AJCN. First published ahead of print December 16, 2008 as doi: 10.3945/ajcn.2008.26566.

Special Task Force Report

Can a small-changes approach help address the obesity epidemic? A report of the Joint Task Force of the American Society for Nutrition, Institute of Food Technologists, and International Food Information Council[1,2]

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ABSTRACT

The continued rise in obesity rates in most countries suggests that current programs and initiatives designed to combat obesity have not been successful in reversing the obesity epidemic. Obesity rates are increasing because of a gradual weight gain in most populations. There has been little long-term success in treating established obesity through lifestyle change, perhaps because of the large permanent changes in diet and physical activity required to keep weight off. An alternative strategy to address the obesity epidemic involves not focusing on weight loss but promoting small changes in diet and physical activity to initially prevent further weight gain. With the use of this strategy, obesity rates could first be stabilized in most populations and then, over time, decrease gradually. Supporting data show that small reductions in conscious energy intake and increases in physical activity can reduce excessive weight gain. The opportunity exists to use the small-changes approach to bring different stakeholders together to create a national initiative to address the global epidemic of obesity. The Joint Task Force of the American Society for Nutrition, Institute of Food Technologists, and International Food Information Council believe that a small-changes framework, aimed at helping people make conscious small changes in lifestyle behaviors, in combination with efforts by the private sector to gradually ''ratchet down'' some of the environmental factors that have contributed to excessive energy intake and the declining rates of physical activity, can be successful in reducing obesity rates. Such an initiative would benefit from the support of educational and social marketing campaigns developed with governmental input and support. *Am J Clin Nutr* 2009;89:1–8.

INTRODUCTION

Obesity is already recognized as one of the most serious public health issues in the world (1, 2) and will likely get worse because obesity rates are continuing to increase in most countries (3, 4). Moreover, increases in weight appear to affect all populations. A comparison of the US body mass index (BMI; in kg/m^2) distribution in 1976–1980 with that in 2005–2006 (**Figure 1**), indicates that the latter distribution is shifted to the right, which indicates that body weight and BMI are increasing in the entire population (5).

There is little disagreement about the urgent need to address the global epidemic of obesity. However, despite heightened awareness of the problem and many suggestions on how obesity can be reduced (1, 6–8), there has been no real long-term success in tackling this public health problem. This lack of long-term success is due in part to the difficulty many people have in maintaining healthy dietary and physical activity patterns in an environment that discourages physical activity and encourages excessive energy consumption (9–11). In fairness, it is possible that some existing initiatives have had some success over longer periods of time.

On an individual level, treating established obesity through lifestyle modification has proven to be extremely difficult (12), and those few who do succeed have had to make dramatic changes in their diet and physical activity patterns (13). Most people who achieve weight loss through lifestyle modification regain most of the weight lost over time (12, 14).

On a population level, efforts have been directed toward either producing weight loss or preventing those who are not obese from becoming obese. Even though population efforts aim for smaller behavioral changes, there is little indication that these efforts have produced any sustainable changes. Given the complexity of the situation and the many factors promoting weight gain in the population, many consider the situation to be hopeless and predict that most of the population will eventually become obese (15).

In 2003, Hill et al (11) published an article in *Science* suggesting a paradigm shift in prioritizing strategies to reverse the global epidemic of obesity. These authors suggested that efforts should be focused first on promoting small lifestyle changes and not on producing weight loss or preventing obesity but on eliminating or reducing the gradual excessive weight gain that is occurring in people of all ages. Over time, such efforts can lead to observable reductions in obesity rates. Although previous efforts at promoting small behavioral changes have been made,

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doi: 10.3945/ajcn.2008.26566.

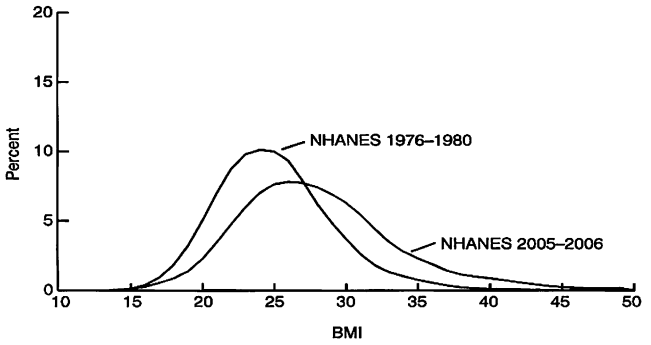

FIGURE 1. Distribution of BMI for 1976–1980 and for 2005–2006 from the National Health and Nutrition Examination Survey (NHANES). The latter distribution is shifted to the right, which indicates an increase in BMI across the population. The data are available at http://www.cdc.gov/nchs/nhanes.htm.

this article is the first to suggest that a comprehensive approach involving small changes in both diet and physical activity can be effective at addressing the global epidemic of obesity.

RATIONALE FOR CONSIDERING A SMALL-CHANGES APPROACH TO ADDRESSING OBESITY

A task force consisting of members of the American Society for Nutrition, the Institute of Food Technologists, and the International Food Information Council was established to consider whether a small-changes approach could be useful in addressing obesity. This 17-member task force met in person and by telephone to review data and to evaluate the small-changes approach.

There are several reasons why a small-changes approach might be an effective way to address the obesity epidemic.

