# Examination of the Obesity Epidemic from a Behavioral Perspective

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## Abstract

Obesity prevalence has doubled among adults and overweight has tripled among children since 1980. This article discusses behavioral approaches to the obesity epidemic, focusing on recent environmental changes, the resulting behaviors, and possible solutions. Over the last 4 decades, time spent in sedentary activities, the consumption of fast food, the structural environment, and the percentage of women in the work force have changed dramatically. The cumulative effect of these changes on the eating and exercise habits adopted by Americans has been disastrous. In order to reverse the obesity trend, physical and social environments that support healthful habits must develop. Behavioral approaches to weight loss have proven to be the most effective at promoting individual health behavior changes; however, these changes will be much more likely to persist if supported by family, school, and work environments, organizations, policies, and communities.
**Key words**: obesity, overweight, behaviorism, social learning theory, behavioral treatment, socioecological model, behavioral interventions, environment, community level interventions

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Americans are getting fatter. Currently 66.3% of American adults are overweight or obese. Nearly 1 in 3 children and youth ages 6-19 are overweight (Ogden, Carroll, Curtain, McDowell, Tabak, & Flegal, 2006). These statistics represent a doubling of obesity prevalence among adults and a tripling of overweight among children since 1980 (Flegal, Carroll, & Ogden, 2002; Hedley, Ogden, Johnson, Carroll, Curtin, & Flegal, 2004). This rate of obesity raises concern due to its physical and economic costs. Obesity is associated with increased risk for heart disease, diabetes, certain cancers, hypertension, high cholesterol, stroke, liver and gall bladder disease, sleep apnea, osteoarthritis, depression, and anxiety (Bouchard, Shephard, & Stephens, 1994; Gortmaker, Must, Perrin, Sobol, & Dietz, 1993; Must, Spadano, Coakley, Field, Colditz, & Dietz, 1999; U.S. Department of Health and Human Services, 1996). In addition, overweight children are more likely to experience bullying, peer disapproval, eating disorders, low self-image, and academic discrimination (Epstein and Wing, 1987). According to the Office of the U.S. Surgeon General (2000), obesity results in an estimated $117 billion in medical bills and lost productivity each year.There is little agreement as to the exact origin of the obesity epidemic. However, several ecological models have been proposed to examine the etiology from a population perspective. These models suggest that three broad areas influence body weight: genetics, the environment (physical, economic, and sociocultural), and behavior (habits, cognitions, attitudes, and beliefs) (Egger & Swinburn, 1997; Mooibroek, 2001; National Health and Medical Research Council, 1997). However, the gene pool does not change rapidly enough to explain the recent, alarming rise in obesity so professionals must focus their investigations on the roles of the latter two areas.

Behavior analysts recognize a direct relationship between these two areas, and examine the environment to determine the root of a given target behavior. Researchers began studying the roles of the environment and learning on weight issues in the 1960s (Stuart, 1967; Ferster, Nunberger, & Levitt, 1962). These approaches, based on the principles of learning, assume that behaviors leading to weight gain (increased engagement in sedentary activities and overeating) are learned and can therefore be unlearned and replaced with alternate behaviors (physical activity and healthy eating). The goal of the development of behavioral interventions is to create an environment that encourages such alternate behaviors, and discourages behaviors that lead to weight gain (Jeffrey, Epstein, & Wilson, 2000; Wadden, Crerand, & Brock, 2005; Wing, 1998). The current article will discuss the obesity epidemic from a behavioral perspective , focusing on recent environmental changes, the resulting behaviors, and possible solutions.

*Definitions*

We must begin by defining energy balance, overweight and obesity. In order to maintain body weight, one must achieve an energy balance, that is energy intake and expenditure must be relatively equal. To lose weight, a negative energy balance must exist, where calories consumed through food are less than those expended. Likewise, a positive energy balance leads to weight gain and over time can lead to overweight and obesity. Adults are classified as overweight or obese based on body mass index (BMI) reaching certain thresholds. BMI is calculated by dividing one's weight in kilograms by one's height in meters squared. Thus it is a measure of body weight relative to height and does not take actual body composition into account. However, excess body fat is highly correlated with excess body weight in populations where high levels of adiposity are common, rendering BMI a useful tool for identifying overweight and obesity in the general population, but less appropriate for use with populations who typically have low levels of adiposity but high body weight due to increased muscle mass, such as body builders (American College of Sports Medicine, 2006). For adults, body mass indexes greater than 18.5 $kg/m^2$ and less than 25 $kg/m^2$ are classified as "normal"; those ranging from 25-25.9 $kg/m^2$ are considered "overweight" and those $\geq$ 30 $kg/m^2$ are considered "obese" (American College of Sports Medicine, 2006). For children, a BMI >85$^{th}$ percentile for age and sex is considered "at risk for overweight" and most likely corresponds to the adult definition of overweight. BMIs >95$^{th}$ percentile for age and sex are considered "overweight" and correspond to the adult definition of obese.

*Changes in the Determinants of Energy Balance*

Our environment is changing. Over the last four decades, time spent in sedentary activities, the availability and marketing of fast food, per capita income, and the percentage of women in the work force have increased dramatically (French, Story, and Jeffery, 2001). The cumulative effect of these changes on the eating and exercise habits adopted by Americans has been catastrophic. Our environment is now one that promotes the consumption of calorically dense, convenience foods and discourages physical activity.

There is a reduced need to be physically active, due to technological advancements (Philipson & Posner, 2003). Most adults spend the majority of time sitting whether at work, home, or during leisure. This makes reduced physical activity a strong player in the obesity epidemic (Hill, Wyatt, Reed, & Peters, 2003; Levine & Miller, 2007; Levine, Vander Weg, Hill, & Klesges, 2006). Many adults ride escalators and elevators rather than climb the stairs and email co-workers rather than walk down the hall to converse. Adults and children have also increased the amount of time they are sitting in front of a screen through TVs, computers, and video games. The average American spends 4 hours/day watching television (U.S. Bureau of the Census, 2006). This coincides with the dramatic increase in the number of televisions per household. In 1970 only 35% of households had multiple televisions while 88% of households did in 1999. Seventy-seven percent of sixth graders surveyed in 1999 even had a TV in their bedrooms (Rideout, Foehr, Roberts, & Brody, 1999). Each additional hour spent viewing television increases the incidence of childhood obesity by 2%. TV time reduces the time available for physical activity, increases exposure to advertisements for high-fat, calorically dense foods, and may increase snacking since TV viewing is often paired with eating (Dietz & Gortmaker, 1985). In addition, studies have shown people to exhibit lower resting metabolic rates while watching television than even while sleeping (Klesges, Shelton, & Klesges, 1993).

In addition, fewer Americans rely on public transit, bicycles, or walking for transportation. For instance, 161 million autos were travelling U.S. roads in 1980. According to the U.S. Department of Transportation, that number has exceeded 225 million today. Likewise, vehicles miles travelled per person increased 151% from 1977 to 2001 (White, 2008). This is five times the rate of population growth during that period. Interestingly, a study by Besser and Danenberg (2005) demonstrated that people

accumulate an extra 20 minutes of physical activity per day when using public transportation rather than a personal vehicle.

