

## Featured Article

# Using Behavioral Economics to Design More Effective Food Policies to Address Obesity

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**Abstract** *Many policy interventions that address rising obesity levels in the United States have been designed to provide consumers with more nutrition information, with the goal of encouraging consumers to decrease their caloric intake. We discuss existing information-provision measures and suggest that they are likely to have little-to-modest impact on encouraging lower caloric intake, because making use of such information requires understanding and/or motivation, which many consumers lack, as well as self-control, which is a limited resource. We highlight several phenomena from the behavioral economics literature (present-biased preferences, visceral factors, and status quo bias) and explain how awareness of these behavioral phenomena can inform both more effective information-provision policies and additional policies for regulating restaurants and public school cafeterias that move beyond information to nudge people towards healthier food choices.*

**Key words:** Behavioral economics, Food policy, Obesity, Choice architecture, Food environment, Menu labeling, Front-of-package labeling, Nutrition labeling, Food marketing.

**JEL codes:** D00, I12, I18, L66, M31, M38, Q18.

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## Introduction

Promoting individuals' healthy eating behavior is crucial for those interested in obesity-related policy questions (Costa-Font et al. 2013). Many existing policies designed to reduce obesity have focused on reducing calorie

intake by increasing the availability of nutrition information, in the hopes that such information will lead consumers to make healthier food choices (Downs et al. 2009). These policies are based on the assumption that people act rationally when making food choices (Cawley 2004), which implies that people make suboptimal food decisions because they lack perfect information (Stigler 1961) and that access to better information should lead to better decision making. However, it is increasingly clear that such well-meaning policies, guided by a rational view of human behavior, have a relatively small impact on people's food choices. Recognizing that many people have difficulty understanding numeric nutrition information and/or lack the motivation to make use of it can guide the design of better policies. In addition, it is important to realize that making use of such information can be difficult when self-control—a limited resource—is depleted (Baumeister et al. 1998).

Perhaps the best-known example of an information-provision policy is the Nutrition Labeling and Education Act (NLEA), implemented in 1994, which required accurate and consistent nutrition information to be printed on the Nutrition Facts label on packaged foods (Wilkening 1993). However, the NLEA does not regulate other on-package labels and exempts restaurant meals (despite such meals being higher in calories, fat, and saturated fat than home-cooked meals [Guthrie et al. 2002]). Thus, recent legislative and regulatory efforts have sought to extend the spirit of the NLEA to front-of-package labeling by devising a uniform nutrition label to post prominently on the front of packaged foods, and to restaurant dining through menu labeling, which requires chain restaurants to post caloric information prominently on menus (Hawley et al. 2013; Pomeranz and Brownell 2008; Roberto et al. 2011).

Although consumers support nutrition labeling policies (Krieger and Saelens 2013) and have the right to such information, evidence of nutrition labeling's effect on food choices has been inconsistent. In experimental settings and small field trials, some studies have found moderate effects on reducing calories purchased and/or consumed (Bassett et al. 2008; Bollinger et al. 2011; Burton et al. 2006; Chu et al. 2009; Pulos and Leng 2010; Roberto et al. 2010; Variyam and Cawley 2006), while other studies have found no or minimal impact of menu labeling (Downs et al. 2009; Elbel et al. 2009; Finkelstein et al. 2011; Harnack et al. 2008; Vadiveloo et al. 2011).

At best, existing information-provision policies have the potential to modestly influence individuals' food choices. Therefore, to make substantial progress in addressing obesity and poor dietary habits, it will be crucial both to improve existing information-provision policies and to consider implementing noninformation-based policies. Such improvements will require policy makers to move beyond the narrow "rational choice" view of human nature that has guided previous policies designed to improve diet (Cawley 2004).

Human behavior may be more fully described by including the insights of behavioral economics, which assumes that people depart from rationality in systematic ways (Kahneman 2003b; Simon 1955, 1986) and encompasses findings from human motivation, self-control, and behavioral change (Ubel 2009). These behavioral economic principles can move us past information-based approaches to approaches that design choice environments to improve choices (Downs et al. 2009; Kooreman and Prast 2010; Loewenstein et al. 2007, 2011; Ratner et al. 2008; Schwartz et al. 2012).