1) Small changes are more feasible to achieve and maintain than are large changes. Hill et al (11) argued that given human biology and the external food and physical activity environment in the United States, it is difficult to sustain the large behavioral changes required to achieve reductions in body weight by those who were already overweight or obese. The authors argued that small lifestyle changes, such as 2000 more steps of walking (which would burn ≈100 kcal) and simple food substitutions, such as a diet soda for a regular soda [saving ≈150 kcal per 12-oz (340.2 g) serving] would be more sustainable than efforts to achieve the larger changes in diet and physical activity required for permanent weight-loss maintenance. This is not to say that small lifestyle changes will have a greater impact on body weight than will smaller ones but rather that small sustainable changes are better than larger ones that cannot be sustained.

2) Even small changes can have an important impact on body weight regulation. Small changes in diet and/or in physical activity, which might still fall short of optimal diet and physical activity recommendations, might be sufficient to stop the gradual weight gain of individuals and populations. Hill et al (11) made this argument based on their analysis showing that most of the US adult population gradually gains weight over time because of, on average, a very slight average daily discrepancy between energy intake and energy expenditure. This "energy gap" could be eliminated with very small daily behavioral changes resulting in increases in energy expenditure and decreases in energy intake of ≈100 kcal/d. The energy gap was estimated from the average weight gain in US adults, which was determined, using longitudinal and cross-sectional weight data, to be ≈0.4–0.9 kg/y. This gain would result from an average accumulation of body energy of ≈15 kcal/d. The authors assumed that excess energy intake is stored with 50% efficiency (a very conservative assumption), so that the average energy gap in the population is 30 kcal/d. The average accumulation of excess energy at the 90th percentile for weight gain was 50 kcal, producing an energy gap of 100 kcal/d.

3) Achieving small lifestyle changes could lead to increased self-efficacy and could stimulate people to make additional small changes. Thus, the small-changes approach could be the start of a process that could ultimately lead to larger changes.

4) The small-changes approach can be applied to reduce environmental forces that promote increases in energy intake and decreases in physical activity. The environmental situation thought to promote obesity did not develop overnight and will not be reversed immediately. A small-changes approach could be used to lessen, over time, the environmental pressures toward obesity.

5) The small-changes approach could be a unifying platform to allow the public and private sectors to work together to address obesity. This platform would not focus on blame to existing forces, but rather would provide credit for making positive changes, regardless of the starting point. For example, a food company would not be evaluated on the "healthiness" of their current products but rather would be given credit for positive changes in their product offerings.

Since the publication of the *Science* article, the small-changes approach has been widely embraced. For example, the US Department of Health and Human Services launched a small-changes initiative that included television and radio commercials and a website (www.smallstep.gov; accessed 13 October 2008). The small changes message was promoted by the US Surgeon General (www.surgeongeneral.gov/priorities/prevention; accessed 1 December 2008). A nonprofit initiative, America On the Move (www.americaonthemove.org; accessed 13 October 2008), was formed to promote the small-changes approach to modifying diet and physical activity. Through its Partner with My Pyramid Corporate Challenge, the US Department of Agriculture enlisted 81 companies to make product, packaging, and promotion changes to help consumers make small changes consistent with the Dietary Guidelines (www.MyPyramid.gov; accessed 2 December 2008). Groups such as the American Diabetes Association, the American Heart Association, and the American Cancer Society recommend the small-changes approach, as do many other public health organizations.

The food industry has embraced the small-changes approach by addressing portion size. Offering snacks in 100-kcal packages has become extremely popular and is based on research showing slightly higher energy intakes when food is presented in large rather than small portions, although the impact of packaging snacks in smaller portions on energy intake of the population is yet unclear.

In short, the small-changes strategy is increasingly being embraced by many of those interested in addressing the obesity epidemic. The purpose of this article is to evaluate the scientific evidence supporting the feasibility and effectiveness of this strategy for addressing the global epidemic of obesity. An additional intent is to consider how this approach could be used in modifying environmental determinants of energy intake and physical activity. In this review, we consider the following specific questions:

1) Can the energy gap help in developing strategies to address obesity?

2) Is there evidence to suggest that a small-changes approach can be effective at reducing or stabilizing obesity rates?

3) Has the small-changes approach been used successfully to reduce or prevent excessive weight gain?
4) Can the small-changes approach be used to change environmental determinants of obesity?
5) Can the small-changes approach serve as the foundation for a national campaign to address obesity?

CAN THE ENERGY GAP HELP IN DEVELOPING STRATEGIES TO ADDRESS OBESITY?

Hill et al (11) defined the energy gap for preventing weight gain as the average difference between energy intake and energy expenditure of the population or of an individual that leads to weight gain over time. This energy gap is the level of energy intake above energy expenditure that is causing weight gain. For example, an extra 15 kcal/d will not lead to continued weight gain over time, whereas an extra 15 kcal/d above energy expenditure will. This energy gap is small (median: ≈15 kcal/d) and is in contrast with the energy gap that is created by cumulative weight gain leading to obesity. The energy gap provides an estimate of the degree of behavioral change that would be required to achieve a specific weight outcome. For example, the energy gap required for an obese individual to return to a healthy BMI would be large (16). This is because there is a cumulative increase in body weight as obesity progresses, which leads to increased energy costs. The energy gap for preventing weight gain is small because it estimates the degree of behavioral change required to not gain any additional weight, regardless of whether the person is lean, overweight, or obese.