Urban sprawl is a primary contributor to the increase in vehicle miles travelled (Ewing, Pendall, & Chen, 2002; Hu & Reuscher, 2004). People live further from work, school, and retail stores. Saelens, Sallis, and Frank (2003) identified two fundamental aspects of the way land is used that influence transportation mode: 1) proximity, more specifically the compactness of the area and mixed land usage (e.g. both residential and retail areas) and 2) connectivity, more specifically the directness (e.g. a grid pattern versus asymmetrical layouts with cul-de-sacs) and ease of travel (e.g. multiple route choices and a high density of intersections). People prefer to walk and cycle in neighborhoods characterized by mixed land usage, high street connectivity, and a high density of intersections. Most urban suburbs are characterized by the opposite. This changing landscape has rendered cycle and pedestrian travel less convenient and less safe. Currently, one in four short-distance trips made in the U.S. are < 1 mile, yet 75% of those trips are made by automobile (U.S. Department of Transportation, 1995).

Children can no longer bike or walk to school. A nationally representative survey conducted in 2002 revealed that only 22% of children walk or ride their bikes to school. Of the parents whose children do not walk or bike to school, the vast majority cited the school's distant location as the main reason why. Seventy percent of those parents reported having walked or biked to school when they were children (Surface Transportation Policy Partnership, 2005).

Students also participate in less physical activity once they reach school. The recommended level for youth is 60 minutes of moderate-intensity physical activity daily, yet only 27% of high school students engage in just 30 minutes or more per day (U.S. Department of Health & Human Services, 2000). Daily physical education is offered in only 8% of elementary schools, 6% of middle schools, and 6% of high schools (Burgeson, Wechsler, Brener, Young, & Spain, 2000). Physical education and active recess have been reduced during the school day to provide more time for academic instruction (Lenfant, 1992; Gortmaker, Dietz, and Sobol, 1987; Huttunen & Allison, 1995) although there is no evidence that physical education reduces academic performance (Kahn, Ramsey, Brownson, Heath, Howze, Powell, Stone, Rajab, & Corso, 2002). Studies have even shown that ten-minute physical activity breaks within the classroom can increase the on-task behavior of students during class time (Mahar, Murphy, Rowe, Golden, Shields, & Raedeke, 2006).

Decreased physical activity coupled with increased consumption of food prepared outside the home intensifies the energy imbalance and furthers weight gain. The increase in dual-income households and women in the workforce corresponds with an increased need for take-out meals and convenience foods (U.S. Bureau of the Census, 1998). Money spent on away-from-home food has steadily increased since the 1970s (Guthrie, Lin, & Frazao, 2002; Lin, Frazao, & Guthrie, 1999; Putnam & Allshouse, 1996). Several studies published between the years 1999-2002 reported that fast food claimed 40% of family food budgets; this is projected to increase to 53% by 2010 (Frazao, 1999; French & Jeffrey, 2001; Information Resources Incorporated). Away-from-home food actually comprises one third of Americans' total caloric intake (Guthrie et al, 2002; Lin et al., 1999).

Multiple characteristics of away-from-home food encourage overconsumption. First, meals eaten out may correspond with increased calories through alcohol consumption (Ledikwe, Ello-Martin, & Rols, 2005; Rolls, 2003). In addition, the foods are typically higher in fat and calories and lower in fruit and vegetable servings than meals prepared at home (American Academy of Pediatrics, 2003; French et al., 2001; The Keystone Center, 2006). For example, a Big Mac and medium order of French fries from McDonald's contain 1020 kcals and 54 grams of fat. This represents about 50% of the recommended daily energy intake and 83% of the recommended daily fat intake, based on a 2000 kcal/day diet – and includes practically zero servings of fruits and vegetables (French et al., 2001). People also tend to over consume at restaurants because the foods are typically highly palatable (Rolls, 1986) and are served in

larger portions (Ledikwe et al., 2005). Over the last several decades, portion sizes have increased in restaurants, fast-food establishments, at home, and even for pre-packaged foods (Smiciklas-Wright, Mitchell, Mickle, Gold, & Cook, 2003; Young & Nestle, 2002).

Americans are also consuming more calories through sugar-sweetened beverages, which are served in increasingly larger portion sizes when purchased away from home. Soft drink production in the U.S. is sufficient to provide every citizen with 14 oz. of soda per day (Nestle, 2000). Annual non-diet soft drink consumption doubled between 1970 and 1994, and now exceeds 40 gallons/person/year (Putnam & Gerrior, 1999). The larger serving sizes of food and beverages are problematic. Studies show that young children will stop eating when full (Rolls, Engell, & Birch, 2000) and can even adjust their energy output to match input (Birch & Deysher, 1986); however this ability is lost as we grow older and food intake becomes more influenced by environmental stimuli such as the portion served (Fisher, Rolls, & Birch, 2003). A study by Rolls et al. (2004) found that men and women consumed more potato chips as the size of the snack bag increased. Women ate 18% more and men 37% more when the package increased from 85g to 170g.

The increased portion of total calories consumed by American families away from home corresponds with increased overweight and decreased consumption of fruits and vegetables. Only 20% of Americans meet the recommended five servings of fruits and vegetables a day. Only 15% of families with children meet that recommendation (Lin, Guthrie, Frazao, 2001). These data agree with findings that convenience vetoes both cost and nutritious value when selecting foods (Information Resources, Inc., 2002; National Restaurant Association, 2000). In an environment where calorically dense, low nutrient food is easily accessible and physical activity has been engineered out of the lifestyle, weight gain is not a surprising consequence.

*Community Level Strategies to Address the Obesity Epidemic*

In order to reverse the obesity trend, we must create an environment that supports healthful behaviors. As Dr. Hans Hoogervorst of the World Health Organization stated, "We must make the healthy choice the easy choice" (2006). Home, family, school, and work environments, policies, communities, organizations, practices, and social norms all affect a person's choices and ability to live a healthy lifestyle. In order for changes in health behaviors to persist, physical and social environments that support healthful habits are required (McLeroy, Bibleau, Streckler, & Glanz (1988). Several multi-level, socioecological models have been proposed to address the many facets of successful behavior change and provide a framework to prevent and reverse the rising obesity trends. Figure 1,an example of one of these models, was presented by Caldwell et al. (2006) as part of North Carolina's 2007-2012 Plan to Prevent Overweight, Obesity, and Related Chronic Diseases. (insert Figure 1. here)

According to this model social norms and values, sectors of influence, behavioral settings, and individual factors all play an important role in determining behavior (Caldwell et al., 2006). The media has the potential to affect social norms with multi-media campaigns that promote healthy diets, appropriate portion sizes, and increased physical activity. Such campaigns can spark public interest and generate support for community policies that encourage healthful living. A review by Heath et al. (2006) found such community-wide campaigns to be an effective tool for increasing physical activity levels.

