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Effectiveness of Behavior-Based Counseling for Weight Loss Maintenance: A Systematic Literature Review

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Abstract

Objective: To review the current literature on the effectiveness of behavior-based counseling compared to standard dietary counseling alone for weight loss maintenance (WLM) in adult patients in primary care. Background: Obesity is linked to the development of chronic health conditions such as diabetes, hypertension, and atherosclerotic cardiovascular disease (ASCVD) at an annual expense of $147 billion in related healthcare costs. Effective lifestyle modification treatment for long-term WLM remains elusive. Traditional advice from primary care providers regarding dietary modification and increased physical activity has not led to WLM as a long-term outcome. Newer guidelines for the treatment of obesity now recommend high-intensity behavior-based counseling (BBC) programs that deliver traditional weight loss education in tandem with behavior-change strategies. Methods: A database search was conducted for peer reviewed literature published in 2012-2020 on the subjects of WLM and behavior-based therapies. The use of pharmacotherapeutics and bariatric surgery modalities were considered beyond the scope of this review. Findings: When duplicate results were removed, 42 articles met inclusion criteria of which 26 were selected for in-depth review. Conclusion: BBC is superior for WLM compared to dietary counseling in terms of the facilitation of a 5%-10% clinically significant weight loss that is maintained for at least one year. Treatment of obesity in primary care should consist of the identification and diagnosis of obesity, referral to intensive BBC services, and ongoing support of patients' weight loss efforts over the long term.

Keywords: weight loss maintenance, weight loss counseling, cognitive behavioral therapy, dietary counseling, nutrition therapy, primary care, obesity, overweight

Effectiveness of Behavior-Based Counseling for Weight Loss Maintenance: A Systematic Literature Review

For many adults living with obesity, achieving a clinically significant weight loss of 5%-10% of their body weight is attainable in the short term through dietary restriction. However, maintaining that degree of weight loss for greater than one year has been challenging for patients, with only 2%-5% of individuals successfully maintaining their weight loss over the long term (Brunacini, 2019). Long-term maintenance of weight loss is the end goal for treatment of obesity (Gibbs et al., 2020; Montesi et al., 2016) and has been described as the "Holy Grail" of weight loss research (Voils et al., 2017) due to its elusiveness. Despite the direct link between obesity and five of the top ten causes of mortality in the United States (Centers for Disease Control and Prevention [CDC], 2020b), obesity is stigmatized and undertreated by primary care providers (PCPs) (Blane et al., 2020). PCPs are often undertrained in obesity management science (Heymsfield & Wadden, 2017) and unable to provide adequate care to this population within the constraints of the primary care setting. The most recent guidelines from the United States Preventive Services Task Force (USPSTF), the American Academy of Clinical Endocrinologists (AACE), and the Endocrine Society all call for PCPs to provide or refer patients with obesity to intensive behavioral counseling as a first line treatment (Bray et al., 2017; Curry et al., 2018; Garvey et al., 2016). However, this is uncommon in practice (Gibbs et al., 2020) and any short-term weight loss is typically regained within a year (Heymsfield & Wadden, 2017; Montesi et al., 2016). Therefore, as PCPs, family nurse practitioners (FNPs) need to be competent regarding weight-loss science and contemporary obesity guidelines. This will prepare them to provide the most effective care for patients with obesity and help prevent the development of chronic conditions such as heart disease and type 2 diabetes mellitus (DM) in

this population. This paper will review the current evidence on how WLM can best be supported by FNPs in primary care through identification and diagnosis of obesity, referral to intensive behavioral weight loss programs, and long-term support of patients participating in weight loss treatment.

Background

The lack of robust obesity treatment that focuses on long-term WLM within primary care has been a missed opportunity in terms of disease prevention and healthcare costs. As of the year 2018, 42.4% of American adults were obese (CDC, 2021a), meaning that they had a BMI of greater than 30kg/m^2. This represents a nearly 12% increase over the last 20 years and an annual cost of $147 billion in obesity-related healthcare expenses (CDC, 2020a). Much of this cost is attributable to the treatment of chronic conditions that are causally linked to or exacerbated by obesity. As weight increases, there is a curvilinear increase in the prevalence of diabetes, kidney disease, hypertension, stroke, heart disease, male and female reproductive cancers, colon cancer, gall-bladder disease, arthritis, gout (Bray et al., 2018), GERD, and sleep apnea (Tronieri et al., 2019). Conversely, weight loss that is maintained can reverse some of these effects and prevent progression of others (Bray et al., 2018). Successful maintenance is defined as weight loss that is maintained for at least one year (Montesi et al., 2016), but truly impactful health outcomes require diligence and strategies to assist patients in keeping lost weight off perpetually.

Common consensus within the obesity literature points to a 5%-10% weight loss goal as being a clinically significant objective in reducing mortality and improving quality of life for adults living with obesity (Gibbs et al., 2020). This reduction can be achieved through a variety of weight loss diets that restrict caloric intake, none of which have been scientifically proven as superior to another, which are effective in the short term (Bray et al., 2018). Unfortunately,

patients and providers often have an unrealistic expectation for weight loss in the range of 20%-40% (Hall & Kahan, 2018), and when this is not achieved, consider a modest weight loss that does not result in drastic cosmetic changes as a failure (Bray et al., 2018). Many weight loss programs focus only on short-term loss (Conroy et al., 2019) and do not teach maintenance-specific strategies and behaviors needed to improve long-term success. Up to 70% of individuals will regain half or more of their initial weight loss within two years (Bray et al., 2018; Stelmach-Mardas et al., 2014), and 95%-98% will return to their baseline weight by five years (Brunacini, 2019).

Maintaining progress after an initial weight loss is difficult for a myriad of reasons. Research has shown that the human body adapts to weight loss through a compensatory increase in appetite, a decrease in satiety, and a decreased caloric expenditure (Hall & Kahan, 2018). This means patients become hungrier, need to eat more to feel full, and require fewer overall calories to maintain their current weight. “For each kilogram of lost weight, calorie expenditure decreases by about 20 to 30 kcal/d, whereas appetite increases by about 100 kcal/d above the baseline level before weight loss” (Hall & Kahan, 2018, p. 185). This is why even patients in intense weight-loss programs plateau after their initial loss (Tronieri et al., 2019) and why the maintenance phase of weight loss requires more sustained physical activity than the initial phase (Bray et al., 2018). Additionally, maintenance also depends on long-term behavior change (Lenoir et al., 2015) and avoidance of behavioral regression (Gibbs et al., 2020). As time passes and weight loss slows or stops, patients lose their initial enthusiasm for healthier behaviors and return to pre-treatment lifestyle choices. Patients are not educated about the metabolic adaptations that occur with weight loss or the challenges that are unique to the maintenance of lost weight, so they are unprepared to deal with these as they arise. Often, their lack of additional progress is seen in a

negative light by healthcare providers and they are labeled as being in poor compliance with treatment or as lacking willpower (Hall & Kahan, 2018).

Most visits to a healthcare provider occur in the primary care setting which is why addressing weight loss and maintenance at these visits is essential (Tronieri et al., 2019), but the subject is not often broached by PCPs (Plourde & Prud'homme, 2012). When it is addressed, the intervention is often ineffective**.** While there is no standard definition of "usual care" in primary care weight-loss counseling, patterns of care have been observed. When the subject of weight loss is addressed by the PCP, the intervention typically involves formally diagnosing the patient with obesity, prescribing a hypocaloric diet and increased physical activity, and relying on the patient's willpower to carry them through the treatment (Dalle Grave et al., 2020) without additional support. WLM is typically not addressed at all (Brunacini, 2019). This form of intervention most often results in a weight loss of less than 5%, long-term weight regain, a 50% rate of non-adherence, guilt and a feeling of failure on the part of the patient, and a deterioration of the therapeutic relationship (Dalle Grave et al., 2020). Therefore, since 2012 the USPSTF has advised that providers either offer or refer patients to high-intensity, multi-component behavioral interventions as a Grade B level recommendation (Curry et al., 2018).

Behavior-based counseling is the foundation of weight loss treatment because it teaches skills that enable patients to adhere to healthy diet and activity patterns over the long term (Heymsfield & Wadden, 2017; Montesi et al., 2016). Components of a BBC program may include self-monitoring techniques, goal setting, education, problem solving strategies, stimulus control, stress reduction, psychological treatment, cognitive behavior therapy (CBT), and identification of social supports (Garvey et al., 2016). Furthermore, providing anticipatory guidance related to the unique challenges of WLM enables patients to prepare contingency plans

for behavior fatigue and relapses (Hall & Kahan, 2018). Evaluating the optimal maintenance specific behavioral interventions to include within a BBC program is an ongoing area of study (Crain et al., 2014). However, it is known that as the intensity of such programs increases (both in number of patient contacts as well as intervention duration) so does the likelihood of long-term behavioral change.

While offering intensive BBC by a PCP is possible, it is uncommon (Bennett et al., 2014), and there are many barriers to implementation. Barriers in the primary care setting include the short duration of visits that do not allow adequate time for high-intensity behavioral counseling, lack of PCP training in behavioral therapy, limited reimbursement (Katzmarzyk, et al., 2020), undertraining on modern weight loss science including the need for continued vigilance (Heymsfield & Wadden, 2017), and the high primary care workload (Gibbs et al., 2020) which makes it difficult to obtain multiple appointments. To provide some form of weight loss counseling, PCPs may employ motivational interviewing (MI) techniques during an office visit. However, randomized control trials (RCTs) of MI compared with control groups has not been associated with clinically significant weight loss over the long term (Tronieri et al., 2019). Recommendations for the use of smartphone applications such as MyFitnessPal alone without associated dietary counseling have also not been associated with clinically significant weight loss, much less WLM (Bray et al., 2018; Heymsfield & Wadden, 2017).

Given the difficulties of offering intensive behavior-based weight loss counseling within the primary care setting, the alternative USPSTF recommendation is then to refer patients to intensive behavior-based weight loss counseling in another appropriate setting. This literature review seeks to answer the question, In obese adults seen in primary care, how effective is a referral for behavior-based counseling compared to standard dietary counseling for long-term

weight loss maintenance? Uncovering the answer to this question will guide the FNP in delivering evidence-based weight loss care in primary practice.

Methods

Search Process and Data Abstraction

In order to answer the clinical question above, a targeted literature search was completed in October of 2020 focusing on articles published between 2012-2020. The databases included in the literature search were Academic Search Premier, CINAHL Plus, Medline, the Nursing and Allied Health Database, and APA PsycArticles. These databases were selected to cover both the breadth and depth of evidence about BBC from the nursing, biomedical, and psychological perspectives. The specific focus of each database, subjects included, and search restrictions are covered in Table 1 (see Appendix).

Search terms applied within the database queries included the following keyword phrases: “weight loss counseling”, “dietary counseling”, “obesity”, “weight loss maintenance”, “primary care”, and “cognitive behavioral therapy”. Keyword phrases were then applied in combinations of increasing specificity to narrow the results. Articles were eliminated from consideration if they were duplicates, did not address WLM, included a pediatric population focus, addressed WLM in a non-generalizable, specific population, or discussed behavior therapies unrelated to weight loss. Once the search process was completed, 46 articles were included for further review. Specific search dates, keyword phrase combinations, number of results, and number of studies selected for review from each database are covered in detail in Table 2 of the Appendix with articles selected for review noted in bold print.