The energy gap for weight loss can also be estimated. Energy requirements are higher in the obese, but decline with weight loss because of declines in resting energy expenditure and reductions in the energy cost of physical activity (17). The energy gap required to produce and maintain weight loss would be significantly larger than the energy gap required to prevent weight gain. We used data obtained in a whole-room calorimeter (JO Hill, HR Wyatt, unpublished observations, June 2007) to estimate that the energy gap to maintain a 9–14-kg weight loss in obese subjects would be ≈175–250 kcal/d and that the energy gap to maintain an 18–27-kg weight loss would be 325–480 kcal/d (**Figure 2**). This large energy gap created by weight loss illustrates why large behavioral changes are required to achieve and maintain reductions in body weight in obese individuals. It

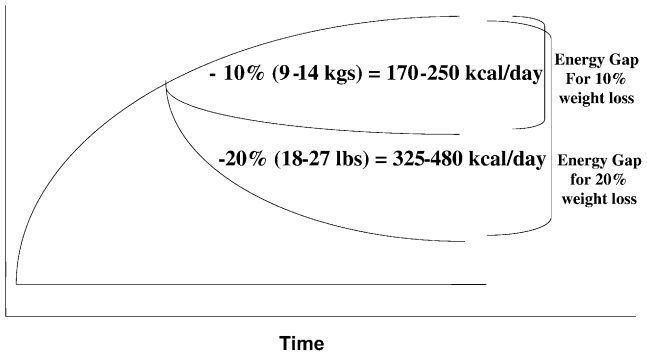

FIGURE 2. Estimates of the energy gap for weight losses of 10% and 20%. A reduction in body weight of ≈10% in obese individuals would create an energy gap of 170–250 kcal/d. A reduction in body weight of ≈20% in obese individuals would create an energy gap of 325–480 kcal/d. The energy gap represents the reduction in energy requirements that occurs with weight loss.

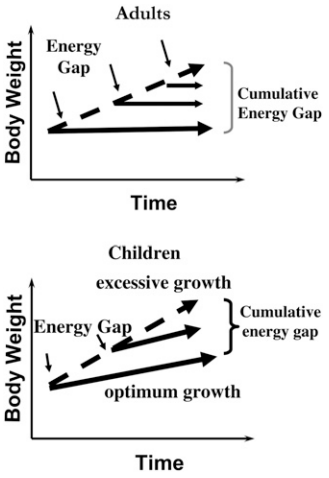

FIGURE 3. Energy gap for preventing weight gain in adults and in children and adolescents. The energy gap is the amount of energy that would prevent additional weight gain. Estimates of energy gaps in different populations are shown in Table 1.

is important to emphasize that these values are applicable to the obese population and should not be extrapolated to whole populations because there may be some metabolic adaptations to established obesity.

Alternatively, regardless of someone's current weight or BMI, further weight gain can be prevented by small decreases in energy intake and/or increases in physical activity. This concept is illustrated in **Figure 3** for adults and children.

The fact that there is a small energy gap underlying global increases in body weight and obesity is supported by several other investigators in other populations. The studies in which the energy gap was estimated or could be estimated from the data collected are listed in **Table 1**. In addition to Hill et al (11), Brown et al (18) determined the energy gap in middle-aged Australian women and reported that the average weight gain was ≈0.5 kg/y over 5 y and resulted in the daily accumulation of energy of ≈10 kcal/d. More recently, Zhai et al (19) estimated the energy gap in the Chinese population to be 45 kcal/d. Wang et al (20) estimated the energy gap to be 110–165 kcal/d among children by investigating the difference between the actual and optimal trajectory of weight gain. In a longitudinal study that compared growth in children of 2 lean parents with growth in children of 2 obese parents, Goran et al (21) found that the average excess accumulation of body energy between groups was ≈25 kcal/d, or ≈50 kcal/d, based on the assumptions of Hill et al concerning energy storage.

Several other studies did not calculate the energy gap but reported rates of weight gain over time in populations that would be consistent with a small energy gap. For example, Tataranni et al (22) examined the Pima Indians, a largely obese population in southwestern Arizona. An average weight gain comparable with an accumulation of body energy of 30–40 kcal/d was found. Sheehan et al (23) found that Americans gain weight at a steady rate until ≈60 y of age. From 1971 to 1992, the average weight gain of those aged <60 y ranged from 0.25 to 0.54 kg/y. Ebrahimi-Mameghani et al (24) followed a Scottish population for a total of 9 y and found that only 20% of the population remained at a stable weight. Approximately 42.2% of the population gained >5 kg, and 17.6% of the population gained >10 kg

TABLE 1
Energy gap in different populations

Population	Energy accumulation	Energy gap
US adults (9)	15 kcal/d; 59 kcal/d for 90th percentile	30 kcal/d; 100 kcal/d for 90th percentile
US children (20)	—	110–165 kcal/d
US children (21)	25 kcal/d	50 kcal/d
Australian women (18)	10.5 kcal/d	21 kcal/d
Chinese adults (19)	22.5 kcal/d	45 kcal/d
Adult Pima Indians (22)	30.6 kcal/d	61.2 kcal/d
Scottish adults (24)	11.5 kcal/d in 42.2% of population; 23 kcal/d in 17.6% of population	23 kcal/d for 42.2% of population; 46 kcal/d for 17% of population
Swedish adults (25)	4.1 kcal/d for men; 6.2 kcal/d for women	8.2 kcal/d for men; 12.4 kcal/d for women
Chilean women aged 40–53 y (26)	16.8 kcal/d	33.6 kcal/d

during the 9-y study period. Berg et al (25) examined a population of men and women in Sweden and found a mean body weight increase of 3.3 kg for women and 5 kg for men over the 17-y study period. A study in Chilean women aged 40–53 y found an average weight gain of 3.8 kg over 5 y (26).