Various sectors of influence such as government, land use and transportation officials, and community and faith-based organizations can affect entire populations through policies and built environments that offer opportunities, support, and prompts for increased physical activity and healthy eating. For example, "The Bike Bill," passed by the Oregon legislature in 1971, has dramatically increased access to sidewalks and bike lanes throughout that state. This bill requires the inclusion of facilities for pedestrians and bicyclists wherever a road, street or highway is built or rebuilt in Oregon Department of Transportation cities and counties. These facilities must be located within the right-of-way

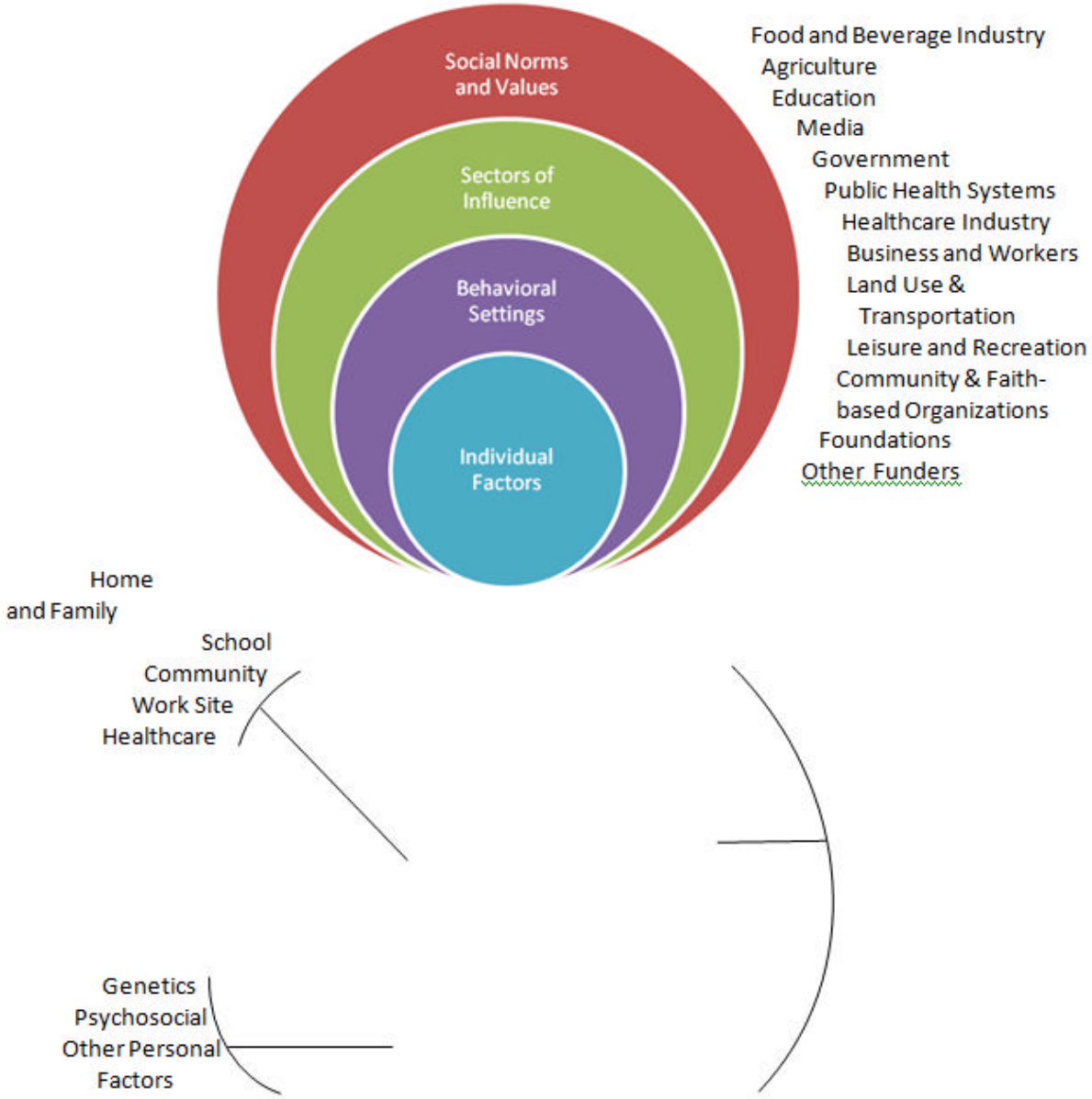


**Figure 1. A Framework to Prevent and Control Obesity** (Source: Caldwell, D., Dunn, C., Keene, A., Kolasa, K., Hardison, A., Lenihan, A., Nelson, S., Reeve, R., Ritzman, R., Sauer, M., Schneider, L., Thomas, C., Vodicka, S., 2006. *Eat Smart, Move More: North Carolina's Plan to Prevent Overweight, Obesity, and Related Chronic Disease*. Eat Smart Move More Leadership Team, Raleigh, NC.)

of public roads, streets or highways open to motor vehicle traffic. A literature review by Heath (2006) found other street-scale (e.g. improved street lighting, enhanced safety for pedestrian crossings, and improved aesthetics) and community-scale urban design and land use policies (e.g. zoning regulations and building codes) can also increase physical activity.

Access can be very influential for both physical activity and eating habits. For example, physical activity is associated with the proximity and density of activity settings in neighborhoods (Sallis, Bauman, & Pratt, 1998). Those living close to parks frequent parks more often and report greater physical activity levels (Centers for Disease Control and Prevention, 2001). Building new or improving existing places to be physically active has been found to increase the number of people exercising at least 3 days/week by over 25% (Centers for Disease Control and Prevention, 2001). Worksites offer an additional opportunity to reach large numbers of adults. Not only have worksite wellness programs been shown to have at least short-term effectiveness for improving employee fitness, they also benefit the employer by reducing absenteeism and employee turnover, and increasing productivity (Goetzel et al., 1998; Riedel, Lynch, Baase, Hymel, & Peterson, 2001). This can be a worthwhile investment, considering that the Duke Health and Safety Surveillance System demonstrated that severely overweight employees file double the workers' compensation claims, accumulate 7 times the medical claims cost, and miss 13 times the number of workdays than employees at a healthy body weight (Ostbye, Dement, & Krause, 2007).

Likewise, increasing access to healthy foods can increase consumption of fruits and vegetables. The Pilot Fruit and Vegetable Snack Project provided $6 million worth of free fruit and vegetable snacks to children at 107 schools across the country. Students ate 93% of servings offered (Buzby, Guthrie, & Kantor, 2003). Because supermarkets typically offer numerous healthy food choices at lower prices than smaller food stores (Sallis, Nadar,& Atkins, 1986; Kaufman, MacDonald, Lutz, & Smallwood, 1997), those residing in areas with supermarket access have lower risk for overweight and obesity, while the opposite is true for those living near convenient stores (Kaufman, MacDonald, Lutz, & Smallwood, 1997). Each additional neighborhood supermarket has been shown to increase fruit and vegetable consumption by 32% for African Americans, while increases of 11% have been found for Caucasian families (Moreland, Wing, & Diez-Roux, 2002).

