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2013 AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults

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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

Endorsed by the American Association of Cardiovascular and Pulmonary Rehabilitation, American Pharmacists Association, American Society for Nutrition, American Society for Preventive Cardiology, American Society of Hypertension, Association of Black Cardiologists, National Lipid Association, Preventive Cardiovascular Nurses Association, The Endocrine Society, and WomenHeart: The National Coalition for Women with Heart Disease

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Preamble and Transition to ACC/AHA Guidelines to Reduce Cardiovascular Risk

The goals of the American College of Cardiology (ACC) and the American Heart Association (AHA) are to prevent cardiovascular (CV) diseases, improve the management of people who have these diseases through professional education and research, and develop guidelines, standards and policies that promote optimal patient care and cardiovascular health. Toward these objectives, the ACC and AHA have collaborated with the National Heart, Lung, and Blood Institute (NHLBI) and stakeholder and professional organizations to develop clinical practice guidelines for assessment of CV risk, lifestyle modifications to reduce CV risk, and management of blood cholesterol, overweight and obesity in adults.

In 2008, the NHLBI initiated these guidelines by sponsoring rigorous systematic evidence reviews for each topic by expert panels convened to develop critical questions (CQs), interpret the evidence and craft recommendations. In response to the 2011 report of the Institute of Medicine on the development of trustworthy clinical guidelines (1), the NHLBI Advisory Council (NHLBAC) recommended that the NHLBI focus specifically on reviewing the highest quality evidence and partner with other organizations to develop recommendations (2,3). Accordingly, in June 2013 the NHLBI initiated collaboration with the ACC and AHA to work with other organizations to complete and publish the 4 guidelines noted above and make them available to the widest possible constituency. Recognizing that the expert panels did not consider evidence beyond 2011 (except as specified in the methodology), the ACC, AHA and collaborating societies plan to begin updating these guidelines starting in 2014.

The joint ACC/AHA Task Force on Practice Guidelines (Task Force) appointed a subcommittee to shepherd this transition, communicate the rationale and expectations to the writing panels and partnering organizations and expeditiously publish the documents. The ACC/AHA and partner organizations recruited a limited number of expert reviewers for fiduciary examination of content, recognizing that each document had undergone extensive peer review by representatives of the NHLBAC, key Federal agencies and scientific experts. Each writing panel responded to comments from these reviewers. Clarifications were incorporated where appropriate, but there were no substantive changes as the bulk of the content was undisputed.

Although the Task Force led the final development of these prevention guidelines, they differ from other ACC/AHA guidelines. First, as opposed to an extensive compendium of clinical information, these documents are significantly more limited in scope and focus on selected CQs in each topic, based on the highest quality evidence available. Recommendations were derived from randomized trials, meta-analyses, and observational studies evaluated for quality, and were not formulated when sufficient evidence was not available. Second, the text accompanying each recommendation is succinct,

summarizing the evidence for each question. The Full Panel Reports include more detailed information about the evidence statements (ESs) that serves as the basis for recommendations. Third, the format of the recommendations differs from other ACC/AHA guidelines. Each recommendation has been mapped from the NHLBI grading format to the ACC/AHA Class of Recommendation/Level of Evidence (COR/LOE) construct (Table 1) and is expressed in both formats. Because of the inherent differences in grading systems and the clinical questions driving the recommendations, alignment between the NHLBI and ACC/AHA formats is in some cases imperfect. Explanations of these variations are noted in the recommendation tables, where applicable.

Table 1. Applying Classification of Recommendation and Level of Evidence

ESTIMATE OF CERTAINTY (PRECISION) OF TREATMENT EFFECT	SIZE OF TREATMENT EFFECT: CLASS I *Benefit >>> Risk* Procedure/Treatment **SHOULD** be performed/ administered	CLASS IIa *Benefit >> Risk* *Additional studies with focused objectives needed* **IT IS REASONABLE** to perform procedure/administer treatment	CLASS IIb *Benefit ≥ Risk* *Additional studies with broad objectives needed; additional registry data would be helpful* Procedure/Treatment **MAY BE CONSIDERED**	CLASS III *No Benefit* or CLASS III *Harm* COR III: No benefit — Procedure/Test: Not Helpful — Treatment: No Proven Benefit COR III: Harm — Procedure/Test: Excess Cost w/o Benefit or Harmful — Treatment: Harmful to Patients
LEVEL A Multiple populations evaluated* Data derived from multiple randomized clinical trials or meta-analyses	■ Recommendation that procedure or treatment is useful/effective ■ Sufficient evidence from multiple randomized trials or meta-analyses	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Sufficient evidence from multiple randomized trials or meta-analyses
LEVEL B Limited populations evaluated* Data derived from a single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is useful/effective ■ Evidence from single randomized trial or nonrandomized studies	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Evidence from single randomized trial or nonrandomized studies
LEVEL C Very limited populations evaluated* Only consensus opinion of experts, case studies, or standard of care	■ Recommendation that procedure or treatment is useful/effective ■ Only expert opinion, case studies, or standard of care	■ Recommendation in favor of treatment or procedure being useful/effective ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation's usefulness/efficacy less well established ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Only expert opinion, case studies, or standard of care
Suggested phrases for writing recommendations	should is recommended is indicated is useful/effective/beneficial	is reasonable can be useful/effective/beneficial is probably recommended or indicated	may/might be considered may/might be reasonable usefulness/effectiveness is unknown/unclear/uncertain or not well established	COR III: No Benefit is not recommended is not indicated should not be performed/ administered/ other is not useful/ beneficial/ effective COR III: Harm potentially harmful causes harm associated with excess morbidity/mortality should not be performed/ administered/ other
Comparative effectiveness phrases†	treatment/strategy A is recommended/indicated in preference to treatment B treatment A should be chosen over treatment B	treatment/strategy A is probably recommended/indicated in preference to treatment B it is reasonable to choose treatment A over treatment B		

A recommendation with Level of Evidence B or C does not imply that the recommendation is weak. Many important clinical questions addressed in the guidelines do not lend themselves to clinical trials. Even when

randomized trials are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.
*Data available from clinical trials or registries about the usefulness/efficacy in different subpopulations, such as sex, age, history of diabetes, history of prior myocardial infarction, history of heart failure, and prior aspirin use.
†For comparative effectiveness recommendations (Class I and IIa; Level of Evidence A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.

In consultation with NHLBI, the policies adopted by the writing panels to manage relationships of authors with industry and other entities (RWI) are outlined in the methods section of each panel report. These policies were in effect when this effort began in 2008 and throughout the writing process and voting on recommendations, until the process was transferred to ACC/AHA in 2013. In the interest of transparency, the ACC/AHA requested that panel authors resubmit RWI disclosures as of July 2013. Relationships relevant to this guideline are disclosed in Appendix 1. None of the ACC/AHA expert reviewers had relevant RWI (Appendix 2).

Systematic evidence reports and accompanying summary tables were developed by the expert panels and NHLBI. The guideline was reviewed by the ACC/AHA Task Force and approved by the ACC Board of Trustees, the AHA Science Advisory and Coordinating Committee, and the governing bodies of partnering organizations. In addition, ACC/AHA sought endorsement by other stakeholders, including professional organizations. It is the hope of the writing panels, stakeholders, professional organizations, NHLBI, and the Task Force that the guidelines will garner the widest possible readership for the benefit of patients, providers and the public health.

Guidelines attempt to define practices that meet the needs of patients in most circumstances and are not a replacement for clinical judgment. The ultimate decision about care of a particular patient must be made by the healthcare provider and patient in light of the circumstances presented by that patient. As a result, situations might arise in which deviations from these guidelines may be appropriate. These considerations notwithstanding, in caring for most patients, clinicians can employ the recommendations confidently to reduce the risks of atherosclerotic cardiovascular disease events.

See Tables 2 and 3 for an explanation of the NHLBI recommendation grading methodology.

Table 2. NHLBI Grading the Strength of Recommendations

Grade	Strength of Recommendation*
A	**Strong recommendation** There is high certainty based on evidence that the net benefit† is substantial.
B	**Moderate recommendation** There is moderate certainty based on evidence that the net benefit is moderate to substantial, or there is high certainty that the net benefit is moderate.

C	**Weak recommendation** There is at least moderate certainty based on evidence that there is a small net benefit.
D	**Recommendation against** There is at least moderate certainty based on evidence that it has no net benefit or that risks/harms outweigh benefits.
E	**Expert opinion ("There is insufficient evidence or evidence is unclear or conflicting, but this is what the Panel recommends.")** Net benefit is unclear. Balance of benefits and harms cannot be determined because of no evidence, insufficient evidence, unclear evidence, or conflicting evidence, but the Panel thought it was important to provide clinical guidance and make a recommendation. Further research is recommended in this area.
N	**No recommendation for or against ("There is insufficient evidence or evidence is unclear or conflicting.")** Net benefit is unclear. Balance of benefits and harms cannot be determined because of no evidence, insufficient evidence, unclear evidence, or conflicting evidence, and the Panel thought no recommendation should be made. Further research is recommended in this area.

*In most cases, the strength of the recommendation should be closely aligned with the quality of the evidence; however, under some circumstances, there may be valid reasons for making recommendations that are not closely aligned with the quality of the evidence (e.g., strong recommendation when the evidence quality is moderate, like smoking cessation to reduce CVD risk or ordering an ECG as part of the initial diagnostic work-up for a patient presenting with possible MI). Those situations should be limited and the rationale explained clearly by the Panel.
†Net benefit is defined as benefits minus risks/harms of the service/intervention.

CVD indicates cardiovascular risk; ECG, electrocardiography; MI, myocardial infarction; and NHLBI, National Heart, Lung, and Blood Institute.

Table 3. Quality Rating the Strength of Evidence

Type of Evidence	Quality Rating*
• Well-designed, well-executed† RCTs that adequately represent populations to which the results are applied and directly assess effects on health outcomes. • MAs of such studies. Highly certain about the estimate of effect. Further research is unlikely to change the Panel's confidence in the estimate of effect.	High
• RCTs with minor limitations‡ affecting confidence in, or applicability of, the results. • Well-designed, well-executed nonrandomized controlled studies§ and well-designed, well-executed observational studies‖. • MAs of such studies. Moderately certain about the estimate of effect. Further research may have an impact on the Panel's confidence in the estimate of effect and may change the estimate.	Moderate
• RCTs with major limitations. • Nonrandomized controlled studies and observational studies with major limitations affecting confidence in, or applicability of, the results.	Low

• Uncontrolled clinical observations without an appropriate comparison group (e.g., case series, case reports). • Physiological studies in humans. • MAs of such studies. Low certainty about the estimate of effect. Further research is likely to have an impact on the Panel's confidence in the estimate of effect and is likely to change the estimate.	

*In some cases, other evidence, such as large all-or-none case series (e.g., jumping from airplanes or tall structures), can represent high or moderate quality evidence. In such cases, the rationale for the evidence rating exception should be explained by the Panel and clearly justified.
†Well-designed, well-executed refers to studies that directly address the question, use adequate randomization, blinding, allocation concealment, are adequately powered, use ITT analyses, and have high follow-up rates.
‡Limitations include concerns with the design and execution of a study that result in decreased confidence in the true estimate of the effect. Examples of such limitations include, but are not limited to: inadequate randomization, lack of blinding of study participants or outcome assessors, inadequate power, outcomes of interest are not prespecified or the primary outcomes, low follow-up rates, or findings based on subgroup analyses. Whether the limitations are considered minor or major is based on the number and severity of flaws in design or execution. Rules for determining whether the limitations are considered minor or major and how they will affect rating of the individual studies will be developed collaboratively with the methodology team.
§Nonrandomized controlled studies refer to intervention studies where assignment to intervention and comparison groups is not random (e.g., quasi-experimental study design)
‖Observational studies include prospective and retrospective cohort, case-control, and cross sectional studies.

ITT indicates intention-to-treat; MA, meta-analysis; and RCT, randomized controlled trial.

1. Introduction/Scope of Guideline

More than 78 million adults in the United States were obese in 2009–2010 (4). Obesity raises the risk of morbidity from hypertension, dyslipidemia, type 2 diabetes mellitus (diabetes), coronary heart disease (CHD), stroke, gallbladder disease, osteoarthritis, sleep apnea and respiratory problems, and some cancers. Obesity is also associated with increased risk in all-cause and cardiovascular disease (CVD) mortality. The biomedical, psychosocial, and economic consequences of obesity have substantial implications for the health and well-being of the U.S. population.

According to the 1998 Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults—The Evidence Report (5), overweight is defined as a body mass index (BMI) of 25 kg/m^2 to 29.9 kg/m^2 and obesity as a BMI of $\geq$30 kg/m^2. Current estimates are that 69% of adults are either overweight or obese with approximately 35% obese (6). These latest data from the National Health and Nutrition Examination Surveys report that for both men and women, obesity estimates for 2009–2010 did not differ significantly from estimates for 2003–2008 and that the increases in the prevalence rates of obesity appear to be slowing or leveling off (6). Yet, overweight and obesity continue to be highly prevalent especially in some racial and ethnic minority groups as well as in those with lower incomes and less education. Overweight and obesity are major contributors to chronic diseases

in the United States and present a major public health challenge. It has been reported that, compared with normal weight individuals, obese patients incur 46% increased inpatient costs, 27% more physician visits and outpatient costs, and 80% increased spending on prescription drugs (7). The medical care costs of obesity in the United States are staggering. In 2008 dollars, these costs totaled about $147 billion (7).

The Expert Panel (Panel) was first convened in September 2008 by the NHLBI in cooperation with the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) to update the 1998 Clinical Guidelines Report (5). The Panel considered new evidence related to critical issues on overweight and obesity evaluation and treatment, particularly in individuals with other risk factors for CVD and diabetes. The critical issues identified included the appropriateness of the current BMI and waist circumference cutpoints that are used for determining risk in overweight and obese adults across diverse populations; the impact of weight loss on risk factors for CVD and type 2 diabetes as well as CVD morbidity and mortality; optimal behavioral, dietary intervention strategies, and other lifestyle treatment approaches for weight loss and weight loss maintenance; and benefits and risks of various bariatric surgical procedures. The Panel's ultimate goal was to systematically develop evidence statements and recommendations for 5 CQs to assist clinicians in primary care. The recommendations are based on evidence from a rigorous systematic review (SR) and synthesis of recently published medical literature.

This guideline is based on the Full Panel Report (http://jaccjacc.cardiosource.com/acc_documents/2013_FPR_S5_Obesity.pdf) which is provided as a supplement to the guideline. The Full Panel Report contains background and additional material related to content, methodology, evidence synthesis, rationale, and references and is supported by the NHLBI Systematic Evidence Review which can be found at http://www.nhlbi.nih.gov/guidelines/obesity/ser/. Refer to the 2013 ACC/AHA Blood Cholesterol, Lifestyle Management, and Risk Assessment Guidelines for topics outside the scope of the 2013 AHA/ACC/TOS Obesity Guideline (8-10).

