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Foresight

Trends and drivers of obesity:

A literature review for the Foresight project on obesity

This report was commissioned by the Foresight Programme of the Office of Science and Technology to support its project on obesity. Any opinions expressed have emerged from reviewing existing futures work and are not those of the Office of Science and Technology or the Government.

Executive summary

The World Health Organisation claims over a billion people worldwide are overweight, and at least 300 million obese (WHO 2003). The UK population has grown steadily fatter: twenty-three percent of the UK population is now obese, a threefold increase since 1980 (Lister 2005). Obesity is both a major cause of chronic ill health and “*considered a disease in its own right*” (WHO 2003).

Emerging drivers and trends

Our analysis starts with the contention that obesity is caused by an imbalance between calories consumed and expended through physical activity. It then explores some of the underlying drivers that influence how and why our diet and activity levels have changed to such waistline expanding effect. For the purpose of clarity, we have grouped these drivers into social, technological, economic, environmental and political categories. A summary image of the key drivers identified is offered on page 5 below. We have tried to bring together alternative possible futures of these forces and have proposed ways in which they might develop or combine to change future obesity rates.

Emerging social trends suggest there may be continued and growing discrimination against obese people, which may reinforce wider social inequalities, and perpetuate a situation where the least well off are also the least well. But there is great complexity, even at the household level. Individual food and activity choices seem to be being made, even among young children, in the absence of parental or social pressure to consider health. This may be ingraining unhealthy future behaviour. Sports and physical activity may continue to decline, becoming commoditised into a ‘fan experience’ rather than exercise.

Technological advances already permit gene-testing and personally tailored healthcare; analysts predict significant advances in drugs, nutrition and genetic modification. Nanotechnology offers the prospect of changing the way our bodies work at the molecular level, but questions of ethical and social acceptability and cost are likely to arise. Developments in pharmaceuticals, genomics, nanotechnology and neuroscience may make use of drugs and manipulation of our bodies more commonplace; demand for drugs and interventions to alter body shape may increase.

From an economic perspective, predictions are for sharp rises in the costs to the taxpayer of treating obesity and related chronic illness. There is a good business case for public health investment, but challenges remain in knowing how to allocate funds effectively, and finding the right boundaries of what some consider to be ‘nanny state’ intervention. The food supply chain will continue to focus on profits rather than health; growing consumer awareness of nutrition appears to be an emerging trend, which may help to align the profit motive with human health.

WHO believes that urbanisation creates conditions which promote poor eating habits and inactivity. As over half the world’s population live in cities, making urban existence healthier is of increasing concern. We have initiatives to encourage cycling and walking; these may become increasingly popular as hydrocarbon fuels are exhausted. Optimists anticipate that there will be greater emphasis on the health values of food, with positive environmental benefit; greater ecological and nutritional awareness may demand more wholesome, local foods, or may see a trend towards more highly-processed ‘functional foods’.

The future role of government in regulation, investment and promotion of good health is likely to change. Government's current commitments to review legislation on advertising to children may be the start of a raft of health-driven legislation, tax, regulation and promotion. A challenge is to avoid unintended negative consequences of these interventions. With increased information and consumer awareness, threat of litigation of companies, institutions and even parents may increase.

Emerging queries

While there are no proven, national-level precedents for action to reverse obesity, it is striking how variable the prevalence of obesity is between countries and socio-economic groups. Improving our understanding of social and cultural aspects of the 'nutrition transition' (as economies grow, populations switch to more energy-dense diets) could provide valuable information for decision-makers of the future.

Social trends indicate there may be continued polarisation of the population, into the junk-food eating, less-educated poor and functional food eating, better-informed higher classes. The negative correlation between education and obesity may suggest that improving education for the poorest groups is an intervention that could help reduce obesity. There are also links between poverty and obesity, although these may be of a lower order than between poverty and smoking. Government may find a growing role in informing consumers and encouraging people to manage sometimes conflicting initiatives and information. It seems clear that obesity won't be resolved through healthcare interventions alone; this raises questions of 'joined-up government'. While some will dislike nanny-state intrusions, WHO has suggested independent national institutions be created specifically to promote nutrition and coordinate health messages, policy development, legislation and taxation.

One complication is that obesity is an easily observed indicator or proxy for both lack of physical activity or poor nutrition in the population. Should a 'technical fix' or genomic intervention be found, we may have a slimmer nation, but fail to address and indeed hide from view the underlying issues of poor diet or insufficient activity, making them harder to track.

WHO suggests that establishing independent national institutions may help promote nutrition and coordinate health messages, policy developments, legislation and taxation. Any significant new government regulation or EU-funded initiatives might confront those who dislike nanny-state intrusion into their choices.

Possible areas for Foresight

A continuing challenge is to understand how the complex range of drivers affecting obesity inter-relate. As we look to the longer-term, the importance of feedback loops and the impact of multiple, additive and dynamic interventions may be critical. Foresight might consider developing a complex model in a systemic way to understand and forecast outcomes of these drivers. It could also explore the potential impacts of previously unrecognised technologies and processes, policy interventions to address them, and the wider consequences of their interaction. There could be an added component of welfare economics measuring costs and benefits of possible interventions to help identify possible areas for action.

Our analysis attempted to look at social, technological, economic, environmental and political drivers, and the arbitrary delineation between these categories was evident to us as we did our research. Determining what is a driver, an influence, a trend or a sub-factor is a difficult process. Another approach sees 'cultural' drivers as predominant, with the economics, technology, etc... as merely the mechanical expression of underlying cultural decisions. This might suggest exploring how different societies' expectations about food, diet and physical activity are formed, shared and changed.

Most of the research we reviewed focused on identifying and defining problems. We found insufficient evidence of effective programmes that have reduced obesity, from which learning might be extrapolated and applied to other situations. Indeed, we were told that these do not exist. Finding (or if necessary creating) practical examples of successful national-level programmes or structures might be a fruitful area of further work.

The growing incidence of obesity may reflect changes in individual's choices and behaviour. It is unclear whether it is the environment that is abnormal and people's behaviour that is normal or vice versa, but most commentators believe the upward trend in weight is damaging human health. Further study into the circumstances that support healthy behaviour in different environments and at different life stages,

or facilitate behaviour change across the social spectrum, might be useful. This could include analysis of individuals, families, communities, and the role of GPs/ healthcare, government and media.