Several studies have shown that some groups are gaining weight at a much higher rate than the general population. In these populations, the energy gap is >100 kcal/d. Levitsky et al (27) followed a sample of students during their first semester in college. The results showed a mean weight gain of almost 2 kg in the first 12 wk of college, which constituted an energy gap of 367 kcal/d. A study conducted by Butte et al (28), which followed a large cohort of Hispanic children (4–19 y of age) for 1 y, found that the mean weight gain was significantly higher in overweight children (7.5 kg/y) than in nonoverweight children (4.4 kg/y). The energy gap was ≈130 kcal/d more for overweight Hispanic children than for nonoverweight Hispanic children.

In summary, the available data suggest that many populations are gradually gaining weight, which is being fueled by a relatively small difference between energy intake and energy expenditure. Put simply, on average, most people are consuming only slightly more calories than they are expending and, consequently, are gradually gaining weight at an average of 0.5–1 kg/y.

IS THERE EVIDENCE TO SUGGEST THAT A SMALL-CHANGES APPROACH CAN BE EFFECTIVE AT REDUCING OR STABILIZING OBESITY RATES?

Effects of large compared with small changes on increases in physical activity

Several government bodies and scientific organizations have issued guidelines for physical activity. Many of these guidelines (29, 30) recommend 30 min/d of moderate-intensity physical activity most days. Some guidelines recommend 60 min/d of moderate-intensity physical activity to prevent weight gain and 60–90 min/d of physical activity to maintain weight loss and prevent weight regain (31, 32). Meeting these recommendations requires large changes for most people. Brownson et al (32) reviewed population data on physical activity trends among US adults. In 2000, only ≈26% of this population met even the 30-min/d physical activity level recommendation. Moreover, this number has not changed over the past decade. It is clear that guidelines that set large behavioral goals for physical activity have not been successful.

Alternatively, Hill et al (11) estimated that an extra 2000 steps/d would be sufficient to increase energy expenditure by ≈100 kcal/d and that this simple change could stop weight gain in most adults. These authors further suggested that pedometers could be used as tools to allow people to set and monitor physical activity in steps/d. Before 2003, several studies had been published that used pedometers to measure physical activity, but a Medline search found that only 4 of these studies used an increase in the number of steps per day as a physical activity intervention. Since 2003, >30 studies that used an increase in the number of steps per day as a physical activity intervention have been conducted. A review by Ogilvie et al (33) provides the details and outcomes of these interventions. Bravita et al (34) reviewed 26 studies ($n = 2767$ subjects) in which pedometers were used as tools to increase physical activity. Pedometers work because they provide physical activity goals that are simple and measurable. The average increase in steps per day was 2491, which represented a 26.9% increase in physical activity over baseline. Most people can obtain this type of increase by walking for ≈20–25 min. Such an increase would be effective for most people to achieve the recommended physical activity level of 30 min/d. Moreover, this increase of 2491 steps/d, or ≈20 min/d of walking, was associated with a slight decline in BMI (0.38). The main point is that 20 min of walking is a small behavioral change that was achieved and was sufficient to prevent weight gain.

Other small-changes approaches to increasing physical activity have been shown to be effective. Dolan et al (35) evaluated the impact of prompts to take the stairs instead of the escalator. These researchers reviewed 8 studies and found that the mean (± SD) increase in stair usage was 2.8% ± 2.4%. It was projected that a 2.8% increase in stair usage could result in the prevention of a weight gain of 300 g/person per year in new stair users. The authors concluded that this strategy could have a slight impact on reducing the national prevalence of obesity. However, it should be noted that if the impact of the environment worsens, additional changes might be required to avoid weight gain.

Another small-changes approach is the Take 10! Program, which is aimed at integrating increased energy expenditure into academic curricula. Caloric expenditure with this intervention ranges from 25 to 37 kcal/10-min session (36). Participating in 5–10 Take 10! sessions per week would burn an additional 150–300 kcal during this period. This small change could have a big impact on energy balance and weight maintenance in the school-aged population.

Effects of large compared with small changes on improvements in diet

Efforts to achieve large changes in the diets of Americans have not been widely successful. The More Matters program (formerly known as the 5-a-Day program) has promoted the consumption of 5 servings of fruit and vegetables/d since 1991, with only modest success. The percentage of Americans who know that they should eat $\geq$5 servings of fruit and vegetables/d has increased from $\approx$8% to $\approx$20%, but the consumption of fruit and vegetables changed little from 1994 to 2005 (37).

Americans were told to make big reductions in dietary fat intake in 1980 and in the early 1990s (38, 39). Although much was made of the resulting decline in the percentage of calories from fat eaten, the total fat consumed (in g/d) declined very slightly in the mid-1980s but actually began increasing in the late 1980s (40). The percentage of calories consumed from fat declined because of an increase in total energy intake (40). Additionally, efforts to promote big reductions in dietary carbohydrate during the late 1990s and early 2000s were not sustainable, as evidenced by a decline in several formerly very popular low-carbohydrate diets.

Some big changes in diet have been successful. One such change has been an increase in the consumption of reduced-fat milk; however, this change has occurred over 35 y (41). Another successful big dietary change has been recent efforts to eliminate most synthetic *trans* fatty acids from the US diet. This change may be working largely because it does not require major behavioral changes on the part of the consumer. The changes are being done by the food manufacturers and by restaurants, which have reduced their use of partially hydrogenated fats. Consumers who seek to eliminate *trans* fatty acids can do it with little or no sacrifice of taste or convenience.