Characteristics of Literature Included and Excluded

Inclusion criteria for the articles selected for final literature review were those that addressed WLM of one year or greater in an outpatient, obese, adult population or that addressed WLM behaviors in the primary care setting. Study designs included were those that may be applied to an intervention-type PICOT question which are inclusive of all levels of evidence (Melnyk & Fineout-Overholt, 2018, p. 46). Articles excluded from the final literature review were those that addressed only short-term weight loss, did not measure weight loss as a primary outcome, employed pharmacotherapy or bariatric surgery treatments for weight loss, utilized inpatient treatment, or included unintentional weight loss due to health conditions. Details on the specific criteria for inclusion or exclusion for each of the 42 articles considered for final review are included in Table 3 (see Appendix).

After all inclusion and exclusion criteria were applied, 26 articles were selected for the final literature review. The primary types of studies included, in decreasing order of rigor, were meta-analyses, prior systematic reviews on BBC, prior systematic reviews on WLM, individual BBC RCTs, and evidence-based guidelines. All studies included in the literature review are described in detail in Table 4 (see Appendix).

Literature Review

The focus of this literature review is to describe the current science of behavior-based counseling in relation to WLM starting with a review of the evidence for BBC and then further delineating elements of behavior science that may contribute to its success. Finally, intervention intensity will be explored to determine the most evidence-based dose of BBC.

Behavioral Based Counseling

Preventing weight regain after a clinically significant loss requires the development of behavioral competence in maintenance-specific skills. While BBC has been a part of weight loss

programs for the last 50 years (Bray et al., 2018), it is only within the last 20 or so years that behavioral competencies for WLM have been actively under investigation. In their 2018 literature review, the USPSTF committee appraised 89 trials employing behavior-based techniques for weight loss and maintenance and found that participants in the intervention groups regained less weight than those in the control groups (Curry et al., 2018). The AACE also reviewed the evidence on BBC. They found that while trying to separate the contribution of the behavioral component of a BBC intervention from the intervention's overall effectiveness is difficult, inferences can be drawn through comparisons of RCTs that included a BBC component with those that did not (Garvey et al., 2016). In their review, the AACE found that BBC interventions showed no statistically significant weight loss difference at 3-6 months, but significantly more weight loss by 12 months (Garvey et al., 2016) compared to controls without an intense behavior component. This may indicate that BBC is especially useful for long-term weight loss success. In a double-blind RCT of 222 obese patients who had previously lost at least 8 kg, Voils et al. (2017) found that a 16-week, maintenance specific BBC intervention led to a statistically significant slowed weight regain by 56 weeks. A recent synthesis of evidence on WLM found similar results. In many of the studies, participants were taught maintenance-specific skills and maintained more weight loss than those who received a usual care intervention though overall results were mixed (Hall & Kahan, 2018).

BBC programs are not a homogenous entity in that many types of treatment fall under the umbrella of behavior. This makes the study and comparison of effective modalities challenging. Therefore, this review will artificially classify types of WLM behavior therapies into those that focus on technical competencies (such as regular self-weighing) and those that focus on adaptive competencies (such as cognitive training). These classifications originate from an aggregation of

results from retrospective studies on participants in the National Weight Control Registry (n.d.), a database started in 1994 of over 10,000 individuals who have lost at least 30 pounds and maintained that weight loss for over one year (Brunacini, 2019).

Technical Competency Behavioral Counseling

Studies that promote technical behavioral competence for WLM focus on teaching what to do and how to do it. The technical competencies themselves are behaviors largely derived from National Weight Control Registry studies and have become accepted as evidence-based practice for WLM (Bray et al., 2018). The most common technical competencies employed in WLM studies are daily to weekly self-monitoring of weight and dietary intake, 225-300 minutes of physical activity per week, eating a hypocaloric diet of 1,200-1,500 kcal/day, eating breakfast regularly, and maintaining consistent dietary intake seven days a week (Bray et al., 2018, Montesi et al., 2016). The active area of research, then, is in the best way to educate and support patients in adopting these behaviors over the long term while delivering BBC programs in the most efficient, cost effective way possible.

Katzmarzyk et al. (2019) found that 16 weeks of individual in-person health education delivered to 803 obese adults in primary care by non-provider health coaches, followed by six weeks of telephone coaching, led to a 5%-10% weight loss maintained at 24 months by 50.7% of intervention participants vs. 19.6% of the usual care group. In a non-experimental study, Gilis-Januszewska et al. (2018) delivered 11 in-person healthy lifestyle counseling sessions and six telephone sessions over 10 months resulting in 36.9% of participants maintaining their weight loss at 36 months. Maintainers most often reported increased physical activity, eating a diet lower in fat, and increasing fruit and vegetable consumption. Those that did not adopt these technical maintenance behaviors returned to their baseline weight by 36 months. Stelmach-

Mardas et al. (2014) used a less intense intervention employing only three in-person educational sessions combined with individualized nutritional counseling at baseline, six weeks, and 12 weeks. By week 12, the average weight loss was 10.9% which was maintained at one year in 46.4% of participants who had taken up the technical competence of following a low-fat diet. However, the study did not include longer-term maintenance results which may have indicated the need for ongoing intervention to maintain this degree of success in a low-intensity program.

In order to reduce costs, studies have employed telephone and online coaching interventions for supporting WLM behaviors. Both Eakin et al. (2014) and Crain et al. (2018) studied telephone coaching to deliver weight loss interventions. In their RCT, Eakin et al. (2014) offered 27 weight loss counseling calls over 18 months to obese participants who had type 2 DM which resulted in temporary modest weight loss but no clinically significant weight loss at 24 months despite a self-reported increase in physical activity. Crain et al.'s (2018) RCT recruited participants who had already lost 10% of their body weight. The intervention group received 24 maintenance-specific health coaching calls over two years, as well as feedback in the form of weight graphs and monthly progress letters, whereas the self-directed control group only received two calls. By the end of the study, those in the intervention group regained 2% less weight than controls. Finally, Conroy et al.'s (2019) novel study used tools deployed within an electronic health record (EHR) to deliver their WLM intervention. Over 24 months, 194 participants who had previously lost at least 5% of their weight were randomized to either independently use EHR tools to track dietary intake, physical activity, and weight or were provided with these tools plus EHR-delivered individualized maintenance coaching. After 24 months, 50% of the independent group and 65% of the intervention group had maintained their weight loss. Though impressive, the high success rate of control group may indicate that the

effectiveness of the intervention lies more with the ease of use of the EHR to support technical competency behaviors than with the coaching intervention itself.

Adaptive Competency Behavioral Counseling

While much of the evidence that exists for the contribution of adaptive competencies to WLM is of high quality, this area has received significantly less attention in the literature than have more traditional technical competencies (Montesi, et al., 2016). In their systematic review of 35 studies of self-regulation mediators for WLM, Teixeira et al. (2015) identified high levels of autonomous regulation (ownership of one's own behavior), self-efficacy over perceived barriers (one's self-confidence that they can solve a problem), self-regulation (self-monitoring of diet, physical activity, and weight), flexible eating restraint (not adhering to a rigid diet mentality), and a positive body image as being correlated with long-term WLM success. Additionally, they found that participants who engaged in higher levels of physical activity also showed high levels of autonomous motivation, self-efficacy, and self-regulation. In regard to maintaining a low-calorie, low-fat diet, the authors were unable to identify any mediators that were consistent across studies. Finally, they postulated that implementation skills such as self-regulation may be essential to possess or learn early in weight loss treatment whereas motivational skills are useful throughout weight loss and WLM.

In their literature review on the current science of WLM, Montesi et al. (2016) focused on common personal characteristics of long-term maintainers that may make them more successful than those who do not maintain. They found that successful maintainers had a high internal locus of control, a higher satisfaction with their weight loss results, a lower level of disinhibition, and a higher level of self-efficacy. JaKa et al., 2015 also studied the relationship of disinhibition and restraint with weight loss and maintenance. They conducted a prospective

analysis study of a 24-month RCT of 442 obese participants using a commercial weight loss program involving in-person and telephone counseling by health coaches in primary care. At baseline, six, 12, and 24 months, each participant completed the validated 51 question "Three-Factor Eating Questionnaire" (Stunkard & Messick, 1985) that measures disinhibition, dietary restraint, and hunger. The authors found that a decreased level of dietary disinhibition had a larger impact on the ability to maintain weight loss at 24 months than did increased levels of dietary restraint (JaKa et al., 2015). Future BBC programs that include education and strategies to reduce disinhibition behaviors (such as reducing emotional eating) may be more useful than promoting behaviors that increase restraint (such as portion control education). Interestingly, Brunacini (2019) operationalized the idea of increasing self-efficacy in WLM through including adaptive competency behaviors in a BBC program via a quality control study at their telehealth weight-loss practice site. Patients completed a weight-loss competency survey at baseline, received weekly training in weight loss management, and completed the competency survey again during month three of treatment. Results showed a 27.5% increase in patient self-efficacy in WLM competency potentially leading to a greater possibility of long-term WLM. However, the study was of short duration and low quality so the results need to be repeated within a more academically vigorous design for validation.

Cognitive Behavioral Therapy Counseling. Most of the attempts to incorporate adaptive competencies into WLM programs have been done through cognitive behavioral therapy (CBT). Unlike traditional BBC that is directed at changing specific behaviors, CBT is meant to address dysfunctional thinking (Berk et al., 2018). Patients use techniques taught in CBT to recognize a cognitive distortion (such as all or nothing thinking) and replace it with productive thinking (Bray et al., 2018). This cognitive restructuring allows patients to replace rigid beliefs around

dietary intake and physical activity with flexible thinking allowing them to view any slip-ups as part of the WLM process versus a personal failing (Hall & Kahan, 2018).

Most of the literature on CBT and weight loss to-date has focused only on short term loss rather than maintenance behaviors and what does exist has demonstrated variable results. Berk et al.'s (2018) RCT of 158 obese adults with type 2 DM who had previously lost at least 5% of their weight, employed a mix of traditional CBT techniques and weight-loss-specific CBT techniques in a series of 17 group sessions over two years. The control group received diabetes care and nutritional counseling. By the end of the study, there was no statistically significant difference in weight between the intervention and control groups. It is unknown whether the patients' diabetes diagnosis affected the outcome. Dalle Grave et al. (2020) conducted a longitudinal trial with 67 obese patients over 18 months using a method of CBT tailored for weight loss in obesity described as CBT-OB. CBT-OB was designed by the authors specifically to decrease disinhibition and increase restraint as in the JaKa et al., (2015) trial above. At the 18-month end point, the mean weight lost was 9.9% with an average weight regain of 2.7 kg between months six and 18. Additionally, the participant's anxiety, depression, and disordered eating scores all decreased perhaps demonstrating a health benefit beyond weight loss, yet there was no control group against which to compare results. A RCT focused on WLM using a CBT format similar to CBT-OB with 113 women who had previously lost at least 10% of their weight was conducted over 24 weeks against a control group who were prescribed diet and exercise (Madjd et al., 2020). At the end of the trial, the CBT group had lost an additional 1.27 kg on top of their previous weight loss while the control group had regained 0.62 kg. The authors concluded that the CBT training had enabled the participants to modify their behavior to follow a reduced energy diet and continue to engage in high levels of physical activity.

