating disorders in obese women: results of a randomized controlled trial. *Am J Clin Nutr*. 2004;80:560-8. [PMID: 15321793]
46. Anderson JW, Hamilton CC, Crown-Weber E, Riddlemoser M, Gustafson NJ. Safety and effectiveness of a multidisciplinary very-low-calorie diet program for selected obese individuals. *J Am Diet Assoc*. 1991;91:1582-4. [PMID: 1960353]
47. Anderson JW, Brinkman-Kaplan V, Hamilton CC, Logan JE, Collins RW, Gustafson NJ. Food-containing hypocaloric diets are as effective as liquid-supplement diets for obese individuals with NIDDM. *Diabetes Care*. 1994;17:602-4. [PMID: 8082533]
48. Kirschner MA, Schneider G, Ertel N, Cortes G. Supplemented starvation: a successful method for control of major obesity. *J Med Soc N J*. 1979;76:175-9. [PMID: 286061]
49. Bischoff SC, Damms-Machado A, Betz C, Herpertz S, Legenbauer T, Löw T, et al. Multicenter evaluation of an interdisciplinary 52-week weight loss program for obesity with regard to body weight, comorbidities and quality of life—a prospective study. *Int J Obes (Lond)*. 2012;36:614-24. [PMID: 21673653] doi:10.1038/ijo.2011.107
50. Wadden TA, Foster GD, Letizia KA, Stunkard AJ. A multicenter evaluation of a proprietary weight reduction program for the treatment of marked obesity. *Arch Intern Med*. 1992;152:961-6. [PMID: 1580722]
51. Collins CE, Morgan PJ, Jones P, Fletcher K, Martin J, Aguiar EJ, et al. Evaluation of a commercial web-based weight loss and weight loss maintenance program in overweight and obese adults: a randomized controlled trial. *BMC Public Health*. 2010;10:669. [PMID: 21047432] doi:10.1186/1471-2458-10-669
52. Collins CE, Morgan PJ, Jones P, Fletcher K, Martin J, Aguiar EJ, et al. A 12-week commercial web-based weight-loss program for overweight and obese adults: randomized controlled trial comparing basic versus enhanced features. *J Med Internet Res*. 2012;14:e57. [PMID: 22555246] doi:10.2196/jmir.1980
53. Hutchesson MJ, Collins CE, Morgan PJ, Watson JF, Guest M, Callister R. Changes to dietary intake during a 12-week commercial web-based weight loss program: a randomized controlled trial. *Eur J Clin Nutr*. 2014;68:64-70. [PMID: 24129359] doi:10.1038/ejcn.2013.194
54. Ditschuneit HH, Flechtner-Mors M, Johnson TD, Adler G. Metabolic and weight-loss effects of a long-term dietary intervention in obese patients. *Am J Clin Nutr*. 1999;69:198-204. [PMID: 9989680]
55. Flechtner-Mors M, Ditschuneit HH, Johnson TD, Suchard MA, Adler G. Metabolic and weight loss effects of long-term dietary intervention in obese patients: four-year results. *Obes Res*. 2000;8:399-402. [PMID: 10968732]
56. Ditschuneit HH, Flechtner-Mors M. Value of structured meals for weight management: risk factors and long-term weight maintenance. *Obes Res*. 2001;9 Suppl 4:284S-289S. [PMID: 11707555]
57. Ditschuneit HH, Frier HI, Flechtner-Mors M. Lipoprotein responses to weight loss and weight maintenance in high-risk obese subjects. *Eur J Clin Nutr*. 2002;56:264-70. [PMID: 11960302]
58. Noakes M, Foster PR, Keogh JB, Clifton PM. Meal replacements are as effective as structured weight-loss diets for treating obesity in adults with features of metabolic syndrome. *J Nutr*. 2004;134:1894-9. [PMID: 15284372]
59. Clifton PM, Keogh JB, Foster PR, Noakes M. Effect of weight loss on inflammatory and endothelial markers and FMD using two low-fat diets. *Int J Obes (Lond)*. 2005;29:1445-51. [PMID: 16172619]
60. Miller GD, Nicklas BJ, Davis C, Loeser RF, Lenchik L, Messier SP. Intensive weight loss program improves physical function in older obese adults with knee osteoarthritis. *Obesity (Silver Spring)*. 2006;14:1219-30. [PMID: 16899803]
61. Miller GD. Improved nutrient intake in older obese adults undergoing a structured diet and exercise intentional weight loss program. *J Nutr Health Aging*. 2010;14:461-6. [PMID: 20617289]
62. Davis NJ, Tomuta N, Schechter C, Isasi CR, Segal-Isaacson CJ, Stein D, et al. Comparative study of the effects of a 1-year dietary intervention of a low-carbohydrate diet versus a low-fat diet on weight and glycemic control in type 2 diabetes. *Diabetes Care*. 2009;32:1147-52. [PMID: 19366978] doi:10.2337/dc08-2108
63. Foster GD, Wyatt HR, Hill JO, McGuckin BG, Brill C, Mohammed BS, et al. A randomized trial of a low-carbohydrate diet for obesity. *N Engl J Med*. 2003;348:2082-90. [PMID: 12761365]
64. Foster GD, Wyatt HR, Hill JO, Makris AP, Rosenbaum DL, Brill C, et al. Weight and metabolic outcomes after 2 years on a low-carbohydrate versus low-fat diet: a randomized trial. *Ann Intern Med*. 2010;153:147-57. [PMID: 20679559] doi:10.7326/0003-4819-153-3-201008030-00005
65. Friedman AN, Ogden LG, Foster GD, Klein S, Stein R, Miller B, et al. Comparative effects of low-carbohydrate high-protein versus

