

## Obesity 1



# Patchy progress on obesity prevention: emerging examples, entrenched barriers, and new thinking

Christina A Roberto, Boyd Swinburn, Corinna Hawkes, Terry T-K Huang, Sergio A Costa, Marice Ashe, Lindsey Zwicker, John H Cawley, Kelly D Brownell

Despite isolated areas of improvement, no country to date has reversed its obesity epidemic. Governments, together with a broad range of stakeholders, need to act urgently to decrease the prevalence of obesity. In this Series paper, we review several regulatory and non-regulatory actions taken around the world to address obesity and discuss some of the reasons for the scarce and fitful progress. Additionally, we preview the papers in this *Lancet* Series, which each identify high-priority actions on key obesity issues and challenge some of the entrenched dichotomies that dominate the thinking about obesity and its solutions. Although obesity is acknowledged as a complex issue, many debates about its causes and solutions are centred around overly simple dichotomies that present seemingly competing perspectives. Examples of such dichotomies explored in this Series include personal versus collective responsibilities for actions, supply versus demand-type explanations for consumption of unhealthy food, government regulation versus industry self-regulation, top-down versus bottom-up drivers for change, treatment versus prevention priorities, and a focus on undernutrition versus overnutrition. We also explore the dichotomy of individual versus environmental drivers of obesity and conclude that people bear some personal responsibility for their health, but environmental factors can readily support or undermine the ability of people to act in their own self-interest. We propose a reframing of obesity that emphasises the reciprocal nature of the interaction between the environment and the individual. Today's food environments exploit people's biological, psychological, social, and economic vulnerabilities, making it easier for them to eat unhealthy foods. This reinforces preferences and demands for foods of poor nutritional quality, furthering the unhealthy food environments. Regulatory actions from governments and increased efforts from industry and civil society will be necessary to break these vicious cycles.

## Introduction

Overweight and obesity have increased globally, with only some regions experiencing stabilisation of the average body-mass index (BMI).<sup>1</sup> In 2010, elevated BMI accounted for about 2.8 million deaths each year,<sup>2</sup> and diet-related risk factors (eg, low fruit consumption and high sodium intake) and physical inactivity accounted for 10% of global disability-adjusted life-years.<sup>3</sup> In the first *Lancet* Series on obesity published in 2011, the globalisation of food systems that promote overconsumption of energy-dense, nutrient-poor foods and beverages was identified as the major driver of the obesity pandemic.<sup>4</sup> At the time, projections of increasing burdens of obesity and its related diseases on society,<sup>5</sup> as well as predictions of high economic costs associated with this burden, highlighted the need for urgent and substantial action. Policy and regulatory actions were identified as the most effective and cost effective means of tackling the problem.<sup>6</sup> What progress has been made since then?

An important global step was made in 2013 with the adoption of WHO's Global Action Plan for the Prevention and Control of Non-communicable Diseases 2013–2020<sup>7</sup> and its accompanying Noncommunicable Disease Global Monitoring Framework.<sup>8</sup> This framework includes obesity targets for adults and adolescents and recommended indicators to track progress. The obesity target in the Monitoring Framework appears modest, calling for a zero increase in prevalence from 2010 to 2025. The WHO's plan to address infant and young

child feeding and maternal nutrition likewise calls for a zero increase in prevalence of overweight children.<sup>9</sup> Yet, achievement of even this seemingly low bar is one of the largest challenges of all the global non-communicable disease targets and will need urgent actions from governments, as well as a broader range of stakeholders than previously emphasised.

No country to date has reversed its obesity epidemic. Although there are some examples of positive change, these mainly stem from a flattening of childhood obesity in some cities and countries where rates were already high.<sup>10</sup> Even where there has been progress, there is widening inequality in obesity prevalence, as discussed by Swinburn and colleagues<sup>11</sup> in this Series. The papers<sup>11–15</sup> in this second *Lancet* Series on obesity collectively ask what else is needed to meet the global targets of a zero increase in obesity prevalence. The first *Lancet* Series on obesity explained the reasons for the rise in obesity, the projections for the future, and the specific actions needed to reverse the trend. The *Lancet* Series that this paper is part of identifies the areas of progress around the world and provides a deeper and more systemic analysis of key aspects of obesity to identify underlying barriers to progress. Importantly, this Series proposes new ways to accelerate progress. Additionally, the papers challenge some of the entrenched and competing perspectives that describe obesity and its solutions in “either/or” terms. Although obesity is acknowledged as a complex issue,

Published Online

February 18, 2015

[http://dx.doi.org/10.1016/S0140-6736\(14\)61744-X](http://dx.doi.org/10.1016/S0140-6736(14)61744-X)

See Online/Comment

[http://dx.doi.org/10.1016/S0140-6736\(15\)60163-5](http://dx.doi.org/10.1016/S0140-6736(15)60163-5) and

[http://dx.doi.org/10.1016/S0140-6736\(14\)62397-7](http://dx.doi.org/10.1016/S0140-6736(14)62397-7)

This is the first in a Series of six papers about obesity

Harvard T.H. Chan School of Public Health, Boston, MA, USA (C A Roberto); School of Population Health,

University of Auckland, Auckland, New Zealand (B Swinburn MD); World Cancer Research Fund International, London, UK (C Hawkes PhD);

City University of New York, School of Public Health, New York, NY, USA

(Prof T T-K Huang PhD, S A Costa PhD); University of Nebraska Medical Center, College of Public Health, Omaha, NE, USA (T T-K Huang, S A Costa); ChangeLab

Solutions, Oakland, CA, USA

(M Ashe JD, L Zwicker JD);

Law Center to Prevent Gun Violence, San Francisco, CA, USA (L Zwicker);

Cornell University, Ithaca, NY, USA (J H Cawley PhD); and

Sanford School of Public Policy, Duke University, Durham, NC, USA (K D Brownell PhD)

Correspondence to:

Dr Christina A Roberto, Harvard T.H. Chan School of Public Health, Boston, MA 02115, USA  
[croberto@hsph.harvard.edu](mailto:croberto@hsph.harvard.edu)

## Key messages

- No country to date has reversed its obesity epidemic. Although there have been isolated pockets of progress, these mainly stem from the plateauing of childhood obesity in some cities and countries where the prevalence was high. Barriers to action have included lobbying from the food industry (specifically, manufacturers of prepared processed foods) and restaurant industry, restricted ability or unwillingness of governments to implement policies, absence of pressure from civil society for political action, and too little empirical assessment of the effects of many programmes and policies.
- There is emerging consensus on core policy actions that should be taken to promote healthy diets. We use the NOURISHING framework created by the World Cancer Research Fund International to categorise and describe these actions. The framework identifies possible policy actions across three broad domains: the food environment, the food system, and behaviour-change communication.
- Worldwide actions to address obesity include restriction of the marketing of food aimed at children, regulation of food nutritional quality and availability in schools, labelling of the front of packages with nutritional values, taxes on sugar-sweetened beverages, mass media campaigns, provision of financial incentives to improve food retail environments, private-public partnerships to encourage food industry reformulation, and inclusion of health-in-all-policies approaches by governments, among others.
- Divergent beliefs exist about what drives and sustains obesity. The way the problem is framed underlies many of the existing barriers. In this paper, we examine the false dichotomy that obesity is driven by either personal choice or the environment and suggest that these two competing perspectives be merged to show the reciprocal relationship between the individual person and the environment.
- The problem of obesity must be reframed to acknowledge on one hand that individuals bear some personal responsibility for their health, but that, on the other hand, environmental factors exploit biological, psychological, social, and economic vulnerabilities that promote overconsumption of unhealthy foods. A vicious cycle is created in which the preference and demand for unhealthy products are not only shaped by the environment, but lead to environmental changes that further encourage consumption of unhealthy foods. This cycle makes it difficult for people to act in their own long-term self-interest, but it can be broken with regulatory actions from governments and joint efforts from industry and civil society to create healthier food systems.