Intensity of Behavioral Based Counseling Interventions

The USPSTF's recommendation for the intensity of BBC for obese individuals is 12 or more sessions per year (Curry et al., 2018). This recommendation stems from numerous studies demonstrating the dose of counseling needed to produce clinically significant weight loss (Bray et al., 2018, Garvey et al., 2016, Montesi et al., 2016, Tronieri et al., 2019). A retrospective analysis of 14,256 records of participants in a dedicated primary care delivered weight loss program showed that successful maintainers (26.68% of participants) met with their provider an average of 19.6 times over 34.2 months, and the frequency of contact was positively correlated with the duration of WLM. The Katzmarzyk et al. (2020) trial described above showed similar results with 40 contacts over 24 months. While effective, intense BBC interventions are also time and resource intensive which increases delivery cost making them cost-prohibitive for many patients or inaccessible in rural areas. Remotely delivered online commercial interventions have attempted to fill this gap, but no trials have demonstrated clinically significant, long-term success through this format (Tronieri et al., 2019). In order to calculate an efficient dose of BBC for resource-challenged populations, Perri et al. (2014) utilized health coaches within the offices of the United States Department of Agriculture Cooperative Extension Services for their 24-month RCT involving 612 obese adults living in a rural area. Participants were randomized to low (8 sessions), medium (16 sessions), or high dose (24 sessions) BBC groups vs. a usual care group that received only one-time nutrition education. At 24 months, the percentage of participants within each group who achieved and maintained clinically significant weight loss were 40% (control), 43% (low), 58% (medium), and 58% (high) respectively. There was little added benefit for a low intensity intervention over control and no additional benefit for offering greater than 16

sessions. In designing future interventions, these results may allow for a more targeted, cost effective intervention.

Limitations

This review has several limitations of note. Many of the studies included have only a small number of participants or were not RCTs. BBC studies are heterogenous in nature, making comparisons between intervention effects difficult. The review did not include evidence of the effectiveness of non-lifestyle interventions for obesity such as pharmacotherapy or bariatric surgery though these are mainstream treatments that are increasingly being considered earlier in the clinical course of contemporary obesity treatment than in the past (Garvey et al., 2016).

Discussion

This literature review has presented the current evidence for the effectiveness of BBC programs for WLM as a whole, a targeted appraisal on the effectiveness of their potential behavioral components, and an evaluation of the evidence for a high level of intervention intensity. With two exceptions, studies that incorporated intense behavior-based therapies demonstrated efficacy for maintaining a 5%-10% weight loss at one year compared to those that did not. Interestingly, the two trials reviewed that showed no maintenance benefit after weight loss (Berk et al., 2018; Eakin et al., 2014), focused solely on patient populations living with type 2 DM. This may signal that this population would be better served by combining lifestyle modifications with pharmacotherapy or bariatric surgery rather than intensive BBC for long-term weight management.

It is established health science that a reduced calorie diet and moderate to vigorous physical activity maintained over a long period of time leads to sustained WLM, but helping patients living with obesity to follow this lifestyle remains a challenge. The evidence for intense

BBC as part of weight loss treatment has led to BBC becoming a best practice recommendation from the USPSTF (Curry et al., 2018), the AACE (Garvey et al., 2016), and the Endocrine Society (Bray et al., 2018). However, the question of which behavioral components, if any, are the key to success in long-term behavior change remains unanswered (Berk et al., 2018). Though most studies demonstrated that BBC interventions were superior to controls without it, there were always control group participants who succeeded in maintaining their weight loss without the aid of the intense intervention. Garvey et al. (2016) terms it "reductionist" (p. 101) to attempt to separate the behavioral component of a WLM intervention from the diet and physical activity components, but this knowledge could lead to a new generation of more effective WLM treatments.

Studies on habits of participants in the National Weight Control Registry (n.d.), have spawned the current recommendations for technical competency behaviors (such as dietary and physical activity tracking and frequent self-weighing) within current obesity treatment guidelines, as well as a new generation of research on adaptive competencies. While still an understudied focus of research in behavior-based WLM science, the evidence thus far on adaptive competencies may soon yield important results. The translational study utilizing CBT-OB (Dalle Grave et al., 2020), in particular, is of interest because of its targeted use of CBT to address disinhibition and restraint, two adaptive behavioral competencies identified in earlier research (JaKa et al., 2015; Teixeira et al., 2015) as important mediators of weight loss. While the CBT-OB study was not a randomized control trial, the result of a 9.9% weight loss at 18 months coupled with significant improvements in mental health assessment scores, make CBT-OB a prime candidate for further study. In addition to disinhibition and restraint, three articles identified having a high level of self-efficacy as being important for long-term WLM (Brunacini,

2019; Montesi et al., 2016; Teixeira et al., 2015). This may be significant because 95%-98% of the general public does not feel confident enough to lose weight without assistance (Brunacini, 2019) perhaps indicating low levels of weight loss self-efficacy.

There is clear evidence regarding the necessary intensity, or dose, of intervention needed to achieve clinically significant weight loss and long-term WLM. Weight loss and maintenance positively correlate with the number of provider contacts over the course of treatment and low-intensity interventions do not typically lead to clinically significant weight loss (Curry et al., 2018; Lenoir et al., 2015; Perri et al., 2014). Given this information, it stands to reason that appropriately treating obesity within the primary care setting is time and resource prohibitive for most primary care providers (Bray et al., 2018; Tronieri et al., 2019). This is most likely why few weight loss and WLM trials are conducted with PCPs delivering the intervention (Tronieri et al., 2019). Most interventions within this literature review were delivered by non-PCP health coaches, such as registered dieticians, nurses, or behavioral counselors, who work as part of a dedicated weight loss team (Montesi et al., 2016). Health coach delivery also allows for BBC programs to be delivered within non-clinic settings such as offices and community centers (Garvey et al., 2016). This flexibility is important to increase accessibility to effective WLM treatment for patients with limited resources for payment and travel.

This review posed the following clinical question: In obese adults seen in primary care, how effective is a referral for behavior-based counseling compared to standard dietary counseling for long-term weight loss maintenance? Based on the most current evidence summarized above, the answer is that compared to standard dietary counseling, BBC is more effective for maintaining a clinically significant weight loss over a long period of time and may

have health benefits that go beyond weight loss-associated morbidity reduction, such as mental health improvement.

Implications

Implications for Clinical Practice

To state that FNPs and other PCPs cannot themselves realistically deliver intense BBC interventions does not imply that the PCP role is not important in weight loss treatment. Evidence has demonstrated that patients are more likely to lose weight when it is advised by their PCP (Bennett et al., 2014; Plourde & Prud'homme, 2012). The 5A model (assess, advise, agree, assist, and arrange) is a straightforward, easy to understand mnemonic that can be used by a PCP to facilitate weight loss treatment (Plourde & Prud'homme, 2012).

Using the 5A framework, FNPs should assess their patients' BMIs and waist circumferences to identify and diagnose obesity, their patients' willingness to consider losing weight, and their ability to participate in treatment. The second step is to advise that they lose 5%-10% of body weight for benefits such as improved blood pressure and diabetes prevention and then refer them to appropriate BBC either within the practice or in the community. Many commercial weight loss programs available in the community are evidence-based, often include WLM education, and are an option for patients to consider in areas where no structured clinical programs are available (Garvey et al., 2016). The FNP and patient should agree on treatment goals, stressing realistic expectations that are achievable through lifestyle modification alone (Hall & Kahan, 2018; Tronieri et al., 2019). If a higher degree of weight loss is clinically necessary, this would require consideration of pharmacotherapy and/or bariatric surgery (Hall & Kahan, 2018). After referral for counseling, the FNP can assist the patient by reinforcing information taught in BBC, offering suggestions on overcoming barriers to behavior change, and

providing feedback on progress over time. A PCP can be the patient's cheerleader and advocate (Bennett et al., 2014). Finally, the FNP should arrange follow-up visits to monitor progress, any necessary referrals, and offer continuing support for WLM over the patient's lifetime.

Implications for Research

The "Holy Grail" of weight loss maintenance is yet to be discovered. As discussed above, research into specific cognitive and behavioral adaptive competencies is needed to determine which variable(s) within structured BBC programs lead to WLM. There is also a lack of evidence for the efficacy of behavior modification over pharmacotherapy or bariatric surgery for WLM (Tronieri et al., 2019). A head-to-head comparison between BBC and these interventions over a long period of time would add greatly to the evidence base and assist PCPs in providing or referring for the appropriate treatment. If the ultimate goal of WLM is for the health effects of weight loss to last the duration of the patient's life, much longer trials will need to be held. The average intervention duration in this review was only 18-24 months. Finally, many people with chronic conditions such as obesity also suffer from comorbid depression and/or anxiety. One of the studies in this review measured depression and anxiety as outcomes, but many purposely excluded those with known mental health disorders from participation and did not assess depression at baseline or as an outcome. Future research should address whether treating comorbid mental health conditions enhances the effectiveness of BBC for WLM.

Implications for Education

FNP education should include information on the pathophysiology and evidence-based treatments for the disease of obesity so as to remove the stigma from patients with obesity. All providers need to examine their beliefs for personal biases vs. what is borne out by science. The AACE considers obesity a disease because it meets the three main criteria for diseases in that it

impairs normal function, has standard diagnostic criteria, and causes morbidity to the patient (Garvey et al., 2016). It is not a lifestyle choice nor is it the result of laziness or lack of willpower on the part of the patient. Just as an FNP would not expect a patient with high cholesterol to experience a myocardial infarction before treating them, nor should they wait for an obese patient to develop diabetes before treating them. FNPs should also be taught that WLM requires a different set of competencies than weight loss induction and that long-term vigilance is needed on both the part of the provider and patient. For those FNPs already in practice, continuing education (CE) courses or lunch-and-learn meetings on the diagnosis, treatment, and long-term management of patients living with obesity could be employed.

Implications for Policy

Though not discussed significantly within this review, reimbursement is also a barrier for PCPs to deliver intense BBC in primary care. Though the USPSTF gives providing BBC an evidence grade of B (Curry et al., 2018) and the Patient Protection and Affordable Care Act mandates that any service receiving an A or B level USPSTF recommendation be covered without co-pay (Tronieri et al., 2019), reimbursement is not a guarantee. For those on Medicare insurance, the Centers for Medicare and Medicaid Services (CMS) will only cover intensive BBC for obesity if the counseling is provided directly by a PCP but not a health coach or ancillary staff member (CMS, 2012). This does not reconcile with the evidence that demonstrates such services are not easily provided for in primary care due to constrained resources. For those obese patients with prediabetes on Medicare, CMS will reimburse for participation in a Diabetes Prevention Program (CDC, 2021b; Medicare.gov, n.d.). Patients with obesity and prediabetes who are not eligible for Medicare may join the CDC's National Diabetes Prevention Program (CDC, 2020c) but there is a cost to participate that may not be covered by insurance. Both

programs meet the USPSTF standard of a high-intensity BBC program and include a focus on WLM. While claiming to be preventive, neither allows a patient to join until they have developed prediabetes. To increase accessibility to these programs for the prevention of comorbid conditions in adults living with obesity, FNPs should advocate for improved high-intensity BBC coverage by Medicare and private insurance, and for such services to be covered when provided by trained health coaches in addition to PCPs.