- low-fat diets on the kidney. *Clin J Am Soc Nephrol*. 2012;7:1103-11. [PMID: 22653255] doi:10.2215/CJN.11741111
66. McAuley KA, Hopkins CM, Smith KJ, McLay RT, Williams SM, Taylor RW, et al. Comparison of high-fat and high-protein diets with a high-carbohydrate diet in insulin-resistant obese women. *Diabetologia*. 2005;48:8-16. [PMID: 15616799]
67. Yancy WS Jr, Olsen MK, Guyton JR, Bakst RP, Westman EC. A low-carbohydrate, ketogenic diet versus a low-fat diet to treat obesity and hyperlipidemia: a randomized, controlled trial. *Ann Intern Med*. 2004;140:769-77. [PMID: 15148063] doi:10.7326/0003-4819-140-10-200405180-00006
68. Westman EC, Yancy WS Jr, Olsen MK, Dudley T, Guyton JR. Effect of a low-carbohydrate, ketogenic diet program compared to a low-fat diet on fasting lipoprotein subclasses. *Int J Cardiol*. 2006;110:212-6. [PMID: 16297472]
69. Yancy WS Jr, Almirall D, Maciejewski ML, Kolotkin RL, McDuffie JR, Westman EC. Effects of two weight-loss diets on health-related quality of life. *Qual Life Res*. 2009;18:281-9. [PMID: 19212822] doi:10.1007/s11136-009-9444-8
70. Gardner CD, Kiazand A, Alhassan S, Kim S, Stafford RS, Balise RR, et al. Comparison of the Atkins, Zone, Ornish, and LEARN diets for change in weight and related risk factors among overweight premenopausal women: the A TO Z Weight Loss Study: a randomized trial. *JAMA*. 2007;297:969-77. [PMID: 17341711]
71. Moore SD, King AC, Kiernan M, Gardner CD. Outcome expectations and realizations as predictors of weight regain among dieters. *Eat Behav*. 2011;12:60-3. [PMID: 21184975] doi:10.1016/j.eatbeh.2010.08.007
72. Shai I, Schwarzfuchs D, Henkin Y, Shahar DR, Witkow S, Greenberg I, et al; Dietary Intervention Randomized Controlled Trial (DIRECT) Group. Weight loss with a low-carbohydrate, Mediterranean, or low-fat diet. *N Engl J Med*. 2008;359:229-41. [PMID: 18635428] doi:10.1056/NEJMoa0708681
73. Greenberg I, Stampfer MJ, Schwarzfuchs D, Shai I; DIRECT Group. Adherence and success in long-term weight loss diets: the Dietary Intervention Randomized Controlled Trial (DIRECT). *J Am Coll Nutr*. 2009;28:159-68. [PMID: 19828901]
74. Tirosh A, Golan R, Harman-Boehm I, Henkin Y, Schwarzfuchs D, Rudich A, et al. Renal function following three distinct weight loss dietary strategies during 2 years of a randomized controlled trial. *Diabetes Care*. 2013;36:2225-32. [PMID: 23690533] doi:10.2337/dc12-1846
75. Womble LG, Wadden TA, McGuckin BG, Sargent SL, Rothman RA, Krauthamer-Ewing ES. A randomized controlled trial of a commercial internet weight loss program. *Obes Res*. 2004;12:1011-8. [PMID: 15229342]
76. Allen JK, Stephens J, Dennison Himmelfarb CR, Stewart KJ, Hauck S. Randomized controlled pilot study testing use of smartphone technology for obesity treatment. *J Obes*. 2013;2013:151597. [PMID: 24392223] doi:10.1155/2013/151597
77. Ahrens RA, Hower M, Best AM. Effects of weight reduction interventions by community pharmacists. *J Am Pharm Assoc* (2003). 2003;43:583-9. [PMID: 14626750]
78. Li Z, Hong K, Saltsman P, DeShields S, Bellman M, Thames G, et al. Long-term efficacy of soy-based meal replacements vs an individualized diet plan in obese type II DM patients: relative effects on weight loss, metabolic parameters, and C-reactive protein. *Eur J Clin Nutr*. 2005;59:411-8. [PMID: 15674301]
79. Yip I, Go VL, DeShields S, Saltsman P, Bellman M, Thames G, et al. Liquid meal replacements and glycemic control in obese type 2 diabetes patients. *Obes Res*. 2001;9 Suppl 4:341S-347S. [PMID: 11707563]
80. Ashley JM, Herzog H, Clodfelter S, Bovee V, Schrage J, Pritsos C. Nutrient adequacy during weight loss interventions: a randomized study in women comparing the dietary intake in a meal replacement group with a traditional food group. *Nutr J*. 2007;6:12. [PMID: 17592648]
81. Johnston BC, Kanters S, Bandayrel K, Wu P, Naji F, Siemieniuk RA, et al. Comparison of weight loss among named diet programs in overweight and obese adults: a meta-analysis. *JAMA*. 2014;312:923-33. [PMID: 25182101] doi:10.1001/jama.2014.10397
82. Finkelstein EA, Kruger E. Meta- and cost-effectiveness analysis of commercial weight loss strategies. *Obesity (Silver Spring)*. 2014;22:1942-51. [PMID: 24962106] doi:10.1002/oby.20824
83. Johansson K, Sundström J, Marcus C, Hemmingsson E, Neovius M. Risk of symptomatic gallstones and cholecystectomy after a very-low-calorie diet or low-calorie diet in a commercial weight loss program: 1-year matched cohort study. *Int J Obes (Lond)*. 2014;38:279-84. [PMID: 23736359] doi:10.1038/ijo.2013.83
84. Madigan CD, Daley AJ, Lewis AL, Jolly K, Aveyard P. Which weight-loss programmes are as effective as Weight Watchers®?: non-inferiority analysis. *Br J Gen Pract*. 2014;64:e128-36. [PMID: 24567651] doi:10.3399/bjgp14X677491
85. Finley CE, Barlow CE, Greenway FL, Rock CL, Rolls BJ, Blair SN. Retention rates and weight loss in a commercial weight loss program. *Int J Obes (Lond)*. 2007;31:292-8. [PMID: 16755283]



