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Review

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State of the Evidence Regarding Behavior Change Theories and Strategies in Nutrition Counseling to Facilitate Health and Food Behavior Change

JOANNE M. SPAHN, MS, RD, FADA; REBECCA S. REEVES, DrPH, RD, FADA; KATHRYN S. KEIM, PhD, RD, LDN; IDA LAQUATRA, PhD, RD, LDN; MOLLY KELLOGG, RD, LCSW; BONNIE JORTBERG, MS, RD, CDE; NICOLE A. CLARK, DCN, RD, LDN, CDE

ABSTRACT

Behavior change theories and models, validated within the field of dietetics, offer systematic explanations for nutrition-related behavior change. They are integral to the nutrition care process, guiding nutrition assessment, intervention, and outcome evaluation. The American Dietetic Association Evidence Analysis Library Nutrition Counseling Workgroup conducted a systematic review of peer-reviewed literature related to behavior change theories and strategies used in nutrition counseling. Two hundred fourteen articles were reviewed between July 2007 and March 2008, and 87 studies met the inclusion criteria. The workgroup systematically evaluated these articles and formulated conclusion statements and grades based upon the available evidence. Strong evidence exists to support the use of a combination of behavioral theory and cognitive behavioral theory, the foundation for cognitive behavioral therapy (CBT), in facilitating modification of targeted dietary habits, weight, and cardiovascular and diabetes risk factors. Evidence is particularly strong in patients with type 2 diabetes receiving intensive, intermediate-duration (6 to 12 months) CBT, and long-term (>12 months duration) CBT targeting prevention or delay in onset of type 2 diabetes and hypertension. Few studies have assessed the application of the transtheoretical model on nutrition-related behavior change. Little research was available documenting the effectiveness of nutrition counseling utilizing social cognitive theory. Motivational interviewing was shown to be a highly effective counseling strategy, particularly when combined with CBT. Strong evidence substantiates the effectiveness of self-monitoring and meal replacements and/or structured meal plans. Compelling evidence exists to demonstrate that financial reward strategies are not effective. Goal setting, problem solving, and social support are effective strategies, but additional research is needed in more diverse populations. Routine documentation and evaluation of the effectiveness of behavior change theories and models applied to nutrition care interventions are recommended.

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J. M. Spahn is director, Nutrition Evidence Library, Center for Nutrition Policy and Promotion, Alexandria, VA. R. S. Reeves is an assistant professor of medicine, Baylor College of Medicine, Houston, TX. K. S. Keim is an associate professor, clinical nutrition, Rush University, Chicago, IL. I. Laquatra is director of global nutrition, H.J. Heinz Company, Pittsburgh, PA. M. Kellogg is a consultant in private practice, Philadelphia, PA. B. Jortberg is a senior instructor, Department of Family Medicine, University of Colorado Denver School of Medicine, Aurora, CO. N. A. Clark is an instructor, Department of Food and Nutrition, University of Indiana of Pennsylvania, Indiana, PA.

Address correspondence to: Joanne M. Spahn, MS, RD, FADA, Nutrition Evidence Library, Center for Nutrition Policy and Promotion, 3101 Park Center Dr, Alexandria, VA 22302. E-mail: joanne.spahn@cnpp.usda.gov

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Evidence-based medicine is the dominant trend in health care, and dietitians are on the leading edge, demonstrating how nutrition interventions are measurably effective. Use of theoretical foundations for interventions is key for understanding and measuring effectiveness. Hypotheses and randomized controlled trials (RCTs) can be designed around the theories that drive

Theory or model	Key developers	Underlying philosophy	Nutrition counseling strategies
Cognitive Behavioral Theory[a]	Albert Skinner, Aaron Beck, Albert Ellis	Utilizes a directive, action-oriented approach that teaches a person to explore, identify, and analyze dysfunctional patterns of thinking and acting. How we act (behavior), think (cognition), and how we feel (emotion) all interact. Both cognitive and behavior change strategies are used to effect change (2-5).	• Self-monitoring (eg, thoughts, emotions, food intake, behavior) • Problem solving • Goal setting • Rewards and contingency management • Cognitive restructuring • Social support • Stress management • Stimulus control • Relapse prevention
Transtheoretical model	James O. Prochaska	Describes a sequence of cognitive (attitudes and intentions) and behavioral steps people take to change behavior. The model offers specific strategies found effective at various points in the change process and suggests outcome measures including decision balance and self-efficacy (6).	Appropriate application of strategies is dependent upon the client's stage of change • Motivational interviewing • Skill development training and coaching • Demonstration and modeling • Reinforcement • Self-monitoring • Goal setting and behavioral contracting • Social support • Stimulus control
Social cognitive theory (also called social learning theory)	Albert Bandura (7)	Based on the idea that people learn by observing other's social interactions, experiences, and outside media influences. Provides structure for understanding, predicting, and changing behavior. Changes are based on four conditions: attention, retention, motor reproduction, and motivation (7).	• Demonstration and modeling • Skill development and coaching • Social support • Reinforcement • Goal setting • Stimulus control • Motivational interviewing

Figure 1. Summary of behavior change theories evaluated by the American Dietetic Association Evidence Analysis Library Nutrition Counseling Workgroup and associated nutrition counseling strategies. [a]A combination of behavioral theory and cognitive behavioral theory, which are the foundation for behavioral therapy or cognitive behavioral therapy interventions.

selection of specific counseling methods or strategies based on a client's targeted changes.