Conclusion

As stated so succinctly by Brunacini (2019), "This country does not have a weight loss problem but rather a weight maintenance problem" (p. 752), and the large increase in obesity over the past two decades speaks to that truth. This literature review has shown that BBC is superior for WLM compared to dietary counseling alone in terms of the facilitation of a clinically significant weight loss of 5%-10% that is maintained for at least one year. Traditional weight loss research has focused on incorporating technical competencies such as self-monitoring of weight into BBC programs. Emerging research is focused on using CBT to enhance adaptive competencies, such as restraint and self-efficacy, to increase a patient's ability to adopt positive behavior changes that influence WLM over the long term. In order to be effective for weight loss and maintenance, treatment intensity, as measured by the number of provider or coach contacts, positively correlates with WLM. Treatment of obesity in primary care should focus on the identification of obesity, referral for appropriate intensive BBC services, expectation setting, and long-term support of the patient. Areas of future research should include studies that incorporate adaptive competencies into BBC programs, studies that measure outcomes over longer duration, and how mental health treatment affects long-term WLM outcomes. FNP education should emphasize that obesity is a disease and focus on

pathophysiology, diagnosis, and evidence-based interventions derived from contemporary treatment guidelines. Finally, FNPs should advocate for increased coverage of BBC services for obese patients to prevent the progression of disease. Taken together, these measures may bring FNPs closer to uncovering the “Holy Grail” of obesity treatment, reduce the national obesity rates, and prevent the development of obesity-related chronic disease. This could not only save billions in healthcare costs annually but improve the lives of patients, their families, and the overall health of the country.

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Appendix

Table 1

Database Search Description

Database (or Search Engine)	Restrictions Added to Search	Dates Included in Database	General Subjects Covered by Database
1. Academic Search Premier	Scholarly (Peer Reviewed) Journals; Language: English; Apply equivalent subjects; Apply related words	2012 - 2020	Provides citations and abstracts to articles, as well as full text of articles from over 4,600 publications, covering almost every academic subject.
2. CINAHL Plus with Full Text	References Available; Abstracts Available; English Language, Peer Reviewed; Exclude MEDLINE records; Human; Age Groups: All Adult	2012 - 2020	Provides full text access to e-books about nursing and 29 core nursing journals. Also provides citations and abstracts to articles, books, dissertations, proceedings, and other materials about all aspects of nursing and allied health, including cardiopulmonary technology, emergency service, health education, medical/laboratory, medical assistant, medical records, occupational therapy, physical therapy, physician assistant, radiologic technology, social service/health care, and more.
3. Medline	Peer reviewed; Humans; Language: English; Age group: Adults: All 19 years+	2012 - 2020	Provides citations and abstracts to articles covering all medical topics, including "research, clinical practice, administration, policy issues, and health care services. Produced by the U.S. National Library of Medicine, MEDLINE contains all records published in Index Medicus and since 2002, most citations previously included in separate NLM specialty databases such as SPACELINE and HISTLINE.
4. Nursing & Allied Health Database	Peer reviewed; Age group: adult 19-44, Middle Aged 45-64, and Aged 65+; Language: English	2012 - 2020	(Formerly ProQuest Nursing and Allied Health Source) Provides citations, abstracts, and selected full text to articles about all aspects of nursing and allied health.
5. APA PsycArticles	Date: After January 01 2010 Language: English; Age group: Adulthood (18 Yrs & Older), Aged (65 Yrs & Older), Middle Age (40-64 Yrs), Thirties (30-39 Yrs), Young Adulthood (18-29 Yrs); Population: Human	2012 - 2020	Provides full-text articles from journals published by the American Psychological Association, the APA Educational Publishing Foundation, the Canadian Psychological Association, and Hogrefe & Huber. The database includes all material from the print journals with the exception of advertisements and editorial board lists.

Table 2

Data Abstraction Process

Date of Search	Key Words	Results in ASP	Results in CINAHL	Results in Medline	Results in N&AHDb	Results in APA PA
10/20/20	"Weight loss counseling"	1088	824	882	2249	921
	"Dietary counseling" AND "obesity"	594	329	361	1005	186
	"Weight loss maintenance"	1857	641	1383	4463	1049
	'weight loss maintenance" AND "primary care"	162	78	135	137	502
	"Weight loss maintenance" AND "weight loss counseling"	82	67	97	668	334
10/21/20	"weight loss maintenance" AND "dietary counseling"	33	20	27	405	118
	"weight loss maintenance" AND "cognitive behavioral therapy"	37	29	38	590	454
10/24/20	"weight loss maintenance" AND "weight loss counseling" AND "dietary counseling"	16**(5)**	5(0 – all duplicates)	27**(6)**	405	75
	"weight loss maintenance" AND "cognitive behavioral therapy" AND "primary care"	10**(6)**	**5**	6**(2)**	16(**1**)	257
	"weight loss maintenance" AND "dietary counseling" AND "primary care"	7**(3)**	**6**	6(0 – all dups)	15 **(1)**	77
	"weight loss maintenance" AND "cognitive behavioral therapy" AND "dietary counseling"	**3**	0	2(0)	9 **(1)**	159
	"weight loss maintenance" AND "cognitive behavioral therapy" AND "dietary counseling" AND "primary care"	1(0)	0	0	0	**87(3)**

***BOLD** = articles reviewed for match with systematic review inclusion criteria

Inclusion criteria: Population: Aged 18+, Study design: Systematic review, meta-analysis, randomized control trial, quasi-experimental studies, qualitative. Peer reviewed. Not bariatric surgery.

Table 3

Characteristics of Literature Included and Excluded

Reference	Included or Excluded and Document	Rationale
Aller, E., Mariman, E. C. M., Bouwman, F. G., & van Baak, M. A. (2017). Genetic predictors of ≥5% weight loss by multidisciplinary advice to severely obese subjects. *Journal of Nutrigenetics and Nutrigenomics, 10*(1-2), 32-42.	Excluded	This study is interesting and the participants are from a group who are participating in a multi-modal weight loss program but the authors are only looking at the genetics of the participants.
Beaulac, J., & Sandre, D. (2017). Critical review of bariatric surgery, medically supervised diets, and behavioural interventions for weight management in adults. *Perspectives in Public Health, 137*(3), 162-172.	Excluded	Literature review focusing on successfully modalities in weight loss. Talks mostly about bariatric surgery. Little attention is paid to other modalities.
Bennett, W., Gudzune, K., Appel, L., & Clark, J. (2014). Insights from the POWER practice-based weight loss trial: A focus group study on the PCP's role in weight management. *Journal of General Internal Medicine, 29*(1), 50-58.	Included	Qualitative study of PCPs and their role in weight management. This trial provided a unique opportunity to understand PCPs' actual and desired roles in a multi-component weight loss intervention.
Berk, K. A., Buijks, H. I. M., Verhoeven, A. J. M., Mulder, M. T., Özcan, B., van't Spijker, A., Timman, R., Busschbach, J. J., & Sijbrands, E. J. (2018). Group cognitive behavioural therapy and weight regain after diet in type 2 diabetes: Results from the randomised controlled POWER trial. *Diabetologia, 61*(4), 790-799.	Included	To determine the 2-year effectiveness of a cognitive behavioural group therapy (group-CBT) program in weight maintenance after diet-induced weight loss in overweight and obese adults with type 2 diabetes, using a randomized, parallel, non-blinded, pragmatic study design.
Blane, D. N., Macdonald, S., & O'Donnell, C. A. (2020). What works and why in the identification and referral of adults with comorbid obesity in primary care: A realist review. *Obesity Reviews*, *21*(4), 1–18.	Included	Literature synthesis of 6 databases for intervention studies targeted at PCPs to improve the identification and referral of adults with comorbid obesity.
Bray, G. A., Heisel, W. E., Afshin, A., Jensen, M. D., Dietz, W. H., Long, M., Kushner, R. F., Daniels, S. R., Wadden, T. A., Tsai, A. G., Hu, F. B., Jakicic, J. M., Ryan, D. H., Wolfe, B. M., & Inge, T. H. (2018). The science of obesity management: An endocrine society scientific statement. *Endocrine Reviews*, *39*(2), 79–132.	Included	This ROL provides an overview of the current science of obesity management inclusive of dietary, exercise, behavioral, pharmaceutical and surgical modalities. Best practice recommendations are made throughout the text.
Brunacini, K. (2019). Implementation of a virtual patient-centered weight loss maintenance behavior competency assessment in adults with obesity. *Journal of the American Association of Nurse Practitioners, 31*(12), 752–759.	Included	Quality Control Study.
Buclin-Thiébaud S, Pataky Z, Bruchez V, Golay A, Buclin-Thiébaud, S., Pataky, Z., Bruchez, V., & Golay, A. (2010). New psycho-pedagogic approach to obesity treatment: a 5-year follow-up. *Patient Education & Counseling*, *79*(3), 333–337. https://doi-org.ezproxy.mnsu.edu/10.1016/j.pec.2009.11.001	Excluded	The effect of an inpatient weight loss program on long term weight maintenance.

Reference	Included or Excluded and Document	Rationale
Crain, A. L., Sherwood, N. E., Martinson, B. C., & Jeffery, R. W. (2018). Mediators of weight loss maintenance in the keep it off trial. *Annals of Behavioral Medicine: A Publication of the Society of Behavioral Medicine, 52*(1), 9-18.	Included	This study aimed to assess the viability of mediated relationships between the Keep It Off Guided intervention, conceptually and empirically grounded potential mediators, and weight loss maintenance.
Conroy, M. B., McTigue, K. M., Bryce, C. L., Tudorascu, D., Gibbs, B. B., Arnold, J., Comer, D., Hess, R., Huber, K., Simkin-Silverman, L. R., & Fischer, G. S. (2019). Effect of electronic health record-based coaching on weight maintenance: A randomized trial. *Annals of Internal Medicine*, *171*(11), 777–784.	Included	Study of an EHR tool to use in the primary care setting to promote weight loss maintenance.
Curry, S. J., Krist, A. H., Owens, D. K., Barry, M. J., Caughey, A. B., Davidson, K. W., Doubeni, C. A., Epling, J. W., Grossman, D. C., Kemper, A. R., Kubik, M., Landefeld, C. S., Mangione, C. M., Phipps, M. G., Silverstein, M., Simon, M. A., Tseng, C., & Wong, J. B. (2018). Behavioral weight loss interventions to prevent obesity-related morbidity and mortality in adults: US preventive services task force recommendation statement. *JAMA, 320*(11), 1163-1171.	Included	Recommendation article. The USPSTF recommends that clinicians offer or refer adults with a body mass index of 30 or higher to intensive, multicomponent behavioral interventions. (B recommendation). This is based on a ROL.
Dalle Grave, R., Calugi, S., Bosco, G., Valerio, L., Valenti, C., El Ghoch, M., & Zini, D. (2020). Personalized group cognitive behavioural therapy for obesity: A longitudinal study in a real-world clinical setting. *Eating and Weight Disorders: EWD, 25*(2), 337-346.	Included	RCT with 77 participants undergoing CBT strategies for long term weight loss maintenance.
Donaldson, E. L., Fallows, S., & Morris, M. (2014). A text message based weight management intervention for overweight adults. *Journal of Human Nutrition & Dietetics*, 90–97.	Excluded	Semi-controlled study using text message reminders for 12 weeks after a weight loss program to reinforce messaging and get updates on progress. Not specific to a behavioral or dietary component. Small n.
Duncan, M. J., Brown, W. J., Burrows, T. L., Collins, C. E., Fenton, S., Glozier, N., Kolt, G. S., Morgan, P. J., Hensley, M., Holliday, E. G., Murawski, B., Plotnikoff, R. C., Rayward, A. T., Stamatakis, E., & Vandelanotte, C. (2018). Examining the efficacy of a multicomponent m-health physical activity, diet and sleep intervention for weight loss in overweight and obese adults: Randomised controlled trial protocol. *BMJ Open, 8*(10), 1.	Excluded	This study will be an excellent resource when completed. However, it is currently in the design phase. This article describes the protocol.
Eakin, E. G., Winkler, E. A., Dunstan, D. W., Healy, G. N., Owen, N., Marshall, A. M., Graves, N., & Reeves, M. M. (2014). Living well with diabetes: 24-month outcomes from a randomized trial of telephone-delivered weight loss and physical activity intervention to improve glycemic control. *Diabetes Care*, *37*(8), 2177–2185.	Included	Randomized controlled trial of telephone counseling (n = 151) versus usual care (n = 151). 18- and 24-month outcomes. This is behavioral counseling delivered via telehealth.
Ebbeling, C. B., Klein, G. L., Luoto, P. K., Wong, J. M. W., Bielak, L., Eddy, R. G., Steltz, S. K., Devlin, C., Sandman, M., Hron, B., Shimy, K., Heymsfield, S. B., Wolfe, R. R., Wong, W. W., Feldman, H. A., & Ludwig, D. S. (2018). A randomized study of dietary composition during weight-loss maintenance:	Excluded	This study focuses on feeding a controlled amount of prepared food in the maintenance phase of weight loss to determine which macronutrient compositions are effective at maintaining loss and

