Second, Claire Wang and colleagues[5] take forward the work of Foresight to predict body-mass index (BMI) among the population of the USA and UK for the next several decades, with a microsimulation to estimate the health consequences—for various scenarios describing the future. The health consequences are clear qualitatively, but these methods put estimates on the actual extent of attributable effect on disease in the future, and on life expectancy. Although the predicted health service costs to 2020 are large, a 1% reduction in predicted BMI prevalence in the USA could prevent 2·4 million cases of type 2 diabetes, for example.

Third, Kevin Hall and colleagues[6] investigate a validated dynamic mathematical model of human metabolism to predict individual weight change after changes in energy balance. The authors show that previous methodologies greatly overestimate expectations for weight loss. Moreover, the model is able to predict the lag times associated with interventions as well as how much more energy is needed to maintain the present high average weights.

Finally, Steven Gortmaker and colleagues[7] summarise the range of requirements, based on the previous analyses, to deal effectively with the obesity epidemic, recognising that sustained prevention efforts have hardly begun. The conclusions are unambiguous. We need collaborative societal changes in many aspects of our environment to avoid the morbid consequences of overweight and obesity. This change will require global political leadership across public policy, considerably broader than that of health policy, and far better monitoring.

I hope that this work will play a significant role in the upcoming UN High-level Meeting on Non-communicable Diseases in New York, USA, in September, 2011, and in further national and international policy programmes.

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Reversing the tide of obesity

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See **Series** pages 804, 815, 826, and 838

The accompanying four papers in *The Lancet*[1–4] address several crucial areas relevant to the impact and future course of the obesity epidemic. In the past 30 years, obesity has increased in most countries and regions of the world.[5] Boyd Swinburn and colleagues[1] emphasise that obesity control will require policy interventions to improve the environments that promote poor dietary intake and physical inactivity rather than individually focused interventions, and that the necessary policy changes are fraught with political challenges not associated with clinical interventions that focus on individuals.

Claire Wang and colleagues[2] model the effect of increasing rates of obesity on the incidence and costs of type 2 diabetes, cardiovascular disease and stroke, arthritis, and several types of cancer in the USA and UK. If US trends based on historical data for 1988–2008 continue, the prevalence of obesity in US adults will increase from its present level of about 32% to about 50% by 2030, with increased costs of up to US$66 billion per year for treatment of obesity-associated diseases. If the UK trends for 1993–2008 continue, the prevalence of obesity will rise from 26% to 35–48% by 2030, depending on the sex considered, and the costs will increase by £2 billion per year. In both countries, the rate of increase in the prevalence of obesity has slowed in the past decade. Nonetheless, even when the more recent trends are taken into account, annual US and UK costs are still projected to increase by $48 billion and £1·9 billion, respectively, by 2030. As the authors show, even a modest 1% reduction in body-mass index (BMI) would substantially reduce the number of obesity-related diseases and their costs.

Kevin Hall and colleagues[3] provide a much-needed simulation model that can be used to estimate the effect and time course of caloric deficits necessary to achieve weight losses in individuals and populations. According to their model, every change in energy intake of 100 kJ per day will lead to an estimated weight change of about 1 kg. In terms more commonly used in the USA, a change in energy intake of 10 kcal per day will eventually achieve a weight change of 1 lb. About 50% of the weight change will be reached after about 1 year and 95% of the weight change in 3 years, which provides a realistic assessment of the time course necessary to see the full result of a successful intervention. Hall provides a web-based dynamic model that will enable simulations of the effect of changes in caloric intake on bodyweight in individuals and populations. Finally, Steven Gortmaker and colleagues[4] provide calls for action at various levels of society and give a useful Australian modelling analysis that shows that various interventions are cost effective, and that eight interventions, particularly those aimed at children and adolescents, seem cost-saving.

This Series is timely and highly relevant to clinicians and policy makers. It renews attention to the obesity epidemic and the cost and consequences of inaction. The authors show that statistical modelling provides useful insight into the approaches and challenges necessary to prevent and control obesity, and they also make a compelling case for the need for multicomponent and multisectoral policy interventions.