Summary image of obesity drivers and trends

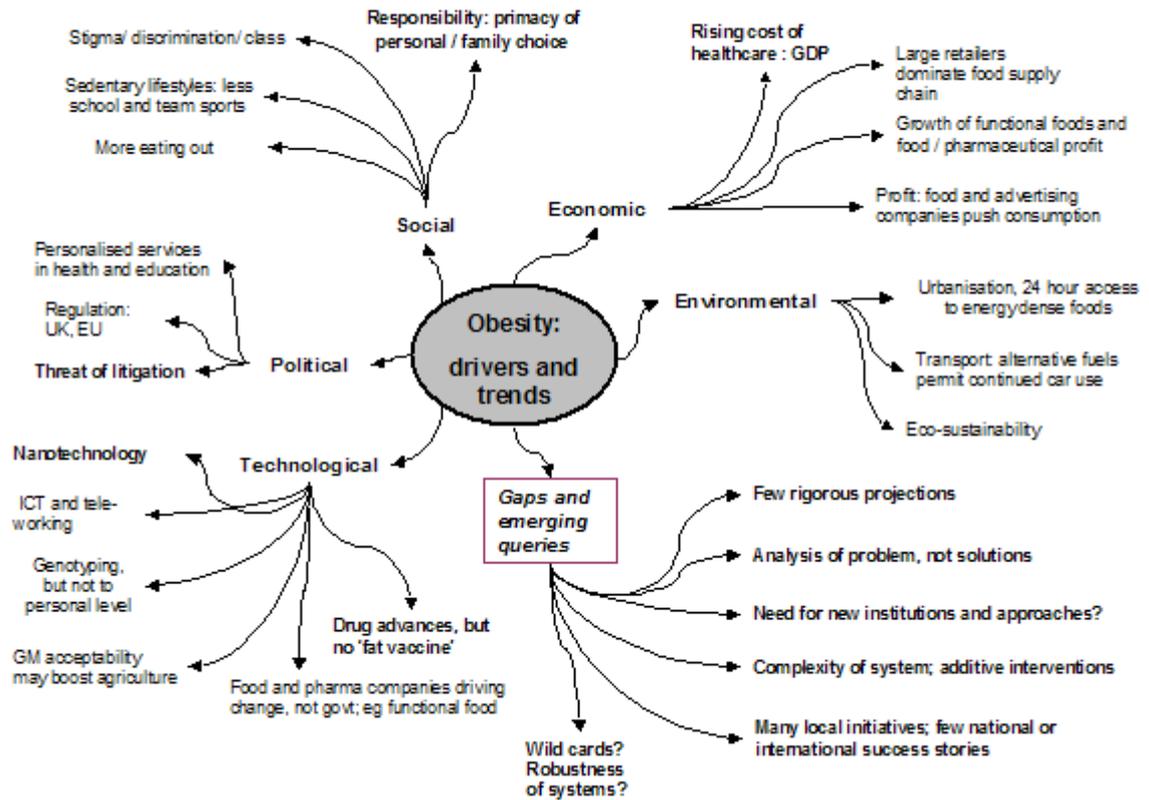


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Review of futures past

The Foresight project on obesity will explore the implications of science and technology for future patterns of obesity. It will examine how in the coming 50 years changes in some of the underlying drivers that have been prevalent in the development of the obesity epidemic may develop and influence obesity prevalence and resultant chronic disease.

This paper is intended to inform the Foresight project on obesity, in its scoping stage at the time of writing. The project will explore how science and technology and a consideration of alternative futures might help to address some of the factors underlying the growth in obesity. This paper is a review of existing written viewpoints, mostly of UK or US origin and all in English language, and faced the inevitable constraints of time and resources. The intention is that it should stimulate discussion and to help Foresight to decide what the project should and should not cover.

This report first explores individual drivers and trends within specific realms, and then attempts to highlight the most prominent drivers and possible dynamic processes that increase or slow the trend towards increased obesity in the future. This review of futures literature hopes to stimulate thinking and offer suggestions of:

- Where and how Foresight can add value;
- Topics on which Foresight might concentrate; and
- Key outstanding questions that could be considered in further enquiry and analysis.

The information in this paper is derived from documents and opinions from sources including government departments, think tanks, academics, non-governmental organisations, futurists and the public media. Our research looked as broadly as possible with the aim of identifying futures that are anticipated in areas regarded as relevant to obesity. Nothing was deliberately omitted to present a bias, and while the report attempts to condense a broad range of material, it does not purport to be either comprehensive in its research or accurate as a prediction of the future.

This paper is a discussion document intended to stimulate further understanding of possible futures, and is not a statement of Office of Science and Technology policy, or of the UK Government policy. The opinions expressed are based on the underlying research. Sourced are attributed where possible, and any errors unintentional.

Introduction

Obesity^[1] may be defined as “an excess of body fat frequently resulting in a significant impairment of health and longevity” (House of Commons Health Committee 2004). Being obese or overweight is associated with a higher likelihood of suffering numerous chronic illnesses, including, among others, life-threatening cardiovascular disease, diabetes, certain types of cancers and gallbladder disease (WHO 2003, 2005a, Wanless 2004). The risk of death seems to increase as weight increases, albeit at different rates for different groups; as a rough summary, experts conclude that obese patients suffer a nine year reduction in their life expectancy (NAO 2001).

