

Using Marketing Muscle to Sell Fat: The Rise of Obesity in the Modern Economy

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Abstract

The large increase in obesity in the past 30 years has often been explained in rational choice terms; for example, a decline in food prices has engendered greater food consumption. On closer examination, this kind of explanation does not fit the facts of the current obesity epidemic. Instead, an unprecedented expansion in the scope, power, and ubiquity of food marketing has coincided with an unprecedented expansion in food consumption in predictable ways.

Ongoing protestations that the causes of the recent increase in obesity are unknown may overstate the case. Ample evidence indicates that the obesity epidemic is, at least to a large degree, the result of increased marketing power over the American diet. Only by reigning in or countering marketing power can rationality be restored to the dietary choices of Americans.

INTRODUCTION

Developing an appropriate response to the current epidemic of obesity would be considerably helped by a well-informed understanding of its genesis. Ample evidence indicates that an increase in caloric consumption is a major—if not the major—contributor to the increase in obesity.

Currently there are two broad explanations for increased caloric consumption, one rooted in rational choice, and the other rooted in structural factors. The rational choice theory, favored by many economists, focuses on technological changes that have shifted incentives to favor more food consumption: lower prices or reduced adverse health effects of obesity. On the other side are those who have emphasized that eating is sensitive to environmental cues. In this paradigm, overeating results from more extensive advertising, new product development, increased portion sizes, and other tactics of food marketers that have caused shifts in the underlying demand for total food calories.

The explanations differ markedly on whether the observed increases in obesity—and by extension changes in diet and exercise—should be the subject of public health interventions at all. The rational choice proponents vigorously defend the consumer's right to choose against any intervention by those interested in public health. Yet because the rational choice side lacks an understanding of how food marketing influences tastes, preferences, and therefore choices, they misread all choices as free choices. In fact, argue those who point to the effects of advertising, consumers are not the only ones making choices. Because individual choices are highly influenced by the profit-maximizing choices of marketers, only by restraining or countering food marketing's influence can individual choice become truly free choice.

If we accept the explanation of the rational-choice camp, how do we understand the role of public health? If one of the biggest noninfectious threats to public health in the history of the world can be understood as a collection

of individual, rational decisions that are making everyone better off, can we continue to enforce childhood vaccinations, monitor the cleanliness standards of restaurants, or review drugs for approval? A lot is at stake in this debate.

Because both types of explanations rely on factors that have changed at a societal level (prices or marketing), the usual statistical evidence is unlikely ever to shed much light on the causes of the increase in obesity, although it could be useful in suggesting explanations, ruling them out, or providing important context.

This article has two objectives: first, to present some of the ways in which technological and regulatory changes have led to qualitative shifts in the power and scope of food marketing, and second to argue that in light of these changes, marketing is the single most plausible explanation for obesity trends in the past 30 years.

ATTRIBUTES OF OBESITY

To assess the causes of the recent upsurge in obesity, it helps to review several important features of this increase: Who was affected? When did it happen? Which food types were most affected?

The Increase in BMI

Mean body mass index (BMI) increased very slowly throughout the twentieth century until about the early 1980s, at which point it began to increase substantially, accelerating further in the 1990s (see **Figure 1**).

Although some meaningful racial/ethnic and socioeconomic disparities do exist in rates of obesity, these disparities are small relative to the increase in obesity over time, and the disparities have been relatively constant over time. **Figure 1** shows the increase in average BMI for two groups: those with household incomes in the top quartile and those with incomes in the bottom quartile. The phenomenon of rising BMI is present in both groups, and the time trend overwhelms the relative disparity.

Similar patterns would emerge if we were to graph trends for African Americans versus Whites, high- versus low-education individuals, young versus old, men versus women. The increase in obesity has been universal and remarkably evenly distributed, even if the baseline risk is not. Perhaps even more remarkably, those at the 15th percentile of BMI have seen a substantial increase in BMI since 1970 (63), as have, of course, those at the median and at the 85th percentile. The biggest cause of disparities in obesity is not race/ethnicity, income, education, gender, age, or region, but rather year of birth: Those who reach a given age before 1980 have lower BMI than do those who reach the same age after 1980, and the disparity is huge.

PHYSICAL ACTIVITY VERSUS INCREASED CONSUMPTION OF CALORIES

Although Americans may be more sedentary than is ideal for their general health, evidence indicating changes in physical activity over the past several decades that might explain the increase in obesity is limited. Two possible explanations have gained currency: a reduction on the activity intensity of employment and sedentary lifestyles. Yet although precise data on physical expenditure are poor and unevenly available, a consensus is emerging that these two explanations are inadequate to explain major shifts in obesity. Careful analysis suggests that most or indeed all the increase in obesity is to be explained by increases in caloric consumption, rather than changes in physical activity (7).

Sedentary Lifestyles

Television viewing has been associated with obesity in many studies, and researchers have jumped to attribute obesity to the sedentary nature of television and to sedentary lifestyles generally. However, a recent longitudinal study found that viewing of noncommercial television (e.g., PBS or shows on DVD) was not associated with obesity, whereas commercial viewing (i.e.,

viewing that included advertising) was associated, suggesting that a causal pathway through sedentariness to obesity is implausible (106). Television does not in any event displace physical activity, but instead displaces other forms of sedentary leisure such as reading and listening to music (21, 65, 71, 83, 98). Moreover, television viewing has been relatively constant since the early 1970s, whereas leisure time physical activity, by contrast, has been stable or perhaps even increased slightly since 1980 (11, 29).

Changes in Work Demands

Changes in the composition of employment from a labor-intensive manufacturing and farming economy to a service economy could explain a reduction in caloric expenditure on the job. Available data are not adequate to reliably assess the changing activity demands of work at a population level, but a recent study documents a rise in employment in low-activity occupations from 1950 to 1970, followed by relative stability, paired with relative stability in high-activity employment from 1950 to 1970, followed by a gradual decrease (11). On net, the employment transition from goods-producing to service employment has been remarkably steady since 1950, with nothing to suggest a dramatic change around 1980 (see **Figure 2**).

Moreover the magnitude of the impact of employment changes on obesity is not clear. One study finds that BMI is slightly higher in occupations that demand a lot of muscle and slightly lower in occupations with a lot of physical demands (61). Because these job attributes tend to go hand-in-hand, however, it is hard to interpret the net effect of these results. Taken together, the changing shifts in types of employment have been too gradual over time and their effects not sufficiently clear to suggest that changing employment is a major contributor to the huge increase in obesity beginning around 1980.

Other writers have focused on changes in the physical demands of work within job types, citing, for example, the diffusion of cheap

printers that disincentivize walking to a communal printer or the replacement of hammers with pneumatic nailers (24). The magnitude of these effects is difficult to measure at a population level, and a case can be made for better data on the caloric demands of different job types or the use of different tools within jobs. The answers are not obvious and the magnitudes are particularly unclear. For example, assuming the communal printer is 25 feet away, and that one might walk there 10 times a day, the calorie savings is about 5 1/2 kcal per day. Even a great many such changes would not adequately account for the change in caloric balance associated with the rise in obesity.

Although it may at first blush seem obvious that automation in labor-intensive occupations reduces calorie expenditure, the literature does not always adequately distinguish between the caloric demands of a given task and the caloric demands per hour. The main effect of labor-saving technologies has been to increase productivity by raising the number of tasks done during a day, and this increased number of tasks partially offsets the caloric reduction in the calorie cost of completing one task. Concretely, consider that a framing hammer weighs about one pound, whereas a nail gun used in framing weighs about 9 pounds. The calorie difference between swinging a highly ergonomic one-pound hammer for an hour as opposed to manipulating a nine-pound pneumatic nailer for an hour is not clear. A useful research agenda would be to measure carefully caloric expenditure both across occupations and within occupations using different kinds of tools.

