McKinsey Global Institute




November 2014

Overcoming obesity: An initial economic analysis

Discussion paper

The McKinsey Global Institute

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Sorcha McKenna
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Preface

The world has made huge advances in containing infectious diseases, but that progress is being partially offset by a sharp rise in the incidence of heart and lung disease, diabetes, lifestyle-related cancers, and other non-communicable diseases. One of the major drivers of the increase in these diseases is the rising prevalence of obesity.

Obesity is a complex, systemic, multi-causal problem, rooted in the sedentary nature of modern post-industrial life, more widely available and more affordable food, a change in the nature and mix of diets, psychological stimuli such as stress and epigenetic triggers, and potentially even physiological disruption to the gut microbiome. There is considerable ongoing academic research into the scale and causes of the rapidly rising obesity epidemic. Researchers are digging deep into specific questions and analyzing potential solutions. However, there is a lack of integrated analysis of the holistic program that would be needed to reverse rising obesity, and what it would take to start to deliver such a program.

This discussion paper seeks to start to close this gap. We set out to learn as much as possible from existing research and build on it with our own understanding of micro- and behavioral economics, and McKinsey's experience and research across sectors, including consumer-facing, public, and health-care sectors. Our aim then has been to step back and attempt to develop a perspective on what might be the building blocks of a societal response that could overcome rising obesity. As with all MGI research, this has not been funded by any company, government, or external organization but by the partners of McKinsey.

In this discussion paper, the McKinsey Global Institute has cataloged a comprehensive list of interventions that are being used or piloted somewhere in the world by central and local governments, employers, schools, health-care systems, food retailers, manufacturers, and foodservice providers. We have identified 74 interventions and developed an initial assessment of their cost-effectiveness and the potential scale of their impact if they were applied at a national level. As a start, we have tested this for the United Kingdom, an example of a developed economy in which the prevalence of obesity is rising. In doing this, we have relied on the evidence of the impact of these interventions when applied somewhere in the world. We have not independently verified the analysis of each intervention or the third-party research, an important caveat that we return to in this paper's discussion of the quality of the evidence in this complex area.

We explore the key questions about what action is going to be required to abate obesity, and we discuss some of the major barriers to that action for different sectors of society. We identify priority intervention areas that could form part of an effective response to turn the obesity trajectory, and we suggest approaches that could help to get that program off the ground. We have a particular focus on behavioral interventions that can improve nutrition and physical activity. We do not directly address clinical questions such as the role of different nutrients or genetics, leaving those to the scientists. Moreover, because this research focuses on obesity, we capture only the health benefits delivered by physical activity and other interventions that change body mass index (BMI). However, we acknowledge that BMI changes give only a partial picture of the full health benefits of physical activity.

Almost everyone reading this discussion paper will disagree with some parts of it, partly because of the polarized nature of the debate on obesity but arguably more because obesity is a complex, systemic issue with no simple solution. This means that analysis on the potential impact of an intervention is valid from some perspectives, but limited from others. We regard this discussion paper as an initial contribution and thought-starter on what it is likely to take to address rising obesity. Our hope is that this analysis will be built on in the future as the collective knowledge base, and therefore the ability to respond to this crisis, is expanded.

This analysis was led by Richard Dobbs, a McKinsey and MGI director based in London; Peter Child, a McKinsey director based in London specializing in consumer goods; Sorcha McKenna, a McKinsey partner in Dublin specializing in consumer goods and health care; Robin Nuttall, a partner in McKinsey's Strategy Practice in London; James Manyika, a McKinsey and MGI director based in San Francisco; Angela Spatharou, a McKinsey partner specializing in health care in Mexico City; Fraser Thompson, a MGI senior fellow based in Singapore; and Jonathan Woetzel, a McKinsey and MGI director based in Shanghai. Corinne Sawers, a McKinsey consultant in London, led the project team, which comprised Simon Alfano, Alexia Cesar, Sumeet Jha, Sakshi Mor, Ainhoa Manterola Solans, and Alison Underwood.

We would like to thank the panel of academic advisers to this discussion paper, whose diversity of expertise reflects the multifaceted nature of the issue, and who have provided invaluable advice, guidance, and pressure test: Dr. William H. Dietz, director, Strategies to Overcome and Prevent Obesity Alliance, Milken Institute School of Public Health, George Washington University; Kevin D. Hall, senior investigator, Laboratory of Biological Modeling, Integrative Physiology Section, National Institute of Diabetes and Digestive and Kidney Diseases; Philip James, president of the International Association for the Study of Obesity and projects director of the World Public Health Nutrition Association; Susan Jebb, professor of diet and population health, University of Oxford; Tim Lobstein, director of policy and programmes, International Association for the Study of Obesity; Professor David Russell-Jones, consultant endocrinologist; Boyd Swinburn, Alfred Deakin Professor of Population Health and director of the World Health Organization Collaborating Centre for Obesity Prevention at Deakin University in Melbourne; and Lennert Veerman, senior research fellow in the School of Population Health, University of Queensland.

Among the many other people whose input was so vital for this paper are Tatiana Andreyeva, Rudd Centre for Food Policy and Obesity, Yale University; Jan Barendregt, associate professor in epidemiological modeling, School of Population Health, University of Queensland; Tom Blake, Sprout Wellness Solutions; Bryan Bollinger, New York University School of Business; Sir Peter Bottomley, UK member of Parliament for Worthing West; Baroness Virginia Bottomley, Nettlestone; Karen Campbell, Deakin University; Frank Chaloupka, University of Illinois at Chicago; Michel Chauliac, Ministry of Health and Sport, France; Rachel Craig, Health Survey for England, United Kingdom; Steven Cummins, London School of Hygiene and Tropical Medicine; Antoine de Saint-Affrique, Unilever; Ravi Dhar, Yale School of Management; Peter Dolan, ChildObesity180; Dustin Duncan, New York University Langone Medical Center; Brian Elbel, New York University Langone Medical Center; Charlotte Evans, University of Leeds; Peter Freedman, managing director, The Consumer Goods Forum; Simone French, University of Minnesota; Alan Garber, Harvard University; Fiona Geaney, University College Cork; Moria Golan, Hebrew University of Jerusalem; David Halpern, UK Government Behavioural Insights Team; Lisa Harnack, University of Minnesota; Corinna Hawkes, World Cancer Research Fund; Katy Hunter, Transport for London; Stephen Jan, University of Sydney Medical School; Martyn Jones, Morrisons; David Just, Cornell University Center for Behavioral Economics; Scott Kahan, Johns Hopkins and George Washington universities; Ariane Kehlbacher, University of Reading; David Lee, Department for Environment, Food, and Rural Affairs, United Kingdom; George Loewenstein, Carnegie Mellon University and London School of Economics; Carlos Monteiro, University of São Paulo; Mike Rayner, Nuffield Department of Population Health, University of Oxford; Christina Roberto, Harvard School of Public Health; Kim Roberts, HENRY; Tom Robinson, Stanford University School of Medicine; Barbara Rolls, Pennsylvania State University; Mary Rudolf, Bar Ilan Medical School, Tzfat; Harry Rutter, London School of Hygiene and Tropical Medicine; Rick Sadler, University of Western Ontario, Canada; Jim Sallis, University of California, San Diego; Lucy Saunders, Greater London Authority; Andrew Scaife, Department for Environment, Food and Rural Affairs, United Kingdom; Peter Scarborough, Nuffield Department of Population Health, University of Oxford; Marlene Schwartz, Rudd Centre for Food Policy and Obesity, Yale University; David Scott, Morrisons; Sinne Smed, University of Copenhagen; Peter Speyer, Institute for Health Metrics and Evaluation; Christiane Stock, University of Southern Denmark; Claire Tardy, Euromonitor; Richard Tiffin, University of Reading; Helen Walters, Greater London Authority; and Y. Claire Wang, Columbia University.

We also wish to thank academic advisers to MGI, namely Martin Baily, senior fellow in the Economic Studies Program and Bernard L. Schwartz Chair in Economic Policy Development at the Brookings Institution; Richard Cooper, Maurits C. Boas Professor of International Economics at Harvard University; and Nobel laureate Michael Spence, William R. Berkley Professor in Economics and Business at New York University.

We also are grateful for the advice and input of many McKinsey colleagues around the world who work with governments, health-care systems, and pharmaceutical, food and beverage, packaged goods, retail, and restaurant companies. They include Jeffrey Algazy, James Arnold, Roy Berggren, Sachin Chaudhary, Peter Child, Ian Davis, Alexandru Degeratu, Cristina Del Molino, Martin Dewhurst, Thierry Elmalem, Travis Fagan, Yvonne Fahy, Dave Fedewa, Tim Fountaine, Sundiatu Dixon Fyle, Tracey Griffin, Jyotishko Gupta, Graham Hall, Judith Hazlewood, Viktor Hediger, Nicolaus Henke, Bret Huber, Vivian Hunt, Bill Huyett, Gregor Kelly, Sajal Kohli, Liz Lempres, Dennis Martinis, Lenny Mendonca, Martin Møller, James Naylor, Vivian Riefberg, Jørgen Rugholm, Jane Thomson, Chris Turner, Rob Turtle, Olivier Sibony, Shubham Singhal, Saum Sutaria, Steven Swartz, Guillermo Lopez Velarde, John White, Chris Wigley, and Christina Zaybekian.

We would also like to thank Janet Bush, senior MGI editor; Julie Philpot, MGI editorial production manager; Rebeca Robboy of MGI external communications; Marisa Carder, MGI graphics specialist; and Marcia Kramer, copy editor.

We are grateful for all of the input we have received, but the final discussion paper is ours and any errors are our own. This paper contributes to MGI's mission to help business and policy leaders understand the forces transforming the global economy, identify strategic locations, and prepare for the next wave of growth. As with all MGI research, this work is independent and has not been commissioned or sponsored in any way by any business, government, or other institution, although it has benefited from the input and collaborations that we have mentioned. We welcome your emailed comments on the research at obesity@mckinsey.com.

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IN BRIEF

Overcoming obesity: An initial economic analysis

Obesity is now a critical global issue, requiring a comprehensive intervention strategy rolled out at scale. More than 2.1 billion people—nearly 30 percent of the global population—are overweight or obese. That's nearly two and a half times the number who are undernourished. Obesity, which should be preventable, is now responsible for about 5 percent of all deaths worldwide. If its prevalence continues on its current trajectory, almost half of the world's adult population will be overweight or obese by 2030. This paper aims to start a global discussion on the components of a successful societal response. Among our main findings are:

- Based on existing evidence, any single intervention is likely to have only a small overall impact on its own. A systemic, sustained portfolio of initiatives, delivered at scale, is needed to address the health burden. Almost all the identified interventions are cost-effective for society—savings on health-care costs and higher productivity could outweigh the direct investment required to deliver the intervention when assessed over the full lifetime of target population. In the United Kingdom, such a program could reverse rising obesity, saving about $1.2 billion a year for the National Health Service (NHS).

- Education and personal responsibility are critical elements of any program to reduce obesity, but not sufficient on their own. Additional interventions are needed that rely less on conscious choices by individuals and more on changes to the environment and societal norms. Such interventions "reset the defaults" to make healthy behaviors easier. They include reducing default portion sizes, changing marketing practices, and restructuring urban and education environments to facilitate physical activity.

- No individual sectors in society, whether they are governments, retailers, consumer-goods companies, restaurants, employers, media organizations, educators, health-care providers, or individuals, can address obesity on their own. Capturing the full potential impact requires engagement from as many sectors as possible. Successful precedents suggest that a combination of top-down corporate and government interventions with bottom-up community-led ones is required to change public-health outcomes. Moreover, some kind of coordination is likely to be required to capture potentially high-impact industry interventions, given that there are market share risks facing any first mover.

- Implementing an obesity abatement program at the required scale will not be easy. We see three imperatives: (1) deploy as many interventions as possible at scale and delivered effectively by the full range of sectors in society; (2) understand how to align incentives and build cooperation; and (3) do not focus unduly on prioritizing interventions because this can hamper constructive action.

- The evidence base on the clinical and behavioral interventions to reduce obesity is far from complete, and ongoing investment in research is imperative. However, in many cases this is proving a barrier to action. It need not be so. We should experiment with solutions and try them out rather than waiting for perfect proof of what works, especially in the many areas where interventions are low risk. We have enough knowledge to be taking more action than we currently are.

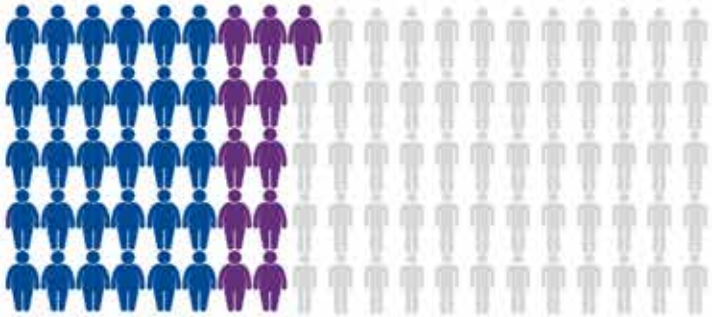
MGI has initially assessed the elements of a potential program for the United Kingdom, but we believe our findings are broadly applicable around the world. MGI intends to continue to analyze additional interventions and update our data as more research and interventions take place.

Addressing rising global obesity...

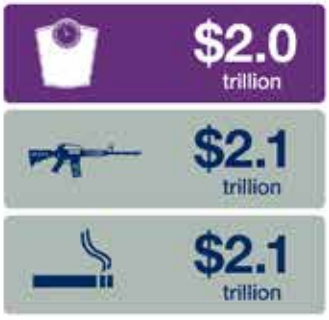
(5% of all deaths each year)

Today: **30%**[1]

In 2030: **41%**[2]



Obesity has roughly the same economic impact **as smoking or armed conflict**



...will require a sustained portfolio of interventions delivered by a range of different sectors.

UK case study findings:

- 44 interventions bring 20% of overweight/obese Britons back to a normal weight.
- A range of sectors are required to deliver impact.
- All interventions are cost-effective for society.
- A portfolio of interventions could deliver £25bn benefit.

[1] combines prevalence of obese and overweight; [2] based on regional historial trends; combines prevalence of obese and overweight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Executive summary

Almost everyone reading this discussion paper will disagree with some parts of it. That is because much of the global debate on obesity has become polarized and sometimes deeply antagonistic. But, even more importantly, disagreement about the way forward reflects the fact that obesity is a complex, systemic issue with no single or simple solution, and the fact that there is currently a lack of integrated assessments of those potential solutions. All of this is getting in the way of addressing rising obesity. This research tries to overcome hurdles by offering an independent view on the components of a potential strategy.

A strategy of sufficient scale is needed as obesity is now reaching crisis proportions. More than 2.1 billion people—close to 30 percent of the global population—today are overweight or obese.[1] That's nearly an estimated two and a half times the number of people in the world—adults and children—who are undernourished. And the obesity problem is getting worse, and rapidly. If the growth rate in the prevalence of obesity continues on its current trajectory, almost half of the world's adult population is projected to be overweight or obese by 2030.

This has huge personal, social, and economic costs. Obesity is responsible for around 5 percent of all global deaths.[2] The global economic impact from obesity is roughly $2.0 trillion, or 2.8 percent of global GDP, roughly equivalent to the global impact from smoking or armed violence, war, and terrorism (Exhibit E1).

The toll of obesity on health-care systems alone is between 2 and 7 percent of all health-care spending in developed economies. That does not include the large cost of treating associated diseases, which takes the health-care cost toll up to 20 percent by some estimates. There is growing evidence, too, that the productivity of employees is being undermined by obesity, compromising the competitiveness of companies.

There has been a plethora of research projects on the scale of the problem and on individual interventions designed to address obesity. However, to date, there has been limited systematic cataloguing of possible interventions, or analysis of their relative cost-effectiveness and potential impact. Perhaps most importantly, there is a need for more holistic assessments of what an integrated strategy for overcoming obesity would look like. Our research draws on analysis of the impact of existing interventions, along with discussions with policy advisers, population-health academics, and industry representatives, to begin filling that gap. In developing the research, we have received thoughtful input from academics, policy makers, and businesses from many sectors.

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1 Under World Health Organization standards, overweight is defined as having a body mass index over 25. Obese is defined as having a body mass index over 30. Body mass index is mass divided by height squared.

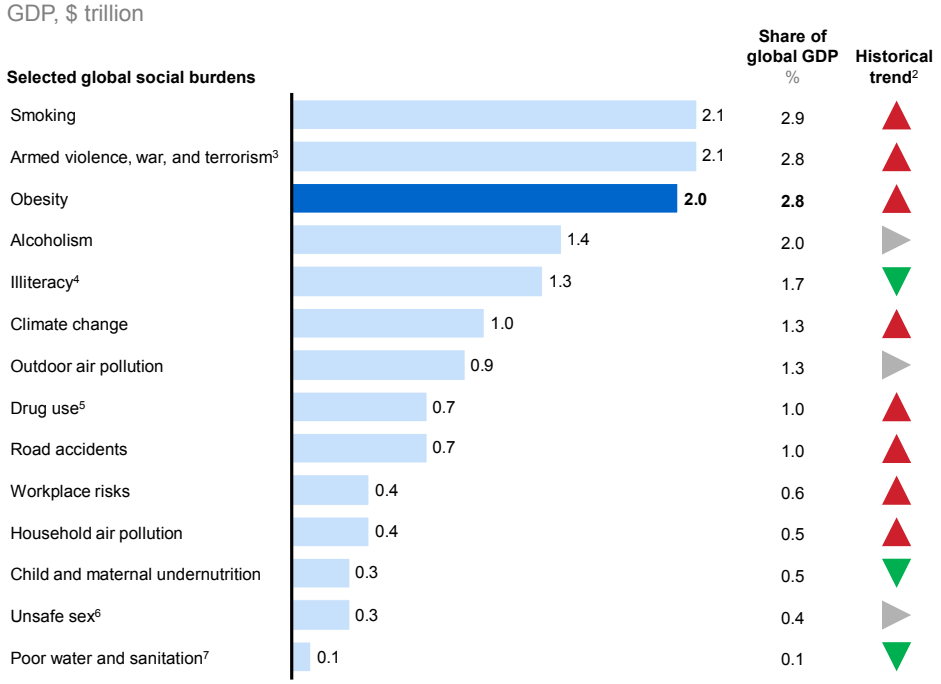
2 The World Health Organization estimates that 2.8 million global deaths a year are attributable to high BMI on a base of 59 million total global deaths per year.

Exhibit E1

Obesity is one of the top three global social burdens generated by human beings

Estimated annual global direct economic impact and investment to mitigate selected global burdens, 2012[1]

GDP, $ trillion



1 Based on 2010 disability-adjusted life years (DALY) data from the Global Burden of Disease database and 2012 economic indicators from the World Bank; excluding associated revenue or taxes; including lost productivity due to disability and death, direct cost, e.g., for health care, and direct investment to mitigate; GDP data on purchasing power parity basis.
2 Based on historical development between 1990 and 2010 of total global DALYs lost (Global Burden of Disease).
3 Includes military budget.
4 Includes functional illiteracy.
5 Includes associated crime and imprisonment.
6 Includes sexually transmitted diseases. Excludes unwanted pregnancies.
7 Excludes lost time to access clean water source.

SOURCE: Literature review; World Health Organization Global Burden of Disease database; McKinsey Global Institute analysis

The McKinsey Global Institute (MGI) has studied 74 interventions to address obesity in 18 areas that are being discussed or piloted somewhere around the world (see Table E1 at the end of this executive summary). We conducted a meta-analysis of research available. Of the 74 interventions, we were able to gather sufficient evidence to estimate what might be the potential cost and impact of 44 interventions. On the basis of this analysis, we have developed a perspective on what it might take to start to reverse rising obesity prevalence in a developed market.

As a starting point for our research on this issue, we have assessed what might be needed in a potential program for the United Kingdom. In the near future, as part of ongoing research on this topic, we intend to present similar analyses for emerging markets, potentially starting with China and Mexico. We expect the potential scale and impact of the interventions to look different in emerging markets than in the United Kingdom. However, we expect our findings to be broadly applicable around the world.

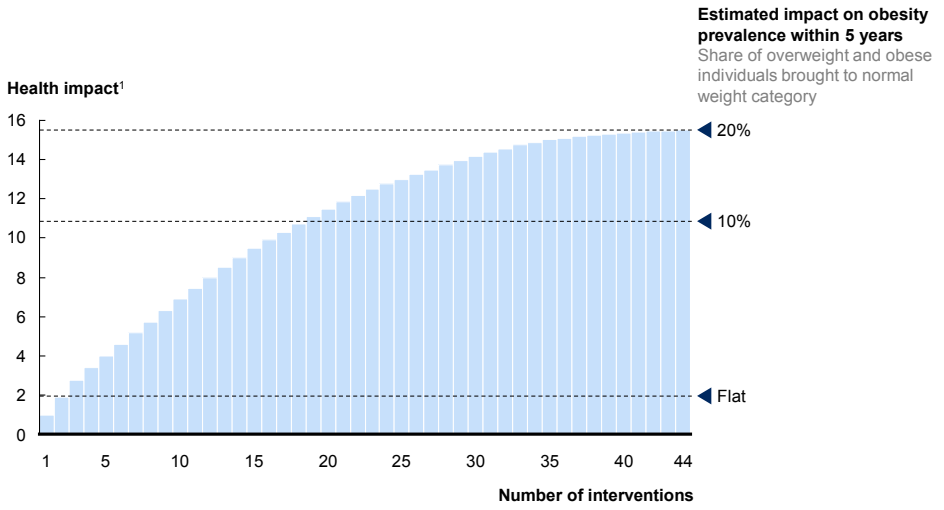
We must stress that our analysis is by no means complete. We see our work on a potential program to address obesity as the equivalent of the 16th-century maps used by navigators. On those maps, some islands were missing and some continents were misshapen, but they were still helpful to the sailors of that era. We are sure that we have missed some interventions and have over- or underestimated the impact of others. But we hope that our work, like 16th-century maps, is a useful guide and a starting point to be built on in years to come as we and others develop this analysis and gradually compile a more comprehensive evidence base on this topic. We have focused on understanding what it takes to address obesity by changing individuals' energy balance through adjustments in consumption or physical activity. However, we have not addressed some important questions that require considerable further research. These questions include the role of different nutrients in affecting satiety hormones and metabolism, and antibiotic disruption of the gut microbiome. As more clarity develops on these research areas, it is to be hoped that important insights about which interventions are likely to work and how to integrate them into a program to tackle obesity will emerge.

Some of our initial findings are:

- **No single solution creates sufficient impact to reverse obesity: only a comprehensive, systemic program of multiple interventions is likely to be effective.** Our analysis suggests that any single intervention is likely to have only a small impact at the aggregate level. Our research suggests that an ambitious, comprehensive, and sustained portfolio of initiatives by national and local governments, retailers, consumer-goods companies, restaurants, employers, media organizations, educators, health-care providers, and individuals is likely to be necessary to support broad behavioral change. These levers must address different population segments and deploy different mechanisms for impact. If the United Kingdom were to deploy all the interventions that we have been able to size at reasonable scale, the research finds that it could reverse rising obesity and bring about 20 percent of overweight and obese individuals—or roughly the population of Austria—back into the normal weight category within five to ten years (Exhibit E2). This would have an estimated economic benefit of around $25 billion a year, including a saving of about $1.2 billion a year for the UK NHS.

Exhibit E2

MGI quantified the maximum potential of 60 percent of the interventions identified, which together could bring 20 percent of overweight and obese individuals into a normal weight category



1 Impact is captured as million DALYs saved over full lifetime of 2014 UK population, taking into account health benefits accrued later in life.

SOURCE: Literature review; expert interviews; McKinsey Global Institute analysis

- **Almost all of the interventions we analyzed are highly cost-effective from the viewpoint of society.** "Cost-effective from the viewpoint of society" means that the health-care costs and productivity savings that accrue from reducing obesity outweigh the direct investment required to deliver the intervention when assessed over the full lifetime of the target population (Exhibit E3).[3] Our analysis does not demonstrate the financial cost-benefit profile of the interventions to a specific entity such as a school, an employer, a retailer, or a food manufacturer. Nonetheless, in terms of the financial "bang for buck" that comes from delivering a positive impact on health, all interventions are attractive.

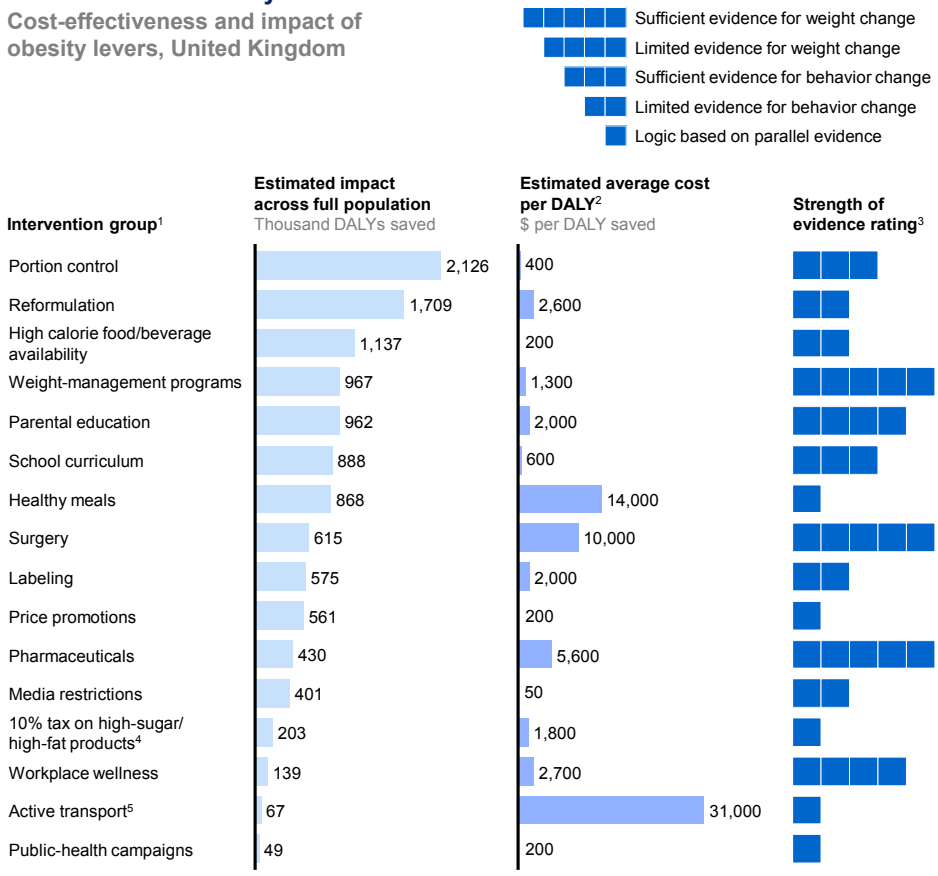
- **Education and encouraging personal responsibility are necessary but not sufficient—restructuring the context that shapes physical activity and nutritional behavior is a vital part of any obesity program.** Education and personal responsibility are critical elements of any program to reduce obesity, but they are not enough on their own. Our research suggests that additional interventions need to be in the mix that rely less on conscious choices by individuals and individual responsibility and more on changes to the environment and societal norms. These interventions reset the default and make healthy behavior easier and more normal, thereby relying less on individual willpower. Examples include reducing portion sizes of packaged foods and fast food, changing marketing practices, and changing physical activity curricula in schools. Such interventions rely less on individual willpower to go against the grain, making healthy lifestyles easier to achieve.

3 We assess cost-effectiveness based on World Health Organization definitions: investing less than one times per capita GDP to save a disability-adjusted life year (DALY) is highly cost-effective, investing one to three times per capita GDP is cost-effective, and more than three times per capita GDP is not cost-effective.

Exhibit E3

There is considerable scope to have high impact on obesity in a cost-effective way

Cost-effectiveness and impact of obesity levers, United Kingdom



1 Includes only non-overlapping levers in each category. Where two levers overlapped, such as plain and engaging labeling or gastric banding and bariatric surgery, the higher-impact lever was chosen.
2 Impact and cost over lifetime of 2014 population; uses UK-specific cost-effectiveness calculated using GDP and World Health Organization methodology.
3 Based on the evidence rating system of the Oxford Centre for Evidence-Based Medicine.
4 All intervention impact modeling was subject to scalable assumptions on potential reach. Tax levers are also subject to scalability of levy incurred. In this case, MGI modeled a 10 percent tax on a set of high-sugar and high-fat food categories, based on empirical precedents and size of levy often studied. It is scalable, and impact would increase close to directly with increase in levy.
5 Impact assessed here is only from reduced body mass index (BMI), not full health benefits of some interventions (e.g., cardiovascular health, mental health). For example, active transport health benefits are higher when all of these benefits are taken into account.
NOTE: We do not include health-care payors because this is a less relevant intervention in the United Kingdom context. There are insufficient data to quantify urban-environment interventions.
SOURCE: Literature review; expert interviews; McKinsey Global Institute analysis

- **Capturing the full potential impact is likely to require commitment from government, employers, educators, retailers, restaurants, and food and beverage manufacturers, and a combination of top-down corporate and government interventions and bottom-up community-based ones.** Our obesity abatement analysis and empirical examples of successful packages of interventions suggest that improvements in public health only result from a comprehensive package of interventions delivered by a wide range of societal sectors including a critical “community-owned” element. Delivering such a package requires engagement from all relevant societal sectors. Moreover, some kind of coordination is likely to be required to capture potentially high-impact industry interventions. Any single company that opts for a particular intervention unilaterally runs the risk of harming its competitive position; unanimous action avoids that risk. In some cases, however, coordination among industry players may be illegal under antitrust constraints. New forms

of cross-industry collaboration and support from government have the best chance of overcoming these challenges.

Implementing an obesity abatement program of the scale required will not be easy. A challenge of this magnitude requires an ambitious set of solutions—and the diffuse range of the many sectors of society relevant to this issue makes it even harder to achieve progress. We need to improve our ability to motivate action across such a diverse set of sectors. We believe that research and trial and error in how to deliver a cross-societal response is as important as research in the specific intervention areas discussed in this paper. We see four imperatives if progress is to be made:

1. **As many interventions as possible must be delivered to have significant impact.** A holistic approach by the public, private, and third sectors is the best way forward. A program that succeeds in reversing obesity prevalence is likely to require as many interventions as possible to be deployed at scale and with high-quality delivery, our research finds. Deploying a comprehensive set of interventions would need the full set of societal sectors we have identified—local and national government, health-care payors and providers, schools, employers, food and beverage manufacturers, retailers, restaurants, and food-service providers—to play a role. Coordination will be crucial. Today, government efforts to tackle the obesity issue seem too fragmented to be effective. In the United Kingdom, 15 central government departments; all local authorities with responsibility for health, education, and local planning; 16 EU directorates-general; and a wide range of nongovernmental organizations all have a significant impact on the major intervention areas that we have identified.

2. **Understanding how to align incentives and build cooperation is critical to success.** Some attempts to overcome obesity failed because they did not align with the incentives of the required participants. An example of this was the attempt by Michael Bloomberg to ban supersize beverages when he was mayor of New York. This change was blocked in the courts after extensive lobbying and legal action by the soft drink and retail industries. Other initiatives such as EPODE, which originated in France, and the Healthy Weight Commitment Foundation in the United States are leading the way in delivering integrated responses to the issue. If society is to succeed in tackling obesity, it will be necessary to find ways to build on such initiatives, to overcome misaligned incentives, and to coordinate action across a diverse set of societal sectors. The same is true of many of the public-health and environmental challenges facing us in the 21st century. In the case of regulation to reduce the incidence of smoking, it was not possible to align incentives; in the case of obesity, we believe that it might be possible.

3. **Government, health-care systems, and private and social-sector organizations and entities should not focus overly on prioritizing interventions because this could hamper constructive action.** As we have said, only a holistic, broad, and multipronged approach can be successful in reversing the obesity crisis. Interventions in the hands of all relevant societal sectors need to be deployed. Prioritization based on potential impact, cost-effectiveness, and feasibility is always important when making investment decisions. However, in the case of obesity, focusing unduly on priority interventions could be unhelpful given the need for a holistic response. A

search for the "best" interventions or a single solution could delay action and displace responsibility. Given the seriousness of the obesity issue, the aim should be to do as much as possible as soon as possible.

4. **While investment in research should continue, society should also engage in trial and error.** Given the scale of the obesity crisis and its economic impact, investment in research, innovation, and experimentation is relatively low. For instance, the United Kingdom invests less than $1 billion a year in prevention activities such as weight-management programs and public-health campaigns. To put that in perspective, that is only about 1 percent of the social cost of obesity in the United Kingdom. More investment is required, especially in understanding the effectiveness of intervention measures when they are applied as part of a comprehensive program. But society should also be prepared to experiment with possible interventions. In many intervention areas, impact data from high-quality, randomized control trials are not possible to gather. So, rather than waiting for such data, the relevant sectors of society should be pragmatic with a bias toward action, especially where the risks of intervening are low, using trial and error to flesh out their understanding of potential solutions.

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The science on obesity and research into how to reverse this growing health burden is by no means complete. Society needs to know more about this complex systemic issue and its causes in order to mount a genuine, sustained, and aggressive challenge. This discussion paper is just a start. We intend to continue to try to capture an even greater range of interventions and update our data with the latest efforts on the ground and research as it is completed. Moreover, we hope that this analysis will help prompt further debate, and most critically, further action.

We reiterate, this analysis is just a 16th-century map, and it will benefit from continued input, research, and debate. We invite contributions to our ongoing research. In particular, we would like to hear about other possible interventions, better and updated data on the impact of interventions, and further insights about overcoming the major barriers to delivering high impact in a large-scale, integrated response. We also welcome challenge and input on our analysis and approach. Please send any comments to obesity@mckinsey.com.

In Chapter 1 of this discussion paper, we survey current worldwide trends in obesity and the diseases linked to it, such as type 2 diabetes. In Chapter 2, we discuss 18 groups of obesity interventions, under which we have classified 44 selected interventions, and introduce our obesity abatement cost-effectiveness analysis and some of its major findings. Finally, in Chapter 3, we review some of the elements of how society might mount a response to obesity, and what it is going to take to deliver it.

Table E1

74 interventions across 18 groups

Highlighted interventions were assessed for potential scaled impact and cost-effectiveness. Those not assessed either did not have sufficient quality data or were not relevant in the context of the United Kingdom (our pilot geography for this analysis)

1. Active transport	Urban redesign: walking	Government authorities redesign urban planning to facilitate and encourage walking
	Urban redesign: cycling	Government authorities redesign urban planning to facilitate and encourage cycling
	Disincentivize driving	Government authorities redesign tariffs, pedestrianization, and parking laws, and improve the quality of public transport
2. Health-care payors	Payor material incentive: general	Health-care payors provide material incentives for better health outcomes such as reduced payments
	Payor material incentive: facilitative	Health-care payors provide material incentives that facilitate healthy behavior (e.g., free gym membership or subsidized healthy food)
	Payor personal tracking and measurement support	Health-care payors provide personal tracking and measurement technical support for healthy behavior and improved health outcomes
	Parental diet and exercise education	Health-care payors provide parental education
3. Healthy meals	Free compulsory school meals for all	Government provides free compulsory school meals and improves health quality
	Subsidized compulsory school meals for all	Government subsidizes compulsory school meals and improves health quality
	Free healthy meals in the workplace	Employers provide free healthy meals
	Supermarket targeted promotions	Grocery retailers promote healthy eating through campaigns and recipes
	Lower-calorie options in the workplace	Employers introduce healthy options in canteens but do not remove existing options
4. High-calorie food and drink availability	Supermarket layout: space	Grocery retailers allocate greater share of space to healthier products and categories
	Supermarket layout: prominence	Grocery retailers allocate greater prominence (aisle ends, checkout counters, store entry) to healthier products
	Reduced access to high-calorie food in schools: regulated	Government bans vending machines and snack shops in schools
	Reduced access to high-calorie food in schools: self-regulated	Schools voluntarily ban vending machines and snack shops
	Reduced access to high-calorie food in the workplace	Employers remove vending machines and easy access to high-calorie foods
	School canteen layout	Schools place healthier canteen areas (e.g., vegetables, fruit, and salad) more prominently
	Workplace canteen layout	Employers place healthier canteen areas (e.g., vegetables, fruit, and salad) more prominently
5. Labeling	Calorie/nutrition "plain" labeling on package: regulated	Government mandates nutritional labeling on all packaged foods
	Calorie/nutrition "plain" labeling on package: self-regulated	Industry self-regulates nutritional labeling on all packaged foods
	Calorie/nutrition "engaging" labeling on package: regulated	Government mandates front-of-pack "engaging" format nutritional information (e.g., traffic-light labels) on all packaged foods
	Calorie/nutrition "engaging" labeling on package: self-regulated	Industry self-regulates front-of-pack and "engaging" format nutritional information (e.g., traffic-light labels) on all packaged foods
	Portion-size "engaging" labeling on package: regulated	Government mandates "engaging" portions information on each package in a clearly communicated way
	Portion-size "engaging" labeling on package: self-regulated	Industry self-regulates "engaging" portions information on the front of the package in a clearly communicated way
	Nutrition labeling in restaurants: regulated	Government mandates labeling on menus and shelf choices in fast-food restaurants
	Nutrition labeling in restaurants: self-regulated	Fast-food restaurants label menus and make shelf choices
	Nutrition "plain" labeling: workplace	Employers provide workplace canteen nutritional labeling
	Nutrition "engaging" labeling: workplace	Employers provide "engaging" workplace canteen nutritional labeling (e.g., traffic-light labels)
	Aggregate meal calorie labeling: workplace	Employers provide aggregated nutritional content and traffic-light labels at checkout
	Aggregate meal calorie labeling: restaurants	Fast-food restaurants provide aggregated nutritional content and traffic-light labels at checkout
	Aggregate basket calorie labeling: retailers	Retailers provide traffic-light rating of basket contents at checkout
6. Media restrictions	Media restriction on high-calorie food advertising on all supports: regulated	Government restricts advertising of high-calorie foods on all advertising supports
	Media restriction on high-calorie advertising on TV: regulated	Government restricts advertising of high-calorie foods on TV from 6 a.m. to 9 p.m.
	Media restriction: self-regulated	Food and beverage industry voluntary restricts high-calorie food advertising (e.g., to children)
7. Parental education	Parental education: preschool-age children	Government authorities provide educational program (e.g., 12-week course) to parents of preschool-age children covering nutrition and parental feeding styles, and providing opportunities for physical activity
	Parental education: schoolchildren	Government authorities provide educational program (e.g., 12-week course) to parents of preschool-age children covering nutrition and parental feeding styles, and providing opportunities for physical activity
8. Pharma-ceuticals	Over-the-counter pharmaceuticals	Provision of non-prescription weight-loss drugs
	Prescription pharmaceuticals	Medical prescription of weight-loss drugs

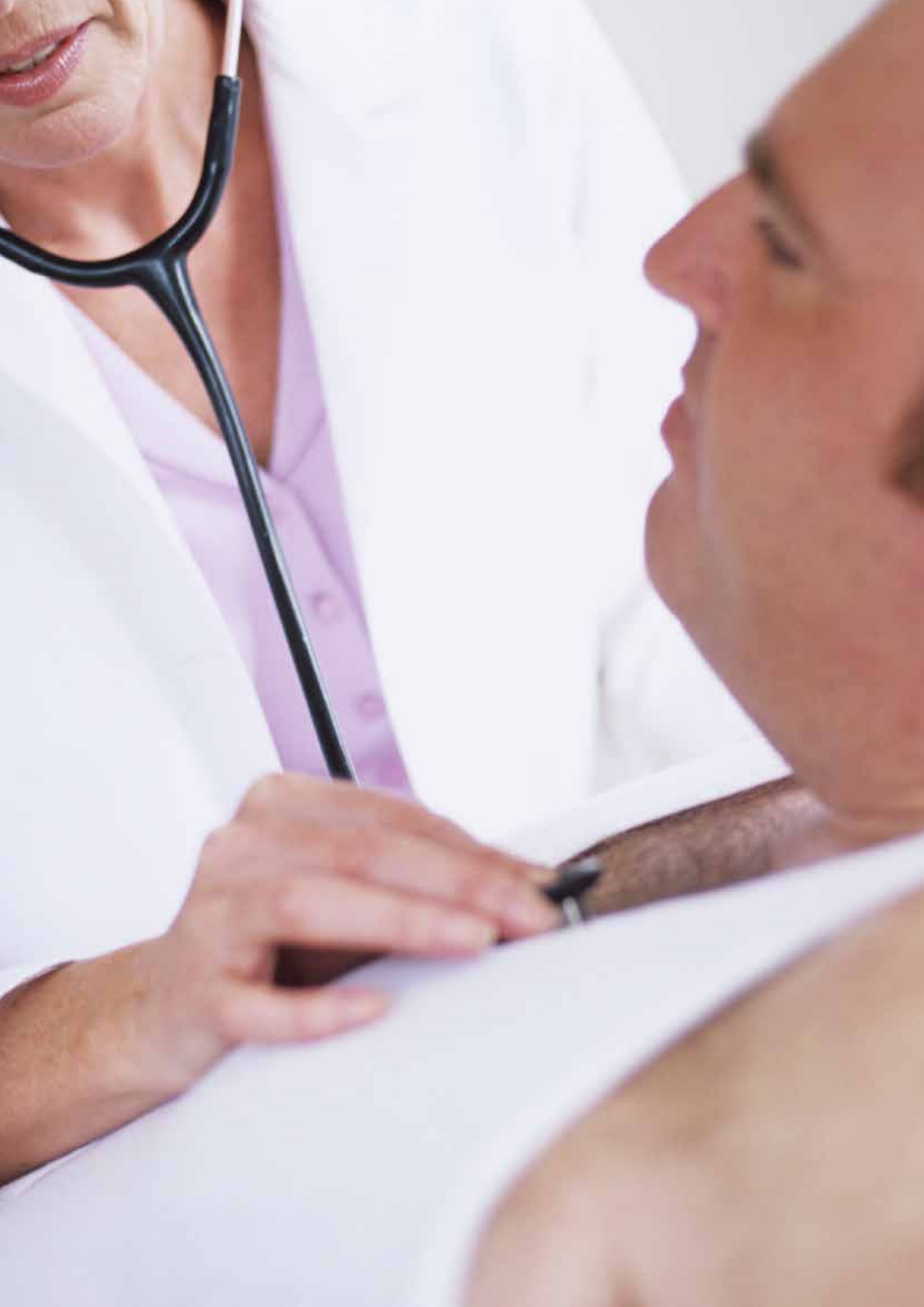
SOURCE: McKinsey Global Institute analysis

Table E1 (continued)
74 interventions across 18 groups

Highlighted interventions were assessed for potential scaled impact and cost-effectiveness. Those not assessed either did not have sufficient quality data or were not relevant in the context of the United Kingdom (our pilot geography for this analysis)

9. Portion control	Reduced portion size	Food producers reduce average portion sizes
	Reduced portion size: restaurants	Restaurants reduce average portion size of meals and snacks
	Reduced portion size: workplace	Employers reduce average portion size of foods in workplace canteens
	Reduced portion size: reduce portions of high-calorie beverages	Beverage producers reduce average portion sizes of high-calorie beverages
	Eliminate "supersize" items from menus and product ranges	Remove extra-large single-serve portions from packaged food ranges and restaurant menus
10. Price promotions	Price promotion reconfiguration: regulated	Retailers and producers restrict promotional activity (e.g., two-for-one) of high-calorie food and beverages
	Price promotion reconfiguration: voluntary	Food producers/retailers voluntarily increase price of high-calorie food and beverages
11. Public-health campaigns	Comprehensive public-health campaign	Government launches public-health campaign promoting healthy habits across various media (e.g., TV, radio, out-of-home advertising)
12. Reformulation	New "better for you" products	Introducing new product ranges with improved nutritional profile, and advertised as such
	Stealth product reformulation: food	Food producers deliver small, incremental changes to formulation of food products (e.g., reduction in sugar) that consumers do not notice
	Stealth product reformulation: beverages	Beverage producers deliver small, incremental reduction in the caloric content of beverages that consumers do not notice
	Stealth product reformulation: restaurants	Fast-food retailers deliver small, incremental changes in the formulation of food products that consumers do not notice
13. School curriculum	School temporary diet and exercise programs	Schools provide short-term intensive nutritional education or exercise programs
	School curriculum mandates physical activity: regulated	Schools mandate or increase the amount of physical activity in the curriculum
	School curriculum includes nutritional-health education: regulated	Schools include or increase the amount of nutritional-health education
14. Subsidies, taxes, and prices	Relative price increase: regulated	Government introduces a tax in order to drive price increases on certain types of food or nutrient
	Relative price increase: reduced agricultural subsidy	Government reduces subsidies on certain food commodities that drive prices (e.g., processed foods such as corn, sugar, and palm oil)
	Relative price decrease on fresh produce and staple foods: increased agricultural subsidy	Government subsidizes fresh food such as fruit and vegetables
	Relative price decrease on fresh produce and staple foods: personal subsidies	Government provides personal subsidies (e.g., food stamps for low-income individuals for sole use on certain healthy food types)
15. Surgery	Bariatric surgery: gastric banding	Provision of gastric-banding surgery
	Bariatric surgery: gastric bypass	Provision of gastric-bypass surgery
16. Urban environment	School physical exercise facilities	Government authorities/schools invest in higher-quality physical exercise facilities
	Improved community sports facilities and programs	Government authorities increase access to community sports facilities and programs
	Supermarket availability	Retailers increase presence in areas with poor access to grocery stores
17. Weight-management programs	Personal technology to support healthy eating and physical activity: cross-platform	Health systems/employers provide personal technology platforms to support goal setting, tracking, and measuring of key behavior and health outcomes
	Health-system individual counseling	Health system provides a short-term (e.g., 12-week) one-to-one counseling program on nutrition and how to change dietary and physical activity behavior
	Health-system group counseling	Health system provides a short-term (e.g., 12-week) group counseling program on nutrition and how to change dietary and physical activity behavior
	Physical activities on prescription	Health system prescribes physical activities and provides free gym membership or other facilitative measures
	Commercial weight-management programs	Commercial provision of weight-management programs (e.g., Weight Watchers) that include group counseling, goal setting, and community support
	Short-term, intensive weight-management programs: adults	Health-care system or commercial market provides short-term (e.g., two- to six-week) residential "boot camp" providing nutritional education and physical activity to adults
	Short-term, intensive weight-management programs: children	Health-care system or commercial market provides short-term (e.g., two- to six-week) residential "boot camp" providing nutritional education and physical activity to children
	Weight management around childbirth	Health-care system provides weight-management advice as part of pre- and postnatal care
18. Workplace wellness	Workplace team challenge incentive schemes	Employers provide team challenge activities to encourage physical activity and improved key health indicators
	Workplace individual challenge incentive schemes	Employers provide team individual challenge activities to encourage physical activity and improved key health indicators
	Employer material (financial) incentive	Employers provide material incentives for improved key health indicators (e.g., discounts on insurance premiums, gym membership, prizes)

SOURCE: McKinsey Global Institute analysis



1. The obesity crisis

Obesity is a major global economic problem caused by a multitude of factors (see Box 1, "The complex causes of obesity"). Today obesity is jostling with armed conflict and smoking in terms of having the greatest human-generated global economic impact. Obesity imposes significant costs on health-care systems; around the world, 2 to 7 percent of all health-care spending relates to measures to prevent and treat this condition, with up to 20 percent of all health-care spending attributable to obesity, through related diseases such as type 2 diabetes and heart disease. These health-care costs place a burden on government finances. Furthermore, overall economic productivity and employers are both affected by impaired productivity.