The position today

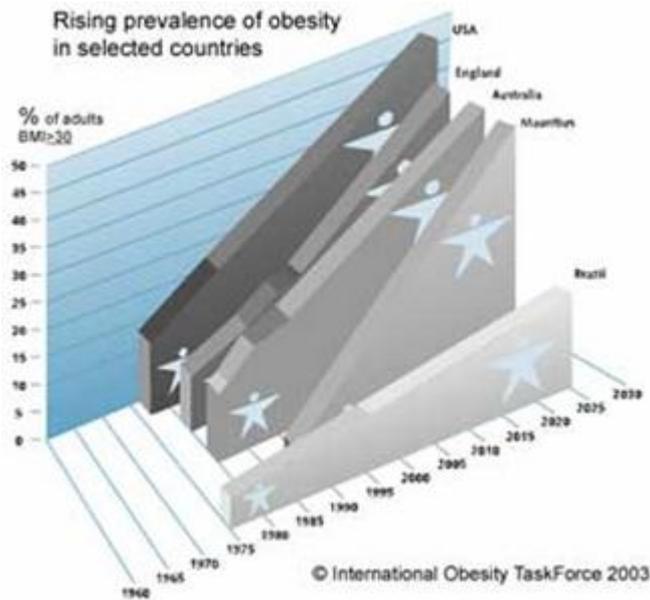
The prevalence of obesity has increased dramatically in recent years; the World Health Organisation (WHO) has declared it “has reached epidemic proportions globally” (WHO 2005b). In the UK, obesity prevalence has more than tripled in the past 25 years, and obesity among children has tripled in a decade (IOTF 2003a). The National Audit Office estimated that obesity costs England 18 million sick days and 30,000 excess deaths (NAO 2001). There are similar trends overseas: deaths directly related to obesity have been estimated at 320,000 a year in Europe and 300,000 in the USA (IOTF 2003a). Obese patients are more likely to be taking multiple drug types and in greater volumes than normal weight patients (Counterweight 2005). US analysts calculate that obese individuals spend an extra 36% per year on healthcare and 77% on medications than the average (DKW Research 2004).

The direct and indirect (loss of earnings due to sickness and premature mortality) annual costs of treating obesity in the UK have been conservatively estimated at £3.3-3.7 billion (House of Commons Health Committee 2004). NAO forecasts the direct costs to rise to £3.6 billion by 2010. As well as intangible ‘quality of life’ measures, this figure also ignores any costs associated with overweight (but not statistically obese, ie BMI below 30), and social costs, such as tax losses from unemployment and disability benefits, which another study puts at £10-20 billion per year (McCormick and Stone unpublished). The tax burden due to diet-induced ill health has been estimated as high as £15 billion a year (IOTF 2003a). The psychological damage caused by overweight and obesity is a further huge health burden (House of Commons Health Committee 2004). The Commons Select Committee concluded, shockingly that “this will be the first generation where children die before their parents as a consequence of childhood obesity” (House of Commons Health Committee 2004). While it is unclear whether they mean ‘at an earlier age than’ rather than ‘at an earlier date than’, this is certainly food for thought!

The government has promised “action on diet and exercise to tackle heart disease, cancer, diabetes, strokes, high blood pressure, high cholesterol and a range of factors critical to our health” (DH White Paper 2004). In July 2004 a joint government Public Sector Agreement target for Departments of Health, Culture Media and Sport and Education and Skills committed to, “halting the year-on-year rise in obesity among children under 11 by 2010, in the context of a broader strategy to tackle obesity in the population as a whole” (Department of Health 2004a).

Projections of obesity prevalence and cost

Our research for this report unearthed surprisingly few organisations making long-term projections of obesity rates. The International Obesity Task Force (IOTF) appears to be the most abundantly referenced source. IOTF bases its forecasts on linear projections of current trends. The following table shows comparative historic and forecast rates of obesity in USA, England, Australia and Brazil.



(Source: <http://www.iotf.org/media/iotfprojection.jpg>)

The UK has a growing population and an ageing population (National Statistics 2005a). Trends indicate that individuals get fatter as they age; as the UK population gets older, there will be an underlying trend towards more overweight. At the same time, IOTF forecasts 24% of boys and 32% of girls will be overweight by 2025, which may reinforce growing obesity rates in the population.

Globally, WHO estimates that over 1 billion people are currently overweight, including 800 million women, and that over 300 million people are obese. More than 2.5 million deaths annually are weight related and this could rise to 5 million by 2020 (IOTF 2003b). Mortality rates resulting from obesity remain relatively low in developed countries, which may be the result of steadily increasing healthcare spending. The US, for example, is forecast to spend 19% of GDP on healthcare by 2014, up from 15% in 2003 (Heffler et al 2005). Of this, analysts expect 20% be devoted to treating obesity diseases (DKW Research 2004). Yet even with this spending, *“the steady rise in life expectancy during the past two centuries may soon come to an end”* (New England Journal of Medicine, in Sunday Times 2005).

Developing countries face a double burden of disease – obesity and malnutrition. Since obesity initially tends to be associated with higher socio-economic groups, this may divert limited health resources and lay foundations for perpetuation of health inequalities. By 2015, over 1.5 billion people may be overweight (WHO 2005a). Marie Ruel of the International Food Policy Research Institute states that many in the developing world are, *“moving from hunger to obesity in a single generation”* (Futurist 2005a). Developing governments do not look likely to have the same resources to devote to long-term care of chronic illness, for example current spending on weight-loss surgery in the US is more than the entire health budget of Vietnam, population 83 million (Rayner 2005).

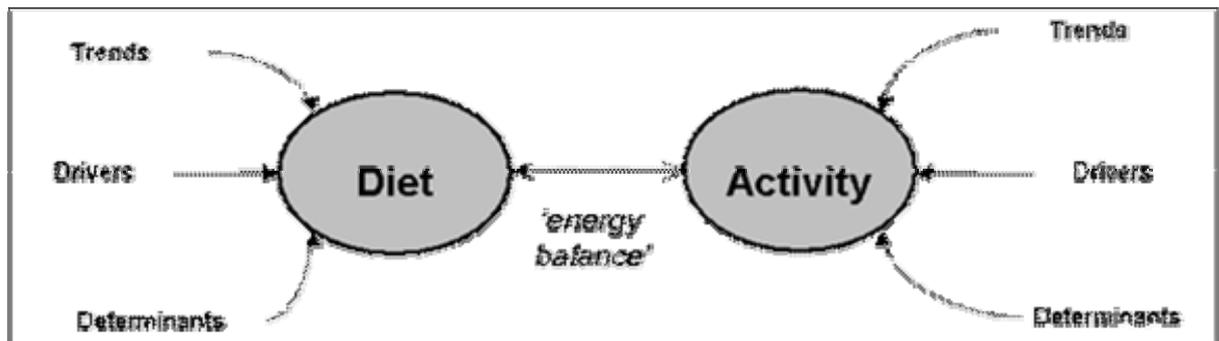
What drives obesity?

Energy balance

We live in an increasingly ‘obesogenic environment’^[2], resulting from a multitude of *“genetic, biological, psychological, sociocultural, and environmental factors that affect both sides of the energy balance equation and the interrelationships among these factors”* (US Food and Nutrition Board 2005). It might even be said that it is the environment that has become abnormal, rather than people’s behaviour.