many debates about its causes and solutions are based on overly simplistic dichotomies. Examples of such dichotomies include individual versus environmental causes of obesity, personal versus collective responsibilities for action against obesity, supply versus demand explanations for consumption of unhealthy food, government regulation versus industry self-regulation, top-down versus bottom-up drivers for change, treatment versus prevention, undernutrition versus overnutrition focus, etc. Examination of the junctures where these competing analyses intersect has led to the emergence of the important new insights discussed in this Series.

Throughout this Series, many examples of progress are described and provide important evidence that the actions recommended by the WHO's Global Non-communicable Disease Action Plan are indeed feasible. However, global progress remains poor. In the present paper, we first

review several regulatory and non-regulatory actions taken around the world to address obesity, and we discuss some of the reasons for isolated and sporadic progress. We then examine one dichotomy that has shaped the framing of obesity: personal choice versus environmental influence. We suggest that these two competing perspectives should be merged to reflect the interaction occurring between each individual person and the environment. Finally, we preview the remaining papers in this Series, most of which focus on food and diets rather than physical activity, which was discussed by Lee and colleagues in the 2011 Series published by *The Lancet*.<sup>16</sup>

## Global actions to address obesity

There is reason to feel optimistic about the future of obesity prevention, because many countries have increased their actions to address unhealthy diets. To start with, 89% of governments report having units dedicated to the reduction of non-communicable diseases (including obesity), although the size and capacity of many of these units is unknown.<sup>17</sup> Several regional and political declarations of commitment to action have been made. Examples include the 2007 Declaration of Port-of-Spain by the heads of government of the Caribbean Community,<sup>18</sup> the 2011 Pan American Conference on obesity in Aruba,<sup>19</sup> the 2006 WHO European Ministerial Conference on Counteracting Obesity in Istanbul, Turkey,<sup>20</sup> and the 2013 Pacific Health Ministers meeting in Apia, Samoa.<sup>21</sup> Most countries now have some form of strategy or action plan on obesity or healthy eating. For example, Chile passed legislation for obesity prevention, and Peru is in the process of discussing a similar law in congress.<sup>22</sup>

There is consensus, based both on research and practice, of the core policy actions that can be taken to promote healthy diets.<sup>6,23–25</sup> These policy areas have been brought together in the NOURISHING framework, created by World Cancer Research Fund International (figure).<sup>26,27</sup> The framework identifies three broad domains covering ten areas in which policy actions can be taken: the food environment (eg, nutrition labelling, economic approaches, such as food taxes or targeted subsidies, restriction of food advertising, and incentivisation of healthy retail environments), the food system (eg, encouragement of healthy behaviours through health-related and non-health-related policies), and behaviour-change communication (eg, health-care visits, nutrition-counselling interventions, and public awareness campaigns). The ten areas of the NOURISHING framework can be adapted to the different geographical contexts around the world.

The NOURISHING framework also provides a structure to categorise and monitor worldwide policy actions. The good news is that international policy actions have been taken across the NOURISHING framework. We now describe a series of policy actions that have been taken across the three key domains of the NOURISHING framework.

Domain		Policy area	Examples of potential policy actions
Food environment	N	Nutrition label standards and regulations on the use of claims and implied claims on foods	eg, nutrient lists on food packages; clearly visible "interpretive" and calorie labels; menu, shelf labels; rules on nutrient and health claims
	O	Offer healthy foods and set standards in public institutions and other specific settings	eg, fruit and vegetable programmes; standards in education, work, health facilities; award schemes; choice architecture
	U	Use economic tools to address food affordability and purchase incentives	eg, targeted subsidies; price promotions at point of sale; unit pricing; health-related food taxes
	R	Restrict food advertising and other forms of commercial promotion	eg, restrict advertising to children that promotes unhealthy diets in all forms of media; sales promotions; packaging; sponsorship
	I	Improve the nutritional quality of the whole food supply	eg, reformulation to reduce salt and fats; elimination of trans fats; reduce energy density of processed foods; portion size limits
	S	Set incentives and rules to create a healthy retail and food service environment	eg, incentives for shops to locate in underserved areas; planning restrictions on food outlets; in-store promotions
Food system	H	Harness the food supply chain and actions across sectors to ensure coherence with health	eg, supply-chain incentives for production; public procurement through "short" chains; health-in-all policies; governance structures for multi-sectoral engagement
Behaviour-change communication	I	Inform people about food and nutrition through public awareness	eg, education about food-based dietary guidelines, mass media, social marketing; community and public information campaigns
	N	Nutrition advice and counselling in health-care settings	eg, nutrition advice for at-risk individuals; telephone advice and support; clinical guidelines for health professionals on effective interventions for nutrition
	G	Give nutrition education and skills	eg, nutrition, cooking/food production skills on education curricula; workplace health schemes; health literacy programmes

**Figure: World Cancer Research Fund International NOURISHING framework**

Food policy framework for healthy diets and the prevention of obesity and diet-related non-communicable diseases.<sup>26,27</sup> Reprinted by permission of World Cancer Research Fund International.

## Food-environment actions

At least 50 countries now require nutrition information labelling on most pre-packaged foods, and several countries have developed or are using interpretative front-of-package nutrition labelling schemes on a voluntary basis (eg, Denmark, Norway, Sweden, Singapore, and the UK).<sup>28</sup> Mexico implemented taxation of sugar-sweetened beverages and other so-called junk foods, and many countries have or are actively pursuing taxes on sugar-sweetened beverages to combat both obesity and dental disease.<sup>29,30</sup> South Korea<sup>31</sup> and the UK<sup>32</sup> have imposed restrictions on television advertising of energy-dense and nutrient-poor foods for children. New York City, USA, has been a leader in obesity prevention by using a wide range of policy approaches to improve the food and physical activity environments, promote healthy behaviours, and improve preventive health services.<sup>33</sup> Swinburn and colleagues<sup>11</sup> describe the efforts of New York City in this *Lancet* Series.

Other policies have focused on schools. For example, the Mexican Government has implemented food regulations aimed at improving the availability and accessibility of healthy foods and beverages in schools.<sup>34</sup> These regulations include nutritional criteria and specific recommendations for a healthy midday snack. In the USA, changes were made to improve the nutrition standards of school meals, including making water freely available during meals, increasing the amount and types of fruits and vegetables served, and reducing fat and

saturated fat content of meals.<sup>35</sup> Improved nutrition criteria for snacks in schools have also been set.<sup>36</sup> Hawkes and colleagues<sup>34</sup> discuss the effectiveness of some of these policies in this *Lancet* Series.