Increased Caloric Consumption

Against the weak evidence of any decrease in caloric expenditure, strong evidence indicates an increase in caloric intake since 1980 (16, 23, 37, 73, 74, 82, 96, 104). Remarkably, mealtime caloric expenditure has been quite stable for several decades, in fact declining slightly when mealtime beverages are considered separately (74).

By contrast, calories consumed in the form of snacks and sugared beverages have increased by significant amounts—easily adequate to explain the increase in obesity (66). Between 1977 and 2001, an additional 280 kcal/day has been added to the average American diet from beverages alone, almost all of which was from soft drinks, sweetened beverage, fruit drinks, and alcohol (73). Snacking has added an additional 145 kcal/day. These large increases have been only slightly offset by decreases in milk and mealtime food consumption. To be sure, fast-food and other restaurants cannot be completely exonerated: The largest proportionate increase in sweetened beverage consumption has been in the context of meals eaten in restaurants (73).

Caloric Increase Required to Explain the Increase in Obesity

The amount of calories necessary to explain the increase in obesity is not trivial nutritionally—about 370 kcal/day by one recent estimate (53)—yet surprisingly common in American commercial food culture: about the amount of one Big Gulp (32 oz) fountain drink or a vending machine bag of Doritos plus a can of soda or a Grande 2% White Chocolate No Whip Mocha. The amount calculated as necessary to produce the observed increase in obesity closely matches the estimated increase of 342 kcal/day estimated for Americans aged 19–39 from 1977 to 1996 (74).

Explaining obesity. In the late twentieth century, people began to consume more food, without offsetting changes in physical activity. Any explanation of obesity must be consistent with the basic epidemiological facts: a sudden increase in consumption beginning some time around 1980; relative stability before this time; its ubiquity in the population across age groups, race/ethnicity, education, and income levels; and its disproportionate source in increased consumption of sugary beverages and snacks.

RATIONAL-CHOICE EXPLANATIONS FOR THE INCREASE IN CALORIC CONSUMPTION

Economists have argued that technological changes have led to changes in relative prices, and these price changes in turn have incentivized greater food consumption (14, 16, 24, 61, 64). Two price changes have been identified: falling food prices since 1980 and the falling time cost of food preparation as technologies such as the food processor and microwave have become widely adopted.

Food Prices Are Too Low

The average price of food has indeed fallen since 1980, by ~10% or so, mostly in the early years. Although frequently invoked, this argument has been rarely tested. The magnitude of effects here is suspect: A 10% decline in overall real food prices is presumed to explain a 10%–15% increase in caloric intake, implying a calorie-income elasticity of 1 or greater, much higher than what has been estimated for individual food groups (4, 77). Moreover, if prices were a meaningful contributor, one might expect the patterns in obesity to be different over time for high-income people—who are less sensitive to price changes—than for more price-sensitive low-income people. Instead, the patterns across incomes are very similar.

A formal econometric analysis finds that several types of local-area food price changes since 1980 are associated with small changes in obesity rates—the total effect is said to explain ~12% of the increase in obesity since 1980—but the level of statistical significance is not reported (14).

Taking a longer view introduces considerable skepticism for the price explanation. In the mid 1970s, food prices experienced a very large—roughly 20%—and sudden increase in food prices relative to nonfood prices, as shown in **Figure 3**. This large exogenous price increase presents a strong

natural experiment to test the hypothesis that BMI responds to food prices.

The results of this experiment suggest that BMI is not highly responsive to food prices because sharply increasing food prices in the 1970s were not associated with any meaningful change in obesity. In sum, we have no persuasive evidence that falling food prices can induce consumers to overeat.

Cheap Corn

A similar explanation argues that farm subsidies, and in particular policies that keep down the price of corn, have contributed to the obesity epidemic (64) or indeed are the primary cause of it (79). Although it is widely recognized that U.S. farm subsidies have caused distortions that have led to environmental and economic harms, and although it is clear that U.S. farm policy distorts dietary choices in injurious ways (60), because the magnitude of the subsidy effect on consumer prices is tiny, the obesity epidemic may be one ill for which they are not responsible (6). Consider the case of soda, or indeed, a single can, which typically contains 38 grams of sugar. The cost of the high-fructose corn syrup (HFCS) in this can has fluctuated substantially but has averaged about 1.6 cents recently. Replacing that with cane sugar would add less than 2 cents to the cost of the can (20)—a fortune for the soda companies, but not much to the average consumer. Alternatively, were corn not subsidized, an economic analysis finds that the price of HFCS would be ~12% higher than it is currently, or well under a penny a can (43). Similar calculations have been made for a whole array of foods that use corn and its fractionated derivatives and have reached similar conclusions: Subsidies may be damaging, but the subsidy value that foods carry is not large to the individual consumer (though, of course, huge to the corporate beneficiaries) (43).

Some Food Prices Are Too High

An explanation of income-related disparities in obesity holds that, in an effort to save money,

poor consumers purchase energy-dense foods, which offer cheaper calories than do energy-light foods. Some writers have attempted to expand this theory into a general explanation of the rise in obesity, although it clearly has limited capacity to explain the obesity trends among the nonpoor.

Although this argument is billed as a rational economic one, it is manifestly not consistent with truly rational choice. A cost-minimizing consumer might well choose inexpensive, energy-dense foods—but would then consume them at a level short of what would cause obesity because any excess consumption would be a waste of resources. Soda, with its empty calories, is a case in point. If poor consumers are rational, they would consume none of it, assuming the rest of their diet meets their caloric needs. Yet that is not the observed pattern.

Empirically, although choices about individual food items have been shown to be sensitive to prices, the extent to which overall energy consumption is responsive to differences in relative prices has not been shown. This explanation does not match the observed facts. Food price elasticities estimated separately for the poor and nonpoor have found that the poor are less sensitive to fruit and vegetable prices than are the nonpoor, not more sensitive as would be expected under this explanation (77).

Moreover, the magnitude of the effects is suspect. Although researchers have often noted, for example, that fruits and vegetables are expensive relative to other foods, a recent analysis by the U.S. Department of Agriculture (USDA) found that half of some 150 fruits and vegetables assessed could be purchased for less than 25 cents per serving, and a 5-a-day regime could be purchased for just 69 cents (91). A 2004 USDA study finds that high-income households spend \$1.43 more per person per week on fruits and vegetables than do low-income households (8). Tragically, there are households in the United States for whom \$1.43 per week is real money, but they are few, and it is difficult to construct a theory of ubiquitous obesity on a difference of this magnitude.

Falling Time Cost of Food Preparation

An alternative rational choice explanation, the “mass food preparation hypothesis” (16) suggests that new technologies have driven down the time costs of meal preparation and in particular the fixed costs associated with each meal episode. It is difficult to think of examples of food technology consistent with this mechanism that are available to the home cook. Food processors would seem to reduce the marginal cost of food preparation, while raising the fixed costs. Preprocessed foods and microwave ovens may reduce the time costs of food preparation but, microwave popcorn notwithstanding, are not commonly used for snacks or sweetened beverages. The authors provide two examples of foods affected by this technological innovation: french fries and creme-filled mini-cakes. But the home technologies for these foods have been unchanged for many decades: Ore-Ida and Simplot began selling frozen french fries in the 1950s, and Twinkies were first sold in 1930.

On the other hand, if the argument is about commercial processing of such foods, then from the consumer’s point of view, all that matters is relative prices. As articulated above, such a shift wouldn’t explain why consumers have suddenly decided to overconsume overall: Calorie consumption might shift from low-preparation foods to high-preparation foods, but that is no reason that total consumption should increase. Clearly the underdeveloped mass food preparation hypothesis needs a bit more time in the oven.