Reports suggest that lower income neighborhoods, *those at greatest risk* for physical inactivity and obesity, *have the least access* to places to be physically active and purchase healthy foods (Weinberg, 1995; International City/County Management Association, 2005). Philadelphia, New York, and Chicago have addressed this issue by launching awareness campaigns and financing programs that offer tax incentives, grants, and loans to increase supermarkets in under-served areas. In Philadelphia this campaign captured local and state level attention and resulted in the creation of the Fresh Food Financing Initiative, which has committed over $27 million in grants and loans to fund 32 supermarkets in underserved areas (Giang, Karpyn, Laurison, Hillier, & Perry, 2008). Other options for increasing access to healthy foods include farmer's markets, Community Supported Agriculture (CSA farms), community or church gardens, and selling a wider range of foods in convenience stores. While community-level interventions involve cooperation and support from multiple partners (health professionals, urban planners, transportation officials, lawmakers, etc.) and there are many obstacles to overcome (the cost of remodeling existing communities, zoning regulations that do not support mixed land use, expense of changing streetscapes, garnering community support, etc.), it can be done. The environment must change to become one that supports healthful living if physical activity and healthy eating are to become lifestyle behaviors.

### *Individual Level Strategies to Address the Obesity Epidemic*

Effective weight reduction programs are needed to combat the current trends in obesity and reduce disease risks. While programs that result in significant weight loss are available to consumers, few have proven to provide long-term results. Participants of structured weight loss programs typically regain any weight that was lost within 5 years (Anderson, Backer, Stockholm, Quaade, 1984; Brownell & Jeffrey, 1987). Because behavioral approaches to weight loss typically involve lifestyle modification of behavior rather than a "quick fix", they may offer hope for more successful long-term weight loss.

Behaviorally-based programs typically involve a combination of any of the following strategies: self-monitoring, goal setting, modeling, stimulus control, cognitive-behavioral strategies, reinforcement control, and relapse prevention. These strategies are used to increase environmental stimuli for healthy eating and physical activity and decrease those that do not support healthy eating and physical activity. They represent the most tested and effective methods for treating obesity (Levy, Finch, Crowell, Talley, & Jeffrey, 2007).

### *Self-Monitoring*

Self-monitoring of physical activity, caloric intake, and weight is commonly included in behavioral weight loss programs for multiple reasons. It can aid in establishing baseline levels for target behaviors and then be used to assess client progress. Self-monitoring can also increase clients' awareness of their own eating and activity behaviors, identify problem behaviors to target, and identify environmental stimuli that contribute to overeating or decreased physical activity. For example, a client may discover that work travel increases her consumption of fast-food. She may then need to develop several strategies to avoid eating fast-food even when on the road (e.g. investing in a small cooler that would allow her to pack a lunch from home, identifying food establishments that offer healthy options located in the areas she travels, etc.). For these reasons, self-monitoring has been associated with successful weight loss (Baker & Kirschenbaum, 1998; Boutelle & Kischenbaum, 1998).

### *Goal Setting*

Goal setting can also enhance weight loss by providing direction, motivation and a sense of accomplishment upon meeting goals. Effective goals are reasonable, realistic, specific, measurable, challenging, not dependent upon another person, and include a time frame (Buckworth & Dishman, 2002). Realistic goals ensure that clients do not experience unnecessary failure and a resulting decrease in self-efficacy. Setting multiple small, realistic goals allows the multifaceted task of losing weight to be broken down into multiple, simple steps that seem more achievable. This follows the learning principle of successive approximation, or shaping (Catania, 1973). As time progresses, the goals become more challenging and complex until the target is reached.

### *Modeling*

Social modeling is another behavioral strategy that can enhance self-efficacy for weight loss. During modeling an individual observes another person performing the target behavior successfully. Models can be mastery models or coping models. A mastery model for someone desiring to lose weight may be an athlete or fashion model. A coping model is someone who had difficulty, but through coping strategies, was eventually able to perform the target behavior successfully (i.e. someone who was overweight at one time, but who now has a healthy body weight). Coping models and those similar to the client are generally more effective at increasing self-efficacy (Buckworth & Dishman, 2002).

### *Stimulus Control*

Stimulus control involves modifying cues, or antecedents that prompt a specific behavior. Cues can be cognitive (reading a post-it note reminding you to exercise), physiological (wanting to relieve stress), or external (a friend asking you to go get ice cream). Stimulus control attempts to strengthen cues that promote the target behavior and minimize cues for competing behaviors. For example, laying exercise clothes out before going to bed can serve as a cue to engage in physical activity the next morning. Cues are strengthened through repeated association with the desired behavior (Buckworth & Dishman, 2002). For example, exercising at 3:00pm every day strengthens that temporal cue to exercise. Time of day is often a temporal cue to eat, regardless of whether one is hungry. Weight loss interventions may also strive to make hunger a client's cue to eat, rather than time of day.

*Cognitive Behavioral Strategies*

Cognitive behavioral techniques are designed to teach individuals cognitive and behavioral skills that equip them to modify cues, reinforcing consequences, and maladaptive thoughts. Decision-balance and cognitive restructuring are examples. Decision balance involves constructing a list of expected positive and negative consequences of engaging in the target behavior. For example, a client may list the costs and benefits he associates with beginning a regular exercise program. This allows him to weigh items on the list and determine if he is ready to begin such an intervention. In addition the clinician can highlight any benefits of regular exercise that the client may have omitted from his list of pros and cons. Anticipated barriers or costs can be addressed and strategies can be developed to overcome them.

Cognitive restructuring involves identifying negative thoughts or self-talk and reframing those thoughts into something more positive that supports the target behavior. For instance, a client may get discouraged and think "I can never stick with an exercise program." That thought can be reframed into "I haven't maintained a regular exercise program yet." Personal thoughts or "self-talk" can either sabotage effort and minimize chances of success or be something motivational that facilitates changes (Head & Brookhart, 1997; Kearney & O'Sullivan, 2003). Asking clients to monitor their thought patterns before and after engaging in target behaviors can identify maladaptive thought patterns that need to be addressed.

*Reinforcement Control*

The rewards of weight loss may be slow or not easily recognized by the client (i.e. reductions in morbidity and mortality risks). Reinforcement control involves adding something positive (positive reinforcement) or removing something aversive (negative reinforcement) during or following the target behaviors that promote weight loss. This can provide an immediate reward to compensate for the immediate punishment associated with caloric restriction (i.e. increased time preparing food at home) or a new exercise program (i.e. sweating, sore muscles, gym fees, etc.). Reinforcing the actual behaviors that promote weight loss (i.e. engaging in physical activity, eating out less often, snacking less, etc.) rather than reinforcing the weight loss itself, will encourage the development of lifelong healthy habits. In addition, clients may become less discouraged once the rate of weight loss begins to slow.

