McKinsey Global Institute




November 2014

Overcoming obesity: An initial economic analysis

Discussion paper

The McKinsey Global Institute

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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, Kate Forster, 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.

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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 preliminary 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 important elements to consider: (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.

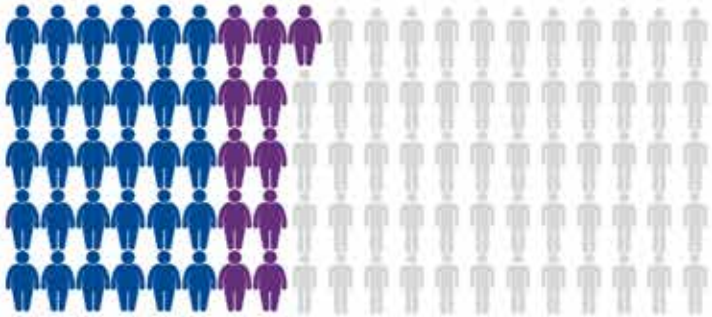
MGI has initially assessed the elements of a potential program for the United Kingdom, but we believe our findings are broadly applicable around the world. This discussion paper is intended as an initial contribution and thought starter on what it is likely to take to address rising obesity. Our hope 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.

Addressing rising global obesity...

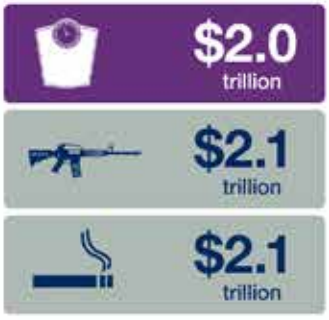
(5% of all deaths each year)

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.

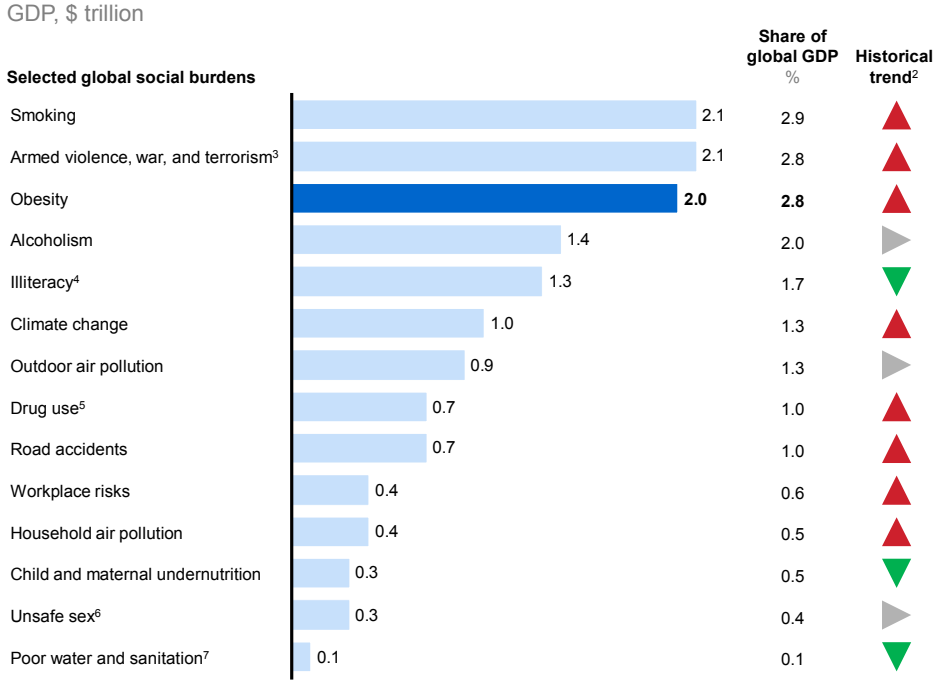
2 The World Health Organization estimates that 2.8 million global deaths a year are attributable to high BMI on a base of 59 million total global deaths per year.

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.

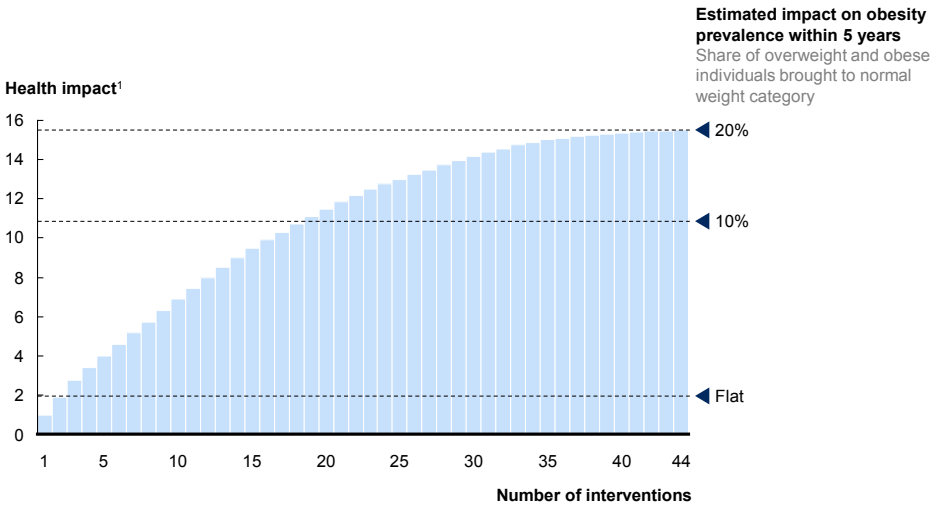
We must stress that our analysis is by no means complete. We see our work on a potential program to address obesity as the equivalent of the 16th-century maps used by navigators. On those maps, some islands were missing and some continents were misshapen, but they were still helpful to the sailors of 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.