Rising Time Cost of Food Preparation

Similarly, a rational-choice argument has been made that with increased female access to labor markets, women’s time has become more valuable, and as a result they are less willing to spend time in the kitchen. The empirical timing for this model is off because much of the labor-market opportunities for women opened up before the big rise in obesity. Putting that problem

aside, changes in women's labor-market opportunities might be a plausible explanation for more meals away from home, but it does not explain why calorie consumption has increased. Rational consumers would presumably respond to these shifting incentives by eating healthy meals at (or taken away from) restaurants with no change to calorie intake.

An empirical analysis of the changing role of women in the labor force since 1980 finds a very small effect of mother's working hours on child obesity for the wealthiest quartile of the labor force, but no effect of number of weeks worked per year, and no effect of any labor supply variable for most of the population (3).

Health Insurance

An argument has been made that extensions of insurance as well as improving therapies for obesity and its sequelae have shifted the incentives for obesity by reducing adverse effects borne by the obese (24). The insurance side of this argument, called moral hazard, is particularly weak. Access to public insurance increased dramatically in 1965 with the enactment of Medicare and Medicaid. Yet there was no abrupt increase in obesity at that time. From 1977 to 1996 the percentage of the population with secure access to care decreased markedly (107), which, under this theory would *ceteris paribus* predict a decrease in obesity. The direct empirical evidence is also weak. One study finds a small association of health-insurance purchase with obesity among men, but not among women, and is not able to disentangle the moral hazard effect from a self-selection effect in decisions to purchase insurance (24).

Although therapies for obesity have undoubtedly improved dramatically since 1970, obesity continues to exert a "devastating impact" on health-related quality of life (26), and obesity is the second most common behavioral cause of death, after smoking (69); therefore, it would be surprising if large numbers of Americans had suddenly decided that obesity was not a threat to their well-being. No empirical evidence exists to suggest that improved

therapies are meaningfully altering people's behavior.

Rational Choice: A Poor Choice of Model

In sum, rational-choice models perform poorly as explanations for the large increase in obesity. Because these models do not identify potential causal mechanisms that were relatively stable before 1980 and increased dramatically around that time, and because they do not identify causal mechanisms that would have similar effects across the population, they fail to meet the explanatory desiderata outlined at the conclusion of the third main section above. In addition, the evidence base supporting them is thin, the magnitudes of proposed mechanisms are small, and in many cases the causal mechanisms are poorly thought out or require tremendous leaps of faith.

However, to highlight the inadequacy of rational-choice models is neither to exonerate individuals for the rise in obesity nor to deny the important role of personal responsibility. Rather, it is to situate these choices in a context that makes personally responsible choices either easier or more difficult to make. It is to recognize that the only way for choice to be truly rational is to unearth the subconscious forces that influence it.

One reason for the inadequacy of rational choice models is the inherent complexity of weight gain, which even now is poorly understood by experts. Not only are consumers largely unaware of their own daily calorie intake/expenditure balance, but they are also largely uninformed about the broader costs and benefits.

One recent study concludes that "individual assessment of diet costs was, to a large extent, a matter of subjective perception rather than of objective facts" (19). In the face of such poor information and uncertainty about the effects of their actions, people turn to cultural norms to regulate behavior. Culture—not individual rationality—has given people around the world broadly healthy diets for millennia. "Culture"

here means the transmissions of tastes and food norms that structure eating for social groups. A family may have a food culture that values eating a sit-down meal together or permits individual eating on the run. Culture permits or discourages eating meals or snacks in front of the television. It regulates the consumption of alcohol. Most pertinently for discussions of obesity, it regulates how much and what type of food is eaten, how quickly, and in which context. Each of these variables has a significant effect on total calorie intake (15, 101).

In the past 30 years, food culture has been manipulated by the marketing of highly processed foods as never before. Food culture no longer hews to tradition, channeling consumption in healthful ways, but increasingly answers to commercial interest, funneling consumption toward high-profit foods.

ADVERTISING, MARKETING, AND THE CHANGING AMERICAN DIET

Several authors have pointed to the role of marketing and advertising in promoting obesogenic and otherwise unhealthy diets (22, 39, 40, 62, 67, 70, 88). Many of these prior treatments have focused on the effects of food marketing or advertising on children's diet and obesity, to the exclusion of the effect of marketing on adults. Given that children are particularly vulnerable to manipulation by marketers, and given that lifelong habits of diet are set in childhood, this emphasis on children is appropriate. Yet it may also be limited.

A huge literature has shown beyond any reasonable doubt that, in the words of the Institute of Medicine, "marketing works" (38, 44, 45, 67). Marketing has been shown to increase the availability of product brands in the mind, to increase preferences for those brands, to increase consumption of those brands, and to increase consumption even of dissimilar foods. Marketing works not only by operating on the unconscious mechanisms that regulate food consumption—the salience of food in the environment being related to perceived hunger and

consumption—but also by changing the conscious preferences of consumers (13, 15, 75, 100). How different this model of human behavior is from the rational-choice assumptions of consciously rational decision-making around stable, exogenously given preferences.

The question is, has the \$11 billion that the food industry spends annually on marketing changed enough in the past 30 years sufficient to explain the increase in obesity observed during this time? Are the observed changes in marketing large enough and significant enough to have induced the extra consumption of 350-odd kcal/person/day that would explain the upsurge in obesity? If so, do these changes in marketing fit the explanatory desiderata outlined in the third section above, that is, do they describe phenomena that were relatively stable before about 1980, increased dramatically after that, and have a ubiquitous effect on society?

Definition of Marketing

Most marketing textbooks refer to the 4 P's in the marketing mix: product, price, place, and promotion. Although several public health discussions of obesity have focused on advertising (29)—or indeed only on television advertising (23, 49)—advertising is but one component of promotion, which is itself only one of the 4 P's. Marketing is far larger than advertising—by one recent estimate five times as large (67). **Table 1** shows some of the innovations in marketing that have taken place between the mid 1970s and the mid 1990s. The table focuses only on marketing practices that were relatively rare or nonexistent before 1975 and that grew rapidly in the late 1970s or the 1980s to achieve significant impact by 1990. Those innovations—such as Internet marketing and social media marketing—that have come online mainly after 1990 are omitted. The information in **Table 1** is intended to be illustrative, not exhaustive. Because marketing thrives on both innovation and variety, the marketing mix in five or ten years is certain to be different than that presented here.

Table 1 Innovations in the food marketing mix

Product
Product innovation
Price
Value meal bundling
Increased portion sizes
Place
Cluster retail strategy
Competitive foods in schools
Promotion
In-school advertising
Product placement and product integrations
Licensing deals
Sponsorship
Endorsement
Improved packaging

As the reader can see, there have been meaningful innovations in each of the 4 P's of the marketing mix.

The Rise of Marketing

By any measure, marketing has expanded dramatically since 1980. One estimate suggests that total advertising expenditures in the United States increased from ~\$506 per person (in 2000 dollars) in 1980 to \$815 per person in 2000, a 60% real increase in 20 years (58).

This increase alone is dramatic, but it is only part of the story. In addition to a huge increase in advertising, the 1980s and 1990s saw an even greater increase in nonadvertising marketing: in-store displays, giveaways, contests, licensing deals, sponsorship deals, product placement, product innovation, sophisticated pricing, and expanded sales venues. In 1983, such marketing expenditures were about half as large as advertising budgets. In the 1980s, nonadvertising marketing began to grow much faster than advertising expenditures (1), and by 1993 it had become three times as large as advertising budgets (58). Not only were consumers being cultivated with ever-larger amounts spent on advertising, but these expenditures were leveraged by a massive increase in the quantity and sophistication of nonadvertising marketing.