Thaler and Sunstein (2008) have promoted the concept of “nudging” people toward optimal behavior by changing their choice environment. For example, people’s food choices can be shifted by subtle changes in the physical layout of food in a lunch line (Just and Wansink 2009). Vegetables are more readily taken when they appear at the front of the line (Wansink and Just 2011), candy is accessed less often when it appears in opaque containers (Wansink, Painter, and Lee 2006), and salad is purchased more when the salad bar is centrally located in the lunchroom (Just and Wansink 2009). These types of interventions are referred to as “asymmetric” or “libertarian” paternalism (Camerer et al. 2003; Loewenstein et al. 2007; Thaler and Sunstein 2003, 2008), because they seek to shift consumers towards behaviors they desire without limiting their freedom of choice.

### *Overview*

The goals of this article are as follows: (1) to present several phenomena from the behavioral economics literature that help explain why eating behavior can be difficult to change with the standard informational approaches that to date have dominated nutrition policies; (2) to explain how awareness of these behavioral phenomena could inform more effective information-provision policies; and (3) to propose several additional policies informed by these behavioral phenomena that move beyond merely providing information to nudge people towards healthier behavior.

## **Three Behavioral Biases Relevant to Overeating**

### *Present-Biased Preferences*

At the heart of many public health problems is the human tendency to overemphasize immediate benefits relative to delayed benefits (O’Donoghue and Rabin 2000). An example is when people choose to receive a smaller amount of money sooner rather than a much larger amount of money later. This pattern of preferences is referred to as “present-biased” preferences (Ainslie 1975; Frederick et al. 2002; O’Donoghue and Rabin 2000; Rick and Loewenstein 2008). Present-biased preferences can make it difficult to eat healthfully and/or exercise. Indeed, overvaluing immediate costs can lead individuals to refrain from dieting or exercising. The immediate benefits of indulging in a high-calorie snack are more salient than the long-term potential for negative effects. Moreover, people tend to be willing to impose greater self-control on their future selves, but once the future becomes the present, people again lack the self-control to stick to their long-term goals.

The tendency to overvalue immediate benefits often leads people to make food decisions based on convenience. For example, there is a positive relationship between the importance of convenience to a consumer and his or her amount of fast-food consumption (Glanz et al. 1998). Indeed, society’s overall reliance on convenience is evidenced by the move away from the labor-intensive production of home-cooked meals and towards mass-prepared foods – packaged foods and restaurant meals (Chou et al. 2004; Cutler et al. 2003; Kant and Graubard 2004). To illustrate this point, in 1962, Americans spent only 27% of their food budget dining out, but by 2002 this number had increased to 46% (Variyam 2005). Similarly, between 1977 and 1996, calories consumed outside the home increased from 18% to 32% of total calories consumed (Guthrie et al. 2002).

Experimental research has confirmed the importance of convenience on people's food decisions. For example, cafeteria patrons are less likely to consume ice cream when the lid of the cooler is closed than when it is open (Levitz 1976), they drink more water when it is available on their table than when it is placed 20 feet away (Engell et al. 1996), and they purchase fewer candies or potato chips if they are required to buy them from a line that is separate from the one in which they purchase the rest of their meal (Meiselman et al. 1994). Similar results have been found in the home environment. For instance, Chandon and Wansink (2002) found that stockpiling products increased consumption, particularly for high-convenience items like crackers, granola bars, and juice. Furthermore, researchers have found that making healthy sandwiches more convenient to order by featuring them more prominently in a restaurant menu and making unhealthy sandwiches less convenient to order by featuring them less prominently, significantly increased choice of a healthier sandwich (Wisdom et al. 2010). In addition, a relatively more heavy-handed convenience intervention (requiring participants to open a sticker-sealed packet to view and order nonfeatured unhealthy sandwiches) was more effective at decreasing total calories ordered than a relatively lighter convenience intervention (requiring participants to turn a menu page to view and order nonfeatured unhealthy sandwiches and to write down their full sandwich order rather than checking it off).