The global economic impact of obesity is increasing. The prevalence of obesity is still rising in developed economies, and now, as emerging markets become richer, they, too, are experiencing rising prevalence. The evidence suggests that the economic and societal impact of obesity is deep and lasting. It may entrench social inequalities between generations; obesity in parents appears to increase the risk of obesity in their children through both physiological and behavioral mechanisms. An additional implication is that, even if the current rise in prevalence can be reversed, the damaging health implications and economic costs the world is experiencing today could persist well into the future.

If the prevalence of obesity continues its current trajectory, almost half of the world's adult population could be overweight or obese by 2030.[4]

4 T. Kelly et al., "Global burden of obesity in 2005 and projections to 2030," *International Journal of Obesity*, volume 32, number 9, September 2008.

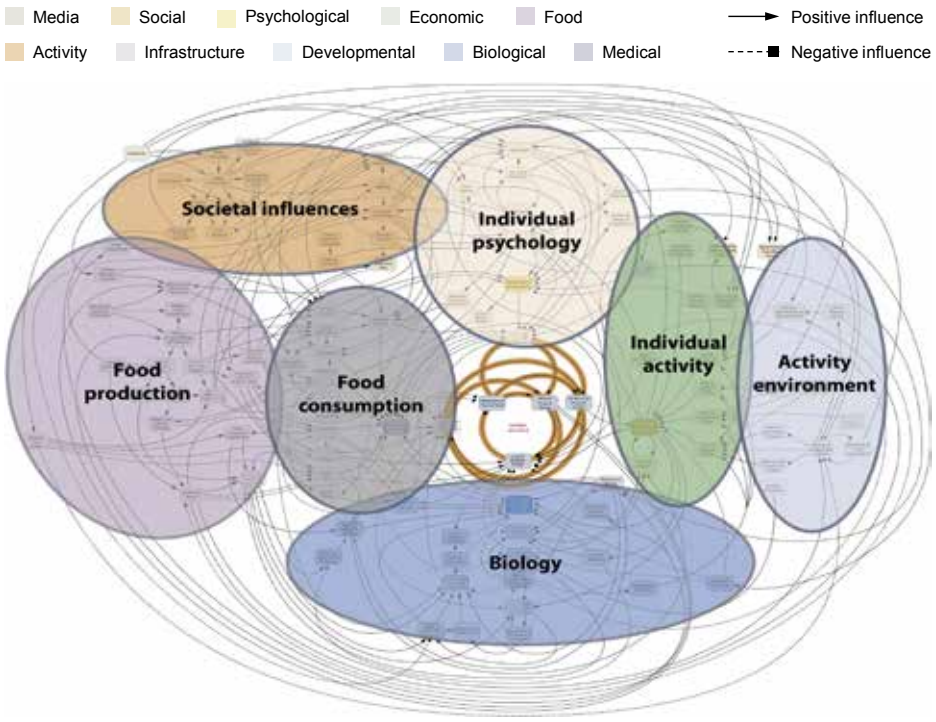
Box 1. The complex causes of obesity

The root causes of rising obesity are highly complex, spanning evolutionary, biological, psychological, sociological, economic, and institutional factors. The UK government Foresight research on obesity identified more than 100 variables that directly or indirectly affect obesity outcomes (Exhibit 1).

Exhibit 1

Academics have emphasized that obesity is a systemic problem: causes are complex, manifold, and interdependent

Obesity causal map



SOURCE: B. Butland et al., *Foresight: Tackling obesities—future choices*, UK Government Office for Science, project report, 2nd ed., October 2007.

Because of centuries of food insecurity, human beings have evolved with a biological ability to cope with food scarcity rather than abundance. The human body seeks out energy-dense foods and tries to conserve energy as fat. Hormones that regulate hunger and satiety encourage people to seek extra food when food is scarce but do not seem to have the ability to prevent over-consumption or encourage extra calorie burning when food is abundant.

Modern life makes fewer physical demands on many people, who lead less active lifestyles as technology replaces the need for physical labor. With many jobs now sedentary, exercise is a conscious and optional choice. As an illustration of the change, in 1969 about 40 percent of US schoolchildren walked or rode their bikes to school; by 2001, only 13 percent did.[1] Over the past 50 years, it has been estimated that a reduction in occupation-related physical activity in the United States has reduced the daily net energy balance by 100 calories per person, a significant share of the overall change in the energy balance during this period.[2]

Mass urbanization in many regions—the global urban population is growing by 65 million a year, the equivalent of adding seven new cities the size of Chicago every 12 months—is boosting incomes but reinforcing a less physical lifestyle.[3] One Chinese study found that urbanization reduces daily energy expenditure by 300 to 400 calories, and traveling to work by car or bus reduces it by a further 200 calories.[4]

Human beings also have a psychological relationship with food that goes beyond a need for basic sustenance. Many of us use food as a reward or to relieve stress, or have a compulsive relationship with certain types of food. There is a correlation between obesity and high rates of some mental health conditions, including depression.

1 Noreen C. McDonald, "Active transportation to school: Trends among US schoolchildren, 1969–2001," *American Journal of Preventative Medicine*, volume 32, issue 6, June 2007.

2 T. S. Church et al., "Trends over 5 decades in US occupation-related physical activity and their associations with obesity," *PLoS ONE*, volume 6, number 5, 2011.

3 For more on urbanization, see, for example, *Urban world: Mapping the economic power of cities*, McKinsey Global Institute, March 2011.

4 W. P. James, "The fundamental drivers of the obesity epidemic," *Obesity Reviews*, volume 9, supplement 1, March 2008.

Box 1. The complex causes of obesity (continued)

People are highly influenced by social norms and subtle social cues in their eating habits and their attitude toward weight. For instance, if they dine with other people who eat more, they eat more themselves; likewise, those who dine with people who eat less, eat less themselves. One study has shown that 35 percent more calories are consumed when having dinner with a friend than when eating alone, and 96 percent more if dining in a group of seven people.[5] Another study has shown that a person is 57 percent more likely to become obese if a friend has also become obese—evidence of social normalization of the condition.[6]

Food has become much more affordable over the past 60 years. In the United States, the share of average household income spent on food fell from 42 percent in 1900 to 30 percent in 1950 and to 13.5 percent in 2003.[7] This is beneficial in welfare terms, reducing rates of undernutrition and freeing up disposable income.

Many of these factors underline the importance of the environmental context as a driver of obesity prevalence. A helpful lens for examining how the environment affects prevalence is looking at expatriate populations, transplanted from one context to another. For example, British expats who have settled in Abu Dhabi have diabetes prevalence rates of 18 percent, compared with a baseline prevalence of 8 percent in the United Kingdom. Physical environment is one factor, but it is likely that sociocultural variables are also relevant. Various studies suggest a correlation between Hispanic immigrants' obesity rate and the length of their stay in the United States and the depth of their cultural assimilation.[8]

Some experts are questioning whether the net energy balance—that people are eating too much and exercising too little—is the appropriate lens to examine root causes. There is growing interest in the role that different nutrients such as carbohydrates, proteins, and fats play in our metabolism and in hormones that regulate satiety and hunger. Many leading scientists support the view that refined carbohydrates promote weight gain and inhibit weight loss.[9] The science to date on this is inconclusive, and we do not include it in the assessment here without further evidence. However, it is an important area for further research and could refocus the design of obesity interventions. Similarly, there is increasing interest in the role of the microbiome—our intestinal bacteria ecosystem. Scientific evidence from controlled trials suggests that individuals whose bodies contain a greater diversity of bacterial species are less prone to high body mass index (BMI) and less likely to gain weight.[10] This also is too inconclusive for us to include at this stage.

Some commentators take the causal complexity illustrated in Exhibit 1 as a pre-determined defeat. They say, "If the causes are so complex, where do we begin?" However, we do have a good understanding of the proximate causes, even if the background causes are complex. We know that over the past 50 years, individuals' daily energy balance equation has changed; physical activity has declined, and energy consumption has increased. Even though there are important outstanding questions about diet composition, gut microbiome, and epigenetics, we are not walking blind with no sense of what to address. However, interventions to increase physical activity, reduce energy consumption, and address diet composition cannot just seek to reverse the historical trends that have left the population where it is today. For example, we cannot, nor would we wish to, reverse the invention of the Internet or the industrialization of agriculture. We need to assess what interventions make sense and are feasible in 2014.

5 Brian Wansink, *Mindless eating: Why we eat more than we think*, Bantam-Dell, 2006.

6 Nicholas A. Christakis and James H. Fowler, "The spread of obesity in a large social network over 32 years," *New England Journal of Medicine*, volume 357, number 4, July 2007.

7 *100 years of US consumer spending data for the nation, New York City, and Boston*, US Department of Labor, report number 991, May 2006.

8 D. A. Himmelgreen et al., "The longer you stay, the bigger you get: Length of time in the US and language are associated with obesity in Puerto Rican women," *American Journal of Physical Anthropology*, volume 125, number 1, 2004.

9 B. J. Brehm et al., "The role of energy expenditure in the differential weight loss in obese women on low-fat and low-carbohydrate diets," *Journal of Clinical Endocrinology and Metabolism*, volume 90, number 3, March 2005.

10 Herbert Tilg and Arthur Kaser, "Gut microbiome, obesity and metabolic dysfunction," *Journal of Clinical Investigation*, volume 121, number 6, June 2011.

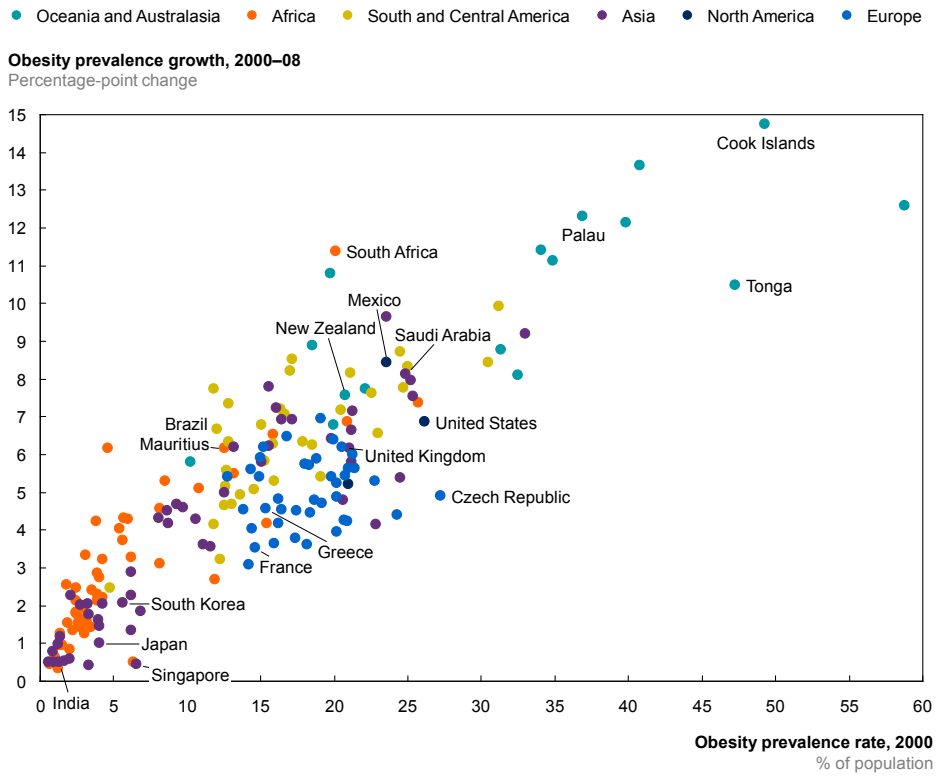
THE PREVALENCE OF OBESITY IS HIGH AND GROWING AS GLOBAL PROSPERITY INCREASES

Nearly one-third of the global population today is overweight or obese—that's more than 2.1 billion people.[5] Putting that into perspective, this is nearly two and a half times the 840 million people estimated to be undernourished. No country reduced its obesity prevalence between 2000 and 2013. During this period, prevalence grew by 0.5 percentage points or more a year in 130 of the 196 countries for which the Organisation for Economic Co-operation and Development (OECD) documents obesity prevalence data. Prevalence growth has momentum; countries with high prevalence in 2000 have continued to see the highest prevalence growth rates since then (Exhibit 2). There does not seem to be convergence to a stable obesity prevalence rate internationally. Recent data suggest a plateauing of prevalence in some developed markets, such as Italy, the United Kingdom, and the United States, while Australia, France, Switzerland, and other advanced economies experience continued growth.[6]

Exhibit 2

Obesity prevalence growth has momentum: countries with the highest prevalence in 2000 have experienced the most growth in prevalence since

Obesity prevalence across all countries, 2000 levels vs. 2000–08 growth



SOURCE: OECD statistics; McKinsey Global Institute analysis

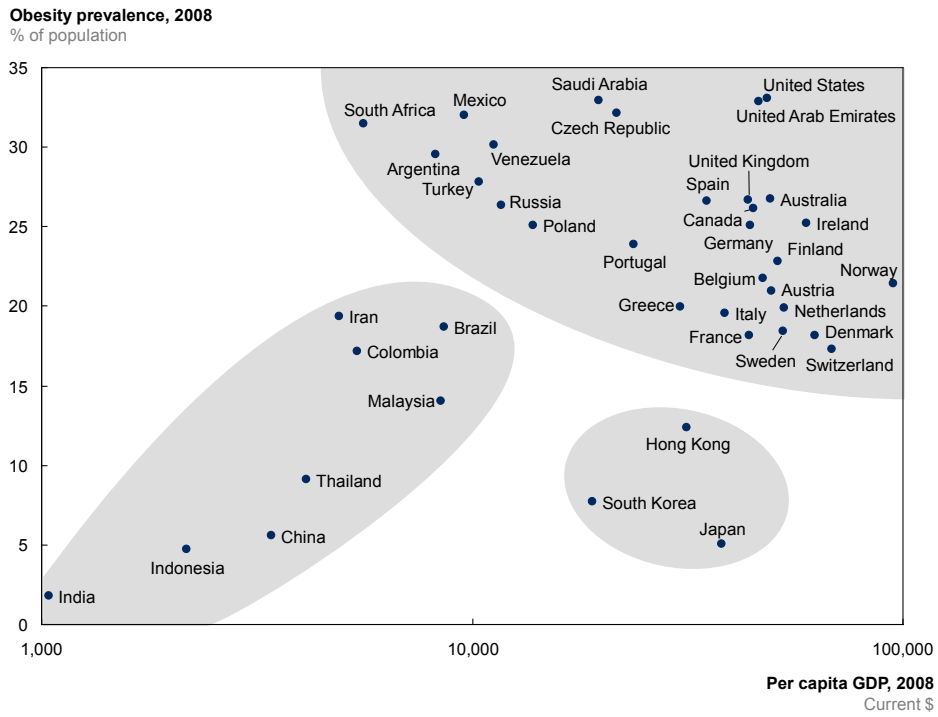
5 Marie Ng et al., "Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: A systematic analysis for the Global Burden of Disease Study 2013," *The Lancet*, volume 384, issue 9945, August 2014. Overweight and obese people are defined as those with a body mass index of 25 or over, and 30 or over, respectively. The BMI is the individual's weight divided by the square of his or her height. Values are expressed in units of kilograms per meter squared.

6 *Obesity update*, Organisation for Economic Co-operation and Development, June 2014.

Overall obesity prevalence does appear to be correlated with a country's wealth (Exhibit 3). It is striking how few countries escape the pattern. Among G-20 nations with per capita GDP exceeding $8,000, only Japan and South Korea have prevalence rates lower than 16 percent. The majority of G-20 countries have rates of more than 20 percent.[7] Looking at children specifically, the prevalence of obesity ranges between 5 and 20 percent.

Exhibit 3

With a few exceptions—up to a certain income threshold—obesity prevalence rises with income



SOURCE: OECD statistics; World Bank GDP statistics; McKinsey Global Institute analysis

China, Indonesia, and India currently have lower obesity prevalence rates than advanced economies. However, as rapid industrialization and urbanization boost incomes, the prevalence rates in these fast-growing emerging economies are rising quickly.[8] In India and China, the prevalence of obesity in cities is three to four times the rate in rural areas, reflecting higher incomes in urban areas and therefore higher levels of nutrition and food consumption and often less active labor. The prevalence of obese and overweight people rose at 1.2 percent a year in Chinese adult males between 1985 and 2004 and 1 percent a year in adult females.[9]

7 The G-20 members are Argentina, Australia, Brazil, Canada, China, European Union, France, Germany, India, Indonesia, Italy, Japan, Mexico, Russia, Saudi Arabia, South Africa, South Korea, Turkey, the United Kingdom, and the United States.

8 For a discussion of the link between rising prosperity and industrialization and urbanization, see MGI's series of reports on urbanization at www.mckinsey.com/insights/mgi/research/urbanization.

9 Barry M. Popkin, "Will China's nutrition transition overwhelm its health care system and slow economic growth?" *Health Affairs*, volume 27, number 4, 2008.

This is a pattern we observe across emerging markets. Many of these countries experienced a rise in prevalence of one percentage point a year between 2000 and 2008. Today, many countries have prevalence rates of 20 percent or even 30 percent and now have well-entrenched rising trends. A report from the Overseas Development Institute found that obesity and overweight rates in North Africa, Latin America, and the Middle East were on a par with Europe at 10 to 30 percent obesity in adults and at 30 to 70 percent overweight. Other regions, including South Asia and East Asia, are catching up with advanced economies in obesity prevalence.[10]

All G-20 countries are experiencing year-on-year growth in prevalence of 0.5 to 1.5 percentage points. In the United Kingdom, for instance, more than 80 percent of the population aged 21 to 60 could be obese or overweight by 2030, according to the government's 2007 Foresight report.[11] Breaking this down by gender, the report estimated that more than 60 percent of men and 50 percent of women would be obese. By 2050, the report estimated, one-quarter of children in the United Kingdom could be obese. These projections largely reflect overweight people becoming obese, rather than a significant absolute rise in the number of people in either of the two categories.

THE ECONOMIC IMPACT OF OBESITY IS IN LINE WITH THAT OF SMOKING AND ARMED VIOLENCE

The global economic impact of obesity is roughly $2.0 trillion, or 2.8 percent of global GDP, according to our analysis, which reflects the fact that obesity places a burden on developed and developing economies alike.[12] This is equivalent to the GDP of Italy or Russia. Obesity today has the same impact on the global economy as armed conflict, and only a shade less than smoking. These three are far and away the largest global economic impact areas driven by human behavior (Exhibit 4).

We assessed the current impact to society of 14 major problems that are caused by humans—that is, those that are the result of human decisions, are amplified by human or societal behavior, or depend on societal, legal, or infrastructural environments created by humans. This analysis therefore excludes diseases such as malaria but includes the impact of diseases such as heart disease and type 2 diabetes whose prevalence lifestyle choices or other human decisions can drive. Our estimate of the global economic toll of obesity includes the cost of lost economic productivity through the loss of productive life years, direct costs to health-care systems, and the investment required to mitigate the impact of obesity. Of the three sources of cost that we assessed, lost productivity is the most significant in our analysis, accounting for nearly 70 percent of the total global cost of obesity. Some critics may argue that lost productivity should not be included, as it does not generate a direct cost. However, we believe that,

10 Sharada Keats and Steve Wiggins, *Future diets: Implications for agriculture and food prices*, Overseas Development Institute, January 2014.

11 B. Butland et al., *Foresight: Tackling obesity—future choices*, UK Government Office for Science, project report, 2nd ed., October 2007.

12 Our analysis assessed the cost of three elements in 2012 dollars at purchasing power parity (PPP): the loss of productive life, direct health-care costs, and investment to mitigate the cost. Loss of productive life is based on Global Burden of Disease assessment of disability-adjusted life years lost attributable to different risk factors. These DALYs are given economic value by GDP per capita for different countries. This is a purely economic lens; it does not suggest that all of the reasons for investing to mitigate should be tied to the economic cost.

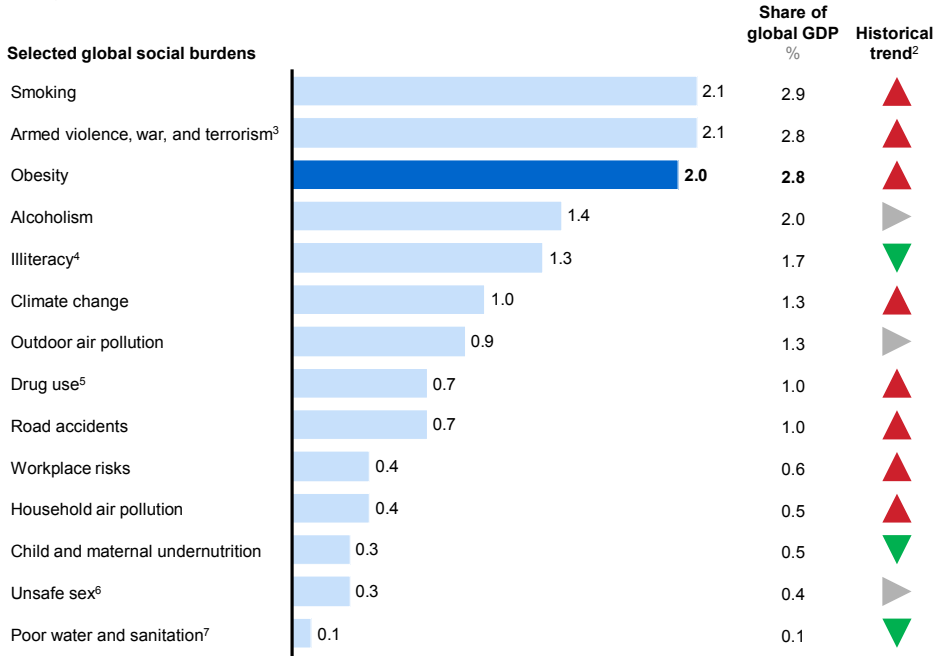
while not a direct cost to society, it should be included because it has a negative economic impact. In addition, it should be noted that our estimates are based on the current cost of these burdens. This means that burdens such as climate change and obesity, which result in a higher future cost, are ranked lower than if we had conducted these analyses on a net present value basis.

Exhibit 4

Obesity is one of the top three global social burdens generated by human beings

Estimated annual global direct economic impact and investment to mitigate selected global burdens, 2012[1]

GDP, $ trillion



1 Based on 2010 disability-adjusted life years (DALY) data from the Global Burden of Disease database and 2012 economic indicators from the World Bank; excluding associated revenue or taxes; including lost productivity due to disability and death, direct cost, e.g., for health care, and direct investment to mitigate; GDP data on purchasing power parity basis.
2 Based on historical development between 1990 and 2010 of total global DALYs lost (Global Burden of Disease).
3 Includes military budget.
4 Includes functional illiteracy.
5 Includes associated crime and imprisonment.
6 Includes sexually transmitted diseases. Excludes unwanted pregnancies.
7 Excludes lost time to access clean water source.

SOURCE: Literature review; World Health Organization Global Burden of Disease database; McKinsey Global Institute analysis

The severity of the economic burden of obesity varies among countries (Exhibit 5).

Exhibit 5
Relative ranking of major social burdens by country

	France	Japan	Indo-nesia	China	Nigeria	Brazil	Morocco	South Africa	Mexico	United States	United Kingdom
Smoking	1	1	1	2	11	5	4	7	5	3	1
Obesity	2	3	8	9	13	3	2	4	1	2	2
Armed violence, war, and terrorism	3	6	9	3	7	1	1	3	4	1	3
Alcoholism	4	4	10	6	5	2	11	2	3	5	5
Illiteracy	5	2	7	8	10	7	7	9	6	4	4
Climate change	6	7	2	4	4	4	3	6	2	8	8
Outdoor air pollution	7	5	6	1	9	12	8	12	8	7	7
Road accidents	8	9	5	7	3	6	9	10	7	9	9
Drug use	9	8	12	11	14	8	6	8	9	6	6
Workplace risks	10	10	11	10	12	9	10	13	11	10	10
Unsafe sex	11	13	13	13	2	11	12	1	13	11	12
Child and maternal undernutrition	12	11	3	12	1	10	5	5	10	13	11
Poor water and sanitation	13	12	14	14	8	14	14	14	14	12	13
Household air pollution	14	14	4	5	6	13	13	11	12	14	14

SOURCE: Literature review; World Health Organization Global Burden of Disease database; McKinsey Global Institute analysis

In most developed economies, obesity ranks among the top three human-generated economic burdens. In the United Kingdom, for instance, obesity has the second-largest impact after smoking, generating an economic loss of more than $70 billion a year in 2012, or 3.0 percent of GDP (Exhibit 6).

In the United States, armed conflict (and especially spending on the military) has the highest social and economic impact, and obesity is second; obesity generated an impact in the United States of $663 billion a year in 2012, or 4.1 percent of GDP. In both countries, the prevalence and associated cost of obesity are growing, albeit less steeply than in recent decades and in comparison with many emerging markets.

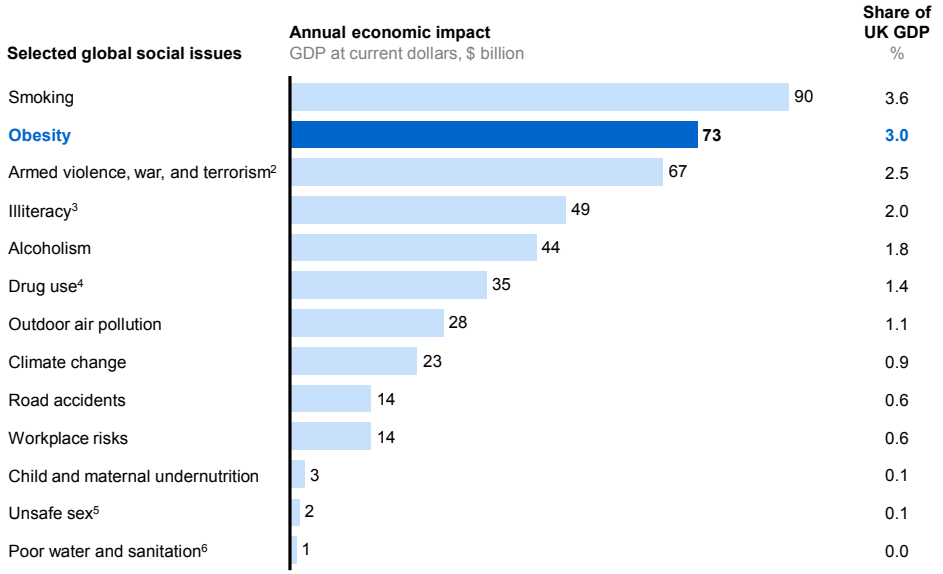
The economic toll of obesity varies more widely in emerging markets. In Mexico, obesity is the largest social impact at 2.5 percent of GDP. We observe comparable burdens in Morocco at 2.8 percent of GDP, in South Africa at 3.0 percent of GDP, and in Brazil at 2.4 percent of GDP. But in other emerging markets obesity is—as of now—a much less significant economic burden. In Nigeria, for instance, obesity's impact on the economy is 0.7 percent of GDP,

ranking as the 13th-largest economic burden; in Indonesia, it has a 1.0 percent impact, ranking eighth; and in China, the figure is 1.1 percent, ranking ninth.

Exhibit 6

Obesity is the second-largest human-generated impact on the United Kingdom

Selected social issues, United Kingdom, 2012[1]



1 Based on 2010 DALY data from the World Bank Global Burden of Disease database and 2012 economic indicators; excluding associated revenue or taxes, including lost productivity due to disability and death, direct cost (such as for health care), and direct investment to mitigate; GDP data on purchasing power parity basis.
2 Includes military budget.
3 Includes functional illiteracy.
4 Includes associated crime and imprisonment.
5 Includes sexually transmitted diseases. Excludes unwanted pregnancies.
6 Excludes lost time to access clean water source.
SOURCE: Literature review; McKinsey Global Institute analysis

We now discuss each of the three categories of economic impact imposed by obesity.

The health burden of obesity constrains economic productivity and can increase business costs

We assessed the productivity lost due to obesity using the standard measurement of disability-adjusted life years, or DALYs, which measure the number of years that are lost or rendered economically unproductive due to disease.[13] Of the DALYs lost to obesity across the world, around 71 percent are due to premature mortality and 29 percent to disability that has prevented individuals from making their full economic contribution.

The number of DALYs lost to obesity today is three times as high in developed economies as it is in emerging markets. However, that gap is narrowing. The rise in the number of DALYs per 100,000 people lost because of obesity slowed in developed economies between 1990 and 2010 but soared by 90 percent in emerging economies (Exhibit 7).

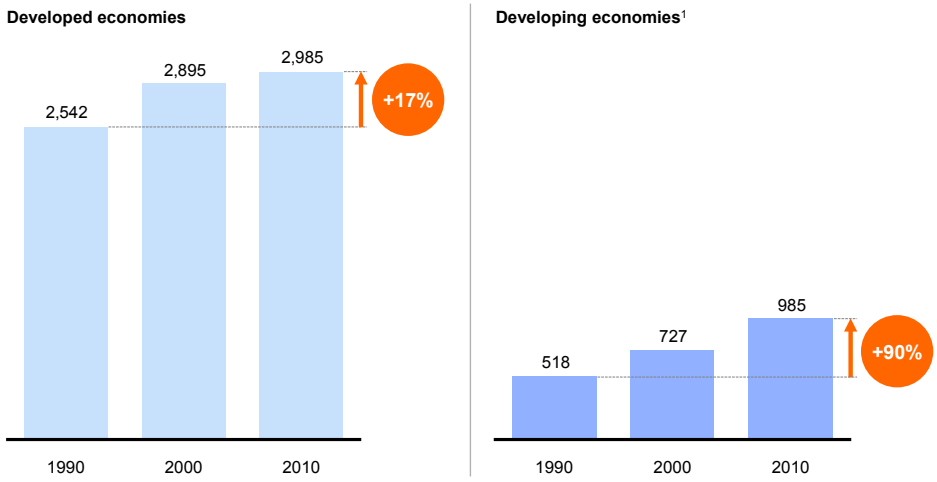
13 Our analysis using DALYs measures the opportunity cost to an economy; we have not measured the broader losses to human well-being associated with lost productivity. We also note that the value of a DALY is tied to per capita GDP and for this reason, our analysis tends to amplify the cost to developed economies, where per capita GDP is higher, and tends to under-record the burden of cost in emerging markets.

Exhibit 7

From 1990 to 2010, growth in obesity-related lost DALYs slowed in developed economies but almost doubled in developing economies

Obesity health burden

DALYs lost per 100,000 people



1 Definition of developing economies based on World Bank categorization of low- and middle-income countries, with per capita gross national income of less than $12,615.

SOURCE: World Health Organization Global Burden of Disease database; McKinsey Global Institute analysis

The productivity loss from the rising prevalence of obesity has jumped from 1990 to 2010 in some emerging markets. In Indonesia, for instance, the number of DALYs lost per 100,000 people due to obesity has risen from 184 in 1990 to 885 in 2010, a jump of nearly 400 percent. In South Africa, DALYs lost to obesity totaled 1,577 in 1990 and 2,659 in 2010, an increase of 69 percent.

The 29 percent "disability" burden affects employers through lost employee productivity and health-care costs. Employees with particularly high BMI can be less productive in the workplace due to the range of health problems that obesity can cause, including, for example, arthritis, fatigue, breathlessness, lack of concentration, and depression.[14] There is also a relationship between obesity and absenteeism from work for health reasons, including frequent medical checkups.[15]

In the United Kingdom, for instance, we estimate that the total impact on employers is $7 billion. Of this, $5 billion, or more than two-thirds, comes from decreased productivity in the workplace rather than outright absenteeism. In the United Kingdom, higher health-insurance premiums are not a major issue for employers because of the central role of public health through the NHS. By contrast, in the United States higher insurance premiums could contribute as much as $7.7 billion of our $18.9 billion to $21.9 billion overall estimate of the cost of obesity to employers.[16]

14 Eric A. Finkelstein et al., "The costs of obesity in the workplace," *Journal of Occupational and Environmental Medicine*, volume 52, number 10, October 2010.

15 L. A. Tucker and G. M. Friedman, "Obesity and absenteeism: An epidemiologic study of 10,825 employed adults," *American Journal of Health Promotion*, volume 12, number 3, January–February 1998; J. Cawley, J. A. Rizzo, and K. Haas, "Occupation-specific absenteeism costs associated with obesity and morbid obesity," *Journal of Occupational and Environmental Medicine*, volume 49, number 12, December 2007.

16 Ross A. Hammond and Ruth Levine, *The economic impact of obesity in the United States*, Economic Studies Program, Brookings Institution, August 2010.

Obesity drives between 2 and 7 percent of global health-care spending

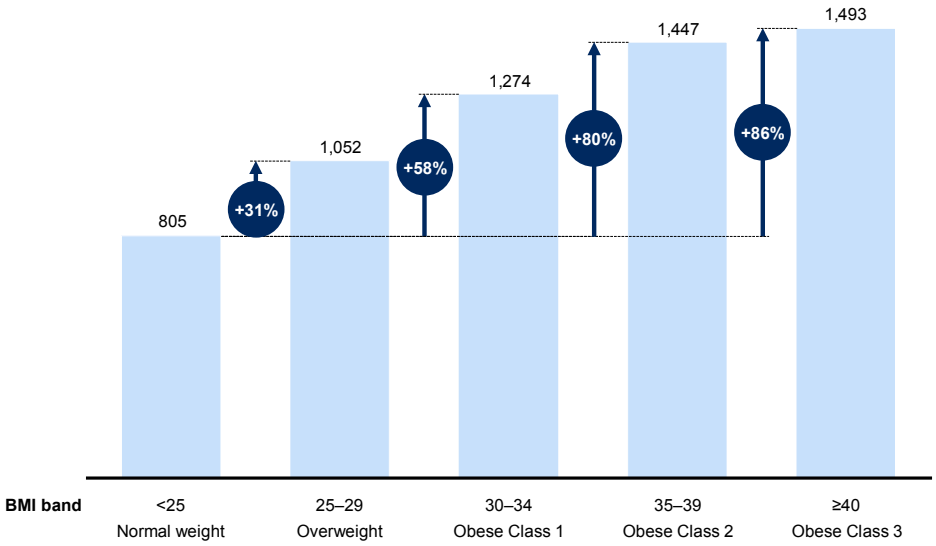
Previous McKinsey analysis on health-care spending in the OECD group of countries has found that, without reform, health-care spending could grow by 50 to 100 percent between 2007 and 2040. In the United Kingdom alone, the research found that health-care spending could account for 11 to 14 percent of GDP by 2040.[17] Separately, the World Health Organization (WHO) estimates that high BMI drives between 2 and 7 percent of global health-care spending.[18] We observe this correlation clearly in the United Kingdom (Exhibit 8).

Exhibit 8

Associated medical costs rise as BMI increases

UK medical costs by BMI group, 2012[1]

£ per capita



1 Includes primary care, general practitioner prescriptions, hospitalization, accident and emergency, and outpatient care. 2003 values taken from Tigbe et al. (2013) adjusted using 2012/13 Fédération Internationale de Médecine du Sport and Health Examination Survey data on per capita UK costs in each category.

SOURCE: W. W. Tigbe, A. H. Briggs, and M. E. J. Lean, "A patient-centred approach to estimate total annual healthcare cost by body mass index in the UK Counterweight programme," *International Journal of Obesity*, August 2013; Fédération Internationale de Médecine du Sport and Health Examination Survey, 2012/13; McKinsey Global Institute analysis

The research found four major drivers of increased spending: an aging population, an explosion of so-called lifestyle diseases, a rise in public expectations, and a lack of value-consciousness among health-care consumers.[19] We cannot address aging populations or rising public expectations of health-care provision. However, we can tackle a lack of consciousness about value among citizens and a lack of efficiency within health-care systems, as well as the burden of lifestyle diseases of which obesity is a major driver. Obesity contributes to cardiovascular disease, type 2 diabetes, and some cancers such as kidney, bowel, and breast. Mitigating or reversing the obesity crisis is a critical element of any strategy for achieving sustainable provision of health care and managing public budgets.

17 *Sustainable health systems: Visions, strategies, critical uncertainties and scenarios,* World Economic Forum in collaboration with McKinsey & Company, January 2013.

18 Ibid.

19 Ibid.

Today, one in 12 of the global adult population has type 2 diabetes, which is at least partly driven by obesity (see Box 2, "Obesity and diabetes"). In addition, a large number of people suffer from "impaired glucose intolerance," a pre-diabetes condition that usually leads to the disease unless significant lifestyle changes are made.

Type 2 diabetes is both preventable and reversible with lifestyle changes. A US study found that a 7 percent weight loss accompanied by moderate physical activity decreased the number of new diabetes cases by 58 percent among the high-risk population.[20] In the United States, the direct cost of obesity to the health-care system is estimated to be between $147 billion and $190 billion a year—or about 7 percent of total annual health-care spending.[21] Per capita medical spending is 24 percent higher for obese individuals than for those who are not obese. Some estimates put the future cost to US health care from obesity as high as $344 billion by 2018, or approximately 20 percent of total health-care spending that year. To put the figure into context, this cost would be greater than the GDP of South Africa today.

In the United Kingdom, the government currently spends about £6 billion ($9.6 billion) a year on the direct medical costs of conditions related to being overweight or obese. That is 5 percent of the entire budget of the NHS. It spends a further £10 billion on diabetes. The cost of obesity and diabetes to the health-care system is equivalent to the United Kingdom's combined "protection" budget for the police and fire services, law courts, and prisons; 40 percent of total spending on education; and about 35 percent of the country's defense budget. The £6 billion cost has increased since 2007, when it was £4 billion to £5 billion. On current projections of rising prevalence of obesity and overweight conditions, the cost to the NHS could increase from between £6 billion and £8 billion in 2015 to between £10 billion and £12 billion in 2030.

The investment to mitigate obesity today accounts for a small share of the overall cost of obesity

Only a small share of the overall cost of obesity comes from investment to mitigate or prevent it, compared with other health- or non-health-related burdens. We estimate that the global investment to prevent obesity is about $5 billion, or only 0.25 percent of the total economic impact of obesity. In comparison, investment in prevention of traffic accidents accounts for about 1.2 percent of the overall cost of such accidents. Instead, obesity spending is weighted toward treatment. For example, the United Kingdom's largest prevention outlay is £11 million a year through the Change4Life campaign. This is equivalent to only 0.18 percent of what the NHS spends on obesity- and overweight-related conditions. Part of the reason for this is that the effectiveness of preventive approaches is difficult to assess.

20 The Diabetes Prevention Program Research Group, "The Diabetes Prevention Program (DPP): Description of lifestyle intervention," *Diabetes Care*, volume 25, number 12, December 2002.

21 Eric A. Finkelstein et al., "Annual medical spending attributable to obesity: Payer- and service-specific estimates," *Health Affairs*, volume 28, number 5, July 2009; John Cawley and Chad Meyerhoefer, "The medical care costs of obesity: An instrumental variables approach," *Journal of Health Economics*, volume 31, issue 1, January 2012.

Box 2. Obesity and diabetes

Type 2 diabetes, a metabolic disorder characterized by resistance to insulin that results in chronically high blood sugar in the body, is one of the major health-care costs of obesity. Left untreated, the condition can result in severe complications, including heart disease, stroke, blindness, kidney failure, and poor blood flow to limbs that can lead to sores and amputations. The prevalence of type 2 diabetes has soared in tandem with obesity-prevalence rates from 30 million diagnosed cases worldwide in 1985 to about 382 million today. By 2035, almost 600 million people could be affected by the disease, according to the International Diabetes Federation. An additional 316 million people globally have "pre-diabetes," or impaired glucose tolerance. These individuals do not have evident symptoms and therefore are not usually diagnosed; however, 40 percent of them progress to fully fledged diabetes within five to ten years.[1]

In the past, diabetes tended to be a disease largely of older people in developed economies. But its demographics are changing rapidly—diabetes today is afflicting younger populations, and its spread is more global. Diabetes is increasingly common in young adults, adolescents, and even children. Type 2 accounted for less than 3 percent of all diabetes cases in adolescents in 1990, but that share had risen to 45 percent in 2005.[2] Insulin resistance progresses faster in young people than older people, and they also suffer earlier and more acute co-morbidities of kidney failure, blindness, and heart disease. Many young people are already suffering kidney disease and high blood pressure on diagnosis.[3]

About 80 percent of the growth in prevalence projected between now and 2035 is expected to be in developing economies, reflecting rapid economic growth, rising incomes, and the adoption of Western lifestyles (Exhibit 9).[4] The MENA (Middle East and North Africa) region and the rest of Africa are projected to experience around a doubling of the number of people with diabetes in this period. Minority and indigenous populations have a higher risk of type 2 diabetes than white Caucasians, the hypothesis being that this is partly driven by different genetic racial susceptibilities. Other factors may also play a role, including socioeconomic disparities and access to health care.