Clinicians often outline reinforcement procedures in contingency contracts. Contingency contracts include a specific description of the target behavior, specific consequences for meeting and not meeting agreed upon criterion levels of the target behavior, and a time frame for completion of the objectives and delivery of the reinforcement. Past studies have documented the effectiveness of contingency contracting for increasing exercise behavior (Fitterling, Martin, Gramling, & Milan, 1988; Wysoki, Iwata, & Riordan, 1979; Aragona, Cassidy, & Drabman, 1975). Wysoki, Iwata, and Riordan (1979) employed contingency contracting to increase the exercise behavior of previously sedentary college students. Subjects deposited six valued personal items with the researchers and "earned them back" upon meeting the criterion level of exercise outlined in the contingency contracts. Such contracts allow the client to participate in creating the behavior program, can serve as references throughout the program, and make a formal commitment between the client and the clinician.

*Relapse Prevention*

Following behavioral treatment programs, steps must be taken to promote maintenance of weight loss. Perri, McAllister, Gange, Jordan, McAdoo, and Nezu (1988) investigated the effectiveness of four weight loss maintenance strategies. They compared: (a) behavior therapy alone (with no maintenance program), (b) behavior therapy plus a post-treatment therapy contact program, (c) behavior therapy plus a post-treatment therapist contact program plus a social support program, (d) behavior therapy plus a post-treatment therapist contact program plus an aerobic exercise program, and (e) behavior therapy plus a post-treatment therapist contact program plus a social support program plus an aerobic exercise program.

At an 18-month follow-up, participants in the behavior therapy plus post-treatment programs had maintained significantly greater weight loss than those in the behavior therapy alone group. Those who only received the behavior therapy had only maintained 33.3% of their weight loss, while those in the other groups maintained an average of 82.7%.

In order to promote maintenance another cognitive behavioral technique can be incorporated into a weight loss intervention. Relapse prevention involves identifying potential high-risk situations for relapse so that preventative measures can be taken. For example, if vacations or business trips are high risk situations because of lack of a readily available exercise facility, the client can attempt to stay at a hotel with an exercise gym, plan to walk around the terminal during layovers at airports, etc. Coping strategies can be developed in anticipation of typical relapse stimuli for exercise such as boredom, lack of time, laziness, vacation, and illness (Simkin and Gross, 1994). If one typically relapses during stressful, busy times such as the holidays, stress and time management skills can be learned to prepare for those seasons.

In addition, clients can learn to avoid "all-or-nothing" thought patterns. Just as with substance abuse treatment, a lapse can trigger an abstinence violation effect in weight loss clients (Jackicic, Wing, Butler, et al., 1995). Clients need to develop a constructive outlook on slips and learn that brief lapses are a normal part of the weight reduction process. Bjorvell and Rossner (1985) conducted an intensive 4-year obesity intervention where subjects received behavioral therapy twice weekly, relapse prevention training, a low calorie diet, exercise sessions 3 days/week, and healthy cooking classes. Almost all of the 107 subjects still experienced lapses during the treatment period. However at a 6-8 year follow-up, the subjects had on average maintained the intervention weight loss of 15 kg for women and 20 kg for men. This study highlights the importance of lengthy treatment periods as well as the fact that lapses are inevitable and will not preclude successful maintenance with appropriate coping strategies.

### *Application of Behavioral Strategies to the Treatment of Childhood Overweight*

These same behavioral treatment strategies have also proven effective for treating childhood overweight (Haddock, Shadish, Kleges, & Stein, 1994). However, childhood overweight needs to be treated at the family level since children's environments are largely influenced by their parents' decisions and behaviors. A meta-analysis of 16 childhood overweight interventions comparing 44 treatment and control groups found that family-behavioral treatments were the most effective (Young, Northern, Lister, Drummond, & O'Brien, 2006). The family-behavioral treatment groups yielded a large mean effect size of -0.89, "other" treatments yielded a moderate mean effect size of -0.52, and the control groups produced a small mean effect size of -0.18. A family approach may encourage parents to limit time their children spend in sedentary activities like watching TV, establish consistent meal and snack times, remove tempting foods from the home, and model healthy behaviors.

### *Application of Stage Theories to Behaviorally-based Weight Loss Interventions*

The effectiveness of behavioral strategies can be enhanced by application during an appropriate stage of the behavior change process. Stage theories assign every individual to a given stage or category throughout the behavior change process. The stage theory that is predominantly applied to physical activity behavior is the Transtheoretical Model of Behavior Change. Developed in the late 1970s by Prochaska and DiClemente, this model was initially applied to addictive health behaviors such as cigarette smoking. However, by the early 1990s, Marcus and others were applying this model to exercise behavior (Marcus, Selby, Niaura, & Rossi, 1992; Marcus and Simpkin, 1993) and it has more recently been applied to weight loss intention (Hawkins, Hornsby, & Schorling, 2001; Andrés, Saldaña, & Gómez-Benito, 2009).

Stage of change refers to the temporal aspect of adopting and maintaining a target behavior. One can progress or regress through stages of behavior change. Those belonging to the same stage have similar characteristics, such as readiness to change the target behavior. According to the Transtheoretical Model, the first stage of change is the precontemplation stage. Those belonging to this stage are not currently engaging in the target behavior and have no desire to begin doing so within the next six months. At this point, the perceived costs of engaging in the target behavior (i.e. eating meals prepared away form home less frequently or exercising) outweigh the benefits. Those in the contemplation stage are not currently engaging in the target behavior, but wish to start within the next six months. The preparation stage is characterized by participation in the target behavior at a level below a given criterion (i.e. engaging in 10 minutes of physical activity/day rather than meeting the goal level of 30 minutes/day), and a desire to increase to the criterion level of behavior within the following thirty days. Those in the action phase are active at the criterion level, but have not yet sustained this level of activity for six months. Although perceived benefits outweigh the costs of engaging in the target behavior, this stage poses the greatest threat of relapse. Once clients have been engaging in the target behavior regularly for six months, they progress to the maintenance stage where the risk of relapse declines.

Interventions based on the Trantheoretical Model are dynamic, applying specific strategies as clients move through the different stages of change. For example, a decision balance and evaluation of perceived barriers may be beneficial during the contemplation stage. Self-monitoring and goal setting may be more appropriate for those in the preparation stage. Marcus et al. (1998) demonstrated the importance of matching strategies with stage of change in regards to exercise behavior when they compared the effectiveness of two worksite-based interventions involving 1,559 employees. Employees who received educational materials appropriate to their stage of change reported greater exercise participation and were more likely to have progressed to the next stage during the 3 month assessment period than employees who received standard self-help materials. Thus stage theories, in accordance with the typical individualized nature of behavioral interventions, highlight the importance of applying strategies at appropriate phases during the behavior change process.

## *Conclusion*

The majority of Americans are currently overweight or obese. These conditions have serious health and economic ramifications. Numerous environmental changes must now be made to reverse the trend. While behavioral strategies have proven very effective at promoting individual health behavior changes, they represent one step toward reversing the trend. Family, school, and work environments; organizations; policies; and communities must all support and sustain healthful behavior. Supportive environments allow individual behavior changes to survive and morph into lifelong habits.

## References

American Academy of Pediatrics. (2003). Prevention of pediatric overweight and obesity. *Pediatrics, 112,* 424-430.