Reference	Included or Excluded and Document	Rationale
Rationale, study design, intervention, and assessment. *Contemporary Clinical Trials, 65*, 76-86.		curbing hunger. The participants did not have to self-regulate or make choices, only eat what was prepared for them.
Garvey, W. T., Mechanick, J. I., Brett, E. M., Garber, A. J., Hurley, D. L., Jastreboff, A. M., Nadolsky, K., Pessah-Pollack, R., Plodkowski, R., & Reviewers of the AACE/ACE Obesity Clinical, Practice Guidelines. (2016). American association of clinical endocrinologists and endocrinology comprehensive clinical practice guidelines for medical care of patients with obesity. *Endocrine Practice: Official Journal of the American College of Endocrinology and the American Association of Clinical Endocrinologists, 22 Suppl 3*, 1-203.	Included	National practice guidelines for obesity management.
Gelli, C., Tarocchi, M., Abenavoli, L., Di Renzo, L., Galli, A., & De Lorenzo, A. (2017). Effect of a counseling-supported treatment with the Mediterranean diet and physical activity on the severity of the non-alcoholic fatty liver disease. *World Journal of Gastroenterology, 23*(17), 3150-3162.	Excluded	Though the participants in this study were involved in a program that used diet and counseling to enhance their nutritional intake, this study did not use weight as an outcome but rather liver function.
Gibbs, B. B., Tudorascu, D., Bryce, C. L., Comer, D., Fischer, G. S., Hess, R., Huber, K. A., McTigue, K. M., Simkin-Silverman, L. R., & Conroy, M. B. (2020). Lifestyle habits associated with weight regain after intentional loss in primary care patients participating in a randomized trial. *Journal of General Internal Medicine, 35*(11), 3227-3233.	Included	Secondary analysis of RCT data focused on what leads to weight regain in the maintenance phase of weight loss. A successful long-term weight loss maintenance program needs to address these issues.
Gilis-Januszewska, A., Barengo, N. C., Lindström, J., Wójtowicz, E., Acosta, T., Tuomilehto, J., Schwarz, P. E. H., Piwońska-Solska, B., Szybiński, Z., Windak, A., & Hubalewska-Dydejczyk, A. (2018). Predictors of long term weight loss maintenance in patients at high risk of type 2 diabetes participating in a lifestyle intervention program in primary health care: The DE-PLAN study. *PloS One, 13*(3), 1.	Included	This study's objective was to identify factors predicting long-term successful weight reduction maintenance achieved during a DM2 prevention program in patients with high DM2 risk in primary health care using behavioral interventions.
Golubic, R., Laur, C., Kelsey, M., Livesy, A., Hoensch, J., Park, A., & Ray, S. (2018). The cambridge intensive weight management programme appears to promote weight loss and reduce the need for bariatric surgery in obese adults. *Frontiers in Nutrition, 5*, 54.	Excluded	Non-randomized prospective study to investigate the impact of a weight management program on weight change, eligibility for bariatric surgery, HbA1c, and blood pressure. Lasted for only 6 months. No weight maintenance phase.
Gudzune, K. (2016). Dietary and behavioral approaches in the management of obesity. *Gastroenterology Clinics of North America, 45*(4), 653-661.	Excluded	This is not a research study. Useful information for the PCP to incorporate the discussion of weight loss into the visit.
Hall, K. D., & Kahan, S. (2018). Maintenance of lost weight and long-term management of obesity. *The Medical Clinics of North America*, *102*(1), 183–197.	Included	Meta-analysis of literature regarding how PCPs can manage long term obesity treatment.
Hartmann-Boyce, J., ×, P. A., Piernas, C., Koshiaris, C., Velardo, C., Salvi, D., & Jebb, S. A. (2018). Cognitive and behavioural strategies for weight	Excluded	Prospective cohort study to assess cognitive and behavioral strategies for weight loss and their associations with weight change. However,

Reference	Included or Excluded and Document	Rationale
management in overweight adults: Results from the oxford food and activity behaviours (OxFAB) cohort study. *PLoS One, 13*(8).		this study was about short-term weight loss behaviors and only followed participants for 3 months.
Heymsfield, S. B., & Wadden, T. A. (2017). Mechanisms, pathophysiology, and management of obesity. *The New England Journal of Medicine, 376*(3), 254-266.	Included	ROL focusing on the efficacious forms of weight loss/maintenance.
Jacob, A., Moullec, G., Lavoie, K. L., Laurin, C., Cowan, T., Tisshaw, C., Kazazian, C., Raddatz, C., & Bacon, S. L. (2018). Impact of cognitive-behavioral interventions on weight loss and psychological outcomes: A meta-analysis. *Health Psychology, 37*(5), 417-432.	Excluded	This is a meta-analysis that examines the effects of cognitive–behavioral therapy weight loss (CBTWL) interventions on weight loss, psychological outcomes (eating behaviors [cognitive restraint, emotional/binge eating], and depressive/anxiety symptoms) in adults with overweight or obesity. However, it did not include any focus on maintenance of weight loss over time.
JaKa, M. M., Sherwood, N. E., Flatt, S. W., Pacanowski, C. R., Pakiz, B., Thomson, C. A., & Rock, C. L. (2015). Mediation of weight loss and weight loss maintenance through dietary disinhibition and restraint. *Journal of Obesity & Weight Loss Therapy, 5*(2), 1-6.	Included	Prospective analysis of a weight loss program to determine if dietary disinhibition and restraint contribute to successful weight loss at 6 months and 12 months out.
Katzmarzyk, P. T., Martin, C. K., Newton, R. L., Apolzan, J. W., Arnold, C. L., Davis, T. C., Price-Haywood, E., Denstel, K. D., Mire, E. F., Thethi, T. K., Brantley, P. J., Johnson, W. D., Fonseca, V., Gugel, J., Kennedy, K. B., Lavie, C. J., Sarpong, D. F., & Springgate, B. (2020). Weight loss in underserved patients – A cluster-randomized trial. *The New England Journal of Medicine, 383*(10), 909-918.	Included	RCT. Primary care delivered intensive lifestyle intervention over 24 months vs. usual care.
Kozlovsky, A., Ryan, A., Chung, S., Zhu, S., Friedmann, E., Kelleher, C., Griffith, K., Macfarlane, K., Tkaczuk, K., Macfarlane, K. W., Tkaczuk, K. H. R., Ryan, A. S., & Griffith, K. A. (2016). Weight loss with mindful eating in African American women following treatment for breast cancer: a longitudinal study. *Supportive Care in Cancer*, *24*(4), 1875–1881.	Excluded	Study uses a mindfulness intervention which is interesting but was done only in patients who were experiencing BC survivorship and rooted strongly in that culture which may make it non-applicable to the general population.
Lenoir, L., Maillot, M., Guilbot, A., & Ritz, P. (2015). Primary care weight loss maintenance with behavioral nutrition: An observational study. *Obesity (Silver Spring, Md.)*, *23*(9), 1771–1777.	Included	Retrospective study of ~14,000 participants who used a dietary + behavioral control for their weight loss maintenance. To evaluate the rate of weight loss maintenance, defined as a 10% loss of initial weight maintained beyond 1 year, among patients with BMI > 25 who had been managed by primary care physicians practicing behavioral nutrition (moderately high-protein diet, carbohydrate restriction, and behavioral therapy).
Madjd, A., Taylor, M. A., Delavari, A., Malekzadeh, R., Macdonald, I. A., & Farshchi, H. R. (2020). Effects of cognitive behavioral therapy on weight maintenance after successful weight loss in women; a randomized clinical trial. *European Journal of Clinical Nutrition*, *74*(3), 436–444.	Included	RCT The aim of this study was to evaluate the effects of CBT on weight maintenance after successful weight loss.

Reference	Included or Excluded and Document	Rationale
Montesi, L., El Ghoch, M., Brodosi, L., Calugi, S., Marchesini, G., & Dalle Grave, R. (2016). Long-term weight loss maintenance for obesity: A multidisciplinary approach. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy, 9*, 37-46.	Included	Several factors have been associated with better weight loss maintenance in long-term observational and randomized studies. A few pertain to the behavioral area (eg, high levels of physical activity, eating a low-calorie, low-fat diet; frequent self-monitoring of weight), a few to the cognitive component (eg, reduced disinhibition, satisfaction with results achieved, confidence in being able to lose weight without professional help), and a few to personality traits (eg, low novelty seeking) and patient-therapist interaction.
Perri, M. G., Limacher, M. C., von Castel-Roberts, K., Daniels, M. J., Durning, P. E., Janicke, D. M., Bobroff, L. B., Radcliff, T. A., Milsom, V. A., Kim, C., & Martin, A. D. (2014). Comparative effectiveness of three doses of weight-loss counseling: Two-year findings from the rural LITE trial. *Obesity, 22*(11), 2293–2300.	Included	This RCT examined "doses" of weight-loss behavior therapy counseling and its effect on weight loss compared to a control group at 6 months through 24 months.
Plourde, G., & Prud'homme, D. (2012). Managing obesity in adults in primary care: CMAJ. *Canadian Medical Association.Journal, 184*(9), 1039-44.	Included	Evidence based guidelines useful for PCPs.
Stelmach-Mardas, M., Mardas, M., Warchoł, W., Jamka, M., & Walkowiak, J. (2014). Successful maintenance of body weight reduction after individualized dietary counseling in obese subjects. *Scientific Reports, 4*, 6620, 1-7.	Included	This study focuses on dietary intervention alone for weight loss maintenance. The aim of this study was to describe the effectiveness of individualized dietary counseling in obese subjects based on narrative interview technique on the maintenance of body weight reduction, changes in dietary behaviors, including type of cooking and physical activity.
Teixeira, P. J., Carraça, E. V., Marques, M. M., Rutter, H., Oppert, J., De Bourdeaudhuij, I., Lakerveld, J., & Brug, J. (2015). Successful behavior change in obesity interventions in adults: A systematic review of self-regulation mediators. *BMC Medicine, 13(84), 1-16.*	Included	Systematic review of 35 studies on behavior change in weight loss management.
Thomas, D., Vydelingum, V., & Lawrence, J. (2011). E-mail contact as an effective strategy in the maintenance of weight loss in adults. *Journal of Human Nutrition and Dietetics: The Official Journal of the British Dietetic Association, 24*(1), 32-38.	Excluded	Participants only followed for 6 months. Long term weight loss maintenance effect not assessed.
Tronieri, J. S., Wadden, T. A., Chao, A. M., & Tsai, A. G. (2019). Primary care interventions for obesity: Review of the evidence. *Current Obesity Reports, 8*(2), 128-136.	Included	This review describes the results of randomized controlled trials that have evaluated the efficacy of behavioral interventions for obesity in primary care settings.
Vesco, K. K., Karanja, N., King, J. C., Gillman, M. W., Perrin, N., McEvoy, C., Eckhardt, C., Smith, K. S., & Stevens, V. J. (2012). Healthy Moms, a randomized trial to promote and evaluate weight maintenance among obese	Excluded	RCT but focuses only on weight maintenance during pregnancy.