Although explicit data on food marketing are proprietary and accordingly difficult or impossible to obtain, it is clear that these changes—documented for marketing overall—are similar for food marketing specifically.

Technological Change and P1: Product

One of the most powerful, most important, and—crucially—subtle forms of marketing begins with the product itself. Or indeed with the consumer him- or herself, whose tastes are carefully plumbed to create products whose formulations fit like keys into the psychological and physiological locks that keep consumption within reasonable limits. These products open up limitless possibilities of consumption and, by extension, sales.

Food product innovation. Food science entered a period of rich efflorescence in the 1970s and has hardly looked back since. On the strength of its discoveries, new food product introductions accelerated through the 1980s and into the 1990s, beginning from 5,600 per year in 1985 and peaking at more than 16,000 in 1995 before falling back in 2000 to ~9,000 (30, 31, 42). The result was an increasing array of choice. The average number of items offered in the supermarket had risen gradually from ~1,000 in 1930 to ~8,000 in 1976 (68). Thereafter it began to accelerate rapidly, reaching 26,000 by the late 1980s and stabilizing at 40,000 by the year 2000—a fivefold increase in just over 20 years (41, 42).

Because so much of marketing is not about the product, but about the lifestyle, real or imagined, that the product conveys, food manufacturers have been eager to develop new products that can more precisely appeal to the different aspirations of different consumers. This process of segmenting the market by creating new products has accelerated recently as innovations in food science have enabled manufacturers to combine both new and old ingredients in new shapes, colors, textures, and flavors that can be marketed as new lifestyle choices.

Most of this increase was for highly processed, branded products that have the potential to create a special tie with the consumer. Just in the potato space alone, one can choose among antique potato chips, all natural potato chips, Hawaiian chips, Cajun potato chips, Magic Masala, mesquite-grilled BBQ potato chips, or salt and malt vinegar chips. A chip for every chap.

The efforts of the marketers in food product innovation have enlisted not only psychologists, but biologists as well. Many researchers have argued that people overconsume energy-dense products such as fatty foods, sugary beverages, and salty snacks because they are more palatable than other foods (17, 19, 56). Sugar, fat, and salt have been called the three points of the compass, and the hyperpalatability they impart, the “superstimulating nature of food,” has been carefully manipulated to maximize their appeal to the evolutionary triggers of taste (18, 56, 79). Food has in addition been painstakingly engineered to minimize chewing. To minimize the time and effort of consumption, processed foods are generally softer than real foods (the dubious advantage of a chicken nugget to real chicken), and even crunchy snacks are soft—consider the pseudo crunch of a Cheez-It. Because faster consumption has been associated with greater consumption, it is no surprise that such foods tend to be overeaten.

Although the basic science of the psychological and biological appeal of food has enabled manufacturers to target their product development efforts better, these products have been refined by extensive real-world field testing made feasible by new information technologies.

Scanner data. The first grocery store scanners were rolled out in 1974, enabling retailers to link promotional data to sales data instantly (68). In 1978, Information Resources, Inc. was founded to use data-driven methods to test-market new food products with large panels of consumers (68). In 1986, scanner data were leveraged with data on test marketing of new products to provide rapid, real-world local test marketing of new products

(68). It is surely no accident that the heyday of new product introductions occurred just after the widespread adoption of scanner technology and real-world market research, which provides manufacturers with detailed data on the success of new products in exact sociodemographic niches and provides retailers with instant feedback on local tastes and on the success of in-store promotional strategies. Food product development and promotion was no longer a matter of hunches in the lab; they became scientific, data driven, and nearly immediate. Product innovation and promotion now merged with market segmentation to provide very small groups of consumers exactly the kinds of products they wanted—or could conveniently be induced to want—promoted by exactly the means that would best work on them.

Cultural Change and P2: Pricing and Portion Sizes

Prices provide relative incentives, but they can also be strategically deployed to convey information about norms and values. Retailers can exploit consumers’ tendency to refer to relative prices by adding a high-price, low-value item to boost sales of a high-margin item nearby (5). What is less important than the price itself is the appearance of value that the price and other prices nearby convey. However, strong cultural forces limit consumption. The marketer’s trick is to get the consumer to overconsume by focusing on the virtue of economy, not on the vice of gluttony (79).

These insights have led to bundling of products at retail, particularly “value meals” at fast-food restaurants, and to increased portion sizes. Consumers may perceive that larger portion sizes confer better value or that they indicate a social norm of greater consumption (99). Retailers can earn large profits on large portions because the marginal cost of food is typically quite small relative to the fixed costs of running a retail food establishment (105), but also because the supersize may be priced to reflect the true marginal costs, whereas the regular size may in fact be an inflated price. One executive

was quoted as saying that of the 50-cent price to supersize a particular product, 40 cents accrued to the bottom line (2).

Portion size has been shown in carefully designed experiments to affect how much food people eat (84, 101, 105). In one example, an often-cited study in which movie-goers were randomized to receive different-sized containers of stale popcorn (101), those randomized to receive large containers ate 33% more stale popcorn than those receiving the medium containers. Each container was large enough so that there was no ceiling effect—the size of the container was a cultural signal, not a constraint. Unmistakably, the experimental manipulation caused the difference in snack consumption.

Portion sizes began to increase slightly in the 1970s, accelerated rapidly in the 1980s, and continued their increase into the 1990s, when a take-away drink larger than the human bladder was introduced. Portion sizes are now many times greater than originally offered, a phenomena to be observed in virtually all food-and-beverage categories, but most particularly in restaurants, snacks, and beverages (105). Although those who consume the largest sizes are obviously affected, those who look at the largest size and instead choose the medium size may also be affected, given that the medium size has also trended upward over time. Clearly, portion size increase has been a powerful marketing tool pushing toward expanded consumption.

In this exchange, rationality itself has been transformed, migrating from concerns of health and taste to concerns of economizing. Although this economizing may not, in fact, be rational, the appearance of economizing justifies a choice that might before have been culturally taboo. Some evidence now indicates that those who are the most price-sensitive—at all income levels—are also the most obese (33).

Regulatory Change, Contract Innovation, and P3: Place

Regulations restricting advertising were relaxed during the Reagan years, and the changing regulatory environment permitted new forms of

contract that extended marketers' reach into previously untapped territory.

Competitive food in schools. Reduction in school funding since the 1970s has left schools “hungry for business” in the form of in-school advertising and sales deals (76). As a result, schools have been more willing to countenance advertising and nonschool sales of food on the premises, called “competitive foods,” most of which are of poor nutritional quality (28). The 1980s saw the beginnings of a significant expansion of commercial food availability in schools, and the trend intensified in the 1990s, with a 13-fold increase in the reported number of exclusive sales rights agreements (76). By the year 2000, an estimated one-quarter of middle schools and high schools sold brand-name fast foods (3).

Schools make large margins on vending machine sales and other competitive foods (88). Not only have competitive foods become more prominent in schools over time, but in a new innovation since the late 1980s, schools are directly incented to help pump up sales of soda, snacks, and other competitive foods through exclusive rights contracts (72). By the time a student was expelled from a Georgia high school for wearing a Pepsi shirt on his school's Coke day in 1998, 42% of elementary schools, 58% of middle schools, and 73% of high schools had exclusive pouring rights contracts (3), which had been nonexistent before 1990 (72).

Cluster retail strategy. Experiments have shown that the availability of food affects its salience, and therefore how much of it is consumed (75). It may therefore be that the retail availability of prepared food increases purchases and consumption. An econometric analysis found that a 10% increase in the number of fast-food restaurants per capita associated with a 1.7% increase in the number of obese individuals (14). One may fairly worry about reverse causality in this analysis, but it bespeaks the possibility of a meaningful effect.