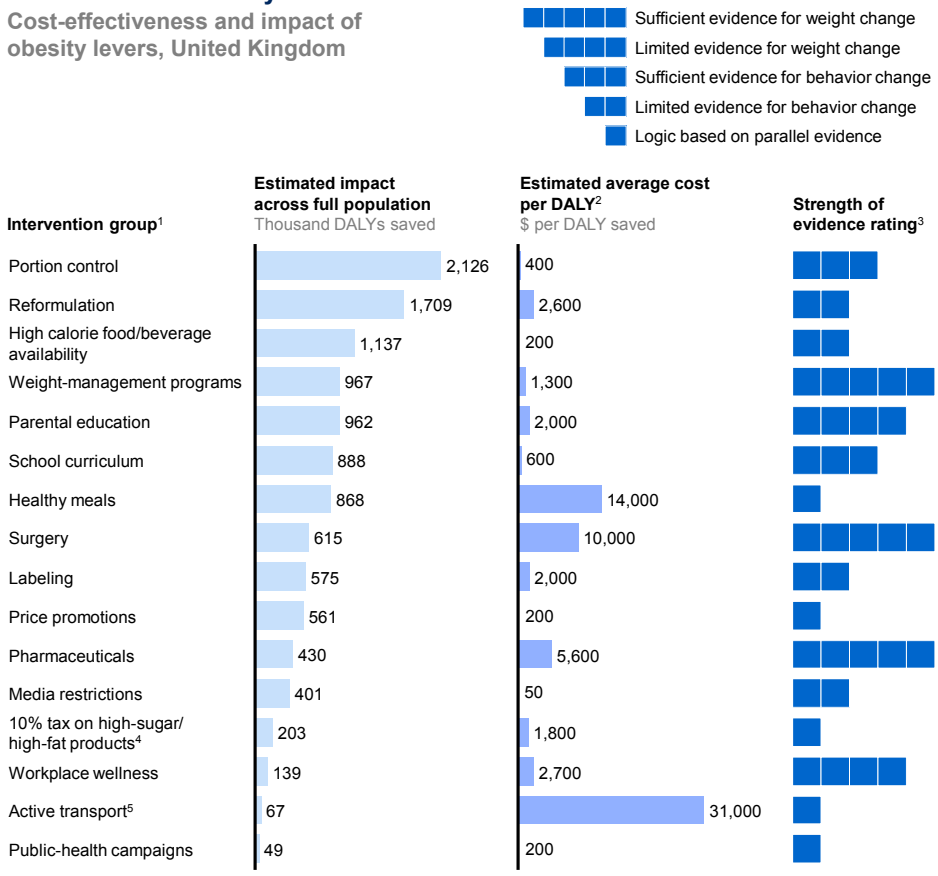
- **Education and encouraging personal responsibility are necessary but not sufficient—restructuring the context that shapes physical activity and nutritional behavior is a vital part of any obesity program.** Education and personal responsibility are critical elements of any program to reduce obesity, 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.

□ □ □

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: pre-schoolchildren	Government authorities provide educational program (e.g., 12-week course) to parents of pre-schoolchildren 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 schoolchildren 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

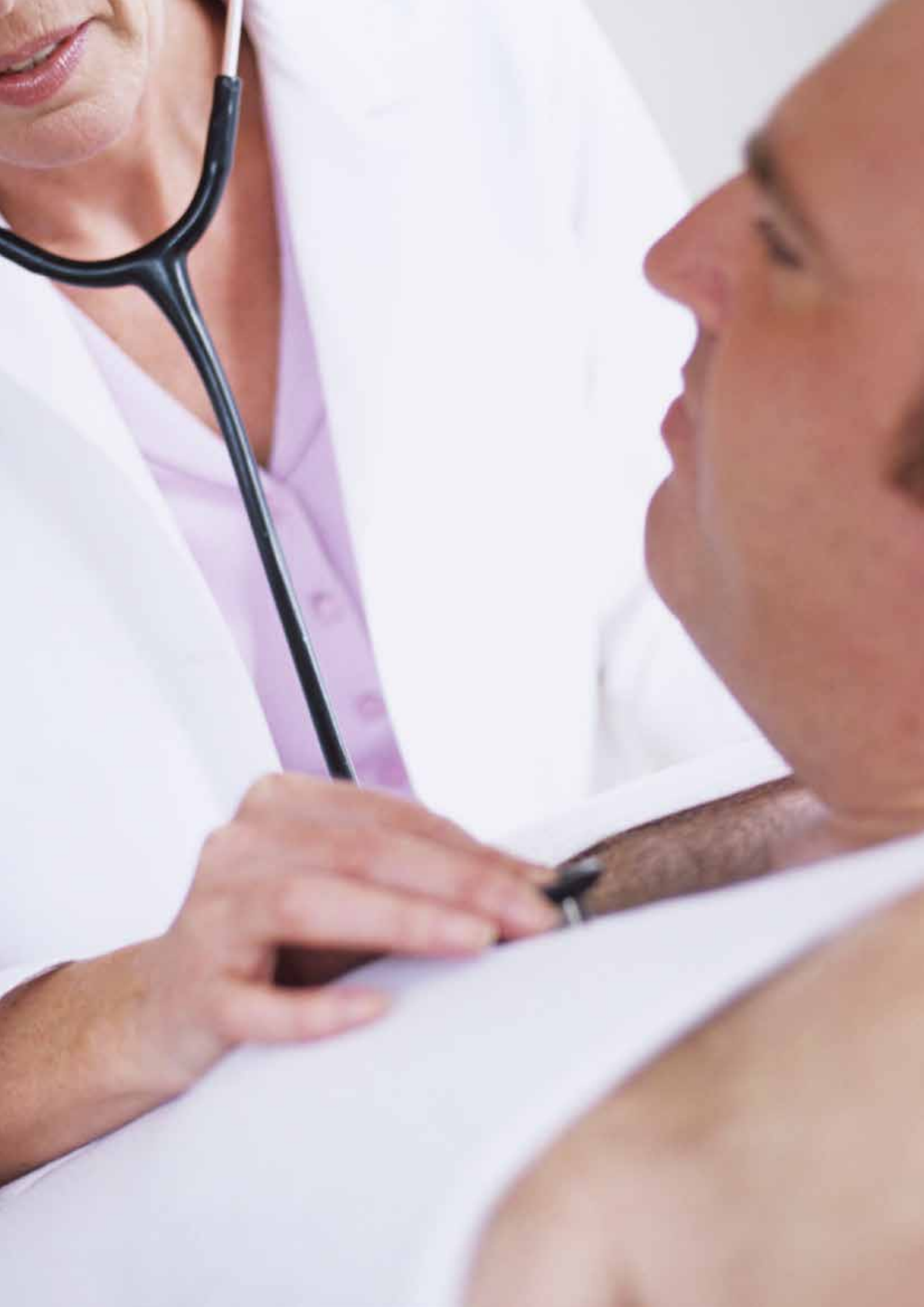
SOURCE: McKinsey Global Institute analysis