Another aspect of present-biased preferences is people's tendency to impose greater self-control on future selves than on present selves, but to change their minds and indulge when the future becomes the present. In one study, researchers analyzed purchases from an online grocery store and found that as the time delay between order and delivery decreased, customers ordered a lower percentage of healthy items and a higher percentage of unhealthy items (Milkman et al. 2010). In another study (Read and Van Leeuwen 1998), researchers found that when office workers were asked to choose between healthy snacks (apples and bananas) and unhealthy snacks (nuts and chocolate bars) that they would receive in one week, 74% of those who chose a healthy snack in advance changed their minds when they had to execute their choice. On the other hand, very few of the people who had picked the unhealthy choice in advance switched to the healthy choice. These findings illustrate that people are inclined to believe their present biases toward healthy food choices will last, but in actuality, they are much less likely to follow through with these decisions.

### ***Visceral Factors***

In addition to present-biased preferences, emotions and drives – “visceral factors” – also increase the likelihood that consumers eat unhealthily. Visceral factors lead consumers to attend and respond to short-term desires in favor of long-term self-interest (Loewenstein 1996; Loewenstein and Angner 2003; Loewenstein and Schkade 1999) and are often activated by exposure to a cue, such as a smell, sound, or sight, that temporarily elevates craving for a desired item (Laibson 2001).

Researchers have proposed that sensory cues and other stimuli in the environment can be processed by two different systems: a cool one and a hot one (Metcalfe and Mischel 1999; Mischel et al. 2003). The cool system is cognitive, complex, reflective, and responsible for self-control, whereas the

hot system is emotional, simple, reflexive, and largely driven by automatic responses to environmental stimuli.

Consistent with the idea of “hot” and “cool” systems of stimuli processing, people tend to experience “hot-cold empathy gaps,” during which they have difficulty imagining how they will feel or behave in affective states that differ from their current state. This gap can be experienced in either of two ways: first, a person could experience a “hot-to-cold empathy gap,” during which he or she gets “caught up in the moment,” and overestimates the stability of his or her current, passionate preferences. Alternatively, a person could experience a “cold-to-hot empathy gap,” during which he or she is currently in a “cold” state (i.e., not experiencing a strong visceral drive) and cannot appreciate the intensity of his or her own feelings and behavior in future hot states (Loewenstein 2005; Loewenstein and Angner 2003; Loewenstein and Schkade 1999). This intrapersonal empathy gap leads to systematic failure in predicting the impact of different emotions and drives on future behavior. In addition, it leads to a projection bias, that is, the tendency for people to exaggerate the degree to which their future preferences will resemble their current ones (Loewenstein et al. 2003).

A broad body of literature has examined the effects of visceral cues on eating behavior. Research has found that the sight of pizza while choosing a meal option led people to choose the pizza over a healthier alternative (tomato soup) more often than when the pizza was not in sight (Shiv and Fedorikhin 2002). Researchers have also found that food cues (based on either taste, sight, or cognition) increased the desire to eat, regardless of hunger level (Lambert et al. 1991). Restrained eaters are particularly susceptible to unhealthy food cues. For example, food cues, including cognitive, olfactory, and visual, led restrained eaters but not unrestrained eaters to eat significantly more calories than when no such cue was present (Fedoroff et al. 1997, 2003).

In addition to the direct impact of food cues on consumption, these cues can also activate visceral states that lead to “cold-to-hot” and “hot-to-cold” empathy gaps. In the “cold-to-hot” gap, people who are not hungry have difficulty imagining how it would feel to be hungry or what they might end up eating when hungry. In one study (Nordgren et al. 2009), participants in a relatively “cold” state could not accurately predict their susceptibility to the temptation of the visceral cue of their favorite snack once they no longer felt satiated. Alternatively, in the “hot-to-cold” gap, people who are hungry have difficulty imagining ever *not* being hungry. For instance, when researchers manipulated shoppers’ hunger and whether or not they had a grocery list with them while shopping, they found that hungry shoppers purchased a larger proportion of unplanned, impulse items, but only when they did not have a grocery list to keep them on track (Gilbert et al. 2002).

### *Status Quo Bias and Default Options*

The highly visceral nature of food suggests that once a tempting food is presented to a person, it is difficult to avoid eating it. It also points to the importance of how options are presented to people in the first place. Traditional economic theory suggests that people will pick their most preferred option (the one that maximizes their utility), regardless of how the options are presented. In reality, individuals are highly prone to sticking with the current or default option even when superior options are available,

regardless of the order in which the alternative options are presented (Kahneman 2003a).