There have also been instances of quasiregulatory actions that provide financial incentives for businesses to advance public health, while encouraging and rewarding private sector innovation.<sup>37</sup> For example, private philanthropies have partnered with government agencies to incentivise improvements to the food retail environment by funding healthy food initiatives in American cities and states such as Philadelphia, Louisiana, and California.<sup>38–40</sup>

## Food-system actions

Governments are taking several steps to harness action by actors throughout the food system. South Australia has implemented a health-in-all-policies approach, which emphasises that government objectives for a healthy population are best achieved when all sectors include health and wellbeing as a key component of policy development.<sup>41</sup> The Australian state of Victoria has implemented a systems-based prevention approach in disadvantaged areas through local governments.<sup>42</sup> Within the Healthy Together Victoria initiative, the professionals in place to promote local health do not deliver programmes or projects, but they support local settings and community leaders to map their systems (such as food provided in schools or the fruits and vegetables

supplied in a town) and identify and take the necessary measures within the systems to promote healthy food and physical activity environments and behaviours.

Local governments have traditionally regulated the use of land through comprehensive land-use planning, zoning controls, transportation planning, and the like. Increasingly, these planning processes are being integrated with public health goals to address issues such as obesity and other chronic conditions.<sup>43–45</sup> Governments are using these planning processes to demand that new housing and commercial developments adhere to activity or transit-oriented design guidelines,<sup>46–51</sup> increase access to healthy food markets (eg, farmers' markets<sup>52</sup> and mobile vendors of healthy foods),<sup>53</sup> and increase physical activity access through bike lanes,<sup>45</sup> green space,<sup>45</sup> complete streets (designed for all users, including pedestrians, bicyclists, motorists, and public transit vehicles),<sup>54,55</sup> safe routes to school, or slow-speed zones.<sup>56</sup> South Africa has adopted a Strategic Plan for the Prevention and Control of Non-Communicable Diseases 2013–17<sup>57</sup> that includes a health-in-all-policies framework.

Some countries have also taken action further upstream in the food system to promote healthier eating. For example, Samoa, which has one of the world's highest prevalence of overweight and obesity, affecting 85% of the population,<sup>58</sup> instituted a ban on the importation of fatty turkey tails. However, the ban was subsequently removed as part of Samoa's negotiated accession to WHO. The country replaced the ban with a high tax on turkey tail imports, and is now developing alternative, less trade-restrictive policies to achieve a similar outcome.<sup>59</sup> Additionally, governments have developed procurement policies with model nutrition standards for government workplace cafeterias and snack shops, schools, park and recreation departments, hospitals, prisons and jails, and nursing homes.<sup>60</sup> Brazil has integrated family farming with schoolmeal procurement programmes.<sup>61</sup> During President Luiz Inacio Lula da Silva's administration, the Brazilian Government changed procurement policies, favouring the purchase of non-processed, fresh, and locally produced foods, such as rice, beans, vegetables, and fruits, for more than 45 million children in the public education system. The programme aims to support family farmers and cooperatives by requiring that at least 30% of all foods supplied to schools comes from local producers.<sup>22,61,62</sup> The strategy has now been adopted in Africa under the Purchase from Africans for African Programme, and participating countries include Ethiopia, Malawi, Mozambique, Niger, and Senegal.<sup>63</sup>

To encourage changes in the food supply that will promote health, many governments have developed initiatives that engage with the food industry, such as the US White House Task Force on Childhood Obesity, created in conjunction with US First Lady Michelle Obama's Let's Move initiative.<sup>64</sup> As part of these efforts, companies have pledged to improve the nutritional quality and reduce calories and sodium content of children's school menu

items. One major company committed to work with manufacturers to eliminate trans fats and reduce sugar and sodium in products sold in their stores and took action to lower the costs of fruits, vegetables, and whole grains. Additionally, through the Healthy Weight Commitment Foundation, a group of the largest food manufacturers are taking actions to fulfil their pledge to cut 1·5 trillion calories from food supply by 2015.<sup>65</sup>

Since launching in 2011, the Public Health Responsibility Deal<sup>66</sup> in the UK has also motivated a series of pledges and actions by food companies.<sup>67</sup> For example, two companies have pledged to implement the UK Government's 2013 recommended Front of Pack Nutrition Labelling scheme, and 36 leading food and drink companies have signed up for a calorie-reduction pledge. In the final paper of this *Lancet* Series, Swinburn and colleagues<sup>11</sup> discuss the ways in which these companies are being held accountable for these changes.

### Behaviour-change actions

There are several examples of behaviour-change communication strategies. China has focused its efforts on the development and promulgation of guidelines, including the Guidelines for Prevention and Control of Overweight and Obesity of Chinese Adults and the Guidelines on Snacks for Chinese Children and Adolescents.<sup>68</sup> The government has also launched a small number of campaigns, notably the 121 Health Action strategy of "ten thousand steps a day, the balance of eating and activity and a healthy life" in 2007.<sup>68</sup> In a survey by WHO,<sup>69</sup> 23 Latin American countries and territories reported programmes related to food-based dietary guidelines, nutritional counselling in primary care, and public service campaigns.

There are many examples of public service campaigns in the USA, including New York City's "pouring on the pounds" public education campaign that emphasises the risks of overconsumption of sugar-sweetened beverages.<sup>70</sup> This campaign was also coupled with several policy changes. Los Angeles, CA, USA, launched a "sugar pack" campaign designed to inform consumers of the number of sugar packs in sugar-sweetened beverages, using transit and billboard advertisements, as well as social media.<sup>71</sup> In Western Australia, the public health education campaign LiveLighter was launched to encourage healthy dietary habits and physical activity.<sup>72</sup> Mass media campaigns, coupled with other efforts to engage communities through social media, online and print resources, advocacy efforts, and engagement with retailers, are the major components of the LiveLighter campaign.

### Not enough progress

Obesity and related non-communicable diseases are being taken more seriously than ever before by many governments. However, although we reviewed several promising policy actions from across the world, there is still a long way to go in terms of the quantity and quality of food-policy

actions and understanding their effectiveness (see Hawkes and colleagues,<sup>12</sup> this Series). Many countries still do not have food policies. According to WHO, about one quarter of countries did not have a policy on unhealthy eating by 2010, and few countries had developed policy options in all the key areas.<sup>17</sup> Low-income countries do worse than high-income countries: more than 50% said they had no policy on diet, compared with 9% of high-income countries. Whereas almost all high-income countries report some kind of initiative to promote fruit and vegetable consumption in schoolchildren,<sup>73,74</sup> results of a survey by the UN Food and Agriculture Organization showed that very few middle-income countries have undertaken such efforts.<sup>75</sup>

The actual implementation of strategies to address obesity has largely favoured changes in behaviour over changes in food and physical activity environments.<sup>76,77</sup> Furthermore, although we described some promising examples of governments engaging industry to promote healthy diets, some of these efforts have occurred instead of government regulatory intervention, rather than alongside. For example, in the case of food promotion to children, most action has been in the form of voluntary self-regulation.<sup>78,79</sup> Internationally, there are now more industry-led pledges on food advertising to children than government regulations.<sup>79</sup> However, a major concern with industry regulation is the failure of these efforts to be sufficiently comprehensive in scope, rigorous in the nutritional criteria, or adequate in their enforcement and sanctions.<sup>80,81</sup>

## The second *Lancet* Series on obesity

In this *Lancet* Series, each paper tackles a particular set of actions that will be crucial to the achievement of worldwide and national progress. In doing so, the papers challenge several dichotomies that frame obesity and its solutions in overly simplistic “either/or” terms. The challenging of these dichotomies has generated new perspectives and actions. The papers argue that a more nuanced appreciation of situations in which these dichotomies are too simplistic is needed and that the seemingly opposite perspectives both have some merit. Such complex areas are often where action is most needed. Throughout the Series, examples and case studies are used to compel policy makers to think about and implement the necessary changes.