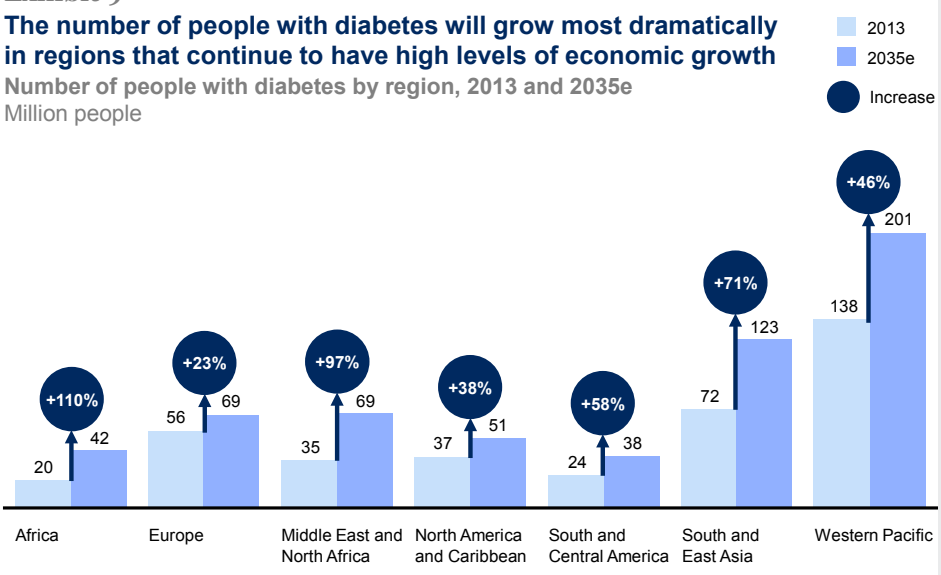
The burden on health-care systems is already high and rising. It has been estimated that diabetes accounts for 12 percent of global health-care costs at between $376 billion and $672 billion.[5] In the United Kingdom, the NHS spends 10 percent of its total budget on treating diabetes, 80 percent of which we can attribute to treating the complications of unmanaged diabetes. These are costs that could be reduced with better management through changes in lifestyle.

Exhibit 9

The number of people with diabetes will grow most dramatically in regions that continue to have high levels of economic growth

Number of people with diabetes by region, 2013 and 2035e

Million people



SOURCE: International Diabetes Federation; McKinsey Global Institute analysis

1 P. Zimmet, K. G. Alberti, and J. Shaw, "Global and societal implications of the diabetes epidemic," *Nature*, volume 414, December 13, 2001.

2 O. Pinhas-Hamiel and P. Zeitler, "The global spread of type 2 diabetes mellitus in children and adolescents," *Journal of Pediatrics*, volume 146, 2005.

3 Ibid.

4 S. Wild et al., "Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030," *Diabetes Care*, volume 27, number 5, May 2004.

5 P. Zhang et al., "Global healthcare expenditure on diabetes for 2010 and 2030," *Diabetes Research and Clinical Practice*, volume 87, number 3, March 2010.

OBESITY AND SOCIOECONOMIC DISADVANTAGE MAY BE MUTUALLY REINFORCING

Developed economies have a clear inverse correlation between income levels and the prevalence of obesity, particularly in the case of women and children. Put simply, lower-income groups tend to have higher obesity prevalence. And it seems likely that causation works both ways. Across a range of developed markets, this inverse relationship is most acute for women (see Box 3, "Gender disparity").

A study conducted by the US Centers for Disease Control and Prevention found that obesity prevalence is generally similar at all income levels for men in the United States (around 30 percent), while for women it was 42 percent at low-income levels vs. 29 percent at high-income levels.[22] In Australia the relationship holds across genders, with obesity prevalence ten percentile points higher for adults in the most disadvantaged quintile vs. the least disadvantaged one.[23] In several other countries, it has been observed that obesity prevalence for women ranges from 1.6 (United States) to 18.4 (South Korea) times as high at the lower end of the education spectrum as it is for those at the upper end. This relative index of inequality is lower on average for men.

The same pattern appears in the United Kingdom.[24] The inverse relationship holds for different measures of socioeconomic status, including household income, the occupational status of the parent, educational achievement, and a score of area deprivation. The prevalence of obesity is almost double among women with unskilled occupations (35.2 percent) than among professional women (18.2 percent).[25] In the case of British children, the prevalence of obesity is almost 50 percent as high among boys in the lowest household income quintile as for those in the highest household income quintile; for girls, the prevalence is more than 50 percent as high.[26] Children in the bottom decile of most deprived areas are twice as likely to be obese as children in the decile of least deprived areas (Exhibit 10).[27] The UK Health Survey for England did not find a relationship between household income and obesity for men. However, the survey did find that among men with a higher level of educational attainment, the prevalence of obesity is lower.[28]

22 Cynthia L. Ogden et al., *Obesity and socioeconomic status in adults in the United States, 2005–2008*, National Center for Health Statistics data brief number 50, December 2010.

23 Australian Institute of Health and Welfare, *Who is overweight?* AIHW analysis of the 2007–08 National Health Survey, 2013.

24 *Adult obesity and socioeconomic status*, National Obesity Observatory Data Factsheet, September 2012.

25 Ibid.

26 S. Bridges and J. Thompson, "Children's BMI, overweight and obesity," in *Health survey for England—2010, respiratory health*, R. Craig and J. Mindell, eds., Health and Social Care Information Centre, December 2011.

27 *Socio and economic inequalities in diet and physical activity,* National Obesity Observatory, November 2013.

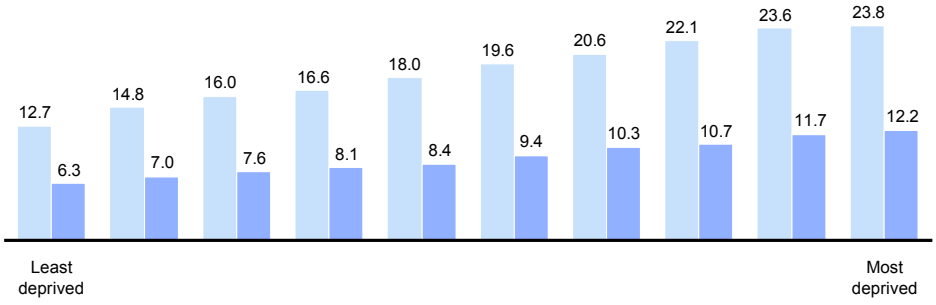
28 *Adult obesity and socioeconomic status*, National Obesity Observatory Data Factsheet, October 2010.

Exhibit 10

Children of all ages are twice as likely to be obese in the most deprived areas as in the least deprived areas

Proportion of children, England, 2010–11

%



SOURCE: National Child Measurement Programme, Health and Social Care Information Centre; McKinsey Global Institute analysis

Given that obesity has a higher incidence among disadvantaged households, it also imposes a disproportionate burden on these already disadvantaged households in terms of higher health-care costs and reduced welfare. This entrenchment of inequalities operates both within countries and at the international level. In emerging economies where public-health provision is nascent, these health-care costs fall directly on households. In addition, there is some evidence that epigenetic factors may disproportionately increase the burden of obesity in emerging markets (see Box 4, "The thrifty phenotype").

Moreover, it seems that obesity can be passed from generation to generation. There is evidence that obesity risk is tied to parental BMI through both physiological and behavioral mechanisms. Studies find that a mother with a high BMI is a significant predictor of obesity in her children when they grow to adulthood because fetuses develop a compromised metabolism and a resistance to insulin.[29] However, other sociocultural factors and genetic predisposition drive the onset of obesity, too.[30] For instance, eating habits that confound adult eating patterns are typically passed along by parents in early life.[31]

29 J. Eriksson et al., "Size at birth, childhood growth and obesity in adult life," *International Journal of Obesity*, volume 25, number 5, June 2001; R. Huxley et al., "Ethnic comparisons of the cross-sectional relationships between measures of body size with diabetes and hypertension," *Obesity Reviews*, volume 9, supplement 1, March 2008; L. C. Fernald and L. M. Neufeld, "Overweight with concurrent stunting in very young children from rural Mexico: Prevalence and associated factors," *European Journal of Clinical Nutrition*, volume 61, number 5, May 2007; Elizabeth W. Kimani-Murage et al., "The prevalence of stunting, overweight and obesity, and metabolic disease risk in rural South African children," *BMC Public Health*, volume 10, number 1, March 2010.

30 R. Huxley et al., "Ethnic comparisons of the cross-sectional relationships between measures of body size with diabetes and hypertension," *Obesity Reviews*, volume 9, supplement 1, March 2008; Obesity in Asia Collaboration, "Waist circumference thresholds provide an accurate and widely applicable method for the discrimination of diabetes," *Diabetes Care*, volume 30, number 12, December 2007.

31 Jennifer S. Savage, Jennifer Orlet Fisher, and Leann L. Birch, "Parental influence on eating behavior: Conception to adolescence," *Journal of Law, Medicine, and Ethics*, volume 35, issue 1, March 2007.

Box 3. Gender disparity

The prevalence of obesity (and overweight) is higher in women than men in the majority of countries, and, with a few exceptions, including the United Kingdom among developed economies, this effect is exaggerated in the countries with the highest overall obesity prevalence (Exhibit 11). The gender disparity is the result of a complex interplay of social, cultural, and biological factors that vary by socioeconomic groups within each country.[1] In Egypt, for instance, there is a 24 percentage-point difference—male prevalence of obesity is 21 percent vs. female prevalence of 45 percent. Eleven of the top 20 countries for prevalence have a gender gap of ten percentage points or more.[2] There is higher prevalence among females in 168 of the 196 countries for which OECD data are available. The 28 countries where there is no gender gap tend to have low overall prevalence and high GDP, and the prevalence in males is less than three percentage points greater than in females.

Higher prevalence in women implies that they carry more of the burden of obesity, including reduced life expectancy, greater risk of obesity-related disease, and increased medical costs. There is some evidence that higher prevalence has an impact on women's social mobility because of the link between obesity and educational attainment and income. One American study showed that obese teenage girls were less likely to enroll in college than girls in their age group who are not obese; this did not hold true for teenage boys. Enrollment by girls in high schools that had relatively few obese teenagers was also lower, suggesting that self-perception and confidence play a role.[3] Research has also shown that obese women earn less than those who are not obese and that this income penalty continues throughout their careers. Men are not as disadvantaged as women in this respect.[4]

In countries with a large obesity gender gap, careful thought needs to be given about how best to intervene, particularly in countries where effective mitigation may require overcoming strong social and cultural barriers.[5]

1 L. D. Howe, R. Patel, and B. Galobardes, "Tipping the balance: Wider waistlines in men but wider inequalities in women," *International Journal of Epidemiology*, volume 39, number 2, April 2010.

2 We count the Pacific Islands and Caribbean Islands as one country each. The Pacific Islands comprise Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Kiribati, Marshall Islands, Nauru, Palau, Samoa, Solomon Islands, and Tonga. The Caribbean Islands comprise Bahamas, Barbados, Netherlands Antilles, Puerto Rico, and Saint Kitts and Nevis.

3 Robert Crosnoe, "Gender, obesity, and education," *Sociology of Education*, volume 80, number 3, July 2007.

4 Katherine Mason, "The unequal weight of discrimination: Gender, body size, and income inequality," *Social Problems*, volume 59, number 3, August 2012.

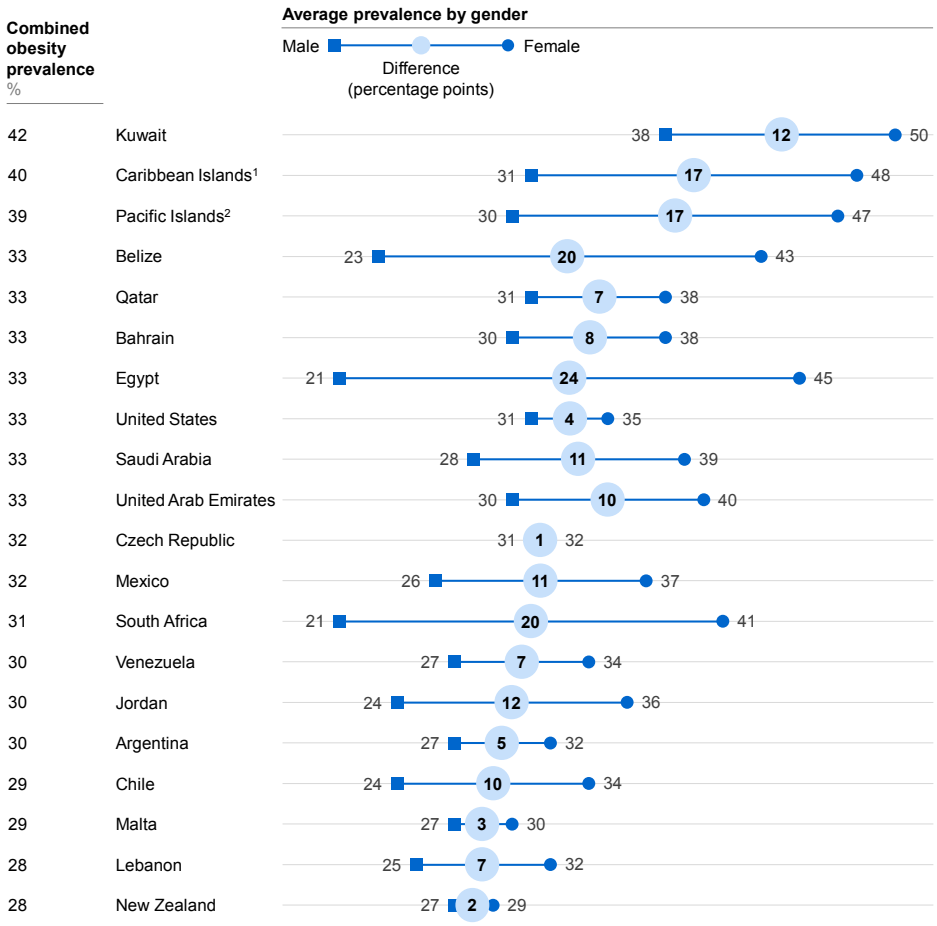
5 Ibid. L. D. Howe, R. Patel, and B. Galobardes, "Tipping the balance," April 2010.

Box 3. Gender disparity (continued)

Exhibit 11

The prevalence of obesity is consistently higher in women than in men—with a gap of up to 24 percentage points

Male and female obesity prevalence for top 20 countries with highest prevalence, 2008
% of population



1 Comprising Bahamas, Barbados, Netherlands Antilles, Puerto Rico, and Saint Kitts and Nevis.
2 Comprising Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Kiribati, Marshall Islands, Nauru, Palau, Samoa, Solomon Islands, and Tonga.

SOURCE: OECD statistics; McKinsey Global Institute analysis

Box 4. The thrifty phenotype

There is some evidence that the nutritional condition of one generation is a significant variable affecting the BMI of subsequent generations. Research finds that epigenetic variations—a change in gene expression due to environmental factors—explain some of this and may contribute to the growing prevalence rates of major lifestyle diseases such as obesity, diabetes, and heart disease.[1] Two important relationships are being researched. One links recent undernutrition to a high propensity to metabolic disorders and high BMI in future generations; the other links obesity in parents to a higher propensity in their children, controlling for other confounding variables.

The Barker Theory—or the "thrifty phenotype hypothesis"—finds that fetal undernutrition during pregnancy is a risk factor for increasing mortality rates from a range of diseases and for becoming obese in later life.[2] The likelihood of developing type 2 diabetes increases in undernourished newborns.[3] In-uterus undernutrition might inhibit sufficient fetal insulin production to ensure that enough of the scarce sugar is made available for the development of the brain. When sugar intake rises, children born to undernourished mothers are not able to produce the amount of insulin required to manage increased sugar levels in the body. The Barker Theory suggests that in countries where food was scarce but is now more plentiful—as incomes rise—obesity rates explode disproportionately compared to the rates in countries with no recent history of food scarcity, controlling for other major factors, such as economic development.

The Republic of Nauru, a Micronesian island, provides an apt case study. Until the mid-20th century, the island had a history of repeated food shortages and starvation. Once islanders left food poverty behind them, obesity and type 2 diabetes prevalence rates soared to among the highest worldwide; in 2010, 94 percent of men and 93 percent of women were overweight, and approximately 71 percent of the population was obese.[4] The International Diabetes Federation identifies 31 percent of Nauruans as diabetic; in the 56- to 65-year-old age group, the share is 45 percent. The impact of these high obesity and diabetes rates has major consequences. These high prevalence rates are due to a range of factors: sedentary lifestyle, lack of arable land and reliance on highly processed food, and lack of health education. Some studies suggest that "epigenetic programming" of gene activity to protect from scarcity of nutrition also may be relevant.[5]

If this epigenetic programming is a driver of the exploding obesity prevalence in countries undergoing a major "nutritional transition"—which includes most rapidly developing middle-income countries in Asia, Latin America, the Middle East, and Africa—it raises serious concerns. The obesity and diabetes burden faced by these regions is likely to be disproportionately high, and in many cases, their health-care systems will not be sufficiently developed or accessible to mount an adequate response.

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1 Reinhard Stöger, "The thrifty epigenotype: An acquired and heritable predisposition for obesity and diabetes?" *Bioessays*, volume 30, number 2, February 2008.

2 D. J. P. Barker, "The origins of the developmental origins theory," *Journal of Internal Medicine*, volume 261, number 5, May 2007.

3 J. G. Eriksson et al., "Early adiposity rebound in childhood and risk of type 2 diabetes in adult life," *Diabetologia*, volume 46, number 2, February 2003; George J. Dover, "The Barker hypothesis: How pediatricians will diagnose and prevent common adult-onset diseases," *Transactions of the American Clinical and Climatological Association*, volume 120, January 2009.

4 *Nauru country health information profile 2011*, statistical annex, World Health Organization.

5 Ibid. Reinhard Stoger, "The thrifty epigenotype," February 2008.

□ □ □

It is no exaggeration to say that across the globe, obesity and its associated medical conditions have reached crisis proportions. Left unchecked, rising prevalence is very likely to have an even more significant economic impact than it does today—putting pressure on employers and the productivity of their companies and on health-care systems, and on the public purse. The question is how best to combat it. In Chapter 2, we discuss 18 major groups of interventions that have been deployed somewhere in the world—a menu of options to consider in the intensifying fight against obesity.


BIKES

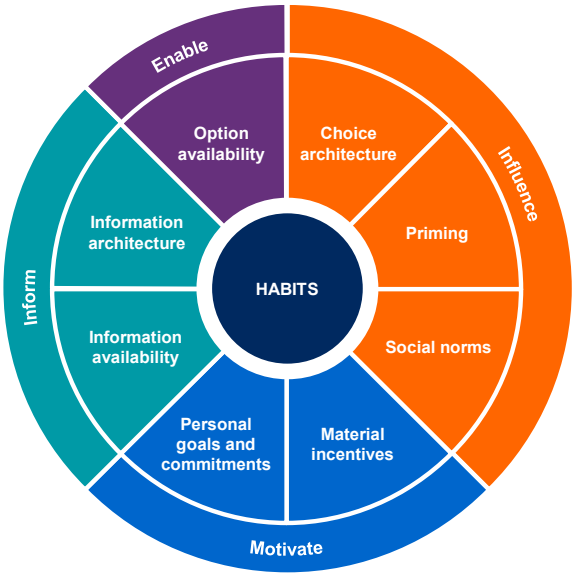
2. Tackling obesity

Obesity is the result of a multitude of factors, and therefore no single solution is likely to be effective in tackling it. A range of interventions that encourage and empower individuals to make the required behavioral changes will be necessary. These interventions need to be systematic, not only aiming for an immediate impact on the net energy balance but also making sure that change is sustained. A comprehensive portfolio of interventions is also required to target the different needs and responsiveness of various population segments. Governments, health-care systems, employers, retailers, consumer-goods companies, and consumers themselves all need to play their part.

To map out the range of solutions available to society to change its collective behavior and reduce obesity, we have developed a framework that classifies interventions to tackle obesity. The framework draws on the most recent health-related behavioral-change theory and insights from behavioral economics. The framework comprises four types of mechanism: mechanisms that inform, enable, motivate, and influence (Exhibit 12).

Exhibit 12

MGI has developed a framework to disaggregate mechanisms for population behavioral change



SOURCE: Expert interviews; McKinsey Global Institute analysis

The “inform” segment includes whether information is made available and how it is communicated. Information availability tests whether appropriate information is provided to relevant populations to stimulate behavioral change. One example would be a doctor advising a patient to lose weight in order to reduce the risk of a heart attack. Another example is whether nutritional information is included on food labels. Information architecture describes where and how information is

presented. So, for instance, a doctor does not just issue a general warning but details how the risk of having a heart attack decreases with every pound lost. Food labels are color-coded so that they are more easily understood.

The "enable" segment assesses the extent to which options to change behavior are available. Examples include giving individuals access to green spaces or a gym to facilitate exercise, or introducing healthy options in a canteen.

The "motivate" segment explores the main methods for encouraging people to consciously change their behavior, such as by setting personal goals or making commitments (exercising, losing weight). These goals or commitments can be aided by, for instance, exercise-tracking wristbands. The other major motivational mechanism is the use of material incentives, including financial incentives, to lose weight or exercise more. Financial incentives can be direct. For instance, the government of Abu Dhabi rewards participants in a weight-loss challenge with a gram of gold for each kilogram lost. Or they can be indirect, as in employers or insurers reducing health-care premiums.

"Influence" is the final segment, covering the major means for stimulating different behavior—whether or not individuals are fully aware of their behavioral change. Of these, choice architecture reflects how choices are presented and includes the importance of standards or defaults. Examples of using choice architecture to change diet or exercise behavior are making portion sizes of unhealthy food smaller and changing the relative pricing of different food products. Priming covers exposure to a particular stimulus or cue that affects perception, judgment, and decisions about consumption, such as cartoon characters promoting fruit and vegetables to children, or pictures associated with health in supermarkets.[32] The final influencing mechanisms relate to the effect of social norms on individuals' behavior, which can arise from a wide range of interventions that change attitudes.

To shed light on how the framework may help in the fight against obesity, we looked at other attempts to change the behavior of entire populations to ascertain how the different mechanisms have worked in practice (see Box 5, "The lessons from efforts to change behavior").

MGI HAS IDENTIFIED 74 INTERVENTIONS TO TACKLE OBESITY THAT FALL INTO 18 GROUPS

We set out to develop a comprehensive catalog of interventions that could be used to reduce obesity. Working in conjunction with policy advisers, population-health academics, and individuals from companies, and drawing on an extensive review of research, we have identified 74 intervention levers that are being discussed or piloted around the world. The 74 intervention levers fall broadly into 18 groups (Exhibit 13.[33]

32 The Healthy Choices Pilot, launched in a Morrisons supermarket in Salford, United Kingdom, increased fresh fruit sales by 20 percentage points through the introduction of "Let's shop healthier" signage and pictures of health-care professionals. The cartoon "Popeye" reportedly increased spinach sales in the 1930s in the United States by 33 percent. Market dynamics have evolved considerably, but children today are likely to be just as responsive to the eating habits of their cartoon heroes.

33 For a detailed assessment of documented impact, examples, and feasibility constraints of each intervention area, please contact obesity@mckinsey.com for back-up materials.

Exhibit 13
Intervention groups and descriptions

1. Active transport
Facilitating and encouraging walking, cycling, and public transport, which engender more physical activity

2. Health-care payors
Providing incentives or support to encourage healthy behavior. These can include general financial incentives, such as premium rebates or reward points, or more targeted facilitating incentives such as free gym membership. Payors can also deliver other interventions such as parental and weight-management programs

3. Healthy meals
Improving the health quality of meals in controlled settings such as schools and workplaces

4. High-calorie food and drink availability
Reducing the ready availability of high-calorie foods to help control impulse consumption, including removing vending machines from schools and workplaces, high-calorie foods from supermarket checkouts, and fast-food retailers from locations outside schools

5. Labeling
Providing calorie and other nutritional labeling so that consumers can understand the content of their food. Labels can be plain text or "engaging"—an easy-to-interpret assessment of the health of the product (e.g., traffic lights)

6. Media restrictions
Restricting high-calorie food advertising to reduce exposure to marketing that is proven to promote consumption

7. Parental education
Empowering and educating parents to promote a healthier lifestyle for their children through regular parental guidance sessions

(not behavioral)

8. Pharmaceuticals
Intervening with drugs to reverse obesity rapidly in cases where it is creating immediate health risks

9. Portion control
Encouraging appropriate consumption through incremental (i.e., 1 to 5 percent) reductions in portion sizes and designing packaging to better delineate portion size to help consumers moderate their consumption

10. Price promotions
Restricting promotional activity in high-calorie impulse foods to decrease consumption

11. Public-health campaigns
Delivering a public-health campaign through multiple media outlets to promote healthy eating and physical activity habits

12. Reformulation
Incrementally reducing calories in food products to drive subconscious reduction in consumption

13. School curriculum
Introducing additional hours of physical education and healthy nutrition in school curricula to encourage healthier habits

14. Subsidies, taxes, and prices
Changing agricultural policy or regulatory policy to adjust consumer prices and the supply of select food and/or beverage categories

(not behavioral)

15. Surgery
Scaling up delivery of bariatric surgery to reduce stomach capacity and deliver immediate change in food consumption

16. Urban environment
Making changes to physical activity and food access to facilitate and encourage healthy habits, such as increasing the walkability of cities and green space, and improving access to grocery stores

17. Weight-management programs
Educating and empowering individuals to change key weight behavior through counseling, physical activity programs, and education

18. Workplace wellness
Offering programs and engaging employees to encourage healthy behavior, for example through financial and non-financial incentives, team competitions, and the provision of education and self-management tools such as personal tracking devices

SOURCE: McKinsey Global Institute analysis

Box 5. The lessons from efforts to change behavior

Having developed the behavioral-change framework, we tested it against existing examples of major behavioral-change campaigns over the past few decades. Specifically, we have examined campaigns to improve road safety in the United Kingdom since the 1960s, Australia's campaign to reduce the prevalence of skin cancer that took off in the 1980s, and a campaign against drug abuse in the United States that began in the 1980s. This exercise shed some light on how the different mechanisms have been used to date, their relative importance or potential impact, and success factors for effective behavioral change. We highlight findings on each of the four types of behavioral-change mechanism in the framework: inform, enable, motivate, and influence.

Inform: The impact of information availability can be enhanced by thoughtful information architecture. All public-health campaigns inform the public about the risks of certain behavior, whether that is taking recreational drugs, driving while drunk, not using seat belts, or not wearing sunscreen. Although the information itself is important, the evolution of public-health campaigns suggests that for maximum impact, the information needs to be delivered effectively. The experience of the campaigns that we have analyzed suggests that successful behavioral change relies on a number of elements. It is crucial to identify what information is likely to influence different groups. In all the case studies we looked at, young people, particularly males, are less amenable than other groups to warnings about risky behavior. In addition, changing behavior requires a real understanding of what has an impact on attitudes. For instance, initial "drink driving" advertisements in the United Kingdom focused on the risk of injury or death, but focus groups suggested that this message did not seem to resonate with 17- to 24-year-old males, the biggest offenders. The UK Department for Transport tested members of this group for what really motivated them and concluded that they were more fearful of getting caught drunk driving, having an accident, and being prosecuted. Subsequent ads highlighted the impact of a criminal record on future career prospects, and this significantly raised the response rate in that demographic group, leading to court convictions for drunk or drugged driving of young males falling 41 percent from 2003 to 2010.

The theory of best-practice communications suggests that a memorable message or slogan is also important. The very successful Australian sun protection campaign employed a memorable message. The campaign phrase "Slip Slop Slap" (slip on a shirt, slop on sunscreen, slap on a hat), with its use of alliteration and monosyllables, is short and memorable. The medium of the message can also help to target unresponsive groups. The UK drink-driving campaign was primarily channeled through Radio 1, the main pop-radio station for young people. The right timing is also important. One leg of Unilever's hand-sanitation campaign in India was held during Kumbh Mela, an annual pilgrimage when millions of Hindus gather in the same place. Unilever stamped 2.5 million pieces of roti (Indian flatbread) provided to pilgrims with the phrase, "Did you wash your hands with Lifebuoy?" How, where, and when information is communicated are important dimensions in the effectiveness of the messaging.

Enable: Making change easy through option availability and choice architecture (influence) is critical. For individuals who want to tackle being overweight and even for those who do not particularly care about their weight, making behavior change easy will improve outcomes. The Department for Transport in the United Kingdom encouraged the improved availability of non-alcoholic drinks in British pubs to make it easier to not drink while out with friends. In some areas of the United Kingdom, the NHS posts free chlamydia tests (urine sample pots with prepaid envelopes to send for testing) for 14- to 24-year-olds to make it easier for young people to get tested. Conversely, making bad behavior more difficult is highly effective. The ban on smoking indoors in many countries is a compelling example.

Box 5. The lessons from efforts to change behavior (continued)

Motivate: Personal goals and commitments and material incentives are important but have more variable success rates than other behavioral-change programs. Programs based solely on setting personal goals and commitments have a mixed record of success. One example of such a program is Drug Abuse Resistance Education, or DARE, a high-profile US education campaign in place since 1984 in which 26 million American children and ten million children in other countries have participated. Children are taught about drug abuse over the course of ten weeks in a program facilitated by their schools and led by police officers, and they commit to a pledge to take a stand against drug abuse. However, education and commitment alone were not enough. In 2001, the US surgeon general removed federal funding from the program because he judged it to be ineffective. In 2003, the US Government Accountability Office concluded that the program generated a boomerang effect: those who participated in DARE proceeded to have above-average rates of drug use. This finding was given traction by a University of Indiana study that found that students completing the program had higher rates of hallucinogenic drug use than those who had not taken part. More successful programs that rely on personal commitments, such as Weight Watchers, make other behavioral-change mechanisms such as leveraging social norms central to their efforts. On material incentives or disincentives, tobacco taxes in the United Kingdom have grown steadily since first introduced and now account for about 80 percent of the recommended retail price. These taxes have likely contributed to a steady decline in smoking over the past 30 years, particularly deterring teenagers from starting to smoke.[1] The price disincentive was delivered alongside comprehensive and aggressive public-health and school curriculum education campaigns. Research shows that, in the United Kingdom and the United States, changes in social norms were at least as important as shifting behavior.[2]

Influence: Addressing social norms together is a powerful change mechanism. Campaigns that deploy both these mechanisms are motivated by the hypothesis that they are likely to be more effective in changing public behavior than education alone. The United Kingdom aimed to stigmatize drunk drivers as recklessly risking the lives of others. An Australian campaign to discourage speeding implied that men who speed lacked virility, which proved a highly effective message. Endorsement by celebrities is a powerful way to shift social norms. A campaign led by Esther Rantzen, a well-known television presenter in the United Kingdom, stimulated public concern over child car seats that led to Parliament's making the seats mandatory. Stop-smoking campaigns stigmatized smoking in the presence of children and helped to make smoking less socially acceptable.

1 Pearl Bader, David Boisclair, and Roberta Ferrence, "Effects of tobacco taxation and pricing on smoking behavior in high risk populations: A knowledge synthesis," *International Journal of Environmental Research and Public Health*, volume 8, number 11, November 2011.

2 Kevin Callison and Robert Kaestner, *Do higher tobacco taxes reduce adult smoking? New evidence of the effect of recent cigarette tax increases in adult smoking*, NBER working paper number 18326, August 2012.

MGI HAS ASSESSED THE POTENTIAL IMPACT AND COST-EFFECTIVENESS OF A SUBSET OF INTERVENTIONS

While there have been research projects and pilots on individual interventions to address obesity, there has been little systematic attempt to analyze the relative potential cost-effectiveness and impact of a set of interventions if they are applied at the population level. To begin to address this gap, MGI has posed the question, "What is the full possible solution set out there, and what could be achieved in the near future if all relevant societal sectors properly engage and interventions are scaled up?" We analyzed the potential impact at a population level of those interventions for which we have been able to gather sufficient evidence of their impact from pilots and research projects around the world. We have been able to gather information relevant to 44 of the 74 interventions that we have identified in total, which appear in 16 of the 18 intervention areas. We have used this analysis to assess what a program to reverse rising obesity might look like.

The impact of an intervention is likely to be different in different countries due to distinct structural, behavioral, and cultural baselines. We have illustrated the potential scale of impact and cost-effectiveness of the individual interventions in a developed economy by looking at the United Kingdom. We are developing a similar projection for a developing economy through studies for Mexico or China. Both countries have high current and projected obesity prevalence. While there are likely to be differences between countries, we believe that the United Kingdom, Mexico, and China pilots are directionally correct for the impact and cost-effectiveness of interventions in other developed and developing economies.

Our research is based on an extensive review of more than 500 research studies from around the world. Although we pressure-tested each of these studies for quality of design, comprehensiveness and relevance, this discussion paper does not act as independent verification for each and every one, but rather an attempt to generalize for their findings. From these we have extrapolated the potential impact of various measures if they were to be adopted in the United Kingdom. We have conducted considerable pressure testing of our assessment of the existing evidence with a wide range of academics and experts on obesity. Our approach to interpreting existing data and the potential to scale up impact has been conservative.

However, we should stress that the science of addressing obesity is relatively young, and, due to limitations in the available data, the analysis presented here should be regarded as only an initial attempt to determine the potential impact and cost-effectiveness of a subset of potential interventions. The conclusions we draw on an integrated response to obesity should be viewed as the equivalent of a 16th-century map of the world; some islands may be missing and the shapes of continents may be somewhat skewed, but it is directionally correct. Our program undoubtedly misses some interventions and over- or underestimates the impact of other interventions. However, over the next few years, we intend to develop our analysis of the impact of different obesity intervention areas.

Some of the 74 interventions that we have identified do not yet lend themselves to a sufficiently robust assessment of their impact on obesity. These include building more parks to facilitate physical activity, making urban centers pedestrian-friendly to encourage active transport, or providing improved access to grocery stores to facilitate balanced diets. Such interventions have a long-term, diffuse impact that is hard to measure in a controlled study. This does not mean that they are due any less consideration.

Furthermore, some interventions, including drugs such as liraglutide and food-stamp programs that subsidize healthy foods and restrict unhealthy foods, are only now being tested for the first time.[34] For these reasons, this analysis is both an early and incomplete perspective on the range of potential solutions.

The main findings that emerge from our analysis are:

- **High impact is affordable from the perspective of society.** Our analysis suggests that 95 percent of interventions measured are highly cost-effective.[35] If the United Kingdom were to deploy all the interventions we were able to analyze, it could reverse rising obesity and bring roughly 20 percent of overweight and obese individuals back into the normal weight category within five to ten years. This would reduce the number of obese and overweight people in the United Kingdom by roughly the population of Austria.

- **However, reversing the health burden requires a multipronged approach—no single intervention can offer a solution.** Deploying as many interventions as possible of those we have identified would likely create considerable long-term synergies by raising awareness of the issue.

- **Education and personal responsibility are important to deliver this impact but, in themselves, are not enough.** To reverse the growing obesity burden, interventions are required that change society-wide norms and the environment that individuals face when making choices on eating, drinking, and engaging in physical activity.

- **Different interventions target different population segments, and some have long-term, slow-burn impact.** Even if some interventions have a low impact in the short term, they are still an important part of the solution.

- **Effective action to tackle obesity requires a renewed focus on coordination.** It is particularly important if we are to capture the high potential impact that food and beverage manufacturers, retailers, food-service providers, and restaurants could have on the problem.[36]

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34 Researchers at the University of Minnesota are conducting trials on two strategies for improving the nutritional quality of the diets of participants in food-benefit programs, considering the impact of different incentives and restrictions, namely bonus refunds for each dollar spent on fruit and vegetables, and restrictions on the purchase of high-calorie processed goods using benefit dollars.

35 According to World Health Organization measures of cost-effectiveness, spending below one times per capita GDP per DALY saved is very cost-effective, investment of one to three times per capita GDP per DALY saved is cost-effective, and spending of above three times per capita GDP is not cost-effective.

36 In the food and beverage industry, we include manufacturers, retailers, and foodservice providers.

AN OBESITY ABATEMENT PROGRAM

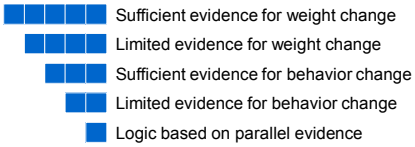
Our analysis suggests that a number of interventions have particularly high immediate impact at a low cost to society. The fact that a large number of effective interventions could be deployed cost-effectively suggests that the multipronged response necessary to mitigate rising obesity-prevalence rates is indeed possible and economically attractive.

We hope that this analysis can be used to help understand the nature of the response required, as well as start to build a fact base that can serve as an ongoing—and evolving—tool to help policy makers, the private sector, and individuals estimate the potential impact and cost-effectiveness of different interventions (see Exhibit 14 and Box 6, "MGI's analysis of the effectiveness of obesity interventions").

Exhibit 14

There is considerable scope to have high impact on obesity in a cost-effective way

Cost-effectiveness and impact of obesity levers, United Kingdom



Intervention group[1]	Estimated impact across full population, Thousand DALYs saved	Estimated average cost per DALY[2], $ per DALY saved	Strength of evidence rating[3]
Portion control	2,126	400	
Reformulation	1,709	2,600	
High calorie food/beverage availability	1,137	200	
Weight-management programs	967	1,300	
Parental education	962	2,000	
School curriculum	888	600	
Healthy meals	868	14,000	
Surgery	615	10,000	
Labeling	575	2,000	
Price promotions	561	200	
Pharmaceuticals	430	5,600	
Media restrictions	401	50	
10% tax on high-sugar/ high-fat products[4]	203	1,800	
Workplace wellness	139	2,700	
Active transport[5]	67	31,000	
Public-health campaigns	49	200	

1 Includes only non-overlapping levers in each category. Where two levers overlapped, such as plain and engaging labeling or gastric banding and bariatric surgery, the higher-impact lever was chosen.
2 Impact and cost over lifetime of 2014 population; uses UK-specific cost-effectiveness calculated using GDP and World Health Organization methodology.
3 Based on the evidence rating system of the Oxford Centre for Evidence-Based Medicine.
4 All intervention impact modeling was subject to scalable assumptions on potential reach. Tax levers are also subject to scalability of levy incurred. In this case, MGI modeled a 10 percent tax on a set of high-sugar and high-fat food categories, based on empirical precedents and size of levy often studied. It is scalable, and impact would increase close to directly with increase in levy.
5 Impact assessed here is only from reduced body mass index (BMI), not full health benefits of some interventions (e.g., cardiovascular health, mental health). For example, active transport health benefits are higher when all of these benefits are taken into account.

NOTE: We do not include health-care payors because this is a less relevant intervention in the United Kingdom context. There are insufficient data to quantify urban-environment interventions.

SOURCE: Literature review; expert interviews; McKinsey Global Institute analysis

Our decision to quantify just 44 of the 74 measures we have identified should not be taken as a judgment on whether other interventions might or might not be effective. Just because we cannot estimate the potential impact of some of the others to robust standards does not mean they do not have considerable impact. Policy makers and other sectors of society should consider all 74 interventions—and any others that we have not identified—as opportunities for innovation. Our list of 74 interventions should be seen as a starting point in a broad effort to achieve a significant step change in individual behavior and the food and beverage and physical activity environment necessary to reverse the rising prevalence of obesity. It is also important to understand the underlying assumptions that we have made; depending on which assumptions we use, the impact can vary. We took an initial cut to help engender a good dialogue that we hope will continue.

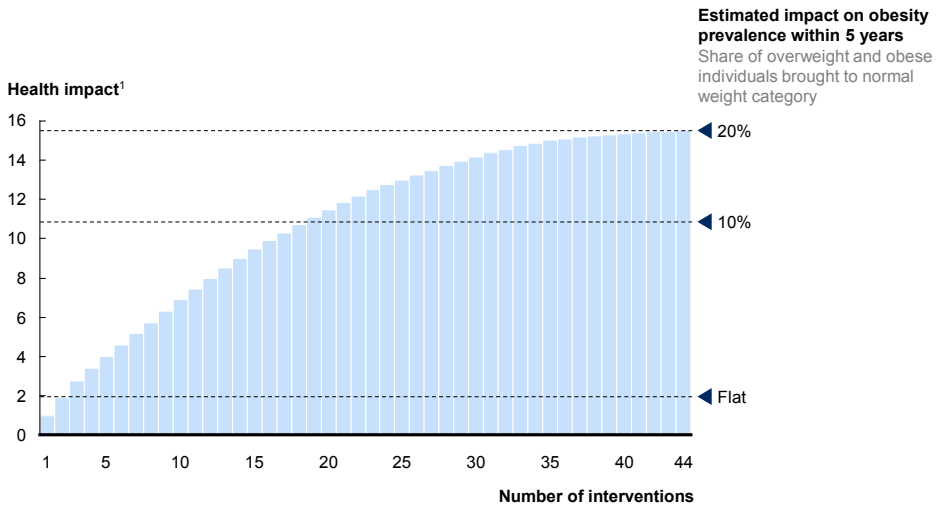
HIGH IMPACT IS ACHIEVABLE AT LOW COST TO SOCIETY

Significant impact on obesity prevalence should be possible at a low cost, according to our analysis. In our UK analysis, we find that 95 percent of the 44 interventions included are highly cost-effective from the point of view of society under WHO definitions. Moreover, many of the less cost-effective interventions have other important benefits beyond a reduction in obesity that are not captured here. For example, subsidizing school meals has been shown to improve exam results; investing in urban cycling improves cardiovascular and mental health and reduces carbon emissions.

Our UK pilot analysis indicates that deploying all 44 interventions that we were able to assess could reverse the rising trajectory of obesity and return roughly 20 percent of overweight and obese individuals to the normal weight category (Exhibit 15). This is approximately equivalent to the entire population of Austria of 8.5 million people. The impact could be even greater with effective deployment of other interventions that we have not yet been able to analyze or that are still under development, such as pharmaceuticals in their early research stages.

Exhibit 15

MGI quantified the maximum potential of 60 percent of the interventions identified, which together could bring 20 percent of overweight and obese individuals into a normal weight category



1 Impact is captured as million DALYs saved over full lifetime of 2014 UK population, taking into account health benefits accrued later in life.

SOURCE: Literature review; expert interviews; McKinsey Global Institute analysis

Box 6. MGI's analysis of the effectiveness of obesity interventions

MGI has assessed the relative impact and likely cost to deploy interventions to abate obesity. These deployment costs can then be compared with the value that comes from reducing obesity, including, for instance, reduced health-care costs and higher productivity.

In this analysis, we assessed both interventions to address existing cases of obesity and structural measures to prevent new cases. Our initial analysis is for the United Kingdom, using the 44 interventions for which we were able to gather sufficient data. These interventions are highlighted in the full table in the executive summary. While the scale and cost of interventions are likely to vary in different geographies, the methodology that underlies the UK analysis can be applied to overcoming obesity in other countries and to other obesity intervention areas. Where interventions could either be regulated by government or "self-regulated" by the food and beverage industry, schools, employers, or health-care systems, we have assessed both regulated and self-regulated options only where there is a precedent of government regulation.