American College of Sports Medicine. (2006). ACSM's Guidelines for Exercise Testing and Prescription. (7 ed.). Baltimore: Lippincott, Williams, & Wilkins.)

Anderson T, Backer OG, Stockholm KH, Quaade F. (1984). Randomized trial of diet and gastroplasty with diet alone in morbid obesity. *New England Journal of Medicine, 310*:352–6.

Andrés A, Saldaña C, & Gómez-Benito J. (2009). Establishing the stages and processes of change for weight loss by consensus of experts. *Obesity*, in press. Epub ahead of print abstract retrieved July 14, 2009 from http://www.ncbi.nlm.nih.gov/pubmed/19360014?ordinalpos=2&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum.

Aragona, J., Cassady, J., & Drabman, R.S. (1975). Treating overweight children through parental training and contingency contracting. *Journal of Applied Behavior Analysis, 8,* 269-278.

Baker, R.C., & Kirschenbaum, D.S. (1998). Weight control during the holidays: Highly consistent self-monitoring as a potentially useful coping mechanism. *Health Psychology, 17,* 367-370.

Besser, L.M. & Dannenberg, A.L. (2005). Walking to public transit: steps to help meet physical activity recommendations. *American Journal of Health Promotion, 29*, 273–280.

Birch, L.L., & Deysher, M. (1986). Caloric compensation and sensory specific evidence for self-regulation of food intake by young children. *Appetite, 7,* 323-331.

Bjorvell, H., & Rossner, S. (1985). Long term treatment of severe obesity: four year follow up of results of combined behavioural modification programmer. *British Medical Journal, 291,* 379-382.

Bouchard, C., Shephard, R., & Stephens, T. (1994). Consensus statement. In. C. Bouchard, R. Shephard, & T. Stephens (Eds.), *Physical activity, fitness, and health: International proceedings and consensus statement* (p. 9-76). Champaign, IL: Human Kinetics Books.

Boutelle, K.N., & Kirschenbaum, D.S. (1998). Further support for consistent self-monitoring as a vital component of successful weight control. *Obesity Research, 6,* 219-224.

Brownell KD, Jeffrey RW. (1987). Improving long-term weight loss: pushing the limits of treatment. *Behavior Therapy 18,* 353–74.

Brownson, R.C., Baker, E.A., Houseman, R.A., Brennan, L.K., Bacack, S.J. (2001). Environmental and policy determinants of physical activity in the United States. *American Journal of Public Health, 91,* 1995-2003.

Buckworth, J. and Dishman, R.K. (2002). *Exercise Psychology*. Champaign, IL: Human Kinetics.

Burgeson, C.R., Wechsler, H., Brener, N.D., Young, J.C., & Spain, C.G. (2001). Physical education and activity: Results from the school health policies and programs study 2000. *Journal of School Health, 71 (7),* 279-293.

Buzby, J.C., Guthrie, J.F., & Kantor, L.S. (2003). Evaluation of the USDA fruit and vegetable pilot program: Report to congress. Washington, D.C.: USDA Economic Research Service.

Caldwell, D., Dunn, C., Keene, A., Kolasa, K., Hardison, A., Lenihan, A., Nelson, S., Reeve, R., Ritzman, R., Sauer, M., Schneider, L., Thomas, C., Vodicka, S., 2006. *Eat Smart, Move More: North Carolina's Plan to Prevent Overweight, Obesity, and Related Chronic Disease.* Eat Smart Move More Leadership Team, Raleigh, NC.

Catania, A.C. (1973). The Nature of Learning. In J.A. Nevin, G.S. Reynolds (Eds.). *The study of behavior: Learning, motivation, emotion, and instinct (31-68).* Glenview: Scott Foresman.

Centers for Disease Control and Prevention. (2001). *Increasing physical activity: A report on recommendations of the task force on community preventive services* (p.1).

Dietz, W.H., & Gortmaker, S.L. (1985). Do we fatten our children at the television set? Obesity and television viewing in children and adolescents. *Pediatrics, 91,* 807-812.

Egger, G., & Swinburn, B. (1997). An "ecological" approach to the obesity pandemic. *British Journal of Medicine, 315,* 477-480.

Epstein, L.H., & Wing, R.R. (1987). Behavioral Treatment of Childhood Obesity. *Psychological Bulletin, 101*, 331-342.

Ewing, R., Pendall, R., & Chen, D. (2002). *Measuring sprawl and its impact: The character and consequences of metropolitan expansion*. Retrieved from Smart Growth America: http://www.smartgrowthamerica.org/sprawlindex/sprawlreport.html.

Ferster, C.B., Nurnberger, J.I., Levitt, E.B. (1962). The control of eating. *Journal of Mathetics,* 1, 87-109.

Fisher, J.O., Rolls, B.J., & Birch, L.L. (2003). Children's Bite size and intake of an entrée are greater with larger portions than with age-appropriate or self-selected portions. *American Journal of Clinical Nutrition, 77,* 1164-1170.

Fitterling, J. M., Martin, J. E., Gramling, S., Cole, P., & Milan, M. (1988). Behavioral management of exercise training in vascular headache patients: An investigation of exercise adherence and headache activity. *Journal of Applied Behavior Analysis, 21,* 9-19.

Flegal, K.M., Carroll, M.D., Ogden, C.L., Johnson, C.L. (2002). Prevalence and trends in obesity among U.S. adults 1999-2002. *Journal of the American Medical Association, 288*, 1723-1727.

Frazao, E. (1999). High costs of poor eating patterns in the United States. In E. Frazao (ed.). *America's Eating Habits: Changes and Consequences (p.5-32)*. Washington, D.C.: Economic Research Service, USDA.

French, S.A., Story, M., & Jeffery, R.W. (2001). Environmental influences on eating and physical activity. *Annual Review of Public Health, 22,* 309-335.

Giang, T., Karpyn, A., Burton, L.H., Hillier, A., & Perry, R.D. (2008). Closing the grocery gap in underserved communities: The creation of the Pennsylvania fresh food financing initiative. *Journal of Public Health Management and Practice, 14, (3),* 272-279.

Goetzel, R.Z., Anderson, D.R., Whitmer, R.W., Ozminkowski, R.J., Dunn, R.L., & Wasserman, J. (1998). The relationship between modifiable health risksand health care expenditures. An analysis of the multi-employer HERO health risks and costs database. *Journal of Occupational and Environmental Medicine, 40 (10),* 843-854.

Gortmaker, S.L., Dietz, W. & Sobol, A. (1987). Increasing pediatric obesity in the United States. *American Journal of the Disabled Child, 141,* 535-540.

Gortmaker, S.L., Must, A., Perrin, J.M., Sobol, A.M., & Dietz, W.H. (1993). Social and economic consequences of overweight in adolescence and young adulthood. *New England Journal of Medicine, 329,* (14), 1008-1012.

Guthrie, J.F., Lin, B.H., & Frazao, E. (2002). Role of food prepared away from home in the American diet, 1977-78 versus 1994-96: Changes and consequences. *Journal of Nutrition Education and Behavior, 34,* 140-150.