## Barriers to progress

There are many reasons for the patchy progress on obesity prevention, as discussed throughout this Series. These include industry lobbying to prevent food policies designed to improve public health, the restricted ability or unwillingness of governments to implement policies, and absence of pressure from civil society for policy action. There are also a range of reasons for the scarce demand for action from civil society, including absence of organisations, restricted capacity and funding, weak coordination, and low priority of obesity-related issues.<sup>82</sup>

In this paper, we examine the framing of obesity, which contributes to many of the barriers to preventing obesity. By framing, we refer to divergent beliefs about what drives and sustains obesity. Public health problems often tend to be viewed from one of two competing perspectives: an individualising frame that places responsibility on the individual, or a systemic frame that places responsibility on environmental and social factors. These frames can have a powerful effect on public opinion, as well as support for and enactment of competing policies.<sup>83–85</sup> Systemic frames tend to encourage government action on behalf of the public's health, while individualising frames bring no or restricted government action.<sup>86</sup> However, this dichotomy can impede progress. In reality, both positions have some merit. People have some personal responsibility for their health, and environmental factors can affect the ability of people to exercise personal responsibility. Furthermore, the individual and environment interact in reciprocal ways. The environments deliver large amounts of unhealthy foods to people, which, in turn, affects their food preferences and sustains or increases the demand for unhealthy foods.<sup>12</sup>

A series of environmental factors are exploiting biological, psychological, social, and economic vulnerabilities of people in ways that undermine their ability to act in their long-term self-interest. The high profits that come from the successful exploitation of vulnerabilities are often the driving force behind environmental changes that promote overconsumption of food. These environmental factors affect personal preferences and demands for unhealthy foods, which, as part of a vicious cycle, encourage environments to continue promoting unhealthy foods. This suggests that the vicious cycle can most effectively be broken through government regulation and efforts from industry and civil society, rather than trying to intervene at the level of individuals or their environments in isolation.

## Biological vulnerabilities

Modern food environments are filled with nutrient-poor and energy-dense foods. These foods are highly appetising and processed in ways that make it difficult for the body to regulate intake and weight. Although the perception that some foods can be addictive is widespread in popular culture, research is underway to study the ways in which consumption of some foods and consumption of addictive substances can have similar effects in the brain.

Incentivised to maximise profits, the food industry manipulates ingredients, such as sugar, fat, and salt, along with flavour enhancers, food additives, and caffeine, to increase the reward value of foods.<sup>87</sup> Many ultra-processed foods are also depleted of fibre and protein, two components that can enhance satiation and slow absorption of ingredients, such as sugar, into the bloodstream. Research using rats suggests that exposure to ultra-processed foods high in added sugar, fat, and salt



leads to behavioural and neurobiological changes,<sup>88</sup> consistent with an addictive process. Neuroimaging of human brains has also shown that food intake and drug use trigger similar brain activity.<sup>89</sup> This biological vulnerability to ultra-processed foods is especially concerning for children because they have a stronger preference for sweet foods than do adults.<sup>90–92</sup>

Childhood is a period of a person's life when industries work to develop brand loyalty. Marketing and early exposure at a young age to ultra-processed foods shape children's taste expectations and preferences for unhealthy products.<sup>12,92</sup> The key question is whether these ultra-processed, appetising foods affect the brain in ways that create a public health threat. The discovery that nicotine was addictive strengthened support for tobacco control policies, such as taxation and restrictions, on advertisement to young people.<sup>93</sup> If research finds that some foods might trigger an addiction, it could shift public opinion about the role of policy in addressing obesity.

There are also important biological barriers to losing excess weight, once gained. Changes in brain chemistry, metabolism, and hunger and satiety hormones, which occur during attempts to lose weight, make it difficult to definitively lose weight.<sup>94</sup> This can prompt a vicious cycle of failed dieting attempts, perpetuated by strong biological resistance to rapid weight loss, the regaining of weight, and feelings of personal failure at the inability to sustain a weight-loss goal. This sense of failure makes people more susceptible to promises of quick results and minimally regulated claims of weight loss products.

### Psychological vulnerabilities

Psychological research has highlighted the many ways in which we are affected by food-choice architecture (the context in which people make dietary decisions),<sup>95</sup> including the serving size of containers, the placement of food items in supermarkets, the price of products, and the promotional strategies used to market foods.<sup>96</sup> The food industry is incentivised to design choice environments that promote consumption of foods of poor nutritional quality, which tend to be the products with the highest profit. These environmental factors are varied, subtle, and very influential<sup>96,97</sup> because they leverage psychological biases in favour of overeating. For example, people have a strong tendency to adhere to default options.<sup>98</sup> This psychological bias is exploited by food defaults at restaurants, such as large portion sizes and included side orders, which promote overeating.<sup>99,100</sup> Despite consumers' desire for smaller portions, customers rarely depart from the status quo by asking for less food.<sup>101</sup>

### Social and economic vulnerabilities

Social vulnerabilities are also exploited in many modern environments. Societal shifts in family roles and the entrance of women into the full-time labour force increase the appeal of restaurant food and other ready-to-eat foods that are quick and convenient, but less

healthy than home-cooked meals.<sup>102</sup> In high-income countries, energy-dense and nutrient-poor foods tend to be inexpensive, thus saturating low-income neighbourhoods with unhealthy options.<sup>103,104</sup> Additionally, food and beverage companies target their marketing towards specific groups, including adolescents and children, racial and ethnic minority groups, and people in low-income neighbourhoods.<sup>105,106</sup> These socioeconomic issues underlie the difficulty of taking personal responsibility for food choices in certain contexts.

Taken together, the environment clearly interacts with personal vulnerabilities in problematic ways that promote overconsumption of ultra-processed foods. Thus, the debate that seeks to blame either the environment or the individual is more productively reframed by acknowledging that environmental effects that exploit individuals' vulnerabilities can make it difficult for people to make healthier decisions. Because adults have to buy and eat their own food, there will always be a component of personal responsibility to everyday food decisions. However, there is also a role for citizens to exercise personal responsibility by mobilising political and economic demand for health, as discussed by Huang and colleagues.<sup>13</sup>

### Papers in this Lancet Series

In this first paper of this *Lancet* Series, we have proposed that the debate over individual choice versus environmental influence be reframed so as to acknowledge the interaction between the two. We frame obesity as a problem driven largely by environmental effects that undermine the self-regulatory capacity people have to make responsible decisions about personal diet and physical activity.

The second paper by Hawkes and colleagues<sup>12</sup> also challenges the dichotomy between a traditional public health-based perspective (which identifies food systems, food environments, and the food industry as the leading cause of obesity) and an individual-based perspective (which argues that consumer demand drives unhealthy food consumption because the market simply delivers what consumers want). Hawkes and colleagues discuss the ways in which the food, social, and information environments affect the development of personal dietary preferences and the ability of people to express existing food preferences. They argue that an understanding of the interaction between these supply-and-demand factors is critical to the development of smart and effective obesity prevention policies.