Data from the Economic Census show that the number of grocery stores in the United

States decreased by about half from 1963 to 2007. Accounting for an increasing population, the per-capita number of stores decreased by some two-thirds. By contrast, the number of restaurants remained about the same on a per-capita basis, though with fluctuations over time. But the number of establishments selling food products expanded dramatically in the 1970s and 1980s as gasoline stations, building material outlets, auto parts stores, drug stores, and home furnishing stores all began to add candy and snacks at their checkout counters. In 1963, there was one such nongrocery seller of food for every 1,700 people. By 2007, there was one such outlet for every 1,000 people, a 70% increase in the number of nongrocery food sellers per capita.

Technological Change, Contract Innovation, Regulatory Change, and P4: Promotion

One of the major exogenous changes in the American economy since 1980 has been the tremendous growth in new forms of marketing contracts.

Product placement. Product placement was a sleepy and informal business in the first three-quarters of the twentieth century, in which film producers might on occasion secure a prop for free in exchange for its use on screen. Money generally did not change hands, and the arrangements were informal (52, 90). Then, in 1982, E.T. was shown eating Reese's Pieces and sales increased by 65% (90). The era of paid product placement was born. Product placement contracts were worth some \$50 million by the end of the decade (90), and a trade association was founded (52). By the time parched American Idol judges were seen unable to make it through a show without drinking Coke, product placement had become a "vehicle for multimillion-dollar integrated promotional campaigns" (52) and was valued at \$3.6 billion in 2009 (36).

A recent study found that 69% of popular movies from 1996–2005 included brand

placement of foods or beverages, with an average of more than 8 branded episodes per film (94). Nearly half of the product placements were for sugared beverages or snacks: 27% for sugary beverages and 21% for salty or sugary snacks and candy. The vast majority of the remaining placements were for fast food or casual dining. Almost none were for fruits and vegetables or for grocery stores.

Corporate sponsorship. One of the major new types of contracts to be written beginning in the 1980s was sponsorship deals. In 1980, 900 companies sponsored special events with a total value of \$300 million. Although corporate sponsorship had been around for a long time, its character changed dramatically with the recognition that sponsorship could earn the sponsor much greater rights to promote their products and brand. By 1987, special-event sponsorship involved 3,700 firms and \$1.75 billion (51). Sponsorships include professional and amateur athletic competitions, charity athletic events, air shows, car racing, arts festivals, and teacher-training conferences. In 1999, special-event sponsorship was \$6.8 billion in the United States, not including Pepsico's sponsorship of the Pope's visit to Mexico that year, marked by billboards and television commercials that welcomed the pontiff above the Pepsi logo and by images of the Pope included in bags of Sabritas potato chips, a subsidiary of Pepsi's parent company, Frito-Lay (95).

Technological change and packaging. Packaging is an important part of marketing, and the food-packaging industry has experienced a virtual revolution since the 1970s and 1980s.

One example is in carbonated beverage containers. Prior to about 1970, nearly all packaged soda was sold in steel cans or glass bottles, but by the mid 1970s, almost all soda was sold in aluminum cans. Not only is aluminum cheaper than steel, but it also allows for a more eye-catching glossy printing on its shiny surface (103). In the early 1970s, plastics began to be used in take-away drink cups

for fountain drinks, offering new opportunities for vivid printing and for souvenir cups. Even more dramatically, after a process to manufacture carbonated soda bottles from polyethylene terephthalate (PET) was perfected in the 1970s, the use of plastic bottles in the U.S. soft-drink industry went from zero to almost completely replacing glass. These packaging innovations not only permitted larger package sizes at a weight that a consumer could tolerate—previously impossible with glass or even steel—but also permitted much more vivid printing on wrap-around labels or even on the container itself. Promoting the product in a way that is truly novel since the 1970s, the package would now not only contain the product, but would also help move it.

In-school advertising. In-school advertising has been the subject of several recent reports, which find that it has increased dramatically since the 1980s as schools have struggled to cope with a steady defunding of K-12 education (27, 35, 67, 102). School marketing takes many different forms (35), including the inclusion of food and drink manufacturer’s logos on official school calendars; advertisements on school notice boards and on athletic field scoreboards; distribution of branded textbook jackets; advertisements in computer rooms, in lunch rooms, and on school bus stops; “scrip” programs that return a portion of sales at specified stores to the school; fundraising sales of candy; in-school distribution of free food samples; corporate-sponsored contests; corporate-sponsored student marketing surveys; corporate-developed curricular material that makes positive references to particular brands; and school-sponsored branded activities (such as one school’s infamous “Coke Day,” which occasioned the suspension of student wearing a Pepsi T-shirt) (58). These disparate forms of promotion are difficult to quantify in a single metric, but the main point is the large increase in school-based marketing, as in the larger society. One source, summarizing the literature, says that commercialization in

schools “has mushroomed and morphed into new dimensions” since about 1990 (76).

The analysis presented here strongly suggests that the tremendous rise in obesity in the past 30 years is due primarily—and perhaps exclusively—to the explosion in the power and reach of marketing, particularly for snacks and sugary beverages. This conclusion is consistent with others in the literature. Several recent overviews of marketing have concluded that “marketing works” (67), and it should be clear from this overview that the power of marketing is in the whole effect of its many and disparate elements, and as such is greater than the sum of its parts. These parts change over time, but what is constant is the ineluctable spread of marketing influence into every corner of American life and culture.

One recent article surveys the research literature on why people make the dietary choices they do and concludes that there is a strong automatic—i.e., not consciously rational—component to eating behavior (15, 38). This analysis extends this previous work by arguing that changes in technology, regulation, and contracts have given food marketing sufficient reach to have caused the obesity epidemic.

REASSERTING CONTROL OVER COMMERCIAL MARKETING THROUGH POLICY AND CULTURE

The rational-choice framework and the marketing explanation have very different implications for how the obesity epidemic should be addressed. Before turning to those ideas, however, the larger issue is whether they should be addressed at all. Consider the conclusions of the rational-choice proponents:

In my opinion, obesity is more the result of the success—not the failure—of the market. But on net, we are still better off (24).

We suspect that most people are better off from the technological advances of mass food preparation, even if their weight has increased (16).

In a world-view in which people choose rationally exactly what is best for them, it is natural to conclude that people's rational choice to become obese is making them better off. And if they are better off, any intervention can only make them worse off:

The government should stay out of personal choices I make. . . . My eating habits or yours don't justify the government's involvement in the kitchen (55).

The introduction noted that a lot is at stake in the attempt to unpack the sources of the obesity epidemic. Marketing of these products consistently tries to frame debates about obesity as matters of personal responsibility, not public policy (34, 40, 88, 97). The executive director of the Center for Consumer Freedom, a trade group for soda and chain restaurants, has been quoted as saying, "people should prevent obesity by getting regular exercise" (97).

Many states have laws on the books that prevent lawsuits against food manufacturers and marketers, and these laws often style themselves as "personal responsibility" or "commonsense consumption" laws. Yet as institutional economists have long recognized, personal responsibility takes place only within a particular legal and social environment, and this legal and social environment profoundly shapes the decisions that people make (47, 10).

What is at stake, then, is not merely an etiological exercise, but a defense of the very notion of public health. If everyone is perfectly rational, then there is no need for much of what public health does, which instead can be relegated to a kind of specialized statistical service with no need for regulation, enforcement, or health behavior change.

However, if obesity has arisen from the increasing power and reach of marketers over choices that are not perfectly rational but involve elements of subconscious control, then it is reasonable to intervene to limit that power.