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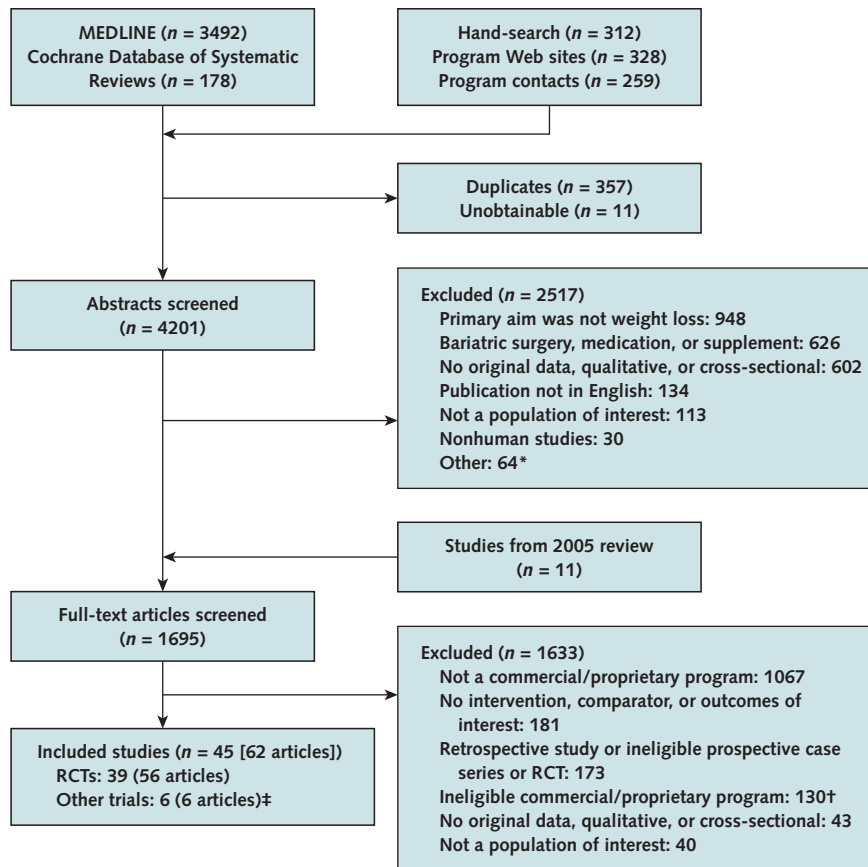
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Appendix Figure. Summary of evidence search and selection.