In this abatement analysis, we assessed the impact of each intervention on a single cohort—the UK population in 2014. For each intervention, we reviewed the evidence of sustained impact on weight, energy consumption, or physical activity, taking into account patterns in weight regain or evidence on compensation and substitution behavior. We also assessed a best-case scenario of feasible interventions that could be rolled out across the population of the United Kingdom and assumed best-practice delivery of each intervention. We project the impact on health over a full lifetime compared with a baseline of the state of each individual's health if the intervention had not been deployed. This approach ensures that we capture the full preventive effect of many interventions whose impact is not realized until later in life. We measure the impact of each intervention using DALYs—disability-adjusted life years—saved. DALYs capture the burden of poor health by measuring years of life lost and years of life impaired by a disease condition. In the case of interventions that include an increase in physical activity, such as various weight-management programs, community-sports programs, school interventions, and workplace wellness, we capture the health benefits that are associated with a reduced BMI. This is only a partial picture of the full health benefits delivered by physical activity, which include cardiovascular and mental health improvements. Therefore, this assessment does not capture the full potential return on investment of physical activity as a source of health improvement.

For each intervention, we estimate the cost-effectiveness of deploying it in terms of thousands of dollars spent per DALY saved. Cost-effectiveness is derived from the average, rather than the marginal, cost of delivering each intervention. We include only the direct cost of deployment and exclude secondary economic impacts such as reduced revenue to a manufacturer or increased tax revenue that are salient from the perspective of a specific sector in society but not from a "societal" lens.

These costs can then be compared with the benefits of a reduction in DALYs, including savings accruing to health-care systems and employers. Our societal lens uses a neutral "value of a DALY" metric, which does not apply to any single sector of society, to assess which interventions emerge as societally cost-effective. This accounts for the approximate societal economic benefit of a DALY saved.

Box 6. MGI's analysis of the effectiveness of obesity interventions (continued)

To assess the cost-effectiveness of interventions, we have applied the World Health Organization's cost-effectiveness brackets for DALYs. The WHO defines an intervention that costs less than one times per capita GDP per DALY saved as highly cost-effective. On the same basis, any cost that is one to three times per capita GDP is considered cost-effective, and any cost above three times per capita GDP is not cost-effective. In the UK context, less than £22,500 ($30,000) per DALY is very cost-effective; £22,500 to £67,500 per DALY is cost-effective; and any intervention costing more than £67,500 per DALY is not cost-effective.

It is critical to note that some interventions assessed—such as taxation and changing pricing and promotion practices—are scalar and can be deployed at lower or higher levels. Our analysis is based on what is standardly assessed or recommended in academic literature. Potential impact is tied to size of a levy or price change.

There is high variability in the quality of the assessment of obesity interventions to date. While it is clearly not possible to achieve double-blind trials of behavioral interventions, we do believe that more rigor is needed on this in the future. To highlight the quality of the evidence to date, we have developed a categorization of the strength of evidence of each intervention based on the Oxford Centre for Evidence-Based Medicine 2011 Levels of Evidence system. This categorization picks up the quality of the evidence and also whether the evidence covers changes in energy in/energy out or goes further and reflects changes in weight.

Our classification categories are (from high to low):

- **Level 5:** Sufficient evidence of effectiveness on weight. Based on systematic review of randomized trials on **weight change**.
- **Level 4:** Limited evidence of effectiveness on weight. Based on observational study or cohort/follow-up study on **weight change**.
- **Level 3:** Sufficient evidence of effectiveness on change in consumption or physical activity. Developed physiological model of weight change based on a review of randomized trials on **change in consumption or physical activity levels**.
- **Level 2:** Limited evidence of effectiveness on change in consumption or physical activity. Developed physiological model of weight change based on at least one randomized trial or observational study on **change in consumption or physical activity levels**.
- **Level 1:** Logic based on parallel or indirect evidence. **No direct evidence for change in weight or change in consumption or physical activity levels.**

Based on this analysis, the highest-impact intervention area is portion control, and this might have the advantage of being profitable as there is a saving in ingredients. Reformulation of fast food and processed foods is the second-highest-impact intervention type, but here some costs are involved. Many of the other highest-impact intervention areas—parental education, introducing healthy meals in schools and workplaces, changes in the school curriculum to include more physical exercise—are also highly cost-effective.

We find that some high-impact intervention areas have not received much public attention. Intensive parental-education schemes are not widely deployed or discussed but show considerable potential for improving childhood obesity rates. Reconfiguring price promotions, for instance, which involves reducing retail promotion (such as offers of three for the price of two) of nutritionally poor foods and investing it in promoting healthier foods is an intervention that few are discussing. Another effective intervention that has received relatively little attention in the United Kingdom is introducing calorie labeling in fast-food restaurants, coffee shops, and other eating environments away from home. In the United States, such labeling has encouraged producers and retailers to make their products healthier or reduce portion size.[37]

While the context of every country is different, our findings for the United Kingdom are, we believe, indicative of the impact that could be achieved in other developed economies. Indeed, we believe that our UK estimates of impact are conservative for two reasons. First, we have interpreted the existing evidence on impact and reach using conservative assumptions. Second, and importantly, we measure only the medium-term impact—after compensation and weight regain are taken into account—of the 44 interventions across 16 intervention areas. Yet, particularly if interventions are simultaneous, in the long term there are likely to be some synergies that reinforce behavioral change. For instance, if a country were to intervene through hands-on nutritional and physical activity education in schools, an end to easy access to high-calorie foods and beverages in schools, and a public-health campaign associating healthy eating and active living with popular cultural icons for children such as celebrities or cartoon characters, this could help to support a broad cultural shift in the way children view nutrition and physical activity. We have seen a similar shift in attitudes in relation to smoking and drunk driving that has a multiplier effect. Such a shift in regard to food would potentially have a larger impact on children's health than our assessment of these three individual interventions.

NO SINGLE INTERVENTION CAN REVERSE THE OBESITY BURDEN—A MULTIPRONGED APPROACH IS REQUIRED

Our assessment finds that the single highest-impact intervention area is reducing the size of portions in packaged foods, fast-food restaurants, and canteens. This saves more than two million DALYs over the lifetime of the 2014 population, about 4 percent of the total disease burden attributable to high BMI. However, even deploying the intervention with maximum impact, we achieve only this relatively modest reduction in the overall burden of obesity. Significant impact requires as many interventions as possible to be deployed by as wide as possible a range of

37 Barbara Bruemmer et al., "Energy, saturated fat, and sodium were lower in entrées at chain restaurants at 18 months compared with 6 months following the implementation of mandatory menu labeling regulation in King County, Washington," *Journal of the Academy of Nutrition and Dietetics*, volume 112, number 8, August 2012.

sectors of society—particularly if the aim is to shift cultural norms around eating and physical activity habits.

An additional reason that a comprehensive portfolio of interventions is required is the desirability of addressing all relevant segments of the population. High-income older women have different behavioral change triggers than low-income young men. To influence the diet of three-year-olds, there is only one route—through their parents. For those people who are already struggling with high BMI, subconscious interventions or changes to societal norms are very unlikely to reverse their condition. Targeted interventions are needed, even if they are not the most cost-effective. As we have discussed, prevention is both easier and less costly than targeted later-stage intervention, but prevention does not help those who are already at the extreme end of the BMI spectrum. For most of these individuals, intensive, and less cost-effective, interventions that induce a change in behavior, such as education and motivational tools, need to be supplemented by subconscious, structural changes.[38]

CHANGES TO SOCIETAL NORMS AND SUBCONSCIOUS MECHANISMS ARE CRITICAL TO SUPPORT LONG-TERM BEHAVIORAL CHANGE

From our analysis, we see a clear pattern in the types of interventions that can have significant impact on obesity as well as those that are likely to have less impact or have impact of only short duration. In general, we find that the interventions likely to have the most lasting effects are those that rely less on the volition of citizens and more on changes in their external environment, such as reducing portion sizes, reconfiguring promotional practices, or increasing compulsory exercise in schools.

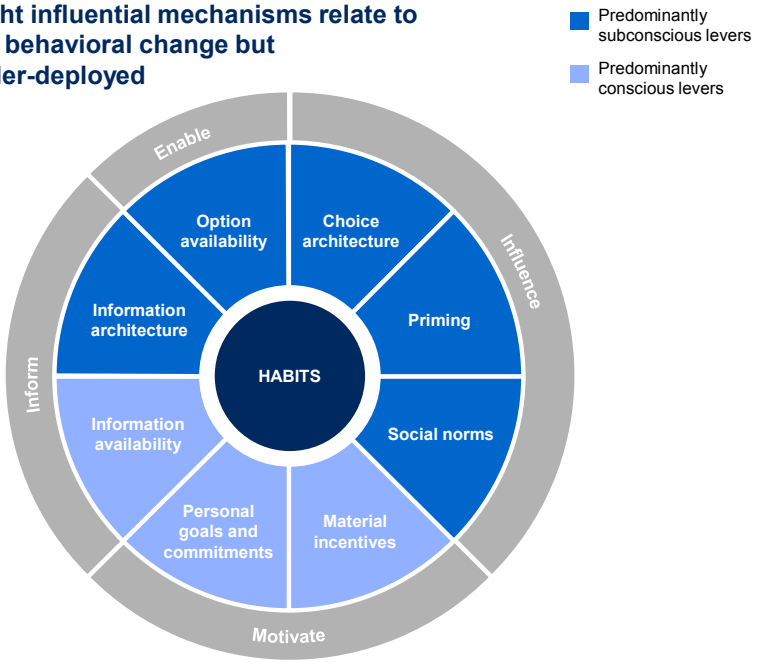
We have allocated our interventions to curb obesity into two groups: “conscious” mechanisms, which individuals participate in or engage with, and “subconscious” mechanisms, which alter the environment facing the consumer, maybe in ways that might not even be detectable (Exhibit 16).

Conscious approaches include educating individuals and motivating them through explicit goal setting and material incentives, such as monetary rewards. The segments that are most associated with conscious behavioral change are information availability, personal goals and commitments, and material incentives. Subconscious mechanisms can include changes in available options (changing school canteen provisions, for example) and shifts in social norms that shape behavior. The segments that drive subconscious behavioral change include information architecture (variation in how information is presented), option availability, and three forms of influence: choice architecture (variation in how choices are presented), priming (exposure to a specific stimuli), and social norms.

38 Our model takes into account the full demographic profile of the population affected by the deployment of interventions in the analysis. It is sensitive to the fact that bariatric surgery applies only to people with a BMI of 35-plus but that some food and beverage industry interventions affect most of the population.

Exhibit 16

Five out of eight influential mechanisms relate to subconscious behavioral change but tend to be under-deployed



SOURCE: Expert interviews; McKinsey Global Institute analysis

Society to date has disproportionately focused on conscious mechanisms such as education and personal responsibility

So far, society's approach to addressing obesity has focused heavily on conscious mechanisms: ensuring information availability through labeling practices and public-health campaigns, weight-management plans with explicit goal setting, and material incentives in workplace wellness schemes. These are critical elements in a comprehensive program of behavioral change. However, based on existing evidence, they have not proved effective enough to slow or reverse the progression of the obesity crisis. Part of the reason for this is lack of scale, but based on our analysis, interventions are also needed to make behavioral change easier.

Why are conscious mechanisms by themselves often not enough? Human nature is to blame. Human beings have amazing power to rationalize and selectively interpret their own behavior—and, too often, they also have inadequate willpower. When individuals consciously try to change net energy balance by reducing caloric intake and raising activity levels, they consistently fail.

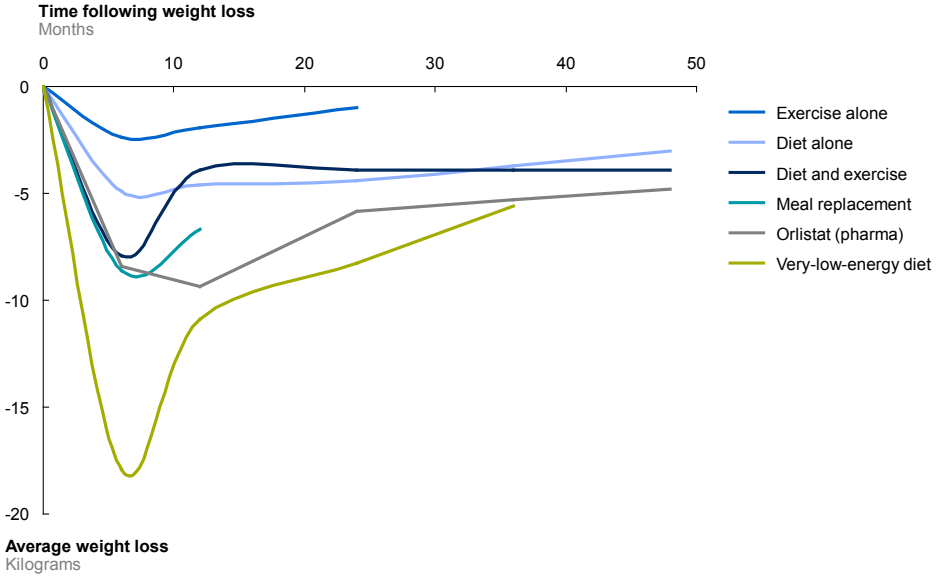
Moreover, brain power is no match for lack of willpower. Intellectually, people grasp the messages of public-health campaigns that seed an understanding of the issue and make clear the desired behavior. But these programs have low conversion rates—the number of people who then make the choice to change behavior. Moreover, of the small proportion of the population who turn thought into action, a significantly smaller share is likely to succeed. Willpower is a notoriously limited resource, and as a result individuals have a poor record of changing their own habits, particularly in the face of an environmental and cultural context that makes that change harder.

Conscious efforts by individuals do have an impact—but often this impact reverses in the long term. Participants in weight-management programs, dietary counseling, and drug treatment, as well as bariatric surgery patients, all achieve good weight loss in the first six months. But even in the case of surgery, initial success is typically followed by a slow, creeping regain of the weight lost. Individuals often end up at the same weight they were before the interventions (Exhibit 17).

Exhibit 17

Traditional targeted interventions struggle to sustain their impact, with weight regain ranging from 30 to 70 percent of the original loss

Average weight loss according to different strategies—a meta-study of clinical trials



SOURCE: Marion Franz et al., "Weight-loss outcomes: A systematic review and meta-analysis of weight-loss clinical trials with a minimum 1-year follow-up," *Journal of the American Dietetic Association*, volume 107, number 10, October 2007; D. Foxcroft, "Orlistat for the treatment of obesity: Cost utility model," *Obesity Reviews*, volume 6, number 4, November 2005; O. O'Meara et al., "A rapid and systematic review of the clinical effectiveness and cost-effectiveness of orlistat in the management of obesity," *Health Technology Assessment*, volume 5, number 18, February 2001; J. Torgerson et al., "XENical in the prevention of diabetes in obese subjects (XENDOS) study: A randomized study of orlistat as an adjunct to lifestyle changes for the prevention of type 2 diabetes in obese patients," *Diabetes Care*, volume 27, number 1, January 2004; McKinsey Global Institute analysis

These late-stage interventions often fail because they are fighting a losing battle with a powerful pair of forces: the body's desire to secure high-energy foods, honed after centuries of evolution, and the modern environment, where cheap, high-calorie food is readily available and work and lifestyles require little physical exertion. The individual's desire to change—no matter how intense—is overwhelmed by these forces. One specialist in childhood obesity describes the challenge of today's children to maintain a healthy weight as like the plight of the mythological Sisyphus pushing his rock up a hill, only to have it slip back to the bottom, over and over again. So, in addition to conscious mechanisms—educating the child to make healthy choices—the effort to control obesity requires changing the environment that shapes behavior relating to nutrition and physical activity, which serves to lighten the mass of Sisyphus's stone as it is pushed uphill.

Subconscious mechanisms change the physical activity and food and drink environments, and are therefore more likely to change behavior

Subconscious mechanisms serve to reset the default in order to make healthy behaviors easier and more natural. The advantage of subconscious mechanisms for behavioral change is that they do not rely on an individual's deciding to change. By removing the need for willpower from the equation, subconscious interventions have a greater chance of succeeding. They also can have wider impact than interventions that target an individual's behavior: a reformulation of fast food to reduce fat and sugar reaches all regular fast-food eaters, while a healthy menu option is likely to be considered by only a small minority.

Perhaps not surprisingly, the subconscious mechanisms in our behavioral-change framework map to interventions seem likely to have the greatest impact in our preliminary analysis. Most of the interventions in the food and beverage environment are driven by subconscious mechanisms such as limiting access to high-calorie foods, reducing portion sizes, reformulating foods to decrease sugar and fat content, and reducing promotional activity in expandable categories. Other interventions that rely on subconscious mechanisms include structural changes that determine physical activity levels, such as urban redesign that forces people out of their cars and mandating physical activity in school curricula.

These subconscious interventions all rely on fundamental principles of behavioral economics. Research in this field has shown that most people accept the default option, are highly susceptible to "anchors" or suggestions of what norms are—such as, for instance, accepting an offer of a supersized portion—and follow social norms and behavior. The most striking outcome of the obesity abatement analysis is that classical targeted interventions such as education, weight-management programs, surgery, and pharmaceuticals do not have as much impact as changing the defaults in the food and beverage environment.

Subconscious interventions not only have greater impact than conscious ones; they are also more cost-effective (Exhibit 18).

We should note that the two subconscious interventions that do not deliver high impact and cost-effectiveness—active transport and healthy meals—nevertheless deliver considerable benefits that do not relate specifically to weight, including improved mental and cardiovascular health, and they mitigate social inequality.

In addition to employing the most effective ideas from behavioral economics, subconscious interventions share three important traits:

- **Structural.** Subconscious mechanisms tend to be structural in nature—they change the rules or the environment. This can mean literal changes in the physical environment, such as closing off parts of a city to vehicular traffic. Or it can mean expanding or restricting choices—changing school canteen provisions or redefining the standard size of a coffee shop muffin.

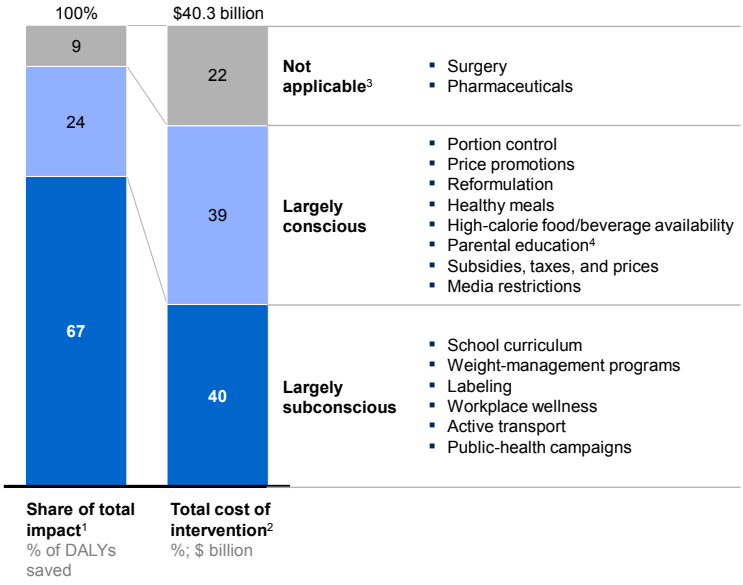
- **Far-reaching.** By their nature, structural interventions tend to apply to a very wide population. For example, changes to school curricula apply to all schoolchildren. Changes to a food producer's marketing practices have potential impact across consumer media and marketing channels. As a result, the per capita cost of subconscious interventions is far lower than that of conscious interventions targeted at individuals.

- **Permanent.** Structural changes tend to be long lasting. If school meals are made healthier or supermarkets and suppliers reduce the intensity of their promotions of certain categories, these changes remain in place unless policy alters. The new status quo soon becomes the norm—consumers tend to quickly forget the old status quo and may be less likely to question new arrangements.

Exhibit 18

The highest-impact levers do not rely on individual willpower to change, but restructure the choices in our environment

Impact and cost of obesity interventions, by behavioral-change mechanism, United Kingdom, full lifetime 2014 population



1 Includes only non-overlapping levers in each category. Where two levers overlapped, such as plain and engaging labeling or gastric banding and bariatric surgery, the higher-impact lever was chosen.
2 Impact and cost over lifetime of 2014 population; uses UK-specific cost-effectiveness calculated using GDP and World Health Organization methodology.
3 Surgery and pharmaceuticals do not rely on behavioral change.
4 Parental education works by conscious mechanisms on parents but subconscious mechanisms on children who are the main target.
NOTE: We do not include health-care payors because this intervention is not relevant in the United Kingdom context. There were insufficient data to quantify urban-environment interventions. Numbers may not sum due to rounding.
SOURCE: Literature review; expert interviews; McKinsey Global Institute analysis

INVESTING IN LOWER-IMPACT AND LESS COST-EFFECTIVE INTERVENTIONS IS STILL WORTHWHILE

Given the overall high cost-effectiveness of the set we examined, even lower-impact and less cost-effective interventions should be considered. Some of the interventions we have analyzed are low cost but low impact in the short term. Nevertheless, they are important because they play a role in educating the population and helping to engineer a gentle shift in attitudes and behavior—although we acknowledge that this is difficult to quantify. For instance, our analysis finds that public-health campaigns to promote physical activity and healthy eating have a low impact but they help to create broad understanding that a balanced diet and active life are important and not necessarily easily achieved. This insight, in itself, is not usually sufficient to change behavior but is still an important baseline ingredient in any effort to create a cultural shift. Introducing high-quality nutritional education and increasing the amount of physical activity in national school curricula are other lower-impact types of intervention. Nevertheless, it should not be dismissed because these efforts could help to shift attitudes among the young.

Similarly, parental education is not an intervention with the best value for money but it is critical in helping to shift the way future generations think about food and exercise. There may be low-cost ways of shifting social norms that have not yet been explored. Today, parental interventions tend to identify high-risk families and deliver intensive counseling on nutrition, feeding habits, and parenting habits to support appropriate nutrition and physical activity behavior in children. But there could be different models for intervening in this way. For example, it could become part of the core task of midwives and pediatricians to give new parents nutritional guidance and counseling. Pediatricians in Italy already do this. In the United Kingdom and elsewhere, monthly child benefit payments could be accompanied by practical and detailed nutritional guidance and meal ideas. Society should experiment as much as possible with new ways of delivering the message on food and exercise, and it should monitor and measure the impact.

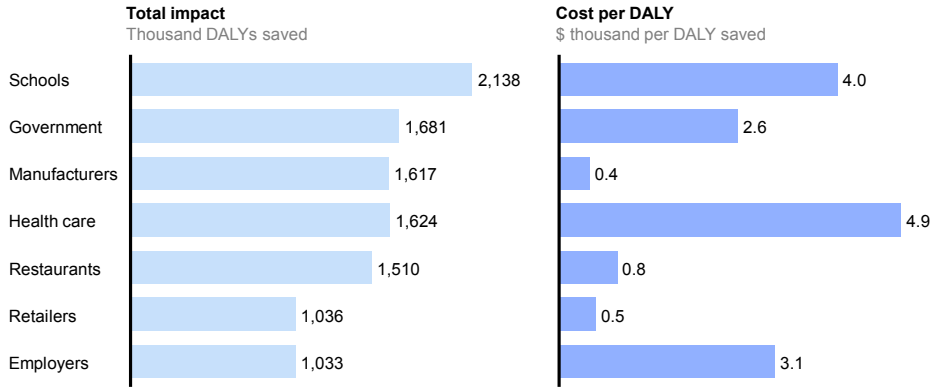
New collaborations are needed within the food and beverage industry and between industry and government

A successful program to abate obesity will require collaboration and deep engagement across all groups in deploying the wide range of intervention areas that we have identified (Exhibit 19). All of the societal sectors identified—government, schools, health-care providers, food and beverage manufacturers, retailers, and fast-food retailers—can make a contribution.

Exhibit 19

Impact is spread fairly evenly across all relevant stakeholders

Cost-effectiveness and impact of obesity levers, United Kingdom[1]



1 Cost and impact assessed over lifetime of 2014 UK population. Uses UK-specific cost-effectiveness calculated using GDP and World Health Organization methodology. Some food and beverage industry impact could be captured through government (regulation). In the food and beverage industry, we include manufacturers, food retailers, restaurants, and food-service providers.

SOURCE: Literature review; expert interviews; McKinsey Global Institute analysis

To make a positive contribution to tackling obesity, food and beverage manufacturers, retailers, food-service providers, and restaurants will need to deploy a wide range of interventions including portion control, reformulation, adapting price promotion and marketing practices, and introducing best-in-class labeling. Interventions could rely on industry participants using their world-class expertise in marketing and sales to nudge consumers toward healthier choices, or to invest in a healthier portfolio mix.

There is no straightforward and simple road map for delivering industry levers. Some could be delivered though industry self-regulation or government

regulation. Others will require a clear pull from consumers, creating the opportunity for companies to gain a competitive advantage.

There may be a prisoner's dilemma inhibiting many industry interventions in which a first mover in, say, reformulating products faces risk to market share, but in which no one company bears a great deal of risk if the whole industry moves together. All major players in a competitive industry acting in concert is no small feat—but not impossible.

In some cases, the industry cannot intervene without help from government. Consider, for instance, a reconfiguration in promotional activity away from higher-calorie food products to lower-calorie ones. This reconfiguration works only if all players in the industry agree to take action. If only voluntary agreements are in place, there is a risk that one or more players could depart from the agreement. An additional problem is that the industry could be in breach of competition law if it were to act in concert on this type of intervention; it would need protection from antitrust authorities. The depth of the challenge of collective action in the industry—to the point where sometimes collective action is even illegal—needs to be better addressed. We further explore these barriers to action in Chapter 3.

The UK government offers an example of an attempt to engage the food and beverage industry more broadly. Its Responsibility Deal invites players to commit to certain pledges, including on labeling practices and reformulation. The Responsibility Deal has secured impressive commitments from a range of manufacturers, retailers, food-service providers, and restaurants, and has made considerable progress on delivering progress on reformulation, labeling, and marketing practices. However, because it is voluntary, a number of players in the industry have not signed up for the commitments, creating frustration among "leaders," and failing fully to shift defaults in the food and beverage environment. A more ambitious approach is required to secure a fully coordinated industry response. This may require regulation or standardization to level the playing field for industry. The challenge ahead is to identify where there is willingness to act and to facilitate collective action, while recognizing that any food and beverage industry action will ever be only part of the solution. A major cultural shift is necessary, and achieving such a shift will require comprehensive and ambitious education, engagement by the mass media, and sufficient provision of health care to provide the tools and knowledge that people need to remain healthy in the context of modern sedentary lifestyles and plentiful food supply.

□ □ □

In a field as complex and wide-ranging as tackling obesity, where there are substantial limits to the research that has been undertaken, we believe that our analysis of the cost-benefit economics of a wide range of interventions can help policy makers and the industry to plot a path toward effective action. The MGI obesity abatement analysis suggests that interventions are, by and large, highly cost-effective, but it also makes it clear that any small subset of initiatives will not be enough to reverse rising obesity. Rather, a wide range of societal sectors needs to deploy as wide as possible a range of interventions. There needs to be new collaboration and cooperation within the food and beverage industry and between the industry and government to push the boundaries on what is currently being delivered. In our final chapter, we discuss how the analysis underpinning the program could help to bring forward the agenda to tackle obesity.

3. Moving toward action

The severity of the global obesity crisis—and its economic and social costs—is beyond doubt. But our survey of interventions around the world that are already being used or piloted suggests that there are plenty of ways to tackle this issue.

Our preliminary obesity abatement analysis for the United Kingdom contains a great deal of encouraging news. Most of the interventions that we have reviewed are cost-effective at a societal level and could potentially have a high impact. This discussion paper suggests that disparate, small-scale interventions that have been tried somewhere could be sufficient to reverse rising obesity if they are scaled up and delivered effectively. No single type of intervention—or any single sector of society—will be able to rein in the rising prevalence of obesity. However, as large as possible a set of interventions deployed by all relevant sectors has the potential to break that trend.

This is not to argue that the effort will be easy. For a large number of interventions to be used in concert, more cooperation within and between the public and private sectors than we have observed so far is likely to be necessary. We also believe that, if the relevant sectors of society are to move toward action quickly, they cannot focus too heavily on debating which interventions should be prioritized and they should be prepared to engage in trial and error to reach an understanding of which approaches are likely to be most effective. We see the last piece of the jigsaw puzzle being more investment in obesity prevention and in research.

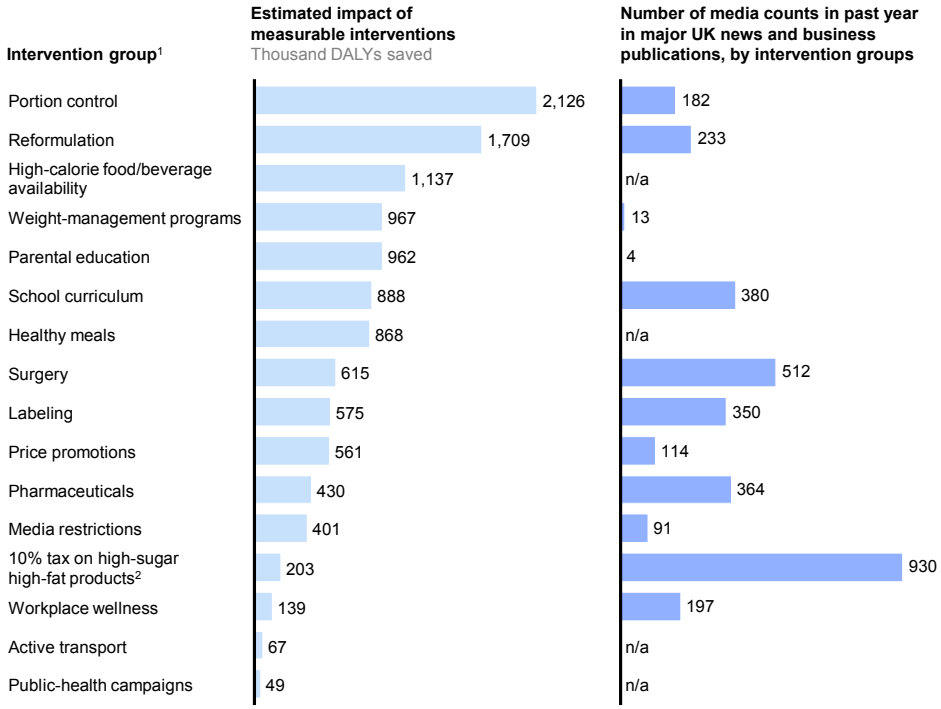
SUCCESS REQUIRES AS MANY INTERVENTIONS AS POSSIBLE BY A FULL RANGE OF PRIVATE AND PUBLIC SECTORS OF SOCIETY

The current debate on addressing obesity still tends to revolve around the search for a single killer intervention. Commentators also tend to focus on a particular societal group—whether educators or the food and beverage industry—as holding the key to solving the problem. This approach will not be sufficient for two reasons. First, the debate tends not to focus on the initiatives that our analysis would suggest could have the most impact (Exhibit 20). Second, and most critically, as we discussed in Chapter 2, a successful program to tackle the rising prevalence of obesity is likely to require as many interventions as possible to be deployed by the full range of sectors of society—at a large scale and with highly effective delivery.

Exhibit 20

Some high-impact intervention areas are receiving less media and public focus

Impact and media count of intervention groups, United Kingdom



1 At 50 years since deployment; uses UK-specific cost-effectiveness calculated using GDP and World Health Organization methodology; includes only non-overlapping levers for each cluster. Where levers overlapped, the higher-impact lever was chosen; excludes clusters that are difficult to complete media searches for: healthy meals, active transport, high-calorie food and beverage availability, and public-health campaigns.

2 All intervention impact modeling was subject to scalable assumptions on potential reach. Tax levers are also subject to scalability of levy incurred. In this case, we have modeled a 10 percent tax on a set of high-sugar and high-fat food categories, based on empirical precedents and size of levy often studied. It is scalable, and impact would increase close to directly with increase in levy.

SOURCE: Literature review; expert interviews; McKinsey Global Institute analysis

Today, government efforts to tackle the obesity issue seem too fragmented to be effective. In the United Kingdom, 15 central government departments; all local authorities with responsibility for health, education, and local planning; 16 EU directorates-general; and a wide range of nongovernmental organizations all have a significant impact on the major intervention areas that we have identified (Exhibit 21).

Exhibit 21

16 EU directorates-general and 15 UK central government departments have an impact on UK obesity intervention and prevention levers

EU directorates-general

- **Agriculture and Rural Development**
- **Budget**
- Climate Action
- Communication
- Communications Networks
- **Competition**
- **Economic and Financial Affairs**
- **Education and Culture**
- **Employment, Social Affairs and Inclusion**
- Energy
- Enlargement
- **Enterprise and Industry**
- Environment
- **EuropeAid**
- Eurostat
- **Health and Consumers**
- **Home Office**
- Humanitarian Aid and Civil Protection
- Human Resources and Security
- Informatics
- **Internal Market and Services**
- Interpretation
- Joint Research Centre
- Justice
- Maritime Affairs and Fisheries
- **Mobility and Transport**
- **Regional Policy**
- **Research and Innovation**
- Secretariat-General
- Service for Foreign Policy Instruments
- **Taxation and Customs Union**
- **Trade**
- Translation

UK central government, ministerial departments

- **Cabinet Office**
- **Department for Business, Innovation and Skills**
- **Department for Communities and Local Government**
- **Department for Culture, Media and Sport**
- **Department for Education**
- **Department for Environment, Food and Rural Affairs**
- **Department for International Development**
- **Department for Transport**
- **Department for Work and Pensions**
- **Department of Energy and Climate Change**
- **Department for Health**
- Foreign & Commonwealth Office
- Home Office
- **HM Treasury**
- Ministry of Defence
- Ministry of Justice
- **Northern Ireland Office**
- **Scotland Office**
- **Wales Office**

SOURCE: www.gov.uk; European Commission; McKinsey Global Institute analysis

There are examples around the world of effective action that is mitigating or reversing obesity prevalence rates for pockets of the population. These programs always involve the coordination of multiple groups, and always deploy a combination of top-down interventions with bottom-up grass-roots activity led by the community. Examples include the Healthy Weight Commitment Foundation in the United States; EPODE's community public-private partnership approach, which originated in France and is being replicated around the world; and the Singapore government's "1 million kg Challenge" (see Box 7, "Integrated efforts to respond to obesity: Healthy Weight Commitment Foundation and EPODE"). These cases show that no single intervention is enough and that genuine change will require all societal sectors to act in concert. They also suggest that some of the biggest food and beverage industry interventions will require coordination across this highly competitive and fragmented industry or between industry and government. Among the crucial first steps that could be taken is galvanizing momentum to scale up these examples of successful public-private partnerships that engage all sectors of society and balance community and centralized levers.

Box 7. Integrated efforts to respond to obesity: Healthy Weight Commitment Foundation and EPODE

Our analysis suggests that an integrated effort will be necessary to change public-health outcomes related to high BMI. The evidence from efforts already under way suggests that such an integrated approach will require commitments to action from a wide range of organizations across industry, and the public and social sectors. Two of the most prominent efforts to tackle obesity through a multistakeholder response, both of which have displayed an impressive understanding about how to align incentives and deliver concrete change, are the Healthy Weight Commitment Foundation and EPODE. Each of these examples combines top-down interventions by government and large corporate players, with bottom-up interventions by grass-roots organizations in local communities. Both are needed. The former have the influence to deploy wide-reaching changes to the environment by, for instance, setting consistent standards in urban planning, school curricula, and food and beverage industry practices. This means that interventions can be designed, led, and delivered in the context of local communities, schools, and families—the heart of where behavioral change occurs.

The Healthy Weight Commitment Foundation. The foundation was founded in 2009 and since then has established a partnership of more than 250 non-profit organizations and businesses in order to promote healthy eating and increased physical activity to schools, families, and community organizations in the United States. In this time, it has succeeded in garnering commitments from food and beverage industry players that have resulted in the removal of 6.4 trillion calories per year from the US marketplace. It has also delivered more than $1 million in grants and prizes to school and community organizations for community-led initiatives such as investing in school vegetable gardens and Girl Scout cooking classes. The foundation partnered with Discovery Education to step-change quality of and access to education products to promote nutrition, physical activity, and energy balance knowledge and behavior changes in schools. Discovery Education designed an evidence-based, flexible, open-source curriculum with modules and tools that could be used in a wide variety of courses. This curriculum is now available in more than half of US elementary and preschools. The Healthy Weight Commitment Foundation has said, "Aligned incentives and powerful partnerships were critical to our success."[1]

EPODE. *Ensemble, Prévenons l'Obésité des Enfants*, or "Together, Let's Prevent Childhood Obesity," started in France in 2003. It is a community-based approach that targets childhood obesity from multiple angles, including by making changes in the child's environment—schools and homes—to encourage and enable the adoption of healthy lifestyles.[2] The EPODE approach and principles are now being shared worldwide through the EPODE International and European networks. By 2015, the international network aims to bring its work to more than 400 million people worldwide.[3] The distinctiveness of the EPODE approach lies in its operating at the local level by involving multiple stakeholders and holding them accountable for concrete goals. Municipal health services are involved, as are many other departments: communication, education, sports, social affairs, community life, and community planning.[4] As it has grown, EPODE has enlisted the support of food and beverage companies such as Nestlé and Coca-Cola.[5] One of EPODE's main goals is to modify local community norms about physical activity and healthy eating by increasing availability of after-school sports clubs, improving walkability of towns, and upgrading school meal nutrition.[6] These structural changes are accompanied by local media campaigns on healthy living themes. The campaigns include related activities led by leisure centers, local businesses, schools, and other local groups and sectors.[7]

1 *Working together to change the outlook of a generation: Five-year anniversary report*, Healthy Weight Commitment Foundation, 2014.

2 EPODE European Network website.

3 Ibid.

4 J.-M. Borys et al., "EPODE approach for childhood obesity prevention: Methods, progress and international development," *Obesity Reviews*, volume 13, number 4, April 2012.

5 EPODE European Network website.

6 Ibid. J.-M. Borys et al., "EPODE approach for childhood obesity prevention," April 2012.

7 Ibid.

If a multipronged approach is to be successful, a forum that brings together all relevant societal sectors including industry representatives, local health-care providers, representatives of business, economics, health, and innovation and skills ministries, and academics could be a useful approach. Such a forum could not only be a space in which representatives from these sectors can discuss these complex issues, but also facilitate commitments to action. Any such forum would need the resources and legislative powers necessary to play an effective coordinating role. One inspiration might be the London Organising Committee for the Olympic Games and the Olympic Delivery Authority. Both were established in 2005 after London won the bid to host the 2012 Olympic Games, and they coordinated the spending of nearly £9 billion.

The appropriate approach to obesity will almost certainly vary from country to country depending on the nature of the local challenges. For example, some emerging markets will need greater focus on the development of urban infrastructure and environments given the rapid development of cities and the concentration of obesity in urban areas; public-health services may be a second-order priority. In the United Kingdom, by contrast, public health is arguably the key focus, and therefore leadership from health, health economics, or behavioral economics backgrounds is likely to play a central role. In all geographies, engagement with the food and beverage industry is likely to be critical, although the specific challenges will vary from country to country; for example, some countries' food retail is informal and highly fragmented, which will have an impact on how an anti-obesity drive would have to be formulated to be effective. While acknowledging the need to calibrate any obesity program to the specific context of each country, it is still clear that representation from the food and beverage industry, health and education authorities, local authorities, and civil society at the local and national levels will be necessary to deliver on the highest-priority intervention areas.

At the international level, some highly effective organizations are already developing research, garnering commitments and alignment from a wide range of societal sectors, and sharing best practices. They include the World Obesity Federation, the Non-Communicable Disease Alliance, the WHO Commission on Ending Childhood Obesity, and EPODE International Network. However, there is scope to be even more ambitious and consider developing a global entity that can facilitate the transfer of knowledge about tackling obesity and galvanize the momentum needed to replicate existing successes around the world. The fight to reverse the rising prevalence of obesity—and to tackle non-communicable diseases more broadly—would likely be more effective if there were to be an international body with the status and responsibilities of the Intergovernmental Panel on Climate Change in the case of climate change, the World Trade Organization in the case of trade, or the International Monetary Fund in the case of financial markets. Such a forum could reside within an existing global entity, such as the WHO or the World Bank, or there may need to be an entirely new entity.

UNDERSTANDING HOW TO ALIGN INCENTIVES AND DEVELOP NEW FORMS OF COOPERATION IS IMPORTANT

A lack of incentive to take action—and therefore inertia in decision making—has proved to be a major barrier to mitigating obesity. Its burden does not fully affect those who are central to making the interventions—such as educators, employers, and the food and beverage industry—but with health departments. Even where there are incentives to act, these societal sectors may not fully understand or acknowledge them. Many employers may not understand the extent to which the productivity of their employees is being compromised by obesity. Many food and beverage industry players may not recognize the longer-term value at risk to their financials and brand strength. In general, there is more work to be done to understand the specific value at risk due to the obesity health burden.

In many cases, societal sectors have recognized an incentive to act but face considerable challenges in coordinating the action they take. As we have suggested, for some interventions to be feasible and effective, many sectors of society need to act in concert. This is almost certainly the case in the food and beverage industry where, in some instances, unilateral interventions to tackle obesity may put income at risk. The consumer packaged goods and retail industries are intensely competitive, and collaboration is hard (and in some cases illegal). Even if a particular intervention is neutral for the bottom line or is highly attractive, companies are caught in a prisoner's dilemma—taking unilateral action that may put market share at risk would undermine companies' obligations to their shareholders. There is evidence that current commitments are not being followed through by all players, and that some in the industry may therefore need government help in a more concerted approach.

There are many factors that make this hard. In some cases, there is a lack of understanding about which interventions are likely to be most effective in tackling obesity. For instance, many schools approach the issue by introducing nutritional education. That is a useful contribution, but the impact is highly dependent on how such education is delivered. Where it has proved successful, it has been practical and sustained, has involved parents, and, where possible, has deployed popular role models as advocates. Moreover, nutritional education depends on the successful deployment of other interventions such as removing vending machines and snack shops from schools.

Gaps in current research compound inertia and tend to produce a bias toward interventions that are easily measurable but do not necessarily have the highest impact. Obesity is governed by a complex system that is not fully understood. Many interventions can have unintended consequences and side effects that are challenging to measure (see Box 8, "Methodological challenges in obesity research").

Lack of public acceptance has often weakened the mandate for change and hindered decision making. In some cases, entrenched consumer behavior may be difficult to overcome. Consumers may, for instance, continue to choose a high-calorie product out of habit despite having full information about the potential negative consequences for their health. Behavioral nudges to persuade consumers to change—such as marketing, priming an individual to associate a

product with a celebrity, or encouraging consumers to choose smaller portions by replacing larger ones—have all proved effective. But tone is important (including in the media). A moral tone that consumers may find patronizing is not helpful.

Finally, there may be insufficient political will to overcome reluctance to change, whether in the private sector or among consumers. In some cases, regulation may be necessary to level the playing field in relevant industries—through labeling, for instance. In other cases, government may find that it needs to deregulate or facilitate coordination on industry interventions such as reducing promotional activity. Central and local governments are best positioned to facilitate and encourage schools and local communities to take a leading role in abating obesity, but this may require both resources and political prioritization, neither of which may be in place.