The paper by Huang and colleagues<sup>13</sup> builds on this broad theme by challenging the false dichotomy that either top-down (eg, government) or bottom-up (eg, grassroots) solutions are needed. Public health experts and policy makers tend to focus on top-down solutions (ie, the policies that can be passed now to alter the environment and improve health), which treats people as passive recipients of information and change. However, the reality is that many policy efforts have little support from voters

and intended programme participants, and although the passage of policies is crucial, there is also a need to mobilise policy action from the bottom up. Huang and colleagues focus on bottom-up strategies that view people as active agents who can change their environments.

Lobstein and colleagues<sup>14</sup> focus their paper on childhood obesity, which is showing increases in prevalence worldwide and a recent, steep increase in low-income to middle-income countries. Their paper, in part, explores the difficulties of prioritising undernutrition versus overnutrition in policy making.

Many countries, communities, and even households struggle with the coexistence of people who are undernourished and people who have excess weight. Yet policy makers focusing on undernutrition or on obesity address these problems in different ways and advocate for different policy approaches, despite having very similar goals. This situation suggests a need for solutions that target both issues simultaneously.

In the fifth paper of this Series, Dietz and colleagues<sup>15</sup> discuss treatment approaches for weight loss and maintenance. They also note the difficulty of prioritising investment between obesity prevention (with its low costs but long-term benefits) or obesity treatments (with its shorter-term gains but higher costs). They argue that reduction of global obesity will need a combination of effective and compassionate health care, coupled with policy and environmental changes to both support those who have lost weight and prevent weight gain. They also note the power of doctors and health professionals as advocates for prevention and societal approaches.

The final paper in the Series by Swinburn and colleagues<sup>11</sup> focuses on accountability systems as a means to ensure action on obesity and healthy food environments. Classically, enactment of food policies has been framed as a responsibility of the government, production of healthy foods as a responsibility of the food industry, and the demand for healthy foods as a responsibility of the consumers. Swinburn and colleagues shift the focus of debate from the responsibility framework, where the obligation lies with one party, to an accountability framework, where the obligations are between two or more parties. In their analysis, there are many opportunities for parties to hold each other to account within the range of government regulations, which is the highest accountability but strongly contested, and voluntary industry codes, which have very little evidence of effect. In particular, quasiregulatory approaches hold some promise for overcoming the impasse over the regulation versus non-regulation dichotomy.

## Conclusion

The modest-sounding, but impressively challenging goal ahead is to prevent any further increase in obesity prevalence. There is no question that obesity is a complex problem and that meeting this goal will need substantial and urgent actions, not only from governments, but from

a range of actors. Through the WHO Global Action Plan for the Prevention and Control of Non-communicable Diseases,<sup>7</sup> there are clear agreements on what strategies should be implemented and tested to address obesity. The challenge now is how to implement the specific actions within those strategies. Here we have highlighted positive examples of multisectoral efforts to tackle obesity, but the progress is patchy and clearly insufficient. In this *Lancet* Series, several areas of priority action are described across many different systems. Additionally, this Series examines competing narratives where arguments and actions have stalled and proposes new ways to face the problems and find solutions. Major areas for potential progress have emerged from this examination, and the multiple actors who can contribute to the solutions are urged to increase their efforts and find new ways to turn the patchy progress into serious strides towards halting the obesity epidemic.

### Contributors

All authors jointly formulated the major concepts, read, and approved the final version of this paper. CAR led the writing of the paper, with the assistance of BS, CH, and TT-KH. SAC, MA, LZ, and JHC contributed to the writing and provided comments. KDB provided comments on the paper.

### Declaration of interests

BS is a researcher within a NHMRC Centre for Research Excellence in Obesity Policy and Food Systems (APP1041020). We declare no competing interests.

### Acknowledgments

We thank the World Cancer Research Fund International design team for the diagram depicted in the figure, and we acknowledge the contribution of Jo Jewell to this paper.

### References

- 1 Finucane MM, Stevens GA, Cowan MJ, et al, and the Global Burden of Metabolic Risk Factors of Chronic Diseases Collaborating Group (Body Mass Index). National, regional, and global trends in body-mass index since 1980: systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9.1 million participants. *Lancet* 2011; **377**: 557–67.
- 2 WHO. Global status report on non-communicable diseases 2010. Geneva: World Health Organization, 2011. [http://whqlibdoc.who.int/publications/2011/9789240686458\\_eng.pdf?ua=1](http://whqlibdoc.who.int/publications/2011/9789240686458_eng.pdf?ua=1) (accessed April 30, 2014).
- 3 Lim SS, Vos T, Flaxman AD, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012; **380**: 2224–60.
- 4 Swinburn BA, Sacks G, Hall KD, et al. The global obesity pandemic: shaped by global drivers and local environments. *Lancet* 2011; **378**: 804–14.
- 5 Wang YC, McPherson K, Marsh T, Gortmaker SL, Brown M. Health and economic burden of the projected obesity trends in the USA and the UK. *Lancet* 2011; **378**: 815–25.
- 6 Gortmaker SL, Swinburn BA, Levy D, et al. Changing the future of obesity: science, policy, and action. *Lancet* 2011; **378**: 838–47.
- 7 WHO. Global action plan for the prevention and control of noncommunicable diseases 2013–2020. Geneva: World Health Organization, 2013. [http://apps.who.int/iris/bitstream/10665/94384/1/9789241506236\\_eng.pdf?ua=1](http://apps.who.int/iris/bitstream/10665/94384/1/9789241506236_eng.pdf?ua=1) (accessed Jan 15, 2015).
- 8 WHO. Noncommunicable disease global monitoring framework. [http://www.who.int/nmh/global\\_monitoring\\_framework/en/](http://www.who.int/nmh/global_monitoring_framework/en/) (accessed April 30, 2014).
- 9 WHO. Comprehensive implementation plan on maternal, infant and young child nutrition. 65th World Health Assembly. Geneva: World Health Organization, 2012 [http://www.who.int/nutrition/topics/WHA65.6\\_annex2\\_en.pdf](http://www.who.int/nutrition/topics/WHA65.6_annex2_en.pdf) (accessed April 30, 2014).