This status quo bias shapes food choices in a variety of ways. For example, selections at restaurants often come with a “default” setting (e.g., the side dish that comes with the meal unless you change it). Given that there is a range of how much food one person can comfortably eat during a meal (Herman and Polivy 1983), consumers often rely on external cues such as these defaults to decide how much to eat and when to stop eating (Schachter and Gross 1968; Wansink 2004; Wansink et al. 2007).

One problematic default setting is large portion sizes, which promote increased caloric intake (Wansink, Van Ittersum, and Painter 2006). Researchers have identified increasing portion sizes over time (Nielsen and Popkin 2003) as a contributor to overeating in the United States (Rolls 2003). Today, many portions marketed as “single-serving” are generally not recommended as appropriate for a person to consume at a single meal, with some foods exceeding portion size recommendations by as much as 700% (Young and Nestle 2002). These increases in portion size are prevalent in many environments in which we choose and consume food, including supermarkets, restaurants, and our homes (Wansink, Van Ittersum, and Painter 2006). Even *The Joy of Cooking* has been increasing the portion sizes of its recipes over time. Since 1936, it has increased the average calories per recipe by 44% and the average calories per serving by 63% (Wansink and Payne 2009).

## Improving Information-Provision Policies

These three behavioral phenomena hint at the breadth of both conscious and nonrational forces that influence people’s eating behaviors. Phenomena like these partly explain why standard information-provision policies like nutrition labels and menu-labeling have not had much impact on people’s food consumption. Nevertheless, awareness of these phenomena can help us design more effective information-provision policies.

For example, the behavioral phenomena we described share a common mechanism—all involve nonconscious, impulsive actions that are fast (Kahneman 2011). By contrast, many information approaches are slow. For instance, nutrition information is currently presented in a numerical format (e.g., percentage of daily value or a calorie range) that people have difficulty evaluating (Liu et al. 2013; Rothman et al. 2006). Therefore, information-provision policies can be improved by making nutrition information easier to understand and use.

One way to make information processing easier is to leverage automatic associations. A good example of this is the traffic light food labeling system developed by the United Kingdom Food Standards Agency (FSA). Because most people strongly associate different colors with certain meanings (Bergum and Bergum 1981), the FSA devised a packaged food label that uses traffic lights to draw upon strong consumer associations between red and “stop” (for less healthy foods) and green and “go” (for healthier foods). In a hospital cafeteria field study, traffic light labeling was effective at increasing the sale of healthy foods labeled green and decreasing the sale of less healthy foods labeled as red (Thorndike et al. 2012). Furthermore, this intervention was especially effective among hospital workers with lower

educational levels (Levy et al. 2012), who may have greater difficulty in processing complex nutrition information. Traffic light symbols may also improve the effectiveness of calorie labeling on restaurant menus (Liu et al. 2012; Morley et al. 2013).

Another promising communication strategy is to present nutrition information in units that are part of everyday life, again to make the associations more automatic. To draw a parallel to a different health challenge, smoking cessation researchers found that presenting lung volume measurements to smokers as a “lung age” instead of standard Forced Expiratory Volume in one second (FEV<sub>1</sub> units), a measure unfamiliar to most people, significantly increased the likelihood that they quit smoking (Parkes et al. 2008). Like FEV<sub>1</sub> units, calories can be difficult for many people to comprehend (Schindler et al. 2013). Promisingly, one field study with adolescents found that presenting the physical activity equivalent of 250 calories (approximately 50 minutes of jogging) led to decreased sugar-sweetened beverage purchases compared to calorie information alone (Bleich et al. 2012).