Box 8. Methodological challenges in obesity research

The health-care and public-health sectors have typically relied on evidence from randomized, controlled studies to aid policy decisions.[1] Given the complex systemic nature of the obesity topic, it is much more difficult to run studies or measure population-level change robustly enough to provide such scientific quality of data. Take installing pavements in an urban setting to help encourage walking—it is very difficult to create a double-blind control group for this intervention. It is also difficult to independently measure what individuals eat throughout their days, without very expensive live-in studies. In such cases, decision making can be informed only by rational assumptions. Moreover, many environmental interventions have only small, long-term direct effects or an indirect impact, as is the case with labeling.

Studies on labeling have had mixed results. Nevertheless, there is consensus that labeling has a small, direct effect on some groups of people—an impact that is not usually detectable in studies that pick up only those changes that are between 50 and 100 calories. Reformulation, a direct effect of labeling, may lag behind implementation of a regulatory change because of the investment required. However, as we have discussed, labeling also has indirect signaling effects. So while research into labeling may suggest that this intervention is only marginally attractive, an assumption-based cost-effectiveness estimate suggests the opposite. These methodological challenges suggest that, if an intervention is perceived to have more benefits than harm, there may be a case for a bias toward implementation.

1 A. J. Fischer et al., "The appraisal of public health interventions: An overview," *Journal of Public Health*, volume 35, number 4, December 2013.

FOCUSING TOO MUCH ON PRIORITIZING INTERVENTIONS CAN STAND IN THE WAY OF ACTION

The political capital and resources to deliver change that can help the fight against obesity—including time, money, and effort—are necessarily finite. For this reason, good sense suggests that it is worth prioritizing interventions based on their potential impact, cost-effectiveness, and feasibility. However, focusing too heavily on which interventions should be the highest priority can delay constructive action and even allow some sectors of society to pass the buck when what is needed is the deployment of as many interventions as possible by the full range of those sectors.

SOCIETY SHOULD TAKE A "JUST START" APPROACH TO OBESITY INTERVENTIONS, WHILE STEPPING UP INVESTMENT IN RESEARCH

Investment in obesity prevention and mitigation is relatively low given the scale of the problem. For instance, the United Kingdom invests less than $1 billion a year in prevention activities such as weight-management programs and public-health campaigns. To put that in perspective, that is only about 1 percent of the social cost of obesity in the United Kingdom. Given the high return on effective prevention, more aggressive investment in prevention measures would be worthwhile.

At the same time, it is worth considering stepping up investment in what is, to date, limited research into obesity. Global investment in obesity research is not insignificant at an estimated $4 billion a year. This is 0.2 percent of the social cost of obesity that we assessed in Chapter 1. However, this amount pales in comparison to the estimated future economic burden facing society. And it is important to use research to motivate action. We believe three important elements should be considered:

- **Be aware of the limits of scientific research methods in the context of obesity.** Obesity is a highly complex system of countless interacting variables. Research to understand relationships among these variables is important, but in many prevention and intervention areas such as intervening on urban infrastructure, we cannot assess the impact with the full rigor of randomized-control trials. In such cases, society should still pursue interventions but also use other criteria to inform decision making, such as risk assessment, other benefits, and cost to deliver.

- **Develop improved data collection.** There is a strong case for improving the collection of data on intervention areas in order to expand research capabilities and cover some existing blind spots. We picked up evidence of considerable variation in the quality of execution of different interventions across all types of societal sectors. Improved data gathering would help to further refine perspectives on best practices. Over time, more sophisticated abilities to measure impact in complex behavioral systems may develop. But, in the meantime, there are areas where efforts to track and measure more of the many interventions being deployed around the world can be stepped up. Some type of forum to provide tools and guidance for tracking and measuring would support this.

- **Engage in more trial and error on low-risk interventions.** Obesity is not a topic that lends itself to perfect evidence, and therefore efforts to tackle this issue shouldn't necessarily depend on the usual strictures of evidence-based medicine. To ease any bottlenecks to action, where the cost and risk of delivering an intervention are low, the bias should be in favor of deployment rather than waiting for perfect evidence. Examples of low-risk, low-cost interventions include restricting high-calorie food access in schools, mandating consistent labeling practices, and introducing nutritional counseling as part of prenatal care.

□ □ □

This research is just the start of an attempt to develop a holistic perspective on what it may take to reverse the growing health burden imposed by obesity. The science on obesity and research into how to reverse the rising health burden is by no means complete, and learning more about this complex issue and its causes is clearly vital if the global community is to mount a genuine, sustained, and aggressive challenge.

We intend to continue to try to develop our knowledge on an even greater range of obesity programs and update our data with the very latest efforts on the ground and research as it is completed. We invite contributions to our ongoing research. In particular, we would like to hear about other possible interventions, better and updated data on the impact of interventions, and further insights about overcoming the major barriers to delivering high impact in a large-scale, integrated response. We also welcome challenge and input on our analysis and approach. Please send any comments to obesity@mckinsey.com.

There is huge scope to rein in the rising trend of obesity across the world—and to do so in a cost-effective way. Above all, boldness is imperative. Nothing else will mitigate the huge and rising human, social, and economic costs of this crisis.

Appendix

1. Social-cost analysis

The goal of the McKinsey Global Institute analysis of social costs is to provide an understanding of the economic impact of selected human-generated burdens on society.

Selection of social-cost categories

We selected the evaluated social costs using one of the following criteria:

- Involvement of direct human decision making (for example, alcohol or tobacco consumption)
- Amplification through human and societal behavior (for example, climate change)
- Dependency on the societal and legal environment and infrastructure shaped by humans (for example, illiteracy, road accidents)

We believe that we have identified the major costs that meet one of these criteria but acknowledge that our analysis may not be comprehensive.

QUANTIFYING THE COSTS

The purpose of quantifying social costs is not to help public–policy makers to prioritize among them but to provide a directionally correct fact base on the size of the different categories that can aid our understanding of them. There are a number of caveats with this analysis. Necessarily, we have had to make some subjective judgments on, for instance, the value of productive life years saved. In addition, we came up against a lack of robust data in some cases (for example, estimating the costs of illiteracy). The analysis also considers only current social costs, and not the expected future costs. In some cases, such as climate change and obesity, this could represent a significant underestimate of the total costs.

We included three major sources of economic cost:

- **Loss of productivity** attributable to loss of life or impaired life quality. We estimate this using the Global Burden of Disease assessment of annual disability-adjusted life years lost attributable to each risk factor using data denominated in 2010 pound sterling.[39] We quantified the economic value of the disability-adjusted life years lost by valuing each DALY using national per capita GDP data sourced from the World Bank. This approach overweights the cost of lost DALYs in developed markets because their per capita GDP tend to be higher than those of emerging markets. For this reason, we emphasize that

39 Institute for Health Metrics and Evaluation, Global Burden of Disease 2010 database.

our analysis uses a purely economic lens and does not take into account all relevant reasons for investing in each one.

- **Direct costs** associated with each cost category. Direct health-care costs largely dominate total direct costs across countries. However, in some countries there is a wider group of relevant direct costs (for example, drunk-driving costs in the case of alcoholism). Country-level data were not available in some countries. In these cases, we allocated the global cost of the category (for example, high BMI, smoking, water, and sanitation) based on the share of DALYs in global DALYs weighted by per capita GDP relative to global GDP.

- **Direct investment** for the remediation, adaptation, and prevention of the specific social-cost category (for example, diet counseling, public-health programs, greenhouse-gas adaptation investment). This was based on various research initiatives, detailed by social cost below.

We did not include consumer spending, such as on tobacco or alcohol, in each category.

DETAILS BY TYPE OF SOCIAL COST

Alcoholism. Productivity losses based on DALYs lost to alcohol are expressed in 2010 pound sterling. We use Rehm et al. (2009) to estimate the cost of global health care and law enforcement.[40] We use Baumberg (2006) to estimate the cost of criminal damage, drunk driving, and unemployment related to alcoholism.[41]

Armed violence, war, and terrorism. We base productivity losses on DALYs lost to assault by firearm, sharp object, and other means, and collective and armed violence in 2010 pound sterling. For investment in remediation and prevention, we include global military expenditure, using a 2013 report from the Stockholm International Peace Institute.[42] We estimated the direct health-care cost of war using the Geneva Declaration report on the global burden of armed violence.[43]

We estimated DALYs lost to terrorism by looking at the lives lost to terrorism as a share of all lives lost to total armed violence, and then extrapolated proportional to DALYs. We calculate the DALYs lost to total armed violence using DALYS lost (in 2010 pound sterling) because of assault by firearm, sharp object, and other means, and collective and armed violence. Investment in prevention of terrorism is based on an estimate by the North Atlantic Treaty Organization.[44]

Child and maternal undernutrition. We calculate productivity losses based on DALYs lost due to child and maternal undernutrition in 2010 pound sterling. Our estimate of the investment used to mitigate obesity uses data from the

40 Jürgen Rehm et al., "Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders," *The Lancet*, volume 373, number 9682, June 2009.

41 Ben Baumberg, "The global economic burden of alcohol: A review and some suggestions," *Drug and Alcohol Review*, volume 25, number 6, November 2006.

42 "Military expenditure" in *SIPRI Yearbook 2013: Armaments, disarmament, and international security*, Stockholm International Peace Research Institute, 2013.

43 *Global burden of armed violence*, Geneva Declaration Secretariat, 2008.

44 Bjorn Lomborg, "Is counterterrorism good value for money?" *NATO Review*, April 2008.

World Food Program on food aid and the G-8 L'Aquila Accord 2009 budget for agricultural aid.[45]

Climate change. We calculate productivity losses based on estimated DALYs attributable to climate change in 2000 (that is, famine, vector-borne diseases, and waterborne diseases) using the World Health Organization's report *Climate change and human health: Risks and responses*. We then scaled up to 2012 using an estimate of an increase in deaths attributable to climate change in that time frame from the DARA Climate Vulnerability Monitor for 2012.[46]

For the cost of adapting to climate change, we used World Bank estimates of the cost between 2010 and 2050 of adapting to a world temperature that is 2 degrees Celsius warmer than pre-industrial levels by 2050. The World Bank estimate of the cost is between $70 billion and $100 billion a year. Adaptation costs are the only outlier in our methodology because the figure we use does not reflect actual 2012 spending.

We base our estimate of the economic impact of climate change on the DARA assessment of the 2010 economic impact of environmental disasters, habitat change, and industry stress. Our analysis does not include the health impact used by DARA, which is largely captured in our figure for the number of DALYs lost.

Drug use. We estimate productivity losses by assessing the DALYs lost that are attributable to drug-use disorders in 2010 pound sterling. We used the United Nations Office on Drugs and Crime *World drug report* for 2012 and 2013 to estimate the direct health-care costs of drug-related crime and imprisonment.[47]

Indoor air pollution. We estimate productivity losses by estimating the DALYs lost that are attributable to household air pollution. To estimate the direct health-care costs of household air pollution, we used DARA's international assessment, which assumes that about 50 percent of the DALYs lost are attributable to indoor air pollution and the other 50 percent to outdoor air pollution.

Illiteracy. We include only productivity costs, for which we use the World Literacy Foundation report *The economic and social cost of illiteracy*.[48]

Obesity. We estimate productivity losses by assessing the DALYs lost that are attributable to high BMI. For direct health-care costs, we use World Health Organization estimates. Our estimate of the investment devoted to mitigating obesity comes from our analysis of the research budgets government investment in prevention programs, and commercial weight-management markets.

Outdoor air pollution. We base productivity losses based on an assessment of DALYs lost that are attributable to ambient ozone pollution and ambient

45 Lídia Cabral and John Howell, *Measuring aid to agriculture and food security*, Overseas Development Institute, ODI briefing paper number 72, February 2012.

46 A. J. McMichael et al., *Climate change and human health: Risks and responses*, World Health Organization, 2003; *Climate vulnerability monitor: A guide to the cold calculus of a hot planet*, 2nd ed., DARA and the Climate Vulnerable Forum, 2012.

47 *World drug report 2013*, United Nations Office on Drug and Crime, May 2013.

48 *The economic and social cost of illiteracy: A snapshot of illiteracy in a global context*, final report, World Literacy Foundation, April 2012.

particulate-matter pollution in 2010 pound sterling. We estimate investment in mitigation using the United Nations sustainable development financing report.[49]

Poor water and sanitation. We estimate productivity losses by assessing the DALYs lost that can be attributed to poor water and sanitation in 2010 pound sterling. We estimate direct health-care costs using WHO estimates.[50] We assess government and international aid spending to mitigate poor water and sanitation using the United Nations' global analysis and assessment of sanitation and drinking water.[51]

Road accidents. To estimate productivity losses here, we assess DALYs lost that can be attributed to injury on the roads expressed in 2010 pound sterling. We use WHO estimates in our assessment of the investment to mitigate.[52]

Smoking. We estimate productivity losses based on DALYs lost attributable to tobacco use in 2010 pound sterling, tying the value to per capita GDP in each country. We base direct medical costs on *The tobacco atlas*, fourth edition (2012).[53] Our estimate of investment in smoking cessation is based on a literature review of a subset of public-health systems.

Workplace risks. We assess the productivity lost in the workplace by assessing DALYs lost that can be attributed to occupational risks in 2010 pound sterling. There are no data on investment to mitigate these risks of the health-care cost, so we assumed that these costs are low and therefore not a significant omission.

Unsafe sex. We estimate productivity losses based on DALYs lost attributable to HIV and other sexually transmitted diseases in 2010 pound sterling, tying the value to per capita GDP by country. We base our estimated of direct medical costs and investment in prevention on estimates from the WHO, UNAIDS, and AVERT.

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49 *Chapter 1: Financing for sustainable development: Review of global investment requirement estimates*, UN System Task Team Working Group on "Financing for sustainable development," background paper, October 2013.

50 *Global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage*, World Health Organization, May 2012.

51 *UN-Water global analysis and assessment of sanitation and drinking-water: The challenge of extending and sustaining services*, World Health Organization and UN Water Report, April 2012.

52 G. Jacobs, A. Aeron-Thomas, and A. Astrop, *Estimating global road fatalities*, Transport Research Laboratory and Department for International Development, TRL report number 445, 2000.

53 Michael Eriksen, Judith Mackay, and Hana Ross, *The tobacco atlas*, fourth edition, American Cancer Society and World Lung Foundation, 2012.

2. MGI Obesity Abatement analysis

INTERVENTION SET

Criteria for global intervention sets

We conducted a literature review and expert interviews to identify as wide as possible a range of interventions that fulfilled the following criteria:

- The interventions have been tried somewhere in the world even if they do not have the explicit goal of reducing obesity prevalence; we do not include blue-sky thinking.
- There is evidence that the intervention has an impact on obesity in at least some settings or segments of the population.

Regulated vs. unregulated

Many interventions could be deployed in a self-regulated or regulated version. We considered the regulated version only when it had been enacted or strongly considered by a legislative body. The Australian Responsible Children's Marketing Initiative is an example of industry self-regulated media restrictions on promoting unhealthy food to children. In the United Kingdom, the government banned advertising of high-fat, high-salt, and high-sugar products during children's television airtime. We considered both regulated and self-regulated versions in the analysis. For interventions such as these, the regulated version tends to have greater reach and impact than the self-regulated version.

Interventions assessed in the UK abatement analysis

For each intervention, we conducted a literature review and interviews to assess if it is relevant and feasible in the UK context (even if there are some barriers to implementation) and whether the data are of sufficient quality to be able to robustly model impact and cost-effectiveness. We quantified only those interventions that fulfilled both criteria.

ASSESSING HEALTH GAIN

Metric for impact: DALYs

We assessed the health impact of obesity intervention and prevention levers using disability-adjusted life years, the standard international health metric to assess the health burden or health saving. A DALY can be conceived of as a year of healthy life. It captures two elements: years of life lost and years of life whose quality is impaired. The WHO's Global Burden of Disease project uses DALYs.[54] DALYs are also the standard metric in other cost-effectiveness analyses on obesity interventions and other public-health investments, facilitating comparison and contextualization.[55]

54 Global Burden of Disease database, World Health Organization, 2010.

55 Examples include ACE (Assessing Cost Effectiveness), led by Boyd Swinburn, Marjory Moodie, and Robert Carter, and the OECD "Fit not fat" study, led by Franco Sassi, Michele Cecchini, and Marion Devaux.

Scope and timescale

For each intervention, we assessed the lifetime health impact on the entire UK population in 2014. We identified which interventions affected which population segments and then followed the health impact through the entire lifespan of members of each segment. This approach captures the full impact of interventions targeting children and young people that is not realized until later in life as the obesity-related disease burden is greatest between the ages of 40 and 50.

Methodology for assessing impact

All the interventions that we assessed either change the net energy intake—food and beverage consumption—or net calorie expenditure through physical activity. Assessing DALYs saved by an intervention at the population level requires an understanding of its impact on the net energy intake for each age group and for different BMI segments of the population. We then translate this impact on the net energy intake into the BMI change for each population segment and then the BMI change into DALYs saved.

In the case of some classic obesity interventions such as weight-management programs, bariatric surgery, and pharmaceuticals, the body of evidence captures impact in terms of the average BMI/weight change rather than net energy intake, and therefore it is not necessary to convert the calorie change into BMI. In these cases, we assessed the change in BMI on the evidence available five years after the intervention or applied a discount factor on weight change recorded immediately after the intervention to ensure that we included regained weight subsequent to that intervention.

Net energy change to BMI

We developed a deterministic model based on Kevin Hall's system of physiological mathematical modeling to simulate body weight over the course of five years when subjected to an energy imbalance.[56] This dynamic assessment of body weight change—steady state as well as transient—at any time (t) in this period requires us to estimate a change in the extracellular fluids (ECF) and the gain or loss of fat mass (FM) and fat-free mass (FFM). The relationships between these and their intermediaries are given below:

Equation 1 $$BWt = FFMt + FMt + ECFt$$

Equation 2 $$d(FM)/dx = F(P, Ei, TEF, EE, Ci, G)$$

Equation 3 $$d(FFM)/dx = f(1-P, Ei, TEF, EE, C)$$

Equation 4 $$d(ECF)/dx = f(Nai, CI)$$

Equation 5 $$TEF = f(Ei, Ci, G)$$

Equation 6 $$EE = f(Ei, Ci, P)$$

Equation 7 $$d(G)/dx = f(G, Ci)$$

56 Kevin D. Hall, "Modeling metabolic adaptations and energy regulation in humans," *The Annual Review of Nutrition*, volume 32, August 2012; Kevin D. Hall et al., "Quantification of the effect of energy imbalance on bodyweight," *The Lancet*, volume 378, number 9793, August 2011; Carson C. Chow and Kevin D. Hall, "The dynamics of human body weight change," *PLoS Computational Biology*, volume 10, number 1371, March 2008.

where P = P ratio; TEF = adaptive thermogenesis; C = carbohydrate intake; G = glycogen level; E = energy intake; EE = energy expenditure; and $Na1$ = sodium intake level.

Solving this system of mixed equations leads us to the body weight at any instant t. These equations involve 25 different physiological and biochemical constants.

The inputs to this model include the following initial physiological parameters: gender, body weight, age, height, and change in calorie intake. This Excel-based model uses the Runge-Kutta order 4 algorithm for solving the differential equations. When tested against the original Web-based simulator developed by Kevin Hall and his team, our model produces results with accuracy to the third decimal place.

BMI change to DALYs saved

For each population segment in an age group by BMI matrix, we compared the baseline BMI trajectory to the post-intervention BMI trajectory.

Baseline years of life lost (YLL)

To estimate baseline YLLs, we calculated deaths per population segment (that is, male and female by age cohort) based on disease-specific mortality rates by age group for the following diseases whose incidence is related to high BMI: kidney cancer, breast cancer, endometrial cancer, diabetes, ischaemic, hypertensive heart disease, arthritis, stroke, and colorectal cancer. We calculated the percentage of deaths attributable to each BMI point by using relative risk ratios. We assessed what proportion of these deaths could be attributable to obesity by taking the incremental relative risk due to a BMI over 22—the level at which the relative risk for these diseases starts to increase—and holding all other variables constant.

We calculated total YLLs attributable to high BMI from the percentage of deaths per population segment (that is, age bracket by BMI point) due to obesity and multiplied by the remaining life expectancy.

For baseline population data, we segmented age and BMI from the United Kingdom's NHS census. We smoothed five-point BMI brackets to estimate point-by-point distribution. UK disease prevalence rates come from a proprietary McKinsey patient database. Overall mortality rates come from the United Kingdom's National Statistics data. We took disease-specific mortality rates from the WHO's western EU regional rates. Disability weights came from Global Burden of Disease data. These data are granular in taking account of the severity of disease. For instance, the data differentiate severities of cancer, namely "diagnosis and primary therapy" to "terminal with no medication." They also categorize by the prevalence of certain "disabling" factors such as diabetic symptoms (for example, diabetic foot, kidney disease, liver cirrhosis, or incontinence). We calculated a weighted-average overall disability weight for each disease using estimates of the distribution of severity of each disease in the UK population.

Baseline years of life disabled (YLD)

We calculated disability years by examining the number of people in a population segment, disease prevalence by age times disability weight times percent of disability attributable to obesity.

A disability weight is a weighting factor that reflects the severity of the disease in terms of its impact on the quality of life on a scale from zero (perfect health) to 1 (death).

We calculated weighted-average disability weights using WHO disability weight data, adjusting for UK population-specific estimates on the prevalence of different symptoms. As in our calculation of YLLs, we calculated the percentage of disability caused by each disease that is attributable to obesity through relative risk factors.

Population-wide BMI distribution shift

We calculated a new population-wide BMI distribution by reallocating people who shift from one category of BMI to new BMI brackets. To do this, we assumed constant distribution of BMI within a BMI point (for example, the number of people with a BMI of 21.1 is the same as the number of people with a BMI of 21.8).

If the shift is less than 1, the relevant percentage of the population is distributed between original and new BMI points. For example, if 50 percent of the population reduces its BMI by 0.5 points, 25 percent of that population shifts to the next BMI category down. If the shift is greater than 1 BMI point, we distributed the population between the initial BMI point, the BMI point rounded up, and the BMI point rounded down of the new BMI point. So if 50 percent of the population shifts from a BMI of 27 to a BMI of 22.5, 25 percent of the initial population will shift to a BMI of 22 and 25 percent will have a BMI of 23, while 50 percent will stay at a BMI of 27.

DALYs saved

We recalculated the fraction of DALYs attributable to obesity using the methodology for baseline DALYs that we have described with a new population BMI distribution. The difference between baseline DALYs and post-intervention DALYs gives us the number of DALYs saved by each intervention.

Strength of evidence

We have developed a system for categorizing the strength of evidence on each intervention based on the Oxford Centre for Evidence-Based Medicine 2011 Levels of Evidence system. We included further detail on quality of evidence, and whether evidence was for change in energy in/energy out or change in weight (see Box A1, “Strength of evidence analysis”).

We constructed the estimated impact of each intervention on the net energy balance or overall change in BMI largely from peer-reviewed studies, supplementing these extensively with expert interviews and pressure testing. We included more than 400 studies, of which about 75 percent were peer reviewed. Details of the full set of studies are found in the bibliography.

Box A1. Strength of evidence analysis

- **Level 5:** Sufficient evidence of effectiveness on weight. Based on systematic review of randomized trials on **weight change**.
- **Level 4:** Limited evidence of effectiveness on weight. Based on observational study or cohort/follow-up study on **weight change**.
- **Level 3:** Sufficient evidence of effectiveness on change in consumption or physical activity. Developed physiological model of weight change based on a review of randomized trials on **change in consumption or physical activity levels**.
- **Level 2:** Limited evidence of effectiveness on change in consumption or physical activity. Developed physiological model of weight change based on at least one randomized trial or observational study on **change in consumption or physical activity levels**.
- **Level 1:** Logic based on parallel or indirect evidence. **No direct evidence for change in weight or change in consumption or physical activity levels.**

ASSESSING COST

We based cost data on the actual estimated costs of delivering interventions where they were available, including subsidized school meals, parental interventions, bariatric surgery, and urban cycling schemes. We based our assessments of the cost of other interventions on external research and industry interviews.

We have included the cost of deploying each intervention in the cost function only as a contrast to other analyses that include health-care savings and, in some cases, productivity savings. Our reasoning was that we wanted, as much as possible, to take a purely societal view of the cost-benefit economics of interventions against obesity. In one sense, health-care savings are savings to society but they also accrue directly to governments or health-care systems. In order to take a societal perspective on the cost-benefit economics, we used World Health Organization brackets for cost-effective investment ratios to save a DALY. The WHO defines an intervention that costs less than one times per capita GDP per DALY as highly cost-effective, an intervention of one to three times per capita per DALY as a cost-effective investment, and an intervention costing more than three times per capita GDP per DALY saved as not cost-effective.[57]

Given that we are assessing each intervention for its cost and impact across a single cross-sectional population cohort, in the case of one-off interventions (for example, weight-management programs and bariatric surgery), we assess only the cost for delivery. For ongoing interventions that produce a permanent change in environment, we assessed the up-front cost for delivering change and 30 years of ongoing costs with a cumulative net present value discount rate of minus 3 percent a year.[58] We assume that the change will be maintained over the full lifetime of the cohorts, but consider it most likely that, by 30 years, the ongoing costs would have been absorbed into business as usual, or technological advances would have rendered them much lower than we currently estimate. Most of the cost incurred is up-front rather than ongoing.

57 *Cost-effectiveness thresholds*, World Health Organization, Cost effectiveness and strategic planning (WHO-CHOICE).

58 M. R. Gold et al., *Estimating costs in cost-effectiveness analysis: Cost-effectiveness in health and medicine*, Oxford University Press, 1996.

Bibliography

ABC News/*Time* magazine/*Washington Post* poll, *A look under the hood of a nation on wheels*, February 2005.

Abu-Abeid, Subhi, Nancy Gavert, Joseph M. Klausner, and Amir Szold, "Bariatric surgery in adolescence," *Journal of Pediatric Surgery*, volume 38, number 9, September 2003.

Adams, Jean, Rachel Tyrrell, Ashley J. Adamson, and Martin White, "Effect of restrictions on television food advertising to children on exposure to advertisements for 'less healthy' foods: Repeat cross-sectional study," *PLoS ONE*, volume 7, number 2, February 2012.

Ahern, Amy L., Ashley D. Olson, Louise M. Aston, and Susan A. Jebb, "Weight Watchers on prescription: An observational study of weight change among adults referred to Weight Watchers by the NHS," *BMS Public Health*, volume 11, June 2011.

Ahima, Rexford S., "Digging deeper into obesity," *Journal of Clinical Investigation*, volume 121, issue 6, June 2011.

Ailawadi, Kusum, and Scott Neslin, "The effect of promotion on consumption: Buying more and consuming it faster," *Journal of Marketing Research*, volume 35, number 3, August 1998.

Aktas Arnas, Yasare, "The effects of television food advertisement on children's food purchasing requests," *Pediatrics International*, volume 48, issue 2, April 2006.

Albin, Amy, "Parent-training intervention curbs pediatric obesity rates, study shows," *UCLA Newsroom*, February 15, 2012.

Alemanno, Alberto, and Ignacio Carreño, "'Fat taxes' in Europe: A legal and policy analysis under EU and WTO law," *European Food and Fee Law Review*, volume 8, issue 2, April 2013.

Algazy, J., S. Gipstein, F. Riahi, and K. Tryon, "Why governments must lead the fight against obesity," *McKinsey Quarterly*, October 2010.

Allender, S., C. Foster, P. Scarborough, and M. Rayner, "The burden of physical activity-related ill health in the UK," *Journal of Epidemiology and Community Health*, volume 61, number 4, April 2007.

Allender, S., and M. Rayner, "The burden of overweight and obesity-related ill health in the UK," *Obesity Reviews*, volume 8, number 5, September 2007.

Almond, Douglas, and Janet Currie, "Killing me softly: The fetal origins hypothesis," *Journal of Economic Perspectives*, volume 25, number 3, summer 2011.

Alpha NHS Information Centre for Health and Social Care, *Statistics on obesity, physical activity and diet: England, 2012*, February 2012.

Alston, Julian, Conner Mullally, Daniel Sumner, Marilyn Townsend, and Stephen Vosti, "Likely effects on obesity from proposed changes to the US food stamp program," *Food Policy*, volume 34, number 2, April 2009.

Alter, D. A., and D. Withrow, "The economic burden of obesity worldwide: A systematic review of the direct costs of obesity," *Obesity Reviews*, volume 12, number 2, February 2011.

An, Ruopeng, Deepak Patel, Darren Segal, and Roland Sturm, "Eating better for less: A national discount program for healthy food purchases in South Africa," *American Journal of Health Behavior*, volume 37, number 1, January 2013.

Andersen, S. A., "Core indicators of nutritional state for difficult-to-sample populations," *The Journal of Nutrition*, volume 120, 1990.

Anderson, James, Elizabeth Konz, Robert C. Frederich, and Constance L. Wood, "Long-term weight loss maintenance: A meta-analysis of US studies," *American Journal of Clinical Nutrition*, volume 74, number 5, November 2001.

Anderson, Laurie M., Toby A. Quinn, Karen Glanz, Gilbert Ramirez, Leila C. Kahwati, Donna B. Johnson et al., "The effectiveness of worksite nutrition and physical activity interventions for controlling employee overweight and obesity: A systematic review," *American Journal of Preventive Medicine*, volume 37, number 4, October 2009.

Andreyeva, Tatiana, Frank J. Chaloupka, and Kelly D. Brownell, "Estimating the potential of taxes on sugar-sweetened beverages to reduce consumption and generate revenue," *Preventive Medicine*, volume 52, number 6, June 2011.

Andreyeva, Tatiana, Inas Rashad Kelly, and Jennifer L. Harris, "Exposure to food advertising on television: Associations with children's fast food and soft drink consumption and obesity," *Economics and Human Biology*, volume 9, number 3, July 2011.

Andreyeva, Tatiana, Michael W. Long, and Kelly D. Brownell, "The impact of food prices on consumption: A systematic review of research on the price elasticity of demand for food," *American Journal of Public Health*, volume 100, number 2, February 2010.

Arcan, Chrisa, Meg Bruening, and Mary Story, "L'impact de la télévision et des publicités télévisées sur les comportements alimentaires des enfants," *Encyclopédie sur le développement des jeunes enfants*, September 2013.

Arenz, S. R. Rückerl, B. Koletzko, and R. von Kries, "Breast-feeding and childhood obesity: A systematic review," *International Journal of Obesity*, volume 28, number 10, August 2004.

Arora, Pankaj, "Why Pavan Sukhdev thinks the mandatory 2 percent CSR spend is short-sighted," *Linking Sustainability*, January 2013.

AsiaOne, "Health Promotion Board launches incentive-based national weight management movement," January 2014.

Association canadienne des annonceurs, Association canadienne des radiodiffuseurs, et Annonceurs responsables en publicité pour enfants, *La publicité destinée aux enfants au Canada: Guide de référence*, 2006.

Astrup, Arne, Stephan Rössner, Luc Van Gaal, Aila Rissanen, Leo Niskanen, Mazin Al Hakim et al., "Effects of liraglutide in the treatment of obesity: A randomised, double-blind, placebo-controlled study," *The Lancet*, volume 374, number 9701, November 2009.

Atlantis, E., E. H. Barnes, and M. A. Fiatarone Singh, "Efficacy of exercise for treating overweight in children and adolescents: A systematic review," *International Journal of Obesity*, volume 30, number 7, July 2006.

Australian government, *Economic impact of restrictions on television food and beverage advertising*, August 2008.

Australian Institute of Health and Welfare, *Who is overweight? AIHW analysis of the 2007–08 National Health Survey*, 2013.

Averett, Susan, and Sanders Korenman, "The economic reality of the beauty myth," *Journal of Human Resources*, volume 31, number 2, spring 1996.

Azar, Kristen M. J., Lenard I. Lesser, Brian Y. Laing, Janna Stephens, Magi S. Aurora, Lora E. Burke, and Latha P. Palaniappan, "Mobile applications for weight management," *American Journal of Preventive Medicine*, volume 45, number 5, November 2013.

Bader, Pearl, David Boisclair, and Roberta Ferrence, "Effects of tobacco taxation and pricing on smoking behavior in high risk populations: A knowledge synthesis," *International Journal of Environmental Research and Public Health*, volume 8, number 11, November 2011.

Baicker, K., D. Cutler, and Z. Song, "Workplace wellness programs can generate savings," *Health Affairs*, volume 29, number 2, February 2010.

Baillargeon, Jean-Patrice, André Carpentier, Denise Donovan, Martin Fortin, Andrew Grant, Judith Simoneau-Roy et al., "Integrated obesity care management system: Implementation and research protocol," *BMC Health Services Research*, volume 7, article number 163, 2007.

Ball, Kylie, Karen Lamb, Noemi Travaglini, and Anne Ellaway, "Street connectivity and obesity in Glasgow, Scotland: Impact of age, sex and socioeconomic position," *Health and Place*, volume 18, number 6, November 2012.

Ball, Kylie, Sarah A. McNaughton, Cliona Ni Mhurchu, Nick Andrianopoulos, Victoria Inglis, Briohny McNeilly et al., "Supermarket Healthy Eating for Life (SHELf): "Protocol of a randomised controlled trial promoting healthy food and beverage consumption through price reduction and skill-building strategies," *BMC Public Health*, volume 11, article number 715, September 2011.

Balls, J., *How much does obesity cost the NHS?* FullFact.org, May 2011.

Barker, D. J. P., "The origins of the developmental origins theory," *Journal of Internal Medicine*, volume 261, number 5, May 2007.

Barker, M., W. T. Lawrence, T. C. Skinner, C. O. Haslam, S. M. Robinson, H. M. Inskip et al., "Constraints on food choices of women in the UK with lower educational attainment," *Public Health Nutrition*, volume 11, number 12, December 2008.

The Barker Theory, *Type 2 diabetes and obesity*, 2014.

Barte, J. C. M., N. C. W. Ter Bogt, R. P. Bogers, P. J. Teixeira, B. Blissmer, T. A. Mori, W. J. E. Bemelmans, "Maintenance of weight loss after lifestyle interventions for overweight and obesity: A systematic review," *Obesity Reviews*, volume 11, number 12, December 2010.

Bartlett, Susan, Jacob Klerman, Parke Wilde, Lauren Olsho, Michelle Blocklin, Christopher Logan, and Ayesha Enver, "Healthy Incentives Pilot (HIP) interim report," US Department of Agriculture, *Nutrition Assistance Program Report*, July 2013.

Bassler, Elissa J., Jamie F. Chriqui, Kendall Stagg, Linda M. Schneider, Katie Infusino, and Yuka Asada, *Controlling junk food and the bottom line: Case studies of schools successfully implementing strong nutrition standards for competitive foods and beverages*, Illinois Public Health Institute, 2013.

Basu, Sanjay, Sukumar Vellakkal, Sutapa Agrawal, David Stuckler, Barry Popkin, Shah Ebrahim, and Tony Blakely, "Averting obesity and type 2 diabetes in India through sugar-sweetened beverage taxation: An economic-epidemiologic modeling study," *PLoS Medicine*, volume 11, number 1, January 2014.

Baughcum, A. E., L. A. Chamberlin, C. M. Deeks, S. W. Powers, and R. C. Whitaker, "Maternal perceptions of overweight preschool children," *Pediatrics*, volume 106, number 6, December, 2000.

Baumberg, Ben, "The global economic burden of alcohol: A review and some suggestions," *Drug and Alcohol Review*, volume 25, number 6, November 2006.

Bayerisches Bier: Die Biersorten. Bayerisches Bier, www.bayrisch-bier.de/bier-wissen/die-biersorten/.

BBC, "Alcohol calories 'too often ignored,'" *BBC News Health*, January 2, 2013.

BBC, "'Unhealthy food "returning to school,' warn caterers," *BBC Education and Family*, November 25, 2011.

BBC, "US moves to ban trans fats in foods," *BBC News US and Canada*, November 7, 2013.

BBC, "Why food 'traffic-light' labels did not happen," *BBC News Health*, July 11, 2014.

Bell, E. A., V. H. Castellanos, C. L. Pelkman, M. L. Thorwart, and B. J. Rolls, "Energy density of foods affects energy intake in normal-weight women," *American Journal of Clinical Nutrition*, volume 67, number 3, March 1998.

Bemelmans, Wanda Jose Erika, Trudy Maria Arnoldina Wijnhoven, Marieke Verschuuren, and João Breda, "Overview of 71 European community-based initiatives against childhood obesity starting between 2005 and 2011: General characteristics and reported effects," *BMC Public Health*, volume 14, July 2014.

Bennett, Gary G., Sharon J. Herring, Elaine Puleo, Evelyn K. Stein, Karen M. Emmons, and Matthew W. Gillman, "Web-based weight loss in primary care: A randomized controlled trial," *Obesity* (Silver Spring), volume 18, number 2, February 2010.

Berardi, Nicoletta, Patrick Sevestre, Marine Tepaut, and Alexandre Vigneron, *The impact of a "soda tax" on prices: Evidence from French micro data*, Banque de France working paper number 415, December 2012.

Bergman, U. Michael, and Niels Lynggård Hansen, *Are excise taxes on beverages fully passed through to prices? The Danish evidence*, University of Copenhagen working paper, April 5, 2010.

Bertz, Fredrik, Hilde K. Brekke, Lars Ellegard, Kathleen M. Rasmussen, Margareta Wennergren, and Anna Winkvist, "Diet and exercise weight-loss trial in lactating overweight and obese women," *American Journal of Clinical Nutrition*, volume 96, number 4, October 2012.

Birch, Leann L., and Jennifer Orlet Fisher, "Development of eating behaviors among children and adolescents," *Pediatrics*, volume 101, number 2, March 1998.

Black, Andrew P., Julie Brimblecombe, Helen Eyles, Peter Morris, Hassan Vally, and Kerin O'Dea, "Food subsidy programs and the health and nutritional status of disadvantaged families in high income countries: A systematic review," *BMC Public Health*, volume 12, number 1, December 2012.

Blair, Steven N., Gregory A. Hand, and Edward Archer, "Physical activity has a crucial role in weight management and determinants of obesity," *International Journal of Epidemiology*, volume 42, issue 6, December 2013.

Blatt, A. D., L. S. Roe, and B. J. Rolls, "Hidden vegetables: An effective strategy to reduce energy intake and increase vegetable intake in adults," *American Journal of Clinical Nutrition*, volume 93, number 4, February 2011.

Bluford, Dontrell A., Bettylou Sherry, and Kelley S. Scanlon, "Interventions to prevent or treat obesity in preschool children: A review of evaluated programs," *Obesity* (Silver Spring), volume 15, number 6, June 2007.

Bollinger, Bryan, Phillip Leslie, and Alan Sorensen, *Calorie posting in chain restaurants*, National Bureau of Economic Research working paper number 15648, January 2010.

Bonnet, Céline, and Vincent Requillart, *Is the EU sugar policy reform likely to increase obesity?* selected paper prepared for presentation at 1st Joint European Association of Agricultural Economists/Agricultural and Applied Economics Association seminar in Freising, Germany, September 15–17, 2010.

Bonnet, Céline, Vincent Requillart, Andrew Jones, and Owen O'Donnell, "Does the EU sugar policy reform increase added sugar consumption? An empirical evidence on the soft drink market," *Health Economics*, volume 20, number 9, September 2011.

Borgmeier, Ingrid, and Joachim Westenhoefer, "Impact of different food label formats on healthiness evaluation and food choice of consumers: A randomized-controlled study," *BMC Public Health*, volume 9, number 1, June 2009.

Borys, J.-M., Y. Le Bodo, S. A. Jebb, J. C. Seidell, C. Summerbell, D. Richard et al., "EPODE approach for childhood obesity prevention: Methods, progress and international development," *Obesity Reviews*, volume 13, number 4, April 2012.

Borys, J-M., L. Valdeyron, E. Levy, J. Vinck, D. Edell, L. Walter, H. Ruault de Plessis et al., "EPODE: A model for reducing the incidence of obesity and weight related co-morbidities," *US Endocrinology*, volume 9, number 1, summer 2013.

Boseley, Sarah, "Almost two-thirds of adults in England classed as overweight by health body," *The Guardian*, February 4, 2014.

Boyland, Emma J., Joanne A. Harrold, Terence M. Dovey, Maxine Allison, Sarah Dobson, Marie-Claire Jacobs, and Jason C. G. Halford, "Food choice and overconsumption: Effect of a premium sports celebrity endorser," *Journal of Pediatrics*, volume 163, number 2, August 2013.

Brehm, B. J., S. E. Spang, B. L. Lattin, R. J. Seeley, S. R. Daniels, and D. A. D'Alessio, "The role of energy expenditure in the differential weight loss in obese women on low-fat and low-carbohydrate diets," *Journal of Clinical Endocrinology and Metabolism*, volume 90, number 3, March 2005.

Bridges, S., and J. Thompson, "Children's BMI, overweight and obesity," in *Health survey for England—2010, respiratory health*, R. Craig and J. Mindell, eds., Health and Social Care Information Centre, December 2011.

Briefel, R., M. Crepinsek, C. Cabili, A. Wilson, and P. Gleason, "School food environments and practices affect dietary behaviors of US public school children," *Journal of the American Dietetic Association*, volume 109, number 2, February 2009.

Briggs, A. D. M., O. T. Mytton, A. Kehlbacher, R. Tiffin, M. Rayner, and P. Scarborough, "Overall and income specific effect on prevalence of overweight and obesity of 20 percent sugar sweetened drink tax in UK: Econometric and comparative risk assessment modelling study," *BMJ*, volume 347, October 2013.

Briggs, H., "Call for mandatory salt curbs," *BBC News Health*, November 2, 2010.

Brissette, Ian, Ann Lowenfels, Corina Noble, and Deborah Spicer, "Predictors of total calories purchased at fast-food restaurants: Restaurant characteristics, calorie awareness, and use of calorie information," *Journal of Nutrition Education and Behavior*, volume 45, number 5, September–October 2013.

Brown, Rebecca E., Thomas A. Willis, Nichola Aspinall, Candida Hunt, Jackie George, and Mary C. J. Rudolf, "Preventing child obesity: A long-term evaluation of the HENRY approach," *Community Practitioner*, volume 86, number 7, July 2013.

Brownell, Kelly D., "Improving long-term weight loss: Pushing the limits of treatment," *Behaviour Therapy*, volume 18, number 4, autumn 1987.

Brownell, K. D., R. Y. Cohen, A. J. Stunkard, M. R. Felix, and N. B. Cooley, "Weight loss competitions at the work site: Impact on weight, morale and cost-effectiveness," *American Journal of Public Health*, volume 74, number 11, November 1984.

Brownell, Kelly D., Thomas Farley, Walter C. Willett, Barry M. Popkin, Frank J. Chaloupka, Joseph W. Thompson, and David S. Ludwig, "The public health and economic benefits of taxing sugar-sweetened beverages," *New England Journal of Medicine*, volume 361, number 16, October 2009.

Bruemmer, Barbara, Jim Krieger, Brian E. Saelens, and Nadine Chan, "Energy, saturated fat, and sodium were lower in entrées at chain restaurants at 18 months compared with 6 months following the implementation of mandatory menu labeling regulation in King County, Washington," *Journal of the Academy of Nutrition and Dietetics*, volume 112, number 8, August 2012.

Bryant, M., A. Farrin, D. Christie, S. A. Jebb, A. R. Cooper, and M. Rudolf, "Results of a feasibility randomised controlled trial (RCT) for WATCH IT: A programme for obese children and adolescents," *Clinical Trials*, volume 8, number 6, December 2011.

Bryden, Anna, Mark Petticrew, Nicholas Mays, Elizabeth Eastmure, and Cecile Knai, "Voluntary agreements between government and business: A scoping review of the literature with specific reference to the Public Health Responsibility Deal," *Health Policy*, volume 110, numbers 2–3, May 2013.

Buchner, Barbara, Angela Falconer, Morgan Hervé-Mignucci, and Chiara Tabacchi, *The landscape of climate finance 2012*, Climate Policy Initiative, December 2012.