- 10 Olds T, Maher C, Zumin S, et al. Evidence that the prevalence of childhood overweight is plateauing: data from nine countries. *Int J Pediatr Obes* 2011; **6**: 342–60.
- 11 Swinburn B, Kraak V, Rutter H, et al. Strengthening accountability systems to create healthy food environments and reduce global obesity. *Lancet* 2015; published online Feb 18. [http://dx.doi.org/10.1016/S0140-6736\(14\)61747-5](http://dx.doi.org/10.1016/S0140-6736(14)61747-5).
- 12 Hawkes C, Smith TG, Jewell J, et al. Smart food policies for obesity prevention. *Lancet* 2015; published online Feb 18. [http://dx.doi.org/10.1016/S0140-6736\(14\)61745-1](http://dx.doi.org/10.1016/S0140-6736(14)61745-1).
- 13 Huang TT-K, Cawley JH, Ashe M, et al. Mobilisation of policy support for policy actions to prevent obesity. *Lancet* 2015; published online Feb 18. [http://dx.doi.org/10.1016/S0140-6736\(14\)61743-8](http://dx.doi.org/10.1016/S0140-6736(14)61743-8).
- 14 Lobstein T, Jackson-Leach R, Moodie ML, et al. Child and adolescent obesity: part of a bigger picture. *Lancet* 2015; published online Feb 18. [http://dx.doi.org/10.1016/S0140-6736\(14\)61746-3](http://dx.doi.org/10.1016/S0140-6736(14)61746-3).
- 15 Dietz WH, Baur LA, Hall K, et al. Management of obesity: improvement of health-care training and systems for prevention and care. *Lancet* 2015; published online Feb 18. [http://dx.doi.org/10.1016/S0140-6736\(14\)61748-7](http://dx.doi.org/10.1016/S0140-6736(14)61748-7).
- 16 Lee IM, Shiroma EJ, Lobelo F, et al. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet* 2012; **380**: 219–29.
- 17 WHO. Assessing national capacity for the prevention and control of noncommunicable diseases. Report of the 2010 global survey. Geneva: World Health Organization, 2012. [http://www.who.int/cancer/publications/national\\_capacity\\_prevention\\_ncds.pdf](http://www.who.int/cancer/publications/national_capacity_prevention_ncds.pdf) (accessed April 30, 2014).
- 18 Declaration of Port-of-Spain. Uniting to stop the epidemic of chronic noncommunicable diseases. Caribbean Community Secretariat. 2007. [http://www.caricom.org/jsp/communications/meetings\\_statements/declaration\\_port\\_of\\_s\\_pain\\_chronic\\_ncds.jsp](http://www.caricom.org/jsp/communications/meetings_statements/declaration_port_of_s_pain_chronic_ncds.jsp) (accessed April 25, 2014).
- 19 Visser R, Atkinson RL. Proceedings of the Second Pan American Conference on Obesity with special attention to childhood obesity and a workshop. Education for childhood obesity prevention: a life-course approach. *Int J Obes Suppl* 2013; **3**: S1–2.
- 20 WHO. WHO European ministerial conference on counteracting obesity. Geneva: World Health Organization, 2007. [http://www.euro.who.int/\\_data/assets/pdf\\_file/0006/96459/E90143.pdf](http://www.euro.who.int/_data/assets/pdf_file/0006/96459/E90143.pdf) (accessed April 30, 2014).
- 21 WHO. Apia communique on healthy islands, NCDs, and the post-2015 development agenda. Tenth Pacific Health Ministers Meeting. Geneva: World Health Organization, 2013. [http://www.wpro.who.int/southpacific/pic\\_meeting/2013/meeting\\_outcomes/10th\\_PHM\\_M\\_Apia\\_Communique.pdf?ua=1](http://www.wpro.who.int/southpacific/pic_meeting/2013/meeting_outcomes/10th_PHM_M_Apia_Communique.pdf?ua=1) (accessed May 1, 2014).
- 22 Jacoby E, Rivera J, Cordera S, et al. Legislation, children, obesity. Standing up for children's rights in Latin America. [Commentaries]. *World Nutrition* 2012; **3**: 483–516.
- 23 Cecchini M, Sassi F, Lauer JA, Lee YY, Guajardo-Barron V, Chisholm D. Tackling of unhealthy diets, physical inactivity, and obesity: health effects and cost-effectiveness. *Lancet* 2010; **376**: 1775–84.
- 24 Mozaffarian D, Afshin A, Benowitz NL, et al, and the American Heart Association Council on Epidemiology and Prevention, Council on Nutrition, Physical Activity and Metabolism, Council on Clinical Cardiology, Council on Cardiovascular Disease in the Young, Council on the Kidney in Cardiovasc. Population approaches to improve diet, physical activity, and smoking habits: a scientific statement from the American Heart Association. *Circulation* 2012; **126**: 1514–63.
- 25 Kumanyika SK, Obarzanek E, Stettler N, et al, and the American Heart Association Council on Epidemiology and Prevention, Interdisciplinary Committee for Prevention. Population-based prevention of obesity: the need for comprehensive promotion of healthful eating, physical activity, and energy balance. A scientific statement from American Heart Association Council on Epidemiology and Prevention, Interdisciplinary Committee for Prevention (formerly the expert panel on population and prevention science). *Circulation* 2008; **118**: 428–64.
- 26 Hawkes C, Jewell J, Allen K. A food policy package for healthy diets and the prevention of obesity and diet-related non-communicable diseases: the NOURISHING framework. *Obes Rev* 2013; **14** (suppl 2): 159–68.
- 27 World Cancer Research Fund International. WCRF International food policy framework for healthy diets: NOURISHING. <http://www.wcrf.org/int/policy/nourishing-framework> (accessed April 30, 2014).
- 28 World Cancer Research Fund International. Nutrition label standards and regulations on the use of claims and implied claims on foods. <http://www.wcrf.org/int/policy/nourishing-framework/nutrition-labels> (accessed April 25, 2014).
- 29 World Cancer Research Fund International NOURISHING framework. Use economic tools to address food affordability and purchase incentives. <http://www.wcrf.org/int/policy/nourishing-framework/use-economic-tools> (accessed April 25, 2014).
- 30 Brownell KD, Farley T, Willett WC, et al. The public health and economic benefits of taxing sugar-sweetened beverages. *N Engl J Med* 2009; **361**: 1599–605.
- 31 Kim S, Lee Y, Yoon J, Chung S-J, Lee S-K, Kim H. Restriction of television food advertising in South Korea: impact on advertising of food companies. *Health Promot Int* 2013; **28**: 17–25.
- 32 Adams J, Tyrrell R, Adamson AJ, White M. Effect of restrictions on television food advertising to children on exposure to advertisements for 'less healthy' foods: repeat cross-sectional study. *PLoS One* 2012; **7**: e31578.
- 33 Dowell D, Farley TA. Prevention of non-communicable diseases in New York City. *Lancet* 2012; **380**: 1787–89.
- 34 United States Department of Agriculture Foreign Agricultural Service. Global Agricultural Information Network. GAIN report: Mexico. 2014. [http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Food%20and%20Agricultural%20Import%20Regulations%20and%20Standards%20Mexico%202013\\_Mexico%20ATO\\_Mexico\\_1-23-2014.pdf](http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Food%20and%20Agricultural%20Import%20Regulations%20and%20Standards%20Mexico%202013_Mexico%20ATO_Mexico_1-23-2014.pdf) (accessed April 30, 2014).
- 35 United States Department of Agriculture. USDA unveils historic improvements to meals served in America's schools. 2013. <http://www.fns.usda.gov/pressrelease/002312> (accessed Sept 14, 2014).
- 36 United States Department of Agriculture. National school lunch program and school breakfast program: nutrition standards for all foods sold in school as required by the Healthy, Hunger-Free Kids Act of 2010; Interim Final Rule. 2013. <http://www.gpo.gov/fdsys/pkg/FR-2013-06-28/pdf/2013-15249.pdf> (accessed Sept 14, 2014).
- 37 Fry C, Chen L, Graff S. Putting business to work for health: incentive policies for the private sector. 2012. [http://changelabsolutions.org/sites/default/files/documents/Incentives\\_FINAL\\_20120514.pdf](http://changelabsolutions.org/sites/default/files/documents/Incentives_FINAL_20120514.pdf) (accessed Feb 28, 2013).
- 38 Karpyn A, Young C, Weiss S. Reestablishing healthy food retail: changing the landscape of food deserts. *Child Obes* 2012; **8**: 28–30.
- 39 US Department of Health and Human Services. Healthy food financing initiative. 2011. <http://www.acf.hhs.gov/programs/ocs/resource/healthy-food-financing-initiative-0> (accessed May 8, 2013).
- 40 ChangeLab Solutions. Healthy Corner Stores: The State of the Movement. 2009. <http://changelabsolutions.org/sites/default/files/documents/HCSReport.pdf> (accessed Feb 28, 2013).
- 41 WHO and the Government of South Australia. The Adelaide Statement on Health in All Policies: moving towards a shared governance for health and well-being. *Health Promot Int* 2010; **25**: 258–60.
- 42 Department of Health, Victoria, Australia. Prevention and population health. Healthy Together Victoria. 2014. <http://www.health.vic.gov.au/prevention/healthytogether.htm> (accessed April 30, 2014).
- 43 Frank LD, Schmid TL, Sallis JF, Chapman J, Saelens BE. Linking objectively measured physical activity with objectively measured urban form: findings from SMARTAQ. *Am J Prev Med* 2005; **28** (suppl 2): 117–25.
- 44 Ewing R, Frank L, Chapman J, Kreutzler R. Understanding the relationship between public health and the built environment: a report prepared for the LEED-ND Committee. Washington: US Green Building Council, 2009 <http://www.usgbc.org/Docs/Archive/General/Docs3901.pdf> (accessed Oct 29, 2013).
- 45 Stair P, Wooten H, Raimi M. How to create and implement healthy general plans: a toolkit for building healthy, vibrant communities through land use policy change. Oakland: ChangeLab Solutions (formerly Public Health Law & Policy) and Raimi + Associates, 2008.