The marketing explanation of obesity suggests three strategies to combat the deleterious changes in the American diet that have

led to increased obesity: restrict marketing, encourage marketing literacy, and engage in countermarketing.

Restrictions of Marketing

Many marketers have voluntarily agreed to limit their activities in a variety of ways. For example, after the IOM report on food marketing to children (67) was released, Disney and the Cartoon Network pledged to use their characters to support consumption of fruits and vegetables, a laudable step in the right direction.

Yet collectively, these voluntary arrangements have been unsatisfactory. They are often accepted unevenly, applied haphazardly, and implement standards so low as to allow vigorous marketing of highly obesogenic foods (41, 67).

More muscular policy has been more successful. Many jurisdictions have laws restricting various forms of commercialism in schools, including the promotion and sales of obesogenic foods (76). Yet these restrictions have been fought at every turn by the food industry and are typically implemented in watered-down form, when they are implemented at all (76).

Recent restrictions of food marketing in schools in both Los Angeles and California have been associated with improvements in the weight status of school children in both of those jurisdictions (86, 89). Whether the policy change caused the health improvements warrants further research, but certainly the effects are promising.

Corporate Responsibility

Notwithstanding the imperfections in existing attempts to induce corporations to change their food marketing, enhanced corporate responsibility and better codes of marketing ethics could significantly change the mix and intensity of food marketing. Scorecards of ethical food marketing could be developed and companies rated on their performances. The public health community could help by better clarifying the importance not only of choosing healthy foods,

but also of avoiding unhealthy ones, and also by aggressively disseminating the literature that shows that marketing in all its forms strongly influences food choice for adults as well as children.

Taxes as Cultural Intervention

Several writers have proposed taxing obesogenic foods (34, 50). It may seem in light of the analysis here that such policies would have limited effect, and indeed existing evidence suggests that taxes have so far had a very modest effect on consumption (80, 81, 92). Yet just because falling food prices have not caused the increase in obesity does not mean that a tax on obesogenic foods could not help reverse the trend. A large tax on a specific product or set of products could reduce demand for that product. After all, even if the price elasticity of demand is low, there is some price increase large enough to induce a meaningful reduction in demand. Perhaps more importantly, a tax that was widely perceived as a sin tax on particular food types could send a powerful social signal about shifting norms of appropriate consumption and could have an effect much larger than the monetary value of the tax. This effect could be enhanced by pronutritional advertising.

Cultural Engagement

The influence of pervasive marketing on the American diet has been largely unhealthy, but it is probably no longer feasible to stuff that genie entirely back in the bottle. Fortunately, a successful policy need not be the reverse of a damaging development, and several promising approaches have been proposed. One approach involves directly informing people about the manipulative effects of advertising on food culture and providing them with the defensive media literacy tools to exert greater control over their cultural influences (39). This approach is useful for its direct focuses on the roots of the problem in extensive marketing of obesogenic foods. Such an orientation would do well to engage with the powerful cultural forces already

in place, such as social-networking groups, whether online or real-world.

One helpful initiative might be to engage with church groups to develop a modern-day kashrut, a set of religiously validated dietary laws that evolved in part to maintain the health of a social group. Some evidence exists that religion has a positive influence on diet (48), and working with churches and with the religious affinities of individuals has been shown to be an ethical and effective means of promoting healthy behavior (12, 57). Such laws might limit the consumption of processed foods, constrain eating to mealtimes, or prohibit the consumption of sugary beverages.

Fighting Fire with Fire

Pronutritional marketing works, just as obesogenic marketing does. Health advocates and those interested in limiting the growth in health care costs can turn to many of the marketers' tools to achieve a substantial improvement in the American diet. The USDA spends only ~\$1.50 per person to advertise fruits and vegetables (32), yet this expenditure—about 3% as much as is spent on the advertising of obesogenic foods—has helped to foster increasing consumption of fruits and vegetables despite their rising relative prices (91). Since 1970, fruit and vegetable consumption has increased by 15% and 23%, respectively (91).

As one observer has pointed out, however, public health advocates have so far not been willing to follow the number one rule of marketing, which is to have a single, consistent message that is hammered home in many different media and modes (91). For those concerned about the rise in obesity, that message should be clearly stated: Processed snacks and sugary beverages cause obesity.

DISCUSSION

It is frequently observed that “correlation does not imply causality,” and so it must be here. Yet it must also be remembered that correlation is indeed the only thing that does imply causality.

The usual, statistical approach to ascertaining causal connections has come under attack recently for both its epistemological shortcomings and its practical pitfalls (46, 54, 85, 93). One scholar argues for a “sharp distinction between statistical and causal concepts” (78).

The approach to causal inference pursued here is accordingly not statistical. Rather than attempting to rule out all possible alternative explanations by statistical brute force, the approach here is logical abduction—or what Aristotle called diagnosis (10). That is, the curious fact of a sudden and rapid increase in obesity has been observed. Yet if marketing were able to change the American diet, then this curious fact would be quite expected. Alternative explanations are ruled out explicitly, by arguing in each case for their inadequacy. The goal of this analysis is not to prove causality because proving causality is to mix epistemic categories. Rather, the goal is to present a persuasive case for a particular causal theory.

This analysis makes a case that is intended to be compelling enough to justify changes in policy, even if it cannot be definitive. The analysis presented here accordingly fits in with a crucial initiative to reduce the cycle time on the production of effective interventions and policy changes for the prevention of obesity [see Brennan et al. (9), in this volume].

To recap this argument, all the elements of a persuasive causal case are present:

1. A large number of well-conducted randomized experiments have shown that exposure to marketing—especially, but not only, advertising—changes people’s eating behavior. Marketing causes people to choose to eat more.
2. Marketing is associated with obesity in longitudinal studies that control for potential confounders.
3. The timing of the increase in marketing is as expected. Most of the phenomena described here began to accelerate within 5 years of 1980, and all did with 10 years. All had been either nonexistent or stable in the decades before 1980.

4. The magnitude of the increase in marketing is large. Several of the marketing strategies here have had a real, per-capita increase of 100% or more in the past 30 years (retail food outlets, competitive food in schools, licensing deals, product differentiation, etc.). Others have had even more dramatic increases, skyrocketing from essentially zero to multi-billion-dollar industries in the past 30 years (product placement, in-school advertising, event sponsorships). Others are difficult to quantify (value-meal bundling, improved packaging, increased portion sizes). If one conservatively estimates that overall food-marketing expenditures have doubled in real, per capita terms since 1980 (including advertising, which alone has risen by 60% in real, per-capita terms), then the implied elasticity of total calorie intake with respect to marketing expenditure is on the order of 0.10–0.15. This estimate is extremely rough, but it suggests that the magnitude of marketing expansion is adequate to have realistically induced the increased consumption and resulting obesity that we have observed.

This analysis is not the first to claim that marketing has played an important role in the obesity epidemic (39, 62). The contribution here is to argue that marketing is the single most important cause of obesity because only the marketing explanation has adequate conceptual plausibility, paired with a strong evidence base for each link in its causal chain.

By contrast, none of the rational-choice-oriented explanations has a persuasive case on any of these criteria: A causal effect has not been demonstrated in experimental studies; longitudinal data do not support their implications; the timing is off; the magnitude of the changes is not impressive. Despite poor evidence for it, the rational-choice frame has tremendous staying power. Even explanations that are incoherent or have insufficient evidence continue to be regularly and prominently cited.