Nutrition counseling is a supportive process to set priorities, establish goals, and create individualized action plans that acknowledges and fosters responsibility for self-care (1). Registered dietitians (RDs) and dietetics practitioners frequently conduct nutrition counseling with clients to facilitate behavior change. To be effective, dietetics practitioners must be knowledgeable in nutrition and food science, diverse ethnic and regional culinary cuisines, and have practical experience with theory-based behavior change strategies. Theories and models, validated within the field of dietetics, are frameworks for helping practitioners understand external and internal issues, and the dynamics that lead to behavioral changes. Use of these frameworks provides a rationale for selection of specific counseling strategies to achieve a counseling objective (Figure 1).

Behavioral theory and cognitive behavioral theory are based on the assumption that all behavior is learned and that environmental and internal factors are related to one's behavior (2-5). The theories endorse strategies such as self-monitoring and problem solving, which make people more aware of internal and external cues and their response. Clients may be taught a variety of strategies to promote behavior change, including self-monitoring, problem solving, goal setting, contingency management, cognitive restructuring, social support, stimulus control, stress management, and relapse prevention. The transtheoretical model describes behavior change as a series of stages and provides a rationale for matching counseling strategies to different stages of change (6). Social cognitive theory introduces a construct called self-efficacy (confidence in one's ability to do a specific task), which influences the effort a client is willing to expend to achieve a goal (7). Peer modeling, skill development training, and goal setting are some strategies endorsed by social cognitive theory to be effective in enhancing self-efficacy and a client's persistence in behavior change efforts.

Use of behavior change theories and models when designing and implementing nutrition counseling programs and protocols enables dietetics practitioners to leverage proven strategies to enhance counseling effectiveness. Behavior change theories provide the framework or rationale for individualizing nutrition counseling interventions to meet the needs of clients who may demonstrate

varying degrees of motivation, confidence, environmental support, and skills. Regular documentation of the theoretical framework and strategies used in nutrition counseling as part of the Nutrition Care Process will prompt dietetics practitioners to deliberately apply specific counseling strategies to address documented nutrition problems linked to specific desired outcomes. Broad adoption of electronic medical records or systems will enable practitioners to evaluate the success of various counseling strategies in achieving intermediate treatment goals (eg, increase self-efficacy or move a client from the precontemplation to the action stage of change) and ultimate treatment goals (eg, weight loss of 5% body weight sustained for 1 year) across the populations they serve.

METHODS

The American Dietetic Association Evidence Analysis Library Nutrition Counseling Workgroup was formed to conduct a systematic review of literature related to behavior change theories and strategies used in nutrition counseling. The workgroup, appointed by the American Dietetic Association Evidence-Based Practice Committee, consisted of seven highly accomplished experts in the area of counseling who are researchers, practitioners, or work in industry. These experts posed a series of questions related to the most commonly used behavior change theories, models, and strategies used in nutrition counseling in the outpatient setting, since these are the foundation of evidence-based counseling. Nutrition counseling strategies included in the *International Dietetics & Nutrition Terminology (IDNT) Reference Manual: Standardized Language for the Nutrition Care Process* (8) were evaluated. Numerous cognitive behavioral therapy (CBT) studies reviewed incorporated either meal replacements and/or structured meal plans as an intervention strategy, so a question was added to address this strategy.

A comprehensive literature search was conducted using PubMed MEDLINE, bibliographies of recent review articles, and hand searches of primary article references. The literature search was limited to adult human subjects who received nutrition counseling (provider type such as RD, nurse, or physician not specified) in an outpatient or clinic setting and English language articles published between 1986 and 2007. Articles were excluded if the sample size was <10 in each treatment group, individuals were diagnosed with eating disorders, or the dropout rate was >30%. Drop-out rate criteria was not used if drop-out rate was a dependent variable in the study or there was so little available research that there was no alternative but to examine studies with higher dropout rates. Use of weight-loss medications was excluded except when incorporated into a theoretically based counseling intervention protocol.

Two hundred fourteen articles were reviewed by the workgroup, and 87 met the inclusion criteria. The workgroup members evaluated the evidence and graded the strength of the evidence based on the quality, consistency, quantity, impact, and generalizability. The following grades were applied: Grades I, II, and III, for strong, fair, and weak evidence, respectively; Grade IV designated expert opinion; and Grade V indicated no evidence that directly supports or refutes the question (9).

RESULTS

This section includes the findings from the 86 primary studies and one systematic review related to one or a combination of three behavior change theories and 10 nutrition counseling strategies.

Behavior Change Theories

Questions related to a combination of behavioral theory and cognitive behavioral theory, social cognitive theory and transtheoretical model, and length of treatment were addressed in this comprehensive review and all can be found in Figure 2, along with the grade assigned the research evidence and the conclusion statement.

Cognitive Behavioral Theory and Therapy. Behavioral theory and cognitive behavioral theory are the oldest and most tested behavior-change theories used in nutrition counseling (2-5). These two theories provide the theoretical basis of most structured diet, exercise, and behavioral therapy programs, commonly referred to as CBT, behavioral therapy, behavior modification, or lifestyle modification. The National Heart, Lung, and Blood Institute and the American Diabetes Association both recommend behavioral therapy for overweight clients (10,11). CBT assumes that behavior is learned and can be unlearned by using a variety of cognitive and behavioral strategies that are taught to clients for use throughout their lifetimes (2-5). CBT focuses on both the external factors (eg, environmental stimulus and reinforcement) and the internal factors (eg, thoughts and thinking). RDs typically apply strategies targeting both internal and external factors in an effort to disrupt undesirable eating patterns and behaviors.