- 46 Philadelphia Department of Public Health. Philadelphia 2035: planning and zoning for a healthier city the city's new comprehensive plan and its role in improving public health. 2010 [http://phila2035.org/wp-content/uploads/2011/02/Phila2035\\_Healthier\\_City\\_Report.pdf](http://phila2035.org/wp-content/uploads/2011/02/Phila2035_Healthier_City_Report.pdf) (accessed Oct 29, 2013).
- 47 ChangeLab Solutions. Pedestrian Friendly Code Directory: Public art. <http://changelabsolutions.org/childhood-obesity/public-art> (accessed Feb 28, 2013).
- 48 ChangeLab Solutions. Pedestrian Friendly Code Directory: Medium to High Densities. <http://changelabsolutions.org/childhood-obesity/medium-high-densities> (accessed Feb 28, 2013).
- 49 ChangeLab Solutions. Pedestrian Friendly Code Directory: Landmarks. <http://changelabsolutions.org/childhood-obesity/landmarks> (accessed Feb 29, 2013).
- 50 ChangeLab Solutions. Abundant Seating Pedestrian Friendly Code Directory: Abundant Seating. <http://changelabsolutions.org/childhood-obesity/abundant-seating> (accessed Feb 28, 2014).
- 51 ChangeLab Solutions. Pedestrian Friendly Code Directory: Adequate Access to Transit. <http://changelabsolutions.org/childhood-obesity/adequate-access-transit> (accessed Feb 28, 2014).
- 52 National Policy and Legal Analysis Network. Establishing land use protections for farmers markets. Oakland: ChangeLab Solutions (formerly Public Health Law & Policy), 2009.
- 53 ChangeLab Solutions (formerly Public Health Law & Policy). Healthy Mobile Vending Policies. Oakland: ChangeLab Solutions (formerly Public Health Law & Policy), 2009. [http://changelabsolutions.org/sites/default/files/MobileVending\\_FactSheet\\_FINAL\\_091008.pdf](http://changelabsolutions.org/sites/default/files/MobileVending_FactSheet_FINAL_091008.pdf) (accessed Oct 29, 2013).
- 54 Seskin S, McCann B. Complete Streets Local Policy Workbook. Washington: Smart Growth America and National Complete Streets Coalition, 2012 <http://www.smartgrowthamerica.org/documents/cs/resources/cs-policyworkbook.pdf> (accessed Oct 29, 2013).
- 55 Seskin S, McCann B. Complete Streets Policy Analysis 2011. Washington, DC: Smart Growth America and National Complete Streets Coalition, 2012.
- 56 Safe Routes to School National Partnership. Safe Routes to School: Helping Communities Save Lives and Dollars 2011. <http://saferoutespartnership.org/sites/default/files/pdf/SRTS-policy-report-fact-sheet.pdf> (accessed Dec 6, 2014).
- 57 Government of South Africa. Strategic Plan for the Prevention and Control of Non-Communicable Diseases 2013-17. 2013. <http://www.health-e.org.za/wp-content/uploads/2013/09/NCDs-STRAT-PLAN-CONTENT-8-april-proof.pdf> (accessed Oct 29, 2013).
- 58 WHO. Non-communicable diseases country profiles. Geneva: World Health Organization, 2011. [http://whqlibdoc.who.int/publications/2011/9789241502283\\_eng.pdf](http://whqlibdoc.who.int/publications/2011/9789241502283_eng.pdf) (accessed April 30, 2014).
- 59 Thow AM, Swinburn B, Colagiuri S, et al. Trade and food policy: case studies from three Pacific Island Countries. *Food Policy* 2010; 35: 556-64.
- 60 ChangeLab Solutions. Model Healthy Beverage Vending Agreement. <http://changelabsolutions.org/publications/healthy-bev-vending-agreement> (accessed Feb 28, 2013).
- 61 Fundo Nacional de Desenvolvimento da Educação. <http://www.fnnde.gov.br/programas/alimentacao-escolar/alimentacao-escolar-apresentacao> (accessed Oct 1, 2013).
- 62 Otsuki K. The local food revolution in Brazil's schools. Doha: Aljazeera, 2013. <http://www.aljazeera.com/indepth/opinion/2013/02/201322853527633979.html> (accessed Oct 29, 2013).
- 63 Food and Agriculture Organization. Africa to benefit from Brazil FAO school meals experience. 2013. <http://reliefweb.int/report/world/africa-benefit-brazil-fao-school-meals-experience> (accessed Oct 1, 2013).
- 64 Let's Move. <http://www.letsmove.gov/accomplishments> (accessed April 25, 2014).
- 65 Healthy Weight Commitment Foundation. Fighting obesity by balancing calories in with calories out. 2014. [http://www.healthweightcommit.org/news/major\\_food\\_beverage\\_companies\\_remove\\_6.4\\_trillion\\_calories\\_from\\_u.s.\\_market/](http://www.healthweightcommit.org/news/major_food_beverage_companies_remove_6.4_trillion_calories_from_u.s._market/) (accessed April 25, 2014).
- 66 Department of Health UK. Public health responsibility deal. 2012. <https://responsibilitydeal.dh.gov.uk/about/> (accessed April 30, 2014).
- 67 Jebb SA. The public health responsibility deal food network. *Nutr Bull* 2012; 37: 355-58.
- 68 Wang H, Zhai F. Programme and policy options for preventing obesity in China. *Obes Rev* 2013; 14 (suppl 2): 134-40.
- 69 WHO. Global nutrition policy review: what does it take to scale up nutrition action? 2013. [http://apps.who.int/iris/bitstream/10665/84408/1/9789241505529\\_eng.pdf](http://apps.who.int/iris/bitstream/10665/84408/1/9789241505529_eng.pdf) (accessed April 30, 2014).
- 70 New York City Department of Health and Mental Hygiene. Pouring on the pounds campaign. 2009. <http://www.nyc.gov/html/doh/html/living/sugarydrink-media.shtml> (accessed April 25, 2014).
- 71 Barragan NC, Noller AJ, Robles B, et al. The "sugar pack" health marketing campaign in Los Angeles County, 2011-2012. *Health Promot Pract* 2014; 15: 208-16.
- 72 LiveLighter. 2012. <http://livelighter.com.au/about.aspx> (accessed April 30, 2014).
- 73 Capacci S, Mazzocchi M, Shankar B, et al. Policies to promote healthy eating in Europe: a structured review of policies and their effectiveness. *Nutr Rev* 2012; 70: 188-200.
- 74 European Commission. Agriculture and rural development. School fruit scheme. [http://ec.europa.eu/agriculture/sfs/eu-countries/index\\_en.htm](http://ec.europa.eu/agriculture/sfs/eu-countries/index_en.htm) (accessed April 30, 2014).
- 75 Wijesinha-Bettoni R, Orito A, Löwik M, Mclean C, Muehlhoff E. Increasing fruit and vegetable consumption among schoolchildren: efforts in middle-income countries. *Food Nutr Bull* 2013; 34: 75-94.
- 76 Hawkes C. Promoting healthy diets through nutrition education and change in the food environment: an international review of actions and their effectiveness. Rome: Food and Agriculture Organization of the United Nations, 2013.
- 77 Lachat C, Otchere S, Roberfroid D, et al. Diet and physical activity for the prevention of noncommunicable diseases in low- and middle-income countries: a systematic policy review. *PLoS Med* 2013; 10: e1001465.
- 78 Hawkes C, Lobstein T. Regulating the commercial promotion of food to children: a survey of actions worldwide. *Int J Pediatr Obes* 2011; 6: 83-94.
- 79 Yale Rudd Center for Food Policy and Obesity. Pledges on food marketing to children worldwide. <http://www.yaleruddcenter.org/marketingpledges/> (accessed April 30, 2014).
- 80 Hawkes C, Harris JL. An analysis of the content of food industry pledges on marketing to children. *Public Health Nutr* 2011; 14: 1403-14.
- 81 Galbraith-Emami S, Lobstein T. The impact of initiatives to limit the advertising of food and beverage products to children: a systematic review. *Obes Rev* 2013; 14: 960-74.
- 82 Popkin B, Monteiro C, Swinburn B. Overview: Bellagio conference on program and policy options for preventing obesity in the low- and middle-income countries. *Obes Rev* 2013; 14 (suppl 2): 1-8.
- 83 Nelson T, Oxley Z, Clawson R. Toward a psychology of framing effects. *Polit Behav* 1997; 19: 221-46.
- 84 Jacobs L, Shapiro R. Politicians don't pander: political manipulation and the loss of democratic responsiveness. Chicago: University of Chicago Press, 2000.
- 85 Stimson JA. Tides of consent: how public opinion shapes American politics. New York: Cambridge University Press; 2004.
- 86 Lawrence RG. Framing obesity: the evolution of news discourse on a public health issue. *Int J Press/Polit* 2004; 9: 56-75.
- 87 Gearhardt AN, Bragg MA, Pearl RL, Schvey NA, Roberto CA, Brownell KD. Obesity and public policy. *Annu Rev Clin Psychol* 2012; 8: 405-30.
- 88 Johnson PM, Kenny PJ. Dopamine D2 receptors in addiction-like reward dysfunction and compulsive eating in obese rats. *Nat Neurosci* 2010; 13: 635-41.
- 89 Volkow ND, Wang G-J, Tomasi D, Baler RD. Obesity and addiction: neurobiological overlaps. *Obes Rev* 2013; 14: 2-18.
- 90 Desor JA, Beauchamp GK. Longitudinal changes in sweet preferences in humans. *Physiol Behav* 1987; 39: 639-41.
- 91 Schwartz C, Issanchou S, Nicklaus S. Developmental changes in the acceptance of the five basic tastes in the first year of life. *Br J Nutr* 2009; 102: 1375-85.
- 92 Beauchamp GK, Moran M. Dietary experience and sweet taste preference in human infants. *Appetite* 1982; 3: 139-52.
- 93 Nathanson CA. Social movements as catalysts for policy change: the case of smoking and guns. *J Health Polit Policy Law* 1999; 24: 421-88.