As for tobacco, for which increased attention to the adverse effects of smoking was associated with a plateau in cigarette consumption per capita before any major policy shift,[6] increased awareness of the adverse effects of obesity might partly account for the recent reduced rate of increase in the prevalence of obesity in the USA and the UK. This finding suggests that we could be at a turning point, but that we have not yet turned the corner. The challenge posed by this Series is how to implement the strategies necessary to reverse these trends.

In the USA, a number of national, state, and local efforts have begun to address the obesity epidemic. Federal initiatives include: the Affordable Care Act's inclusion of mandatory menu labelling in restaurants and vending machines, which will provide consumers with information about the caloric content of the foods they purchase and might prompt reformulation of products to those with a lower caloric content; a procurement policy that sets standards for products purchased by the federal government that has already been instituted in the US Department of Health and Human Services; the Healthy Hunger Free Kids Act, which will set standards for foods in schools and child care; efforts to promote breastfeeding by increasing the number of Baby Friendly hospitals; and the announcement of a Let's Move Child Care Challenge by Michelle Obama to encourage child-care settings to adopt voluntary standards for physical activity, limits on screen time, healthy beverages, and the availability of healthy foods. State and community programmes funded through stimulus funds and the Affordable Care Act have begun to implement policy initiatives that focus on increasing physical activity and improvement of dietary intake. The need to assess the effect of these interventions is essential to build the library of practice-based evidence.[7] Whether these and other initiatives in the USA will be transformative remains to be seen. Nonetheless, the struggle to prevent and control obesity has been intensified.

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For the **web-based dynamic model** see http://bwsimulator.niddk.nih.gov

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Where next for obesity?

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See **Comment** pages 743 and 744
See **Series** pages 804, 815, 826, and 838

There is a seductive simplicity to the conceptualisation of obesity as a straightforward problem of energy balance—calories in versus calories out. But the physiological, behavioural, and environmental influences on this relation are asymmetrical. Therefore, although the basic arithmetic holds true, in practice it is much easier for people, and populations, to gain weight than to lose it. As Boyd Swinburn and colleagues[1] describe in *The Lancet*, increasing fatness is the result of a normal response, by normal people, to an abnormal situation. This holds true across the globe: although obesity is always thought of as a problem of the developed world, it is increasingly seen in developing nations too.[2] Supporting and encouraging people to respond more healthily to that abnormal situation is important, but the range of options within which people make their choices is skewed in favour of weight gain rather than weight loss. No approach will work alone, but changing the environments within which those decisions are made is likely to be far more effective than merely exhorting people to make better choices.[3]

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A rapidly growing body of research is helping us to identify the most effective and cost-effective approaches to tackle obesity. Research within the biomedical paradigm tends to focus on specific topics such as dietary behaviour and physical activity, psychological drivers, or genetic influences; the wider issue of obesity is then constructed from these elements.

Obesity is thus treated as a complicated issue, not a complex one. The distinction is important. A complicated system might contain many different elements, with various interactions, but it is knowable and ultimately predictable: a Saturn rocket is not simple, but plans for it exist, and to calculate its trajectory and send astronauts to the moon and back is possible. A complex system does us no such favours. It is non-linear, subject to unexpected and unintended consequences, contains feedback loops, and displays emergent properties—it is more than the sum of its parts. This kind of wicked[3] problem needs a different set of approaches to understand it and deal with it from those needed for issues that are merely complicated.[4]

However, there are structural obstacles to this approach. In *The Hedgehog and the Fox*,[5] Isaiah Berlin describes how "the fox knows many little things, but the hedgehog knows one big thing". Berlin was writing about literature, but he could just as easily have been describing academia. The world of scientific research favours subject-specific expertise. Most of us tend to focus on fairly narrow specialisms, with both funding and academic career structures promoting this kind of knowledge—we are hedgehogs. For complex issues like obesity the shortage of foxes, with their breadth of knowledge, presents a major obstacle to progress.