Lest it be claimed that the rational-choice explanations have been subjected to greater scrutiny than the marketing perspective, consider that the goal of this exercise is to compare the relative plausibility of the rational-choice model versus the marketing effects at an ecological level. The effect of marketing on individual consumption has been amply demonstrated in the existing literature, typically in the context of carefully controlled experiments. These experiments have demonstrated advertising's effect on the product advertised, on other products in the same category, and on overall consumption. By contrast, the proposed effects of incentives on food consumption have either never been tested (e.g., for food preparation time) or, in the case of food prices, have been shown to have an effect only on the product whose price has changed, but not on overall consumption. Competing with these two theoretical approaches, then, the marketing-oriented explanation fares better at both the individual and ecological levels.

Attempts to obscure the sources of the obesity epidemic, by referring to a host of implausible explanations such as personal responsibility, food prices, and sedentary lifestyles, serve the needs of food manufacturers and marketers more than they serve the interests of scientific inquiry or of public health (40). Part of the impetus toward rational-choice models comes from economists, preternaturally disposed to look first toward incentives when confronted with any social problem. But another reason for general affinity for rational-choice models may be human nature. Who among us wants to concede that we are not masters of our own destiny, that others have power over us? Yet, this perfectly reasonable impulse presents a logical problem. For if each of us alone, individually, has sole control over our own decisions, how do we explain the facts of a multitude of carefully designed experiments in which decisions are manipulated?

For example, in one recent randomized experiment, adults were induced by means of a television commercial to eat more of both the advertised food and other foods as well,

compared with adults in the control group (38). If one accepts the basic premises of a randomized experiment, then one must conclude that the television commercials caused the participants in the intervention arm to eat more food. And if one accepts the validity of this kind of inference, one must acknowledge the possibility that increased exposure to advertising and other forms of marketing may have caused nearly everyone to consume more. These statements may seem unexceptionable in context, but they are quite bold. If we accept the reality of a causal influence of advertising on individual decisions, then we must accept that advertising has the potential to cause broad behavioral changes in society. Individuals make decisions about their actions; however, social forces partly control the decisions that individuals make. In that sense, this work distinguishes the causes of cases from the causes of incidence (59) and thereby helps to make good on earlier promises (47, 87) to engage in causal explanations that operate at several different ontological levels.

Of course, every individual determines his or her own dietary decisions. Yet as structural changes in the food-marketing environment over the past 30 years have made it increasingly difficult to make healthy dietary choices, many adults have faltered. Or rather, virtually everyone has faltered to some degree, and some are unlucky enough to be consigned to pay a huge cost in terms of obesity from their poor choices.

Although this may seem to be a pessimistic conclusion, it is in fact an optimistic one. Only by identifying the structural forces that operate on individual choices can we make a collective choice to limit their influence, and thereby be freed of them. By clearly indicating how these forces act on health, we can restore individual rationality to choice.

CONCLUSION

Obesity is not a rational choice. Most obese people regret their weight status, and obese individuals have poor quality of life (26), which implies that any choices made along the path

toward obesity were made either without adequate information or without due foresight.

Highly knowledgeable researchers continue to aver that “relatively little is known about the causes of the trends” in obesity (25). This statement may be true in part because of limited historical data, which leads to a densely perforated patchwork of relevant information, and in part because of a failure to connect the dots for the information that is available. In fact, the most compelling single interpretation of the admittedly incomplete data we have is that the large increase in obesity is due to marketing.

It is time to restore rationality to individual choices around diet by restricting, countering, and offsetting the otherwise pervasive power of marketers.

Obesity is a significant health problem at the individual level, but at the social level, it is the symptom of an unhealthy society. Any number of individual interventions may help to mitigate the effects of obesity on individual health, but only by changing the structural rules of the game can we restore free choice to diet, and thereby restore health to society. That is the role of public health.

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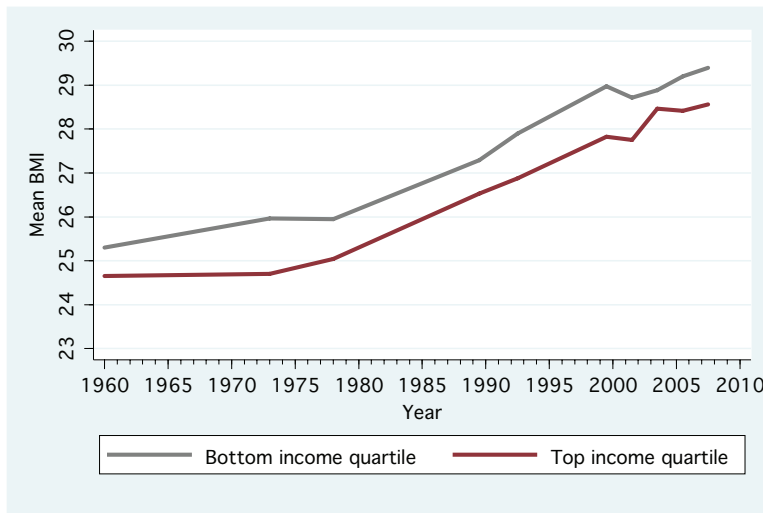


Figure 1

Trends in body mass index over time. From author's calculations using data from the National Health and Nutrition Examination Survey (<http://www.cdc.gov/nchs/nhanes.htm>).

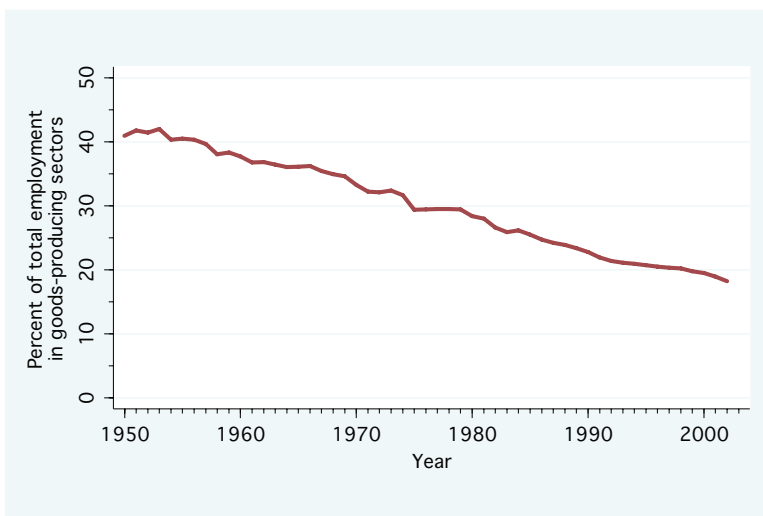


Figure 2

Trends in U.S. employment over time. From author's calculations using data from the Bureau of Labor Statistics.

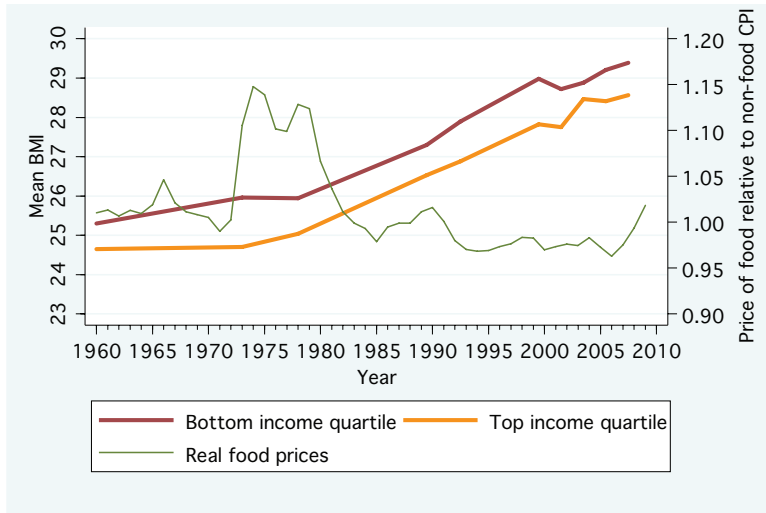


Figure 3

Food prices and body mass index over time. From author's calculations using data from the NHANES (<http://www.cdc.gov/nchs/nhanes.htm>) and the Bureau of Census Consumer Price Index (<http://www.bls.gov/cpi>).