The small-changes approach as a single strategy to reducing energy intake in populations has not been directly tested. However, a great deal of research suggests that small changes in specific components of the diet could produce small but important changes in energy intake without the need for conscious energy restriction. For example, Donahoo et al (42) found that energy intake will decrease by $\approx$20 kcal/d with each 1% decrease in the percentage of fat in the diet. Perhaps small changes in dietary fat would be more sustainable than larger ones. Similarly, small reductions in portion size can produce reductions in energy intake without stimulating hunger (43–46). Consumption of sugar-sweetened beverages in the United States has increased from an average of 222 to 458 kcal/d over the past 25 y (47). Reducing the consumption of caloric beverages has been found to decrease total energy intake (48), so there may be merit in recommending small reductions in the consumption of these products. Studies have also shown that fiber supplementation can reduce energy intake by 15–20% (49).

Reducing the energy density of certain foods is a strategy that can be achieved with reductions in fat or sugar intake (provided these macronutrients are replaced by ingredients with fewer calories, such as protein or carbohydrate in the case of fat) or with increases in fiber, water, or air. The advantage of this approach is that calorie intake can be reduced without a decrease in serving size. Prentice and Jebb (50) reviewed the published data on energy density and energy intake and concluded that the evidence is clear that energy intake increases directly with increases in energy density. Rolls et al (51) consistently found that reducing energy density produces small reductions in energy intake in short-term experiments. They estimated that a reduction of 0.1 kcal/g in the energy density of the diet produces reductions in energy intake of 110 kcal/d in men and of 82 kcal/d in women. The strategy of reducing energy density seems to reduce energy intake in children as well. Leahy et al (52) found that reducing the energy density of an entrée served to children reduced energy intake from that entrée by 25% and total intake from the meal by 18%.

HAS THE SMALL-CHANGES APPROACH BEEN USED SUCCESSFULLY TO REDUCE OR PREVENT EXCESSIVE WEIGHT GAIN?

A substantial amount of research suggests the feasibility of changing energy intake and total physical activity through a small-changes approach. Another important question is whether the small-changes approach can be shown to be effective at reducing excessive weight gain, as suggested by Hill et al (11).

The most direct evidence for the ability of the small-changes approach to reduce or prevent excessive weight gain comes from Rodearmel et al (53, 54), who used a family-based small-changes intervention in families with at least one child who was overweight or at risk of overweight. These researchers tested the efficacy of the America On the Move initiative, which advocates an increase in walking by 2000 steps/d and reducing energy intake by 100 kcal/d. In one study (53), the intervention families were asked to make 2 small changes: *1*) to consume cereal for breakfast and *2*) to increase physical activity by 2000 steps/d over baseline. After 14 wk, the increase in BMI-for-age in the target children was significantly less in the intervention group than in the control group. Mothers in the intervention group also experienced a favorable change in BMI.

In a second study conducted by Rodearmel et al (54), the intervention consisted of *1*) reducing energy intake by $\approx$100 kcal/d by replacing sugar or sugar-containing beverages with noncaloric sweeteners or products containing noncaloric sweeteners, and *2*) increasing walking by 2000 steps/d over baseline. After 6 mo, significantly more children in the intervention group than in the control group maintained or decreased their BMI-for-age (**Figure 4**).

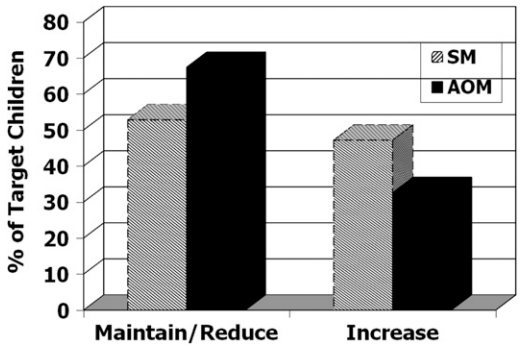

FIGURE 4. Percentage of target children in the America On the Move (AOM) and Self-Monitoring (SM) groups who maintained/reduced or increased their percentage BMI-for-age over 6 mo (54). Significantly more AOM children than SM children maintained or reduced their percentage BMI-for-age ($P < 0.05$). Significantly fewer AOM children than SM children increased their percentage BMI-for-age ($P < 0.05$).

Several studies that used pedometers to increase physical activity showed reductions in weight. Chan et al (55) used pedometers in a 12-wk work-site intervention in 106 sedentary workers and achieved slight decreases in both BMI and waist circumference. Toole et al (56) conducted a self-reported pedometer-walking program in which participants increased their walking by 2000 steps/d and experienced a decrease in BMI. Clarke et al (57) used pedometers to measures increases in physical activity in low-income mothers. They found that the use of pedometers was associated with increased physical activity and with reductions in body weight, percentage body fat, and waist circumference.

Fewer studies have been conducted to evaluate the impact of a small-changes approach to reducing energy intake alone on obesity rates. James et al (58) reported initial success in a school-based intervention aimed at reducing the consumption of carbonated soft drinks by children. The percentage of overweight children increased by 7.6% in the control group and decreased by 0.2% in the intervention group. The difference in energy intake due to the intervention was ≈35–40 kcal/d. However, the impact of the intervention was not sustained over 3 y (59). This illustrates the potential of a relatively modest decrease in energy intake to affect anthropometric variables but also emphasizes the difficulty of sustaining even small behavioral changes.