Reference	Included or Excluded and Document	Rationale
pregnant women: Study design and rationale. *Contemporary Clinical Trials*, *33*(4), 777–785.		
Voils, C. I., Olsen, M. K., Gierisch, J. M., McVay, M. A., Grubber, J. M., Gaillard, L., Bolton, J., Maciejewski, M. L., Strawbridge, E., & Yancy, W. S., Jr. (2017). Maintenance of weight loss after initiation of nutrition training: A randomized trial. *Annals of Internal Medicine*, *166*(4), 463-473.	Included	RCT. 56-month weight maintenance intervention and follow-up after initial loss.
Wadden, T. A., Tronieri, J. S., & Butryn, M. L. (2020). Lifestyle modification approaches for the treatment of obesity in adults. *American Psychologist, 75*(2), 235-251.	Excluded	This is written in an editorial style with references to literature interspersed throughout.
Wadden, T. A., Butryn, M. L., Hong, P. S., & Tsai, A. G. (2014). Behavioral treatment of obesity in patients encountered in primary care settings. *JAMA: Journal of the American Medical Association*, *312*(17), 1779–1791.	Excluded	This study was superseded by Tronieri et al. (2019) that contains updated evidence.

Table 4

Literature Review Table of All Studies Included

Citation	Study Purpose	Pop (N)/ Sample Size (n) /Setting(s)	Design/ Level of Evidence	Variables/ Instruments	Intervention	Findings	Implications
Bennett, W., Gudzune, K., Appel, L., & Clark, J. (2014). Insights from the POWER practice-based weight loss trial: A focus group study on the PCP's role in weight management. *Journal of General Internal Medicine, 29*(1), 50-58.	This trial provided a unique opportunity to understand PCPs' actual and desired roles in a multi-component weight loss intervention. 1) To explore the PCP role, inclusive of and beyond the trial's intended role, in a practice-based weight loss trial; and 2) to elicit recommendations by PCPs for wider dissemination of the successful multicomponent program.	n=26 PCP	Level VI Qualitative study using focus groups of PCPs	Five focus groups with a semi-structured moderator guided question list. Focus groups were audio-recorded and transcribed verbatim.	NA	The authors identified five major themes related to the PCP's role in patients' weight management: (1) refer patients into program, provide endorsement; (2) provide accountability for patients; (3) "cheerlead" for patients during visits; (4) have limited role in weight management; and (5) maintain the long-term trusting relationship through the ups and downs. PCPs provided several recommendations for wider dissemination of the program into primary care practices, highlighting the need for specific feedback from coaches as well as efficient, integrated processes.	Weight loss programs have the potential to partner with PCPs to build upon the patient–provider relationship to improve patient accountability and sustain behavior change. However, rather than directing the weight loss, PCPs preferred a peripheral role by utilizing health coaches.

Citation	Study Purpose	Pop (N)/ Sample Size (n) /Setting(s)	Design/ Level of Evidence	Variables/ Instruments	Intervention	Findings	Implications
Berk, K. A., Buijks, H. I. M., Verhoeven, A. J. M., Mulder, M. T., Özcan, B., van't Spijker, A., Timman, R., Busschbach, J. J., & Sijbrands, E. J. (2018). Group cognitive behavioural therapy and weight regain after diet in type 2 diabetes: Results from the randomised controlled POWER trial. *Diabetologia, 61*(4), 790-799.	Thea aim was to determine the 2-year effectiveness of a cognitive behavioral group therapy (group-CBT) program in weight maintenance after a diet-induced weight loss in overweight and obese adults with type 2 diabetes, using a randomized, parallel, non-blinded, pragmatic study design.	N=158 obese adults with DMII who had lost 5% of their weight previous to the study	Level II RCT, non-blinded	Data were analyzed using linear mixed modelling. The between-group differences after 2 years in: (1) body weight (2) weight regain. Secondary outcomes were HbA1c levels, insulin dose, plasma lipid levels, depression, anxiety, self-esteem, quality of life, fatigue, physical activity, eating disorders and related cognitions.	Participants were randomized (stratified by weight loss) to usual care or usual care plus group-CBT (17 group sessions).	During the initial 8-week dieting phase, the control group (n = 75) lost a mean of 10.0 kg and the intervention group (n = 83) lost 9.2 kg (p = 0.206 for the between-group difference). During 2 years of follow-up, mean weight regain was 4.7 kg for the control group and 4.0 kg for the intervention group, with a between-group difference of −0.7 kg (p = 0.6). The mean difference in body weight at 2 years was −1.2 kg (p = 0.7). None of the secondary outcomes differed between the two groups.	Despite increased treatment contacts, a group-CBT program for long-term weight maintenance. after an initial ≥5% weight loss from dieting in obese individuals with type 2 diabetes, was not superior to usual care alone.
Blane, D. N., Macdonald, S., & O'Donnell, C. A. (2020). What works and why in the identification and referral of adults with comorbid obesity in primary care: A realist review. *Obesity Reviews*, *21*(4), 1–18.	In this realist review, we searched six databases for intervention studies targeted at PCPs to improve the identification and referral of adults with comorbid obesity.	N=27 studies	Level I Realist Synthesis	Realist analysis was used to identify context-mechanism-outcome (CMO) configurations across 30 included papers (reporting on 27 studies).	Most studies used multiple intervention strategies, categorized into: (a) training, (b) tools to improve identification, (c) tools to improve ease of referral, (d) audit/feedback, (e) working in networks/quality circles, and (f) other.	This realist synthesis identified 12 mechanisms through which interventions work to improve identification and referral, including increasing knowledge about obesity and awareness of and confidence in weight management services (WMS) among practitioners, improved communication and trust between practitioners and WMS, and higher priority given to weight management among primary care teams.	Primary care practitioners are well placed to support adults with comorbid obesity, particularly by signposting or referring patients to WMS when appropriate. The findings from this review demonstrate the importance of good communication between WMS and primary care referrers to improve identification and referral processes. Successful interventions were usually multicomponent, including training

Citation	Study Purpose	Pop (N)/ Sample Size (n) /Setting(s)	Design/ Level of Evidence	Variables/ Instruments	Intervention	Findings	Implications
							of practitioners, audit/feedback on referrals, quality circles, and tools to aid both identification and referral. Higher priority should be given to weight management by primary care teams.
Bray, G. A., Heisel, W. E., Afshin, A., Jensen, M. D., Dietz, W. H., Long, M., Kushner, R. F., Daniels, S. R., Wadden, T. A., Tsai, A. G., Hu, F. B., Jakicic, J. M., Ryan, D. H., Wolfe, B. M., & Inge, T. H. (2018). The science of obesity management: An endocrine society scientific statement. *Endocrine Reviews*, *39*(2), 79–132.	This ROL provides an overview of the current science of obesity management inclusive of dietary, exercise, behavioral, pharmaceutical and surgical modalities. Best practice recommendations are made throughout the text.	N/A	Level I Review of Literature	N/A	N/A	Weight loss is best achieved by reducing energy intake and increasing energy expenditure. Programs that are effective for weight loss include peer-reviewed and approved lifestyle modification programs, diets, commercial weight-loss programs, exercise programs, medications, and surgery. Weight loss maintenance is best maintained through self-monitoring of weight, recording food intake, limiting calories to 1,200 – 1,200/day and exercise.	A 5-10% weight loss is clinically significant in prevention. Primary care providers stigma prevents best care for patients. Behavior-based counseling is best provided through a specialty referral and is dose based. The more contacts, the more effective the therapy. Weight regain is to be expected and patients should be counseled as such.
Brunacini, K. (2019). Implementation of a virtual patient-centered weight loss maintenance behavior competency assessment in adults with obesity. *Journal of the American Association of Nurse Practitioners, 31*(12), 752–759.	Thus, the aim of this quality improvement (QI) study was to increase patient self-efficacy by 30%, by incorporating the team's perceived competence, and implementation of a WLM behavior competency assessment among adults with obesity over a 90-day period.	N/A Study conducted in 4 two-week long segments using data collected during that time.	Level VI Quality Improvement Project	Quantitative data were gathered through two separate online 5-point Likert surveys designed to evaluate team and patient WLM behavior competence. Data were analyzed using run charts to evaluate the impact of interventions on outcomes.	The clinical team submitted a weekly WLM competency survey. A patient intake form was completed to identify behavior risks, followed by implementation of a WLM assessment in weekly follow-ups. A team adherence audit was completed and submitted every week.	Team WLM competency levels increased 32%, averaging 82% at study conclusion. Completion of the patient intake form reached and held at 100% for the entire duration. Team usage of the WLM assessment peaked at 97%, correlating to increased patient behavior competence by 27.5% as the patient advanced. Team adherence gradually increased, peaking at 100%. Conclusions: Patient screening forms and audit logs created a standardized process to collect, deliver, and better coordinate care.	This country does not have a weight loss problem but rather a weight maintenance problem. The findings suggest that patients who embodied higher behavioral competence will have a greater likelihood of sustaining their weight loss results and become the successful 2%–5% of weight maintainers.