In addition to nutrition and calorie labels, front-of-packaging labels are becoming increasingly important. Several years ago, the U.S. Food and Drug Administration undertook an initiative to recommend a uniform labeling system that could appear on all packaged foods. This initiative represents an opportunity to design a nutrition labeling system with simplicity in mind (Sunstein 2013). One possibility has emerged from the Institute of Medicine, which recommended a uniform labeling system that displays calories and assigns products from zero to three nutrition points based on levels of saturated and trans fats, sodium, and added sugars (Wartella et al. 2011). These points could be displayed as stars, check marks, or other intuitive symbols, with the idea being to implement a simple, easy-to-understand ordinal indicator of a food’s nutrition value. There are other examples of front-of-pack nutrition symbols that strive to present nutrition information in an intuitive manner, such as NuVal, which rates foods on a score from 1 to 100. Currently, different manufacturers display different symbols on the fronts of their packages to inform consumers about the nutrition content of their products. This variation in symbols is confusing to consumers and slows down their ability to process the information. The more slowly people process information, the more susceptible they are to “fast” phenomena like visceral factors and status quo biases.

Finally, when designing nutrition labeling systems, it is also important to consider symbols that might prompt the food industry to reformulate food products. Research in King County, Washington, for example, found a decrease in restaurant entrée calories following the implementation of menu labeling (Bruemmer et al. 2012). Therefore, rather than only focusing on strategies to influence human behavior, it is important to consider strategies that might prompt companies to offer healthier foods. It is possible that other nutrition symbols, such as traffic lights on the label, would prompt greater reformulation than calorie labels alone.

## Noninformational Nudges

### *Precommitment*

The three behavioral phenomena we have discussed should not only influence how policy makers design informational interventions, but also

influence them to adopt noninformational nudges that reduce unhealthy behaviors and increase healthy behaviors. For example, people's present-biased preferences, or their susceptibility to visceral factors, highlight the important role that precommitment devices can potentially play in promoting healthier eating habits.

A precommitment device is any means through which consumers impose constraints on their own future behavior. Typically, consumers use precommitment devices if they recognize that when the future becomes the present, they will have trouble enforcing their own long-term preferences. The classic example of a precommitment device comes from Greek mythology, when the hero Ulysses demands that his crew bind him to the boat's mast as they sail by the Sirens, women whose song lures men to their deaths, so that he can listen to them without jumping overboard (Elster 2000).

Precommitment devices may also be applied in the food domain to promote healthy eating. O'Donoghue and Rabin (2000) describe the example of a person who is willing to pay more per ounce for a pint of ice cream to keep at home, rather than a quart, as a means of precommitting to the behavior desired by her preferred future self (eating less ice cream). This kind of self-rationing of "vices" (consumption items chosen for their immediate gratification rather than their consequences) was observed by Wertenbroch (1998) in an experiment in which he found that hedonics—people who may need "to self-impose external constraints on their vice consumption because they are more likely to give in to temptation when they have an opportunity to do so"—try to limit the number of cookies they purchase, even in the face of unit-price discounts.

Companies are responding to interest in self-rationing by using marketing techniques such as 100-calorie packs for "vice-like" snacks. However, consumers do not always respond to these marketing ploys by consuming less. Restrained eaters (those actively trying to restrict their food consumption) tend to consume as many, if not more, calories when eating food from small packages (Scott et al. 2008). Thus, when designing precommitment strategies, it is important to consider ways in which they might have paradoxical effects such as encouraging overconsumption for some. A more effective precommitment strategy might be to encourage precommitment in the form of predetermined grocery shopping lists. Such lists, when combined with behavioral therapy, have been shown to be effective at producing weight-loss among obese people (Au et al. 2013).

Precommitment devices are rarely used in policy design, in large part because it is difficult to know how to encourage such commitments. No government we know of mandates that people use (and stick to) grocery shopping lists. However, governments may want to consider ways to incentivize such behaviors. For instance, perhaps supermarkets that offer and promote online ordering (e.g., through discounts) could receive tax breaks, although more research should examine whether the long-term use of online ordering impacts the healthfulness of food purchases. Online ordering also has the potential advantage of reducing exposure to other in-store cues to purchase less healthy products.

### ***Managing Unhealthy Cues***

Although visceral factors typically spur unplanned consumption, their salience can be selectively manipulated to improve consumption decisions.

In many domains, a popular way to reduce the impact of visceral factors is to avoid the cues that activate them. Although this strategy is potentially very useful in some domains (e.g., alcoholics can avoid going to bars), avoiding salient food cues can be very difficult to achieve considering that each of us makes around 200 food decisions daily (Wansink and Sobal 2007).

