1. Introduction

The UK Government’s Foresight Programme creates challenging visions of the future to help inform effective Government strategies, policies and priorities. The Government Office for Science commissioned the Foresight Programme to support its project on Tackling Obesities: Future Choices; looking at how the Government can deliver a sustainable response to obesity over the next 40 years. This involved the assembly of evidence and expertise from a variety of disciplines thought to be involved in the Obesity debate. Such disciplines included epidemiology, food science, genetics, psychology and sociology. It involved professional and interested organisations within and beyond the Government. The report represents an independent scientific enquiry and does not represent government policy.

2. The scale of the problem

The most recent UK data, the Health Survey for England 2004, showed that 23.6% of men and 23.8% of women were obese, 10% of 6-10 year-old boys and girls, 5% of 11-15 year-old boys and 11% of 11-15 year-old girls were also obese. In 2003/04 the mean BMI of UK adults was 27kg/m$^2$, the healthy range being 18.5-25kg/m$^2$.

The analysis by the Foresight programme projects that nearly 60% of the UK population could be obese by 2050, which is anticipated to create an overall cost of overweight and obesity per annum of £45.5 billion at today’s prices, compared to the current cost of as much as £10 billion.

The UK is not alone in having a high prevalence of overweight and obesity; the World Health Organisation (WHO) estimates that currently approximately 1.2 billion people in the world are overweight, of which 300 million are obese.

It is suggested that links between socioeconomic status and obesity in the UK may be associated with the degree of relative social inequality. The prevalence of obesity in Social Class I was about 18% of men and 10% of women, and in Social Class V it was about 28% of men and 25% of women. There is no evidence to suggest that social class differences in the prevalence of obesity will increase above and beyond those that already exist. However, Foresight’s projections are that it may increase for women (aged 20-60) in Social Class 1 to 15% and for women in Social Class V to 62%.

As overweight and obesity have become a more ‘normal’ part of society, the media often portrays excess weight as an appearance issue, rather than one that concerns health. Several conditions are associated with overweight and obesity which adversely affect people’s quality of life and create increasing financial and social burdens. Such conditions include type 2 diabetes, hypertension, coronary heart disease and stroke, metabolic syndrome, osteoarthritis and cancer.

It is predicted that the increase in the incidence of type 2 diabetes could be greater than 70% by 2050, with increases of 30% for stroke and 20% for coronary heart disease, based on changes in population BMI.

3. Causes of obesity

The causes of obesity are complex and multifaceted; however, it is now generally accepted by health and other professionals that the current prevalence of obesity in the UK population is primarily caused by people’s latent biological susceptibility interacting with a changing environment that includes more sedentary lifestyles and increased dietary abundance.
Biology
It is suggested that the pace at which technological progress is taking place has outstripped the capacity of human evolution, and the human biological system now struggles to maintain energy balance to keep the body at a constant weight.

Studies have also identified a number of specific genes associated with obesity and risk of excess weight gain, thought to impact critical hormonal and neural pathways and feedback loops. Research has also shown that sensory factors such as sight, smell, palatability and availability of food can increase appetite to such an extent that it overwhelms innate control mechanisms, including satiety cues.

Further research of specific areas of the biological system is still required to further understand the relative importance of genetics and different metabolic pathways on the prevalence of obesity.

Impact of early life and growth patterns
Evidence indicates that early life is a critical time period for healthy development, and conditions in early life may impact on health risks in adult life. There is strong evidence to suggest that low birth weight is associated with the risks of heart disease and diabetes. While there is less evidence of a direct link between birth weight and obesity, weight gain in early life appears to be critical; low birth weight babies may be susceptible to rapid weight gain as a result of catch up growth or as a consequence of their diet.

Behaviour
Eating and physical activity are two critical behaviours with the potential to influence energy balance in the body. Although behaviour has historically been considered as a product of free will, it is increasingly recognised as being constrained by individual circumstances. There is no doubt that positive changes in diet and activity are likely to result in health benefit, both in relation to, and independent of, body weight.

Attention has been focused on the importance of energy expenditure during routine daily activities, as there has been a lack of opportunity for activity. Some success in enhancing weight control has been shown by reducing sedentary behaviour. Dietary risk factors for obesity have also been identified and provide targets for behavioural interventions; these include frequent consumption of foods with a high energy density, diets high in fat and low in fibre and the frequent consumption of sugar-rich drinks.