1.1. Rationale for Updating Obesity Clinical Guidelines

The NHLBI, in cooperation with the NIDDK, released the 1998 *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults—The Evidence Report* (11) as an SR of the published scientific literature found in MEDLINE from January 1980 to September 1997 on important topics reviewed by the Panel. The published literature was evaluated to determine appropriate treatment strategies that would constitute evidence-based clinical guidelines on overweight and obesity. The San Antonio Cochrane Center assisted in literature abstraction and in organizing the data into evidence tables, and a methodology consultant worked with the Panel to develop ESs and recommendations.

In 2005 NHLBI initiated the process to update the overweight/obesity guidelines and convened stakeholder groups to provide input on what should be the next-generation guideline development process. The resulting recommendations were used to design the process. To continually improve the quality and impact of the guidelines, the process was updated to assure rigor and minimize bias by employing strict, evidence-based methodologies to guide the development of ESs and recommendations based on a SR of the biomedical literature for a specific period of time.

1.2. CQ-Based Approach

The Panel began its deliberations by developing 23 possible CQs and after considerable discussion, narrowed the possibilities to 5 targeted CQs. Questions were chosen to aid primary care practitioners (PCPs) and providers who frequently work with obese patients to identify patients at health risk for weight-related comorbidities and to update them on the benefits and risks of weight loss achieved with various approaches. Examples of CQs that were not included for this review included consideration of genetics of obesity, binge eating disorders, pharmacotherapy, and cost effectiveness of interventions to manage obesity. For each of the CQs, Panel members reviewed the final list of included and excluded articles along with the quality ratings and had the opportunity to raise questions and appeal the ratings to the methodology team. The team then re-examined these papers and presented their rationale for either keeping or changing the quality rating of the papers. Panel members also played a key role in examining the evidence tables and summary tables to be certain that the data from each paper was accurately displayed.

The body of this report is organized by CQ and the following information is included for each CQ:

- The rationale for its selection is provided and methods described.
- The body of evidence is summarized, and ESs are presented which include a rating for quality and a supportive narrative summary.
- Recommendations and their strength are accompanied by a narrative summary of how the recommendation was derived from the evidence and a discussion of issues taken into consideration by the Panel in formulating the recommendation.

CQ1 and CQ2 were chosen to help providers determine the appropriate criteria to guide a weight loss recommendation. CQ1 addresses the expected health benefits of weight loss as a function of the amount and duration of weight loss. CQ2 addresses the health risks of overweight and obesity and seeks to determine if the current waist circumference cutpoints and the widely accepted BMI cutpoints defining persons as overweight (BMI 25 to 29.9 kg/m^2) and obese (BMI $\geq$30 kg/m^2) are appropriate for population

subgroups. Because patients are interested in popular diets that are promoted for weight loss and see the PCP as an authoritative source for information, CQ3 asks which dietary intervention strategies are effective for weight loss efforts. CQ4 seeks to determine the efficacy and effectiveness of a comprehensive lifestyle approach (diet, physical activity, and behavior therapy) to achieve weight loss and weight loss maintenance. CQ5 seeks to determine the efficacy and safety of bariatric surgical procedures, including benefits and risks. CQ5 also seeks to determine patient and procedural factors that may help guide decisions to enhance the likelihood of maximum benefit from surgery for obesity and related conditions.

1.3. Organization of the Expert Panel

In 2007, the NHLBI sought nominations for panel membership that would ensure adequate representation of key specialties and appropriate expertise. The NHLBI staff reviewed the nominees and selected potential chairs and co-chairs for the panels. A Guidelines Executive Committee was formed with the chairs from each of the 3 panels—obesity, high blood pressure (BP), and high blood cholesterol—and the 3 cross-cutting working groups—lifestyle, risk assessment, and implementation. This committee worked with the NHLBI to select panel members from the list of nominees.

The Obesity Panel was comprised of 15 members and 3 ex-officio members, including individuals with specific expertise in psychology, nutrition, physical activity, bariatric surgery, epidemiology, internal medicine, and other clinical specialties. The full Obesity Panel met 23 times throughout the years (5 times face-to-face and 18 times via Webinar). Panel chairs asked all members to disclose any conflict of interest information to the full Panel in advance of the deliberations; members with conflicts were asked to recuse themselves from voting on any aspect of the guideline where a conflict might exist. Each of the 5 CQs had working groups consisting of a leader and various Panel members who met via conference calls to discuss all aspects of the CQ, to review the list of included and excluded articles along with the quality ratings, to review the evidence tables and summary tables, and to develop spreadsheets, the ESs, resulting recommendations, and research/evidence gaps. Panel members had the opportunity to raise questions about the included and excluded articles, submit additional articles that were not identified in the original search, appeal the quality ratings on articles, or to question articles that were excluded. Each working group presented their findings to the full Panel for all final decisions on ES and recommendations, including the strength of the evidence.

The evidence-based process followed most of the standards from the Institute of Medicine report, "Clinical Practice Guidelines We Can Trust." It included support from a methodology contractor and a SR and general support contractor and included the following steps:

- Constructed CQs relevant to clinical practice.

- Identified (a priori) inclusion/exclusion (I/E) criteria for each CQ.
- Developed a literature search strategy, based on I/E criteria, for each CQ.
- Executed a systematic electronic search of the published literature from relevant bibliographic databases for each CQ. The date for the overall literature search was from January 1998 to December 2009. Since CQ1 and CQ2 used SRs and meta-analyses (MA), the literature search included those published from January 2000 to October 2011. CQ3 and CQ4 added major randomized controlled trials (RCT) published after 2009 with >100 people per treatment arm; and CQ5 added some major studies published after 2009 that met the I/E criteria.
- Screened, by 2 independent reviewers, thousands of abstracts/full text returned from the search to identify relevant original articles, SRs, and/or MA. Rigorous validation procedures were applied to ensure that the selected articles met the pre-established detailed I/E criteria before being included in the final review results.
- Determined, by 2 independent raters on the methodology team, the quality of each included study (good, fair, and poor).
- Abstracted relevant information from the included studies into an electronic central repository database using common templates and types of data elements.
- Constructed detailed evidence tables, which organized the data from the abstraction database.
- Analyzed the evidence tables and constructed summary tables, which display the evidence in a manageable format to answer specific parts of the CQ.
- Used summary tables to develop ESs for each CQ. The quality of evidence for each ES was graded as high, moderate, or low based on scientific methodology, scientific strength, and consistency of results. For CQ1 and CQ2, spreadsheets with relevant data from SRs/MAs were developed rather than summary tables.
- Used the graded ESs to write clinical recommendations and graded the strength of each recommendation. Recommendations were graded as Strong Recommendation (Grade A), Moderate Recommendation (Grade B), Weak Recommendation (Grade C), Recommendation Against (Grade D), Expert Opinion (Grade E), or No Recommendation for or Against (Grade N).
- Performed Guideline Implementability Appraisals, planned and coordinated by the NHLBI Implementation Work Group, to identify and address barriers to guideline implementation.

1.4. Document Review and Approval

A formal peer review process was initially completed under the auspices of the NHLBI which included 10 expert reviewers and representatives from multiple Federal agencies. This document was also reviewed

by 6 expert reviewers nominated by the ACC, AHA, and The Obesity Society, when the management of the guideline transitioned to the ACC/AHA. The ACC, AHA, and The Obesity Society Reviewers' RWI information is published in this document (Appendix 2).

This document was approved for publication by the governing bodies of the ACC, AHA and The Obesity Society, and endorsed by the American Association of Cardiovascular and Pulmonary Rehabilitation, American Pharmacists Association, American Society for Nutrition, American Society for Preventive Cardiology, American Society of Hypertension, Association of Black Cardiologists, National Lipid Association, Preventive Cardiovascular Nurses Association, The Endocrine Society, and WomenHeart: The National Coalition for Women with Heart Disease.

2. Obesity Recommendations and Algorithm

2.1. Summary of Evidence-Based Recommendations

The recommendations in Table 4 serve as a guide for PCPs in making evaluations and treatment decisions for overweight and obese patients. The CQs answered by evidence-based recommendations summarize current literature on the risks of overweight and obesity and the benefits of weight loss. They also summarize knowledge on the best diets for weight loss, the efficacy and effectiveness of comprehensive lifestyle interventions on weight loss and weight loss maintenance, and the benefits and risks of bariatric surgery. This information will help PCPs decide who should be recommended for weight loss and what health improvements can be expected. The Panel did not choose a CQ that dealt with various aspects of pharmacotherapy for a comprehensive evidence assessment, since at the time the CQs were chosen there was only 1 approved medication (orlistat) for weight loss. However, CQ1 has some ESs regarding the efficacy of orlistat since the effect of pharmacotherapy on weight loss was included in its evidence review.

Table 4. Summary of Recommendations for Obesity

Recommendations	NHLBI Grade	NHLBI ES	ACC/AHA COR	ACC/AHA LOE
Identifying Patients Who Need to Lose Weight (BMI and Waist Circumference)				
1a. Measure height and weight and calculate BMI at annual visits or more frequently.	E (Expert Opinion)	CQ2	I	C
1b. Use the current cutpoints for overweight (BMI >25.0-29.9 kg/m^2) and obesity (BMI ≥30 kg/m^2) to identify adults who may be at elevated risk of CVD and the current cutpoints for obesity (BMI ≥30) to identify adults who may be at elevated risk of mortality from all causes.	A (Strong)	CQ2	I	B
1c. Advise overweight and obese adults that the greater the BMI, the greater the risk of CVD, type 2 diabetes, and all-cause mortality.	A (Strong)	CQ2	I	B

1d. Measure waist circumference at annual visits or more frequently in overweight and obese adults. Advise adults that the greater the waist circumference, the greater the risk of CVD, type 2 diabetes, and all-cause mortality. The cutpoints currently in common use (from either NIH/NHLBI or WHO/IDF) may continue to be used to identify patients who may be at increased risk until further evidence becomes available.	E (Expert Opinion)	CQ2	IIa	B
Matching Treatment Benefits With Risk Profiles (Reduction in Body Weight Effect on CVD Risk Factors, Events, Morbidity and Mortality)				
2. Counsel overweight and obese adults with CV risk factors (high BP, hyperlipidemia and hyperglycemia), that lifestyle changes that produce even modest, sustained weight loss of 3%-5% produce clinically meaningful health benefits, and greater weight losses produces greater benefits. a. Sustained weight loss of 3%-5% is likely to result in clinically meaningful reductions in triglycerides, blood glucose, HbA1C, and the risk of developing type 2 diabetes; b. Greater amounts of weight loss will reduce BP, improve LDL–C and HDL–C, and reduce the need for medications to control BP, blood glucose and lipids as well as further reduce triglycerides and blood glucose.	A (Strong)	CQ1	I	A
Diets for Weight Loss (Dietary Strategies for Weight Loss)				
3a. Prescribe a diet to achieve reduced calorie intake for obese or overweight individuals who would benefit from weight loss, as part of a comprehensive lifestyle intervention. Any 1 of the following methods can be used to reduce food and calorie intake: a. Prescribe 1,200–1,500 kcal/day for women and 1,500–1,800 kcal/day for men (kcal levels are usually adjusted for the individual's body weight); b. Prescribe a 500 kcal/day or 750 kcal/day energy deficit; or c. Prescribe one of the evidence-based diets that restricts certain food types (such as high-carbohydrate foods, low-fiber foods, or high-fat foods) in order to create an energy deficit by reduced food intake.	A (Strong)	CQ3	I	A
3b. Prescribe a calorie-restricted diet, for obese and overweight individuals who would benefit from weight loss, based on the patient's preferences and health status and preferably refer to a nutrition professional* for counseling. A variety of dietary approaches can produce weight loss in overweight and obese adults, as presented in CQ3, ES2.	A (Strong)	CQ3	I	A
Lifestyle Intervention and Counseling (Comprehensive Lifestyle Intervention)				
4a. Advise overweight and obese individuals who would benefit from weight loss to participate for ≥6	A (Strong)	CQ4	I	A

months in a comprehensive lifestyle program that assists participants in adhering to a lower calorie diet and in increasing physical activity through the use of behavioral strategies.				
4b. Prescribe on site, high-intensity (i.e., ≥14 sessions in 6 months) comprehensive weight loss interventions provided in individual or group sessions by a trained interventionist.†	A (Strong)	CQ4	I	A
4c. Electronically delivered weight loss programs (including by telephone) that include personalized feedback from a trained interventionist† can be prescribed for weight loss but may result in smaller weight loss than face-to-face interventions.	B (Moderate)	CQ4	IIa	A
4d. Some commercial-based programs that provide a comprehensive lifestyle intervention can be prescribed as an option for weight loss, provided there is peer-reviewed published evidence of their safety and efficacy.	B (Moderate)	CQ4	IIa	A
4e. Use a very low calorie diet (defined as <800 kcal/day) only in limited circumstances and only when provided by trained practitioners in a medical care setting where medical monitoring and high intensity lifestyle intervention can be provided. Medical supervision is required because of the rapid rate of weight loss and potential for health complications.	A (Strong)	CQ4	IIa‡	A
4f. Advise overweight and obese individuals who have lost weight to participate long-term (≥1 year) in a comprehensive weight loss maintenance program.	A (Strong)	CQ4	I	A
4g. For weight loss maintenance, prescribe face-to-face or telephone-delivered weight loss maintenance programs that provide regular contact (monthly or more frequent) with a trained interventionist† who helps participants engage in high levels of physical activity (i.e., 200-300 minutes/week), monitor body weight regularly (i.e., weekly or more frequent), and consume a reduced-calorie diet (needed to maintain lower body weight).	A (Strong)	CQ4	I	A
Selecting Patients for Bariatric Surgical Treatment for Obesity (Bariatric Surgical Treatment for Obesity)				
5a. Advise adults with a BMI ≥40 or BMI ≥35 with obesity-related comorbid conditions who are motivated to lose weight and who have not responded to behavioral treatment with or without pharmacotherapy with sufficient weight loss to achieve targeted health outcome goals that bariatric surgery may be an appropriate option to improve health and offer referral to an experienced bariatric surgeon for consultation and evaluation.	A (Strong)	CQ5	IIa§	A
5b. For individuals with a BMI <35, there is insufficient evidence to recommend for or against undergoing bariatric surgical procedures.	N (No Recommendation)	CQ5	N/A	N/A
5c. Advise patients that choice of a specific bariatric surgical procedure may be affected by patient factors, including age, severity of obesity/BMI, obesity-related comorbid conditions, other operative	E (Expert Opinion)	CQ5	IIb	C

risk factors, risk of short- and long-term complications, behavioral and psychosocial factors, and patient tolerance for risk as well as provider factors (surgeon and facility).				