However, when a tempting cue is present and unavoidable, obfuscation, distraction, or abstraction are self-control strategies that can be used to reduce the likelihood of succumbing. These three strategies were demonstrated in a classic study by Rodriguez, Mischel, and Shoda (1989). In their study, children were shown a tempting food treat and told that the experimenter was going to leave the room; if the child could refrain from eating the treat until the experimenter returned 15 minutes later, the child could have another treat (or two treats total). If the child could not wait, however, the child could ring a bell, calling the experimenter back immediately. In this case though, the child would not receive an additional treat.

The first control strategy, obfuscation, refers to reducing the salience of the stimulus by hiding it from the senses. When the treat was out of sight during the waiting period, 75% of the children waited the full 15 minutes for the experimenter to return, compared to only 25% who waited the full time when the treat was visible (Mischel and Ebbesen 1970). The effectiveness of this control strategy was further supported in a study that manipulated the visibility of chocolates in office candy dishes by placing them in either a clear or opaque container. When the office workers were unable to see the chocolates, they ate significantly fewer of them per day (Wansink, Painter, and Lee 2006).

The second strategy, distraction, involves allocating attention away from the stimulus by using either internal or external distractions. In one study, researchers recorded the focus of the child's attention when the experimenter was out of the room (Rodriguez et al. 1989). They found that as the amount of attention directed towards stimuli other than the treat itself increased, so did the amount of time the child was able to wait. In other studies testing this type of strategy, providing children with either internal distractions (e.g., suggesting fun things for them to think about) or external distractions (e.g., providing a slinky toy with which to play) has been shown to increase their ability to delay gratification (Mischel et al. 1972).

The third strategy, abstraction, refers to reframing the representation of the stimulus by focusing on its cool, as opposed to hot, aspects. The effect of this strategy was demonstrated by an experiment (Mischel and Baker 1975) in which children were encouraged to focus either on the hot aspects of the stimulus (e.g., the salty, crunchy taste of the pretzels) or its cool aspects (e.g., the thin, log-like appearance of the pretzels). Children who were encouraged to focus on the cool aspects displayed more self-control and waited longer for the additional treat.

Once again, it is challenging to take approaches that work on an individual level, such as distraction, and implement them on a policy level. Nevertheless, policy makers need to consider more creative approaches that leverage these behavioral phenomena. For instance, to draw a parallel to anti-tobacco efforts, New York City is considering legislation to hide cigarette packages in stores, such as behind closed cabinets (Hartocollis 2013). The idea behind this policy is simple obfuscation—out of sight, out of mind. The policy also has the added benefit of not restricting people's

choices: the policy influences behavior without restricting consumers' freedom. This policy could be adapted to the food domain by requiring that sugar-sweetened beverages be moved to the backs of grocery stores or by introducing candy-free check-out aisles (Cohen and Babey 2012). Such policies would still let stores sell sugar-sweetened beverages and candy but would make consumers less susceptible to impulsive, unhealthy purchases (Cohen and Babey 2012).

### ***Using Defaults***

To leverage the status quo bias to promote healthier eating, the healthiest option could be set as the default option, with a focus on reducing default large portions to smaller ones. Research has shown that decreasing the portion size of meals (Rolls 2003; Rolls et al. 2006), sandwiches (Rolls, Roe, and Meengs et al. 2004), and snacks (Rolls, Roe, and Kral et al. 2004) all significantly decrease the total amount of food consumed. To illustrate this point, a longitudinal study conducted over eleven days found that increasing all portion sizes by 50% resulted in a sustained increase in daily intake of approximately 423 calories (Rolls et al. 2007). Another study found that when consumers were offered the choice to "downsize" the portion of a menu item's side dish, those who opted for the reduction did not overcompensate in other areas of the meal, and thus trimmed the total calorie content of their meal (Schwartz et al. 2012).