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 and wearables to support healthy eating and physical activity: cross-platform	Health systems/employers provide personal technology platforms and wearable technology 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 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.

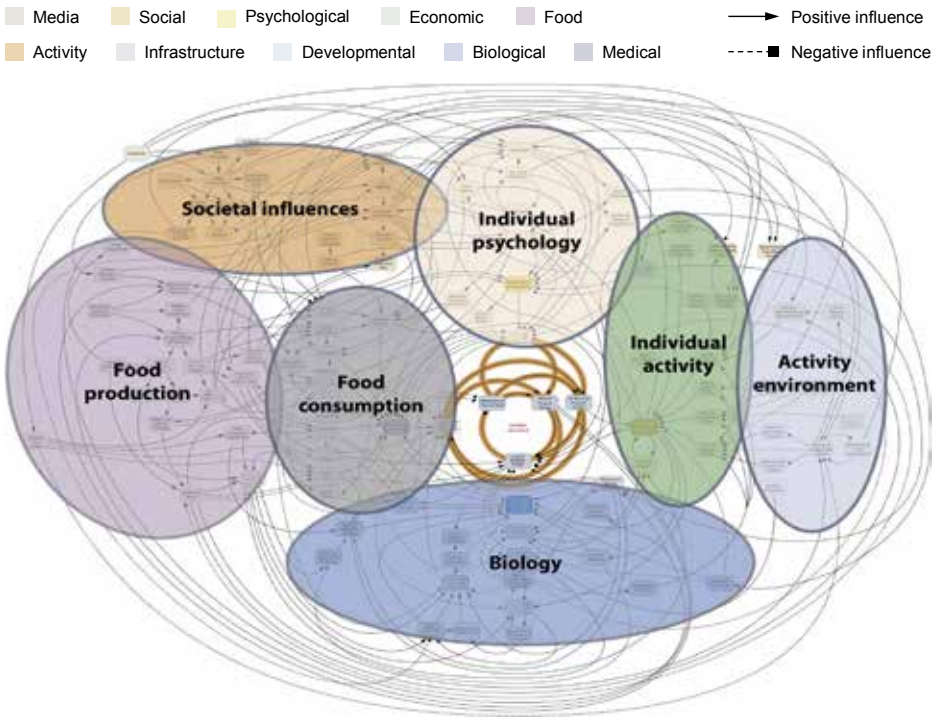
Box 1. The complex causes of obesity

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.