*Nutrition professional: In the studies that form the evidence base for this recommendation, a registered dietitian usually delivered the dietary guidance; in most cases, the intervention was delivered in university nutrition departments or in hospital medical care settings where access to nutrition professionals was available.
†Trained Interventionist: In the studies reviewed, trained interventionists included mostly health professionals (e.g., registered dietitians, psychologists, exercise specialists, health counselors, or professionals in training) who adhered to formal protocols in weight management. In a few cases, lay persons were used as trained interventionists; they received instruction in weight management protocols (designed by health professionals) in programs that have been validated in high quality trials published in peer-reviewed journals.
‡There is strong evidence that if a provider is going to use a very low-calorie diet, it should be done with high levels of monitoring by experienced personnel; that does not mean that practitioners should prescribe very-low calorie diets. Due to concern that an ACC/AHA Class I recommendation would be interpreted as the patients should go on a very-low calorie diet, it was the consensus of the Panel that this maps more closely to an ACC/AHA Class IIa recommendation.
§There is strong evidence that the benefits of surgery outweigh the risks for some patients. These patients can be offered a referral to discuss surgery as an option. This does not mean that all patients who meet the criteria should have surgery. This decision making process is quite complex and best performed by experts. The ACC/AHA criterion for a Class I recommendation states that the treatment/procedure should be performed/administered. This recommendation as stated does not meet the criterion that the treatment should be performed. Thus, the ACC/AHA classification criteria do not directly map to the NHLBI grade assigned to the Panel

ACC indicates American College of Cardiology; AHA, American Heart Association; BMI, body mass index; BP, blood pressure; COR, class of recommendation; CQ, critical question; CV, cardiovascular risk; CVD, cardiovascular disease; ES, evidence statement; HDL–C, high-density lipoprotein cholesterol; IDF, International Diabetes Foundation; LDL–C, low-density lipoprotein cholesterol; LOE, level of evidence; NHLBI, National Heart, Lung, and Blood Institute; NIH, National Health Institute; and WHO, World Health Organization.

2.2. Chronic Disease Management Model for Primary Care of Patients with Overweight and Obesity—Treatment Algorithm

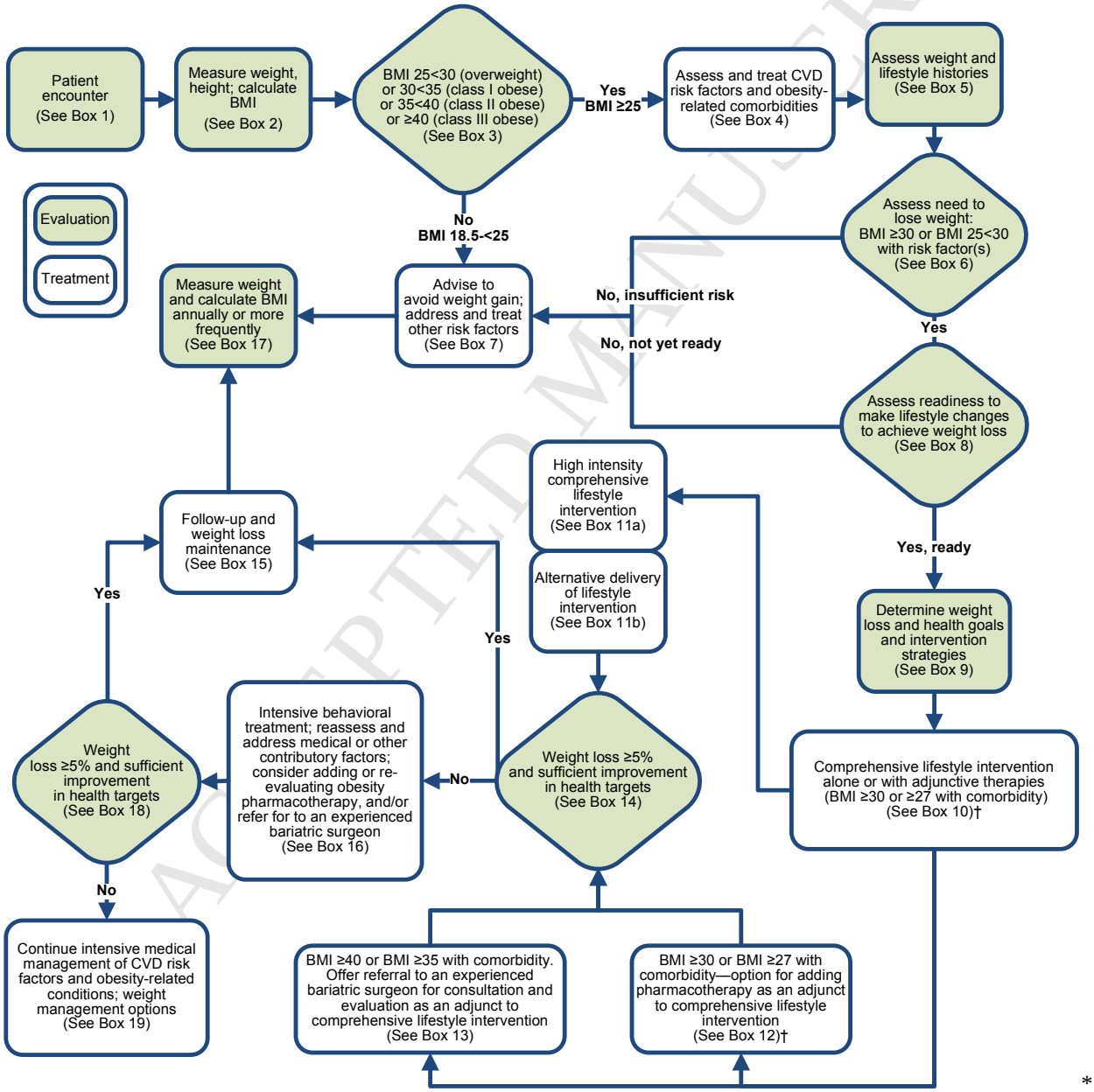
The Panel provides a treatment algorithm, Chronic Disease Management Model for Primary Care of Patients with Overweight and Obesity, to guide PCPs in the evaluation, prevention, and management of patients regarding excess body weight (Figure 1). The algorithm incorporates, wherever possible, the recommendations derived from the 5 CQs that yielded ESs and recommendations. However, because the 5 CQs that were considered did not cover the entire scope of evaluation, prevention, and management of overweight/obesity, the panelists provided advice based upon other guidelines and expert opinion to give providers a more comprehensive approach to their patients with weight-related issues.

The algorithm is not intended to supplant initial assessment for CV risk factors or diseases, but rather, focuses on the identification of patients with excess body weight and those at risk for obesity-related health problems. Its purpose is to guide weight management decision making.

The algorithm incorporates the recommendation from CQ3 and CQ4 that patients who have sufficient health risk from overweight or obesity receive comprehensive lifestyle intervention. These approaches were all found effective under conditions where multidisciplinary teams of medical, nutrition,

and behavioral experts and other highly trained professionals worked intensively with individuals on weight management. This intervention should be foundational to additional weight management efforts, such as addition of medications or bariatric surgery. It also emphasizes a fundamental principle of chronic disease management, i.e., the need to complement a committed patient with informed providers in order to effectively manage a chronic condition like obesity and its associated CVD risk factors.

Figure 1. Treatment Algorithm—The Chronic Disease Management Model for Primary Care of Patients with Overweight and Obesity*



*This algorithm applies to the assessment of overweight and obesity and subsequent decisions based on that

assessment. Each step (designated by a box) in this process is reviewed in this section and expanded upon in subsequent sections.
†BMI cutpoint determined by the FDA and listed on the package inserts of FDA-approved obesity medications.

BMI indicates body mass index; CVD, cardiovascular disease; and FDA, Food and Drug Administration.

Box 1: Patient Encounter for Obesity Prevention and Management
A patient encounter for obesity prevention and management is defined as an interaction with a PCP who assesses a patient's weight status in order to determine presence of overweight or obesity and need for further assessment and treatment.

Box 2: Measure Weight and Height; Calculate BMI
Weight and height are measured with the patient wearing light clothing or an examination gown and no shoes and the BMI calculated. BMI can be calculated manually (weight in kg/ [height in meters]^2), or electronically using the EMR or other resources and documented in the patient medical record.

Box 3: BMI 25 <30 (overweight) or BMI 30<35 (class I obese) or BMI 35<40 (class II obese) or BMI ≥40 (class III obese [extreme obesity])
These BMI cutpoints define overweight and class I to III obese individuals and identify adults who may be at increased risk for CVD and other obesity-related conditions. Within these categories, additional personal risk assessment is needed because degree of risk can vary (Box 4 and CQ 2).

Box 4: **Assess and Treat CVD Risk Factors and Obesity-Related Comorbidities**
Assess risk for CVD and/or presence of obesity-related comorbidities. Risk assessment for CVD and diabetes in a person with overweight or class I to III obesity includes history, physical examination, clinical and laboratory assessments, including BP, fasting blood glucose, and fasting lipid panel (expert opinion). A waist circumference measurement is recommended for individuals with BMI 25 <35kg/m^2 to provide additional information on risk. It is not necessary to measure waist circumference in patients with BMI ≥35 because the waist circumference will likely be elevated and it will add no additional risk information. The Panel recommends, by expert opinion, using the current cutpoints (>88 cm or >35 in for women and >102 cm or >40 in for men) as indicative of increased cardiometabolic risk.

Because obesity is associated with increased risk of hypertension, dyslipidemia, diabetes, and a host of other comorbidities the clinician should assess for associated conditions. The Panel recommends by expert opinion that intensive management of CVD risk factors (hypertension, dyslipidemia, prediabetes or diabetes) or other obesity-related medical conditions (e.g., sleep apnea) be instituted if they are found, regardless of weight loss efforts.

Box 5: Assess Weight and Lifestyle Histories
The Panel recommends, by expert opinion, that the clinician assess weight and lifestyle histories and determine other potential contributory factors: Ask questions about history of weight gain and loss over time, details of previous weight loss attempts, dietary habits, physical activity, family history of obesity, and other medical conditions or medications that may affect weight. This may provide useful information about the origins of or maintaining factors for overweight and obesity, including success and difficulties with previous weight loss or maintenance efforts. This information can assist the clinician in determining any adjustments to the patient's medical regimen that can assist weight management efforts, in providing appropriate advice on lifestyle change, and may also impact recommendations for treatment.

Box 6: Assess Need to Lose Weight
YES – BMI ≥30 or BMI 25<30 with additional risk factor(s):
Weight loss treatment is indicated for 1) obese individuals and 2) overweight individuals with 1 or more indicators of increased CVD risk (e.g., diabetes, prediabetes, hypertension, dyslipidemia, elevated waist circumference) or other obesity related comorbidities.

NO – BMI <25 or BMI 25<30 without additional risk.

Normal weight patients (BMI 18.5<25) should be advised to avoid weight gain (Box 7).
Patients who are overweight (BMI 25<30), and who do not have indicators of increased CVD risk (e.g., diabetes, prediabetes, hypertension, dyslipidemia, elevated waist circumference) or other obesity-related comorbidities should be advised to avoid additional weight gain (Box 7).

Box 7: Advise to Avoid Weight Gain, Address other Risk Factors
A. Normal Weight: Individuals who are normal weight (BMI 18.5<25) and do not have a history of overweight/obesity should be counseled on the desirability of avoiding weight gain to prevent the health risks of increased body weight.
B. Overweight without additional risk factors or normal weight with a history of overweight/obesity: For individuals who are overweight (BMI 25<30), and who do not have indicators of increased CVD risk (e.g., diabetes, prediabetes, hypertension, dyslipidemia, elevated waist circumference) or other obesity-related comorbidities and individuals who have a history of overweight and are now normal weight with risk factors at acceptable levels, advise to frequently measure their own weight, and to avoid weight gain by adjusting their food intake if they start to gain more than a few pounds. Also, advise patients that engaging in regular physical activity will help them avoid weight gain.
C. Overweight or obese individuals who would benefit from weight loss but who are not currently prepared or able to lose weight: Periodically assess the patient's interest in and readiness for weight loss, as shown in Box 8 and counsel the patient on the desirability of avoiding additional weight gain to prevent greater health risk. Regardless of patient's interest in or readiness for weight loss intervention, any CVD risk factors and obesity-related health conditions should be evaluated and treated.

Box 8: Assess Readiness to Make Lifestyle Changes to Achieve Weight Loss and Identify Barriers to Success
The Panel advises (expert opinion) that the clinician and patient agree on whether weight loss is appropriate. The clinician, together with the patient, should assess if the patient is prepared and ready to undertake the measures necessary to succeed at weight loss before undertaking comprehensive counseling efforts. The clinician can ask, "How prepared are you to make changes in your diet, to be more physically active, and to use behavior change strategies such as recording your weight and food intake?" These are the components of a comprehensive lifestyle intervention.

The decision to undertake weight loss efforts must be made in the context of competing priorities (e.g., smoking cessation may supersede a weight loss effort and life events may make the effort at weight reduction futile until a future time). If the patient is not prepared to undertake these changes, attempts to counsel them regarding how to make lifestyle changes are likely to be counterproductive.

Box 9: Determine Weight Loss and Health Goals and Intervention Strategies
Clinician and patient devise weight loss and health goals and comprehensive lifestyle treatment strategies to achieve these goals.

Recommended goals for weight loss: A realistic and meaningful weight loss goal is an important first step. Although sustained weight loss of as little as 3% to 5% of body weight may lead to clinically meaningful reductions in some CVD risk factors, larger weight losses produce greater benefits. The Panel recommends as an initial goal the loss of 5% to 10% of baseline weight within 6 months.

Recommended methods for weight loss: Weight loss requires creating an energy deficit through caloric restriction, physical activity, or both. An energy deficit of ≥500 kcal/day typically may be achieved with dietary intake of 1,200 to 1,500 kcal/day for women and 1,500 to 1,800 kcal/day for men. The choice of calorie restricted diet can be individualized based on the patient's preferences and health status (CQ3). Very low-calorie diets (<800 kcal/day) should be used only in limited circumstances in a medical care setting where medical supervision and a high-intensity lifestyle intervention can be provided. If a specialized diet for CVD risk reduction, diabetes, or other medical conditions is also prescribed, referral to a nutrition professional* is recommended (CQ3).

Recommendations for management of medical conditions during weight loss: While weight loss treatment is ongoing, manage risk factors such as hypertension, dyslipidemia and other obesity-related conditions. This includes monitoring the patient's requirements for medication change as weight loss progresses, particularly for antihypertensive medications and diabetes medications that can cause hypoglycemia.

Box 10: Weight Loss Options – Comprehensive Lifestyle Intervention Alone or With Adjunctive Therapies*
All patients for whom weight loss is recommended should be offered or referred for comprehensive lifestyle

intervention (Box 11a and 11b). Comprehensive lifestyle intervention, preferably with a trained interventionist† or nutrition professional* is foundational to weight loss (Box 11a), regardless of augmentation by medications or bariatric surgery.

By expert opinion, if the weight and lifestyle history indicates that the patient has NEVER participated in a comprehensive lifestyle intervention program, as defined in CQ4 and in Box 11a, it is recommended that he or she be encouraged to undertake such a program prior to adding adjunctive therapies, as a substantial proportion of patients will lose sufficient weight with comprehensive lifestyle treatment alone to improve health. This recommendation may be modified by the availability of comprehensive lifestyle intervention or by patient factors, such as medical conditions that warrant earlier initiation of more intensive treatment.