It is also critical to consider what motivates behaviour. Society often focuses on individuals’ behaviours as a cause of obesity, but organisational behaviours also play a substantial but often unconsidered role in cuing the behaviour of individuals.

The living environment
The term ‘obesogenic environment’ refers to the role environmental factors may play in determining both energy intake and expenditure. It has been defined as the ‘sum of the influences that the surroundings, opportunities or conditions of life have on promoting obesity in individuals and populations.’

Technological influences have tended to engineer physical effort out of the environment by reducing the need to walk and in the decline of manual occupations. Opportunities for physical activity appear to be linked to environmental characteristics, for example walkable neighbourhoods and good access to leisure centres increase activity, and less walkable neighbourhoods and social nuisances decrease activity. Environmental influences on diet often involve physical ease of access to food and drink. As eating habits become more unstructured, the availability of and access to ‘food on the go’ is an important consideration, including how aspects of the built environment influence people’s food habits.

Economic drivers of food and drink consumption
The proportion of household income now devoted to food and drink has fallen as a result of lower prices. However, cheaper food prices tend to be more energy-dense and nutrient-poor with relatively low levels of vitamins and minerals. The relationship between food prices and consumption patterns is complex, with elasticities such as income level, age groups and numbers of people within a household.
4. Tackling obesity

**Prevention**
A number of critical opportunities for intervention during an individual’s life course have been identified at which it would be possible to influence behaviour. These relate to critical periods of metabolic plasticity (e.g. early life, pregnancy), times linked to spontaneous change in behaviour (e.g. leaving home, parenting) or periods of significant shifts in attitude (e.g. peer group pressure, ill health). These opportunities may arise from future technological development, behaviour change and the built environment.

**Treatment**
The effective treatment of overweight and obesity is challenging as the overweight or obese individual often seeks a rapid solution to their problem, when interventions usually take time to have an effect. This explains high attrition rates from weight loss programmes.

In the short term, significant progress could be made by the implementation of policies based on existing knowledge of treatment strategies. Further research is needed to improve the success of behavioural interventions and in using drug therapy more effectively.

**Policy**
Governments in many countries including the UK have recognised obesity as a critical issue and are making it a priority for health policy. More research into wider economic and social determinants of health is needed to help policy makers make sense of the complexity associated with the causation and management of obesity. The viability of government policies is also a matter of finding what works in a manner that society finds acceptable. Finding opportunities that increase the emphasis given to public health may be critical. There are lessons to be learned from progress with other health concerns such as smoking and excess alcohol consumption.

5. A complex system

**Obesity map system**
There is an underlying complexity to obesity, which means tackling it will be difficult and will require a multifaceted approach. The Foresight obesity system map takes into account the complexity of and interrelationships between the variables and determinants of obesity and suggests possible intervention points. It arguably represents the most comprehensive ‘whole systems’ view of the determinants of energy balance that exist.

**The core ‘system engine’**
At the heart of the Foresight map is the ‘core engine’, which encapsulates this problem. An energy gap triggers an innate biological tendency to acquire and/or preserve energy and the success brings the energy equation into balance. But these activities can become self sustaining and a lock-in develops that continues to drive acquisition and preservation of energy despite the absence of a physical need. This drives the system out of balance and leads to increased body weight. This lock-in can be overridden by conscious control, though this doesn’t always occur, as the forces driving energy accumulation are very strong.

**Thematic clusters**
There are seven key themes in the map: physiology cluster, individual activity cluster, physical activity environment cluster, food consumption cluster, food production cluster, individual psychology cluster and the social psychology cluster.

**Key variables**
The core engine is surrounded by four key variables of obesity: the level of primary appetite control, the force of dietary habits, the level of physical activity and the level of psychological ambivalence.
Numerous obesity determinants link to these variables from genetic predisposition, level of recreational activity, the walkability of the living environment, energy density of food, cost of food ingredients, levels of self esteem, education and media consumption.

6. Visualising the Future: scenarios to 2050

The Foresight project generated four possible scenarios, based on two critical uncertainties; (i) people’s values and behaviours and (ii) uncertainty over what strategic approach should be taken to meet challenges. The scenarios provide a tool with which to discuss alternative views of the future.

**Scenario one** is an individualistic, market-driven society that adopts a more long-term and sustainable view. Individuals are responsible for their own health with the Government taking a supportive role by facilitating market-responsive providers and retailers.