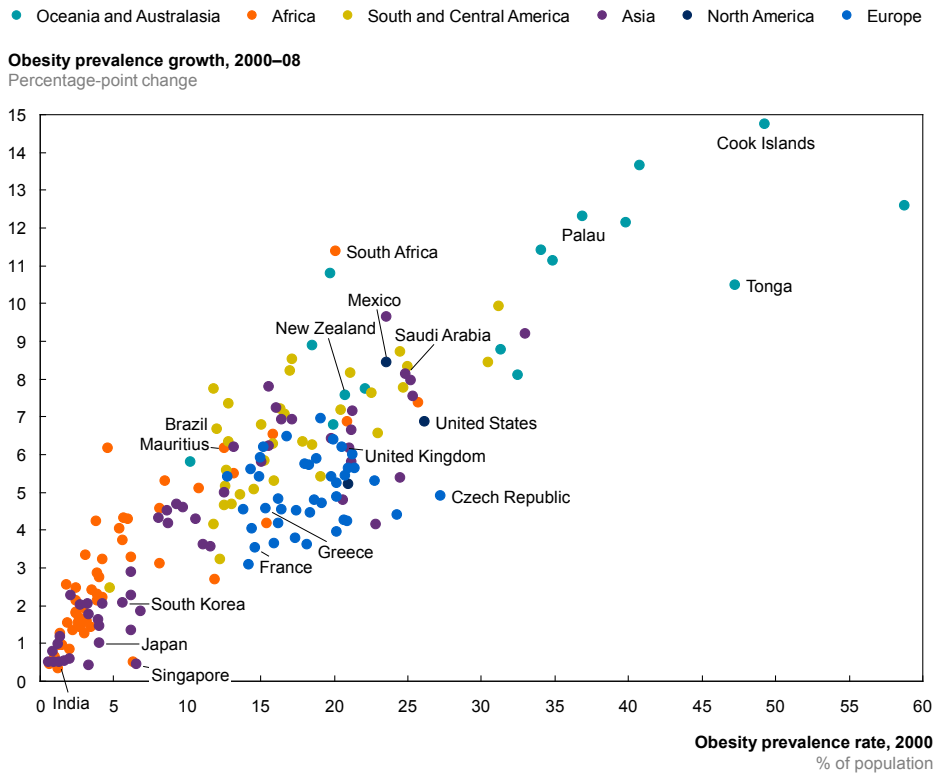
THE PREVALENCE OF OBESITY IS HIGH AND GROWING AS GLOBAL PROSPERITY INCREASES

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

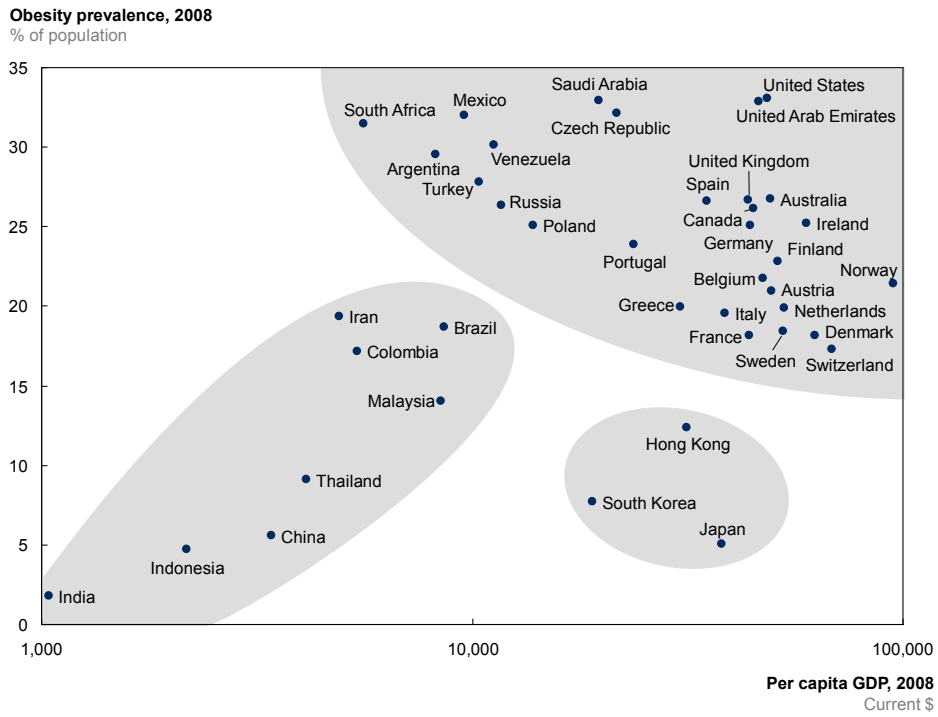
5 Marie Ng et al., "Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: A systematic analysis for the Global Burden of Disease Study 2013," *The Lancet*, volume 384, issue 9945, August 2014. Overweight and obese people are defined as those with 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.

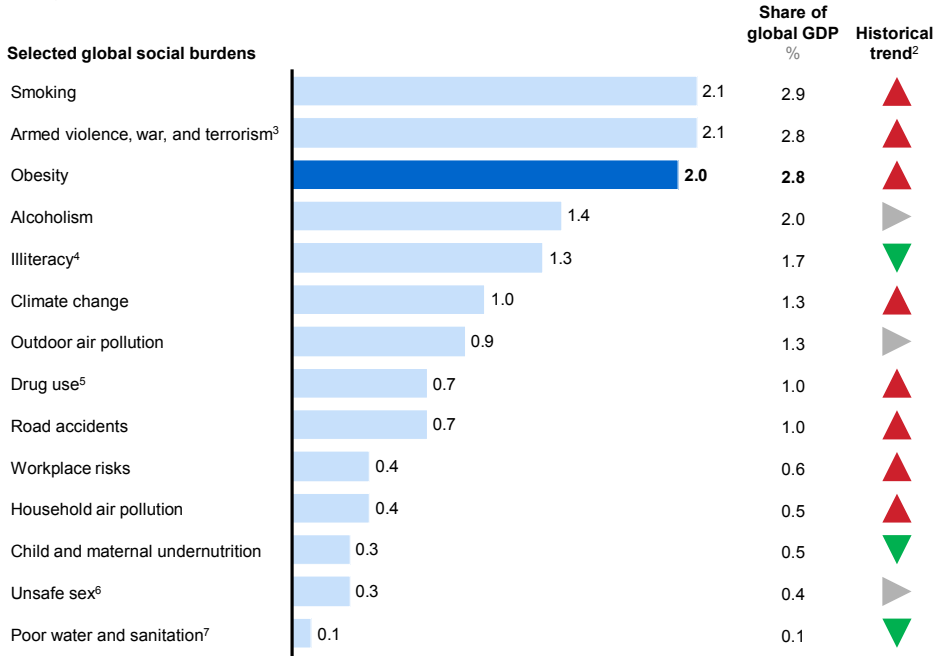
while not a direct cost to society, it should be included because it has a negative economic impact. In addition, it should be noted that our estimates are based on the current cost of these burdens. This means that burdens such as climate change and obesity, which result in a higher future cost, are 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.

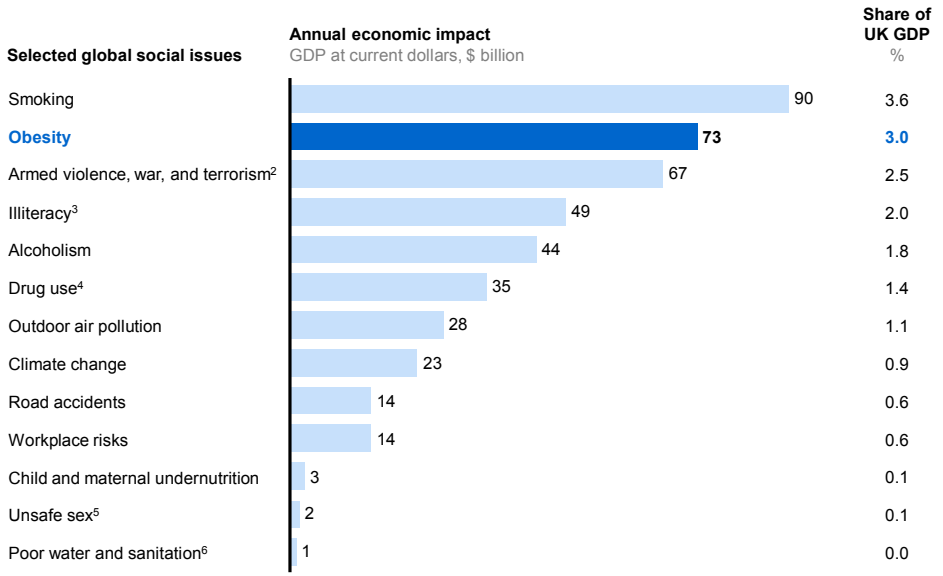
The economic toll of obesity varies more widely in emerging markets. In Mexico, obesity is the largest social impact at 2.5 percent of GDP. We observe comparable burdens in Morocco at 2.8 percent of GDP, in South Africa at 3.0 percent of GDP, and in Brazil at 2.4 percent of GDP. But in other emerging 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).