More than 27 studies (23 RCTs) provide evidence that CBT is beneficial in facilitating modification of targeted dietary habits (eg, decreased energy from fat, increased intake of fruits and vegetables), weight, and cardiovascular and diabetes risk factors.

CBT Targeting Diabetes Prevention and Treatment. Particularly impressive are results achieved from intensive, intermediate-duration (6 to 12 months duration) CBT involving patients with type 2 diabetes. The Look Ahead research group (12) in a large RCT (N=5,145) and Kim and colleagues (13) in a smaller RCT (N=58) both implemented an intensive lifestyle intervention program and showed significant improvements in fasting blood sugar, glycated hemoglobin (HbA1C), and weight. After 1 year, the Look Ahead research group showed nutrition counseling resulted in highly significant improvements in high-density lipoproteins; reduced use of glucose, lipid lowering, and hypertension medications as compared to the controls; reduced triglyceride levels; increased fitness levels; decreased prevalence of urine albumin-to-creatinine ratios >30 μg/mg; and a decrease in the number of patients meeting criteria for metabolic syndrome. At 1 year, Kim and colleagues (13) showed improvements in systolic blood pressure and carotid mean media thickness progression. Mayer-Davis and colleagues (14) assessed the effect of intensive CBT compared to reimbursable care and usual care and found intensive care produced significantly more weight loss. Less intense and shorter (<6 months) application of CBT with clients with type 2 diabetes or impaired glucose tolerance achieved significant

Theory and target	Grade[a]	Conclusion statement
Cognitive Behavioral Theory		
Short duration (<6 mo)	I	Four +[b] quality randomized controlled trials (RCTs), one Ø[c] quality RCT, and one Ø quality nonrandomized trial provide evidence that short-term cognitive behavioral therapy (CBT) results in positive lifestyle change, yielding a reduction in weight, lipid levels, fat intake, and improved glucose control.
Targeted to reduce cardiovascular disease (CVD) risk factors only	III	In two small research studies, one RCT and one nonrandomized trial of Ø quality, CBT of short duration (8 wks) targeted to reduce CVD risk factors was shown to produce modest, but significant, ↓[d] in a variety of CVD risk factors. In one study, researchers found CBT significantly ↓ weight, body fat, and changed regional body composition in both men and women, and ↓ leptin level in women, and serum cholesterol in men. In the other study, researchers found CBT ↓ serum cholesterol levels in both men and women.
Targeted to diabetic management only	II	Two + quality RCTs involving adult subjects aged approximately 60 y with type 2 diabetes, provide evidence that short-term CBT facilitates + lifestyle changes. One traditional CBT program targeting African Americans significantly ↓ weight, body mass index, lipid levels, and improved glucose control beyond that of usual care. One individually tailored CBT intervention significantly ↓ self-reported fat intake and ↑[e] physical activity as compared to a usual care group.
Targeted to weight loss only	III	Two small + quality RCTs provide evidence that short-term (10 wk) CBT is an effective method of overweight and obesity treatment.
Effects on weight maintenance	II	One meta-analysis (29 RCTs), four RCTs, and three observational studies provide strong evidence that weight management treatment with diet and cognitive-behavioral therapy in a 6-mo initial intervention period results in modest weight loss after follow-up of at least 18-mo posttreatment. Attrition rates increased the longer the follow-up was conducted. This is a common weakness of these studies that may result in outcome bias.
Intermediate duration (6-12 mo)	I	Five + quality RCTs, three Ø quality RCTs, and two Ø quality quasi-experimental non-randomized trials provide evidence that intermediate-length CBT, compared to standard treatment results in significant improvements in weight management, cardiovascular risk factors and type 2 diabetes. Evidence is strongest among patients with type 2 diabetes, due to the number, size and quality of studies.
Targeted to reduce CVD risk factors only	III	Two RCTs, + quality and one of Ø quality, evaluated the effect of weight-reduction programs with a behavioral component on reducing CVD risk factors in middle-aged subjects. These researchers found CBT was significantly more effective in facilitating weight loss, beneficial change in diet and exercise habits, ↓ triglyceride levels, ↑ high-density lipoprotein cholesterol in men and women, and ↓ systolic blood pressure in women. Additional studies with more intense, validated behavioral components should be conducted to assess optimal outcomes achievable.
Targeted to diabetes management only	I	Three + quality RCTs, and three Ø quality, one RCT, and two quasi-experimental-nonrandomized trials provide evidence that CBT, targeted to people with type 2 diabetes, resulted in significant improvements in glycated hemoglobin, fasting blood sugar, weight, and numerous CVD risk factors. Additional research is needed to determine whether these positive outcomes can be sustained over time.
Targeted to weight loss only	III	One Ø quality 6-mo RCT (86 obese adults) provides evidence that intermediate duration CBT and behavioral therapy combined with a personalized system of skill acquisition targeting weight loss is more effective than weight-loss education alone in facilitating weight loss, ↓ both total energy intake and percent energy from fat, and ↑ physical activity.
Long duration (>12 mo)	I	Nine + quality RCTs, one Ø quality RCT, one Ø quality nonrandomized trial, and one Ø quality quasi-experimental study provide evidence that long-term CBT (>12 mo), facilitates positive lifestyle change, which may result in significant reductions in weight, lipid levels, blood pressure, and incidence of hypertension. Interventions targeting prevention of type 2 diabetes were highly successful, but those targeting diabetes management indicated difficulty sustaining most outcomes over the long term.