The available data strongly suggest that excessive weight gain in most of the population is due to a slight degree of positive energy balance and that small lifestyle changes can reduce the energy gap. The small-changes approach has been shown to be effective at increasing total physical activity, decreasing total energy intake, and preventing or reducing excessive weight gain. Given the lack of success with other approaches to lifestyle changes, the small-changes approach deserves serious attention. The small-changes approach might, at a minimum, help prevent things from getting worse until larger societal changes can be made. It remains to be established whether small lifestyle changes are easier to sustain than are larger ones. Although this hypothesis seems reasonable, achieving and sustaining the behavioral change necessary to accomplish this goal, even though only small changes are sought, will take concerted and coordinated efforts across all sectors of society. In effect, the obesity epidemic will only be halted through fundamental lifestyle changes in the way individuals work, play, learn, and socialize.

CAN THE SMALL-CHANGES APPROACH BE USED TO CHANGE ENVIRONMENTAL DETERMINANTS OF OBESITY?

Most experts agree that the obesity epidemic is being driven by many interacting determinants, including changes that have occurred in the physical environment. However, these environmental changes have not occurred all at once, nor was their cumulative effect felt all at once. These environmental changes have been small and unidirectional and have acted like a ratchet—always moving in one direction, promoting weight gain. This "ratchet" effect occurred both at a population level and on an individual level.

It is a reasonable hypothesis that stopping the obesity epidemic can be approached by reversing the ratchet effect with small, unidirectional changes that would operate to discourage excess weight gain. These changes do not have to be massive, but they need to be in the right direction and they need to be maintained. In effect, this strategy would engage all stakeholders (eg, the policy environment and the commercial environment) to foster a healthy ratchet effect that is always moving in the right direction. This kind of approach has not been tried because there is the tendency to look at the problem as a whole and to consider that no one small change of any kind can cure the problem in its entirety. However, the available data suggest that a small-changes approach may be the fuel needed to move our nation to a new "tipping point," where the conditions change just enough for the population as a whole to embrace even more change than is currently deemed possible.

Adopting the healthy ratchet approach can also be a means to bring together different stakeholder groups that are often difficult to engage because they are so far apart in their immediate goals. Across private and public sectors, virtually every stakeholder is motivated to do something to help prevent obesity. The end goal of the small-changes approach, moving society in a positive direction healthwise, is something that all stakeholders can embrace in a coordinated fashion. Likewise, small changes easily become institutionalized by policy as they are adopted, which would help solve one of the most vexing problems of public health interventions, namely sustainability. In order for something to be sustainable, it has to become "business as usual," moving beyond a "program" or an "initiative" that has only temporary support. It is important to support an approach that makes it hard to slip back into old habits. This strategy has appeal because it does not require stakeholders to abandon their current business or interest wholesale, but empowers them to contribute something positive to the solution.

The ideal way to sustain positive change is to have it become a key driver of the American way of life. If the desired behaviors are in high demand because people are motivated and rewarded, they will have a greater chance of being adopted long term. In a crude sense, to make an impact in today's culture, there needs to be a compelling business model. There has to be a clear benefits exchange between the provider and the consumer, and it has to fit within the current economic and social values structure. For example, a business model for food already exists. An entire industry supplies food to the market, and the particular types of food vary according to consumer demand. So, if one wants to change some elements of the food supply, it is feasible to estimate the demand, the economics, supply chain requirements, etc. In contrast, the business model for physical activity either does not exist or is grossly underdeveloped. Fitness clubs and sports industries sell goods and services that support physical activity, but they are small industries compared with the food industry. Physical activity is not a requirement for survival, so there is no strong biological drive for it. There is no requirement for physical activity as a driver of the economy. No data as yet provide compelling evidence that physical activity improves productivity, reduces health care costs, or improves some other aspect of our lives that is tied to the current economic values system. It is reasonable to hypothesize that it will be difficult to increase physical activity levels on a population level unless there is compelling evidence for making physical activity "worth" something to society as a whole, beyond just enhancing individual health.

CAN THE SMALL-CHANGES APPROACH SERVE AS THE FOUNDATION FOR A NATIONAL CAMPAIGN TO ADDRESS OBESITY?

Society is poised on the brink of a tremendous opportunity for food science and nutrition to unite and take the lead in a national

campaign to address obesity. The historic record clearly demonstrates remarkable advances in the application of nutrition and food science research to benefit health (60). Given the gravity of the obesity epidemic and the ensuing public health consequences, there is a pressing need to implement the small-changes approach. As presented, a small-changes initiative aimed at affecting the food supply could result in a landmark discovery in nutrition and food science that dramatically benefits public health and could lead to a national initiative to address obesity around the world. This task force believes that a small-changes framework aimed at helping people make conscious small changes in lifestyle behaviors in combination with efforts by the private sector to gradually ''ratchet down'' some of the environmental factors that have contributed to excessive energy intake and to the declining rates in physical activity could be successful in reducing obesity rates. This initiative could be supported by educational and social marketing campaigns driven by or influenced by the many government agencies addressing this problem.

The manuscript was reviewed by all members of the Joint Task Force: Susan Borra (International Food Information Council); Roger Clemens (ET Horn Company); Fergus Clydesdale (University of Massachusetts, Amherst); John Courtney (American Society for Nutrition); Sarah Davis (Institute of Food Technologists); John Erdman (University of Illinois, Urbana-Champaign); Mary Christ-Erwin, Porter-Novelli, and Shelley Goldberg (International Food Information Council); James Hill (University of Colorado, Denver); Lori Hoolihan (Dairy Council of California); Guy Johnson (McCormick Science Institute); Penny Kris-Etherton (Pennsylvania State University); Gil Leveille (Wrigley Science Institute); Daryl Lund (Emeritus, University of Wisconsin, Madison); Indra Mehrotra (General Mills Bell Institute of Health and Nutrition); Keith Singletary (University of Illinois, Urbana-Champaign); and Connie Weaver (Purdue University).