This paper does not attempt to explore the biological aspects of weight gain or look in detail at the future provision of medical interventions and treatments of obesity. This paper concentrates on the contention that the trend towards higher prevalence of obesity in the UK at the population level is driven by increased calorie consumption relative to physical activity in the UK’s population. This worsening in energy balance is felt to be at the core of the challenge of understanding why obesity has changed and looking forward to how it might change in the future. This is what the picture below attempts to portray. This section of the paper looks at what commentators are saying about diet and physical activity

themselves, before it then focuses on the forces one step further removed, what we might call the 'drivers of the drivers' of obesity, or the changes that influence people's consumption and activity levels. The majority of this paper is dedicated to possible futures in these underlying determinants.



Are we less physically active?

Tessa Jowell, Secretary of State for Culture, Media and Sport has suggested *"the problem is not the number of calories kids are taking in, but the fact that they are doing less to burn them off"* (Freedland 2005). As for children, it may be for adults; over the past decade, average adult energy expenditure is thought to have decreased by as much as 30% (Joint Colleges 2004). Calorie intake appears to be at or a little below 1980 levels, but the UK now travels 25% less on foot and by bicycle and watches twice as much television, half as many young people play extra-curricular sport and half as many work in physically active employment (McCormick and Stone unpublished). Daily life also involves a range of labour saving devices, including washing machines, dishwashers, lifts, car-washes and ride-on lawnmowers.

Money talks?

Real disposable incomes have risen 87% since 1980, which has raised the relative cost of time spent on leisure and exercise. This appears to have reduced, rather than increased the time available for active leisure for many. Many people's rational response seems to have been to reduce participation in, for example, team sports. As food basket prices have fallen 22% over the same period, and calorie intake is thought to have stayed level, we have witnessed significant growth in expenditure per calorie. We explore these economic relationships further below.

Are we in denial?

Making healthy choices requires both demand for and availability of healthy alternatives (Maio 2005), and as almost two thirds of overweight and half of obese people do not believe their weight poses significant health risks (McCormick and Stone unpublished), significant challenges may exist in reversing current trends. Some optimists believe that technological developments increase wealth and raise *"the demand for thinness"* (Philipson and Posner 1999), but this may not apply equally across the socio-economic groups.

This report now explores the 'drivers of the drivers' of the obesity trend under five headings: social, technological, economic, environmental and political. This is, in a sense, an arbitrary selection, but we believe it helps highlight some significant issues. We summarise the key drivers in the penultimate section, before attempting to identify areas of further enquiry.

Social drivers

“Body mass is commonly a matter of lifestyle choice” (Swiss Re 2004).

Introduction

For all but a few hermits, our lifestyles are constructed within social parameters. What we consume and how active we are is governed by influences from our families, communities, schools and workplaces, from the government and the media and from messages and products of the many companies selling us products.

Underpinning the social dimension of obesity is the recognition of its negative correlation in the UK with education (McCormick and Stone unpublished) and with affluence. Obese people appear to face considerable discrimination and stigmatisation, including at school and in the workplace. A survey of UK-based recruiters found that almost half believe obesity negatively affects employee output and 93% would prefer of two identically-qualified applicants, the one of normal weight to the obese person (Thomas 2005). Even fast food chains are thought to reject obese applicants (Schmidhuber 2005). While this may drive some people towards adopting healthier weight (Peto to House of Commons Health Committee expert examination 2003), the sociologist Greg Maio recommends interventions should target behaviours that lead to obesity, not the obese directly (Maio 2005).

A BBC scenario forecasts ‘fatpartheid’: *“by 2020 obesity is a divisive social issue, delineated by class, with attitudes hardened on both sides”*. This vision predicts healthcare costs will spiral and hospitals may put obese patients under close scrutiny, while fat people will face healthcare rationing, insurance blacklists and rush-hour bans from public transport, as well as widespread discrimination at school and at work (BBC 2004).

A focus on behaviour change?

“Magic bullet solutions are more likely to be found in research that encompasses the many community and social aspects of childhood obesity, than in technology” (Steinbeck and Pietrobelli 2005).

The Wanless Report stated that a lack of information or a failure by individuals to properly calculate long-term health costs may be contributing to the rising prevalence of obesity (Wanless 2004). Others point to increased temptations of tasty food and sedentary leisure activities, pointing out that even the best-motivated people may need to exert considerable effort to resist cravings for tasty, energy-dense foods and to get out of bed for a cold morning run. But an important part of promoting healthier lifestyles is recognising that healthy foods can also be tasty and healthy activities fun (dancing, for example). Maio identifies a need for ‘empowered choice’ combining the psychological will and the availability of healthy alternatives to resist unhealthy temptations (Maio 2005).

An understanding of how people make diet and activity choices may be key to this empowerment. It seems that traditional influences of parents and families are being eroded and school and team sports becoming less popular, which may mean for many communities that unhealthy lifestyles have become the norm. A Guardian poll found we believe parents are responsible for children consuming junk food (Meikle 2003). Yet a recent Barnardo’s report states that families in the UK are becoming more democratic, that fast food is children’s preferred meal and that peer pressure and advertising were more significant than teachers or parents in determining children’s food choices at home and at school. The same study found that *“the more choice children have, the less likely they are to eat a healthy, nutritionally-balanced meal”* (Barnardo’s 2004). Maio suggests that for both diet and physical activity, rebuilding cohesive family or community groups is important for creating healthier environments (Maio 2005). Stimulating debate around the importance of food, nutrition and health, through a range of media and approaches, may be the way to bring about cultural or social change. The significant public interest in the UK in 2005 surrounding Jamie Oliver’s exploration of school meals may indicate that people are willing to engage with these issues.

Creating supportive social contexts for healthy behaviour may require combined interventions using sticks and carrots (Joffe and Mindell forthcoming). Government efforts to reduce smoking and drink-driving may offer relevant precedents. However, we have found no programmes with effective monitoring and evaluation, that show long-term obesity reduction. There are no national-level examples that provide off-the-shelf approaches for future intervention. The challenges governments may face in

driving future change (whether by intervention, promotion or legislation) in social behaviour are many, not least in getting the timing right.