If the patient has been unable to lose weight or sustain weight loss with comprehensive lifestyle intervention and they have a BMI ≥30 or ≥27 with comorbidity, adjunctive therapies may be considered.

Patients who are otherwise appropriate candidates for obesity drug treatment or bariatric surgery, whose weight and lifestyle history indicates a history of being unable to lose weight or sustain weight loss and who have previously participated in a comprehensive lifestyle intervention, may be offered the option to add pharmacotherapy at the time of initiation of a lifestyle intervention program (BMI ≥30 or ≥27 with comorbidity) or to be referred for evaluation for bariatric surgery (BMI ≥40 or BMI ≥35 with comorbidity) (expert opinion).‡

Box 11a. Offer or Refer for High Intensity Comprehensive Lifestyle Intervention

The most effective behavioral weight loss treatment is in-person, high-intensity (i.e., ≥14 sessions in 6 months) comprehensive weight loss interventions provided in individual or group sessions by a trained interventionist† (CQ4). The principal components of an effective high-intensity, on-site comprehensive lifestyle intervention include: 1) prescription of a moderately-reduced calorie diet; 2) a program of increased physical activity; and 3) the use of behavioral strategies to facilitate adherence to diet and activity recommendations. As shown in CQ4, comprehensive lifestyle intervention consisting of diet, physical activity, and behavior therapy produces average weight losses of approximately 8 kg in a 6 month period of frequent, in-person treatment. This approximates losses of 5% to 10% of initial weight. The observed average weight loss of approximately 8 kg includes people who have variable weight loss (i.e., some more and some less than average), so accurate prediction of individual weight loss is not possible. After 6 months, most patients will equilibrate (caloric intake balancing energy expenditure) and will require adjustment of energy balance if they are to lose additional weight. As demonstrated in CQ4, continued intervention contact following initial weight loss treatment is associated with better maintenance of lost weight (Box 15).

Box 11b. Options for Alternative Modes of Delivery of Lifestyle Intervention

In primary care offices where frequent, in-person individual or group sessions led by a trained interventionist† or a nutrition professional* are not possible or available by referral, the physician may consider alternative modes of delivery. As found in CQ4, emerging evidence supports the efficacy, albeit with less weight loss, of electronically delivered interventions (e.g., by internet or telephone) that provide personalized feedback by a trained interventionist†, and for some commercial programs using counseling (face-to-face or telephonic) with or without prepackaged meals. The Panel recommends by expert opinion that physicians may refer to these alternative sources provided their outcomes are supported by scientific evidence of safety and efficacy. An additional option if a high-intensity comprehensive lifestyle intervention program is not available or feasible is referral to a nutrition professional† for dietary counseling.

Box 12. Option for Adding Pharmacotherapy as an Adjunct to Comprehensive Lifestyle Intervention‡

The Panel did not review comprehensive evidence for pharmacotherapy for weight loss. Based on expert opinion, the panelists recommend that for individuals with BMI ≥30 or BMI ≥27 with at least 1 obesity-associated comorbid condition who are motivated to lose weight, pharmacotherapy can be considered as an adjunct to comprehensive lifestyle intervention to help achieve targeted weight loss and health goals. Medications should be FDA-approved, and clinicians should be knowledgeable about the product label. The provider should weigh the potential risks of the medication being considered against the potential benefits of successful weight loss for the individual patient. The rationale for use of medications is to help patients adhere to a lower calorie diet more consistently in order to achieve sufficient weight loss and health improvements when combined with increased physical activity. The available medications work through effects on appetite or fat absorption. Medications work to reinforce lifestyle change and should be prescribed as an adjunct to lifestyle interventions, as defined in Boxes 11a and 11b.

Box 13. Offer Referral to an Experienced Bariatric Surgeon for Consultation and Evaluation
Advise adults with a BMI ≥40 or BMI ≥35 with obesity-related comorbid conditions who are motivated to lose weight and who have not responded to behavioral treatment (with or without pharmacotherapy) with sufficient weight loss to achieve targeted health outcome goals that bariatric surgery may be an appropriate option to improve health, and offer referral to an experienced bariatric surgeon for consultation and evaluation (CQ5 for additional information). Because bariatric surgery leads to improvements in both weight-related outcomes and many obesity-related comorbid conditions, the benefit-to-risk ratio may be favorable in appropriately selected patients at high risk for obesity-related morbidity and mortality. In the absence of RCTs to identify the optimal duration and weight loss outcomes of nonsurgical treatment prior to recommending bariatric surgery, the decision to proceed to surgery should be based on multiple factors: patient motivation, treatment adherence, operative risk, and optimization of comorbid conditions, among others. Bariatric surgery should be considered an adjunct to lifestyle treatment: behavioral treatment, appropriate dietary modification, and physical activity.

Box 14. Weight Loss ≥5% of Initial Body Weight AND Sufficient Improvement in Health Targets?
Achieving the goals noted in Box 9 of approximately 5% to 10% of initial weight with a comprehensive lifestyle intervention should be considered successful weight reduction that leads to decreased risk for development or amelioration of obesity-related medical conditions and CVD risk factors for many patients. Some patients will require additional weight loss to achieve targeted health outcome goals.

If the patient achieves the weight loss and the health outcome goals previously identified by clinician and patient, the clinician should consider the weight loss maintenance strategies described in Box 15 using the disease management model of obesity treatment. If these weight loss or health outcome goals are not achieved with current treatment, the clinician can consider intensification of behavioral treatment (Box 16), and/or the addition or re-evaluation of obesity pharmacotherapy (Box 12), or referral for evaluation for bariatric surgery (Box 13) in patients otherwise meeting BMI and comorbidity criteria.

Box 15: Weight Loss Maintenance
Typically, obesity is a chronic condition that develops over an individual's life time. The prevalence of obesity has greatly increased over the past 30 years, most likely because of environmental changes that promote increased consumption of high-calorie palatable foods, decreased physical activity, and more sedentary behavior. In this environment, it is difficult to maintain a healthy weight and prevent weight gain. Long-term research has shown that continuing weight loss maintenance interventions produce better long-term results when compared to limited-term intervention programs. Clinicians must acknowledge the life-long challenge that patients experience with obesity, provide support and encouragement, be prepared to assist patients with addressing small weight gains before they become larger ones, and to reinstitute weight management efforts as early as possible in the course of regain.

The usual pattern of weight loss in patients undergoing a lifestyle intervention is that maximum weight loss is achieved at 6 months, followed by plateau and gradual regain over time. This is also true for medication-assisted weight loss, although weight regain may be slower with continued medication use. For bariatric surgery patients, it may take much longer for weight to plateau (CQ3, CQ4, and CQ5).

The strategies for weight maintenance after successful loss differ from the strategies for achieving weight loss. Flexibility and willingness to try different approaches are recommended. Patients should be advised that participation in a long-term (≥1 year) comprehensive weight-loss maintenance program with monthly or more frequent contact, in-person or by telephone can improve successful weight maintenance. Strategies such as frequent self-weighing (at least weekly), consumption of a reduced calorie diet, and high levels of physical activity (>200 minutes/week) are associated with better weight maintenance over time.

Box 16: Unable to Lose Enough Weight With Current Treatment to Meet Weight or Targeted Health Goals
By expert opinion, if patients are unable to lose enough weight to meet weight or targeted health outcome goals with their current treatment, consider offering or referring for more intensive behavioral treatment than currently being attempted, an alternate diet including options for meal replacement, referral to a nutrition professional*, the addition of obesity pharmacotherapy, or referral for evaluation for bariatric surgery if otherwise appropriate. The clinician should also assess the patient's medication regimen for drugs that may contribute to weight gain and consider adjustments if medically appropriate. If the patient is currently taking an obesity medication but has not lost at least 5% of initial body weight after 12 weeks on a maximal dose of the medication, the provider should

reassess the risk-to-benefit ratio of that medication for the patient, and consider discontinuation of that drug.

Box 17: Measure Weight and Calculate BMI Annually or More Frequently
Weight should be measured and BMI calculated and documented by the clinician at least annually in all patients. For those who have never been overweight or who are weight stable, a 1-year interval is appropriate for the reassessment of BMI. For overweight or obese individuals or those of normal weight with a history of overweight, more frequent monitoring may be appropriate. While these follow-up intervals are not evidence based, they are a reasonable compromise between the need to identify weight gain at an early stage and the need to limit the time, effort, and cost of repeated measurements.

Box 18. Weight Loss ≥5% of Initial Body Weight AND Sufficient Improvement in Health Targets?
Determine if the intensified treatment strategies instituted in Box 16 have led to both successful weight loss and sufficient risk factor/comorbidity reduction to achieve the health goals determined by patient and clinician.

Box 19. Continue Intensive Medical Management of CVD Risk Factors and Obesity Related Conditions and Periodic Assessment of Weight Management Options
Actively and intensively manage CVD risk factors and obesity-related conditions, regardless of the patient's ability to achieve or sustain weight loss. Periodically reassess and address medical or other contributory factors and the potential to institute or reinstitute additional weight management options, as shown in Box 16.

*Nutrition professional: In the studies that form the evidence base for this recommendation, a registered dietitian usually delivered the dietary guidance; in most cases, the intervention was delivered in university nutrition departments or in hospital medical care settings where access to nutrition professionals was available.
†Trained interventionist: In the studies reviewed, trained interventionists included mostly health professionals (e.g., registered dietitians, psychologists, exercise specialists, health counselors, or professionals in training) who adhered to formal protocols in weight management. In a few cases, lay persons were used as trained interventionists; they received instruction in weight management protocols (designed by health professionals) in programs that have been validated in high-quality trials published in peer-reviewed journals.
‡BMI cutpoint determined by the FDA and listed on the package inserts of FDA-approved obesity medications.

BMI indicates body mass index; BP, blood pressure; CQ, critical questions; CVD, cardiovascular disease; EMR, electronic medical record; FDA, Federal Drug Administration; PCP, primary care practitioner; and RCT, randomized controlled trial.

3. CQs and Corresponding ESs

Each of the CQs are stated below, together with the number of articles screened against their individual I/E criteria and the number of articles that met the inclusion criteria and were quality rated fair or good. Those CQs that did not have many articles rated fair or good used the articles rated as poor (i.e., CQ2). The resulting ESs that follow reflect the Panel's review of the literature. The stated strength of evidence applies to the overall ES, including any bulleted items, unless noted otherwise.

3.1. CQ1: Statement of the Question

Among overweight and obese adults, does achievement of reduction in body weight with lifestyle and pharmacological interventions affect CVD risk factors, CVD events, morbidity, and mortality?

1a. Does this effect vary across population subgroups defined by the following demographic and clinical characteristics:

- Age

- Sex
- Race/ethnicity
- Baseline BMI
- Baseline waist circumference
- Presence or absence of comorbid conditions
- Presence or absence of CVD risk factors

1b. What amount (shown as percent lost, pounds lost, etc.) of weight loss is necessary to achieve benefit with respect to CVD risk factors, morbidity, and mortality?

- Are there benefits of CVD risk factors, CVD events morbidity, and mortality from weight loss?
- What are the benefits of more significant weight loss?

1c. What is the effect of sustained weight loss for ≥2 years in individuals who are overweight or obese, on CVD risk factors, CVD events, and health and psychological outcomes?

- What percent of weight loss needs to be maintained at ≥2 years to be associated with health benefits?

CQ1 was initially intended to be a de novo SR of original studies plus SRs and MAs. Due to resource and time constraints, the CQ was restricted to SRs/MAs only published between January 2000 and October 2011. The titles and abstracts of 1,630 publications were screened against the I/E criteria independently by 2 reviewers, which resulted in 669 publications being excluded and 697 publications being retrieved for full-text review to further assess eligibility. Six hundred and ninety-seven full-text publications were independently screened by 2 reviewers, who assessed eligibility by applying the I/E criteria; 669 of these publications were excluded based on ≥1 of the I/E criteria. Of the 697 full-text publications, 42 publications met the criteria and were included. The quality (internal validity) of these 42 publications was assessed using the quality assessment tool developed to assess SRs/MAs or RCTs. Of these, 14 publications were rated as poor quality. The remaining 28 publications were rated good or fair quality and included in the evidence base that was used to formulate the ESs and recommendations (12-39). Although the issue of pharmacotherapy was not by itself a CQ, CQ1 was tasked to evaluate this evidence and several MAs included the effect of orlistat on weight loss and risk factors. None of the SR/MA's included the Look AHEAD (Action for Health in Diabetes) trial data, which the Panel considered unique in that the number of participants equaled or exceeded the total number of observations in most SRs/MAs. The Look AHEAD papers were included in the database as a critical supplement to the SR/MA information. The

ESs were developed based upon the published literature available as of October 2011 and could not take into account published or unpublished reports of outcomes subsequent to the approval of the statements.

The following ESs reflect the Panel's review of the literature. See the Full Panel Report Supplement (http://jaccjacc.cardiosource.com/acc_documents/2013_FPR_S5_Obesity.pdf) for the supportive evidence and spreadsheets.

3.1.1. Weight Loss and Risk of Diabetes

ES 1. In overweight and obese adults at risk for type 2 diabetes, average weight losses of 2.5 kg to 5.5 kg at ≥2 years, achieved with lifestyle intervention (with or without orlistat) reduces the risk of developing type 2 diabetes by 30% to 60%.

- ***Strength of the Evidence: High***

ES 2. In overweight and obese adults with type 2 diabetes, 2% to 5% weight loss achieved with 1 to 4 years of lifestyle intervention (with or without orlistat) results in modest reductions in fasting plasma glucose concentrations and lowering of HbA1c by 0.2% to 0.3%.

- ***Strength of the Evidence: High***

ES 3. In overweight and obese adults with type 2 diabetes, those who achieve greater weight loss at 1 year with lifestyle intervention (with or without orlistat) have greater improvements in HbA1C. Weight loss of 5% to 10% is associated with HbA1C reductions of 0.6% to 1.0% and reduced need for diabetes medications.

- ***Strength of the Evidence: High***

ES 4. In overweight and obese adults with type 2 diabetes treated for 1 year with lifestyle intervention (with or without orlistat), those who lose more weight achieve greater reductions in fasting plasma glucose concentrations. Those who achieve weight losses of 2% to 5% are more likely to have clinically meaningful (>20 mg/dL lowering) reductions in fasting glucose than those who remain weight stable (defined as gaining ≤2%, losing <2%).

- ***Strength of the Evidence: High***

ES 5. As comprehensive lifestyle treatment of overweight and obese adults with type 2 diabetes continues over 4 years, some weight regain will occur on average; partial weight regain is associated with an

increase in HbA1C, but HbA1C remains below preintervention levels, and the reduction remains clinically meaningful (23).

- ***Strength of the Evidence: Moderate***

ES 6. In observational cohort studies, overweight and obese adults with type 2 diabetes who intentionally lost 9 kg to 13 kg had a 25% decrease in mortality rate compared to weight stable controls.