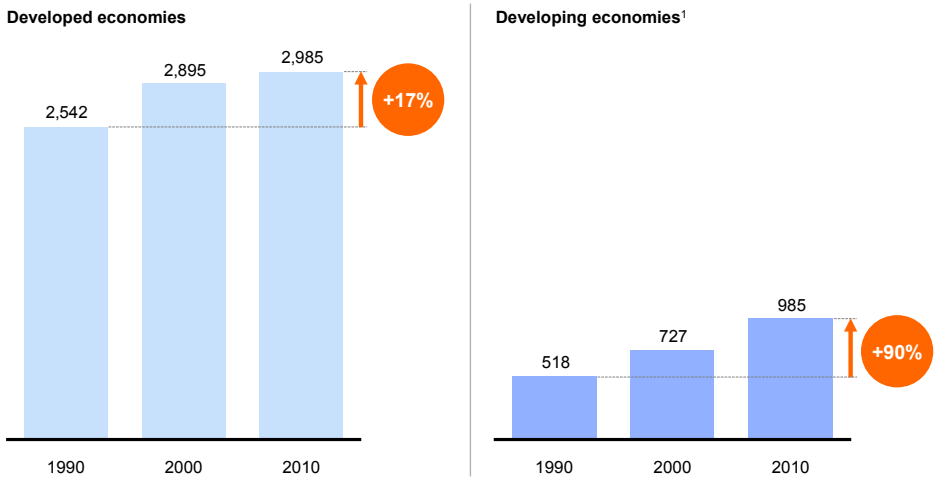
13 Our analysis using DALYs measures the opportunity cost to an economy; we have not measured the broader losses to human well-being associated with lost productivity. We also note that the value of a DALY is tied to per capita GDP and for this reason, our analysis tends to amplify the cost to developed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

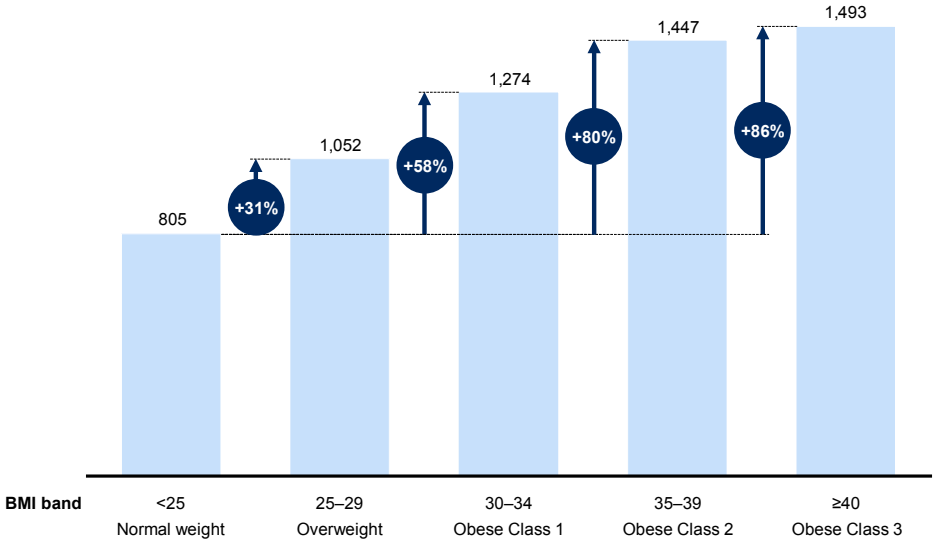
Previous McKinsey analysis on health-care spending in the OECD group of countries has found that, without reform, health-care spending could grow by 50 to 100 percent between 2007 and 2040. In the United Kingdom alone, the research found that health-care spending could account for 11 to 14 percent of 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.

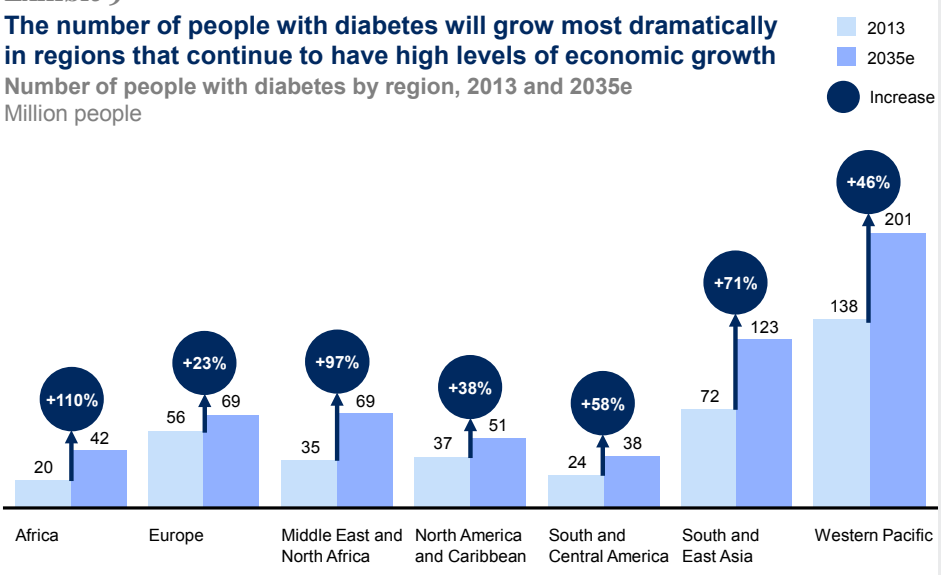
The burden on health-care systems is already high and rising. It has been estimated that diabetes accounts for 12 percent of global health-care costs at between $376 billion and $672 billion.[5] In the United Kingdom, the NHS spends 10 percent of its total budget on treating diabetes, 80 percent of which 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.