(continued)

Figure 2. Graded conclusion statements related to the evidence that theory-based counseling results in health and food behavior change in adults counseled in an outpatient or clinic setting.

Theory and target	Grade[a]	Conclusion statement
Targeted to reduce CVD risk factors only	I	Four large, + quality RCTs provide evidence that CBT of greater than 18-mo duration is beneficial in facilitating modification of dietary habits, weight, and CVD risk factors.
Targeted to diabetic management only	III	One + RCT and one Ø quality nonrandomized trail assessed the effect of CBT added to usual care, on diabetic management over a 2-y period. Clinically significant outcomes reported at 6 mo were generally not sustained at the 2-y point, with the exception of a significant ↓ in total cholesterol. A third + quality study demonstrated sustainment of positive behavioral and psychosocial change well maintained at 2 y, but clinical outcomes beyond 6 mo are not available. Additional research is needed on the effect of CBT of >12-mo duration on patients with diabetes, using a research design which controls for pharmacotherapy
Targeted to prevention or delayed onset of diabetes	I	Three large, + quality RCTs provide evidence that CBT of greater than 2-y duration is beneficial in preventing and/or delaying onset of diabetes mellitus.
Targeted to weight loss	II	Two + RCTs (65 participants received CBT and a very-low-energy diet [VLCD]) and one Ø quasi-experimental study (84 participants received CBT) evaluated CBT as a component of a weight-loss program of long-term duration. CBT was not always the variable of randomization. Participants receiving behavior therapy lost weight at the conclusion of treatments. Upon follow-up, there was some weight regain, but participants remained at a lower weight than baseline. Studies that included a VLCD to initiate rapid initial weight-loss, combined with CBT, also appeared to produce long-term weight loss. [Note: This is not a statement recommending VLCDs or suggesting that VLCDs are more beneficial than low-calorie diets.]
Transtheoretical model	III	One + quality intervention study strongly supported application of the transtheoretical model/stages of change in improving health and food behavior change. Much research has been accomplished to validate instruments to use to measure stage of change in the dietary context. Additional research is needed to support its effective application in nutrition counseling.
Social Learning Theory		
Targeted to reduce CVD risk factors	III	One + quality RCT, evaluated the effect of six telephone-delivered counseling sessions targeting ↑ self-efficacy and outcome expectancy, social learning theory constructs, in 65 hyperlipidemic patients not adherent to their cholesterol-lowering diet. The intervention involved goal setting, self-monitoring, self-reinforcement and verbal persuasion. The intervention group significantly reduced saturated fat and cholesterol intake and had significantly ↓ low-density lipoprotein cholesterol levels relative to the control group. There was no ↑ in perceived self-efficacy in the intervention group vs the usual care group; outcome expectancy significantly ↑ in the intervention group, but was not correlated to the improvements in dietary adherence or ↓ low-density lipoprotein cholesterol levels. Despite positive behavioral and clinical outcomes, researchers failed to show a specific relationship between self-efficacy or outcome expectancy and change in behavior.
Targeted to diabetes management	III	One randomized controlled trial of Ø quality evaluated a 5-wk nutrition education and a nutrition education plus social learning intervention in 78 patients with type 2 diabetes. In addition to nutrition education, the social learning intervention group received information on goal setting based on individual barriers to adherence, modeling of strategies used successfully by other individuals with type 2 diabetes, and was taught a problem-solving method. This 5-wk study failed to show a significant advantage of social learning intervention over nutrition education alone. RCTs of longer duration are needed to further explore the effect of social learning theory on diabetes management.

[a]Grade is assigned by the workgroup, based upon the quality, quantity, consistency, clinical impact and generalizability of the evidence supporting the conclusion. Grade I means good/strong evidence; Grade II means fair evidence; Grade III means limited/weak evidence.
[b]+ = positive.
[c] Ø = neutral.
[d] ↓ = decrease.
[e] ↑ = increase.

Figure 2. Continued

improvements in multiple lifestyle variables, including blood sugar control, weight, and lipid levels (15-19).

The Diabetes Prevention Program and the Finnish Diabetes Prevention Study achieved impressive results with CBT in preventing or delaying the onset of diabetes (20-27). The Diabetes Prevention Program research team found a significant 58% reduction in incidence of type 2 diabetes over a 4-year period, and the Finnish Diabetes Prevention Study research team reported identical results.

Sustaining clinically significant outcomes was more problematic in CBT-treated clients with a diagnosis of diabetes (28-31). In these clients, there were no significant differences between the treatment and control groups on measures such as fasting plasma glucose, low-density lipoprotein cholesterol, triglycerides, and systolic blood pressure beyond 6 months. Additional research is needed in the area of long-term CBT targeting diabetes management.

CBT Targeting Cardiovascular Disease. CBT of greater than 18 months' duration facilitated modification of dietary habits and weight to lower cardiovascular risk as found in four large high-quality RCTs (32-35). Both the Trials of Hypertension Prevention, Phase II and the PREMIER trial demonstrated that CBT applied to middle-aged men and women with pre-hypertension or stage 1 hypertension produced significant and positive effects improving dietary habits, weight, and risk for hypertension, as compared to an advice-only group (32,33). The Women's Health Initiative Randomized Controlled Dietary Modification Trial and the Women's Healthy Lifestyle Project both assessed the effect of long-term (8 and 5 years, respectively) CBT on perimenopausal or postmenopausal women and found significant benefits in dietary intake, weight, waist circumference measures, and lipid levels compared with a control group (34,35). CBT of shorter duration (≤12 months), involving clients with cardiovascular disease, also achieved significant reductions in cardiovascular risk factors, including weight, body composition, and lipid levels (36-40).