- ***Strength of the Evidence: Low***

ES 7. In overweight and obese adults with type 2 diabetes, orlistat compared to placebo, both with lifestyle intervention, results in 2 kg to 3 kg greater weight loss at 1 and 2 years. The addition of orlistat is associated with greater reductions in fasting blood glucose averaging 11 and 4 mg/dL at 1 and 2 years as well as an average greater reduction in HbA1C of 0.4% at 1 year.

- ***Strength of the Evidence: High***

3.1.2. Weight Loss and Impact on Cholesterol/Lipid Profile

ES 1. In overweight or obese adults with or without elevated CVD risk, there is a dose-response relationship between the amount of weight loss achieved by lifestyle intervention and the improvement in lipid profile. The level of weight loss needed to observe these improvements varies by lipid as follows:

  - At a 3 kg weight loss, a weighted mean reduction in triglycerides of at least 15 mg/dL is observed.
  - At 5 kg to 8 kg weight loss, low-density lipoprotein cholesterol (LDL–C) reductions of approximately 5 mg/dL and increases in high-density lipoprotein cholesterol (HDL–C) 2 to 3 mg/dL are achieved.
  - With <3 kg weight loss, more modest and more variable improvements in triglycerides, HDL–C and LDL–C are observed.

- ***Strength of the Evidence: High***

ES 2. Among overweight and obese adults with type 2 diabetes, 8.0% weight loss at 1 year and 5.3% weight loss over 4 years compared to usual care control results in greater average increases (2 mg/dL) in HDL–C and greater average reductions in triglycerides.

- ***Strength of the Evidence: Moderate***

ES 3. A mean 5% weight loss achieved over 4 years by lifestyle intervention in overweight or obese adults with type 2 diabetes is associated with a reduction in newly prescribed lipid lowering medications compared with controls.

- ***Strength of the Evidence: Moderate***

ES 4. Among overweight and obese adults with type 2 diabetes, there is a dose-response relationship between the amount of weight loss and the increase in HDL–C that is most pronounced in those who are the least overweight at baseline.

- ***Strength of the Evidence: Low***

ES 5. Compared to placebo, the addition of orlistat to lifestyle intervention in overweight and obese adults results in an average 3 kg greater weight loss together with an 8 to 12 mg/dL reduction in LDL–C, a 1 mg/dL reduction in HDL–C, and variable changes in triglycerides.

- ***Strength of the Evidence: High***

3.1.3. Weight Loss and Hypertension Risk

ES 1. In overweight or obese adults with elevated CVD risk (including type 2 diabetes and hypertension), there is a dose-response relationship between the amount of weight loss achieved at up to 3 years by lifestyle intervention (alone or combined with orlistat) and the lowering of BP.

  - At a 5% weight loss, a weighted mean reduction in systolic and diastolic BP of approximately 3 and 2 mm Hg respectively, is observed.
  - At <5% weight loss, there are more modest and more variable reductions in BP.
- ***Strength of the Evidence: High***

ES 2. A 5% mean weight loss difference achieved over 4 years by intensive lifestyle intervention in overweight or obese adults with type 2 diabetes is associated with a lower prevalence of patients who are prescribed antihypertensive medications compared with controls.

- ***Strength of the Evidence: Moderate***

3.2. CQ2: Statement of the Question

2a. Are the current cutpoint values for overweight (BMI 25.0–29.9 kg/m^2) and obesity (BMI ≥30 kg/m^2) compared with BMI 18.5–24.9 kg/m^2 associated with elevated CVD-related risk (defined

below)? Are the waist circumference cutpoints of >102 cm (male) and >88 cm (female) associated with elevated CVD-related risk? How do these cutpoints compare with other cutpoints in terms of elevated CVD-related risk and overall mortality?

- Fatal and nonfatal CHD, stroke, and CVD (CHD and stroke)
- Overall mortality
- Incident type 2 diabetes
- Incident dyslipidemia
- Incident hypertension

2b. Are differences across population subgroups in the relationships of BMI and waist circumference cutpoints with CVD, its risk factors, and overall mortality sufficiently large to warrant different cutpoints? If so, what should they be?

- Fatal and nonfatal CHD, stroke, and CVD
- Overall mortality
- Incident type 2 diabetes
- Incident dyslipidemia
- Incident hypertension

Groups being considered include:

- Age
- Sex (both male and female)
- Race/ethnicity (African American, Hispanic, Native American, Asian, White)

2c. What are the associations between maintaining weight and weight gain with elevated CVD-related risk in normal weight, overweight, and obese adults?

Due to resource limitations, CQ2 had to limit its literature search to studies published between 2000 and 2011 and its evidence review to SRs, MAs, and pooled analyses to limit the number of individual articles to be searched, reviewed, and quality rated. Panel members excluded studies that focused on specific subpopulations with a disease or condition (e.g., women with breast cancer or adults on maintenance hemodialysis) and constructed summary evidence tables from the identified articles, and these tables were reviewed and checked by contractor staff for accuracy. Of the 1,571 articles initially screened, 15 of the 482 full-text publications met the I/E criteria and were included. The quality (internal validity) of these 15 publications was assessed using the quality assessment tool developed to assess SRs/MAs. Of these, 3 publications were rated as fair (40-42) and the rest were rated as poor quality but included in the evidence base because the NHLBI policy indicated that poor studies could be used as part of the evidence base if

the majority of included studies were not rated good or fair. The following ESs reflect the Panels review of the literature.

3.2.1. Current BMI Cutpoints and CVD-related Risk and All-cause Mortality

ES 1. Among overweight and obese adults, analyses of continuous BMI show that the greater the BMI, the higher the risk of fatal CHD and combined fatal and nonfatal CHD. The current cutpoints for overweight (BMI ≥25.0 kg/m^2) and obesity (BMI ≥30 kg/m^2) compared with normal weight (BMI 18.5 to <25.0 kg/m^2) are associated with elevated risk of combined fatal and nonfatal CHD.

- ***Strength of the Evidence: Moderate***

ES 2. Among overweight and obese adults, analyses of continuous BMI show that the greater the BMI, the higher the risk of fatal CHD and combined fatal and nonfatal CHD in both men and women. The current BMI cutpoints for overweight (BMI ≥25.0 kg/m^2) and obesity (BMI ≥30.0 kg/m^2) compared with normal weight (BMI 18.5 to <25.0 kg/m^2) are associated with elevated risk of fatal CHD in both sexes.

- ***Strength of the Evidence: Moderate***

ES 3. Among overweight or obese adults, analyses of continuous BMI show that the greater the BMI the higher the risk of fatal stroke overall as well as ischemic and hemorrhagic stroke. The same relationship holds for combined fatal and nonfatal ischemic stroke but across the entire BMI range, not just in overweight and obese adults. There is no evidence from MAs, pooled analyses, and SRs to change current BMI cutpoints as they relate to risk of stroke.

- ***Strength of the Evidence: Moderate***

ES 4. Among overweight and obese adults, analyses of continuous BMI show that the greater the BMI, the higher the risk of combined fatal and nonfatal CVD. The current cutpoint for obesity (BMI ≥30 kg/m^2) compared with normal weight (BMI 18.5 to <25.0 kg/m^2) is associated with an elevated risk of fatal CVD in men and women.

- ***Strength of the Evidence: Moderate***

ES 5. In men only, the current BMI cutpoint for overweight (BMI 25.0 to 29.9 kg/m2) compared to normal weight (BMI 18.5 to <25.0 kg/m2) is associated with an elevated risk of fatal CVD. In both men and women, obesity (BMI ≥30.0 kg/m2) compared with normal weight is associated with an elevated risk of fatal CVD.

- ***Strength of the Evidence: Low***

ES 6. Using current BMI cutpoints, the relative risk of fatal CVD was higher in obese White women than in obese African American women compared to normal weight women. In overweight women, there was no increase in risk of fatal CVD compared to normal weight women in either race group.

- ***Strength of the Evidence: Low***

ES 7. Analyses of continuous BMI across the entire BMI range show that the greater the BMI, the higher the risk of type 2 diabetes, without an indication of a threshold effect.

- ***Strength of the Evidence: Moderate***

ES 8. Among overweight and obese adults, analyses of continuous BMI show that the higher the BMI, the greater the risk of all-cause mortality. The current category for overweight (BMI 25.0 to 29.9 kg/m^2) is not associated with elevated risk of all-cause mortality; but, a BMI at or above the current cutpoint for obesity (BMI ≥30 kg/m^2) is associated with an elevated risk of all-cause mortality, compared with normal weight (18.5 to 24.9 kg/m^2).

- ***Strength of the Evidence: Moderate***

ES 9. Sex-specific analyses of continuous BMI among overweight and obese men and women, show that the greater the BMI, the higher the risk of all-cause mortality. The risk of all-cause mortality associated with the current cutpoints of obesity was similar for men and women.

- ***Strength of the Evidence: Moderate***

3.2.2. Areas of Insufficient Evidence Regarding Cutpoints for BMI and for Waist Circumference.

The Panel was not able to address parts of CQ2 due to the lack of SRs, MAs, and pooled analyses identified in the systematic search. Panel members were aware of a large body of literature from individual studies examining the associations between BMI or waist circumference and hypertension or dyslipidemia but they have not been summarized in MAs, pooled analyses, or SRs that met the criteria. In addition, there were no studies in the search that compared alternative cutpoints to current cutpoints as they relate to risk of CHD, stroke, CVD, overall mortality, and diabetes. There were no SRs, MAs, and pooled analyses identified that examined current waist circumference cutpoints as they relate to the risk of all outcomes addressed in CQ2, however, the Panel examined meta-analyses of studies that used waist circumference as a continuous variable. There is evidence from SRs, MAs, and pooled analyses that risk

factors increase in a continuous manner with waist circumference. Because the Panel was unable to address issues of the adequacy of current waist circumference cutpoints for overweight and obesity in comparison to alternative cutpoints, the choice of cutpoints to apply in patient evaluation is somewhat arbitrary. It was also unable to determine if age-, sex- or race-specific waist circumference cutpoints for overweight and obesity are warranted to delineate elevated risk of all outcomes examined in CQ2. The absence of evidence from the available SRs, MAs, and pooled analyses for waist circumference cutpoints is not the same as the evidence of absence of usefulness. The Panel acknowledges that this absence does not mean that waist circumference does not provide useful information in certain circumstances. For several of the outcomes, there were no analyses in the studies retrieved that examined current BMI and waist circumference cutpoints stratified by age, sex, and race-ethnicity. Finally, there was a lack of these types of analyses examining the associations between maintaining weight and weight gain with elevated CVD risk in normal weight, overweight, and obese adults. For this reason, the Panel did not develop ESs addressing questions related to these areas. The methodology team and SR team worked closely with Panel members to ensure the accuracy of data and the application of systematic evidence-based methodology.

3.3. CQ3: Statement of the Question

3a. In overweight or obese adults, what is the comparative efficacy/effectiveness of diets of differing forms and structures (macronutrient content, carbohydrate and fat quality, nutrient density, amount of energy deficit, and dietary pattern) or other dietary weight loss strategies (e.g., meal timing, portion-controlled meal replacements) in achieving or maintaining weight loss?

3b. During weight loss or weight maintenance after weight loss, what are the comparative health benefits or harms of the above diets and other dietary weight loss strategies?

Of the 1,422 articles screened against the I/E criteria, 438 articles were retrieved for full-text to further assess eligibility. Of the 438 full-text publications, 77 publications met the criteria and were included. A total of 17 trials (23 articles) satisfied the final inclusion criteria for CQ3 and were rated fair or good quality. (43-65). The following ESs reflect the Panel's review of the literature.

3.3.1. Overall Dietary Intervention and Composition—Creating Reduced Dietary Energy Intake

ES 1. To achieve weight loss, an energy deficit is required. The techniques for reducing dietary energy intake include the following:

- Specification of an energy intake target that is less than that required for energy balance, usually 1,200 to 1,500 kcal/day for women and 1,500 to 1,800 kcal/day for men (kcal levels are usually adjusted for the individual's body weight and physical activity levels);
- Estimation of individual energy requirements according to expert guidelines (66-68) and prescription of an energy deficit of 500 kcal/day or 750 kcal/day or 30% energy deficit; and
- *Ad libitum* approaches where a formal energy deficit target is not prescribed, but lower calorie intake is achieved by restriction or elimination of particular food groups or provision of prescribed foods.

- ***Strength of Evidence: High***

ES 2. A variety of dietary approaches can produce weight loss in overweight and obese adults. All of the following dietary approaches (listed in alphabetical order below) are associated with weight loss if reduction in dietary energy intake is achieved:

- A diet from the European Association for the Study of Diabetes Guidelines, which focuses on targeting food groups, rather than formal prescribed energy restriction while still achieving an energy deficit. Descriptions of the diet can be found in the Full Panel Report Supplement (http://jaccjacc.cardiosource.com/acc_documents/2013_FPR_S5_Obesity.pdf).
- Higher protein (25% of total calories from protein, 30% of total calories from fat, 45% of total calories from carbohydrate) with provision of foods that realized energy deficit.
- Higher protein Zone™-type diet (5 meals/day, each with 40% of total calories from carbohydrate, 30% of total calories from protein, 30% of total calories from fat) without formal prescribed energy restriction but realized energy deficit.
- Lacto-ovo-vegetarian-style diet with prescribed energy restriction.
- Low-calorie diet with prescribed energy restriction.
- Low-carbohydrate (initially <20 g/day carbohydrate) diet without formal prescribed energy restriction but realized energy deficit.
- Low-fat (10% to 25% of total calories from fat) vegan style diet without formal prescribed energy restriction but realized energy deficit.
- Low-fat (20% of total calories from fat) diet without formal prescribed energy restriction but realized energy deficit.
- Low-glycemic load diet, either with formal prescribed energy restriction or without formal prescribed energy restriction but with realized energy deficit.

- Lower fat (≤30% fat), high dairy (4 servings/day) diets with or without increased fiber and/or low-glycemic index/load foods (low-glycemic load) with prescribed energy restriction.
- Macronutrient-targeted diets (15% or 25% of total calories from protein; 20% or 40% of total calories from fat; 35%, 45%, 55%, or 65% of total calories from carbohydrate) with prescribed energy restriction.
- Mediterranean-style diet with prescribed energy restriction.
- Moderate protein (12% of total calories from protein, 58% of total calories from carbohydrate, 30% of total calories from fat) with provision of foods that realized energy deficit.
- Provision of high-glycemic load or low-glycemic load meals with prescribed energy restriction.
- The AHA-style Step 1 diet (with prescribed energy restriction of 1,500–1,800 kcal/day, <30% of total calories from fat, <10% of total calories from saturated fat).

- ***Strength of Evidence: High***

3.3.2. Overall Dietary Intervention and Composition—Pattern of Weight Loss Over Time With Dietary Intervention

ES 3. With dietary intervention in overweight and obese adults, average weight loss is maximal at 6 months with smaller losses maintained for up to 2 years, while treatment and follow-up tapers. Weight loss achieved by dietary techniques aimed at reducing daily energy intake ranges from 4 to 12 kg at 6-month follow-up. Thereafter, slow weight regain is observed, with total weight loss at 1 year of 4 kg to 10 kg and at 2 years of 3 kg to 4 kg.