Buhler, Susan, Kim D. Raine, Manuel Arango, Suzie Pellerin, and Neil E. Neary, "Building a strategy for obesity prevention one piece at a time: The case of sugar-sweetened beverage taxation," *Canadian Journal of Diabetes*, volume 27, number 2, 2013.

Bupa, *Obesity: A business issue*, 2014.

Burgoine, T., N. G. Forouhi, S. J. Griffin, N. J. Wareham, and P. Monsivais, "Associations between exposure to takeaway food outlets, takeaway food consumption, and body weight in Cambridgeshire, UK: Population based, cross sectional study," *BMJ*, volume 348, March 2014.

Burns, Cate, *A review of the literature describing the link between poverty, food insecurity and obesity with specific reference to Australia*, Physical Activity Unit, Food Insecurity Program, Victorian Health Promotion Foundation, April 2004.

Butland, B., S. Jebb, P. Kopelman, K. McPherson, S. Thomas, J. Mardell, and V. Parry, *Foresight: Tackling obesities—future choices*, UK Government Office for Science, project report, 2nd ed., October 2007.

Buttriss, Judith L., "Food reformulation: The challenges to the food industry," *Proceedings of the Nutrition Society*, volume 72, number 1, February 2013.

Cabral, Lídia, and John Howell, *Measuring aid to agriculture and food security*, Overseas Development Institute, ODI briefing paper number 72, February 2012.

Cairns, G., K. Angus, G. Hastings, and M. Caraher, "Systematic reviews of the evidence on the nature, extent and effects of food marketing to children: A retrospective summary," *Appetite*, volume 62, March 2013.

Callison, Kevin, and Robert Kaestner, *Do higher tobacco taxes reduce adult smoking? New evidence of the effect of recent cigarette tax increases in adult smoking*, NBER working paper number 18326, August 2012.

Campión, J., F. I. Milagro, and J. A. Martínez, "Individuality and epigenetics in obesity," *Obesity Reviews*, volume 10, number 4, July 2009.

Carr, M., "There's more to obesity than sugar," *News Bites*, January 29, 2014.

Cash, Sean B., David L. Sunding, and David Zilberman, "Fat taxes and thin subsidies: Prices, diet, and health outcomes," *Acta Agriculturae Scandinavica*, Section C, volume 2, issues 3–4, 2005.

Catalina Marketing, *Helping shoppers overcome the barriers to choosing healthful foods*, 2010.

Cavill, N., and A. Bauman, "Changing the way people think about health-enhancing physical activity: Do mass media campaigns have a role?" *Journal of Sports Sciences*, volume 22, number 8, 2004.

Cavill, N., A. Cope, and A. Kennedy, *Valuing increased cycling in the cycling demonstration towns*, Sustrans and Cavill Associates, 2009.

Cawley, J., A. Rizzo, and K. Haas, "Occupation-specific absenteeism costs associated with obesity and morbid obesity," *Journal of Occupational and Environmental Medicine*, volume 49, number 12, December 2007.

Cawley, John, and Chad Meyerhoefer, "The medical care costs of obesity: An instrumental variables approach," *Journal of Health Economics*, volume 31, issue 1, January 2012.

Cawley, John, and Joshua A. Price, "A case study of a workplace wellness program that offers financial incentives for weight loss," *Journal of Health Economics*, volume 32, number 5, September 2013.

Cecchini, Michele, Franco Sassi, Jeremy A. Lauer, Yong Y. Lee, Veronica Guajardo-Barron, and Daniel Chisholm, "Tackling of unhealthy diets, physical inactivity, and obesity: Health effects and cost-effectiveness," *The Lancet*, volume 376, number 9754, November 2010.

Center for Science in the Public Interest, *Product reformulation: A beneficial outcome of menu labeling*, September 2012.

Chance, Zoe, Ravi Dhar, Shane Frederick, Rohit Kichlu, Erin Ratelis, and John Waters, *Influencing health choices at work: Change the environment*, change behaviour, Optum Health, 2012.

Chandon, Pierre, and Brian Wansink, "Does food marketing need to make us fat? A review and solutions," *Nutrition Reviews*, volume 70, number 10, October 2012.

Chandon, Pierre, and Brian Wansink, "When are stockpiled products consumed faster? A convenience-salience framework of postpurchase consumption incidence and quantity," *Journal of Marketing Research*, volume 39, number 3, August 2002.

Chandon, P., J. W. Wesely-Hutchinson, E. T. Bradlow, and S. H. Young, "Does in-store marketing work? Effects of number and position of shelf facings on brand attention at the point of purchase," *Journal of Marketing*, volume 73, November 2009.

Chanoine, Jean-Pierre, Sarah Hampl, Craig Jensen, Mark Boldrin, and Jonathan Hauptman, "Effect of orlistat on weight and body composition in obese adolescents," *Journal of the American Medical Society*, volume 293, number 23, June 2005.

Chen, C., "Kraft helps cut 6.4 trillion calories in Obama challenge," *BloombergBusinessweek*, January 9, 2014.

Children's Food Trust, *Food-based and nutrient-based standards for school food: United Kingdom comparisons*, December 2012.

Chou, Shin-Yi, Inas Rashad, and Michael Grossman, "Fast-food restaurant advertising on television and its influence on childhood obesity," *Journal of Law and Economics*, volume 51, number 4, November 2008.

Chouinard, Hayley H., David E. Davis, Jeffrey T. LaFrance, and Jeffrey M. Perloff, "Fat taxes: Big money for small change," *Forum for Health Economics and Policy*, volume 10, issue 2, 2007.

Chow, Carson C., and Kevin D. Hall, "The dynamics of human body weight change," *PLoS Computational Biology*, volume 10, number 1371, March 2008.

Chriqui, Jamie F., "Differences in nutrient intake associated with state laws regarding fat, sugar, and caloric content of competitive foods," *Archives of Pediatrics and Adolescent Medicine*, volume 166, number 5, May 2012.

Christakis, Nicholas A., and James H. Fowler, "The spread of obesity in a large social network over 32 years," *New England Journal of Medicine*, volume 357, number 4, July 2007.

Christiansen, E., and L. Garby, "Prediction of body weight changes caused by changes in energy balance," *European Journal of Clinical Investigation*, volume 32, issue 11, November 2002.

Chu, Yong H., Edward A. Frongillo, Sonya J. Jones, and Gail L. Kaye, "Improving patrons' meal selections through the use of point-of-selection nutrition labels," *American Journal of Public Health*, volume 99, number 11, November 2009.

Church, T. S., D. M. Thomas, C. Tudor-Locke, P. T. Katzmarzyk, C. P. Earnest et al., "Trends over 5 decades in US occupation-related physical activity and their associations with obesity," *PLoS ONE*, volume 6, number 5, 2011.

Ciliska, Donna, Elizabeth Miles, Mary Ann O'Brien, Cathy Turl, Helen Hale Tomasik, Ursula Donovan, and Joanne Beyers, "Effectiveness of community-based interventions to increase fruit and vegetable consumption," *Journal of Nutrition Education and Behavior*, volume 32, number 6, November 2000.

Claro, Rafael M., Renata B. Levy, Barry M. Popkin, and Carlos A. Monteiro, "Sugar-sweetened beverage taxes in Brazil," *American Journal of Public Health*, volume 102, number 1, January 2012.

Clegg, A., J. Colquitt, M. Sidhu, P. Royle, and A. Walker, "Clinical and cost effectiveness of surgery for morbid obesity: A systematic review and economic evaluation," *International Journal of Obesity*, volume 27, number 10, May 2003.

Coalition québecoise sur la problématique du poids: Marketing alimentaire aux enfants et redevance sur les boissons sucrées favorisant l'accès aux aliments sains, Résumé de la conférence de Suzie Pellerin.

Cobiac, Linda J., Theo Vos, J. Lennert Veerman, and Daniel Tomé, "Cost-effectiveness of interventions to promote fruit and vegetable consumption," *PLoS ONE*, volume 5, number 11, November 2010.

Coelho do Vale, Rita, Rik Pieters, and Marcel Zeelenberg, "Flying under the radar: Perverse package size effects on consumption self-regulation," *Journal of Consumer Research*, volume 35, number 3, January 2008.

Cole, Charlotte F., Jennifer Kotler, and Seeta Pai, "'Happy healthy muppets': A look at Sesame Workshop's health initiatives around the world," in *Igniting the power of community: The role of CBOs and NGOs in global public health*, P. A. Gaist, ed., Springer, 2010.

Committee on Communications, "Children, adolescents, and advertising," *Pediatrics*, volume 118, number 6, December 2006.

Commodity Online, "US beer consumption drops for third year," September 2, 2010.

Confino, J., "Government obesity adviser calls for action on sugary drinks," *The Guardian*, February 10, 2014.

Count the Costs, *The war on drugs: Wasting billions and undermining economies*, 2013.

Cradock, Angie L., Jessica L. Barrett, Jill Carter, Anne McHugh, Jonathan Sproul, Elizabeth T. Russo et al., "Impact of the Boston active school day policy to promote physical activity among children," *American Journal of Health Promotion*, volume 28, special issue number 3, January–February 2014.

Cradock, Angie L., Steven J. Melly, Joseph G. Allen, Jeffrey S. Morris, and Steven L. Gortmaker, "Characteristics of school campuses and physical activity among youth," *American Journal of Preventive Medicine*, volume 33, number 2, August 2007.

Craig, Benjamin M., and Daniel S. Tseng, "Cost-effectiveness of gastric bypass for severe obesity," *American Journal of Medicine*, volume 113, number 6, October 2002.

Craig, R., and J. Mindell, eds., *Health survey for England—2010, respiratory health*, Health and Social Care Information Centre, December 2011.

Crane, Richard, Ross Davenport, and Rod Vaughan, *Poultry production in England: Farm Business Survey 2011/12*, March 2013.

Craven, B., M. Marlow, and A. Shiers, "Fat taxes and other interventions won't cure obesity," *Economic Affairs*, volume 32, number 2, June 2012.

Credit Suisse Research Institute, *Sugar: Consumption at a crossroads*, September 2013.

Croker, H., R. M. Viner, D. Nicholls, D. Haroun, P. Chadwick, C. Edwards et al., "Family-based behavioural treatment of childhood obesity in a UK national health service setting: Randomized controlled trial," *International Journal of Obesity*, volume 36, number 1, January 2012.

Crosnoe, R., "Gender, obesity, and education," *Sociology of Education*, volume 80, number 3, July 2007.

Cummins, S., "Large scale food retailing as an intervention for diet and health: Quasi-experimental evaluation of a natural experiment," *Journal of Epidemiology and Community Health*, volume 59, number 12, December 2005.

Cummins, S., E. Flint, and S. A. Matthews, "New neighborhood grocery store increased awareness of food access but did not alter dietary habits or obesity," *Health Affairs*, volume 33, number 2, February 2014.

Cunningham, Solveig A., Michael R. Kramer, and K. M. Venkat Narayan, "Incidence of childhood obesity in the United States," *New England Journal of Medicine*, volume 370, number 5, January 2014.

Curioni, C. C., and P. M. Lourenço, "Long-term weight loss after diet and exercise: A systematic review," *International Journal of Obesity*, volume 29, number 10, October 2005.

Cutfield, Wayne S., Paul L. Hofman, Murray Mitchell, and Ian M. Morison, "Could epigenetics play a role in the developmental origins of health and disease?" *Pediatric Research*, volume 61, number 5, January 2007.

Daneshku, S., "Sugar debate turns sour for food groups," *Financial Times*, February 5, 2014.

DARA and the Climate Vulnerable Forum, *Climate vulnerability monitor: A guide to the cold calculus of a hot planet*, 2nd ed., 2012.

Darnton, A., *Reference report: An overview of behaviour change models and their uses*, Government Social Research, July 2008.

Davies, R., "Buying pizza? Expect a healthy reminder from Tesco: Supermarket giant will use loyalty card data to see who is eating what," *Daily Mail*, May 27, 2013.

Davis, Anna, "Cost of illiteracy to UK 'tops £81bn each year,'" *Evening Standard*, January 25, 2012.

De Silva-Sanigorski, A. M. A. C. Bell, P. Kremer, M. Nichols, M. Crellin, M. Smith et al., "Reducing obesity in early childhood: Results from Romp and Chomp, an Australian community-wide intervention program," *American Journal of Clinical Nutrition*, volume 91, number 4, April 2010.

DecisionMarketing, *Clubcard data to combat obesity*, May 2013.

DeFelice, Stephen L., "The nutraceutical revolution: Its impact on food industry R&D," *Trends in Food Science and Technology*, volume 6, number 2, February 1995.

Dennison, Barbara A., Theresa J. Russo, Patrick A. Burdick, and Paul L. Jenkins, "An intervention to reduce television viewing by preschool children," *Archives of Pediatrics and Adolescent Medicine*, volume 158, number 2, February 2004.

Department for Education, United Kingdom, *Evidence on physical education and sports in schools: Key findings*, June 2013.

Department for Environment, Food, and Rural Affairs, United Kingdom, *Family Food 2012*, 2013.

Department of Health, United Kingdom, *Changing behaviour, improving outcomes*, 2011.

Department of Health, United Kingdom, *Public Health Responsibility Deal*, 2014.

Department of Health, Victoria, Australia, *ACE—Obesity: Assessing cost-effectiveness of obesity interventions in children and adolescents—summary of results*, February 2013.

Department of Health Statistics and Information Systems, World Health Organization, *WHO methods and data sources for Global Burden of Disease estimates 2000–2011*, November 2013.

Desmet, Pierre, and Valerie Renaudin, "Estimation of product category sales responsiveness to allocated shelf space," *International Journal of Research in Marketing*, volume 15, number 5, December 1998.

Dexia, *Back to sustainable value creation: Health and wellness in the food and beverage sector*, March 2009.

Dhar, T., and K. Baylis, "Fast-food consumption and the ban on advertising targeting children: The Quebec experience," *Journal of Marketing Research*, volume 48, issue 5, October 2011.

Diabetes Prevention Program Research Group, "The Diabetes Prevention Program (DPP): Description of lifestyle intervention," *Diabetes Care*, volume 25, number 12, December 2002.

Diabetes Prevention Program Research Group, "Reduction in the incidence of type 2 diabetes with lifestyle intervention or Metformin," *New England Journal of Medicine*, volume 346, number 6, February 2002.

Die Deutscher Brauer, *Alkoholfreie Biere: die Alternative für bewusstes Genießen*, 2014.

Dishman, Rod K., David M. DeJoy, Mark G. Wilson, and Robert J. Vandenberg, "Move to improve: A randomized workplace trial to increase physical activity," *American Journal of Preventive Medicine*, volume 36, number 2, February 2009.

Dixon, Helen G., Maree L. Scully, Melanie A. Wakefield, Victoria M. White, and David A. Crawford, "The effects of television advertisements for junk food versus nutritious food on children's food attitudes and preferences," *Social Science and Medicine*, volume 65, number 7, October 2007.

Dodds, Pennie, Luke Wolfenden, Kathy Chapman, Lyndal Wellard, Clare Hughes, and John Wiggers, "The effect of energy and traffic light labelling on parent and child fast food selection: A randomised controlled trial," *Appetite*, volume 73, February 2014.

Dodhia, H., and K. Phillips, "Measuring burden of disease in two inner London boroughs using disability-adjusted life years," *Journal of Public Health*, volume 30, number 3, September 2008.

Donev, Doncho, Lijana Zaletel-Kragelj, Vesna Bjegovic, and Gene Burazeri, "Measuring the burden of disease: Disability-adjusted life year (DALY)," in *Health investigation: Analysis-planning-evaluation*, 2nd ed., G. Burazeri and L. Zaletel-Kragelj, eds., Jacobs, 2013.

Dover, George J., "The Barker hypothesis: How pediatricians will diagnose and prevent common adult-onset diseases," *Transactions of the American Clinical and Climatological Association*, volume 120, January 2009.

Drewnowski, Adam, and S. E. Specter, "Poverty and obesity: The role of energy density and energy costs," *American Journal of Clinical Nutrition*, volume 27, number 1, January 2004.

Drèze, Xavier, Stephen J. Hoch, and Mary E. Purk, *Shelf management and space elasticity*, Graduate School of Business, University of Chicago, January 1994.

Duffey, Kiyah J., Penny Gordon-Larsen, James M. Shikany, David Guilkey, David R. Jacobs Jr., and Barry M. Popkin, "Food price and diet and health outcomes: 20 years of the CARDIA Study," *Archives of Internal Medicine*, volume 170, number 5, March 2010.

Dumanovsky, T., C. Y. Huang, C. A. Nonas, T. D. Matte, M. T. Bassett, and L. D. Silver, "Changes in energy content of lunchtime purchases from fast food restaurants after introduction of calorie labelling: Cross sectional customer surveys," *BMJ*, volume 343, July 2011.

Duncan, Dustin T., Jared Aldstadt, John Whalen, Kellee White, Marcia C. Castro, and David R. Williams, "Space, race, and poverty: Spatial inequalities in walkable neighborhood amenities?" *Demographic Research*, volume 26, article 17, May 2012.

Duncan, Dustin T., Marcia C. Castro, Steven L. Gortmaker, Jared Aldstadt, Steven J. Melly, and Gary G. Bennett, "Racial differences in the built environment—body mass index relationship? A geospatial analysis of adolescents in urban neighborhoods," *International Journal of Health Geographics*, volume 11, number 1, April 2012.

Dwyer, T., W. E. Coonan, D. R. Leitch, B. S. Hetzel, and R. A. Baghurst, "An investigation of the effects of daily physical activity on the health of primary school students in South Australia," *International Journal of Epidemiology*, volume 12, number 3, October 1983.

East Midlands Public Health Observatory, *Health, work and well-being: Employee health needs assessment methods and tools*, July 2011.

Ebbeling, C. B., "Effects of decreasing sugar-sweetened beverage consumption on body weight in adolescents: A randomized, controlled pilot study," *Pediatrics*, volume 117, number 3, March 2006.

The Economist, "A fat chance: The Danish government rescinds its unwieldy fat tax," November 17, 2012.

The Economist, "Slim pickings: Evidence that the problem of obesity starts in the womb," November 11, 2010.

The Economist, "Why are sales of non-alcoholic beer booming?" August 11, 2013.

Elbel, B., R. Kersh, V. L. Brescoll, and L. B. Dixon, "Calorie labeling and food choices: A first look at the effects on low-income people in New York City," *Health Affairs*, volume 28, number 6, November–December 2009.

Elinder, L. S., "Obesity, hunger, and agriculture: The damaging role of subsidies," *BMJ*, volume 331, number 7528, December 2005.

Ellaway, Anne, Laura Macdonald, Karen Lamb, Lukar Thornton, Peter Day, and Jamie Pearce, "Do obesity-promoting food environments cluster around socially disadvantaged schools in Glasgow, Scotland?" *Health and Place*, volume 18, number 6, November 2012.

Ellison, Brenna, Jason L. Lusk, and David Davis, "Looking at the label and beyond: The effects of calorie labels, health consciousness, and demographics on caloric intake in restaurants," *International Journal of Behavioral Nutrition and Physical Activity*, volume 10, number 1, February 2013.

Ello-Martin, Julia A., Jenny H. Ledikwe, and Barbara J. Rolls, "The influence of food portion size and energy density on energy intake: Implications for weight management," *American Journal of Clinical Nutrition*, volume 82, number 2, July 2005.

Encyclopedia of the Nations, "Population, aged 15–24, total," 2010.

Epstein, L. H., A. Valoski, R. Koeske, and R. R. Wing, "Family-based behavioral weight control in obese young children," *Journal of the American Dietetic Association*, volume 86, number 4, 1986.

Eriksen, Michael, Judith Mackay, and Hana Ross, *The tobacco atlas, fourth edition*, American Cancer Society and World Lung Foundation, 2012.

Eriksson, J., T. Forsén, C. Osmond, and D. Barker, "Obesity from cradle to grave," *International Journal of Obesity*, volume 27, number 6, June 2003.

Eriksson, J. G., T. Forsén, J. Tuomilehto, C. Osmond, and D. Barker, "Early adiposity rebound in childhood and risk of type 2 diabetes in adult life," *Diabetologia*, volume 46, number 2, February 2003.

Eriksson, J., T. Forsén, J. Tuomilehto, C. Osmond, and D. Barker, "Size at birth, childhood growth and obesity in adult life," *International Journal of Obesity*, volume 25, number 5, June 2001.

Estevez, D., "Mexico's proposed tax on soda, junk food opposed by billionaire beverage and food barons," *Forbes*, October 28, 2014.

European Commission, *Agriculture and rural development: Sugar*, 2013.

European Food Information Council, *Obesity and overweight*, June 2006.

European Union, *EU regulation 1169/2011*, 2011.

Evans, Charlotte E. L., Christine L. Cleghorn, Darren C. Greenwood, and Janet E. Cade, "A comparison of British school meals and packed lunches from 1990 to 2007: Meta-analysis by lunch type," *British Journal of Nutrition*, volume 104, number 4, August 2010.

Evans, Charlotte E. L., Darren C. Greenwood, J. D. Thomas, and Janet E. Cade, "A cross-sectional survey of children's packed lunches in the UK: Food- and nutrient-based results," *Journal of Epidemiology and Community Health*, volume 64, number 11, 2010.

Evans, Charlotte E. L., Darren C. Greenwood, J. D. Thomas, Christine L. Cleghorn, M. S. Kitchen, and Janet E. Cade, "SMART lunch box intervention to improve the food and nutrient content of children's packed lunches: UK-wide cluster randomised controlled trial," *Journal of Epidemiology and Community Health*, volume 64, number 11, 2010.

Evans, W. Douglas, Katherine K. Christoffel, Jonathan W. Necheles, and Adam B. Becker, "Social marketing as a childhood obesity prevention strategy," *Obesity* (Silver Spring), volume 18, supplement 1, February 2010.

Faulkner, Guy E. J., Paul Grootendorst, Van Hai Nguyen, Tatiana Andreyeva, Kelly Arbour-Nicitopoulos, M. Christopher Auld et al., "Economic instruments for obesity prevention: Results of a scoping review and modified delphi survey," *International Journal of Behavioral Nutrition and Physical Activity*, volume 8, number 1, October 2011.

Fearon, J., and D. Laitin, "Ethnicity, insurgency, and civil war," *American Political Science Review*, volume 97, number 1, February 2003.

Fernald, L. C., and L. M. Neufeld, "Overweight with concurrent stunting in very young children from rural Mexico: Prevalence and associated factors," *European Journal of Clinical Nutrition*, volume 61, number 5, May 2007.

FIA Foundation, "Counting the cost: Road crashes and the poor," 2005.

Fielding, G., and J. Duncombe, "Laparoscopic adjustable gastric banding in severely obese adolescents," *Surgery for Obesity and Related Diseases*, volume 1, number 4, July 2005.

Fine Maron, Dina, "Some Danish advice on the trans-fat ban," *Scientific American*, November 2013.

Finkelstein, Eric A., Derek S. Brown, Lisa A. Wrage, Benjamin T. Allaire, and Thomas J. Hoerger, "Individual and aggregate years-of-life-lost associated with overweight and obesity," *Obesity* (Silver Spring), volume 18, number 2, February 2009.

Finkelstein, Eric A., Marco daCosta DiBonaventura, Somali M. Burgess, and Brent C. Hale, "The costs of obesity in the workplace," *Journal of Occupational and Environmental Medicine*, volume 52, number 10, October 2010.

Finkelstein, Eric A., Christopher J. Ruhm, and Katherine M. Kosa, "Economic causes and consequences of obesity," *Annual Review of Public Health*, volume 26, number 1, April 2005.

Finkelstein, Eric A., Kiersten L. Strombotne, Nadine L. Chan, and James Krieger, "Mandatory menu labeling in one fast-food chain in King County, Washington," *American Journal of Preventive Medicine*, volume 40, number 2, February 2011.

Finkelstein, Eric A., Justin G. Trogdon, Derek S. Brown, Benjamin T. Allaire, Pam S. Dellea, and Sachin J. Kamal-Bahl, "The lifetime medical cost burden of overweight and obesity: Implications for obesity prevention," *Obesity* (Silver Spring), volume 16, number 8, August 2008.

Finkelstein, Eric A., Justin G. Trogdon, Joel W. Cohen, and William Dietz, "Annual medical spending attributable to obesity: Payer- and service-specific estimates," *Health Affairs*, volume 28, number 5, July 2009.

Finkelstein, Eric A., Chen Zhen, Marcel Bilger, James Nonnemaker, Assad M. Farooqui, and Jessica E. Todd, "Implications of a sugar-sweetened beverage (SSB) tax when substitutions to non-beverage items are considered," *Journal of Health Economics*, volume 32, number 1, 2013.

Finnish Federation of the Brewing and Soft Drink Industry, *Domestic sales of the brewing and soft drinks industry*, 2012.

Fischer, A. J., A. Threlfall, S. Meah, R. Cookson, H. Rutter, and M. P. Kelly, "The appraisal of public health interventions: An overview," *Journal of Public Health*, volume 35, number 4, December 2013.

Fisher, J., Y. Liu, L. L. Birch, and B. J. Rolls, "Effects of portion size and energy density on young children's intake at a meal," *American Journal of Clinical Nutrition*, volume 86, number 1, July 2007.

Fishman, Elliot, Simon Washington, and Narelle Haworth, "Bike share: A synthesis of the literature," *Transport Reviews*, volume 33, number 2, 2013.

Fitzgibbon, Marian L., Melinda R. Stolley, Linda Schiffer, Linda van Horn, Katherine KauferChristoffel, and Alan Dyer, "Hip-Hop to Health Jr. for Latino preschool children," *Obesity* (Silver Spring), volume 14, number 9, September 2006.

Fleischhacker, S. E., K. R. Evenson, D. A. Rodriguez, and A. S. Ammerman, "A systematic review of fast food access studies," *Obesity Reviews*, volume 12, number 5, May 2011.

Fletcher, Jason M., David E. Frisvold, and Nathan Tefft, "Are soft drink taxes an effective mechanism for reducing obesity?" *Journal of Policy Analysis and Management*, volume 30, number 3, summer 2011.

Fletcher, Jason M., David Frisvold, and Nathan Tefft, "Can soft drink taxes reduce population weight?" *Contemporary Economic Policy*, volume 28, number 1, January 2010.

Fletcher, Jason M., David E. Frisvold, and Nathan Tefft, "The effects of soft drink taxes on child and adolescent consumption and weight outcomes," *Journal of Public Economics*, volume 94, numbers 11–12, August 2010.

Fletcher, Jason M., David E. Frisvold, and Nathan Tefft, "Substitution patterns can limit the effects of sugar-sweetened beverage taxes on obesity," *Preventing Chronic Disease*, volume 10, February 2013.

Flodmark, C. E., T. Ohlsson, O. Rydén, and T. Sveger, "Prevention of progression to severe obesity in a group of obese schoolchildren treated with family therapy," *Pediatrics*, volume 91, number 5, May 1993.

Fontaine, Kevin R., David T. Redden, Chenxi Wang, Andrew O. Westfall, and David B. Allison, "Years of life lost due to obesity," *Journal of the American Medical Association*, volume 289, number 2, January 2003.

Forster, M., J. L. Veerman, J. J. Barendregt, and T. Vos, "Cost-effectiveness of diet and exercise interventions to reduce overweight and obesity," *International Journal of Obesity*, volume 35, number 8, August 2011.

Foster, G. D., T. A. Wadden, and K. D. Brownell, "Peer-led program for the treatment and prevention of obesity in the schools," *Journal of Consulting and Clinical Psychology*, volume 53, number 4, August 1985.

Foster, G. D., T. A. Wadden, C. A. LaGrotte, S. S. Vander Veur, L. A. Hesson, C. J. Homko et al., "A randomized comparison of a commercially available portion-controlled weight-loss intervention with a diabetes self-management education program," *Nutrition and Diabetes*, volume 3, number 3, March 2013.

Fox, M., W. Hamilton, and B. Lin, *Effects of food assistance and nutrition programs on nutrition and health: Volume 3, literature review*, US Department of Agriculture, Economic Research Service, December 2004.

Foxcroft, D., "Orlistat for the treatment of obesity: Cost utility model," *Obesity Reviews*, volume 6, number 4, November 2005.

Foxcroft, D., and R. Milne, "Orlistat for the treatment of obesity: Rapid review and cost-effectiveness model," *Obesity Reviews*, volume 1, number 2, October 2000.

Franz, Marion J., Jeffrey J. VanWormer, A. Lauren Crain, Jackie L. Boucher, Trina Histon, William Caplan et al., "Weight-loss outcomes: A systematic review and meta-analysis of weight-loss clinical trials with a minimum 1-year follow-up," *Journal of the American Dietetic Association*, volume 107, number 10, October 2007.

French, Simone A., "Pricing effects on food choices," *Journal of Nutrition*, volume 133, number 3, March 2003.

French, Simone A., R. W. Jeffery, M. Story, K. K. Breitlow, J. S. Baxter, P. Hannan, and M. P. Snyder, "Pricing and promotion effects on low-fat vending snack purchases: The CHIPS study," *American Journal of Public Health*, volume 91, number 1, January 2001.

French, Simone A., Nathan R. Mitchell, Julian Wolfson, Lisa J. Harnack, Robert W. Jeffery, Anne F. Gerlach et al., "Portion size effects on weight gain in a free living setting," *Obesity* (Silver Spring), February 2014.

French, Simone A., Mary Story, Jayne A. Fulkerson, and Peter Hannan, "An environmental intervention to promote lower-fat food choices in secondary schools: Outcomes of the TACOS study," *American Journal of Public Health*, volume 94, number 9, September 2004.

Friedman, Roberta R., and Kelly D. Brownell, *Sugar-sweetened beverage taxes: An updated policy brief*, Rudd Report, October 2012.

Fulkerson, Jayne A., Simone A. French, Mary Story, Helen Nelson, and Peter J. Hannan, "Promotions to increase lower-fat food choices among students in secondary schools: Description and outcomes of TACOS (Trying Alternative Cafeteria Options in Schools)," *Public Health Nutrition*, volume 7, number 5, August 2004.

Garthwaite, Josie, "To curb driving, cities cut down on car parking," *National Geographic News*, July 13, 2011.

Gately, Paul J., Carlton B. Cooke, Julian H. Barth, Bridgette M. Bewick, Duncan Radley, and Andrew J. Hill, "Children's residential weight-loss programs can work: A prospective cohort study of short-term outcomes for overweight and obese children," *Pediatrics*, volume 116, number 1, July 2005.

Gately, P. J., C. B. Cooke, R. J. Butterly, P. Mackreth, and S. Carroll, "The effects of a children's summer camp programme on weight loss, with a 10 month follow-up," *International Journal of Obesity*, volume 24, number 11, November 2000.

Geaney, Fiona, Jessica Scotto Di Marrazzo, Clare Kelly, Anthony P. Fitzgerald, Janas M. Harrington, Ann Kirby et al., "The food choice at work study: Effectiveness of complex workplace dietary interventions on dietary behaviours and diet-related disease risk—study protocol for a clustered controlled trial," *Trials*, volume 14, number 1, November 2013.

Geisler, B., "Alkoholfreies Bier lässt Brauer hoffen," *Hamburger Abendblatt*, November 12, 2011.

Geneva Declaration, *Global burden of armed violence*, Geneva Declaration Secretariat, 2008.

Gillett, M., A. Brennan, L. Blake, N. Payne, L. Goyder, H. B. Woods et al., *Prevention of type 2 diabetes: Preventing pre-diabetes among adults in high-risk groups*, ScHARR Public Health Collaborating Centre, November 2010.

Gillis, B., C. Mobley, D. D. Stadler, J. Hartstein, A. Virus, S. L. Volpe et al., "Rationale, design and methods of the HEALTHY study nutrition intervention component," *International Journal of Obesity*, volume 33, supplement 4, August 2009.

Give Well—Real Change for Your Dollar, *Interpreting the disability-adjusted life-year (DALY) metric*, 2008.

Glanz, Karen, Michael D. M. Bader, and Shally Iyer, "Retail grocery store marketing strategies and obesity," *American Journal of Preventive Medicine*, volume 42, number 5, May 2012.

Glanz, Karen, and Amy L. Yaroch, "Strategies for increasing fruit and vegetable intake in grocery stores and communities: Policy, pricing, and environmental change," *Preventive Medicine*, volume 39, supplement 2, September 2004.

Glasgow, Russell E., Candace C. Nelson, Kathleen A. Kearney, Robert Reid, Debra P. Ritzwoller, Victor J. Strecher et al., "Reach, engagement, and retention in an Internet-based weight loss program in a multi-site randomized controlled trial," *Journal of Medical Internet Research*, volume 9, number 2, 2007.

Global Health, *A healthy dose of Sesame for children worldwide*, 2012.

Goetzel, Ron Z., Enid C. Roemer, Xiaofei Pei, Meghan E. Short, Maryam J. Tabrizi, Mark G. Wilson et al., "Second-year results of an obesity prevention program at the Dow Chemical Company," *Journal of Occupational and Environmental Medicine*, volume 52, number 3, March 2010.

Golan, Elise, and Laurian Unnevehr, "Food product composition, consumer health, and public policy: Introduction and overview of special section," *Food Policy*, volume 33, issue 6, December 2008.

Golan, M., and S. Crow, "Targeting parents exclusively in the treatment of childhood obesity: Long-term results," *Obesity Research*, volume 12, number 2, February 2004.

Golan, Moria, Vered Kaufman, and Danit R. Shahar, "Childhood obesity treatment: Targeting parents exclusively v. parents and children," *British Journal of Nutrition*, volume 95, number 5, May 2006.

Golan, M., A. Weizman, A. Apter, and M. Fainaru, "Parents as the exclusive agents of change in the treatment of childhood obesity," *American Journal of Clinical Nutrition*, volume 67, number 6, June 1998.

Gold, M. R., J. E. Siegel, L. B. Russell, and M. C. Weinstein, *Estimating costs in cost-effectiveness analysis: Cost-effectiveness in health and medicine*, Oxford University Press, 1996.

Goldberg, Marvin E., "A quasi-experiment assessing the effectiveness of TV advertising directed to children," *Journal of Marketing Research*, volume 27, number 4, November 1990.

Goldblatt, Phillip B., Mary E. Moore, and Albert J. Stunkard, "Social factors in obesity," *Journal of the American Medical Association*, volume 192, number 12, June 1965.

Gomel, M., B. Oldenburg, J. Simpson, and N. Owen, "Work-site cardiovascular risk reduction: A randomized trial of health risk assessment, education, counseling, and incentives," *American Journal of Public Health*, volume 83, number 9, September 1993.

Goris, Janny M., Solveig Petersen, Emmanuel Stamatakis, and J. Lennert Veerman, "Television food advertising and the prevalence of childhood overweight and obesity: A multicountry comparison," *Public Health Nutrition*, volume 13, number 7, July 2010.

Gorn, G., and M. Goldberg, "Behavioral evidence of the effects of televised food messages on children," *Journal of Consumer Research*, volume 9, number 2, September 1982.

Gortmaker, Steven L., Aviva Must, James M. Perrin, Arthur M. Sobol, and William H. Dietz, "Social and economic consequences of overweight in adolescence and young adulthood," *New England Journal of Medicine*, volume 329, number 14, September 1993.

Gortmaker, Steven L., Boyd A. Swinburn, David Levy, Rob Carter, Patricia L. Mabry, Diane T. Finegood et al., "Changing the future of obesity: Science, policy, and action," *The Lancet*, volume 378, number 9793, August 2011.

Government Office for Science, United Kingdom, *Reducing obesity: Future choices, project report, second edition*, October 17, 2007.

Gov.UK, *School meals: Healthy eating standards*, November 8, 2013.

Grant, Kelli B., "Insurers offer new incentives to eat healthy," CNBC, April 16, 2014.

Greenspan, Sam, *11 non-alcoholic beers, taste tested*, 11points.com, 2011.

The Guardian, "UK could introduce 'fat tax,' says David Cameron," October 4, 2011.

Haby, M. M., T. Vos, R. Carter, M. Moodie, A. Markwick, A. Magnus et al., "A new approach to assessing the health benefit from obesity interventions in children and adolescents: The assessing cost-effectiveness in obesity project," *International Journal of Obesity*, volume 30, number 10, October 2006.

Hafner, Gabriella Ries, *Food and sustainability: Will the seed bear fruit?* Bank Sarasin, December 2010.

Halford, Jason C. G., Emma J. Boyland, Georgina M. Hughes, Leanne Stacey, Sarah McKean, and Terence M. Dovey, "Beyond-brand effect of television food advertisements on food choice in children: The effects of weight status," *Public Health Nutrition*, volume 11, number 9, September 2008.

Halford, Jason C. G., Emma J. Boyland, Georgina M. Hughes, Lorraine P. Oliveira, and Terence M. Dovey, "Beyond-brand effect of television (TV) food advertisements/commercials on caloric intake and food choice of 5-7-year-old children," *Appetite*, volume 49, number 1, July 2007.

Halford, Jason C. G, Jane Gillespie, Victoria Brown, Eleanor E. Pontin, and Terence M. Dovey, "Effect of television advertisements for foods on food consumption in children," *Appetite*, volume 42, number 2, April 2004.

Hall, J., "Tesco finally introduces 'traffic light' food label system," *The Telegraph*, August 22, 2012.

Hall, Kevin D., "Modeling metabolic adaptations and energy regulation in humans," *The Annual Review of Nutrition*, volume 32, August 2012.

Hall, Kevin D., Gary Sacks, Dhruva Chandramohan, Carson C. Chow, Y. Claire Wang, Steven L. Gortmaker, and Boyd A. Swinburn, "Quantification of the effect of energy imbalance on bodyweight," *The Lancet*, volume 378, number 9793, August 2011.

Hammond, David, Samantha Goodman, Rhona Hanning, and Samantha Daniel, "A randomized trial of calorie labeling on menus," *Preventive Medicine*, volume 57, number 6, December 2013.

Hammond, Ross A., and Ruth Levine, *The economic impact of obesity in the United States*, Economic Studies Program, Brookings Institution, August 2010.

Handy, Susan L. and Yan Xing, "Factors correlated with bicycle commuting: A study in six small US cities," *International Journal of Sustainable Transportation*, volume 5, number 2, 2011.

Harder, T., "Duration of breastfeeding and risk of overweight: A meta-analysis," *American Journal of Epidemiology*, volume 162, number 5, September 2005.

Harding, Matthew, Ephraim Leibtag, and Michael F. Lovenheim, "The heterogeneous geographic and socioeconomic incidence of cigarette taxes: Evidence from Nielsen Homescan Data," *American Economic Journal: Economic Policy*, volume 4, number 4, November 2012.

Hardman, Kenneth, *An update on the status of physical education in schools worldwide: Technical report for the World Health Organization*, International Council of Sport Science and Physical Education and Canadian Society for the Study of Practical Ethics, 2007.

Harnack, Lisa J., Simone A. French, J. Michael Oakes, Mary T. Story, Robert W. Jeffery, and Sarah A. Rydell, "Effects of calorie labeling and value size pricing on fast food meal choices: Results from an experimental trial," *International Journal of Behavioral Nutrition and Physical Activity*, volume 5, number 1, December 2008.

Harper, Clare, Lesley Wood, and Claire Mitchell, *The provision of school food in 18 countries*, School Food Trust, July 2008.

Harris, Jennifer L., John A. Bargh, and Kelly D. Brownell, "Priming effects of television food advertising on eating behavior," *Health Psychology*, volume 28, number 4, July 2009.

Hartmann-Boyce, J., D. J. Johns, S. A. Jebb, P. Aveyard, P., "Effect of behavioural techniques and delivery mode on effectiveness of weight management: Systematic review, meta-analysis and meta-regression," *Obesity Review*, volume 15, issue 7, July 2014.

Hartstein, Jill, Karen W. Cullen, Amy Virus, Laure El Ghormli, Stella L. Volpe, Myrlene A. Staten et al., "Impact of the HEALTHY study on vending machine offerings in middle schools," *Journal of Child Nutrition and Management*, volume 35, issue 2, fall 2011.

Harvard School of Public Health, *Physical activity: Exercise can help control weight*, Obesity Prevention Source website.

Harvey-Berino, J., S. Pintauro, P. Buzzell, M. DiGiulio, E. C. Gold, C. Moldovan, and E. Ramirez, "Does using the Internet facilitate the maintenance of weight loss?" *International Journal of Obesity*, volume 26, number 9, September 2002.

Harvey-Berino, J., S. Pintauro, and E. C. Gold, "The feasibility of using Internet support for the maintenance of weight loss," *Behavior Modification*, volume 26, number 1, January 2002.

Harvey-Berino, Jean, Stephen Pintauro, Paul Buzzell, and Elizabeth Casey Gold, "Effect of Internet support on the long-term maintenance of weight loss," *Obesity Research*, volume 12, number 2, February 2004.

Harvey-Berino, Jean, and Janine Rourke, "Obesity prevention in preschool Native-American children: A pilot study using home visiting," *Obesity Research*, volume 11, number 5, May 2003.

Hauptman, J., C. Lucas, M. Boldrin, H. Collins, and K. Segal, "Orlistat in the long-term treatment of obesity in primary care settings," *Archives of Family Medicine*, volume 9, volume 2, February 2000.

Have, M. ten, I. D. de Beaufort, P. J. Teixeira, J. P. Mackenbach, and A. van der Heide, "Ethics and prevention of overweight and obesity: An inventory," *Obesity Reviews*, volume 12, number 9, September 2011.

Hawkes, Corinna, "Promoting healthy diets and tackling obesity and diet-related chronic diseases: What are the agricultural policy levers?" *Food and Nutrition Bulletin*, volume 28, supplement 2, June 2007.

Hawkes, Corinna, "Regulating and litigating in the public interest—Regulating food marketing to young people worldwide: Trends and policy drivers," *American Journal of Public Health*, volume 97, number 11, December 2007.

Hawkes, Corinna, "Sales promotions and food consumption," *Nutrition Reviews*, volume 67, number 6, June 2009.

He, F. J., and G. A. MacGregor, "A comprehensive review on salt and health and current experience of worldwide salt reduction programmes," *Journal of Human Hypertension*, volume 23, number 6, June 2009.

He, F. J., N. M. Marrero, and G. A. MacGregor, "Salt and blood pressure in children and adolescents," *Journal of Human Hypertension*, volume 22, number 1, January 2008.

He, K., F. B. Hu, G. A. Colditz, J. E. Manson, W. C. Willett, and S. Liu, "Changes in intake of fruits and vegetables in relation to risk of obesity and weight gain among middle-aged women," *International Journal of Obesity*, volume 28, number 12, December 2004.

Health and Social Care Information Centre, *Drinking behaviour among adults and children: Average weekly consumption of different types of drink, by gender and age*, 2009.

Healthy Weight Commitment Foundation, *Major food, beverage companies remove 6.4 trillion calories from US marketplace*, January 2014.

Healthy Weight Commitment Foundation, *Working together to change the outlook of a generation: Five-year anniversary report*, 2014.

Hector, D., P. Espinel Diaz, A. St George, R. Macniven, C. Rissel, and L. King, *A review of available information on workplace physical activity and nutrition challenges*, Prevention Research Collaboration, 2012.

Helmert, Uwe, and Friedrich Schorb, "Übergewicht und Adipositas: Fakten zur neuen deutschen Präventionsdebatte," *Gesundheitsmonitor*, 2007.

Hendrickson, Deja, Chery Smith, and Nicole Eikenberry, "Fruit and vegetable access in four low-income food deserts communities in Minnesota," *Agriculture and Human Values*, volume 23, number 3, October 2006.

Henteleff, Harry, Daniel Birch, and Peter Hallowell, "Cost-effectiveness of bariatric surgery for severely obese adults with diabetes," *Canadian Journal of Surgery*, volume 56, number 5, October 2013.