RCT = randomized, controlled trial.

* Trials with ineligible study designs (e.g., retrospective case series or RCTs <12 wk in duration) or ineligible programs (e.g., not available in the United States).

† Used medications or supplements; modified specifically for the study; unavailable in the United States; or available only to special populations, such as active-duty military personnel or veterans.

‡ Prospective case series or RCTs without an eligible comparator group of ≥ 12 mo duration that reported harms.

CORRECTION: EFFICACY OF COMMERCIAL WEIGHT-LOSS PROGRAMS

In a recent article (1), Table 6 of the Supplement, which reports adverse events, has been revised to correct several errors. With the addition of this corrected table, the authors would also like to highlight relevant changes that would apply to the original article text. The article previously stated that no studies of Nutrisystem reported adverse events, which should state instead that harms occurred rarely when reported. The article previously stated that 6.3% of Health Management Resources participants experienced cholecystectomy, which was an error and has been removed. The article previously stated that the Medifast study did not report adverse events, which should state instead that no serious harms occurred. The article previously stated that harms occurred rarely among Atkins participants, which should instead state that Atkins participants reported constipation. The authors have made a clarification to Table 3 of the Supplement regarding the exclusion of studies that examine employer-based versions of commercial weight loss programs. Finally, the very-low-calorie programs have been relabeled as "very-low-calorie and low-calorie meal-replacement programs," as this categorization more accurately reflects the program options available and tested.

This has been corrected in the online version.

Reference

1. Gudzone KA, Doshi RS, Mehta AK, Chaudhry ZW, Jacobs DK, Vakil RM, et al. Efficacy of commercial weight-loss programs. An updated systematic review. *Ann Intern Med.* 2014;162:501-12.