Changing defaults to promote healthier eating can also apply to the sizes of serving dishes, individual dishes, and packages, all of which indicate norms on how much to serve and consume. For example, one study found that attendees of a Super Bowl party served themselves 56% more food (a pretzel/chip variety mix) from large serving bowls than smaller ones (Wansink and Cheney 2005). Similarly, when given a larger personal bowl, even nutrition experts served themselves 31% more ice cream without being aware that they were doing so (Wansink, Van Ittersum, and Painter 2006). Other experiments that have simply varied package size have demonstrated the same effect. For example, people indicate that they would use more pasta from a larger box (Wansink 1996).

## **Policy Implications and Concluding Remarks**

Although the most popular policy-based approach to promote healthier eating has thus far been providing additional nutrition information to consumers, this approach needs to be supplemented by new approaches to promote healthy eating (Gittelsohn and Lee 2013). We suggest that the behavioral economic insights discussed above ought to be leveraged at the policy-making level. Below, we consider two sets of food environments and consumers for which our policy-making recommendations differ: (1) public school cafeterias and children; and (2) restaurants and adults.

We begin with school cafeterias for two reasons. First, public schools are public institutions and thus natural places for society to influence children's development through public policy. Second, influencing children's behavior does not raise the same libertarian concerns that would arise if policies attempted to influence adults' behavior, because children do not have the same rights as adults. For example, we can compel children, but not adults, to go to school. Third, when regulating public school cafeterias and

children, government policies can exert a much higher degree of control over the food environment, and a wider range of policies can be adopted. Choice architecture principles can be used to design school cafeterias that adhere to these principles: healthier foods can be made more convenient, unhealthy foods can be made less convenient, and healthier defaults can be set. Precommitment devices can also be utilized by having children indicate their school lunch preferences in advance, with any changes from these precommitments being penalized with small fees.

In addition, school environments are a potential place in which policy makers might consider a restriction on child-targeted food marketing, particularly given our understanding of the impact of visceral factors on decision-making, as well as the ubiquity of food marketing and the increasing use of stealth-marketing tactics on children (Bragg et al. 2013; Harris et al. 2009; Nestle 2006). Such marketing makes food cues very salient and exploits people's vulnerability, especially when in "hot" states. Finally, relatively more heavy-handed policies, such as bans on sales of certain foods, should also be considered for children. For instance, many states have adopted policies that set standards for competitive foods—foods sold outside of the federal school meal program—that are offered in schools (Taber et al. 2012). These policies prevent foods and beverages that fail to meet specific nutrition standards from being sold during certain times of the school day. Moreover, there is evidence that such policies may decrease adolescents' body mass index (BMI) (Taber et al. 2012) and simultaneously benefit schools districts by increasing their revenue via increased participation in the National School Lunch Program (Long et al. 2013).

When regulating restaurants and adults, however, the government has considerably less direct control over the food environment. Moreover, there is much greater variety in restaurant food and more resistance to heavy-handed policies because patrons are adults as well as children. Accordingly, we propose that government policies should provide incentives for restaurants to engage in their own creative solutions for increasing healthy food choices and decreasing unhealthy food choices. Such incentives could include penalties for selling high proportions of unhealthy food, analogous to the penalties that are given to companies that produce high greenhouse gas emissions. Solutions such as these allow restaurants to retain some flexibility and therefore may be more acceptable to companies. Additionally, many of the behavioral economic biases and findings we highlighted in this paper could be adopted as solutions. For instance, restaurants might ask their customers if they want to voluntarily downsize their food orders. Schwartz and colleagues (2012) have shown that a subset of customers is willing to do so without a price discount. Restaurants may also market healthy foods more aggressively. For instance, restaurant menus may show enticing photos for healthy menu items, rather than for unhealthy items. Through this method, consumers may be encouraged to focus on "hot" aspects for healthy food but on "cold" aspects for unhealthy food. As a last resort, government policies may begin to move towards bans of unhealthy food in restaurants, although unlike bans of unhealthy foods in public schools, such bans are more controversial and would likely be met with resistance. However, some of these kinds of policies have been successfully implemented in institutions. For instance, a recent policy restricts the sale of sugary drinks on government property in Boston (Pomeranz and Brownell 2012).