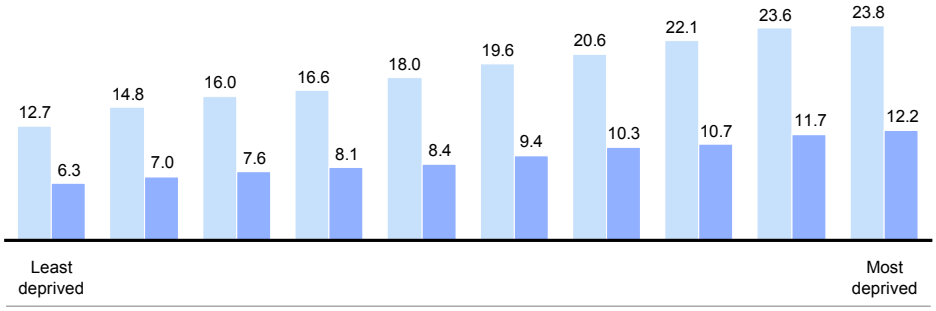
28 *Adult obesity and socioeconomic status*, National Obesity Observatory Data Factsheet, October 2010.

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.

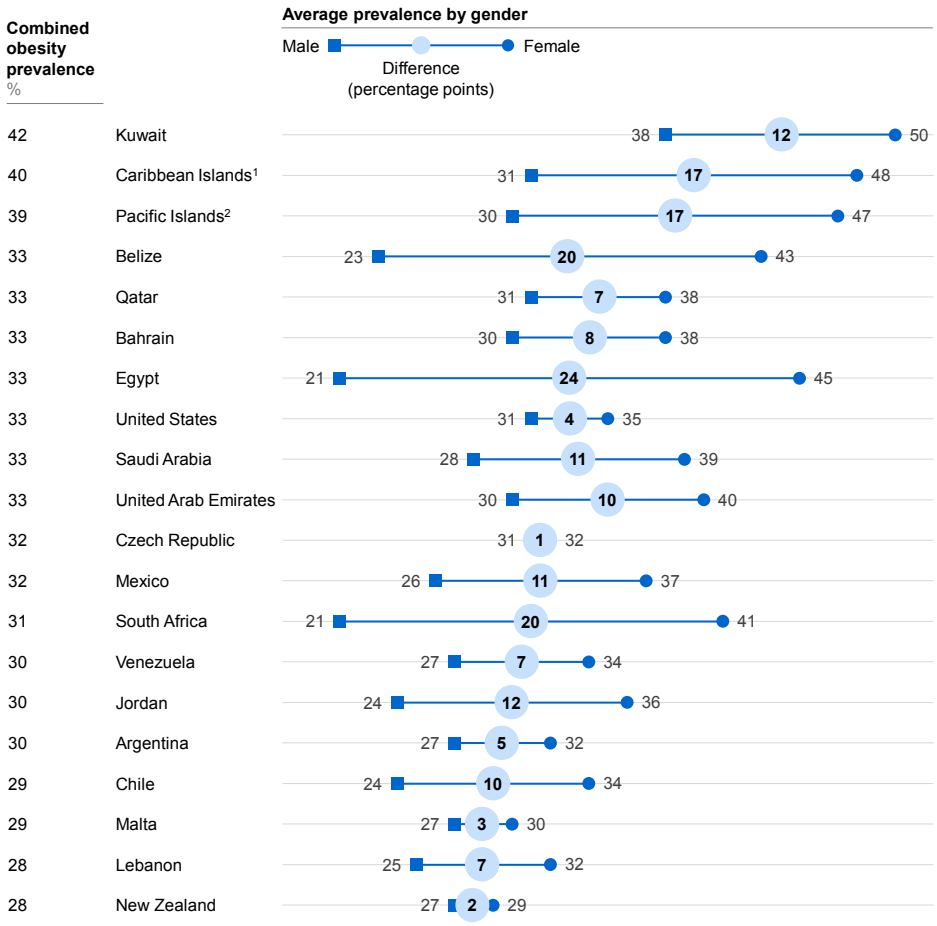
5 Ibid. L. D. Howe, R. Patel, and B. Galobardes, "Tipping the balance," April 2010.

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.

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.


BIKE

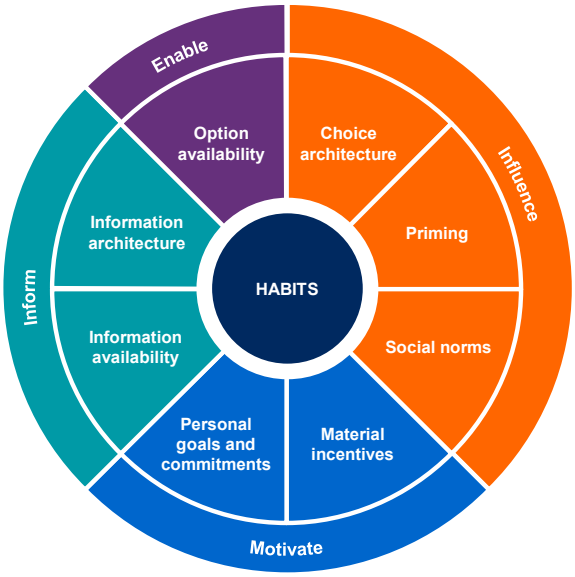
2. Tackling obesity

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"). The analysis has also considered two types of intervention that do not rely as much on behavioral change, and which are targeted at small segments of highly obese people: pharmaceuticals and surgery.