Haddock, C.K., Shadish, W.R., Kleges, R.C., & Stein, R.J. (1994). Treatments for Childhood and Adolescent Obesity. *Annals of Behavioral Medicine: A Publication of the Society of Behavioral Medicine, 16,* 235-244.

Hawkins, D.S., Hornsby, P.P., & Schorling, J.B. (2001). Stages of change and weight loss among rural African American women. *Obesity Research,* 1, 59-67.

Head, S. & Brookhart, A. (1997). Lifestyle modification and relapse-prevention training during treatment for weight loss. *Behavior Therapy, 28,* (2) 307-321.

Heath, G.W., Brownson, R.C., Kruger, J., Miles, R., Powell, K.E., Ramsey, L.T., & the Task Force on Community Preventive Services. (2006). The effectiveness of urban design and land use and transport policies and practices to increase physical activity: A systematic review. *Journal of Physical Activity and Health, 3, S1,* S55-S76.

Hedley, A.A., Ogden, C.L., Johnson, C.L., Carroll, M.D., Curtin, L.R., & Flegal, K.M. (2004). Prevalence of overweight and obesity among US children, adolescents, and adults 1999-2002. *Journal of the American Medical Association, 291*, 2847-2850.

Hill, J.O., Wyatt, H.R., Reed, G.W., Peters, J.C. (2003). Obesity and the environment: Where do we go from here? *Science, 299,* 853-855.

Hoogervorst, H. (2006). *What we must do: Five views from the front.* Retrieved from World Health Organization: http://www.euro.who.int/features/2006/featureobe06/20060804_4.

House Select Committee on Hunger. (1990). *Food Security in the United States, Committee Report*. Washington, D.C.: U.S. Government Printing Office.

Hu, P.S., & Reuscher, T.R. (2004). *Summary of travel trends: 2001 national household travel survey.* Retrieved from USDOT Federal Highway Administration: http://nhts.ornl.gov/2001/pub/STT.pdf.

Huttenun, N., Knip, M., & Paavilainen, T. (1986). Physical activity and fitness in obese children. *International Journal of Obesity*, 10, 519-525.

Information Resources Inc. (2002). What do Americans really eat? Retrieved from: http://www.infores.com/.

Jakicic, J.M., Wing, R.R., Butler, B.A., and Robinson, R.J. (1995). Prescribing exercise in multiple short bouts versus one continuous bout: Effects on adherence, cardiorespiratory fitness, and weight loss in overweight women. *International Journal of Obesity and Related Metabolic Disorders, 19,* 93-901.

Kahn, E., Ramsey, L., Brownson, R., Heath, G., Howze, E., Powell, K., Stone, E., Rajab, M., & Corso, P. (2002). The effectiveness of interventions to increase physical activity: A systematic review. *American Journal of Preventive Medicine*, *22*, (4), 73-107.

Kaufman, P.R., MacDonald, J.M., Lutz, S.M., & Smallwood, D.M. (1997). Do the poor pay more for food? Item selection and price differences affect low-income household food costs. AER-759, 1-32. Food and Rural Economics Divisions, Economic Research Service, U.S. Department of Agriculture, Agricultural Economic Report No. 759, Washington, D.C.

Kearney, M.H. & O'Sullivan, J. (2003). Identity shifts as turning points in health behavior change. *Western Journal of Nursing Research, 25* (2), 134-152.

Klesges, R.C., Shelton, M.L., Klesges, L.M. (1993). Effects of television on metabolic rate: Potential implications for childhood obesity. *Pediatrics, 91,* 281-286.

Koplan, J., Liverman, C., & Kraak, V. (2005). Preventing childhood obesity: Health in the balance: Executive summary. *Journal of the American Dietetic Association, 105,* 131-138.

Ledikwe, J.H., Ello-Martin, J.A., & Rolls, B.J. (2005). Portion sizes and the obesity epidemic. *Journal of Nutrition, 135*, 905-909.

Lenfant, C. (1992). Physical activity and cardiovascular health: Special emphasis on women and youth. Medicine and Science in Sports and Exercise, 24, S191-195.

Levine, J.A., Miller, J.M. (2007). The energy expenditure of using a "walk-and-work desk" for office workers with obesity. *British Journal of Sports Medicine, 41,* 558-561.

Levine, J.A., Vander Weg, M.W., Hill, J.O., & Klesges, R.C. (2006). Non-exercise activity thermogenesis: the crouching tiger hidden dragon of social weight gain. *Arteriosclerosis, Thrombosis, and Vascular Biology, 26,* 729-736.

Levy, R.L., Finch, E.A., Crowell, M.D., Talley, N.J., & Jeffrey, R.W. (2007). Behavioral Intervention for the Treatment of Obesity: Strategies and Effectiveness Data. *American Journal of Gastroenterology, 102,* 2314-2321.

Lin, B.H., Frazao, E., & Guthrie, J. (1999). Away-from-home foods increasingly important to quality of American diet. Economic Research Service/USDA. Agriculture Information Bulletin No. 749.

Lin, B.H., Guthrie, J, & Frazao, E. (2001). American children's diets are not making the grade. *Food Review, 24 (2),* 8-17.

Mahar, M.T., Murphy, S.K., Rowe, D.A., Golden, J., Shields, A.T., Raedeke, T.D. (2006). Effects of a Classroom-Based Program on Physical Activity and On-Task Behavior. *Medicine & Science in Sports & Exercise, 38*(12):2086-2094.

Marcus, B. H., Emmons, K. M., Simkin-Silverman, L. R., Linnan, L. A., Taylor, E. R., Bock, B. C., Roberts, M. B., Rossi, J. S., & Abrams, D. B. (1998). Evaluation of motivationally tailored vs. standard self-help physical activity interventions at the workplace. *American Journal of Health Promotion*, *12*, 246-253.

McCrory, M.A., Fuss, P.J., Hays, N.P., Vinken, A.G., Greenberg, A.S., and Roberts, S.B. (1999). Overeating in America: Association between restaurant food consumption and body fatness in healthy adult men and women. *Obesity Research, 7 (6),* 564-571.

McLeroy, K.R., Bibleau, D., Streckler, A., & Glanz, K. (1988). An ecological perspective on health promotion programs. *Health Education Quarterly, 15,* 351-378.

Mooibroek, M.J. (2001). Community framework for the prevention of obesity subproject c: Strategies and framework. *Candian Steering Committee for Community Framework for the Prevention of Obesity,* Ottawa, Canada.

Moreland, K., Diez-Rouz, A.V., & Wing, S. Supermarkets, other food stores, and obesity. *American Journal of Preventive Medicine, 30,* 333-339.

Moreland, K, Wing, S., & Diez-Roux, A. (2002). The contextual effect of the local food environment on residents' diets: the atherosclerosis risk in communities study. *American Journal of Public Health, 92,* 1761-1767.

Must, A., Spadano, J., Coakley, E.H., Field, A.E., Colditz, G., & Dietz, W.H. (1999). The disease burden associated with overweight and obesity. *Journal of the American Medical Association, 282,* 1523-1529.