Contents

Symposium: Determinants of Changes in Cardiovascular Disease

Cardiovascular Disease: Rise, Fall, and Future Prospects <i>Russell V. Luepker</i>	1
Proportion of the Decline in Cardiovascular Mortality Disease due to Prevention Versus Treatment: Public Health Versus Clinical Care <i>Earl S. Ford and Simon Capewell</i>	5
Prospects for a Cardiovascular Disease Prevention Polypill <i>Kaustubh C. Dabhadkar, Ambar Kulsbreshtha, Mohammed K. Ali, and K.M. Venkat Narayan</i>	23
Social Determinants and the Decline of Cardiovascular Diseases: Understanding the Links <i>Sam Harper, John Lynch, and George Davey Smith</i>	39
Sodium Intake and Cardiovascular Disease <i>Alanna C. Morrison and Roberta B. Ness</i>	71

Epidemiology and Biostatistics

Administrative Record Linkage as a Tool for Public Health Research <i>Douglas P. Jutte, Leslie L. Roos, and Marni D. Brownell</i>	91
Cardiovascular Disease: Rise, Fall, and Future Prospects <i>Russell V. Luepker</i>	1
Proportion of the Decline in Cardiovascular Mortality Disease due to Prevention Versus Treatment: Public Health Versus Clinical Care <i>Earl S. Ford and Simon Capewell</i>	5
Social Determinants and the Decline of Cardiovascular Diseases: Understanding the Links <i>Sam Harper, John Lynch, and George Davey Smith</i>	39
Sodium Intake and Cardiovascular Disease <i>Alanna C. Morrison and Roberta B. Ness</i>	71

Prenatal Famine and Adult Health <i>L.H. Lumey, Aryeh D. Stein, and Ezra Susser</i>	237
Environmental and Occupational Health	
Advances and Current Themes in Occupational Health and Environmental Public Health Surveillance <i>Jeffrey D. Shire, Gary M. Marsh, Evelyn O. Talbott, and Ravi K. Sharma</i>	109
Climate Change, Noncommunicable Diseases, and Development: The Relationships and Common Policy Opportunities <i>S. Friel, K. Bowen, D. Campbell-Lendrum, H. Frumkin, A. J. McMichael, and K. Rasanathan</i>	133
Genetic Susceptibility and the Setting of Occupational Health Standards <i>Paul Schulte and John Howard</i>	149
New Directions in Toxicity Testing <i>Daniel Krewski, Margit Westphal, Mustafa Al-Zoughool, Maxime C. Croteau, and Melvin E. Andersen</i>	161
Promoting Global Population Health While Constraining the Environmental Footprint <i>A. J. McMichael and C. D. Butler</i>	179
Prenatal Famine and Adult Health <i>L.H. Lumey, Aryeh D. Stein, and Ezra Susser</i>	237
Public Health Practice	
Accelerating Evidence Reviews and Broadening Evidence Standards to Identify Effective, Promising, and Emerging Policy and Environmental Strategies for Prevention of Childhood Obesity <i>Laura Brennan, Sarah Castro, Ross C. Brownson, Julie Claus, and C. Tracy Orleans</i>	199
Action on the Social Determinants of Health and Health Inequities Goes Global <i>Sharon Friel and Michael G. Marmot</i>	225
Prenatal Famine and Adult Health <i>L.H. Lumey, Aryeh D. Stein, and Ezra Susser</i>	237
The Growing Impact of Globalization for Health and Public Health Practice <i>Ronald Labonté, Katia Mobindra, and Ted Schrecker</i>	263

Using Marketing Muscle to Sell Fat: The Rise of Obesity in the Modern Economy <i>Frederick J. Zimmerman</i>	285
Cardiovascular Disease: Rise, Fall, and Future Prospects <i>Russell V. Luepker</i>	1
New Directions in Toxicity Testing <i>Daniel Krewski, Margit Westphal, Mustafa Al-Zoughool, Maxine C. Croteau, and Melvin E. Andersen</i>	161
Prematurity: An Overview and Public Health Implications <i>Marie C. McCormick, Jonathan S. Litt, Vincent C. Smith, and John A.F. Zupancic</i>	367
Proportion of the Decline in Cardiovascular Mortality Disease due to Prevention Versus Treatment: Public Health Versus Clinical Care <i>Earl S. Ford and Simon Capewell</i>	5
The U.S. Healthy People Initiative: Its Genesis and Its Sustainability <i>Lawrence W. Green and Jonathan Fielding</i>	451
Social Environment and Behavior	
Ecological Models Revisited: Their Uses and Evolution in Health Promotion Over Two Decades <i>Lucie Richard, Lise Gauvin, and Kim Raine</i>	307
Environmental Risk Conditions and Pathways to Cardiometabolic Diseases in Indigenous Populations <i>Mark Daniel, Peter Lekkas, Margaret Cargo, Ivana Stankov, and Alex Brown</i>	327
Physical Activity for Health: What Kind? How Much? How Intense? On Top of What? <i>Kenneth E. Powell, Amanda E. Paluch, and Steven N. Blair</i>	349
Prematurity: An Overview and Public Health Implications <i>Marie C. McCormick, Jonathan S. Litt, Vincent C. Smith, and John A.F. Zupancic</i>	367
The Social Determinants of Health: Coming of Age <i>Paula Braveman, Susan Egerter, and David R. Williams</i>	381
Toward a Fourth Generation of Disparities Research to Achieve Health Equity <i>Stephen B. Thomas, Sandra Crouse Quinn, James Butler, Craig S. Fryer, and Mary A. Garza</i>	399

Action on the Social Determinants of Health and Health Inequities Goes Global <i>Sharon Friel and Michael G. Marmot</i>	225
Social Determinants and the Decline of Cardiovascular Diseases: Understanding the Links <i>Sam Harper, John Lynch, and George Davey Smith</i>	39
Using Marketing Muscle to Sell Fat: The Rise of Obesity in the Modern Economy <i>Frederick J. Zimmerman</i>	285

Health Services

Prospects for a Cardiovascular Disease Prevention Polypill <i>Kaustubh C. Dabhadkar, Ambar Kulsbreshtha, Mohammed K. Ali, and K.M. Venkat Narayan</i>	23
The Health Care Workforce: Will It Be Ready as the Boomers Age? A Review of How We Can Know (or Not Know) the Answer <i>Thomas C. Ricketts</i>	417
The Health Effects of Economic Decline <i>Ralph Catalano, Sidra Goldman-Mellor, Katherine Saxton, Claire Margerison-Zilko, Meenakshi Subbaraman, Kaja LeWinn, and Elizabeth Anderson</i>	431
The U.S. Healthy People Initiative: Its Genesis and Its Sustainability <i>Lawrence W. Green and Jonathan Fielding</i>	451
Underinsurance in the United States: An Interaction of Costs to Consumers, Benefit Design, and Access to Care <i>Shana Alex Lavarreda, E. Richard Brown, and Claudie Dandurand Bolduc</i>	471
Administrative Record Linkage as a Tool for Public Health Research <i>Douglas P. Jutte, Leslie L. Roos, and Marni D. Brownell</i>	91

Indexes

Cumulative Index of Contributing Authors, Volumes 23–32	483
Cumulative Index of Chapter Titles, Volumes 23–32	488

Errata

An online log of corrections to *Annual Review of Public Health* articles may be found at <http://publhealth.annualreviews.org/>