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

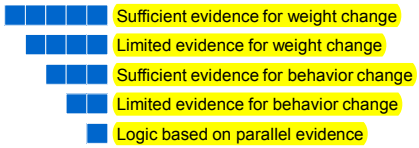
Our analysis suggests that a number of interventions have particularly high immediate impact at a low cost to society. The fact that a large number of effective interventions could be deployed cost-effectively suggests that the multipronged response necessary to mitigate rising obesity-prevalence rates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

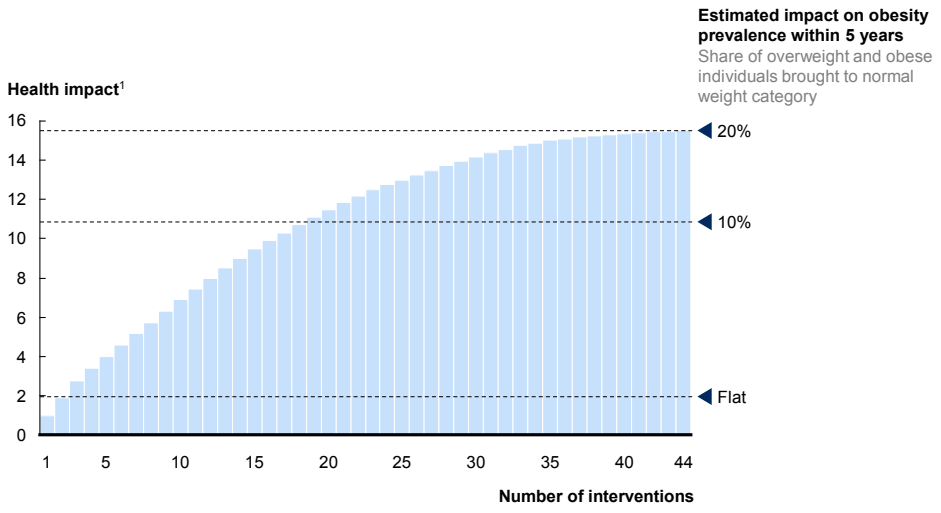
HIGH IMPACT IS ACHIEVABLE AT LOW COST TO SOCIETY

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.

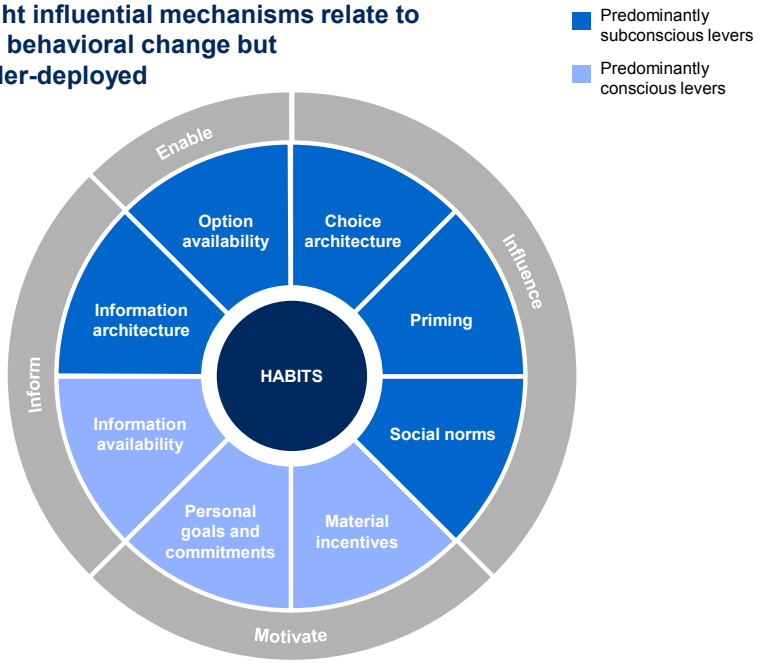
We have allocated our interventions to curb obesity into two groups: “conscious” mechanisms, which individuals participate in or engage with, and “subconscious” mechanisms, which alter the environment facing the consumer, maybe in ways that might not even be detectable (Exhibit 16).

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.

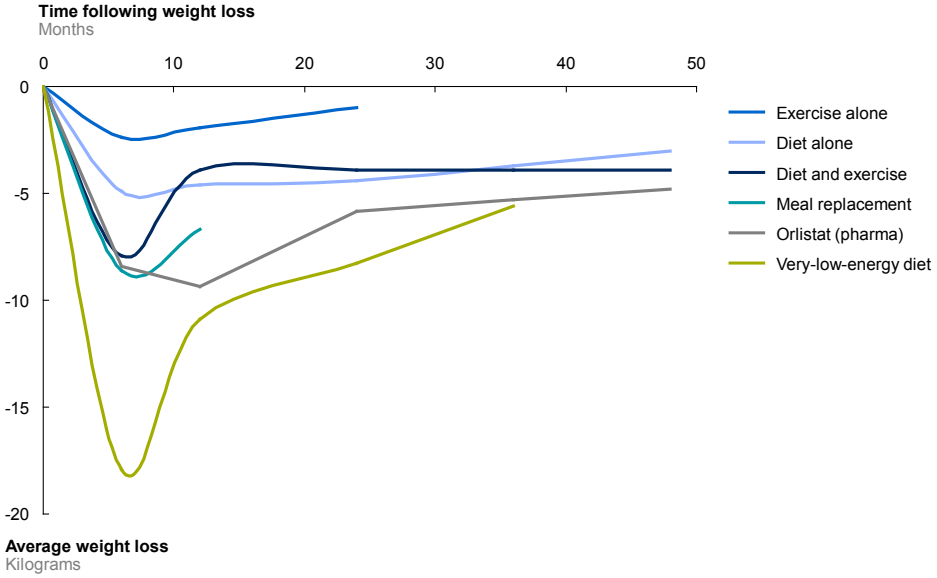
Moreover, brain power is no match for lack of willpower. Intellectually, people grasp the messages of public-health campaigns that seed an understanding of the issue and make clear the desired behavior. But these programs have low conversion rates—the number of people who then make the choice to change 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.