The table below offers some snapshot examples where governments may have effectively helped alter personal choice. We note that obesity rates vary widely across Europe, and wonder why the UK has seen growth rates so much above Scandinavia, the Netherlands or Switzerland over the past 20 years? Is it because the Dutch continue to cycle and walk abundantly around towns, for example? What could we do, if anything, to achieve this sort of health improvement? Many countries are implementing new government-led, obesity-focused policies at the moment, so agreeing the social or cultural dimension of certain behaviours may be valuable, as would ensuring effective monitoring is in place to record any improvements.

SOME POSSIBLE GOVERNMENT-LED PRECEDENTS OF BEHAVIOUR CHANGE?	
Karelia, Finland: diet and activity	Significant reductions in cardiovascular disease through collaboration with industry to produce healthier foods and with non-governmental organisations and the media to promote healthy living and eating (Pushka 2005). Obesity rates did not fall, but mortality rates did.
UK, seatbelt use	Legislation, following a series of public campaigns, led to sustained behaviour change in the wearing of front seatbelts (Wanless 2004).
UK, sexual behaviour	Need for multilevel approach, including active engagement of at risk groups and a specific role for GPs as blunt counsellors who can break through individual defence mechanisms. Information and advertising campaigns should focus on short term and personal cost, for example, lower desirability, rather than longer-term health benefit (Cabinet Office 2003).
Singapore, weight	National Healthy Lifestyle Program, begun in 1992, includes testing schoolchildren for weight and fitness through a standardised national test. Those who fail are assigned to group running or aerobics programmes for an hour a week. The percentage of overweight schoolchildren has dropped from 14% to about 10% since it started. Also, overweight military recruits (for compulsory national service) face an additional six weeks of fitness work on top of the usual 10 weeks of basic training; c. 6% of adults are obese (Walsh 2004).
Thailand, sexual behaviour	A successful campaign against HIV/ AIDS transmission in Thailand had leadership from the very top of government, and included specific actions to protect and empower prostitutes (Cabinet Office 2003).

Should the state intervene?

"By 2020, if current trends continue, the right to privacy for the individual will be an exception" (Davies in Lashmar 2004).

While many agree that our living environment is increasingly obesogenic, views are divided as to whether regulation should be used to directly alter people's choices and how this may be achieved. We assume that people allocate their spending according to what brings them the greatest benefit (Philipson and Posner 1999), even if this is medically sub-optimal. The limit to this behaviour is that there is, *"certainly no right to require others to subsidise the huge costs"* (JP Morgan 2003). The Department of Health acknowledges that rising costs and worsening mortality figures from obesity could presage a time when *"Government must be prepared to act and intervene more forcefully and more directly"* (DH Response to Health Select Committee 2004) to control obesity. It is unclear how this may develop over time, but given finite resources, it is possible the state could provide tax rebates for healthy lifestyles, and provide free services on demand only for the poorest (Horizon Scanning Centre 2005).

In the healthcare arena, patient and provider rights and responsibilities may become more explicit, as a form of 'compact', framing the relationship in terms of reciprocity and underlining that the patient's health is a mutual undertaking (Cabinet Office

2003). We may, for example, see children's BMIs measured annually at school, results sent home in confidence to their parents, with lifestyle advice, follow-up checks and referral to more specialised services (Department of Health 2004a). The Singapore example above may offer a precedent for this approach.

Some commentators fear "*overweening nannyism*" (Lashmar 2004), and note that we may make it acceptable for people simply not to turn up to work. As public health interventions become more prevalent, the constant reminders that people are in sub-optimal physical condition may drive them to declare themselves 'unfit (too heavy!) to work'. A precedent for this is 'stress', which a generation ago was not medically recognised and is now responsible for more sick days each year (33 million in 2002) than were lost to the Miners' Strike (Durodié 2005).

Another possible future is that companies play a greater role in promoting health. The car industry's experience of collisions and airline industry's experience of deep vein thrombosis are examples of companies taking responsibility for delivering healthier products and services (Curry and Kelnar 2004). Could we see a future where supermarkets, responding to government regulations similar to those on cigarettes and alcohol, arbitrate on which customers can buy high fat foods?

Are we becoming less active?

Britain's under-16s now watch 17 hours of television a week (Freedland 2005), and research has shown that reducing this (in)activity is, "a promising approach to preventing obesity in children" (Nestle and Jacobson 2000). Wanless believes the key contributors to reduced physical activity in the UK population are the use of cars for short journeys, sedentary occupations, lower sports participation, parental reluctance to allow children to play outdoors, increased time pressures reducing school sport, and greater TV and computer use (Wanless 2004). US analysts concur (Gunston 2005, US Food and Nutrition Board 2005). These claims are supported by data. For example, we now travel less than 5 billion kilometres a year by bicycle, against over 22 billion in the 1950s (Department for Transport 2003). Fewer than one third of schoolchildren participate in regular weekly physical activity at school, which Wanless believes will continue to fall, despite a government target to double this rate by 2020.

The American futurist, Robin Gunston, forecasts a trend away from team sports towards gym membership and participation in extreme sports, marathons and triathlons. He predicts a polarisation into fitness fanatics and the rest, and a continued separation of physical from social leisure activity, which may make sports less attractive to many (Gunston 2005). A UK government scenario forecasts the growing attraction of 'virtual worlds' lowering traditional audiences for live events, participation in team sports and volunteering (DCMS 2005). The forecasts seem to be for less sport, and less team sport, which may weaken the social 'glue' that keeps many participants involved. Gunston outlines three scenarios for the future of sport in the box below. The first two outcomes suggest participation levels will fall and sports as a spectacle will increase, reducing levels of physical activity in the population and tending to increase obesity. The third is altogether healthier.

THE FUTURE OF SPORT?

Scenario 1 – Religiosport

By 2025, sport has gone beyond spectacular entertainment to become the new 'people's religion'. Participants are highly paid elite stars, and fans' relationship with sport is their identity to a team. Like other consumption habits, this loyalty shifts with fashion and each season's new faces and results. Corporate sponsors associate themselves with teams and players and demand 'sensational' performance. Sport becomes a key aspect of daily life, with regular newsletters, fan uniforms and weekly 'worship': "stadiums are billboards; athletes are celebrities, competitions are sense-bombarding experiences".