**Scenario two** is a society where social responsibilities are prioritised, and communities and Government implement plans to meet long-term challenges. It is seen as an individual’s responsibility to live a healthy lifestyle and to encourage the same in others.

**Scenario three** is a society where communities take the lead and focus on tackling difficulties as they arise. It is a belief that everyone deserves and should receive an adequate level of healthcare, but this creates a high expectation from the public.

**Scenario four** is an individualistic, market-driven society that reacts to problems when and where they occur. Good health is a symbol of status. There is high personal responsibility, either through savings or insurance, to fund personal healthcare and self-reliance is the critical driver for all social services.

The prevalence of obesity does not decrease in any of the scenarios. However, the rate of increase in prevalence is different due to the relative priority given to prevention as opposed to treatment.

7. Managing the consequences

**Qualitative modelling**
Experts and stakeholders were asked to rank the likely impact of different policy options for each of the Foresight project scenarios in a qualitative modelling exercise. This would enable an understanding of how different, plausible, futures could shape the obesity environment and impinge on the effectiveness of obesity interventions.

The exercise suggested a number of responses that could create a positive impact in tackling the prevalence of obesity. However, no single response generated a high impact on obesity prevalence in all scenarios. Some of the top responses included increasing walkability/cyclability of the built environment; controlling the availability of/ exposure to obesogenic foods and drinks, and early life interventions at birth or in infancy.

**Quantitative modelling**
The quantitative simulation of changes in population BMI suggested that significant changes in population BMI would be needed before sizeable changes in chronic disease levels occur.

Even if highly successful, there would be a considerable time lag (20-30 years) before the benefits were seen in terms of chronic disease levels and NHS costs.

A comprehensive strategy would also be needed to target those most at risk of immediate health consequences (the over-50s). If successful, this could make a more significant impact on costs in the short to medium term. Yet tackling the upward drift in average population BMI and preventing future obesity would deliver more sustained and long-term benefits.
8. Building a sustainable response

The scale of the changes needed, to prevent the future costs and scale of the obesity problem from rising, has been compared to that required in the mid-19th century to prevent mass epidemics and worsening health conditions in Britain’s cities. Today, the problems are different in nature but the magnitude of the challenge is similar, as obesity raises fundamental questions about the way we live our lives.

The key challenge will be to reshape the wider environment, in which individuals go about their daily lives, and transform the growing interest in maintaining good health into an achievable goal for all.

The analysis of the complexity of the ‘system engine’ driving the upward trend in obesity, and the scenarios and system map developed in the Foresight project suggest that a broadly based, integrated strategy of preventive action offers a chance to mitigate a potential epidemic that could have serious social and economic consequences.

What makes a successful response to obesity?

A sustainable response would create a scenario in which social and individual priorities favour healthy behaviours and where underlying biological mechanisms to control body weight are continually reinforced. It is important to recognise that, as a general rule, people do not ‘choose’ to be obese. Their obesity is mainly driven by a range of factors beyond their immediate control that in practice constrain individual choice.

To be successful, a comprehensive long-term strategy to tackle obesity must act in two complementary ways to achieve and maintain a healthy population weight distribution. First, an environment that supports and facilitates healthy choices must be actively established and maintained. Second, individuals need to be encouraged to desire, seek and make different choices, recognising that their decisions may be influenced by the behaviours of others, such as families or groups, and other wider influences.

A number of challenges will face the long-term strategy to address obesity: it must include both treatment and prevention and it must align with other policy issues.

Five core principles, critical for tackling obesity, have been identified:

1. A system-wide approach, redefining the nation’s health as a societal and economic issue
2. Higher priority for the prevention of health problems, with clearer leadership, accountability, strategy and management structures.
3. Engagement of stakeholders within and outside Government
4. Long-term, sustained interventions
5. Ongoing evaluation and a focus on continuous improvement.

Foresight’s analysis indicates that there are currently no realistic short- or medium-term solutions to curtail the projected increase in obesity. It is therefore all the more urgent to build the foundations for long-term sustainable change without delay. Tackling obesity is fundamentally an issue about healthy and sustainable living for current and future generations. This is only likely to be achieved if there is a paradigm shift in thinking, not just by the Government but by individuals, families, business and society as a whole. The UK has the opportunity to build on existing work and pioneer a new long-term and integrated approach that sets a global standard for success.