National Health and Medical Research Council. (1997). Acting on Australia's weight: A strategic plan for the prevention of overweight and obesity. Springfield, New South Wales, Australia.

National Restaurant Association. (2000). Restaurant Industry Pocket Factbook. Retrieved from: http://www.restaurant.org/research/pocket/index.htm.

Nestle, M. (2000). Soft drink "pouring rights": Marketing empty calories. *Public Health Reports, 115,* 308-319.

Office of the U.S. Surgeon General. (2000). The Surgeon General's Call To Action To Prevent and Decrease Overweight and Obesity. Retrieved from: http://www.surgeongeneral.gov/topics/obesity/calltoaction/1_3.htm.

Ogden, C.L., Carroll, M.D., Curtin, L.R., McDowell, M.A., Tabak, C.J., & Flegal, K.M. (2006). Prevalence of overweight and obesity in the United States, 1999-2004. *Journal of the American Medical Association, 295,* 1549-1555.

Ostbye, T., Dement, J.M., & Krause, K.M. (2007). Obesity and workers' compensation: Results form the duke health and safety surveillance system. *Archives of Internal Medicine, 167,* 766-773.

Perri, M.G., McAllister, D.A., Gange, J.J., Jordan, R.C., McAdoo, W.G., & Nezu, A.M. (1988). Effects of four maintenace programs on the long-term management of obesity. *Journal of Consulting and Clinical Psychology, 56,* 529-534.

Philipson, T.J., & Posner, R.A. (2003). The long-run growth in obesity as a function of technological change. *Perspectives in Biology and Medicine, 46,* S87-S107.

Prevention Institute for the Center for Health Improvement. Supermarket access in low-income communities. Retrieved from: http://www.preventioninstitute.org/pdf/CHI_Supermarkets.pdf.

Putnam, J., & Allshouse, J. (1996). Food consumption, prices, & expenditures. Statistical Bulletin 928: U.S. Department of Agriculture, Economic Research Service.

Putnam J., & Gerrior, S. (1999). Trends in the U.S. food supply, 1970-1997. In E. Frazao (ed.). *America's Eating Habits: Changes and Consequences (133-159).* Washington: USDA.

Rideout, V.J., Foehr, U.G., Roberts, D.F., & Brody, M. (1999). *Kids and media at the new millennium.* Retrieved from Kaiser Family Foundation: http://www.kff.org/entmedia/1535-index.cfm.

Riedel, J., Lynch, W., Baase, C., Hymel, P., & Peterson, K.W. (2001). The effect of disease prevention, and health promotion on workplace productivity: a literature review. *American Journal of Health Promotion, 15 (3),* 167-191.

Rolls, B.J. (1986). Sensory specific satiety. *Nutrition Reviews, 44,* 93-101.

Rolls, B.J. (2003). The supersizing of America: Portion sizes and the obesity epidemic. *Nutrition Today, 38,* 42-53.

Rolls, B.J., Engall, D., & Birch, L.L. (2000). Serving portion size influences 5-year-old but not 3-year-old children's food intakes. *Journal of the American Dietetic Association, 100,* 232-234.

Saelens, B.E., Sallis, J.F., & Frank, L.D. (2003) Environmental correlates of walking and cycling: Findings from the transportation, urban design, and planning literatures. *Annals of Behavioral Medicine, 25,* 80-91.

Sallis, J.F., Bauman, A., & Pratt, M. (1998). Environmental and policy interventions to promote physical activity. *American Journal of Preventive Medicine, 15,* 379-397.

Sallis, J.F., Nadar, R., & Atkins, J. (1986). San Diego surveyed for heart healthy foods and exercise facilities. *Public Health Report, 101,* 216–218.

Simkin, L.R. & Gross, A.M. (1994). Assessment of coping with high risk situations for exercise relapse among healthy women. *Health Psychology, 13,* 274-277.

Smiciklas-Wright, H., Mitchell, D.C., Mickle, S.J., Goldman, J.D., & Cook, A. Foods commonly eaten in the United States, 1989-1991 and 1994-1996: Are the portion sizes changing? *Journal of the American Dietetic Association, 102,* 41-47.

Stuart, R.B. (1967). Behavioral Control of Overeating. *Behavioral Research Therapy, 5,*357-365.

Surface Transportation Policy Partnership. (2003). Americans' attitudes towards walking and creating better walking communities. Retrieved from http://www.transact.org/report.asp?id=205/.

The Keystone Center. (2006). The Keystone Forum on Away-From-Home Foods: Opportunities for Preventing Weight Gain and Obesity. Retrieved from: http://www.keystone.org/about-us/publications.

U.S. Bureau of the Census. (1998). Measuring 50 years of economic change using the march current population survey, current population reports, P60-203, Washington D.C.:U.S. Government Printing Office.

U.S. Bureau of the Census. (2006). Statistical Abstract of the United States, Section 24: Communications and information technology (p.736, Table 1116).

U.S Department of Health and Human Services. (1996). *Physical activity and health: A report of the surgeon general.* Atlanta, GA: Centers for Disease Control and Prevention, National Center for Chronic Disease prevention and Health Promotion.

U.S Department of Health and Human Services. (2000). *Healthy People 2010.* Conference ed. 2 vols. Washington D.C.: U.S. Department of Health and Human Services.

U.S Department of Transportation, Federal Highway Administration. (1995). National personal transportation survey. Retrieved from Oak Ridge NationalLaboratory: http://nhts.ornl.gov/.

U.S Department of Transportation, Federal Highway Administration, Office of Highway Policy Information. www.fhwa.dot.gov/.

Veerman, J.L., Barendregt, J.J., van Beeck, E.F., Seidell, J.C., & Mackenbach, J.P. (2007). Stemming the obesity epidemic: a tantalizing prospect. *Obesity, 15,* 2365-2370.

Wadden, T.A., Crerand, C.E., & Brock, J. (2005). Behavioral Treatment of Obesity. *Psychiatric Clinics of North America, 28,* 151-170.

Weinberg, Z. (1995). *No Place to Shop: The Lack of Supermarkets in Low-Income Neighborhoods.* Washington, DC: Public Voice for Food and Health Policy, 3.

White, Joseph B. (2008, Feb. 5). The next car debate: Total miles driven. *The Wall Street Journal.*

Wing, R.R. (1998). Behavioral Approaches to the Treatment of Obesity. In G.A. Bray, C. Bouchard, W.P.T. Jampes (Eds.). *Handbook of Obesity (855-873).* New York: Marcel Dekker.

Wysocki, T., Hall, G., Iwata, B, & Riordan, M. (1979). Behavioral management of exercise: Contracting for aerobic points. *Journal of Applied Behavior Analysis, 12,* 55-64.

Young, K.M., Northern, J.J., Lister, K.M., Drummond, J.A., & O'Brien, W.H. (2007). A meta-analysis of family-behavioral weight-loss treatments for children. *Clinical Psychology Review, 27,* 240-249.

Young, L.R., & Nestle, M. (2002). The contribution of expanding portion sizes to the U.S. obesity epidemic. *American Journal of Public Health, 92,* 246-249.

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