Scenario 2 – Technosport

Science and technology drives enhanced performance and fan experience. Sportsmen and women are traded like other market commodities. Investor demand for sensational results drives sports to become more virtual. There is greater use of robots and high-tech inputs, performance-enhancing drugs are omnipresent and gadgets bring results, news and highlights through multiple digital media. Again, sport is increasingly dominated by business, while more peripheral pastimes drift into obscurity. Two global mega-sports dominate: basketball and football. Ultimately, cloning of athletes delivers a new breed of sportsmen and women.

Scenario 3 – Valuesport

A major shock – large scale drugs disgrace, fraud, bankruptcy, irresolvable strike or intellectual property conflict – removes business interest. Legislation bans advertising of unhealthy food products, reducing corporate investment into sport. However, extended 'sin taxes' (collected on sales of junk food and lottery) are disbursed in significant amounts to community sports and well-being initiatives. Health-driven legislation and campaigning promotes society-wide fitness campaigns. A values-based sports movement grows, with an ethos of participation for all. Local, national and international events are held, in a third incarnation of the Olympics.

(Source: Gunston 2003)

More eating outside the home?

US consumption of snacks tripled and soft drinks doubled from 1975 to 1995. Affluence, fashion and pressures on families to minimize food costs and acquisition

and preparation time have raised the proportion of calories consumed outside the home (Sturm 2002) and this is expected to continue to grow (Molitor 2003). Spending on dining out has risen from under a third to over half of US spending on food since 1970, and the greater calorie density of this source of food is thought to account for almost 200 'hidden' calories per day (US Food and Nutrition Board 2005, Sturm 2005). This may be a primary cause of higher obesity, and is strikingly similar to estimates of the energy imbalance that has brought about obesity growth (Cutler, Glaeser and Shapiro 2003). The UK currently spends only £36 per week on hotels and restaurants (National Statistics 2005b); should the UK follow US trends, we might expect calorie intake, and waistlines, to grow.

Deteriorating mental health?

There may be a correlation between obesity and mental illness. Obese women are said to be 37% more likely to commit suicide than women of normal weight (House of Commons Health Committee 2004). Similarly, today's 15 year olds are more than twice as likely to have behavioural problems and 70% more likely to suffer anxiety and depression than a generation ago, and self-harming and youth suicide are "*dramatically on the rise*" (Freedland 2005). While we have found no claims of causation, the personal and social context of weight gain adds another layer of complexity to any potential 'cure'.

Summary of social drivers

Studies indicate that obesity is negatively correlated with education and socio-economic status, and that the obese face considerable discrimination. There may also be a correlation between mental illness and obesity. Obesity may continue to reinforce social inequality, as the least well-off are also the least well. Individuals, including young children, seem to be making diet and physical activity choices without positive parental or social pressure, which may be ingraining unhealthy behaviour for the future. Additionally, the commoditisation of sport into a 'fan experience' and a continued decline in physical activity and participation in team sport among young people may raise future rates of obesity.

Technological drivers

"Obesity is unlikely to prove to be a disorder amenable to a 'magic bullet' solution"
(Steinbeck and Pietrobelli 2005).

Introduction

This section explores how current and possible developments in technology have the potential to alter our lives in numerous ways. We may also see rapid advances in healthcare technology, as we discover new medications and learn how people respond to treatment. The search for a magic pill to treat obesity continues. Developments in genomics and nanotechnology suggest that people will increasingly be able to alter

the shape and function of certain parts of their bodies, and neuroscience may help us better understand and control the appetite and why we succumb to temptation.

Technology is all around us

Technological advance has underpinned many historic improvements in our quality of life, replacing labour with machines, and allowing many of us to live comfortably. The implications of the current generation of developments in information and communications technology (ICT, ie. internet, mobile telephony and computing) in terms of their impact on obesity are only gradually emerging. We may, for example, see an increase in the number of full-time home-workers, as connectivity allows those that can 'telework' to migrate to rural areas. In the UK in 2001, 2.2 million people (7% of the workforce) worked at home at least one day a week and used a telephone and computer (Dwelly 2003). This may number rise to one fifth of jobs (Highways Agency 2003), and increase the amount of time available for active leisure. Alternatively, less regular commuting might reduced walking and cycling opportunities, as home-workers feel pressure to be 'always on', with high stress, poor diet and low activity levels. On the other hand, concerns about privacy and on-line fraud may make many people suspicious of being permanently connected. It may even become fashionable to 'opt out', turning off portable devices (DCMS 2005). The implications for the future of obesity are not clear.

Gaming, computing and video technology advances may further displace active leisure pursuits and reduce levels of physical activity. However, a new genre of physically active gaming is appearing, where physical motion is part of the game. It may mean the next generation of game players will not be as static in front of a screen, but, for example, spend their time orienteering across real countryside or cityscapes, carrying a mobile, GPS-enabled device, tracking or interacting with other players and objects, real or virtual (DCMS 2005).

Technological developments in food retailing forecast more internet shopping, with attendant reductions in physical activity and social communication, and development of 'supermarkets of the future'. Pilot supermarkets in Helsinki and Athens already offer trolleys with computer screens, personalised by customer swipe cards. This offers scope for tailored diets and nutritional/ energy information that may empower customers to monitor and manage the calories they purchase. On the other hand, shoppers may succumb to adverts and promotions that flash up on screens. Research suggests that UK customers dislike the loss of personal data privacy that this process entails (Stirling-Roberts 2005), even though store cards are abundant and popular.

Technology in the future of healthcare

"The trend is faster better cheaper for private, in-home, disposable tests: pee on a stick and see if I'm at risk for many diseases." (Kummer 2005).

Robotic or electronic devices, coupled with Internet-based, interactive medi-mechanics and detailed individual background data, may lead to more effective personal monitoring and management of health (Inayatullah 2003, Horizon Scanning Centre 2005). They may also enable healthcare providers to keep a closer eye on patients. One forecast is that electronic 'fat quota' ration cards may keep a closer eye

on obese people's food purchases and ration specific items; it could even be used to identify overweight teenagers that should attend government-run summer fitness camps (Curry and Kelnar 2004).