The author's responsibility was as follows: JOH: wrote and reviewed the manuscript. JOH has served on advisory boards for PepsiCo, General Mills, the Wrigley Science Institute, and the McCormick Science Institute.

REFERENCES

1. Schmidhuber J. The growing global obesity problem: some policy options to address it. J Agric Develop Econ 2004;1:272–90.
2. Haslam DW, James WPT. Obesity. Lancet 2005;366:1197–209.
3. Wang Y, Lobstein T. Worldwide trends in childhood overweight and obesity. Int J Pediatr Obes 2006;1:11–25.
4. International Association for the Study of Obesity. International Obesity Task Force prevalence data. Available from: http://www.iotf.org/database/index.asp(cited 13 October 2008).
5. Centers for Disease Control and Prevention, US Department of Health and Human Services. US obesity trends 1985–2007. Available from: http://www.cdc.gov/nccdphp/dnpa/obesity/trend/maps/index.htm (cited 13 October 2008).
6. Wang K, Brownell K. Public policy and obesity: the need to marry science with advocacy. Psych Clin North Am 2005;28:235–52.
7. Nestle M. Food marketing and childhood obesity—a matter of policy. N Engl J Med 2006;354:2527–9.
8. Nestle M, Jacobson MF. Halting the obesity epidemic: a public health policy approach. Public Health Rep 2000;115:12–24.
9. Hill JO, Peters JC. Environmental contributions to the obesity epidemic. Science 1998;280:1371–4.
10. Peters JC, Wyatt HR, Donahoo WT, Hill JO. From instinct to intellect: the challenge of maintaining healthy weight in the modern world. Obes Rev 2002;3:69–74.
11. Hill JO, Wyatt HR, Reed GW, Peters JC. Obesity and the environment: where do we go from here? Science 2003;299:853–5.
12. Tsai AG, Wadden TA. Systematic review: an evaluation of major commercial weight loss programs in the United States. Ann Intern Med 2005;142:56–66.
13. Wyatt HR, Wing RR, Hill JO. The National Weight Control Registry. In: Bessesen DH, Kushner R, eds. Evaluation and management of obesity. Philadelphia, PA: Hanley & Belfus, 2002:119–24.
14. Foreyt J, Goodrick K. The ultimate triumph of obesity. Lancet 1995;346:134–5.
15. Heshka S, Anderson JW, Atkinson RL, et al. Self help weight loss vs a structured commercial program: a randomized, controlled two-year trial. JAMA 2003;289:17929–804.
16. Bouchard C. The magnitude of the energy imbalance in obesity is generally underestimated. Int J Obes 2008;32:879–80.
17. Hill JO. Energy metabolism and obesity. In: Draznin B, Rizza R. eds. Clinical research in diabetes mellitus and obesity. Vol 2. Totowa, NJ: Humana Press, 1997:3–12.
18. Brown WJ, Williams L, Ford JH, Ball K, Dobson AJ. Identifying the energy gap: magnitude and determinants of 5-year weight gain in midage women. Obes Res 2005;13:1431–41.
19. Zhai FY, Wang HJ, Wang ZH, Chen CM. [Control the increasing of the prevalence of overweight and obesity by covering the energy gap of Chinese population.] Wei Sheng Yan Jiu 2006;35:72–6 (in Japanese).
20. Wang YC, Gortmaker SL, Sobol AM, Kuntz KM. Estimating the energy gap among US children: a counterfactual approach. Pediatrics 2006;118:e1721–33.
21. Goran MI, Shewchuk R, Gower BA, Nagy TR, Carpenter WH, Johnson RK. Longitudinal changes in fatness in white children: no effect of childhood energy expenditure. Am J Clin Nutr 1998;67:309–16.
22. Tataranni PA, Harper IT, Snitker S, et al. Body weight gain in free-living Pima Indians: effect of energy intake vs expenditure. Int J Obes 2003;27:1578–83.
23. Sheehan TJ, DuBrava S, DeChello LM, Fang Z. Rates of weight change for black and white Americans over a 20 year period. Int J Obes 2003;27:498–504.
24. Ebrahimi-Mameghani M, Scott JA, Der G, Lean MEJ, Burns CM. Changes in weight and waist circumference over 9 years in a Scottish population. Eur J Clin Nutr(Epub ahead of print July 2007).
25. Berg C, Rosengren A, Aires N, et al. Trends in overweight and obesity from 1985 to 2002 in Goteborg, West Sweden. Int J Obes 2005;29:916–24.
26. Blümel JE, Castelo-Branco C, Rocangliolo ME, Bifas L, Tacla X, Mamani L. Changes in body mass index around menopause: a population study of Chilean woman. Menopause 2001;8:239–44.
27. Levitsky DA, Halbmaier CA, Mrdjenovic G. The freshman weight gain: a model for study of the epidemic of obesity. Int J Obes 2004;28:1435–42.
28. Butte NF, Cai SA, Wilson TA, et al. Metabolic and behavioral predictors of weight gain in Hispanic children: the Viva la Familia study. Am J Clin Nutr 2007;85:1478–85.
29. Haskell WL, Lee I-M, Pate RR, et al. Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. Med Sci Sports Exerc 2007;39:1423–34.
30. US Department of Health and Human Services. Physical activity and health: a report of the Surgeon General. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996.
31. US Department of Health and Human Services. Dietary guidelines for Americans 2005. US Department of Health and Human Services, US Department of Agriculture, 2005. Available from: http://www.healthierus.gov/dietaryguidelines(cited 13 October 2008).
32. Brownson RC, Boehmer TK, Luke DA. Declining rates of physical activity in the United States: what are the contributors? Annu Rev Public Health 2005;26:421–43.
33. Ogilvie D, Foster CE, Rothnie H, et al. Interventions to promote walking: systematic review. BMJ 2007;334:1204–13.
34. Bravata DM, Smith-Spangler C, Sundaram V, et al. Using pedometers to increase physical activity and improve health. JAMA 2007;298:2296–304.
35. Dolan MS, Weiss LA, Lewis RA, Pietrobelli A, Heo M, Faith M. Take the stairs instead of the escalator: effect of environmental prompts on community stair use and implications for a national ''small steps'' campaign. Obes Rev 2006;7:25–32.
36. Stewart JA, Dennison DA, Lohl HW, Doyle JA. Exercise level and energy expenditure in the Take 10! in-class physical activity program. J Sch Health 2004;74:397–400.
37. Blanck HM, Gillespie C, Kimmons JE, Seymour JD, Serdula MK. Trends in fruit and vegetable consumption among US men and women, 1994–2005. Public Health Research, Practice, and Policy 5:1-10. 2008.