- ***Strength of Evidence: High***

3.3.3. Low Fat Approaches

ES 4a. In overweight and obese adults, there is comparable weight loss at 6 to 12 months with instruction to consume a calorie-restricted (500 to 750 kcal deficit/day) lower fat diet (<30% of total calories from fat) compared to a higher fat (>40% of total calories from fat) diet. Comprehensive programs of lifestyle change were used in all trials. Comparator diets had ≥40% of total calories from fat, either with a low-carbohydrate or low-glycemic load diet or one that targets higher fat with either average or low protein.

- ***Strength of Evidence: Moderate***

ES 4b. With moderate weight loss, lower fat, higher carbohydrate diets, compared to higher fat, lower carbohydrate diets have the following differential effects:

- Greater reduction in LDL–C,
- Lesser reduction in serum triglycerides, and
- Lesser increases in HDL–C.

- ***Strength of Evidence: Moderate***

ES 4c. There is inconsistent evidence regarding BP differences between lower fat, higher carbohydrate diets and higher fat, lower carbohydrate diets.

- ***Strength of Evidence: Low***

3.3.4. Higher (25% to 30% of Energy) Protein Approaches

ES 5a. In overweight and obese adults, recommendations to increase dietary protein (25% of total calories) as part of a comprehensive weight loss intervention results in equivalent weight loss as compared with a typical protein diet (15% of total calories) when both diets are calorie-restricted (500–750 kcal/day deficit).

- ***Strength of Evidence: High***

ES 5b. In overweight and obese adults, as compared to typical protein diets (15% of total calories), high protein diets (25% of total calories) do not result in more beneficial effects on CV risk factors, in the presence of weight loss and other macronutrient changes.

- ***Strength of Evidence: Low***

ES 5c. Based on studies conducted in settings where all food is provided to deliver increased protein (25% of total calories), either as part of caloric restriction or with *ad libitum* energy consumption, there is insufficient evidence to inform recommendations for weight loss interventions in free-living overweight or obese individuals.

3.3.5. Low-Carbohydrate Approaches (<30 g/day)

ES 6a. In overweight and obese adults, there are no differences in weight loss at 6 months with instructions to consume a carbohydrate-restricted diet (20 g/day for up to 3 months, followed by

increasing levels of carbohydrate intake up to a point at which weight loss plateaus) in comparison to instruction to consume a calorie-restricted, low-fat diet. The comparator diets on which this statement is based were either calorie-restricted higher carbohydrate and lower protein (55% of total calories from carbohydrate, 30% of total calories from fat, 15% of total calories from protein) or a lower fat European Association for the Study of Diabetes food group dietary pattern (40% of total calories from carbohydrate, 30% of total calories from fat, 30% of total calories from protein).

- ***Strength of Evidence: Low***

ES 6b. There is insufficient evidence to comment on the CVD risk factor effects of low carbohydrate diets.

3.3.6. Complex Versus Simple Carbohydrates

ES 7. There is insufficient evidence to comment on the value of substituting either simple or complex carbohydrates for dietary fat for overweight or obese adults for the purpose of weight reduction.

3.3.7. Glycemic Load Dietary Approaches

ES 8. In overweight and obese adults, both high and low glycemic load diets produce a comparable weight loss with a similar rate of loss over 6 months.

- ***Strength of Evidence: Low***

3.3.8. Dietary Patterns (Mediterranean Style, Vegetarian, and Other Dietary Pattern Approaches)

ES 9. In overweight and obese adults, a variety of calorie-restricted dietary patterns (i.e., Mediterranean-style, lower-fat lacto-ovo-vegetarian or vegan-style, or lower fat high dairy/calcium with added fiber and/or low glycemic index/load foods) produce weight loss and CV benefits that are comparable to an energy restricted, lower fat (25% to 30% of total calories from fat, Adult Treatment Panel III or AHA Step 1) dietary pattern.

- ***Strength of Evidence: Low***

3.3.8.9. Meal Replacement and Adding Foods to Liquid Diets

ES 10a. In overweight and obese women, the use of liquid and bar meal replacements is associated with increased weight loss at up to 6 months, in comparison to a balanced deficit diet utilizing only conventional food. Longer-term evidence of continued weight loss advantage is lacking.

- ***Strength of Evidence: Low***

ES 10b. There is insufficient evidence to comment on the value of adding various types of foods to a low-calorie liquid diet.

3.3.8.10. Very-Low-Calorie Diet Approaches

ES 11a. There is insufficient evidence to comment on the value of liquid protein supplementation following the very low-calorie diet induction of weight loss as an aid to weight loss maintenance.

ES 11b. There is insufficient evidence to comment on strategies to provide more supervision of very-low calorie diet adherence or to liberalize very-low calorie diet therapy with the addition of conventional foods as an aid to the induction of weight loss.

3.4. CQ4: Statement of the Question

4a. Among overweight and obese adults, what is the efficacy/effectiveness of a comprehensive lifestyle intervention program (i.e., comprised of diet, physical activity, and behavior therapy) in facilitating weight loss or maintenance of lost weight?

4b. What characteristics of delivering comprehensive lifestyle interventions (e.g., frequency and duration of treatment, individual versus group sessions, onsite versus telephone/email contact) are associated with greater weight loss or weight loss maintenance?

The wording of the CQ evolved over time, from a comprehensive intervention initially including 2 or more components (dietary prescription, physical activity, or behavioral therapy) to all 3 components being required. Additional exclusion criteria were later put in place to remove trials that included comprehensive lifestyle interventions but were designed principally to compare different dietary interventions. The Panel felt that these trials were more appropriately addressed under CQ3. The titles and abstracts of 2,160 publications were screened against the I/E criteria independently by 2 reviewers (i.e., independent contractors) which resulted in 1,776 publications being excluded and 384 publications being

retrieved for full text review to further assess eligibility. Three hundred and eighty-four full-text publications were independently screened by 2 reviewers who assessed eligibility by applying the I/E criteria; 215 of these publications were excluded based on 1 or more of the I/E criteria.

Out of 384 full-text publications, 146 publications met the criteria and were included. The quality (internal validity) of these 146 publications was assessed using the quality assessment tool developed to assess RCTs. Of these, 74 publications were excluded because they were rated as poor quality; of them 43 studies were rated poor due to the intention-to-treat and attrition rates. The remaining 51 trials (72 articles) were rated good or fair quality (22,23,69-138), and included in the evidence base that was used to formulate the ESs and recommendations.

3.4.1. Description of the Diet, Physical Activity, and Behavior Therapy Components in High-Intensity, Onsite Lifestyle Interventions

ES 1. The principal components of an effective high-intensity, on-site comprehensive-lifestyle intervention include: 1) prescription of a moderately-reduced calorie diet; 2) a program of increased physical activity; and 3) the use of behavioral strategies to facilitate adherence to diet and activity recommendations. All 3 components should be included:

- **Reduced-calorie diet:** In comprehensive lifestyle interventions, overweight/obese individuals typically are prescribed a diet designed to induce an energy deficit ≥500 kcal/day. This deficit often is sought by prescribing 1,200 to 1,500 kcal/day for women and 1,500 to 1,800 kcal/day for men. Alternatively, dietary energy deficits can be determined by 1 of the methods described in CQ3.
- **Increased physical activity:** Comprehensive lifestyle intervention programs typically prescribe increased aerobic physical activity (such as brisk walking) for ≥150 minutes/week (equal to ≥30 minutes/day, most days of the week). Higher levels of physical activity, approximately 200 to 300 minutes/week, are recommended to maintain lost weight or minimize weight regain long-term (>1 year).
- **Behavior therapy:** Comprehensive lifestyle interventions usually provide a structured behavior change program that includes regular self-monitoring of food intake, physical activity, and weight. These same behaviors are recommended to maintain lost weight, with the addition of frequent (i.e., weekly or more often) monitoring of body weight.

- ***Strength of Evidence: High***

3.4.2. Comprehensive Interventions Compared with Usual Care, Minimal Care, or No-Treatment Control

ES 2a (Short-Term Weight Loss). In overweight and obese individuals in whom weight loss is indicated and who wish to lose weight, comprehensive lifestyle interventions consisting of diet, physical activity, and behavior therapy (all 3 components) produce average weight losses of up to 8 kg in 6 months of frequent (i.e., initially weekly), onsite treatment provided by a trained interventionist* in group or individual sessions. Such losses (which can approximate reductions of 5% to 10% of initial weight) are greater than those produced by usual care (i.e., characterized by the limited provision of advice or educational materials). Comparable 6-month weight losses have been observed in treatment comparison studies of comprehensive lifestyle interventions, which did not include a usual care group.

- ***Strength of Evidence: High***

ES 2b (Intermediate-Term Weight Loss). Longer-term comprehensive lifestyle interventions, which additionally provide weekly to monthly on-site treatment for another 6 months, produce average weight losses of up to 8 kg at 1 year, losses which are greater than those resulting from usual care. Comparable 1-year weight losses have been observed in treatment comparison studies of comprehensive lifestyle interventions, which did not include a usual care group.

- ***Strength of Evidence: Moderate***

ES 2c (Long-Term Weight Loss). Comprehensive lifestyle interventions which, after the first year, continue to provide bimonthly or more frequent intervention contacts, are associated with gradual weight regain of 1 to 2 kg/year (on average), from the weight loss achieved at 6 to 12 months. Long-term (>1 year) weight losses, however, remain larger than those associated with usual care. Comparable findings have been observed in treatment comparison studies of comprehensive lifestyle interventions, which did not include a usual care group.

- ***Strength of Evidence: High***

*Trained Interventionist: In the studies reviewed, trained interventionists included mostly health professionals (e.g., registered dietitians, psychologists, exercise specialists, health counselors, or professionals in training) who adhered to formal protocols in weight management. In a few cases, lay persons were used as trained interventionists; they received instruction in weight management protocols (designed by health professionals) in programs that have been validated in high quality trials published in peer-reviewed journals.

3.4.3. Efficacy/Effectiveness of Electronically Delivered, Comprehensive Interventions in Achieving Weight Loss

ES 3. Electronically delivered, comprehensive weight loss interventions developed in academic settings, which include frequent self-monitoring of weight, food intake, and physical activity—as well as personalized feedback from a trained interventionist*—can produce weight loss of up to 5 kg at 6 to 12 months, a loss which is greater than that resulting from no or minimal intervention (i.e., primarily knowledge based) offered on the internet or in print.

- ***Strength of Evidence: Moderate***

3.4.4. Efficacy/Effectiveness of Comprehensive, Telephone-Delivered Lifestyle Interventions in Achieving Weight Loss

ES 4. In comprehensive lifestyle interventions that are delivered by telephone or face-to-face counseling, and which also include the use of either commercially-prepared prepackaged meals or an interactive web based program, the telephone delivered and face-to-face delivered interventions produced similar mean net weight losses of approximately 5 kg at 6 months and 24 months, compared with a usual care control group.

- ***Strength of Evidence: Low***

3.4.5. Efficacy/Effectiveness of Comprehensive Weight Loss Programs in Patients Within a Primary Care Practice Setting Compared With Usual Care

ES 5. In studies to date, low to moderate-intensity lifestyle interventions for weight loss provided to overweight or obese adults by primary care practices alone, have not been shown to be effective.

- ***Strength of Evidence: High***

*Trained Interventionist: In the studies reviewed, trained interventionists included mostly health professionals (e.g., registered dietitians, psychologists, exercise specialists, health counselors, or professionals in training) who adhered to formal protocols in weight management. In a few cases, lay persons were used as trained interventionists; they received instruction in weight management protocols (designed by health professionals) in programs that have been validated in high quality trials published in peer-reviewed journals.

3.4.6. Efficacy/Effectiveness of Commercial-Based, Comprehensive Lifestyle Interventions in Achieving Weight Loss

ES 6. Commercial-based, comprehensive weight loss interventions that are delivered in person have been shown to induce an average weight loss of 4.8 kg to 6.6 kg at 6 months in 2 trials when conventional foods are consumed and 6.6 kg to 10.1 kg at 12 months in 2 trials with provision of prepared food, losses that are greater than those produced by minimal-treatment control interventions.

- ***Strength of Evidence: Low***

3.4.7. Efficacy/Effectiveness of Very Low-Calorie Diets, as Used as Part of a Comprehensive Lifestyle Intervention, in Achieving Weight Loss

ES 7a. Comprehensive, high intensity on-site lifestyle interventions that include a medically supervised very low-calorie diet (often defined as <800 kcal/day), as provided by complete meal replacement products, produce total weight loss of approximately 14.2 kg to 21 kg over 11 to 14 weeks, which is larger than that produced by no intervention or a usual care control group (i.e., advice and education only).

- ***Strength of Evidence: High***

ES 7b. Following the cessation of a high intensity lifestyle intervention with a medically supervised very-low calorie diet of 11 to 14 weeks, weight regain of 3.1 kg to 3.7 kg has been observed during the ensuing 21 to 38 weeks of non-intervention follow-up.

- ***Strength of Evidence: High***

ES 7c. The prescription of various types (resistance or aerobic training) and doses of moderate intensity exercise training (e.g., brisk walking 135 to 250 minutes/week), delivered in conjunction with weight loss maintenance therapy does not reduce the amount of weight regained after the cessation of the very-low calorie diet, as compared with weight loss maintenance therapy alone.

- ***Strength of Evidence: Low***

3.4.8. Efficacy/Effectiveness of Comprehensive Lifestyle Interventions in Maintaining Lost Weight

ES 8a. After initial weight loss, some weight regain can be expected, on average, with greater regain observed over longer periods of time. Continued provision of a comprehensive weight loss maintenance program (onsite or by telephone), for periods of up to 2.5 years following initial weight loss, reduces

weight regain, as compared to the provision of minimal intervention (e.g., usual care). The optimal duration of weight loss maintenance programs has not been determined.

- ***Strength of Evidence: Moderate***

ES 8b. 35% to 60% of overweight/obese adults who participate in a high intensity long-term comprehensive lifestyle intervention maintain a loss of ≥5% of initial body weight at ≥2 year's follow-up (post-randomization).

- ***Strength of Evidence: Moderate***

3.4.9. Characteristics of Lifestyle Intervention Delivery That May Affect Weight Loss: Intervention Intensity

ES 9a (Moderate-Intensity Interventions). Moderate intensity, on-site comprehensive lifestyle interventions, which provide an average of 1 to 2 treatment sessions per month typically produce mean weight losses of 2 kg to 4 kg in 6 to 12 months, losses which generally are greater than those produced by usual care (i.e., minimal intervention control group).

- ***Strength of Evidence: High***

ES 9b (Low-intensity Interventions). Low intensity, on-site comprehensive lifestyle interventions, which provide fewer than monthly treatment sessions do not consistently produce weight loss when compared to usual care.

- ***Strength of Evidence: Moderate***

ES 9c (Effect of intervention intensity). When weight loss with each intervention intensity (i.e., low, moderate, and high) is compared to usual care, high-intensity lifestyle interventions (≥14 sessions in 6 months) typically produce greater net-of-control weight losses than low-to-moderate intensity interventions.