Various forms of appetite suppressant have been available for years, indeed Bushmen in Southwest Africa are known to have used them to survive lean periods. Recent studies point to success of injecting a naturally occurring digestive hormone found in the small intestine (oxyntomodulin) in reducing body weight and calorie intake in overweight volunteers (Bloom 2005). Other studies have identified regulators of eating behaviour (oleylethanolamide) that "*could be used as a tool to design new anti-obesity medicines*" (Cristol 2002). New drugs will probably emerge from research on known brain structures and on 'orphan' receptors with unknown functions that help to define new structural requirements for compounds. We can expect new compounds regulating arousal, appetite and weight change (OST Foresight 2005), but we are still a long way from developing a pill that reduces weight regardless of metabolism, for all food and activity combinations without deleterious side effects, and our research found no one predicting this.

A BBC scenario foresees increasing numbers of people of all weights looking for drugs to manage their weight and energy intakes, and generic use of appetite suppressants and drugs which control and modify the brain's regulation of body weight (BBC 2004). As scientific understanding of taste and our sensory perception of pleasure improve, nutritious foods may be made more palatable, encouraging people to switch to better foods; equally, better flavours may tempt people further to over-consumption of all foods.

Gene genies

"Animal breeding studies show very clearly that you can breed for leanness or you can breed for obesity" (Wardle 2004).

Genomics offers the prospect of understanding and manipulating people's susceptibility to being overweight and suffering obesity-related chronic diseases. Elucidating personal differences in response to drug treatment could be helped by substantial genotyping, genetic profiling and the discovery and description of gene variants affecting drug use. Research on humans continues, for example the UK Population Biomedical Collection is testing the 500,000 samples of adults aged 45-60 (WHO 2002). Optimists forecast that in ten years' time scientists will reliably and cheaply test for a thousand different genes, and foresee patients' records available on networked metabolic and genetic databases that allow 'cyber physicians' to diagnose, treat and monitor patient illness in a tailored way (Kummer 2005).

There are already a number of companies offering genetic-screening, charging hundreds of dollars for prescription of 'DNA diets'. However, analysts believe that the best we are likely to see in the next 30 years is an improved general level of understanding, for example to the level of "*a middle-aged man of Hispanic descent*" (Kummer 2005). WHO believes "*an over-optimistic picture of genetic research has emerged*". Not only uncertainty of timing, but also the high cost and potential social and ethical issues make predicting outcomes difficult. WHO also fears bio-warfare,

genetic screening and record fraud, and a growing culture of gene ownership (WHO 2002).

The greatest near term advances are likely to be in agriculture, where social and ethical obstacles, although strongly evident at present in the UK, may face less public challenge than in the arena of manipulation of animal or human genes. As understanding and technical ability improve, genetically modified (GM) crops may deliver greater nutrition, and may even come to be seen as 'better than organic'. The futurist, Molitor forecasts GM crops will cover more acres (in the USA) than 'natural' crops by 2020 and be 100% by the end of the century. He also predicts significant developments in agricultural manipulation, with the aim of raising availability and nutritional content of many food plants, but which could have unintended ecological consequences:

- Medium-term: genetic modification may convert annual plants into perennials that thrive and produce all year long, year after year (but may be susceptible to disease);
- Long-term: biotechnology advances may enable production of just the edible parts of plants, in sterile bioreactors (but may require more resources than sunlight and water);
- Very long-term: in a 'Meta-Materials Age', "food will not be grown, but replicated using robotic nanotechnologies that assemble foodstuffs on demand" (Molitor 2003).

Pharmaceutical companies

We may in the future see a growing emphasis on 'healthy living agreements' between people and health providers (Pharmafutures 2004). One scenario foresees public acceptance of drugs as tools for tackling obesity, and the full harnessing of computing power and genetic profiling in developing individually tailored treatment (Curry and Kelnar 2005).

Nanotechnology

"Homo Technicus will be a fusion of biology and technology at the atomic level. Its living and non-living materials will be indistinguishable" (Inayatullah 2003).

Nanotechnology futures are being considered in numerous fields. As well as new microbiological mechanisms of food production and processing, we expect soon to be able to limit appetites and fat storage and adjust metabolic rates.

Nanomedicine may increase our ability to regulate signals in the bloodstream, and to adjust how individual cells respond to them in the body. Nanoscale sensors could improve our understanding of how different foods travel through and are used by the body, which may enable adjustment of food molecules or digestion processes, for example to reduce absorption of sugars or storing of fat around the body (Foresight Institute 2005).

Nanoscale robots will allow medical doctors to undertake curative procedures at the molecular level. Indeed, one scientist battling cancer believes that use of

nanotechnology to eliminate certain cancers will, by 2015, be “*not a dream but a vision based on a well-defined strategy*”. (Mihail Roco, senior advisor to the US National Science Foundation, in Inayatullah 2003) There are certain to be many technical as well as ethical and economic challenges ahead, but this shows this optimism is an indication of the major progress expected in this field.

Neuroscience

We may soon understand the main neural components of motivated behaviour and temptation, and how drugs and certain other stimuli affect these. One goal is to determine the brain circuits that mediate pleasure and reward, craving and withdrawal; another is to understand at the molecular level the processes of satiation, and relate these to behaviour. By 2025, the brain circuits of learning and memory, action and motivation should be well understood and carefully tailored programmes to support behaviour change and weight loss should be possible (OST Foresight 2005).

Summary of technological drivers

The underlying trend in the UK over recent decades (indeed, centuries) has been for advances in technology to reduce the need for labour. This is at the core of increased inactivity of the population. New technologies may continue to make life generally ‘easier’, and it may also offer breakthroughs in specific areas. As we come to understand the science underpinning metabolism and behaviour, obesity may come to be treated as an ailment we fix through pharmaceutical or medical intervention, just as we might take vitamin supplements or undergo therapy to stop smoking today. Companies are already offering simple gene-testing and personalised healthcare; analysts predict significant advances in nutrigenomics. GM foods may become recognised for having added nutritional benefits, and become more widespread. Nanotechnology may allow us to change the way the body works at the molecular level, enabling us to better monitor and manage weight and its health consequences. Questions of equality and ethics and cost are likely to arise.

Economic drivers

Introduction

In the UK, abundant food and lower real prices in the past generation may have encouraged some to higher consumption, but nationwide, there is evidence that calorie intake has remained fairly constant. As food prices have fallen, spending per calorie has inevitably risen, perhaps reflecting greater quality of foods, or reflecting a charge for greater convenience. This section explores some economic drivers of obesity. The rising costs of obesity to the public purse may necessitate government intervention. Profit is the principal driver in the food supply chain, but the growing consumer awareness appears to be raising the importance of nutrition.