Heraclides, A., and E. Brunner, "Social mobility and social accumulation across the life course in relation to adult overweight and obesity: The Whitehall II study," *Journal of Epidemiology and Community Health*, volume 64, number 8, August 2010.

Herman, Dena R., Gail G. Harrison, Abdelmonem A. Afifi, and Eloise Jenks, "Effect of a targeted subsidy on intake of fruits and vegetables among low-income women in the Special Supplemental Nutrition Program for Women, Infants, and Children," *American Journal of Public Health*, volume 98, number 1, January 2008.

Hess, I., J. Borg, and C. Rissel, "Workplace nutrition and physical activity promotion at Liverpool Hospital," *Health Promotion Journal of Australia*, volume 22, number 1, April 2011.

Hill, James, Holly Wyatt, and John Peters, "The importance of energy balance," *US Endocrinology*, volume 9, number 1, summer 2013.

Himmelgreen, D. A., R. Pérez-Escamilla, D. Martinez, A. Bretnall, B. Eells, Y. Peng, and A. Bermudez, "The longer you stay, the bigger you get: Length of time in the US and language are associated with obesity in Puerto Rican women," *American Journal of Physical Anthropology*, volume 125, number 1, 2004.

Hirani, Vasant, "Adult anthropometric measures, overweight and obesity," in *Health survey for England—2010, respiratory health*, R. Craig and J. Mindell, eds., Health and Social Care Information Centre, 2010.

HIV Vaccines and Microbicides Resource Tracking Working Group, *Investing to end the AIDS epidemic*, July 2012.

Hoerger, T. J., P. Zhang, J. E. Segel, H. S. Kahn, L. E. Barker, and S. Couper, "Cost-effectiveness of bariatric surgery for severely obese adults with diabetes," *Diabetes Care*, volume 33, number 9, September 2010.

Hope, Jenny, "Vending machines banned," *The Daily Mail*, January 5, 2004.

House of Commons Select Committee on Health, *Health: Third report*, 2004.

Howe, L. D., R. Patel, and B. Galobardes, "Tipping the balance: Wider waistlines in men but wider inequalities in women," *International Journal of Epidemiology*, volume 39, number 2, April 2010.

Howerton, Mollie W., B. Sue Bell, Kevin W. Dodd, David Berrigan, Rachael Stolzenberg-Solomon, and Linda Nebeling, "School-based nutrition programs produced a moderate increase in fruit and vegetable consumption: Meta and pooling analyses from 7 studies," *Journal of Nutrition Education and Behavior*, volume 39, number 4, July 2007.

Hudson Institute, *Better-for-you foods: It's just good business*, October 2011.

Huelsing, J., N. Kanafani, J. Mao, and N. H. White, "Camp Jump Start: Effects of a residential summer weight-loss camp for older children and adolescents," *Pediatrics*, volume 125, number 4, April 2010.

Hughes, D., "Can the government's 'Responsibility Deal' work?" *BBC News Health*, March 20, 2011.

Hurling, Robert, Michael Catt, Marco de Boni, Bruce William Fairley, Tina Hurst, Peter Murray et al., "Using Internet and mobile phone technology to deliver an automated physical activity program: Randomized controlled trial," *Journal of Medical Internet Research*, volume 9, number 2, 2007.

Hutchinson, A. D., and C. Wilson, "Improving nutrition and physical activity in the workplace: A meta-analysis of intervention studies," *Health Promotion International*, volume 27, number 2, June 2012.

Huxley, R., W. P. T. James, F. Barzi, J. V. Patel, S. A. Lear, P. Suryawongpaisal et al., "Ethnic comparisons of the cross-sectional relationships between measures of body size with diabetes and hypertension," *Obesity Reviews*, volume 9, supplement 1, March 2008.

Institute of Alcohol Studies, *Alcohol consumption factsheet (complete)*, August 2013.

The Institute for Economics and Peace, *2012 Global terrorism index: Capturing the impact of terrorism from 2002–2011*, December 2012.

Institute for Health Metrics and Evaluation, *The Global Burden of Disease: Generating evidence, guiding policy*, 2010, 2013.

International Diabetes Federation, *Diabetes: Facts and figures*, 2014.

Irmak, Caglar, Beth Vallen, and Stefanie Rosen Robinson, "The impact of product name on dieters' and nondieters' food evaluations and consumption," *Journal of Consumer Research*, volume 38, number 2, August 2011.

Israel, Allen C., Laurie Stolmaker, and Cynthia A. G. Andrian, "The effects of training parents in general child management skills on a behavioral weight loss program for children," *Behavior Therapy*, volume 16, number 2, March 1985.

Jacobs, G., A. Aeron-Thomas, and A. Astrop, *Estimating global road fatalities*, Transport Research Laboratory and Department for International Development, TRL report number 445, 2000.

James, J., "Preventing childhood obesity by reducing consumption of carbonated drinks: Cluster randomised controlled trial," *BMJ*, volume 328, number 7450, May 2004.

James, W. P., "The fundamental drivers of the obesity epidemic," *Obesity Reviews*, volume 9, supplement 1, March 2008.

Jansen, E., S. Mulkens, A. Jansen, "Tackling childhood overweight: Treating parents exclusively is effective," *International Journal of Obesity*, volume 35, number 4, April 2011.

Jarl, Johan, Ulf G. Gerdtham, and Klara Selin, "Medical net cost of low alcohol consumption: A cause to reconsider improved health as the link between alcohol and wage?" *Cost Effectiveness and Resource Allocation*, volume 7, October 2009.

Jebb, S. A., "A system-wide challenge for UK food policy," *BMJ*, volume 344, number 7857, May 2012.

Jeffery, R., J. Forster, J. Baxter, S. A. French, and S. Kelder, "An empirical evaluation of the effectiveness of tangible incentives in increasing participation and behaviour change in a worksite health promotion program," *American Journal of Health Promotion*, volume 8, number 2, November–December 1993.

Jeffery, R., J. Forster, S. A. French, S. Kelder, H. Lando, P. McGovern et al., "The healthy worker project: A work-site intervention for weight control and smoking cessation," *American Journal of Public Health*, volume 83, number 3, March 1993.

Jeffery, Robert W., J. Forster, and M. K. Snell, "Promoting weight control at the worksite: A pilot program of self-motivation using payroll-based incentives," *Preventive Medicine*, volume 14, number 2, April 1985.

Jeffery, Robert W., Phyllis L. Pirie, Barbara S. Rosenthal, Wendy M. Gerber, and David M. Murray, "Nutrition education in supermarkets: An unsuccessful attempt to influence knowledge and product sales," *Journal of Behavioral Medicine*, volume 5, number 2, June 1982.

Jeffery, Robert W., Sarah Rydell, Caroline L. Dunn, Lisa J. Harnack, Allen S. Levine, Paul R. Pentel et al., "Effects of portion size on chronic energy intake," *International Journal of Behavioral Nutrition and Physical Activity*, volume 4, number 1, June 2007.

Jeffery, Robert W., Sarah Rydell, Caroline L. Dunn, Lisa J. Harnack, Allen S. Levine, Paul R. Pentel et al., "Use of personal trainers and financial incentives to increase exercise in a behavioral weight-loss program," *Journal of Consulting and Clinical Psychology*, volume 66, number 5, 1998.

Jensen, Jørgen D., and Sinne Smed, "Cost-effective design of economic instruments in nutrition policy," *International Journal of Behavioral Nutrition and Physical Activity*, volume 4, number 1, April 2007.

Jensen, Jørgen D., and Sinne Smed, *The Danish tax on saturated fat: Short run effects on consumption and consumer prices of fats*, University of Copenhagen, Department of Food and Resource Economics FOI working paper 2012/14, 2012.

Jiang, J., X. Xia, T. Greiner, G. Wu, G. Lian, and U. Rosenqvist, "The effects of a 3-year obesity intervention in schoolchildren in Beijing," *Child: Care, Health, and Development*, volume 33, number 5, September 2007.

John, Leslie K., George Loewenstein, Andrea B. Troxel, Laurie Norton, Jennifer E. Fassbender, and Kevin G. Volpp, "Financial incentives for extended weight loss: A randomized, controlled trial," *Journal of General Internal Medicine*, volume 26, number 6, June 2011.

Jou, Judy, and Win Techakehakij, "International application of sugar-sweetened beverage (SSB) taxation in obesity reduction: Factors that may influence policy effectiveness in country-specific contexts," *Health Policy*, volume 107, number 1, June 2012.

JPMorgan, *Obesity: Reshaping the food industry*, Global Equity Research, January 2006.

Kalavainen, M. P., M. O. Korppi, and O. M. Nuutinen, "Clinical efficacy of group-based treatment for childhood obesity compared with routinely given individual counseling," *International Journal of Obesity*, volume 31, number 10, October 2007.

Kalorientabelle.net, *Kalorientabelle bier*, 2014.

Kang, Cecilia, "Google crunches data on munching in office," *The Washington Post*, September 2, 2013.

Kapinos, Kandice A., Olga Yakusheva, and Daniel Eisenberg, "Obesogenic environmental influences on young adults: Evidence from college dormitory assignments," *Economics and Human Biology*, volume 12, number 1, January 2014.

Karnehed, Nina E. K., Finn Rasmussen, Tomas Hemmingsson, and Per Tynelius, "Obesity in young adulthood is related to social mobility among Swedish men," *Obesity* (Silver Spring), volume 16, number 3, March 2008.

Katz, D. L., M. O'Connell, M. C. Yeh, H. Nawaz, V. Njike, L. Anderson et al., *Public health strategies for preventing and controlling overweight and obesity in school and worksite settings*, Centers for Disease Control and Prevention, Morbidity and Mortality Weekly Report, volume 54, October 2005.

Katz, D. L., M. O'Connell, Y. Njike, M. C. Yeh, and H. Nawaz, "Strategies for the prevention and control of obesity in the school setting: Systematic review and meta-analysis," *International Journal of Obesity*, volume 32, number 12, December 2008.

Keats, Sharada, and Steve Wiggins, *Future diets: Implications for agriculture and food prices*, Overseas Development Institute, January 2014.

Kelly, Mary T., Julie M. W. Wallace, Paula J. Robson, Kirsten L. Rennie, Robert W. Welch, Mary P. Hannon-Fletcher et al., "Increased portion size leads to a sustained increase in energy intake over 4 d in normal-weight and overweight men and women," *British Journal of Nutrition*, volume 102, number 3, August 2009.

Kelly, T., W. Yang, C. S. Chen, K. Reynolds, and J. He, "Global burden of obesity in 2005 and projections to 2030," *International Journal of Obesity*, volume 32, number 9, September 2008.

Khaylis, Anna, Themis Yiaslas, Jessica Bergstrom, and Cheryl Gore-Felton, "A review of efficacious technology-based weight-loss interventions: Five key components," *Telemedicine and e-Health*, volume 16, number 9, November 2010.

Khazan, Olga, "What the world can learn from Denmark's failed fat tax," *The Washington Post*, November 11, 2012.

Kimani-Murage, Elizabeth W., Kathleen Kahn, John M. Pettifor, Stephen M. Tollman, David B. Dunger, Xavier F. Gómez-Olivé, and Shane A. Norris, "The prevalence of stunting, overweight and obesity, and metabolic disease risk in rural South African children," *BMC Public Health*, volume 10, number 1, March 2010.

King, E. L., A. C. Grunseit, B. J. O'Hara, and A. E. Bauman, "Evaluating the effectiveness of an Australian obesity mass-media campaign: How did the 'Measure-Up' campaign measure up in New South Wales?" *Health Education Research*, volume 28, number 6, December 2013.

Kipping, R. R., R. Jago, and D. A. Lawlor, "Obesity in children—Part 2: Prevention and management," *BMJ*, volume 337, October 2008.

Kirby, J., "More than 3 million diabetics in the UK," *Independent Print*, February 10, 2014.

Kirschenbaum, Daniel S., Edward S. Harris, and Andrew Tomarken, "Effects of parental involvement in behavioral weight loss therapy for preadolescents," *Behavior Therapy*, volume 15, number 5, November 1984.

Kitchen, Sarah, Emily Tanner, Vicky Brown, Colin Payne, Claire Crawford, Lorraine Dearden et al., *Evaluation of the free school meals pilot: Impact report*, Department for Education, United Kingdom, research report number DFE-RR227, January 2013.

Klim, Patricia, and Elisa Dumitrescu, *Share the road: Investment in walking and cycling road infrastructure*, United Nations Environment Programme and FIA Foundation for the Automobile and Society, November 2010.

Kolata, Gina, "Obesity is found to gain its hold in earliest years," *The New York Times*, January 29, 2014.

Kolata, Gina, "Obesity spreads to friends, study concludes," *The New York Times*, July 25, 2007.

Krieger, James W., Nadine L. Chan, Brian E. Saelens, Myduc L. Ta, David Solet, and David W. Fleming, "Menu labeling regulations and calories purchased at chain restaurants," *American Journal of Preventive Medicine*, volume 44, number 6, June 2013.

Kries, R. von, B. Koletzko, T. Sauerwald, E. von Mutius, D. Barnert, V. Grunert, and H. von Voss, "Breast feeding and obesity: Cross sectional study," *BMJ*, volume 319, issue 7203, July 1999.

Kumanyika, S. K., E. Obarzanek, N. Stettler, R. Bell, A. E. Field, S. P. Fortmann et al., "Population-based prevention of obesity: The need for comprehensive promotion of healthful eating, physical activity, and energy balance," *Circulation*, volume 118, number 4, July 2008.

Lader, Deborah, and Matthew Steel, *Opinions survey report no. 42: Drinking—adults' behaviour and knowledge in 2009*, Office for National Statistics, United Kingdom, 2010.

Lambert, E. V., and T. L. Kolbe-Alexander, "Innovative strategies targeting obesity and non-communicable diseases in South Africa: What can we learn from the private healthcare sector?" *Obesity Review*, volume 14, supplement 2, November 2013.

Landon, Jane, and Hannah Graff, *What is the role of health-related food duties*? A report of a National Heart Forum meeting in London, June 29, 2012.

Lang, T., G. Rayner, and E. Kaelin, *The food industry, diet, physical activity and health: A review of reported commitments and practice of 25 of the world's largest food companies*, Center for Food Policy, City University London, April 2006.

Langlois, Arnaud, and Rachel Crossley, *The proof of the pudding: Benchmarking ten of the world's largest food companies' response to obesity and related health concerns*, JPMorgan, April 2008.

Larsen, T. M., S. Toubro, and A. Astrup, "Efficacy and safety of dietary supplements containing CLA for the treatment of obesity: Evidence from animal and human studies," *Journal of Lipid Research*, volume 44, number 12, December 2003.

Larson, N. I., M. T. Story, and M. C. Nelson, "Neighborhood environments: Disparities in access to healthy foods in the US," *American Journal of Preventive Medicine*, volume 36, issue 1, January 2009.

Lassen, A. D., A. Beck, E. Leedo, E. W. Andersen, T. Christensen, H. Mejborn et al., "Effectiveness of offering healthy labelled meals in improving the nutritional quality of lunch meals eaten in a worksite canteen," *Appetite*, volume 75, April 2014.

Lavie, Carl, Neil Johannsen, Damon Swift, Martin Sénéchal, Conrad Earnest, Timothy Church et al., "Exercise is medicine: The importance of physical activity, exercise training, cardiorespiratory fitness, and obesity in the prevention and treatment of type 2 diabetes," *US Endocrinology*, volume 9, issue 2, winter 2013.

Leahy, Kathleen E., Leann L. Birch, and Barbara J. Rolls, "Reducing the energy density of an entree decreases children's energy intake at lunch," *Journal of the American Dietetic Association*, volume 108, number 1, January 2008.

Ledikwe, Jenny H., Barbara J. Rolls, Helen Smiciklas-Wright, Diane C. Mitchell, Jamy D. Ard, Catherine Champagne, Njeri Karanja, Pao-Hwa Lin et al., "Reductions in dietary energy density are associated with weight loss in overweight and obese participants in the PREMIER trial," *American Journal of Clinical Nutrition*, volume 85, number 5, May 2007.

Leete, L., N. Bania, and A. Sparks-Ibanga, "Congruence and coverage: Alternative approaches to identifying urban food deserts and food hinterlands," *Journal of Planning Education and Research*, volume 32, number 2, June 2012.

Leicester, Andrew, and Frank Windmeijer, *The "Fat Tax": Economic incentives to reduce obesity*, Institute for Fiscal Studies briefing note number 49, June 2004.

Leistikow, Bruce N., Daniel C. Martin, and Christina E. Milano, "Fire injuries, disasters, and costs from cigarettes and cigarette lights: A global overview," *Preventive Medicine*, volume 31, number 2, August 2000.

Lemon, Stephenie C., Jane Zapka, Wenjun Li, Barbara Estabrook, Milagros Rosal, Robert Magner et al., "Step ahead," *American Journal of Preventive Medicine*, volume 38, number 1, January 2010.

Leslie, E., A. L. Marshall, N. Owen, and A. Bauman, "Engagement and retention of participants in a physical activity website," *Preventive Medicine*, volume 40, number 1, January 2005.

Leung, Cindy W., Sarah Cluggish, Eduardo Villamor, Paul J. Catalano, Walter C. Willett, and Eric B. Rimm, "Few changes in food security and dietary intake from short-term participation in the Supplemental Nutrition Assistance Program among low-income Massachusetts adults," *Journal of Nutrition Education and Behavior*, volume 46, number 1, January 2014.

Li, L., T. Parsons, and C. Power, "Breast feeding and obesity in childhood: Cross sectional study," *BMJ*, volume 327, October 2003.

Lidl UK, *70 percent of customer prefer healthy tills for their family food shopping*, 2013.

Linenger, J. M., C. V. Chesson, and D. S. Nice, "Physical fitness gains following simple environmental change," *American Journal of Preventive Medicine*, volume 7, number 5, September–October 1991.

Liu, P. J., J. Wisdom, C. A. Roberto, L. J. Liu, and P. A. Ubel, "Using behavioral economics to design more effective food policies to address obesity," *Applied Economic Perspectives and Policy*, volume 36, issue 1, March 2014.

Lobstein, T., L. Baur, and R. Uauy, "Obesity in children and young people: A crisis in public health," *Obesity Reviews*, volume 5, supplement 1, May 2004.

Lombard, David N., Tamara Neubauer Lombard, and Richard A. Winett, "Walking to meet health guidelines: The effect of prompting frequency and prompt structure," *Health Psychology*, volume 14, number 2, March 1995.

Lomborg, Bjorn, "Is counterterrorism good value for money?" *NATO Review*, April 2008.

Lopez, Alan D., Colin D. Mathers, Majid Ezzati, Dean T. Jamison, and Christopher J. L. Murray, *Global burden of disease and risk factors*, World Bank, 2006.

Luepker, Russell V., Cheryl L. Perry, Sonja M. McKinlay, Philip R. Nader, Guy S. Parcel, Elaine J. Stone et al., "Outcomes of a field trial to improve children's dietary patterns and physical activity," *Journal of the American Medical Association*, volume 275, number 10, March 1996.

Mackay, Judith, Michael P. Eriksen, and Hana Ross, *The tobacco atlas, 4th ed.*, American Cancer Society, 2012.

Mackey, John, "Conscious capitalism: Creating a new paradigm for business," www.wholefoodsmarket.com, November 9, 2006.

Madden, David, *The poverty effects of a "fat-tax" in Ireland*, University College Dublin Centre for Economic Research working paper number 13/03, March 2013.

Maetzel, Andreas, J. Ruof, Melva Covington, and Anne Wolf, "Economic evaluation of orlistat in overweight and obese patients with type 2 diabetes mellitus," *PharmacoEconomics*, volume 21, number 7, May 2003.

Magnus, A., M. M. Haby, R. Carter, and B. Swinburn, "The cost-effectiveness of removing television advertising of high-fat and/or high-sugar food and beverages to Australian children," *International Journal of Obesity*, volume 33, number 10, October 2009.

Mandalia, Dhriti, "Children's BMI, overweight and obesity," in *Health survey for England—2011: Health, social care, and lifestyles*, Health and Social Care Information Centre, 2012.

Manios, Yannis, Joanna Moschandreas, Christos Hatzis, and Anthony Kafatos, "Evaluation of a health and nutrition education program in primary school children of Crete over a three-year period," *Preventive Medicine*, volume 28, number 2, February 1999.

Martínez-Ruiz, M. P., A. Mollá-Descals, M. A., Gómez-Borja, and J. L. Rojo-Álvarez, "Using daily store-level data to understand price promotion effects in a semiparametric regression model," *Journal of Retailing and Consumer Services*, volume 13, number 3, May 2006.

Mason, Katherine, "The unequal weight of discrimination: Gender, body size, and income inequality," *Social Problems*, volume 59, number 3, August 2012.

Mauri, C., "Card loyalty: A new emerging issue in grocery retailing," *Journal of Retailing and Consumer Services*, volume 10, number 1, January 2003.

McCormick, B., and I. Stone, "Economic costs of obesity and the case for government intervention," *Obesity Reviews*, volume 8, supplement 1, March 2007.

McCrady, Shelly K., and James A. Levine, "Sedentariness at work: How much do we really sit?" *Obesity* (Silver Spring), volume 17, number 11, November 2009.

McDonald, Noreen C., "Active transportation to school: Trends among US schoolchildren, 1969–2001," *American Journal of Preventative Medicine*, volume 32, issue 6, June 2007.

McFadden, Alison, Josephine M. Green, Victoria Williams, Jenny McLeish, Felicia McCormick, Julia Fox-Rushby, and Mary J. Renfrew, "Can food vouchers improve nutrition and reduce health inequalities in low-income mothers and young children? A multi-method evaluation of the experiences of beneficiaries and practitioners of the Healthy Start programme in England," *BMC Public Health*, volume 14, number 1, 2014.

McKinsey & Company, *A cost-effective path to road safety*, McKinsey on Society, 2013.

McKinsey Global Institute, *Urban world: Mapping the economic power of cities*, March 2011.

McMichael, A. J., D. H. Campbell-Lendrum, C. F. Corvalán, K. L. Ebi, A. Githeko, J. D. Scheraga, and A. Woodward, eds., *Climate change and human health: Risks and responses*, World Health Organization, 2003.

Mejia, Luis C., and Mark J. Eppli, "The effect of merchandise space allocation on retail sales in enclosed shopping centers," *Journal of Shopping Center Research*, volume 6, number 2, 1999.

Menrad, Klaus, "Market and marketing of functional food in Europe," *Journal of Food Engineering*, volume 56, numbers 2–3, February 2003.

Mercer, Shawna L., Lawrence W. Green, Abby C. Rosenthal, Corinne G. Husten, Laura Kettel Khan, and William H. Dietz, "Possible lessons from the tobacco experience for obesity control," *American Journal of Clinical Nutrition*, volume 77, number 4, April 2003.

Michie, Susan, Stefanie Ashford, Falko F. Sniehotta, Stephan U. Dombrowski, Alex Bishop, and David P. French, "A refined taxonomy of behaviour change techniques to help people change their physical activity and healthy eating behaviours: The CALO-RE taxonomy," *Psychology Health*, volume 26, number 11, June 2011.

Michie, Susan, Maartje M. van Stralen, and Robert West, "The behaviour change wheel: A new method for characterising and designing behaviour change interventions," *Implementation Science*, volume 6, number 1, April 2011.

Milani, Richard V., and Carl J. Lavie, "Impact of worksite wellness intervention on cardiac risk factors and one-year health care costs," *American Journal of Cardiology*, volume 104, issue 10, November 2009.

Miles, A., L. Rapoport, J. Wardle, T. Afuape, and M. Duman, "Using the mass-media to target obesity: An analysis of the characteristics and reported behavior change of participants in the BBC's 'Fighting Fat, Fighting Fit' campaign," *Health Education Research*, volume 16, number 3, 2001.

Ministry of Justice, New Zealand, *Alcohol law changes for the industry—December 2013*, December 18, 2013.

Moodie, Marjory L., Robert C. Carter, Boyd A. Swinburn, and Michelle M. Haby, "The cost-effectiveness of Australia's active after-school communities program," *Obesity* (Silver Spring), volume 18, number 8, 2009.

Moodie, Marjory L., Jessica K. Herbert, Andrea M. de Silva-Sanigorski, Helen M. Mavoa, Catherine L. Keating, Robert C. Carter et al., "The cost-effectiveness of a successful community-based obesity prevention program: The Be Active Eat Well program," *Obesity* (Silver Spring), volume 21, number 10, October 2013.

Moore, Latetia V., Ana V. Diez Roux, Kelly R. Evenson, Aileen P. McGinn, and Shannon J. Brines, "Availability of recreational resources in minority and low socioeconomic status areas," *American Journal of Preventive Medicine*, volume 34, number 1, January 2008.

Morgan, Philip J., Clare E. Collins, Ronald C. Plotnikoff, Alyce T. Cook, Bronwyn Berthon, Simon Mitchell, and Robin Callister, "Efficacy of a workplace-based weight loss program for overweight male shift workers: The workplace POWER (Preventing Obesity Without Eating like a Rabbit) randomized controlled trial," *Preventive Medicine*, volume 52, number 5, May 2011.

Morley, Belinda, Maree Scully, Jane Martin, Philippa Niven, Helen Dixon, and Melanie Wakefield, "What types of nutrition menu labelling lead consumers to select less energy-dense fast food? An experimental study," *Appetite*, volume 67, March 2013.

Mo-suwan, L., S. Pongprapai, C. Junjana, and A. Puetpaiboon, "Effects of a controlled trial of a school-based exercise program on the obesity indexes of preschool children," *American Journal of Clinical Nutrition*, volume 68, number 5, November 1998.

Mouratidou, Theodora, Fiona A. Ford, Sarah E. Wademan, and Robert B. Fraser, "Are the benefits of the 'Healthy Start' food support scheme sustained at three months postpartum? Results from the Sheffield 'before and after' study," *Maternal and Child Nutrition*, volume 6, number 4, October 2010.

Murray, Christopher J. L., "Quantifying the burden of disease: The technical basis for disability-adjusted life years," *Bulletin of World Health Organization*, volume 72, number 3, 1994.

Mytton, O., D. Clarke, and M. Rayner, "Taxing unhealthy food and drinks to improve health," *BMJ*, volume 344, number 7857, May 2012.

Mytton, O., A. Gray, M. Rayner, and H. Rutter, "Could targeted food taxes improve health?" *Journal of Epidemiology and Community Health*, volume 61, number 8, August 2007.

Nadeau, Marie-Ève, *La publicité alimentaire destinée aux enfants,* Coalition québecoise sur la problématique du poids, January 2011.

Narbro, Kristina, Göran Ågren, Egon Jonsson, Ingmar Näslund, Lars Sjöström, and Markku Peltonen, "Pharmaceutical costs in obese individuals," *Archives of Internal Medicine*, volume 162, number 18, October 2002.

Nascimento, S., J. Pudwell, F. Surita, K. Adamo, and G. Smith, "The effect of physical exercise strategies on weight loss in postpartum women: A systematic review and meta-analysis," *International Journal of Obesity*, volume 38, number 5, May 2014.

National Health Service, *The effectiveness of public health campaigns*, Health Development Agency briefing number 7, June 2004.

National Heart Foundation, *The supermarket as an environment for facilitating dietary behaviour* change, June 2012.

National Institute for Health and Clinical Excellence and National Collaborating Centre for Primary Care, "Health economics," in *Obesity: The prevention, identification, assessment and management of overweight and obesity in adults and children*, December 2006.

National Institute of Alcohol Abuse and Alcoholism, *Study associates alcohol use patterns with body mass index*, February 2005.

National Literacy Trust, *New report shows illiteracy costing the world $1.19 trillion*, March 2012.

National Obesity Forum, *State of the nation's waistline: Obesity in the UK—Analysis and expectations*, January 2014.

National Obesity Observatory, *Adult obesity and socioeconomic status*, NOO Data Factsheet, October 2010.

National Obesity Observatory, *Child obesity and socioeconomic status*, NOO Data Factsheet, September 2012.

National Obesity Observatory, *Socio and economic inequalities in diet and physical activity*, November 2013.

National Public Health Partnership, *An intervention portfolio to promote fruit and vegetable consumption: Part 1—The process and portfolio*, 2000.

National Public Health Partnership, *An intervention portfolio to promote fruit and vegetable consumption: Part 2—Review of interventions*, 2000.

Nelson, Michael, Jo Nicholas, Katy Riley, and Lesley Wood, *Seventh annual survey of take up of school lunches in England 2011–2012*, School Food Trust, July 2012.

Neovius, M., and K. Narbro, "Cost-effectiveness of pharmacological anti-obesity treatments: A systematic review," *International Journal of Obesity*, volume 32, number 12, 2008.

Nestle, M., "Food marketing and childhood obesity: A matter of policy," *New England Journal of Medicine*, volume 354, number 24, June 2006.

Ng, Marie, Tom Fleming, Margaret Robinson, Blake Thomson, Nicholas Graetz, Christopher Margono et al., "Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: A systematic analysis for the Global Burden of Disease Study 2013," *The Lancet*, volume 384, issue 9945, August 2014.

Ng, Shu Wen, Cliona Ni Mhurchu, Susan A. Jebb, and Barry M. Popkin, "Patterns and trends of beverage consumption among children and adults in Great Britain, 1986–2009," *British Journal of Nutrition*, volume 108, number 3, August 2012.

Ng, Shu Wen, and Barry M. Popkin, "Impacts of China's edible oil pricing policy on nutrition," *Society of Science Medicine*, volume 66, number 2, January 2008.

NHS Choices, *Do diet drinks really make you fatter?* National Health Service, January 2014.

NHS Choices, *Food labels,* National Health Service, June 2013.

NHS Choices, *Half of UK obese by 2030*, National Health Service, August 2011.

Ni Mhurchu, C., T. Blakely, Y. Jiang, H. C. Eyles, and A. Rodgers, "Effects of price discounts and tailored nutrition education on supermarket purchases: A randomized controlled trial," *American Journal of Clinical Nutrition*, volume 91, number 3, March 2010.

Nielsen, Samara Joy, Brian K. Kit, Tala Fakhouri, and Cynthia L. Ogden, *Calories consumed from alcoholic beverages by US adults, 2007–2010*, National Center for Health Statistics data brief number 110, November 2012.

Nnoaham, K. E., G. Sacks, M. Rayner, O. Mytton, and A. Gray, "Modelling income group differences in the health and economic impacts of targeted food taxes and subsidies," *International Journal of Epidemiology*, volume 38, number 5, October 2009.

Nolte, Stephan, Jeroen Buysse, Bart Van der Straeten, Dakerlia Claeys, Ludwig Lauwers, and Guido van Huylenbroeck, "Modelling the effects of an abolition of the EU sugar quota on internal prices, production and imports," paper prepared for presentation at the 114th European Association of Agricultural Economists seminar, "Structural Change in Agriculture," in Berlin, April 15–16, 2010.

Norwich Union Healthcare, *UK employees admit that regular drinking affects their jobs*, May 2008.

Novaes, J. F., J. A. Lamounier, E. A. Colosimo, S. C. C. Franceschini, and S. E. Priore, "Breastfeeding and obesity in Brazilian children," *European Journal of Public Health*, volume 22, number 3, June 2012.

Novak, Nicole L. and Kelly D. Brownell, "Taxation as prevention and as a treatment for obesity: The case of sugar-sweetened beverages," *Current Pharmaceutical Design*, volume 17, number 12, January 2011.

Novotny, T. E., and F. Zhao, "Consumption and production waste: Another externality of tobacco use," *Tobacco Control*, volume 8, issue 1, spring 1999.

Oaks, Brion, *An evaluation of the snack tax on the obesity rate of Maine*, masters of public administration applied research project submitted to Texas State University Department of Political Science, fall 2005.

Obadia, J., and J. Porter, *Farmers markets: Impact on fruit and vegetable consumption of Supplemental Nutrition Assistance Program clients*, Boston Collaborative for Food and Fitness, 2013.

Obesity in Asia Collaboration, "Waist circumference thresholds provide an accurate and widely applicable method for the discrimination of diabetes," *Diabetes Care*, volume 30, number 12, December 2007.

Organisation for Economic Co-operation and Development, *Obesity update*, June 2014.

Ofcom, *Television advertising of food and drink products to children: Options for new restrictions*, March 2006.

Ofcom, *Impact assessment: Food advertising to children*, 2007.

Ofcom, *Code on the scheduling of television advertising*, December 2010.

Ofcom, *HFSS advertising restrictions*, July 2010.

Office de la protection du consommateur Quebec, *Publicité destinée aux enfants de moins de 13 ans: Guide d'application des articles 248 et 249*, 2012.

Office for Standards in Education, Children's Services and Skills, United Kingdom, *Beyond 2012: Outstanding physical education for all*, February 14, 2013.

Office for Standards in Education, Children's Services and Skills, United Kingdom, *Not yet good enough: Personal, social, health and economic situation in schools*, May 1, 2013.

Ogden, Cynthia L., Molly M. Lamb, Margaret D. Carroll, and Katherine M. Flegal, *Obesity and socioeconomic status in adults in the United States, 2005–2008*, National Center for Health Statistics data brief number 50, December 2010.

Ogilvie, D., C. E. Foster, H. Rothnie, N. Cavill, V. Hamilton, C. F. Fitzsimons, and N. Mutrie, "Interventions to promote walking: Systematic review," *BMJ*, volume 334, number 7605, June 2007.

O'Grady, M., and J. Capretta, *Assessing the economics of obesity and obesity interventions*, Campaign to End Obesity, March 2012.

Oken, Emily, and Matthew W. Gillman, "Fetal origins of obesity," *Obesity Research*, volume 11, number 4, April 2003.

O'Meara, O., R. Riemsa, L. Shirran, L. Mather, and G. ter Riet, "A rapid and systematic review of the clinical effectiveness and cost-effectiveness of orlistat in the management of obesity," *Health Technology Assessment*, volume 5, number 18, February 2001.

Oommen, V. G., and P. J. Anderson, "Policies on restriction of food advertising during children's television viewing times: An international perspective," in *Proceedings, Australian College of Health Service Executives 2008 Conference*, Gold Coast, Australia, May 29–30, 2008.

Østbye, Truls, Katrina M. Krause, Cheryl A. Lovelady, Miriam C. Morey, Lori A. Bastian, Bercedis L. Peterson et al., "Active mothers postpartum: A randomized controlled weight-loss intervention trial," *American Journal of Preventive Medicine*, volume 37, number 3, September 2009.

Østbye, Truls, Katrina M. Krause, Marissa Stroo, Cheryl A. Lovelady, Kelly R. Evenson, Bercedis L. Peterson et al., "Parent-focused change to prevent obesity in preschoolers: Results from the KAN-DO study," *Preventive Medicine*, volume 55, number 3, September 2012.

O'Tierney, Perrie F., David J. P. Barker, Clive Osmond, Eero Kajantie, and Johan G. Eriksson, "Duration of breast-feeding and adiposity in adult life," *Journal of Nutrition*, volume 139, number 2, February 2009.

Owen, C., R. Martin, P. Whincup, G. Davey-Smith, M. W. Gillman, and D. Cook, "The effect of breastfeeding on mean body mass index throughout life: A quantitative review of published and unpublished observational evidence," *American Journal of Clinical Nutrition*, volume 82, number 6, December 2005.

Pagoto, Sherry, Kristin Schneider, Mirjana Jojic, Michele DeBiasse, and Devin Mann, "Evidence-based strategies in weight-loss mobile apps," *American Journal of Preventive Medicine*, volume 45, number 5, November 2013.

Pamela K. O'Neal, *Childhood obesity campaigns: A comparative analysis of media campaigns targeting general and specific audiences*, master's thesis, Wichita State University, College of Liberal Arts and Sciences, Elliott School of Communication, August 2010.

Panjwani, Clare, and Martin Caraher, "The Public Health Responsibility Deal: Brokering a deal for public health, but on whose terms?" *Health Policy*, volume 114, numbers 2–3, February 2014.

Park, Sohyun, William M. Sappenfield, Youjie Huang, Bettylou Sherry, and Diana M. Bensyl, "The impact of the availability of school vending machines on eating behavior during lunch: The Youth Physical Activity and Nutrition Survey," *Journal of the American Dietetic Association*, volume 110, number 10, October 2010.

Partlow, Joshua, "Mexico's soda companies fear junk-food tax," *The Washington Post*, October 27, 2014.

Patel, Sumaiya, Avni Vyas, Adnan Custovic, and Clare S. Murray, "Estimated portion sizes in a school-aged population," *Public Health Nutrition*, volume 15, number 12, December 2012.

Pearce, J., L. Wood, J. Nicholas, and L. Stevens, "Portion weights of food served in English schools: How do they compare to the portion size guidelines for Scottish schools?" *Proceedings of the Nutrition Society*, volume 71, issue OCE2, January 2012.

Pearce, J., L. Wood, and L. Stevens, "Portion weights of food served in English schools: Have they changed following the introduction of nutrient-based standards?" *Journal of Human Nutrition and Dietetics*, volume 26, number 6, December 2013.

Pearce, Jo, Clare Harper, Dalia Haroun, Lesley Wood, and Michael Nelson, "Short communication: Key differences between school lunches and packed lunches in primary schools in England in 2009," *Public Health Nutrition*, volume 14, number 8, August 2011.

Pedersen, Sue D., Jian Kang, and Gregory A. Kline, "Portion control plate for weight loss in obese patients with type 2 diabetes mellitus: A controlled clinical trial," *Archives of Internal Medicine*, volume 167, number 12, June 2007.

Peñalvo, José L., Jaime Céspedes, and Valentín Fuster, "Sesame Street: Changing cardiovascular risks for a lifetime," *Seminars in Thoracic and Cardiovascular Surgery*, volume 24, number 4, January 2012.

Petkantchin, Valentin, *"Nutrition" taxes: The costs of Denmark's fat tax*, Institute Économique Molinari economic note, May 2013.

Picot, J., J. Jones, J. L. Colquitt, and E. Gospodarevskaya, "The clinical effectiveness and cost-effectiveness of bariatric (weight loss) surgery for obesity: A systematic review and economic evaluation" (executive summary), *Health Technology Assessment*, volume 13, number 41, September 2009.

Piernas, C., and B. M. Popkin, "Snacking increased among US adults between 1977 and 2006," *Journal of Nutrition*, volume 140, number 2, February 2010.

Pietinen, P., *Finland's experiences in salt reduction*, National Institute for Health and Welfare, October 21, 2009.

Pinhas-Hamiel, O., and P. Zeitler, "The global spread of type 2 diabetes mellitus in children and adolescents," *Journal of Pediatrics*, volume 146, 2005.

Pollan, Michael, *Food rules: An eater's manual*, Penguin Press, April 2013.

Pollard, Christina M., Margaret R. Miller, Alison M. Daly, Kathy E. Crouchley, Kathy J. O'Donoghue, Anthea J. Lang, and Colin W. Binns, "Increasing fruit and vegetable consumption: Success of the Western Australian Go for 2&5 campaign," *Public Health Nutrition*, volume 11, number 3, March 2008.

Pomeranz, Jennifer L., "Sugary beverage tax policy: Lessons learned from tobacco," *American Journal of Public Health*, volume 104, number 3, March 2014.

Pomerleau, Joceline, Karen Lock, Cécile Knai, and Martin McKee, "Interventions designed to increase adult fruit and vegetable intake can be effective: A systematic review of literature," *Journal of Nutrition*, volume 35, number 10, October 2005.

Pomerleau, Joceline, Karen Lock, Cécile Knai, and Martin McKee, *Effectiveness of interventions and programmes promoting fruit and vegetable intake*, World Health Organization, 2005.

Popkin, Barry M., "Will China's nutrition transition overwhelm its health care system and slow economic growth?" *Health Affairs*, volume 27, number 4, 2008.

Poulter, Sean, "Shrinking Mars bar: Size cut by 7.2 percent but price stays the same," *The Daily Mail*, June 3, 2009.

Powell, L. M., G. Szczypka, F. J. Chaloupka, and C. L. Braunschweig, "Nutritional content of television food advertisements seen by children and adolescents in the United States," *Pediatrics*, volume 120, number 3, September 2007.

Powell, Lisa M., and Frank J. Chaloupka, "Food prices and obesity: Evidence and policy implications for taxes and subsidies," *Milbank Quarterly*, volume 87, number 1, March 2009.

Powell, Lisa M., and Jamie F. Chriqui, "Food taxes and subsidies: Evidence and policies for obesity prevention," in *The Oxford handbook of the social science of obesity*, John Cawley, ed., Oxford University Press, 2011.

Pratt, Charlotte A., Stephenie C. Lemon, Isabel Diana Fernandez, Ron Goetzel, Shirley A. Beresford, Simone A. French et al., "Design characteristics of worksite environmental interventions for obesity prevention," *Obesity* (Silver Spring), volume 15, number 9, September 2007.

Preston, S., A. Stokes, N. Mehta, and B. Cao, *How will more obesity and less smoking affect life expectancy?* Center for Retirement Research at Boston College IB number 14–2, January 2014.

Proceedings, Australian College of Health Service Executives 2008 Conference, "Going for gold in health: Motivation, effort, performance," Gold Coast, Australia, 2008.

Pronk, Nicolaas P., and R. R. Wing, "Physical activity and long-term maintenance of weight loss," *Obesity Research*, volume 2, number 6, November 1994.

Public Health England, *National Child Measurement Programme: England, 2012/13 school year*, Health and Care Information Centre, December 2013.

Public Health England, *Obesity and health*, 2014.

Pucher, John, and Lewis Dijkstra, "Promoting safe walking and cycling to improve public health: Lessons from the Netherlands and Germany," *American Journal of Public Health*, volume 93, number 9, September 2003.

Quelch, John, Margaret Rodriguez, Carin-Isabel Knoop, and Christine Snively, "Demarketing soda in New York City," *Harvard Business Review*, October 2013.

Raby, G., "The costs of terrorism and the benefits of cooperating to combat terrorism," paper presented to Asia-Pacific Economic Cooperation Senior Officials Meeting in Chiang Rai, Thailand, February 21, 2003.

Racette, Susan B., Susan S. Deusinger, Cindi L. Inman, Tamara L. Burlis, Gabrielle R. Highstein, Trent D. Buskirk et al., "Worksite Opportunities for Wellness (WOW): Effects on cardiovascular disease risk factors after 1 year," *Preventive Medicine*, volume 49, numbers 2–3, August–September 2009.

Ralph, Alex, "Tesco chief calls for laws to extend fight against obesity," *The Times*, December 26, 2013.

Ramanathan, Usha, and Luc Muyldermans, "Identifying demand factors for promotional planning and forecasting: A case of a soft drink company in the UK," *International Journal of Production Economics*, volume 128, number 2, January 2010.

Rao, M., A. Afshin, G. Singh, and D. Mozaffarian, "Do healthier foods and diet patterns cost more than less healthy options? A systematic review and meta-analysis," *BMJ*, volume 3, number 12, December 2013.

Rasch, Andrej, and Wolfgang Greiner, "Cost-effectiveness of smoking prevention measures in adolescents," *Journal of Public Health*, volume 16, number 1, February 2008.

Raulio, Susanna, Eva Roos, and Ritva Prättälä, "School and workplace meals promote healthy food habits," *Public Health Nutrition*, volume 13, number 6A, June 2010.

Ray, R., L. H. Lim, and S. L. Ling, "Obesity in preschool children: An intervention programme in primary health care in Singapore," *Annals of the Academy of Medicine*, Singapore, volume 23, number 3, May 1994.

Rayner, M., "The burden of food related ill health in the UK," *Journal of Epidemiology and Community Health*, volume 59, number 12, December 2005.

Reger-Nash, Bill, Adrian Bauman, Steven Booth-Butterfield, Linda Cooper, Holli Smith, Tien Chey, and Kenneth J. Simon, "Wheeling walks: evaluation of a media-based community intervention," *Family and Community Health*, volume 28, number 1, March 2005.