Policy makers could also consider leveraging social norms about consumption, which have a strong impact on people's choices and behavior (Cialdini et al. 1990; Costa-Font and Gil 2004; Schultz et al. 2007). For example, as Schwartz and colleagues (2012) suggest, a downsizing intervention could incorporate social norms by asking customers whether they want to "right-size," rather than "down-size" their orders, indicating that smaller portions are the preferred or typical choice. Health campaigns that provide information about social norms might also inform people of how often their peers engage in healthy behaviors (e.g., XX of your peers take the stairs each day). However, such campaigns should be carefully designed and tested, perhaps only presenting information about peers who engage in high levels of healthy behavior. Indeed, one field experiment to encourage exercise in the workplace found that providing employees with information about how often their peers exercise led employees to emulate those peers that exercised the least, rather than the most (John and Norton 2013).

Many health insurance companies and employers who pay for their employees' health insurance already have financial incentives to promote healthier behavior (Mello and Rosenthal 2008). Accordingly, some employers and major health insurance companies have started to offer incentives for employees to engage in healthier behaviors (Mello and Rosenthal 2008). In the weight-loss domain, monetary incentives can lead to significantly more weight loss (Volpp et al. 2008); however, this weight loss may not last if incentives are discontinued (Volpp et al. 2008). The effect of financial incentives might also be enhanced by incorporating principles from behavioral economics (Loewenstein et al. 2013; Volpp et al. 2011) such as social incentives, anticipated regret, and introducing a lottery system alongside monetary incentives (Loewenstein et al. 2013). For instance, one study found that employees were more likely to complete a health risk assessment when the monetary incentive was tied to a lottery system in which the lottery payoff was higher if at least 80% of the group members had completed it (Loewenstein et al. 2013). These findings suggest that to promote greater sustained weight loss without requiring a long-term financial commitment from a company, the workplace food environment may also need to be altered through some of the proposed healthy food choice policies outlined in this paper. Therefore, workplaces may consider utilizing choice architecture to re-design their cafeterias, enacting institutional policies such as discouraging workers from bringing unhealthy foods into the office and leaving them in shared workspaces, and encouraging peer mentors to socially incentivize weight loss at work.

Although we have proposed that insights from behavioral economics have the potential to improve existing information-provision policies and to inform noninformation-provision policies to address obesity, other researchers have pointed out that using nudge approaches may reduce the pursuit of more assertive policies, such as taxes, which are less popular with consumers but potentially more effective at inducing healthier eating (Rayner and Lang 2011). Our perspective is that nudge-based approaches should complement, rather than substitute for, more assertive policies (Loewenstein and Ubel 2010). For instance, a tax on unhealthy foods is a policy that, according to traditional economic principles, should lead to reductions in the demand for unhealthy foods. Yet a recent field experiment suggests that a tax on unhealthy foods may be much more effective at decreasing unhealthy food choice if combined with a label that the food is

taxed for being unhealthy—that is, a normative signal (Shah et al. 2013). This work demonstrates that combining a pillar policy recommendation from standard economics—taxes—with a psychological insight can make the policy more effective at promoting the desired behavior change. Thus, behavioral economic insights ought to be viewed as a complement to traditional economic approaches.

More generally, many current policies that have been proposed to address obesity draw from traditional rather than behavioral economic principles. Traditional economic principles encourage policies such as the provision of more nutrition information, taxes on unhealthy foods, and monetary incentives to engage in healthy behavior. Many of these approaches fall short of their expectations, but can be improved by incorporating findings from behavioral economics. Unlike traditional economics, behavioral economics (and the field of psychology more generally) informs us that people are vulnerable to irrational decision-making due to present-based biases, visceral factors, choice presentation format, social consumption norms and incentives, and a host of other influences. Incorporating these nuanced insights might significantly improve policies derived from traditional economic approaches and lead to complementary policies that leverage these insights.

We conclude by urging the greater use of experiments to guide policy-making. Many existing policies aimed at addressing obesity fall short because they incorporate interventions that have not been thoroughly tested with consumers. For instance, currently popular information-provision policies, such as nutrition labeling and menu labeling, could be far more effective if they incorporated principles of simplicity that have been uncovered through experiments. Therefore, to better accomplish the goals of promoting healthy eating and reducing obesity, we urge governmental regulatory bodies to fund controlled pilot trials in the laboratory and in the field (before policy implementation, when possible) and to encourage research that measures the actual effectiveness of policies once they are implemented.

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