- 
- 94 Rosenbaum M, Leibel RL. Adaptive thermogenesis in humans. *Int J Obes (Lond)* 2010; **34** (suppl 1): S47–55.
- 95 Thaler RHSCR. Nudge improving decisions about health, wealth, and happiness. New York, NY: Penguin Group; 2009.
- 96 Chandon P, Wansink B. Does food marketing need to make us fat? A review and solutions. *Nutr Rev* 2012; **70**: 571–93.
- 97 Harris JL, Pomeranz JL, Lobstein T, Brownell KD. A crisis in the marketplace: how food marketing contributes to childhood obesity and what can be done. *Annu Rev Public Health* 2009; **30**: 211–25.
- 98 Samuelson W, Zeckhauser R. Status quo bias in decision making. *J Risk Uncertain* 1988; **1**: 7–59.
- 99 Ledikwe JH, Ello-Martin JA, Rolls BJ. Portion sizes and the obesity epidemic. *J Nutr* 2005; **135**: 905–09.
- 100 Ello-Martin JA, Ledikwe JH, Rolls BJ. The influence of food portion size and energy density on energy intake: implications for weight management. *Am J Clin Nutr* 2005; **82** (suppl): 236S–41S.
- 101 Schwartz J, Riis J, Elbel B, Ariely D. Inviting consumers to downsize fast-food portions significantly reduces calorie consumption. *Health Aff (Millwood)* 2012; **31**: 399–407.
- 102 Guthrie JF, Lin B-H, Frazao E. Role of food prepared away from home in the American diet, 1977–78 versus 1994–96: changes and consequences. *J Nutr Educ Behav* 2002; **34**: 140–50.
- 103 Andreyeva T, Blumenthal DM, Schwartz MB, Long MW, Brownell KD. Availability and prices of foods across stores and neighborhoods: the case of New Haven, Connecticut. *Health Aff (Millwood)* 2008; **27**: 1381–88.
- 104 Moore LV, Diez Roux AV. Associations of neighborhood characteristics with the location and type of food stores. *Am J Public Health* 2006; **96**: 325–31.
- 105 Montgomery KC, Chester J. Interactive food and beverage marketing: targeting adolescents in the digital age. *J Adolesc Health* 2009; **45** (suppl): S18–29.
- 106 Yancey AK, Cole BL, Brown R, et al. A cross-sectional prevalence study of ethnically targeted and general audience outdoor obesity-related advertising. *Milbank Q* 2009; **87**: 155–84.