CBT Targeting Weight Management. Six studies (five RCTs) met the inclusion criteria for weight management. Interventions targeting weight loss for control or prevention of diabetes or cardiovascular disease were reported separately. All studies reported significantly improved weight loss with behavioral therapy (41-46). One meta-analysis (including 29 RCTs), four RCTs, and three observational studies provided strong evidence that weight loss achieved with CBT of 6 months or less duration resulted in sustained weight loss and prevention of further weight gain at least 18 months posttreatment (47-54).

CBT Treatment Duration. The Nutrition Counseling Workgroup analyzed CBT both by health condition and duration of therapy. Since insurance companies typically provide coverage for only short-term treatment (<6 months), the work group looked at the long-term (>18 months) sustainment of short-term therapy. Evidence strongly supported the effectiveness of CBT at all treatment durations. Short-term CBT produced moderately good long-term results, but high study attrition rates were a common problem in these studies (47-54). Figure 2 presents conclusions reached by the work group for each duration question.

Transtheoretical Model in Nutrition Counseling. The transtheoretical model, with its core concept of stages of change, describes the sequence of cognitive (attitudes and intentions) and behavioral steps people use over time to make successful changes in health behavior. The model recommends tailored intervention strategies for each stage (ie, precontemplation, contemplation, preparation, action, and maintenance) to move an individual forward through the stages of change (55,56).

Much research has been accomplished to validate instruments used to measure stage of change in the diet context (57-68); however, only one high-quality randomized controlled trial assessed dietary outcome measures relevant to the use of the transtheoretical model/stages of change (69).

Jones and colleagues (69) applied the transtheoretical model to 1,029 individuals with type 1 or type 2 diabetes who were in one of three pre-action stages for either self-monitoring of blood glucose, healthy eating, or smoking (69). A significant treatment effect was found for the transtheoretical model intervention targeting healthy eating vs usual intervention. The following significant results were reported: An improved stage of change (movement to the action or maintenance stage), a decrease of energy intake from fat, higher daily vegetable and fruit intake, and decreased HbA1C for those in the action stage. Additional intervention studies of strong design are needed to validate the efficacy of the transtheoretical model in nutrition counseling.

Social Cognitive Theory/Social Learning Theory. Social cognitive theory, built upon the foundations of social learning theory, is rooted in the belief that people learn from watching one another and use an internal thought process influenced by the person (eg, beliefs), the environment (eg, how supportive) and behavior, (eg, ease of the task). The following strategies facilitate the learning process: Observational learning (eg, testimonials and demonstrations), sequential goal setting, task breakdown, and skill development training. Social cognitive theory is most commonly used in group settings (4). Only two small RCTs documented use of the social cognitive theory as the theoretical framework for nutrition intervention. These studies failed to show clear effect (70,71). Additional RCTs of increased intensity and duration are needed to better explore application of this theory in nutrition counseling.

Nutrition Counseling Strategies

Nutrition counseling strategies are evidence-based methods or plans of action designed to achieve behavior change toward a particular client goal (8). Each behavior change theory offers constructs or concepts that attempt to explain behavior change and integrate data or information about the behavior change process (eg, self-efficacy, stage of change) that may influence behavior change. Theories and models frequently suggest strategies that leverage components of the change process to promote desired behavior change. There is overlap in that some strategies are used across numerous theories and models. Goal setting is a strategy endorsed by both CBT and social cog-

nitive theory. Dietetics practitioners apply different strategies based on client goals and the dietetics practitioner's personal counseling style and skill set. When using the Nutrition Care Process, practitioners document the strategies used in nutrition counseling and monitor the effectiveness of the nutrition counseling process (eg, readiness to change, self-monitoring frequency, and weight lost). The Nutrition Counseling Workgroup reviewed evidence related to the following nutrition counseling strategies: motivational interviewing, self-monitoring, use of meal replacements and/or structured meal plans, reward strategies, problem-solving, social support, goal setting, cognitive restructuring, stress management, and stimulus control. Eleven questions related to counseling strategies were addressed in this comprehensive review, and all can be found in Figure 3, along with the grade given the research evidence and the conclusion. Full descriptions of these grades and conclusions are available on the American Dietetic Association Evidence Analysis Library Web site (9).

Motivational Interviewing. Motivational interviewing is a client-centered strategy designed to elicit behavior change by assisting clients to explore and resolve ambivalence to change (72,73). Dietetics practitioners frequently use motivational interviewing when they utilize the transtheoretical model with clients who are in the precontemplative, contemplative, and preparation stages and require intervention targeting motivation. When applying this strategy, an RD partners with the client to determine the agenda using empathetic, nonjudgmental, supportive, encouraging, and active listening behaviors. Open-ended questions, reflective listening, affirmations, and summarization are used to help a client explore and resolve ambivalence and barriers to behavior change. Training in motivational interviewing is highly encouraged for working with clients who are not in the action stage of change (72,73).