- ***Strength of Evidence: Moderate***

3.4.10. Characteristics of Lifestyle Intervention Delivery That May Affect Weight Loss or Weight Loss Maintenance: Individual Versus Group Treatment

ES 10. There do not appear to be substantial differences in the size of the weight losses produced by individual- and group-based sessions in high-intensity, comprehensive lifestyle intervention delivered on site by a trained interventionist*.

- ***Strength of Evidence: Low***

3.4.11. Characteristics of Lifestyle Intervention Delivery That May Affect Weight Loss or Weight Loss Maintenance: Onsite Versus Electronically Delivered Interventions

ES 11. Weight losses observed in comprehensive lifestyle interventions, which are delivered onsite by a trained interventionist* in initially weekly and then biweekly group or individual sessions, are generally greater than weight losses observed in comprehensive interventions that are delivered by Internet or email and which include feedback from a trained interventionist.

- ***Strength of Evidence: Low***

3.5. CQ5: Statement of the Question

5a. Bariatric Surgery Efficacy. What are the long-term effects of the following surgical procedures on weight loss, weight-loss maintenance, CV risk factors, related comorbidities, and mortality?

- Laparoscopic adjustable gastric banding (LAGB)
- Laparoscopic Roux-en-Y gastric bypass (RYGB)
- Open RYGB
- Biliopancreatic diversion (BPD) with and without duodenal switch
- Sleeve gastrectomy

What are the long-term effects of these surgical procedures in patients with different BMIs and comorbidities?

- BMI <35
- BMI of 35 to <40 with no comorbidities
- BMI ≥35 with comorbidities

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*Trained Interventionist: In the studies reviewed, trained interventionists included mostly health professionals (e.g., registered dietitians, psychologists, exercise specialists, health counselors, or professionals in training) who adhered to formal protocols in weight management. In a few cases, lay persons were used as trained interventionists; they received instruction in weight management protocols (designed by health professionals) in programs that have been validated in high quality trials published in peer-reviewed journals.

- BMI ≥40 with no comorbidities

5b. Predictors. What are the predictors associated with long-term effects of the following surgical procedures on weight loss, weight loss maintenance, CV risk factors, related comorbidities, and mortality?

- LAGB
- Laparoscopic RYGB
- Open RYGB
- BPD with and without duodenal switch
- Sleeve gastrectomy

What are the predictors associated with long term effects of these surgical procedures in patients with different BMIs and comorbidities?

- BMI <35
- BMI of 35 to <40 with no comorbidities
- BMI ≥35 with comorbidities
- BMI ≥40 with no comorbidities

5c. Complications: What are the short-term (>30 days) and long-term (≥30 days) complications of the following bariatric surgical procedures? What are the predictors associated with complications?

- LAGB
- Laparoscopic RYGB
- Open RYGB
    - BPD with and without duodenal switch
    - Sleeve gastrectomy

What are the complications of these surgical procedures in patients with different BMIs and comorbidities?

- BMI <35
- BMI of 35 to <40 with no comorbidities
- BMI ≥35 with comorbidities
- BMI ≥40 with no comorbidities

Many, if not most, patients with extreme obesity have tried to lose weight numerous times. Some have lost substantial amounts of weight successfully, only to regain it. Although lifestyle intervention is the

mainstay of all weight management treatment, there is increasing recognition of the need for adjunctive treatments for patients with obesity who are at high medical risk, and who are unable to achieve or maintain sufficient weight loss to improve their health. Bariatric surgery is 1 treatment option that has been increasingly utilized in patients with extreme obesity, or with lesser degrees of obesity but with obesity-related comorbid conditions. Bariatric surgery is, by definition, invasive and has inherent short-term risks as well as adverse effects that may only become apparent during longer-term follow-up. Incurring these risks may be acceptable if health benefits are sustained over time. Therefore, the Panel believed that evaluation of efficacy endpoints for weight loss and change in CVD risk factors and other health outcomes required studies with a minimum postsurgical follow-up of 2 years and inclusion of a nonsurgical comparator group. Studies evaluating predictors of weight change or medical outcomes, including patient factors (e.g., presence or absence of diabetes) or surgical factors (e.g., RYGB vs. BPD) required studies that directly compared these factors plus a minimum 2-year follow-up. Studies evaluating complications of bariatric surgery required at least 30-day postsurgical follow-up. For observational studies with ≥10 years of follow-up or for studies on BPD or sleeve gastrectomy procedures, sample size ≥100 was required, and for all other observational studies sample size requirement was ≥500. This sample size requirement was instituted because the most important complications are infrequent (e.g., perioperative mortality <1%), such that smaller studies could give inaccurate estimates of complication rates.

The literature search for CQ5 included an electronic search for RCTs, controlled clinical trials, and observational studies published in the literature from January 1998 to December 2009. The search produced 2,317 citations, with 9 additional citations identified from nonsearch sources, i.e., by Panel members or hand search of SRs/MAs (obtained through the electronic search). Of the 2,317 citations identified through the database search, 811 citations were automatically excluded and the remaining titles and abstracts of the 1,515 remaining citations were screened against the I/E criteria for each of the 3 components (Efficacy, Predictors, and Complications) independently by 2 reviewers which resulted in 1,062 publications being excluded. To further assess eligibility, 453 publications underwent full text review. Of the 453 full-text publications, 64 met the I/E criteria and were included. The quality (internal validity) of these 64 publications was assessed and of these, 29 publications were excluded because they were rated as poor quality; 18 studies were rated poor due to the intent-to-treat and/or attrition rates. The remaining 22 studies (35 articles) which met the criteria for at least 1 of the 3 components were rated good or fair quality and included in the evidence base (139-173). For the Efficacy, Predictors, and Complications components there were 5 studies (17 articles), 10 studies (12 articles) and 14 studies (15 articles) rated as good/fair, respectively. There were a total of 8 articles that were used across more than 1 component (141,142,144,148,156,159,168,169).

3.5.1. Component 1: Efficacy

A total of 5 studies (17 articles) met the criteria for determining the efficacy of bariatric surgery for weight loss and the impact on obesity-related comorbidities and were rated as good or fair quality and are included in the summary table. The number of studies meeting inclusion criteria was limited due to the requirement that surgical treatment be compared to a nonsurgical comparator group with a minimum postsurgical follow-up of 2 years.

ES 1. In obese adults, bariatric surgery produces greater weight loss and maintenance of lost weight than that produced by usual care, conventional medical treatment, lifestyle intervention, or medically supervised weight loss, and weight loss efficacy varies depending on the type of procedure and initial body weight.

- Weight loss at 2 to 3 years following a variety of surgical procedures in adults with presurgical BMI ≥30 varies from a mean of 20% to 35% of initial weight and mean difference from nonsurgical comparators of 14% to 37% depending on procedure.
  - ***Strength of the Evidence: High***

- Mean weight loss at 10 years following a variety of bariatric surgical procedures (predominantly vertical banded gastroplasty) is approximately 16% of initial weight, representing a mean weight regain of 7%.
  - ***Strength of the Evidence: Low***

ES 2. In obese adults, bariatric surgery generally results in more favorable impact on obesity-related comorbid conditions than that produced by usual care, conventional medical treatment, lifestyle intervention, or medically supervised weight loss.

- At 2 to 3 years following a variety of bariatric surgical procedures in adults with BMI ≥30 who achieve mean weight loss of 20% to 35%, fasting glucose and insulin are reduced and incidence of type 2 diabetes is decreased and there is a greater likelihood of diabetes remission among those with type 2 diabetes at baseline.
  - ***Strength of the Evidence: High***

- At 10 years, incidence and prevalence of type 2 diabetes are lower in those who have undergone surgery. However, among those in whom type 2 diabetes remits after surgery, diabetes may recur over time.

- ***Strength of the Evidence: Low***

- At 2 to 3 years following a variety of bariatric surgical procedures in adults with BMI ≥30 who achieve mean weight loss of 20% to 35%, BP or use of BP medication is reduced compared with nonsurgical management. BP tends to increase over time, and at 10 years postsurgery, there is no difference in mean systolic BP or the incidence of new cases of hypertension in those who underwent bariatric surgery compared to those who did not undergo surgery.
  - ***Strength of the Evidence: Low***

- Among obese adults with baseline hypertension, a greater percentage are in remission at 2 to 3 years and 10 years following bariatric surgery compared with nonsurgical management*.
  - ***Strength of the Evidence: Low***

- At 2 to 3 years and 10 years following a variety of bariatric surgical procedures in adults with BMI ≥30 who achieve mean weight loss of 20% to 35%, serum triglyceride levels are lower, HDL–C levels are higher, total cholesterol to HDL–C ratio is lower, and changes in triglyceride or LDL levels are inconsistent, compared with nonsurgical management.
  - ***Strength of the Evidence: Low***

- Most measures of health-related quality of life are improved at 2 and 10 years following bariatric surgery.
  - ***Strength of the Evidence: Moderate***

- Total mortality is decreased compared with nonsurgical management at mean follow up of 11 years after undergoing a variety of bariatric surgical procedures (predominantly vertical banded gastroplasty) in patients with mean BMI >40 who achieve a mean long-term weight loss of 16%.
  - ***Strength of the Evidence: Low***

ES 3. There are insufficient data on the efficacy of bariatric surgical procedures for weight loss and maintenance or CVD risk factors ≥2 years postsurgery in patients with a BMI <35.

*Remission was defined variously depending on the study.

3.5.2. Component 2: Predictors

A total of 10 studies (12 articles) met these criteria and were rated as good or fair quality and are included in the summary table (141,142,144,148,151,155,156,159,161,168,169,172). The studies required a comparator group but not necessarily a nonsurgical comparator as well as outcomes regarding specific bariatric operative procedures.

ES 4. Weight loss following bariatric surgery expressed as percentage of total body weight loss varies by procedure.

In direct comparative studies at 2 to 3 years postsurgery:

- Weight loss following gastric bypass exceeds LAGB.
  - ***Strength of the Evidence: Moderate***

- Weight loss following BPD, gastric bypass, and sleeve gastrectomy are similar.
  - ***Strength of the Evidence: Low***

In direct comparative studies at 5 to 10 years postsurgery:

- Weight loss following gastric bypass exceeds LAGB.
  - ***Strength of the Evidence: Low***

ES 5. The remission of obesity-related comorbidities varies by procedure.

- Type 2 diabetes remission or improved glycemic control occurs with increasing frequency according to procedure as follows: LAGB, gastric bypass, BPD.
  - ***Strength of the Evidence: Low***

- Reduction in the prevalence of hypertension is more frequent following gastric bypass than LAGB.
  - ***Strength of the Evidence: Low***

- The prevalence of dyslipidemia is lower following gastric bypass compared to LAGB.
  - ***Strength of the Evidence: Low***

3.5.3. Component 3: Complications

Fourteen studies met the inclusion criteria for complications. The complication evidence base included those studies from the efficacy and predictors searches that included complication data (141,156) as well as those studies that met the expanded search criteria (139,143,145,146,152,153,160,170,171).

3.5.3.1. Laparoscopic Adjustable Gastric Banding

ES 6. Perioperative (≤30 day) and longer-term (>30 days) complications following bariatric surgery vary by procedure and patient-derived risk factors. When performed by an experienced surgeon, perioperative complications following LAGB:

- Perioperative complications are infrequent and do not tend to be life-threatening: major adverse outcomes (1%) such as deep venous thrombosis and reoperations, and minor complications (3%) such as wound infection.
  - ***Strength of the Evidence: Moderate***

- Longer-term complications continue to occur over time and may require operative correction: misplacement of band approximately 3% to 4%, erosion of gastric wall approximately 1%, and port complication 5% to 11%.
  - ***Strength of the Evidence: Moderate***

- Longer-term LAGB failure leading to removal of the band with or without conversion to another bariatric procedure varies from 2% to 34%. Inadequate weight loss is the most often reported basis for removal of band.
  - ***Strength of the Evidence: Moderate***

3.5.3.2. Roux-en-Y Gastric Bypass

ES 6 (continued). Perioperative (≤30-day) and longer-term (>30 days) complications following bariatric surgery vary by procedure and patient-derived risk factors. When performed by an experienced surgeon, perioperative complications following gastric bypass:

- Consist of a major adverse outcome in approximately 4% to 5%, including mortality (0.2%), deep vein thrombosis and/or pulmonary embolism (0.4%), and a requirement for reoperation (3% to 5%); any complication, major or minor (2% to 18%).
  - ***Strength of the Evidence: Moderate***

- Are less frequent for the laparoscopic approach than for open incision.
  - ***Strength of the Evidence: Moderate***

When performed by an experienced surgeon, perioperative complications following open gastric bypass:

- Consist of a major adverse outcome in approximately 8%, including mortality (2%), deep vein thrombosis/pulmonary embolism (1%), and reoperation (5%).
  - ***Strength of the Evidence: Low***

- Are associated with extremely high BMI, inability to walk 200 feet, history of deep vein thrombosis/pulmonary embolism, and history of obstructive sleep apnea.
  - ***Strength of the Evidence: Low***

3.5.3.3. Biliopancreatic Diversion

ES 6 (continued). Perioperative (≤30 days) and longer-term (>30 days) complications following bariatric surgery vary by procedure and patient-derived risk factors. The mortality rate for BPD was reported by 2 of the 3 included studies. When performed by an experienced surgeon, perioperative complications following BPD:

- Occur in 2% to 8% of cases and include mortality (<1%); deep vein thrombosis/pulmonary embolism (0.4%). The frequency of anastomotic leak, hemorrhage and wound complication is variable.
  - ***Strength of the Evidence: Low***

- 1 to 3 year complications include: anemia (13% to 20%); deficiency of protein (0.3% to 3.0%), iron (17%), zinc (6%), and neuropathy (0.4%). Deficiency of vitamin D and elevated parathyroid hormone may exceed 40%.

- When performed by open incision, include ventral hernia as high as 78%.
  - ***Strength of the Evidence: Low***

3.5.3.4. Laparoscopic Sleeve Gastrectomy

ES 6 (continued). Perioperative (≤30 days) and longer term (>30 days) complications following bariatric surgery vary by procedure and patient-derived risk factors. When performed by an experienced surgeon, perioperative complications following laparoscopic sleeve gastrectomy:

- There is insufficient evidence to establish the incidence of perioperative and longer term complications.

4. Gaps in Evidence and Future Research Needs

The Panel identified gaps in evidence supporting the 5 chosen CQs. For each CQ, the Panel summarized recommendations for future research. See the Full Panel Report Supplement (http://jaccjacc.cardiosource.com/acc_documents/2013_FPR_S5_Obesity.pdf) for a more detailed and comprehensive discussion.