Citation	Study Purpose	Pop (N)/ Sample Size (n) /Setting(s)	Design/ Level of Evidence	Variables/ Instruments	Intervention	Findings	Implications
Conroy, M. B., McTigue, K. M., Bryce, C. L., Tudorascu, D., Gibbs, B. B., Arnold, J., Comer, D., Hess, R., Huber, K., Simkin-Silverman, L. R., & Fischer, G. S. (2019). Effect of electronic health record-based coaching on weight maintenance: A randomized trial. *Annals of Internal Medicine*, *171*(11), 777–784.	To evaluate the benefit of coaching in an electronic health record (EHR)-based weight maintenance intervention.	n=194	Level II	Weight change at 24 months, 5% weight loss maintenance.	Participants were randomly assigned to EHR tools (tracking group) versus EHR tools plus 24 months of coaching. (coaching group).	At 24 months, 65% of participants in the coaching group and 50% in the tracking group-maintained weight loss of at least 5%.	Among adults with intentional weight loss of at least 5%, use of EHR tools plus coaching resulted in less weight regain than EHR tools alone.
Crain, A. L., Sherwood, N. E., Martinson, B. C., & Jeffery, R. W. (2018). Mediators of weight loss maintenance in the keep it off trial. *Annals of Behavioral Medicine: A Publication of the Society of Behavioral Medicine, 52*(1), 9-18.	This study aimed to assess the viability of mediated relationships between the Keep It Off guided intervention, conceptually and empirically grounded potential mediators, and weight.	n=419 209 guided 210 self-directed	Level II RCT blinded	6,12,18 & 24-month weight measurements	The Guided study arm included 10 biweekly phone coaching sessions followed by eight monthly and six bimonthly calls and bimonthly weight graphs and letters beginning at month eight. The Self-Directed study arm included two phone coaching sessions that took place in the first month after randomization.	Guided intervention participants regained about 2% less weight over 24 months than Self-Directed participants. Starting daily self-weighing accounted for the largest share of this difference, followed by not stopping self-weighing.	Daily self-weighing precipitated 24-month weight loss maintenance above any other factor.
Curry, S. J., Krist, A. H., Owens, D. K., Barry, M. J., Caughey, A. B., Davidson, K. W., Doubeni, C. A., Epling, J. W., Grossman, D. C., Kemper, A. R., Kubik, M., Landefeld, C. S., Mangione, C. M., Phipps, M. G., Silverstein, M., Simon, M. A., Tseng, C., & Wong, J. B. (2018). Behavioral weight loss interventions to prevent obesity-related morbidity and mortality in adults: US preventive services task force recommendation statement. *JAMA, 320*(11), 1163-1171.	This evidence review was undertaken to update the US Preventive Services Task Force (USPSTF) 2012 recommendation on screening for obesity in adults. The USPSTF reviewed the evidence on interventions (behavioral and pharmacotherapy) for weight loss or weight loss maintenance that can be provided in or referred from a primary care setting.	N/A	Level I ROL	N/A	N/A	Intensive, multicomponent behavioral interventions in adults with obesity can lead to clinically significant improvements in weight status and reduce the incidence of type 2 diabetes among adults with obesity and elevated plasma glucose levels; these interventions are of moderate benefit. The USPSTF found adequate evidence that behavior-based weight loss maintenance interventions are of moderate benefit.	The USPSTF concludes with moderate certainty that offering or referring adults with obesity to intensive, multicomponent behavioral interventions has a moderate net benefit. Recommendation level B.

Citation	Study Purpose	Pop (N)/ Sample Size (n) /Setting(s)	Design/ Level of Evidence	Variables/ Instruments	Intervention	Findings	Implications
Dalle Grave, R., Calugi, S., Bosco, G., Valerio, L., Valenti, C., El Ghoch, M., & Zini, D. (2020). Personalized group cognitive behavioural therapy for obesity: A longitudinal study in a real-world clinical setting. *Eating and Weight Disorders: EWD, 25*(2), 337-346.	The aim of the study was to establish the immediate and longer-term outcomes following a "personalized" form of group cognitive behavioral therapy for obesity (CBT-OB).	n=77 obese patients	Level IV Longitudinal cohort study	Weight loss at 6 & 18 months	22 group sessions of CBT-OB (14 in the 6-month weight-loss phase & 8 in the subsequent 12-months.	Average weight loss of 11.5% after 6 months (10% in the intention-to-treat analysis) and 9.9% (7.5% in the intention-to-treat analysis) after 18 months.	These findings provide strong preliminary support for the use of CBT-OB for obesity in standard clinical settings, and justify its further evaluation in randomized controlled trials.
Eakin, E. G., Winkler, E. A., Dunstan, D. W., Healy, G. N., Owen, N., Marshall, A. M., Graves, N., & Reeves, M. M. (2014). Living well with diabetes: 24-month outcomes from a randomized trial of telephone-delivered weight loss and physical activity intervention to improve glycemic control. *Diabetes Care*, *37*(8), 2177–2185.	To evaluate the effectiveness of a telephone-delivered behavioral weight loss and physical activity intervention targeting Australian primary care patients with type 2 diabetes.	n=302	Level II RCT	Weight, waist circumference, amount of moderate/vigorous activity and HbA1c at 18 months (end of intervention) and 24 months (maintenance phase).	Telephone delivered weight loss counseling with 27 calls - (4 initial weekly calls; then every other week calls for 5 months; then monthly calls for 12 months).	Relative to usual-care participants, telephone counseling participants achieved modest, but significant, improvements in weight loss MVPA and waist circumference but not in HbA1c level.	The modest improvements in weight loss and behavior change, but the lack of changes in cardio-metabolic markers, may limit the utility, scalability, and sustainability of such an approach.
Garvey, W. T., Mechanick, J. I., Brett, E. M., Garber, A. J., Hurley, D. L., Jastreboff, A. M., Nadolsky, K., Pessah-Pollack, R., Plodkowski, R., & Reviewers of the AACE/ACE Obesity Clinical, Practice Guidelines. (2016). American Association of Clinical Endocrinologists and Endocrinology comprehensive clinical practice guidelines for medical care of patients with obesity. *Endocrine Practice: Official Journal of the American College of Endocrinology and the American Association of Clinical Endocrinologists, 22* Suppl 3, 1-203.	Guideline development was mandated by the AACE Board of Directors and the ACE Board of Trustees and adheres to published AACE protocols for the standardized production of clinical practice guidelines. The goal is to facilitate high-quality care of patients with obesity and provide a rational, scientific approach to management that optimizes health outcomes and safety.	N=1,790 citations	Level I Evidence based guidelines	N/A	N/A	There are 9 broad clinical questions with 123 recommendation numbers that include 160 specific statements (85 strong Grade A; 48 intermediate Grade B, and 11 6.9% weak Grade C, with 16 10.0% based on expert opinion Grade D) that build a comprehensive medical care plan for obesity.	The final recommendations recognize that obesity is a complex, adiposity-based chronic disease, where management targets both weight-related complications and adiposity to improve overall health and quality of life. The detailed evidence-based recommendations allow for nuanced clinical decision-making that addresses real-world medical care of patients with obesity, including screening, diagnosis, evaluation, selection of therapy, treatment goals, and individualization of care.
Gibbs, B. B., Tudorascu, D., Bryce, C. L., Comer, D., Fischer, G. S., Hess, R., Huber,	To identify dietary and physical activity habits associated with 6- and 24-month weight regain among	n=194	Level III	The outcome variable	Connor Diet Habit Survey; moderate-vigorous physical	Overall, participants	Consuming less fish, fewer steps per day, and more frequent restaurant eating

Citation	Study Purpose	Pop (N)/ Sample Size (n) /Setting(s)	Design/ Level of Evidence	Variables/ Instruments	Intervention	Findings	Implications
K. A., McTigue, K. M., Simkin-Silverman, L. R., & Conroy, M. B. (2020). Lifestyle habits associated with weight regain after intentional loss in primary care patients participating in a randomized trial. *Journal of General Internal Medicine, 35*(11), 3227-3233.	participants in a weight loss maintenance clinical trial.		Secondary analysis of RCT data	was weight change at 6 and 24 months.	activity by self-report; steps recorded by a pedometer; and sedentary behavior by self-report.	maintained weight loss at 6 months but began to regain weight by 24 months.	were most consistently associated with weight regain in primary care patients. Primary care providers may consider addressing specific lifestyle behaviors when counseling patients after successful weight loss. Secondary analysis of Conroy et al., 2019 data.
Gilis-Januszewska, A., Barengo, N. C., Lindström, J., Wójtowicz, E., Acosta, T., Tuomilehto, J., Schwarz, P. E. H., Piwońska-Solska, B., Szybiński, Z., Windak, A., & Hubalewska-Dydejczyk, A. (2018). Predictors of long term weight loss maintenance in patients at high risk of type 2 diabetes participating in a lifestyle intervention program in primary health care: The DE-PLAN study. *PloS One, 13*(3), 1-13.	Identify factors predicting long-term successful weight reduction maintenance achieved during a DM2 prevention program in patients with high DM2 risk in primary health care.	n=263	Level III Quasi-experimental	Weight at baseline, 12 months, and 36 months.	11 lifestyle counselling sessions, guided physical activity sessions and motivational support during 10 months.	73 patients (70%) showed weight loss during the intervention (mean weight loss 4.2 kg, SD = 5.1). The total weight loss achieved in the maintainers (27 of 73 study participants) two years after the intervention had finished was 6.54 kg (4.47 kg+2.0 kg). The non-maintainers, on the other hand, returned to their initial weight at the start of the intervention.	This study draws correlations between certain behaviors and weight maintenance such as increased physical activity as a long-term habit and continuing a diet low in fat. Further studies exploring predictors of weight loss maintenance in diabetes prevention is needed to help health care providers to redesign interventions and improve long-term outcomes of real-life interventions.
Hall, K. D., & Kahan, S. (2018). Maintenance of lost weight and long-term management of obesity. *The Medical Clinics of North America*, *102*(1), 183–197.	Synthesis of the current understanding of the biological, behavioral, and environmental factors driving this near-ubiquitous body weight trajectory and the implications for long-term weight management. Treatment of obesity requires ongoing clinical attention and weight maintenance-specific counseling to support sustainable healthful behaviors and positive weight regulation.	N/A	Level I Meta-analysis	N/A	N/A	Long-term maintenance of lost weight is the primary challenge of obesity treatment. Biological, behavioral, and environmental factors conspire to resist weight loss and promote regain. Treatment of obesity requires ongoing attention and support, and weight maintenance–specific counseling, to improve long-term weight management. The magnitude of long-term weight loss typically achieved is usually lower than patient and health care provider expectations. However, even small amounts of sustained	Primacy care providers and patients both need to manage their expectations for how much weight can be realistically lost. PCP need to unlearn the dogma that obesity is a lifestyle choice or compliance failure on the part of the patient. Ongoing weight loss maintenance requires long term attention from the PCP.

Citation	Study Purpose	Pop (N)/ Sample Size (n) /Setting(s)	Design/ Level of Evidence	Variables/ Instruments	Intervention	Findings	Implications
						weight loss lead to clinical health improvements and risk factor reductions.	
Heymsfield, S. B., & Wadden, T. A. (2017). Mechanisms, pathophysiology, and management of obesity. *The New England Journal of Medicine, 376*(3), 254-266.	Management of overweight (BMI ≥ 25) or obesity in the clinical setting, alone or in combination with a chronic disease, is the focus of this review.	N/A	Level I Literature review	N/A	N/A	Practitioners alone, when caring for obese patients, cannot manage all the pathways leading to the genesis of excess adiposity but can proceed with the knowledge that the management interventions described here are likely to benefit the patients who receive them.	PCPs need to refer qualifying patients to specialized care including counseling, dietary, & behavioral therapy. Activity recommendation is 200-300 min/week in weight loss maintenance phase.
JaKa, M. M., Sherwood, N. E., Flatt, S. W., Pacanowski, C. R., Pakiz, B., Thomson, C. A., & Rock, C. L. (2015). Mediation of weight loss and weight loss maintenance through dietary disinhibition and restraint. *Journal of Obesity & Weight Loss Therapy, 5*(2), 1-6.	Prospective analysis of a weight loss program to determine if dietary disinhibition and restrain contribute to successful weight loss 6 months, 12, & 24 months out.	n=442	Level II RCT	Height and weight at baseline, 6, 12, and 24 mo. 51-item Eating Inventory questionnaire	The intervention arms consisted of a multifaceted weight loss program that included in-person or telephone one-to-one counseling conducted by health coaches in primary care, and free-of-charge prepackaged meals during the initial weight loss phase and website and other resources throughout the 2 years. Usual care group had a 1 hour of lifestyle coaching information delivered at the beginning and another at 6 months with monthly email or phone check-ins.	Only decreases in disinhibition between baseline and 6 months mediated the intervention effect on initial weight loss. Decreasing disinhibition (negative behavior) vs increasing restraint (positive behavior) had more impact on weight loss.	PCP should include teaching strategies to reduce disinhibiting factors (that lead to emotional decisions) vs solely teaching about healthy diet and exercise. Results suggest the mediation effects of these eating behaviors are modest and other factors contribute to a larger, more complex long-term weight loss prognosis.
Katzmarzyk, P. T., Martin, C. K., Newton, R. L., Apolzan, J. W., Arnold, C. L., Davis, T. C., Price-Haywood, E., Denstel, K. D., Mire, E. F., Thethi, T. K., Brantley, P. J., Johnson, W. D., Fonseca, V., Gugel, J., Kennedy, K. B., Lavie, C. J., Sarpong, D. F., & Springgate, B. (2020). Weight loss in underserved patients – A cluster-randomized	To assess the effectiveness of treatment for obesity delivered in primary care settings in underserved populations.	n=803 obese adults of whom 67.2% of the were Black, and 65.5% had an annual household	Level II RCT	Outcomes were assessed at baseline and at the visits at 6, 12, 18, and 24 months. The primary outcome was the percent change in weight from baseline at 24 months.	Primary care health coaches conducted health literacy appropriate weekly sessions (16 in person and 6 conducted by telephone) in the first 6 months, followed by sessions (alternating in-person visits and telephone calls) held at	The percent weight loss at 24 months was significantly greater in the intensive-lifestyle group (change in body weight, −4.99%) than in the usual-care group	A high-intensity, lifestyle-based treatment program for obesity delivered in an underserved primary care population resulted in clinically significant weight loss at 24 months.