Researchers in four RCTs of high quality assessed the effect of motivational interviewing as an added component to a cognitive-behavioral program (three studies) or a self-help intervention (one study) (74-77). Strong evidence indicates that motivational interviewing significantly enhanced adherence to program recommendations and improved targeted diet-related outcomes, including glycemic control, percentage of energy intake from fat, fruit and vegetable intake, and weight loss. Two studies employed motivational interviewing as the sole style of intervention (without a behavioral component) with little added effect, when compared to a control group that received diet counseling from RDs not trained in motivational interviewing (78,79).

Self-Monitoring. Self-monitoring is used in CBT and social cognitive theory and involves a client keeping a record of thoughts, emotions, dietary behaviors, physical activities, and/or health measurements (eg, blood sugar, blood pressure). The record is reviewed with the client for triggers and patterns and used to assist with problem solving and goal setting. Three RCTs were reviewed and provided strong evidence that self-monitoring of food intake improves nutrition-related outcomes related to weight loss and compliance with renal diets (80-82). Three observational studies demonstrated that clients enrolled in cognitive behavioral weight-loss programs who were more consistent with self-monitoring were significantly more successful in losing weight (83-85).

Meal Replacements and Structured Meal Plans. Meal replacements and structured meal plans are considered nutrition counseling strategies because meal replacements help participants control their food intake by focusing on portion control as they attempt to modify their eating habits (86). Meal replacements can be over-the-counter shakes and bars or portion-controlled frozen meals. Structured meal plans are detailed meal plans listing exactly the type of food and portion size to be eaten. Meal replacements provide many advantages to participants involved in weight-loss programs. Using meal replacements reduces amount of time thinking about food selection and meal preparation for one or two meals per day, reduces exposure to foods that might tempt participants to overeat, and avoids problems of underestimating portion sizes (87).

Structured meal plans simplify food choices and increase adherence to a daily energy goal. Four RCTs were reviewed that assessed the efficacy of various types of structured meal plans and/or meal replacement strategies as compared to self-selected diets in middle-aged adults (88-91). Strong evidence was provided that various types of meal replacements and/or structured meal plans were helpful strategies in achieving health and food behavior change goals such as weight loss and decreased fat intake in middle-aged adults.

Ashley and colleagues in a high-quality RCT (88,92) evaluated the use of meal replacements with a behavioral program called the Lifestyle, Exercise, Attitude, Relationships and Nutrition (LEARN) Program. The authors found a 1-year RD-led behavioral program incorporating meal replacements significantly more effective than both the behavioral program without meal replacements and individual counseling by a physician and nurse along with meal replacements (88). Two studies incorporated both meal replacements and structured meal plans (89,90). Wing and colleagues (89), in a high-quality RCT, found actual food provision (both provided free and cost-shared with clients) and a structured meal plan with corresponding grocery lists equally beneficial components of a 26-week behavioral weight-loss program and superior to a standard behavioral treatment without added food. Metz and colleagues (90) instructed participants to follow a total meal replacement intervention or a traditional meal plan using food exchanges and both based on the National Cholesterol Education Program/American Heart Association Step 1 and 2 diets. The investigators found that the 10-week total meal replacement intervention was superior to following a traditional meal plan (90). The total meal replacement intervention achieved dietary compliance and cardiovascular risk factor reduction. Ditschuneit and colleagues (91,93,94) followed overweight subjects consuming meal replacements and those following a self-selected diet for 4 years and found meal replacements significantly enhanced long-term weight loss.

Reward Strategies. Reward strategies involve a systematic process by which a practitioner or client uses rewards as an incentive for a specific behavior change. In nutrition counseling, rewards may be used for attendance, completion of food records, weight loss, or may be predetermined