4.1. CQ1 (Benefits of Weight Loss)

The literature available in SRs/MAs did not specifically address whether age, sex, race, or baseline BMI/waist circumference modify the beneficial effects of weight loss in regard to CV risk factors. Likewise, the SRs/MAs did not specifically address the issue of how baseline comorbid conditions and CV risk factors modify the response to weight loss. However, there may be high-quality literature that addresses these issues. Given that caveat and this evidence review, future research in this area should address the following issues:

1. Do the observed improvements in CV risk factors, need for medications and improved quality of life associated with weight loss differ by age, sex, race, and BMI/waist circumference?
2. What is the cost-effectiveness of modest weight loss as a preventative strategy for those at risk of developing type 2 diabetes?
3. What is the best approach to identify and engage those who can benefit from weight loss.

4.2. CQ2 (Risks of Overweight and Obesity)

Because evidence-based methods to identify patients with elevated risk for CVD, its risk factors, and all-cause mortality are essential for health care practitioners, more SRs, MAs, and pooled analyses are needed to inform future guidelines in the following areas:

- Studies are needed that compare current to alternative BMI and waist circumference cutpoints for predicting risk to optimize the specificity of cutpoints.
    - Studies should examine the independent and combined effects of BMI and waist circumference to determine if both in combination are better at predicting elevated risk than either alone.
    - Such studies should explicate the methods and logical framework that guides the choice of optimal cutpoints.

  - Studies comparing the predictive ability of BMI and waist circumference with more objective measures of percent body fat, such as dual-energy x-ray absorptiometry or magnetic resonance imaging, may enhance risk prediction of cutpoints and/or combinations of BMI and waist circumference.

- Similar studies are needed to assess whether overall cutpoints are appropriate for population subgroups stratified by age, sex, and race/ethnicity.
  - Studies that compare risk across different age groups should report absolute risk estimates. This is especially important when examining age.
  - Studies are needed on race-ethnic differences in risk within Western countries, particularly in Asian Americans and Hispanic Americans.
- Longitudinal studies are needed that assess the risks associated with weight change (accounting for intentionality) in normal weight, overweight, and obese adults to determine the role of weight change trajectory in risk assessment.

4.3. CQ3 (Dietary Interventions for Weight Loss)

More research is needed to inform future guidelines in the following areas:

- Because long-term dietary adherence is problematic in weight management, to determine the best dietary approach to sustain weight loss over the long-term, studies are needed:
  - testing the impact of tailoring choice of dietary interventions on the individual's ability to adhere long-term;
  - testing pragmatic approaches to diet intervention delivery in free-living individuals for at least 2 years duration; and
  - evaluating the physiologic and biologic adaptations to weight loss, so as to refine methods of caloric restriction during weight reduction and maintenance.

4.4. CQ4 (Lifestyle Interventions for Weight Loss)

More research is needed to inform future guidelines focusing on improvements in efficiency and efficacy, optimizing delivery and dissemination and targeting special populations. The research is needed in the following areas:

- Onsite (face-to-face) comprehensive, high-intensity lifestyle interventions (14 or more contacts in first 6 months) represent the standard for behavioral weight loss interventions. Further research can help improve efficiency of these interventions with studies:
  - evaluating optimal frequency (and duration) of contact;

  - evaluating characteristics of those who lose less weight in response to a standard, comprehensive behavioral intervention and developing alternative approaches for their treatment.
  - evaluating effective methods of delivering lifestyle interventions remotely (e.g., internet, mobile phone, text messaging, telephone, DVDs, etc., or some combination of these) to achieve and maintain clinically meaningful weight loss

- Because of changing demographics, there is a need for further research to understand the most appropriate strategies and prescriptions for weight loss for some key populations including older adults and racial/ethnic groups.
- Because the efficacy of on-site (face-to-face) comprehensive, high-intensity lifestyle intervention has been established in academic settings, translational studies are needed
  - evaluating programs that can be delivered in community, work-site, and other settings (including commercial programs);
  - determining the personal characteristics, skills, and training required to serve as a lifestyle interventionist;
  - identifying the optimal role for PCPs to play in the management of obesity by lifestyle modification;
  - evaluating head-to-head comparisons of the relative effectiveness and associated costs of delivering interventions on-site (face-to-face), remotely, or by a combination of approaches (i.e., hybrid delivery).
- Because maintenance of lost weight over the long term has been challenging, studies are needed
  - evaluating strategies to promote additional weight loss beyond the first 6 months, the time at which weight loss plateaus in most individuals; and
  - evaluating novel methods of improving the maintenance of lost weight.
- Further study is needed on the effect of weight loss treatment on health care utilization and cost.

4.5. CQ5 (Surgical Procedures for Weight Loss)

More research is needed to inform future guidelines in the following areas:

- Because bariatric surgery offers the potential for prevention or remission of diabetes, better control of CVD risk factors, improvement in quality of life and possibly decreased mortality, there is a need for research to better characterize those patients who are most likely to benefit from and least likely to suffer adverse consequences of bariatric surgical procedures.

- Large and well-designed experimental, quasi-experimental and observational studies, with long-term follow-up are needed to determine if the risks and benefits of bariatric surgery are sustained over time.
    - evaluating which surgical procedures are best applied to different populations, based on factors such as presence and duration of comorbid conditions, age, sex, race/ethnicity, degree and duration of obesity, underlying genetic etiologies, and psychosocial or behavioral characteristics; and
    - evaluating the implementation of bariatric surgery in nonacademic settings, which may be more reflective of real world clinical practice.

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Key Words: Bariatric surgery, behavior therapy, blood pressure, BMI, diabetes mellitus type 2, diet, dyslipidemia, life style, waist circumference, and weight loss.

Appendix 1. Author Relationships With Industry and Other Entities (Relevant)—2013 AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults

Committee Member	Employment	Consultant	Speaker's Bureau	Ownership/ Partnership/ Principal	Personal Research	Expert Witness
Michael D. Jensen *(Co-Chair)*	Mayo Clinic Endocrine Research Unit—Professor of Medicine, Endocrinology, Metabolism, Diabetes, Nutrition, and Internal Medicine Division	**2008-2012** None	**2008-2012** None	**2008-2012** None	**2008-2012** None	**2008-2012** None
		2013 •Eisai •Novo Nordisk •Vivus	**2013** None	**2013** None	**2013** None	**2013** None
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		2013 •Arena Pharmaceuticals •Eisai •Novo Nordisk •Takeda •Vivus	**2013** None	**2013** •Scientific Intake	**2013** None	**2013** None
Caroline M. Apovian	Boston Medical Center—Professor of Medicine and Pediatrics; Center for Nutrition and Weight Management— Director	**2008-2012** •Amylin •Arena Pharmaceuticals •Johnson &Johnson •Merck •Nutrisystem •Orexigen •Sanofi-aventis •Zafgen	**2008-2012** None	**2008-2012** None	**2008-2012** •Amylin •Dr. Robert C. and Veronica Atkins Foundation •Eli Lilly •MetaProteomics •Orexegin •Pfizer •Sanofi-aventis	**2008-2012** None
		2013	**2013**	**2013**	**2013**	**2013**

		• Abbott Nutrition • Allergan • Amylin • Arena Pharmaceuticals • GI Dynamics • Johnson &Johnson • Merck • Novo Nordisk • NutriSystem • Orexigen Therapeutics • Pfizer • Sanofi-Aventis • Zafgen	None	None	• Aspire Bariatrics† • Amylin† • Dr. Robert C. and Veronica Atkins Foundation† • Eli Lilly† • GI Dynamics† • GlaxoSmithKline • MetaProteomics • Orexigen Therapeutics† • Pfizer† • Sanofi-aventis	None
Jamy D. Ard	Wake Forest University—Assistant Professor of Epidemiology and Prevention; Weight Management Center—Co-Director	**2008-2012** • Arena Pharmaceuticals • Nestle Healthcare Nutrition • OPTIFAST Division • Vivus	**2008-2012** None	**2008-2012** None	**2008-2012** • OPTIFAST—Medical Director	**2008-2012** None
		2013 • Eisai • Nestle Healthcare Nutrition • OPTIFAST Division • Vivus	**2013** None	**2013** None	**2013** None	**2013** None
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		2013 None	**2013** None	**2013** None	**2013** None	**2013** None
Frank B. Hu	Harvard University School of Public Health—Professor, Nutrition and Epidemiology	**2008-2012** • Amgen • Novo Nordisk • Nutrition Impact • Unilever	**2008-2012** None	**2008-2012** None	**2008-2012** • Merck	**2008-2012** None
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		2013 None	**2013** None	**2013** None	**2013** None	**2013** None
John M. Jakicic	University of Pittsburgh—Professor and Chair, Physical Activity and Weight Management Research Center	**2008-2012** • Alere Wellbeing • JennyCraig • Nestle Nutrition	**2008-2012** None	**2008-2012** None	**2008-2012** • BodyMedia—PI	**2008-2012** None
		2013 • Calorie Control Council	**2013** None	**2013** None	**2013** • BodyMedia—PI	**2013** None
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		2013 None	**2013** None	**2013** None	**2013** • Aspire Bariatrics	**2013** None
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		2013 None	**2013** None	**2013** None	**2013** None	**2013** None
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		2013 None	**2013** None	**2013** • Boston Nutrition Foundation* • Millennium Prevention*	**2013:** None	**2013:** None
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		2013 None	**2013** None	**2013** None	**2013** None	**2013** None
F. Xavier Pi-	Columbia University—	**2008-2012**	**2008-2012**	**2008-2012**	**2008-2012**	**2008-2012**

Sunyer	Professor of Medicine, College of Physicians and Surgeons	• Amylin • AstraZeneca • Eisai • Eli Lilly • McNeil • Novo Nordisk • Weight Watchers • Zafgen	None	None	• Arena Pharmaceuticals • Novo Nordisk • Orexigen • Roche • Vivus	None
		2013 • AstraZeneca • Eisai • McNeil • Novo Nordisk • Vivus • Weight Watchers • Zafgen	**2013** None	**2013** None	**2013** • Novo Nordisk	**2013** None
June Stevens	University of North Carolina at Chapel Hill—Chair, Department of Nutrition; Department of Epidemiology Schools of Public Health and Medicine—Professor	**2008-2012** • CMeducation Resources	**2008-2012** None	**2008-2012** None	**2008-2012** • Dannon • PepsiCo, Gatorade • Sanofi-aventis • Wyeth Nutrition	**2008-2012** None
		2013 None	**2013** None	**2013** None	**2013** • PepsiCo, Gatorade • Sanofi-aventis • Wyeth Nutrition	**2013** None
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		2013 None	**2013** None	**2013** None	**2013** None	**2013** None
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		2013 • Novo Nordisk • Orexigen	**2013** None	**2013** None	**2013** None	**2013** None
Bruce M. Wolfe	Oregon Health and Science	**2008-2012**	**2008-2012**	**2008-2012**	**2008-2012**	**2008-2012**

	University—Professor of Surgery	• Crospon • EnteroMedics	None	None	None	None
		2013 • EnteroMedics	**2013** None	**2013** None	**2013** None	**2013** None
Susan Z. Yanovski *(Ex-officio)*	NIDDK—Co-Director, Office of Obesity Research, Division of Digestive Diseases and Nutrition	**2008-2012** None	**2008-2012** None	**2008-2012** None	**2008-2012** None	**2008-2012** None
		2013 None	**2013** None	**2013** None	**2013** None	**2013** None

This table reflects the relevant healthcare-related relationships of authors with industry and other entities (RWI) provided by the panels during the document development process (2008-2012). Both compensated and uncompensated relationships are reported. These relationships were reviewed and updated in conjunction with all meetings and/or conference calls of the Expert Panel during the document development process. Authors with relevant relationships during the document development process recused themselves from voting on recommendations relevant to their RWI. In the spirit of full transparency, the ACC and AHA asked Expert Panel members to provide updates and approve the final version of this table which includes current relevant relationships (2013).

To review the NHLBI and ACC/AHA's current comprehensive policies for managing RWI, please refer to http://www.nhlbi.nih.gov/guidelines/cvd_adult/coi-rwi_policy.htm and http://www.cardiosource.org/Science-And-Quality/Practice-Guidelines-and-Quality-Standards/Relationships-With-Industry-Policy.aspx.

Per ACC/AHA policy:
A person is deemed to have a significant interest in a business if the interest represents ownership of ≥5% of the voting stock or share of the business entity, or ownership of ≥$10,000 of the fair market value of the business entity; or if funds received by the person from the business entity exceed 5% of the person's gross income for the previous year. Relationships that exist with no financial benefit are also included for the purpose of transparency. Relationships in this table are modest unless otherwise noted.

*Significant relationship.
†No financial benefit.

NHLBI indicates National Heart, Lung, and Blood Institute; NIDDK, National Institute of Diabetes and Digestive and Kidney Diseases; and PI, principal investigator.

Appendix 2. Expert Reviewer Relationships With Industry and Other Entities (Relevant)

Reviewer	Representation	Employment	Consultant	Speaker's Bureau	Ownership/ Partnership/ Principal	Personal Research	Institutional, Organizational, or Other Financial Benefit	Expert Witness
William H. Dietz	ACC/AHA Expert Reviewer	Centers for Disease Control and Prevention—Director, Division of Nutrition and Physical Activity	None	None	None	None	None	None
Penny Gordon-Larsen	TOS Expert Reviewer	University of North Carolina, Gillings School of Global Publich Health—Professor, Department of Nutrition	None	None	None	None	None	None
Lee M. Kaplan	TOS Expert Reviewer	Massachusetts General Hospital—Director, Weight Center	• AMAG Pharmaceuticals • Bristol-Myers Squibb • Eisai • Ethicon* • Fractyl • Gelesis • GI Dynamics† • MedImmune • Novo Nordisk • Pfizer • Rhythm† • USGI Medical • Vivus • Zafgen	None	None	• Ethicon*	None	None

Paul Poirier	ACC/AHA Expert Reviewer	Laval University, Institut Universitaire de Cardiologie et Pneumologie, Hôpital Laval—Faculty of Pharmacy	• AstraZeneca • Bristol-Myers Squibb • Merck	None	None	None	None	None
Susan J. Pressler	TFPG Representative	University of Michigan School of Nursing—Professor	None	None	None	None	•Pfizer*	None
Rena R. Wing	TOS Expert Reviewer	Brown University—Professor, Psychiatry & Human Behavior	None	None	None	None	None	None

*No financial benefit.
†Significant relationship.

Appendix 3. Abbreviations

ACC = American College of Cardiology
AHA = American Heart Association
BMI = Body Mass Index
BP = blood pressure
BPD = biliopancreatic diversion
CHD = coronary heart disease
CV = cardiovasdcular
CVD = cardiovascular disease
COR = class of recommendation
CQ = critical questions
ES = evidence statements
Expert Panel = Panel
HDL–C = high-density lipoprotein cholesterol
I/E = inclusion/exclusion
LAGB = laparoscopic adjustable gastric banding
LDL–C = low-density lipoprotein cholesterol
LOE = level of evidence
MA = meta-analyses
NHLBI = National Heart, Lung, and Blood Institute
NIDDK = National Institute of Diabetes and Digestive and Kidney Diseases
PCP = primary care practitioner
RWI = relationships of authors with industry and other entities
RYGB = laparoscopic Roux-en-Y gastric bypass
SR = systematic review
Task Force = ACC/AHA Task Force on Practice Guidelines

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