Available from: http://www.cdc.gov/pcd/issues/2008/apr/07_0049.htm (cited 13 October 2008).
38. US Department of Health, Education, and Welfare. Healthy people: the Surgeon General's report on health promotion and disease prevention. Washington, DC: US Department of Health, Education, and Welfare, 1979.
39. US Department of Health and Human Services. Nutrition and health: a report of the Surgeon General. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1988.
40. Kennedy ET, Bowman SA, Powell R. Dietary-fat intake in the US population. J Am Coll Nutr 1999;3:207–12.
41. US Department of Agriculture. Trends in US per capita consumption of dairy products 1909–2001. Available from: http://www.ers.usda.gov/Amberwaves/June03/DataFeature/ (cited 13 October 2008).
42. Donahoo W, Wyatt HR, Kriehn J, et al. Dietary fat increases energy intake across the range of typical consumption in the U.S. Obesity 2008; 16:64–9.
43. Rolls BJ, Roe LS, Meengs JS. Reductions in portion size and energy density of foods are addictive and lead to sustained decreases in energy intake. Am J Clin Nutr 2006;83:11–7.
44. Rolls BJ, Roe LS, Kral TVE, Meengs JS, Wall DE. Increasing the portion size of a packaged snack increases energy intake in men and women. Appetite 2004;42:63–9.
45. Jeffery RW, Rydell S, Dunn CL, et al. Effects of portion size on chronic energy intake. Int J Behav Nutr Phys Act 2007;27:4.
46. Rolls BJ, Roe LS, Meengs JS. The effect of large portion sizes on energy intake is sustained for 11 days. Obesity 2007;15:1535–43.
47. Duffey KJ, Popkin BM. Shifts in patterns and consumption of beverages between 1965 and 2002. Obesity 2007;15:2739–47.
48. Malik VS, Schulze MB, Hu FB. Intake of sugar-sweetened beverages and weight gain: a systematic review. Am J Clin Nutr 2006;84:274–88.
49. Slavin J. Dietary fiber and body weight. Nutrition 2005;21:411–8.
50. Prentice AM, Jebb SA. Fast foods, energy density and obesity: a possible mechanistic link. Obes Rev 2003;4:187–94.
51. Rolls BJ, Drewnowski A, Ledikwe JH. Changing the energy density of the diet as a strategy for weight management. J Am Diet Assoc 2005; 105:S98–103.
52. Leahy KE, Birch LL, Rolls BJ. Reducing the energy density of an entrée decreases children's energy intake at lunch. J Am Diet Assoc 2008;108: 41–8.
53. Rodearmel SJ, Wyatt HR, Barry M, et al. A family-based approach to preventing excessive weight gain. Obesity 2006;14:1392–401.
54. Rodearmel SJ, Wyatt HR, Stroebele N, Smith SM, Ogden LG, Hill JO. Small changes in dietary sugar and physical activity as an approach to preventing excessive weight gain: the America On the Move family study. Pediatrics 2007;120:e869–79.
55. Chan CB, Ryan DAJ, Tudor-Locke C. Health benefits of a pedometer-based physical activity intervention in sedentary workers. Prev Med 2004;39:1215–22.
56. Toole T, Thorn JE, Panton LB, Kingsley D, Haymes EM. Effects of a 12-month pedometer walking program on gait, body mass index, and lower extremity function in obese women. Percept Motor Skills 2007; 104:212–20.
57. Clarke KK, Freeland-Graves J, Klohe-Lehman DM, Milani TJ, Nuss HJ, Laffrey S. Promotion of physical activity in low-income mothers using pedometers. J Am Diet Assoc 2007;107:962–7.
58. James J, Thomas P, Cavan D, Kerr D. Preventing childhood obesity by reducing consumption of carbonated drinks: cluster randomized controlled trial. BMJ 2004;328:1237–9.
59. James J, Thomas P, Kerr D. Preventing childhood obesity: two year follow-up results from the Christchurch obesity prevention programme in schools (CHOPPS). BMJ 2007;335:762–5.
60. Katan MB, Boekschoten MV, Conner WE, et al. Which are the greatest recent discoveries and the greatest future challenges in nutrition? Eur J Clin Nutr (Epub ahead of print 10 October 2007).