Counseling strategy	Grade[a]	Conclusion statement
Motivational interviewing	I	Four randomized controlled trials (RCTs) of +[b] quality assessed the effect of motivational interviewing as an added component to cognitive-behavioral programs (three studies) or a self-help intervention (one study) and found motivational interviewing significantly enhanced adherence to program recommendations and improved targeted diet-related outcomes including glycemic control, percentage of energy intake from fat, fruit and vegetable intake, and weight loss.
Motivational interviewing	III	Two studies (one + and one Ø[c] quality) employed motivational interviewing as the sole style of intervention with little added effect, compared to standard therapy. Further research is warranted with larger sample sizes, longer follow-up periods, and measurement of readiness to change diet behaviors.
Self-monitoring	I	Three RCTs, two + quality and one Ø quality, provide evidence that self-monitoring of food intake improves nutrition-related outcomes related to weight loss and compliance with renal diets. Three observational studies of Ø quality revealed that clients, enrolled in cognitive behavioral weight-loss programs that were successful in losing weight, were significantly more consistent with self-monitoring.
Meal replacements and/or structured meal plans	I	Four RCTs, three + quality and one Ø quality, assessed the efficacy of various types of meal replacement and/or structured meal plan strategies as compared to self-selected diets in middle-aged adults, and found the use of various types of meal replacements and/or structured meal plans helpful strategies in achieving health and food behavior change in middle-aged adults. Additional research is needed to determine whether benefits derived from temporary use of these behavioral strategies can be sustained over time.
Reward strategies	I	Two + quality (one RCT and one meta-analysis of seven RCTs) and one Ø quality RCT found monetary rewards or reinforcement had no treatment effect.
Problem solving	II	Two + quality RCTs, one in overweight and obese women and the other in postmenopausal women with diabetes, utilized interventions that incorporated problem-solving strategies. In both studies, use of problem-solving strategies resulted in improvements in key outcome measures including maintenance of weight loss and in subjects with diabetes, was linked to improvements in fat consumption, self-efficacy and physical activity.
Social support	II	One highly intense lifestyle change study found social support was helpful and four traditional lifestyle change programs did not find it helpful. The definition of social support has evolved to include multiple dimensions of social support measured pre- and posttreatment. Two RCTs, conducted in the 1990s, manipulated social support and found no significant treatment effect. In an RCT published in 2006, multiple dimensions of social support were measured pre- and post-treatment and use of social resources was shown to mediate intervention effects on physical activity, fat consumption, and glycated hemoglobin change. Additional studies are needed to measure impact of social support interventions on outcomes.
Goal setting	II	One + quality RCT found a 30-min motivational interviewing session, based on self-selected diabetic self-management goals, followed by three, 10-min telephone calls at 1, 3 and 7 wks, was significantly more effective than usual care in reducing dietary fat intake and increasing physical activity at 1 y in 100 adults with type 2 diabetes. A + quality RCT showed similar results regarding the value of client self-selected behavior change goals, and demonstrated the effectiveness of goal-attainment training in realizing dietary improvements. One Ø quality observational study found 422 clients with diabetes who used computer technology to self-select a behavior-change goal in an area of diet or exercise, and received brief (8 to 10 mins) counseling related to the goal, were successful in reducing fat intake 2 mo later. Clients' active participation in selecting and setting goals led to the selection of a goal from the area that could use the most improvement and the goal that was most personally appropriate.
Cognitive restructuring	III	One Ø quality RCT assessed the additive effect of a cognitive restructuring component to a 10-wk strictly behavioral weight-loss program in 63 middle-aged, overweight subjects and found no significant difference between the treatment and control group in any physiological, behavioral, or cognitive measures at baseline, posttreatment, and at 3-month follow-up. Additional research is needed on the isolated effect of cognitive restructuring as part of a behavioral intervention on nutrition-related outcomes.
Stress management	V	No new literature was found published in the past 20 years that provided evidence related to the use of stress management on nutrition-related outcomes.
Stimulus control	V	No new literature was found published in the past 20 years that provided evidence related to the use of stimulus control on nutrition-related outcomes.

[a]Grade is assigned by the workgroup, based on the quality, quantity, consistency, clinical impact, and generalizability of the evidence supporting the conclusion. Grade I means good/strong evidence, Grade II means fair evidence, Grade III means limited/weak evidence, and Grade V means no available evidence.
[b]+=positive.
[c]Ø=neutral.

Figure 3. Graded conclusion statements related to the evidence that application of theory-based nutrition counseling strategies results in health and food behavior change in adults counseled in an outpatient or clinic setting. NOTE: Information from this figure is available online at www.adajournal.org as part of a PowerPoint presentation.

by the client for reaching a defined goal. Financial incentives given for skill acquisition or weight lost had no treatment effect as found in two RCTs and one systematic review (including seven RCTs) (95-97).

Problem Solving. Problem solving techniques are frequently used collaboratively with clients and involve identification of barriers to goal achievement, brainstorming solutions, weighing the pros and cons of potential solutions, implementing solutions, evaluating solutions for effectiveness, and adjusting strategies (5). Two positive quality RCTs, one in overweight and obese women and the other in postmenopausal women with diabetes, utilized interventions that incorporated problem-solving strategies. In both studies, use of problem-solving strategies resulted in maintenance of weight loss. In subjects with diabetes, use of problem-solving strategies was associated with improvements in fat consumption, self-efficacy, and physical activity (98,99).

Social Support. Social support may be defined as the ability to build and utilize a network of family, friends, colleagues, and health professionals for information, encouragement, emotional support, and enhancing the environment to support behavior change (8). Dietetics practitioners may assist clients using this strategy by establishing a collaborative relationship with a client, helping a client identify potential family and community support, and coaching a client on how to effectively elicit this support. Assessment of the effect of social support on nutrition-related behavior varies widely and includes multiple dimensions of social support measured by using vastly different tools and criteria.

In two studies conducted in the 1990s, researchers assessed the effect of spouse and friend inclusion in behavioral therapy and found no significant treatment effect (100,101). One highly intense lifestyle change study found social support was helpful to mediate intervention effects on physical activity, fat consumption, and HbA1C change (31,102). Additional research is needed to measure the effect of varying types of social support (eg, perceived social support, quality and size of social network, or emotional support) on specific types of behavior change goals within varying populations (eg, elderly or children).

Goal Setting. Goal setting is a collaborative activity between a client and a dietetics practitioner in which a client determines from a number of potential courses of action what he or she is willing to expend energy to achieve (8). It is an important strategy in CBT, social cognitive theory, and motivational interviewing and frequently a key component of the Nutrition Care Process. It is appropriate for clients who are ready to make behavior change. A client may need coaching on setting realistic, timely, and measurable goals, and require assistance in gaining the required knowledge and skills for goal attainment. It is essential to monitor and document client progress toward long- and short-term goals, providing opportunity for problem solving and celebrating success.