Citation	Study Purpose	Pop (N)/ Sample Size (n) /Setting(s)	Design/ Level of Evidence	Variables/ Instruments	Intervention	Findings	Implications
trial. *The New England Journal of Medicine, 383*(10), 909-918.		income of less than $40,000. 83.4% completed all 24 months.			least monthly for the remaining 18 months.		
Lenoir, L., Maillot, M., Guilbot, A., & Ritz, P. (2015). Primary care weight loss maintenance with behavioral nutrition: An observational study. *Obesity*, *23*(9), 1771–1777.	To evaluate the rate of weight loss maintenance, defined as a 10% loss of initial weight maintained beyond 1 year, among patients with BMI>25 kg/m2 who had been managed by primary care physicians practicing behavioral nutrition (moderately high-protein diet, carbohydrate restriction, and behavioral therapy).	n=14,256	Level IV Observational cohort study	Patient file data from 478 PCP over 12 years. Weight and body composition as measured by an impedance scale minimally at baseline and for at least 12 months afterwards.	PCPs used a behavioral nutrition intervention consisting of behavioral management, dietary counseling, and weight loss follow up visits.	26.7% of subjects met the success criterion, 25.7% did not maintain their weight loss, and 47.6% did not lose 10% of their initial weight. At inclusion, patients in the successful maintenance group had a greater BMI and fat %. These patients lost more weight and fat mass than patients in the unsuccessful maintenance group. Follow-up of patients in the SM group was characterized by a greater frequency of consultations.	The determinants of success are frequency of consultations, initial BMI, and initial weight loss. Management by primary care providers with behavioral nutrition facilitates weight loss maintenance in patients with overweight and obesity.
Madjd, A., Taylor, M. A., Delavari, A., Malekzadeh, R., Macdonald, I. A., & Farshchi, H. R. (2020). Effects of cognitive behavioral therapy on weight maintenance after successful weight loss in women; a randomized clinical trial. *European Journal of Clinical Nutrition*, *74*(3), 436–444.	The aim of this study was to evaluate the effects of CBT on weight maintenance after successful weight loss.	n=113	Level II RCT	Weight and waist circumference after 24 weeks.	24-week CBT therapy for weight maintenance.	CBT treatment improved weight loss maintenance and waist circumference at the end of the 24-week period intervention. Estimated energy intake showed a significant reduction over time in CBT group, while it increased in control group ($P < 0.001$).	Cognitive behavioral therapy is an effective tool for weight maintenance over a 24-week period in successful weight losers, with corresponding maintenance of a reduced energy intake and doing more physical activity which may be helpful for weight maintenance in the long term.
Montesi, L., El Ghoch, M., Brodosi, L., Calugi, S., Marchesini, G., & Dalle Grave, R. (2016). Long-term weight loss maintenance for obesity: A multidisciplinary approach. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy, 9*, 37-46.	Aims: 1) To provide a definition of weight maintenance; 2) To review the data on long-term weight loss maintenance; 3) to describe the characteristics of individuals who successfully achieve long-term weight loss; 4) to review the evidence-based strategies to promote weight loss maintenance; 5) to describe a multidisciplinary approach, based on lifestyle modification aimed at providing	N/A	Level I ROL	N/A	N/A	Weight loss maintenance study success factors: behavioral (eg, high levels of physical activity, eating a low-calorie, low-fat diet; frequent self-monitoring of weight), cognitive (eg, reduced disinhibition, satisfaction with results achieved, confidence in being able to lose weight without professional help), personality traits (eg, low novelty seeking) and patient–therapist interaction.	A provider's primary roles in long term weight loss maintenance are in engaging patients, in team coordination and supervision, in managing the complications associated with obesity and, in selected cases, in the decision for drug treatment or bariatric surgery, as possible more intensive, add-on

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	patients with a comprehensive long-term management of obesity.					Lifestyle modification trials have shown promising results in maintenance	interventions to lifestyle treatment.
Perri, M. G., Limacher, M. C., von Castel-Roberts, K., Daniels, M. J., Durning, P. E., Janicke, D. M., Bobroff, L. B., Radcliff, T. A., Milsom, V. A., Kim, C., & Martin, A. D. (2014). Comparative effectiveness of three doses of weight-loss counseling: Two-year findings from the rural LITE trial. *Obesity, 22*(11), 2293–2300.	The purpose of this study was to determine the most effective "dose" of behavioral weight-loss counseling while evaluating the costs of delivering each dose in a rural setting.	N=612 obese adults	Level II RCT	Body weight percentage change in kg at 0, 6, and 24 months.	Low (16 session), moderate (32 session) or high (48 session) doses of behavioral treatment compared to the control group which received only nutrition education without behavior modification education sessions.	Two-year mean body weight reductions: Control group: 2.9% Low dose group: 3.5% Moderate dose group: 6.7% High dose group: 6.8%	Neither the control or low dose group achieved the goal of >5% weight reduction at two years. The moderate dose group's results were comparable to the high dose group at less time and cost.
Plourde, G., & Prud'homme, D. (2012). Managing obesity in adults in primary care: CMAJ. *Canadian Medical Association Journal, 184*(9), 1039-1044.	Physicians have identified many barriers to managing obesity, including a lack of time, resources and knowledge. This review aims to find simple, effective strategies for improving weight loss counselling in clinical practice.	N= 88 studies of primary care and weight loss/maint	Level 1 ROL	N/A	N/A	Greater physical activity is the strongest correlate of long-term weight loss, followed by treatment attendance and consumption of meal replacements. Intensive behavioral modification has also been shown to promote long-term maintenance of weight loss. Weight-loss maintenance comparable with that after bariatric surgery can be accomplished through nonsurgical methods with intensive behavioral modification.	Educate PCPs to use evidence based weightless promotion interventions. Strategies to improve obesity care include identification of at-risk patients using BMI and measuring waist circumference and actually diagnosing obesity. Reinforce messaging around diet and exercise behaviors and send referrals for diet and lifestyle interventions.
Stelmach-Mardas, M., Mardas, M., Warchoł, W., Jamka, M., & Walkowiak, J. (2014). Successful maintenance of body weight reduction after individualized dietary counseling in obese subjects. *Scientific Reports, 4*, 6620, 1-7.	To describe the effectiveness of individualized dietary counseling in obese subjects based on narrative interview technique on the maintenance of body weight reduction, changes in dietary behaviors, including type of cooking and physical activity.	n=100	Level III Quasi-experimental	Body weight at weeks 0,6,12, & 52. Food Frequency Questionnaire	45-minute educational program with motivational counseling was performed in 0, 6 and 12 weeks of the study with patients being advised to follow a well-balanced diet.	The mean percentage of body weight changes from the baseline were as follows: in 6th week- 5.9%, in 12th week - 10.9% and in 52th week - 9.7% however, there were no statistically significant changes while comparing body weight in 12th and 52nd week.	Individualized dietary counseling, based on narrative interview technique, is an effective intervention for obesity treatment that may help maintain body weight reduction and adapt the pro-healthy changes in type of cooking and sources of dietary fat.
Teixeira, P. J., Carraça, E. V., Marques, M. M., Rutter, H.,	Review of the most consistent self-regulation mediators of medium- and	N=35 studies	Level I	N/A	N/A	Identified mediators for	Higher autonomous motivation, self-efficacy,

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Oppert, J., De Bourdeaudhuij, I., Lakerveld, J., & Brug, J. (2015). Successful behavior change in obesity interventions in adults: A systematic review of self-regulation mediators. *BMC Medicine, 13*(84), 1-16.	long-term weight control, physical activity, and dietary intake in clinical and community behavior change interventions targeting overweight/obese adults.		Systematic Review			medium-/long-term weight control were higher levels of autonomous motivation, self-efficacy/barriers, self-regulation skills (such as self-monitoring), flexible eating restraint, and positive body image.	and self-regulation skills emerged as the best predictors of beneficial weight and physical activity outcomes; for weight control, positive body image and flexible eating restraint may additionally improve outcomes. These variables represent possible targets for future lifestyle interventions in overweight/obese populations
Tronieri, J. S., Wadden, T. A., Chao, A. M., & Tsai, A. G. (2019). Primary care interventions for obesity: Review of the evidence. *Current Obesity Reports, 8*(2), 128-136.	This review describes the results of randomized controlled trials that have evaluated the efficacy of behavioral interventions for obesity in primary care settings.	N/A	Level I ROL	N/A	N/A	Obesity is increasingly being officially classified as a chronic disease. Increasing consensus from national and professional guidelines promote the potential benefit of intensive behavioral interventions. Behavior interventions delivered in-person or by phone in primary care can produce clinically meaningful weight loss.	PCPs should play the cheerleader role and focus on success and health benefits of modest weight loss/maint. Intensive behavior treatment can be difficult to implement in primary care due to the time and resources required. PCPs should discuss weight control with their patients and refer interested individuals to appropriate interventions available in their health care institution or in the greater community.
Voils, C. I., Olsen, M. K., Gierisch, J. M., McVay, M. A., Grubber, J. M., Gaillard, L., Bolton, J., Maciejewski, M. L., Strawbridge, E., & Yancy, W. S., Jr. (2017). Maintenance of weight loss after initiation of nutrition training: A randomized trial. *Annals of Internal Medicine*, *166*(4), 463-473.	To establish the efficacy of a weight loss maintenance program compared with usual care in obese adults.	n=222 obese patients who had already lost at least 4kg in a structured 16-week program.	Level II RCT Double blinded	Primary outcome was mean weight regain at week 56.	Telephone counseling and group sessions for 42 weeks which addressed satisfaction with outcomes, relapse prevention planning, self-monitoring, and social support.	Estimated mean weight regain was statistically significantly lower in the intervention (0.75 kg) than the usual care (2.36 kg) group.	A behavioral-based maintenance specific counseling intervention delivered in a resource-conserving way modestly slowed the rate of weight regain in obese adults. However, the benefits may not outweigh the costs of such a program. Dropout rates would likely be high.