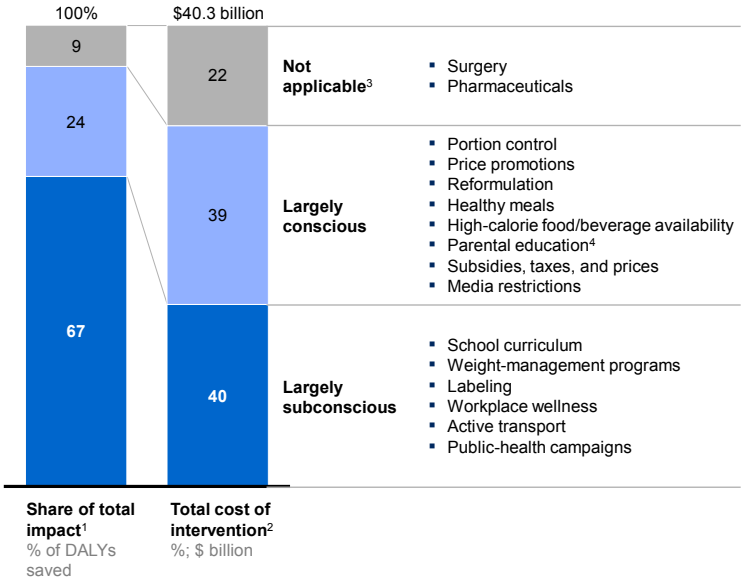
- **Far-reaching.** By their nature, structural interventions tend to apply to a very wide population. For example, changes to school curricula apply to all schoolchildren. Changes to a food producer's marketing practices have potential impact across consumer media and marketing channels. As a result, 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.

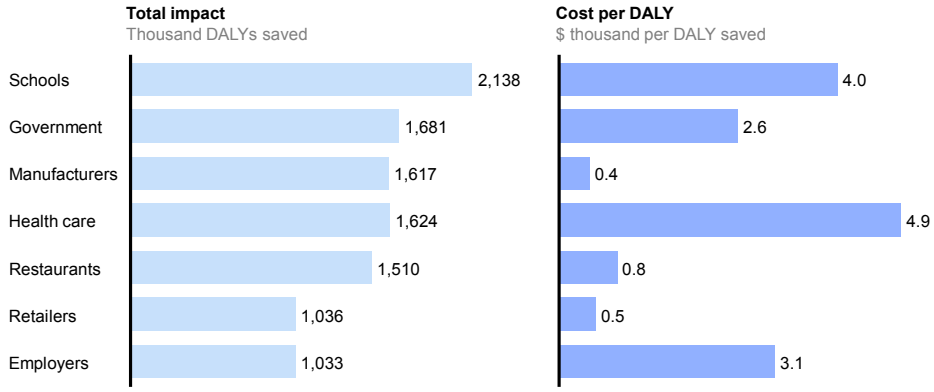
New collaborations are needed within the food and beverage industry and between industry and government

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.

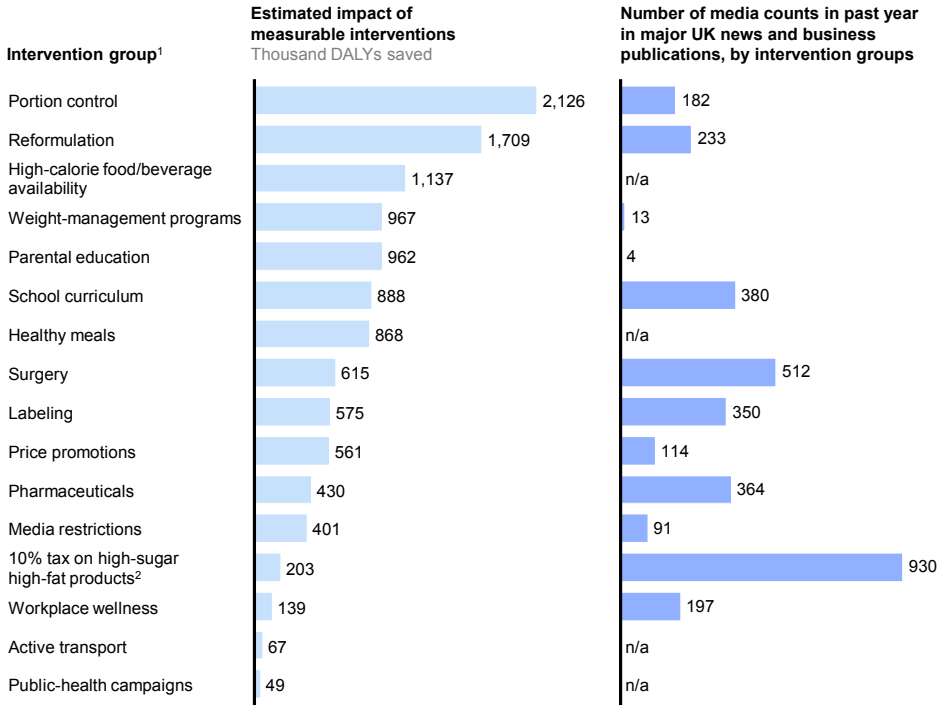
SUCCESS REQUIRES AS MANY INTERVENTIONS AS POSSIBLE BY A FULL RANGE OF PRIVATE AND PUBLIC SECTORS OF SOCIETY

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.

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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.

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