Clark and colleagues (16), in a well-designed RCT, tested the effect of goal setting as the independent variable. A 30-minute goal setting session employing a motivational interviewing style, based on self-selected diabetic self-management goals, was used. Follow-up was provided via three, 10-minute telephone calls at week 1, week 3, and week 7. This relatively low-resource-intensive protocol was significantly more effective than what was described as usual care in reducing dietary fat intake and increasing physical activity at 1 year in 100 adults with type 2 diabetes. Unfortunately, the authors did not define the components of usual care. Berry and colleagues (103), in another RCT, showed similar results regarding the value of client self-selected behavior change goals and demonstrated the effectiveness of goal attainment training in realizing dietary improvements. In a third study, 422 clients with diabetes who used computer technology to self-select a behavior change goal and received brief (8 to 10 minutes) counseling related to that goal were successful in reducing fat intake 2 months later (104). Clients' active participation in selecting and setting goals led to the selection of a goal that was personally appropriate and valued by the client (104).

Cognitive Restructuring. Cognitive restructuring is a strategy frequently used by nutrition counselors to increase clients' awareness of their perceptions of themselves and their beliefs related to diet, weight, and weight-loss expectations (8). Because use of cognitive restructuring targeted to patients with eating disorders was excluded from review, cognitive restructuring as an independent variable was found in only one study. In this RCT, the additive effect of a cognitive restructuring component to a 10-week strictly behavioral weight-loss program was tested in 63 middle-aged, overweight subjects (105). No significant differences were found between the treatment and control group in any physiological, behavioral, and/or cognitive measures at baseline, posttreatment, and at 3-month follow-up. Additional research is needed to isolate the effect of cognitive restructuring as part of a behavioral intervention on nutrition-related behaviors.

Stress Management. Stress management guidance targeting environmental stress (eg, guidance to plan ahead or use of time management skills) and emotional stress (eg, use of positive self-talk or relaxation exercises) are sometimes utilized in nutrition counseling situations (8). No literature published in the 1986-2007 timeframe was found that assessed the effect of stress management strategies on nutrition-related outcomes.

Stimulus Control. Stimulus control is a core strategy used in behavioral therapy that involves modifying social or environmental cues or triggers that encourage undesirable behaviors related to diet and exercise (8). In accordance with strict behavioral theory, attention is given to reinforcement and rewards for successfully modifying environmental triggers. No new literature that provided evidence related to the use of stimulus control on nutrition-related outcomes has been published in the past 20 years.

Individual vs Group Counseling. Few articles assessed the independent effect of group vs individual counseling on nutrition-related outcomes. Three high-quality RCTs evaluated individual vs group counseling targeted to weight or diabetes management in middle-aged subjects (88,106,107). Group counseling was significantly more effective than individual counseling. Attrition rate in two of the studies was >30%. Further research is needed to support these findings.

Commission on Dietetic Registration	www.cdrnet.org
• Certificate of Training in Adult Weight Management	
• Certificate of Training in Childhood and Adolescent Weight Management	
American Association of Diabetes Educators	www.diabeteseducator.org
American Diabetes Association	www.diabetes.org/professional
Institute for Healthcare Communication	www.healthcarecomm.org
Motivational interviewing	www.motivationalinterview.org

Figure 4. Resources for nutrition counseling training.

CONCLUSIONS

The nutrition care process incorporating client-centered counseling techniques is an important component of effective chronic disease prevention and management. Nutrition counseling delivered by dietetics practitioners has been demonstrated to improve weight loss and maintenance, blood glucose levels for persons with type 2 diabetes, and cardiovascular disease risk factors. A plethora of evidence exists to support the use of CBT to facilitate behavior change targeted to the reduction of cardiovascular disease risk, prevention and treatment of diabetes, and weight loss. Evidence related to the use of the transtheoretical model in the context of diet change is emerging. This theory offers not only validated stage-appropriate strategies to enhance behavior change, but suggests meaningful outcome measures (eg, diet readiness to change) to assess progress of clients not in the action stage of change.

Constructs, variables, and strategies central to social cognitive theory (or social learning theory) are frequently used as a part of effective diet counseling—demonstrations, skill training, and testimonials, for example. Numerous tools have been validated that measure core constructs of this theory (eg, self-efficacy and outcome expectation), but few nutrition counseling intervention studies have been published that use this theoretical framework. Improved documentation relevant to this theory will help determine its potential value in facilitating nutrition-related behavior change.

Strong evidence supports the effectiveness of self-monitoring, motivational interviewing (particularly when used in combination with CBT), and meal replacements and structured meal plans as strategies in nutrition counseling. Current research does not support the use of financial rewards as an effective strategy to instigate nutrition-related change. Good evidence supports the use of goal setting, problem solving, and social support strategies, but further research is needed to assess effectiveness in a broader range of populations and over a broader spectrum of nutrition-related goals. Research also supports group vs individual counseling, indicating that dietetics practitioners should be encouraged to develop effective group facilitation skills.

Dietetics educators who teach nutrition counseling courses can use the results of this systematic review to explain the evidence supporting specific theories that provide the framework for helping clients change their dietary and activity behaviors. In addition, educators can guide students to acquire the skills required to make effective use of the strategies that have a sound scientific basis.

Based on this analysis, further research is needed to validate the effectiveness of the transtheoretical model and social cognitive theory as a framework for nutrition counseling. Additional research is also needed to determine the optimal application of goal setting, problem solving, and social support behavior change counseling strategies.

Dietetics practitioners are encouraged to use behavior change theories and strategies to plan effective nutrition counseling interventions. Advanced training in use of theory-based strategies is available and recommended for those who wish to enhance their counseling effectiveness. Good sources of nutrition counseling training are listed in Figure 4. Routine use and documentation of evidence-based interventions will enable members of our profession to better understand the intricacies of nutrition-related behavior change and strategies that are effective in aiding clients in achieving behavior change goals.

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