Regulatory Policy Committee, United Kingdom, *Impact assessment opinion: Banning below cost sales of alcohol*, February 7, 2014.

Rehm, Jürgen, Colin Mathers, Svetlana Popova, Montarat Thavorncharoensap, Yot Teerawattananon, and Jayadeep Patra, "Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders," *The Lancet*, volume 373, number 9682, June 2009.

Relton, C., M. Strong, and J. Li, "The 'Pounds for Pounds' weight loss financial incentive scheme: An evaluation of a pilot in NHS Eastern and Coastal Kent," *Journal of Public Health*, volume 33, number 4, December 2011.

Renwick, Alan, Cesar Revoredo-Giha, George Philippidis, Michael Bourne, Mark Reader, and Ben Lang, "Sugar and spice and all things nice? Assessing the impact of the 2006 EU sugar regime reforms," paper prepared for presentation at the 86th annual conference of the Agricultural Economics Society in Coventry, UK, April 16–18, 2012.

Reynolds, Chelsea, "Myth surrounds reform's 'Safeway Amendment,'" *Association of Health Care Journalists*, January 20, 2010.

Rigsby, Andrea, Daniel M. Gropper, and Sareen S. Gropper, "Success of women in a worksite weight loss program: Does being part of a group help?" *Eating Behaviors*, volume 10, number 2, May 2009.

Rivard, Cheryl, Danielle Smith, Susan E. McCann, and Andrew Hyland, "Taxing sugar-sweetened beverages: A survey of knowledge, attitudes and behaviours," *Public Health Nutrition*, volume 15, number 8, August 2012.

Robert Wood Johnson Foundation, "Impact of menu labeling on consumer behavior: A 2008–2012 update," *Research Review*, June 2013.

Roberto, Christina A., Peter D. Larsen, Henry Agnew, Jenny Baik, and Kelly D. Brownell, "Evaluating the impact of menu labeling on food choices and intake," *American Journal of Public Health*, volume 100, number 2, February 2010.

Roberto, Christina A., Meenakshi Shivaram, Olivia Martinez, Cassie Boles, Jennifer L. Harris, and Kelly D. Brownell, "The Smart Choices front-of-package nutrition label: Influence on perceptions and intake of cereal," *Appetite*, volume 58, number 2, April 2012.

Roberts, T., and A. Wendt, "Indoor air quality," in *Interior Design and Global Impacts 2007*, American Society of Interior Designers, 2006.

Robinson, Thomas N., "Reducing children's television viewing to prevent obesity," *Journal of the American Medical Association*, volume 282, number 16, October 1999.

Rolls, Barbara J., Tanja V. E. Kral, Jennifer S. Meengs, and Denise E. Wall, "Increasing the portion size of a packaged snack increases energy intake in men and women," *Appetite*, volume 42, number 1, February 2004.

Rolls, Barbara J., Liane S. Roe, and Jennifer S. Meengs, "The effect of large portion sizes on energy intake is sustained for 11 days," *Obesity* (Silver Spring), volume 15, number 6, June 2007.

Rolls, Barbara J., Liane S. Roe, and Jennifer S. Meengs, "Larger portion sizes lead to a sustained increase in energy intake over 2 days," *Journal of the American Dietetic Association*, volume 106, number 4, April 2006.

Rose, Brent, "The best non-alcoholic beer," Gizmodo, September 2013.

Rowe, Sylvia, Nick Alexander, Nelson Almeida, Richard Black, Robbie Burns, Laina Bush et al., "Food science challenge: Translating the dietary guidelines for Americans to bring about real behavior change," *Journal of Food Science*, volume 76, number 1, February 2011.

Rowley, Jennifer, "Building brand webs: Customer relationship management through the Tesco Clubcard loyalty scheme," *International Journal of Retail and Distribution Management*, volume 33, number 3, March 2005.

Rucker, D., R. Padwal, S. K. Li, C. Curioni, and D. C. W. Lau, "Long term pharmacotherapy for obesity and overweight: Updated meta-analysis," *BMJ*, volume 335, number 7631, December 2007.

Rudolf, M., "Prevention of obesity through home visiting up to the age of 2 years," *BMJ*, volume 344, number 7865, July 2012.

Rudolf, Mary, *Tackling obesity through the Healthy Child Programme: A framework for action*, Public Health England, November 2009.

Rudolf, M., D. Christie, S. McElhone, P. Sahota, R. Dixey, J. Walker, and C. Wellings, "WATCH IT: A community based programme for obese children and adolescents," *Archives of Disease in Childhood*, volume 91, number 9, September 2006.

Rudolf, M. C. J., C. Hunt, J. George, K. Hajibagheri, and M. Blair, "HENRY: Development, pilot and long-term evaluation of a programme to help practitioners work more effectively with parents of babies and pre-school children to prevent childhood obesity," *Child: Care, Health and Development*, volume 36, number 6, November 2010.

Ruof, J., A. Golay, C. Berne, C. Collin, J. Lentz, and A. Maetzel, "Orlistat in responding obese type 2 diabetic patients: Meta-analysis findings and cost-effectiveness as rationales for reimbursement in Sweden and Switzerland," *International Journal of Obesity*, volume 29, number 5, May 2005.

Rutter, Harry, "The single most important intervention to tackle obesity …" *International Journal of Public Health*, volume 57, number 4, August 2012.

Sacher, Paul M., Maria Kolotourou, Paul M. Chadwick, Tim J. Cole, Margaret S. Lawson, Alan Lucas, and Atul Singhal, "Randomized controlled trial of the MEND Program: A family-based community intervention for childhood obesity," *Obesity* (Silver Spring), volume 18, supplement 1, February 2010.

Sacks, G., M. Rayner, and B. Swinburn, "Impact of front-of-pack 'traffic-light' nutrition labelling on consumer food purchases in the UK," *Health Promotion International*, volume 24, number 4, December 2009.

Sacks, G., J. L. Veerman, M. Moodie, and B. Swinburn, "'Traffic-light' nutrition labelling and 'junk-food' tax: A modelled comparison of cost-effectiveness for obesity prevention," *International Journal of Obesity*, volume 35, number 7, July 2011.

Sacks, Gary, Kim Tikellis, Lynne Millar, and Boyd Swinburn, "Impact of 'traffic-light' nutrition information on online food purchases in Australia," *Australian and New Zealand Journal of Public Health*, volume 35, number 2, April 2011.

Sadler, K., S. Nicholson, T. Steer, V. Gill, B. Bates, S. Tipping et al., *National Diet and Nutrition Survey: Assessment of dietary sodium in adults (aged 19 to 64 years) in England, 2011*, Department of Health, June 2012.

Sadler, Richard, Jason Gilliland, and Godwin Arku, "A food retail-based intervention on food security and consumption," *International Journal of Environmental Research and Public Health*, volume 10, number 8, August 2013.

Sallis, James F., Heather R. Bowles, Adrian Bauman, Barbara E. Ainsworth, Fiona C. Bull, Cora L. Craig et al., "Neighborhood environments and physical activity among adults in 11 countries," *American Journal of Preventive Medicine*, volume 36, number 6, June 2009.

Sallis, James F., and Jacqueline Kerr, "Physical activity and the built environment (President's Council on Physical Fitness and Sports)," Research Digest, series 7, number 4, 2006.

Sallis, James F., Thomas L. McKenzie, John E. Alcaraz, Bohdan Kolody, Melbourne F. Hovell, and Philip R. Nader, "Project SPARK: Effects of physical education on adiposity in children," *Annals of the New York Academy of Sciences*, volume 699, October 1993.

Salonen, Minna K., Eero Kajantie, Clive Osmond, Tom Forsén, Hilkka Ylihärsilä, Maria Paile-Hyvärinen et al., "Role of socioeconomic indicators on development of obesity from a life course perspective," *Journal of Environmental and Public Health*, volume 2009, 2009.

Sánchez-Castillo, Claudia P., Oscar Velásquez-Monroy, Agustín Lara-Esqueda, Arturo Berber, Jaime Sepulveda, Roberto Tapia-Conyer, and W. Philip T. James, "Diabetes and hypertension increases in a society with abdominal obesity: Results of the Mexican National Health Survey 2000," *Public Health Nutrition*, volume 8, number 1, February 2005.

Sanigorski, A. M., A. C. Bell, P. J. Kremer, R. Cuttler, and B. A. Swinburn, "Reducing unhealthy weight gain in children through community capacity-building: Results of a quasi-experimental intervention program, Be Active Eat Well," *International Journal of Obesity*, volume 32, number 7, July 2008.

Sassi, Franco, *Obesity and the economics of prevention: Fit not fat*, OECD, September 2010.

Savage, Jennifer S., Jennifer Orlet Fisher, and Leann L. Birch, "Parental influence on eating behavior: Conception to adolescence," *Journal of Law, Medicine, and Ethics*, volume 35, issue 1, March 2007.

Sayer, A., H. Syddall, E. Dennison, H. Gilbody, S. Duggleby, C. Cooper et al., "Birth weight, weight at 1 y of age, and body composition in older men: Findings from the Hertfordshire Cohort Study," *American Journal of Clinical Nutrition*, volume 80, number 1, July 2004.

Scarborough, Peter, Prachi Bhatnagar, Kremlin K. Wickramasinghe, Steve Allender, Charlie Foster, and Mike Rayner, "The economic burden of ill health due to diet, physical inactivity, smoking, alcohol and obesity in the UK: An update to 2006–07 NHS costs," *Journal of Public Health*, volume 33, number 4, May 2011.

Schmidt, Harald, Andreas Gerber, and Stephanie Stock, "What can we learn from German health incentive schemes?" *BMJ*, volume 339, number 3504, September 2009.

Schmoldt, A., H. F. Benthe, and G. Haberland, "Digitoxin metabolism by rat liver microsomes," *Biochemical Pharmacology*, volume 24, number 17, September 1975.

School Food Trust, *National survey of vending in secondary schools in England, 2006–2009*, May 2010.

School Food Trust, *Parent voice: School meals and packed lunches*, August 2011.

School Food Trust, *School lunch take up and obesity*, June 2012.

School Food Trust, *Secondary school food survey 2011*, 2011.

Schwartz, J., J. Riis, B. Elbel, and D. Ariely, "Inviting consumers to downsize fast-food portions significantly reduces calorie consumption," *Health Affairs*, volume 31, number 2, February 2012.

Schwartz, Marlene B., and Kelly D. Brownell, "Actions necessary to prevent childhood obesity: Creating the climate for change," *Journal of Law, Medicine, and Ethics*, volume 35, number 1, March 2007.

Scott-Thomas, Caroline, "Denmark to scrap decades-old soft drink tax," FoodNavigator.com, April 25, 2013.

Senediak, Christine, and Susan H. Spence, "Rapid versus gradual scheduling of therapeutic contact in a family based behavioural weight control programme for children," *Behavioral Psychotherapy*, volume 13, number 4, October 1985.

Seymour, J. D., A. L. Yaroch, M. Serdula, H. M. Blanck, and L. K. Khan, "Impact of nutrition environmental interventions on point-of-purchase behavior in adults: A review," *Preventive Medicine*, volume 39, supplement 2, September 2004.

Shillcutt, Samuel D., Damian G. Walker, Catherine A. Goodman, and Anne J. Mills, "Cost effectiveness in low- and middle-income countries," *PharmacoEconomics*, volume 27, number 11, November 2009.

Short, Camille E., Corneel Vandelanotte, Marcus W. Dixon, Richard Rosenkranz, Cristina Caperchione, Cindy Hooker et al., "Examining participant engagement in an information technology-based physical activity and nutrition intervention for men: The manup randomized controlled trial," *JMIR (Journal of Medical Internet Research) Research Protocols*, volume 3, number 1, January 2014.

Sifferlin, Alexandra, "Study: Sugars found in tequila could help you lose weight," *Time*, March 18, 2014.

Simon, P. A., D. Kwan, A. Angelescu, M. Shih, and J. E. Fielding, "Proximity of fast food restaurants to schools: do neighborhood income and type of school matter?" *Preventive Medicine*, volume 47, number 3, 2008.

Singh, S. D., and G. P. Rao, "Stevia: The herbal sugar of 21st century," *Sugar Tech*, volume 7, number 1, March 2005.

Singhal, N., A. Misra, P. Shah, and S. Gulati, "Effects of controlled school-based multi-component model of nutrition and lifestyle interventions on behavior modification, anthropometry and metabolic risk profile of urban Asian Indian adolescents in North India," *European Journal of Clinical Nutrition*, volume 64, number 4, April 2010.

Skouteris, H., M. McCabe, B. Swinburn, V. Newgreen, P. Sacher, and P. Chadwick, "Parental influence and obesity prevention in pre-schoolers: A systematic review of interventions," *Obesity Reviews*, volume 12, number 5, May 2011.

Skov, L. R., S. Lourenço, G. L. Hansen, B. E. Mikkelsen, and C. Schofield, "Choice architecture as a means to change eating behaviour in self-service settings: A systematic review," *Obesity Review*, volume 14, number 3, March 2013.

Sleator, Roy D., and Colin Hill, "Molecular analysis of the microbial food safety implications of food reformulations for improved health," *Foodborne Pathogens and Disease*, volume 5, number 4, September 2008.

Sloman, L., N. Cavill, A. Cope, L. Muller, and A. Kennedy, *Analysis and synthesis of evidence on the effects of investment in six cycling demonstration towns*, report for Department of Transport and Cycling England, November 2009.

Slusser, Wendelin M., William G. Cumberland, Ben L. Browdy, Linda Lange, and Charlotte Neumann, "A school salad bar increases frequency of fruit and vegetable consumption among children living in low-income households," *Public Health Nutrition*, volume 10, number 12, December 2007.

Smed, Sinne, Jørgen D. Jensen, and Sigrid Denver, "Socio-economic characteristics and the effect of taxation as a health policy instrument," *Food Policy*, volume 32, numbers 5–6, October–December 2007.

Smith, Travis A., Biing-Hwan Lin, and Jong-Ying Lee, "Taxing caloric sweetened beverages: Potential effects on beverage consumption, calorie intake, and obesity," *SSRN Journal*, USDA-ERS economic research report number 100, July 2010.

Smithers, Lisa G., Tracy L. Merlin, and John W. Lynch, "The impact of industry self-regulation on television marketing of unhealthy food and beverages to Australian children," *Medical Journal of Australia*, volume 199, number 3, August 2013.

Snowdon, Christopher, "The proof of the pudding: Denmark's fat tax fiasco," *IEA Current Controversies*, paper number 42, May 2013.

Sobal, Jeffery, and Albert J. Stunkard, "Socioeconomic status and obesity: A review of the literature," *Psychological Bulletin*, volume 105, number 2, March 1989.

Sorensen, G., L. Linnan and M. K. Hunt, "Worksite-based research and initiatives to increase fruit and vegetable consumption," *Preventive Medicine*, volume 39, supplement 2, September 2004.

Sorensen, G., B. Thompson, K. Glanz, Z. Feng, S. Kinne, C. DiClemente et al., "Worksite-based cancer prevention: Primary results from the Working Well Trial," *American Journal of Public Health*, volume 86, number 7, July 1996.

Spill, M. K., L. L. Birch, L. S. Roe, B. J. Rolls, "Hiding vegetables to reduce energy density: An effective strategy to increase children's vegetable intake and reduce energy intake," *American Journal of Clinical Nutrition*, volume 94, number 3, September 2011.

Spring, Bonnie, Jennifer M. Duncan, E. Amy Janke, Andrea T. Kozak, H. Gene McFadden, Andrew DeMott et al., "Integrating technology into standard weight loss treatment: A randomized controlled trial," *JAMA Internal Medicine*, volume 173, number 2, January 2013.

Sridhar, Sneha B., Jeanne Darbinian, Samantha F. Ehrlich, Margot A. Markman, Erica P. Gunderson, Assiamira Ferrara, and Monique M. Hedderson, "Maternal gestational weight gain and offspring risk for childhood overweight or obesity," *American Journal of Obstetrics and Gynecology*, forthcoming.

Stang, Jamie, and Katie A. Loth, "Parenting style and child feeding practices: Potential mitigating factors in the etiology of childhood obesity," *American Journal of Dietetic Association*, volume 111, issue 9, September, 2011.

Steenhuis, Ingrid H. M., and Willemijn M. Vermeer, "Portion size: Review and framework for interventions," *International Journal of Behavioral Nutrition and Physical Activity*, volume 6, number 1, August 2009.

Stevens, Victor J., Kristine L. Funk, Phillip J. Brantley, Thomas P. Erlinger, Valerie H. Myers, Catherine M. Champagne et al., "Design and implementation of an interactive website to support long-term maintenance of weight loss," *Journal of Medical Internet Research*, volume 10, number 1, January–March 2008.

Stewart, James B., "Looking for a lesson in Google's perks," *The New York Times*, March 15, 2013.

Stice, Eric, Heather Shaw, and C. Nathan Marti, "A meta-analytic review of obesity prevention programs for children and adolescents: The skinny on interventions that work," *Psychological Bulletin*, volume 132, number 5, September 2006.

Stobbe, Mike, "Calories from alcohol nearly equal those Americans consume from soda: Study," *Huffington Post*, November 15, 2012.

Stock, Christiane, and Anne Ellaway, eds., *Neighbourhood structure and health promotion*, Springer US, 2013.

Stockholm International Peace Research Institute, "Military expenditure" in *SIPRI Yearbook 2013: Armaments, disarmament, and international security*, 2013.

Stöger, Reinhard, "The thrifty epigenotype: An acquired and heritable predisposition for obesity and diabetes?" *Bioessays*, volume 30, number 2, February 2008.

Stunkard, Albert J., Rita Yopp Cohen, and Michael R. J. Felix, "Weight loss competitions at the worksite: How they work and how well," *Preventive Medicine*, volume 18, number 4, July 1989.

Sutherland, L. A., L. A. Kaley, and L. Fischer, "Guiding Stars: The effect of a nutrition navigation program on consumer purchases at the supermarket," *American Journal of Clinical Nutrition*, volume 91, number 4, April 2010.

Svetkey, L. P., V. J. Stevens, P. J. Brantley, L. J. Appel, J. F. Hollis, C. M. Loria et al., "Comparison of strategies for sustaining weight loss: The weight loss maintenance randomized controlled trial," *Journal of the American Medical Association*, volume 299, number 10, March 2008.

Swahn, Johan, Lena Mossberg, Åsa Öström, and Ingar-Britt Gustafsson, "Sensory description labels for food affect consumer product choice," *European Journal of Marketing*, volume 46, issue 11/12, 2012.

Swartz, Jonas J., Danielle Braxton, and Anthony J. Viera, "Calorie menu labeling on quick-service restaurant menus: An updated systematic review of the literature," *International Journal of Behavioral Nutrition and Physical Activity*, volume 8, number 1, December 2011.

Swinburn, Boyd A., Gary Sacks, Kevin D. Hall, Klim McPherson, Diane T. Finegood, Marjory L. Moodie, and Steven L. Gortmaker, "The global obesity pandemic: Shaped by global drivers and local environments," *The Lancet*, volume 378, number 9793, August 2011.

Taber, Daniel R., Jamie F. Chriqui, and Frank J. Chaloupka, "Differences in nutrient intake associated with state laws regarding fat, sugar, and caloric content of competitive foods," *Archives of Pediatrics and Adolescent Medicine*, volume 166, number 5, May 2012.

Tamir, Dov, Ann Feurstein, Shmuel Brunner, Siman-Tov Halfon, Abraham Reshef, and Hava Palti, "Primary prevention of cardiovascular diseases in childhood: Changes in serum total cholesterol, high density lipoprotein, and body mass index after 2 years of intervention in Jerusalem schoolchildren age 7–9 years," *Preventive Medicine*, volume 19, number 1, January 1990.

Tapp, A., L. Eagle, and F. Spotswood, "Social marketing-based strategy for obesity interventions," project report, University of the West of England, 2008.

Taras, H., and W. Potts-Datema, "Obesity and student performance at school," *Journal of School Health*, volume 75, number 8, October 2005.

Tate, Deborah F., Elizabeth H. Jackvony, and Rena R. Wing, "Effects of Internet behavioral counseling on weight loss in adults at risk for type 2 diabetes: A randomized trial," *Journal of the American Medical Association*, volume 289, number 14, May 2003.

Tate, Deborah F., Elizabeth H. Jackvony, and Rena R. Wing, "A randomized trial comparing human e-mail counseling, computer-automated tailored counseling, and no counseling in an Internet weight loss program," *Archives of Internal Medicine*, volume 166, number 15, January 2006.

Tate, Deborah F., Rena R. Wing, and Richard A. Winett, "Using Internet technology to deliver a behavioral weight loss program," *Journal of the American Medical Association*, volume 285, number 9, April 2001.

Taylor, R., K. McAuley, W. Barbezat, V. Farmer, S. Williams, and J. Mann, "Two-year follow-up of an obesity prevention initiative in children: The APPLE project," *American Journal of Clinical Nutrition*, volume 88, number 5, November 2008.

The Telegraph, "G8 countries shift from food aid to investing in agriculture," July 6, 2009.

The Telegraph, "Mars and Snickers shrink but prices stay the same," December 16, 2013.

Temple, Jennifer L., Karena Johnson, Kelly Recupero, and Heather Suders, "Nutrition labels decrease energy intake in adults consuming lunch in the laboratory," *Journal of the American Dietetic Association*, volume 110, number 7, July 2010.

Tesco, *Tesco and society report 2013: What matters now—using our scale for good*.

Tesco, *Tesco and society: Using our scale for good—2013/14 half year update*, 2013.

Thiele, Silke, "Fat tax: A political measure to reduce overweight? The case of Germany," University of Kiel, Department of Food Economics and Consumption Studies, selected paper prepared for presentation at 1st Joint European Association of Agricultural Economists/ Agricultural and Applied Economics Association seminar in Freising, Germany, September 15–17, 2010.

Thomas, J. E., and M. J. Glade, "Stevia: It's not just about calories," *The Open Obesity Journal*, volume 2, 2010.

Thomas, Samantha L., Sophie Lewis, Jim Hyde, David Castle, and Paul Komesaroff, "'The solution needs to be complex': Obese adults' attitudes about the effectiveness of individual and population based interventions for obesity," *BMC Public Health*, volume 10, number 1, July 2010.

Thompson, Olivia M., Amy L. Yaroch, Richard P. Moser, Lila J. Finney Rutten, and Tanya Agurs-Collins, "School vending machine purchasing behavior: Results from the 2005 YouthStyles Survey," *Journal of School Health*, volume 80, number 5, May 2010.

Thorndike, Anne N., Lillian Sonnenberg, Jason Riis, Susan Barraclough, and Douglas E. Levy, "A 2-phase labeling and choice architecture intervention to improve healthy food and beverage choices," *American Journal of Public Health*, volume 102, number 3, March 2012.

Thow, Anne Marie, Stephen Jan, Stephen Leeder, and Boyd Swinburn, "The effect of fiscal policy on diet, obesity and chronic disease: A systematic review," *Bulletin of the World Health Organization*, volume 88, number 8, August 2010.

Tiffin, Abigail, and Richard Tiffin, "Estimates of food demand elasticities for Great Britain: 1972–1994," *Journal of Agricultural Economics*, volume 50, number 1, January 1999.

Tiffin, R., and M. Arnoult, "The demand for a healthy diet: Estimating the almost ideal demand system with infrequency of purchase," *European Review of Agricultural Economics*, volume 37, number 4, December 2010.

Tiffin, Richard, Kelvin Balcombe, Matthew Salois, and Ariane Kehlbacher, *Estimating food and drink elasticities*, University of Reading, November 2011.

Tigbe, W. W., A. H. Briggs, and M. E. J. Lean, "A patient-centred approach to estimate total annual healthcare cost by body mass index in the UK Counterweight programme," *International Journal of Obesity*, volume 37, number 8, August 2013.

Tilg, Herbert, and Arthur Kaser, "Gut microbiome, obesity and metabolic dysfunction," *Journal of Clinical Investigation*, volume 121, number 6, June 2011.

Timmins, K., "On with the pennies, off with the pounds? The use of taxation policies in obesity prevention," *Perspectives in Public Health*, volume 131, number 4, July 2011.

Tohill, Beth Carlton, *Dietary intake of fruit and vegetables and management of body weight*, background paper for the Joint Food and Agriculture Organization/World Health Organization workshop on Fruit and Vegetables for Health in Kobe, Japan, September 1–3, 2004.

Torgerson, J., M. Boldrin, J. Hauptman, and Lars Sjöström, "XENical in the prevention of diabetes in obese subjects (XENDOS) study: A randomized study of orlistat as an adjunct to lifestyle changes for the prevention of type 2 diabetes in obese patients," *Diabetes Care*, volume 27, number 1, January 2004.

Traill, B., T. Bech-Larsen, L. Gennaro, A. Koziol-Kozakowska, S. Kuhn, and J. Wills, *Reformulation for healthier food: A qualitative assessment of alternative approaches*, paper prepared for Agricultural and Applied Economics Association and European Association of Agricultural Economists Food Environment Symposium in Boston, Massachusetts, May 30–31, 2012.

Transport for London, *Roads: International case studies*, Steer Davies Gleave, September 2012.

Transport for London, *Transport planning for healthier lifestyles: A best practice guide*, March 2013.

Transport for London, *Travel in London, Report 5*, 2012.

Troy, Lisa M., Emily Ann Miller, and Steve Olson, *Hunger and obesity: Understanding a food insecurity paradigm*, workshop summary, Institute of Medicine of the National Academies, 2011.

Tsai, A. G., D. F. Williamson, and H. A. Glick, "Direct medical cost of overweight and obesity in the USA: A quantitative systematic review," *Obesity Reviews*, volume 12, number 1, January 2011.

Tucker, L. A., and G. M. Friedman, "Obesity and absenteeism: An epidemiologic study of 10,825 employed adults," *American Journal of Health Promotion*, volume 12, number 3, January–February 1998.

Tudor-Locke, C., J. M. Schuna, L. J. Frensham, and M. Proenca, "Changing the way we work: Elevating energy expenditure with workstation alternatives," *International Journal of Obesity*, November 2013.

Turner-McGrievy, G. M., M. W. Beets, J. B. Moore, A. T. Kaczynski, D. J. Barr-Anderson, and D. F. Tate, "Comparison of traditional versus mobile app self-monitoring of physical activity and dietary intake among overweight adults participating in an mHealth weight loss program," *Journal of the American Medical Informatics Association*, volume 20, number 3, May 2013.

Twiddy, Maureen, Inga Wilson, Maria Bryant, and Mary Rudolf, "Lessons learned from a family-focused weight management intervention for obese and overweight children," *Public Health Nutrition, volume 15, number 7, July 2012.*

UN News Service, "Air pollution now linked to 1 in 8 deaths worldwide, UN health agency reports," March 25, 2014.

UNAIDS, *Global AIDS response progress report*, 2012.

UNAIDS, *World AIDS Day report*, 2012.

UNESCO Institute for Statistics, *School enrollment, primary (percent net)*, World Bank, 2014.

Unilever, *Global challenges, local actions: An overview of Unilever's approach to environmental and social responsibility*, 2003.

United Nations Office on Drugs and Crime, *World drug report 2012*, June 2012.

United Nations Office on Drug and Crime, *World drug report 2013*, May 2013.

United Nations Population Fund, *Sexual and reproductive health for all: Reducing poverty, advancing development and protecting human rights*, 2010.

UN System Task Team Working Group on "Financing for sustainable development," *Chapter 1: Financing for sustainable development: Review of global investment requirement estimates*, background paper, October 2013.

US Department of Agriculture, *Food deserts*, 2014.

US Department of Health and Human Services, *Childhood obesity prevention programs: Comparative effectiveness review and meta-analysis*, Effective Health Care Program comparative effectiveness review number 115, June 2013.

US Department of Labor, *100 years of US consumer spending data for the nation, New York City, and Boston*, report number 991, May 2006.

The US President's Emergency Plan for AIDS Relief, *Comprehensive HIV prevention for people who inject drugs, revised guidance*, July 2010.

Vadiveloo, Maya K., L. Beth Dixon, and Brian Elbel, "Consumer purchasing patterns in response to calorie labeling legislation in New York City," *International Journal of Behavioral Nutrition and Physical Activity*, volume 8, number 1, May 2011.

Van Baal, Pieter H. M., Johan J. Polder, G. Ardine de Wit, Rudolf T. Hoogenveen, Talitha L. Feenstra, Hendriek C. Boshuizen et al., "Lifetime medical costs of obesity: Prevention no cure for increasing health expenditure," *PLoS Medicine*, volume 5, number 2, February 2008.

Van Herpen, Erica, Erjen van Nierop, and Laurens Sloot, "The relationship between in-store marketing and observed sales for organic versus fair trade product," *Marketing Letters*, 2011.

Van Raaij, Joop, Marieke Hendriksen, and Hans Verhagen, "Potential for improvement of population diet through reformulation of commonly eaten foods," *Public Health Nutrition*, volume 12, number 3, March 2009.

Van Wark, C., "Fats and figures: What can be done to tackle the UK's obesity problem?" *The Guardian*, January 30, 2014.

Van Wier, Marieke F., Geertje Am Ariëns, J. Caroline Dekkers, Ingrid J. M Hendriksen, Tjabe Smid, and Willem van Mechelen, "Phone and e-mail counselling are effective for weight management in an overweight working population: A randomized controlled trial," *BMC Public Health*, volume 9, number 1, February 2009.

Van Wier, Marieke F., J. Dekkers, Judith E. Bosmans, Martijn W. Heymans, Ingrid J. M. Hendriksen, Nicolaas P. Pronk et al., "Economic evaluation of a weight control program with e-mail and telephone counseling among overweight employees: A randomized controlled trial," *International Journal of Behavioral Nutrition and Physical Activity*, volume 9, number 1, September 2012.

Vandermeulen, Valerie, Ann Verspecht, Bert Vermeire, Guido van Huylenbroeck, and Xavier Gellynck, "The use of economic valuation to create public support for green infrastructure investments in urban areas," *Landscape and Urban Planning*, volume 103, number 2, January 2011.

Variyam, Jayachandran N., *Nutrition labeling in the food-away-from-home sector: An economic assessment*, US Department of Agriculture economic research report number 4, April 2005.

Veerman, J. L., E. F. Van Beeck, J. J. Barendregt, and J. P. Mackenbach, "By how much would limiting TV food advertising reduce childhood obesity?" *The European Journal of Public Health*, volume 19, number 4, August 2009.

Vermeer, W. M., E. Alting, I. H. M. Steenhuis, and J. C. Seidell, "Value for money or making the healthy choice: The impact of proportional pricing on consumers' portion size choices," *The European Journal of Public Health*, volume 20, number 1, February 2010.

Vermeer, W. M., F. H. Leeuwis, S. Koprulu, O. Zouitni, J. C. Seidell, and I. H. M. Steenhuis, "The process evaluation of two interventions aimed at portion size in worksite cafeterias," *Journal of Human Nutrition and Dietetics*, volume 25, number 2, April 2012.

Vermeer, W. M., I. H. M. Steenhuis, F. H. Leeuwis, M. W. Heymans, and J. C. Seidell, "Small portion sizes in worksite cafeterias: Do they help consumers to reduce their food intake?" *International Journal of Obesity*, volume 35, number 9, September 2011.

Vermeer, W. M., I. H. M. Steenhuis, and J. C. Seidell, "From the point-of-purchase perspective: A qualitative study of the feasibility of interventions aimed at portion-size," *Health Policy*, volume 90, number 1, April 2009.

Volkery, C., "Bierselige britische Banker: Druckbetankung nach Feierabend," *Der Spiegel*, November 9, 2012.

Volpe, S. L., W. J. Hall, A. Steckler, M. Schneider, D. Thompson, C. Mobley et al., "Process evaluation results from the HEALTHY nutrition intervention to modify the total school food environment," *Health Education Research*, volume 28, number 6, December 2013.

Volpp, Kevin G., Leslie K. John, Andrea B. Troxel, Laurie Norton, Jennifer Fassbender, and George Loewenstein, "Financial incentive-based approaches for weight loss," *Journal of the American Medical Association*, volume 300, number 22, December 2008.

Voß, H., *Kleiner markt mit zukunft—Ohne bitteren nachgeschmack: Diätbier feiert comeback*, Getränkefachgroßhandel, volume 8, 2006.

Vyth, Ellis L., Ingrid H. M. Steenhuis, Annet J. C. Roodenburg, Johannes Brug, and Jacob C. Seidell, "Front-of-pack nutrition label stimulates healthier product development: A quantitative analysis," *International Journal of Behavioral Nutrition and Physical Activity*, volume 7, number 1, September 2010.

Wadden, T. A., R. Berkowitz, L. Womble, D. Sarwer, D. Phelan, R. Cato et al., "Randomized trial of lifestyle modification and pharmacotherapy for obesity," *New England Journal of Medicine*, volume 353, number 21, November 2005.

Wade, Paul A., and Trevor K. Archer, "Epigenetics: Environmental instructions for the genome," *Environmental Health Perspectives*, volume 114, number 3, March 2006.

Walker, L. L. M., P. J. Gately, B. M. Bewick, and A. J. Hill, "Children's weight-loss camps: Psychological benefit or jeopardy?" *International Journal of Obesity*, volume 27, number 6, July 2003.

Walker, Renee E., Christopher R. Keane, and Jessica G. Burke, "Disparities and access to healthy food in the United States: A review of food deserts literature," *Health and Place*, volume 16, number 5, September 2010.

Wall, Melanie M., Nicole I. Larson, Ann Forsyth, David C. Van Riper, Dan J. Graham, Mary T. Story, and Dianne Neumark-Sztainer, "Patterns of obesogenic neighborhood features and adolescent weight," *American Journal of Preventive Medicine*, volume 42, number 5, May 2012.

Walls, Helen L., Anna Peeters, Joseph Proietto, and John J. McNeil, "Public health campaigns and obesity: A critique," *BMC Public Health*, volume 11, number 1, February 2011.

Wang, Y. Claire, Klim McPherson, Tim Marsh, Steven L. Gortmaker, and Martin Brown, "Health and economic burden of the projected obesity trends in the USA and the UK," *The Lancet*, volume 378, number 9793, August 2011.

Wansink, Brian, "Environmental factors that increase the food intake and consumption volume of unknowing consumers," *Annual Review of Nutrition*, volume 24, number 1, July 2004.

Wansink, Brian, *Mindless eating: Why we eat more than we think*, Bantam-Dell, 2006.

Wansink, Brian, Robert J. Kent, and Stephen J. Hoch, "An anchoring and adjustment model of purchase quantity decisions," *Journal of Marketing Research*, volume 35, number 1, February 1998.

Wansink, Brian, James E. Painter, and Jill North, "Bottomless bowls: Why visual cues of portion size may influence intake," *Obesity Research*, volume 13, number 1, January 2005.

Wansink, Brian, Koert van Ittersum, and James E. Painter, "How descriptive food names bias sensory perceptions in restaurants," *Food Quality and Preference*, volume 16, issue 5, 2005.

Waters, Elizabeth, Boyd A. Swinburn, Jacob Seidell, and Ricardo Uauy, eds., *Preventing childhood obesity: Evidence policy and practice*, BMJ Books, 2010.

Weight Watchers, *The Weight Watchers referral scheme*, October 2009.

West, Felicity, Matthew R. Sanders, Geoffrey J. Cleghorn, and Peter S. W. Davies, "Randomised clinical trial of a family-based lifestyle intervention for childhood obesity involving parents as the exclusive agents of change," *Behaviour Research and Therapy*, volume 48, number 12, December 2010.

Whitaker, Robert C., Jeffrey A. Wright, Margaret S. Pepe, Kristy D. Seidel, and William H. Dietz, "Predicting obesity in young adulthood from childhood and parental obesity," *New England Journal of Medicine*, volume 337, number 13, September 1997.

Widhalm, K., S. Dietrich, and G. Prager, "Adjustable gastric banding surgery in morbidly obese adolescents: Experiences with eight patients," *International Journal of Obesity*, volume 28, supplement 3, November 2004.

Wiecha, J. L., A. M. El Ayadi, B. F. Fuemmeler, J. E. Carter, S. Handler, S. Johnson et al., "Diffusion of an integrated health education program in an urban school system: Planet health," *Journal of Pediatric Psychology*, volume 29, number 6, September 2004.

Wild, S., G. Roglic, A. Green, R. Sicree, and H. King, "Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030," *Diabetes Care*, volume 27, number 5, May 2004.

Wilfley, Denise E., Tiffany L. Tibbs, Dorothy J. Van Buren, Kelle P. Reach, Mark S. Walker, and Leonard H. Epstein, "Lifestyle interventions in the treatment of childhood overweight: A meta-analytic review of randomized controlled trials," *Health Psychology*, volume 26, number 5, September 2007.

Williams, Christine L., Barbara A. Strobino, Marguerite Bollella, and Jane Brotanek, "Cardiovascular risk reduction in preschool children: The 'Healthy Start' project," *Journal of the American College of Nutrition*, volume 23, number 2, May 2004.

Willis, T. A., J. George, C. Hunt, K. P. J. Roberts, C. E. L. Evans, R. E. Brown, and M. C. J. Rudolf, "Combating child obesity: Impact of HENRY on parenting and family lifestyle," *Pediatric Obesity*, July 2013.

Willis, T. A., B. Potrata, C. Hunt, M. C. J. Rudolf, "Training community practitioners to work more effectively with parents to prevent childhood obesity: The impact of HENRY upon Children's Centres and their staff," *Journal of Human Nutrition and Dietetics*, volume 25, number 5, October 2012.

Wing, Rena R., and Suzanne Phelan, "Long-term weight loss maintenance," *American Journal of Clinical Nutrition*, volume 82, number 1, July 2005.

Wing, Rena R., Deborah F. Tate, Amy A. Gorin, Hollie A. Raynor, and Joseph L. Fava, "A self-regulation program for maintenance of weight loss," *New England Journal of Medicine*, volume 355, number 15, October 2006.

Witham, M. D., and A. Avenell, "Interventions to achieve long-term weight loss in obese older people: A systematic review and meta-analysis," *Age and Ageing*, volume 39, number 2, March 2010.

Woodcock, James, Marko Tainio, James Cheshire, Oliver O'Brien, and Anna Goodman, "Health effects of the London bicycle sharing system: Health impact modelling study," *BMJ*, volume 348, number 7946, February 2014.

World Action on Salt and Health, *UK leading the world in salt reduction*, June 21, 2012.

World Economic Forum and Harvard School of Public Health, *The global economic burden of non-communicable diseases*, September 2011.

World Economic Forum in collaboration with McKinsey & Company, *Sustainable health systems: Visions, strategies, critical uncertainties and scenarios*, January 2013.

World Health Organization, *Burden of disease from household air pollution for 2012*, 2014.

World Health Organization, *Cost-effectiveness thresholds*, Cost effectiveness and strategic planning (WHO-CHOICE), 2012.

World Health Organization, *Climate change and human health—risks and responses; Summary: How much disease would climate change cause?* 2014.

World Health Organization, *Global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage*, May 2012.

World Health Organization, *Global status report on road safety 2013: Supporting a decade of action*, March 2013.

World Health Organization, *Interventions on diet and physical activity: What works*, 2009.

World Health Organization, *Population-based approaches to childhood obesity prevention*, November 2012.

World Health Organization, *Treatment of injecting drug users with HIV/AIDS: Promoting access and optimizing service delivery*, 2006.

World Health Organization and UN Water Report, *UN-Water global analysis and assessment of sanitation and drinking-water: The challenge of extending and sustaining services*, April 2012.

World Literacy Foundation, *The economic and social cost of illiteracy: A snapshot of illiteracy and its causes in the UK and a global context*, interim report, January 2012.

World Literacy Foundation, *The economic and social cost of illiteracy: A snapshot of illiteracy in a global context*, final report, April 2012.

Wrotniak, Brian H., Leonard H. Epstein, Rocco A. Paluch, and James N. Roemmich, "Parent weight change as a predictor of child weight change in family-based behavioral obesity treatment," *Archives of Pediatric and Adolescent Medicine*, volume 158, number 4, April 2004.

Wu, T., X. Gao, M. Chen, and R. M. van Dam, "Long-term effectiveness of diet-plus-exercise interventions vs. diet-only interventions for weight loss: A meta-analysis," *Obesity Reviews*, volume 10, number 3, May 2009.

Wyness, Laura A., Judith L. Butriss, and Sara A. Stanner, "Reducing the population's sodium intake: The UK Food Standards Agency's salt reduction programme," *Public Health Nutrition*, volume 15, number 2, February 2012.

Xue, Hong, Hsin-jen Chen, Benjamin F. Hobbs, Tak Igusa, David Levy, Kevin Frick et al., "Evaluating sugar-sweetened beverage tax policy effect using systems dynamics models: What's beyond the equilibrium?" poster abstract presented at Johns Hopkins Global Center on Childhood Obesity Annual Scientific Symposium in Baltimore, Maryland, April 9, 2013.

Yaniv, Gideon, Odelia Rosin, and Yossef Tobol, "Junk-food, home cooking, physical activity and obesity: The effect of the fat tax and the thin subsidy," *Journal of Public Economics*, volume 93, numbers 5–6, June 2009.

Ylikoski, Matti, Matti Lamberg, Erkki Yrjanheikki, Juhani Ilmarinen, Ritva Partinen, and Hannu Jokiluima, eds., *Health in the world of work: Workplace health promotion as a tool for improving and extending work life*, Ministry of Social Affairs and Health, Finnish Institute of Occupational Health, 2006.

Yon, Bethany A., Rachel K. Johnson, Jean Harvey-Berino, Beth Casey Gold, and Alan B. Howard, "Personal digital assistants are comparable to traditional diaries for dietary self-monitoring during a weight loss program," *Journal of Behavioral Medicine*, volume 30, number 2, April 2007.

Young, D., W. Haskell, C. Taylor, S. P. Fortmann, "Effect of community health education on physical activity knowledge, attitudes, and behavior: The Stanford five-city project," *American Journal of Epidemiology*, volume 144, number 3, August 1996.

Young, Leanne, and Boyd Swinburn, "Impact of the Pick the Tick food information programme on the salt content of food in New Zealand," *Health Promotion International*, volume 17, number 1, April 2002.

Young, Lisa. R., and Marion Nestle, "The contribution of expanding portion sizes to the US obesity epidemic," *American Journal of Public Health*, volume 92, number 2, February 2002.

Young, Lisa R., and Marion Nestle, "Expanding portion sizes in the US marketplace: Implications for nutrition counseling," *Journal of the American Dietetic Association*, volume 103, number 2, February 2003.

Young, Lisa R., and Marion Nestle, "Reducing portion sizes to prevent obesity," *American Journal of Preventive Medicine*, volume 43, number 5, November 2012.

Zapka, Jane, Stephenie C. Lemon, Barbara B. Estabrook, and Denise G. Jolicoeur, "Keeping a step ahead: Formative phase of a workplace intervention trial to prevent obesity," *Obesity* (Silver Spring), volume 15, supplement 1, November 2007.

Zhang, P., X. Zhang, J. Brown, D. Vistisen, R. Sicree, J. Shaw, and G. Nichols, "Global healthcare expenditure on diabetes for 2010 and 2030," *Diabetes Research and Clinical Practice*, volume 87, number 3, March 2010.

Zhen, C., E. A. Finkelstein, J. M. Nonnemaker, S. A. Karns, and J. E. Todd, "Predicting the effects of sugar-sweetened beverage taxes on food and beverage demand in a large demand system," *American Journal of Agricultural Economics*, July 29, 2013.

Zheng, Yuqing, and Harry M. Kaiser, "Advertising and US nonalcoholic beverage demand," *Agriculture and Resource Economics Review*, volume 37, number 2, August 2008.

Zimmet, P., K. G. Alberti, and J. Shaw, "Global and societal implications of the diabetes epidemic," *Nature*, volume 414, December 13, 2001.

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