Economic growth and the nutrition transition

Barry Popkin has proposed that economies undergo a 'nutrition transition', raising consumption of livestock products as they become more affluent (Popkin 2001). In the developing world, the share of meat, milk, eggs, oils and sugar, currently 28% of calorie intake, is projected to rise to 35% in 2030 (FAO 2003). This transition to a more energy-dense diet may underpin expanding waistlines around the world, but is nowhere an exact science as many cultural factors play a role. In the UK, different socio-economic groups seem to be disproportionately affected. As well as European differences mentioned earlier under Social drivers, anecdotal evidence indicates that Japan and Korea have largely avoided rising obesity despite rapid economic growth (Timmins 2005). What role do price and economic incentives have to play in supporting healthy food and activity choices? Might we experience a further stage to the transition? One futurist forecasts a further, imminent '*paradigm shift*', in which consumers demand tasty, wholesome food rather than larger portions or greater energy-density, and there is a new awareness of food-borne microbes, gene behaviour and the importance of nutrition (Kummer 2005).

The cost to the taxpayer

"It is going to be very hard to sustain our model of a healthcare system, requiring the huge amounts of money to look after obesity and its consequences" (Nick Finan in BBC's '*If... We Don't Stop Eating*', April 2004).

The UK population is growing and ageing; both of these trends increase health care spending. The Wanless Report analysed some future challenges facing healthcare provision in the UK, and made the case that investment today may be an efficient way to deliver better health outcomes in future.

Wanless constructed three scenarios to explore developments in healthcare provision and expenditure to 2022. He assumed that delivery of healthcare services will be determined by the health needs and demands of the population, technological developments, workforce numbers and productivity, and the availability of sufficient finance. His scenarios made different assumptions of productivity of supply (regarding healthcare delivery and patient experience) and demand (regarding the level of individual engagement in their own health). The difference between the most and least costly scenarios, outlined briefly below, represents an expected annual difference of £30 billion by 2022, or half of current annual expenditure (Wanless 2004). Note: Current UK healthcare expenditure is approximately 8% of GDP.

WANLESS REPORT SCENARIOS

Fully engaged

This scenario forecasts growing demand for high-quality care, as people view the NHS less as a 'sickness service' and actively seek information to maintain their own good health. Treatment is responsive and efficient, thanks to high rates of technology uptake, efficient use of resources and a motivated workforce. Health services keep healthy people fit and the chronically ill active and life expectancy rises faster than forecast. Health care spending rises to 10.3% of GDP in 2012 and 10.6% in 2022, reaping the greatest health benefits for the lowest expenditure.

Slow uptake

There is no change in the public's relatively low level of engagement with their own health

maintenance, slow health service uptake of technology and low productivity in service provision. High demand drives costs to 11.0% of GDP in 2012 and 12.5% in 2022.

Solid progress

Health promotion initiatives are effective in engaging the public and it has confidence in a responsive health service. Technology uptake progresses at a reasonable rate, driving modest efficiency gains; spending is 10.6% of GDP in 2012 and 11.1% in 2022.

(Source: Wanless 2004)

Not everyone shares Wanless' relatively optimistic, 'business-as-usual' outlook. For example, availability of sufficient health care professionals to keep pace with demand may be a constraint, alongside the ethical issues of attracting large numbers of healthcare workers from overseas. A scenario offered by the BBC envisages that, if food and advertising companies are left to determine their own voluntary codes of practice, continued demand for cheap, energy-dense foods is likely to fuel a health crisis. This scenario foresees government efforts bogged down in increasingly intractable national and European political processes, designed to protect producers and maintain prices. *"As waistlines expand, we may enter a 'diabetic world' when the world's biggest production plants pump out insulin, dialysis cannot keep pace with demand and kidneys are auctioned for record amounts on E-bay. By 2020, we may reach the point where record numbers of diabetics, costing the NHS £10,000 a year, overwhelm an ailing health service"* (BBC 2004). To contain upward pressure on budgets, services may be provided at local or regional level with tight central financial control. As already seems to be occurring in some primary care trusts (no knee or hip replacements for obese patients), obese patients may be at the front line of any future rationing (Carvel 2005b).

Business case for health promotion

One economic argument for government intervention in health promotion is the externality associated with the growing public cost of treating conditions related to obesity. If healthcare is privately funded (as is mostly the case in the US) the case for intervention may be weakened (Philipson and Posner 1999). The implications of tax interventions in altering demand are unclear, and are considered further under 'Political drivers' below.

Future spending on healthcare and health promotion may be reconceptualised as investment. This could include mass-media health promotion campaigns, school and workplace education in nutrition and weight management, national 'no television' campaigns and bigger budgets for school, prison and hospital kitchens. We may also see direct interventions into food supply, for example limiting fat content in popular foods, or rewarding farmers who raise cattle with lower levels of milk and beef fat (Jacobson 2004, Lang and Rayner 2005).

Cheap food is big business

"We live in an environment that has been dubbed 'obesogenic', full of stimuli that encourage us to eat, to take less exercise, and to, above all, to consume. This is very much a commercially run environment" (Tim Lobstein in BBC's *'If... We Don't Stop Eating'*, April 2004).

This report's introduction indicated that food prices have fallen significantly relative to income in the UK. Price, quantity and taste are expected to continue to determine diet patterns. For example, relative prices of fruit and vegetables rose (up 160%) versus soft drinks (up only 26%, less than the rate of inflation) from 1984 to 2002, which may have contributed to worsening diets (Sturm 2005). Economists argue that individual's demand for more food is a rational response to lower prices (Philipson and Posner 1999), but this appears not to have happened in the UK, at least not at the national level.

As Adam Smith remarked in *The Wealth of Nations*, "*it is not from the benevolence of the butcher, the brewer or the baker that we expect our dinner, but from their regard to their own interest*" (Smith 1776). The profit motive is primary in food supply. Competition, innovation and economies of scale have driven down costs. The supply chain has become less organic and more industrialised: manufacturing and retail now represent three times farm value (Chopra et al 2002). It has also become more concentrated: five companies now account for half of the US food retail market. Marsden foresees the 'geo-social-agro-ecological' (not to mention nutritional) specifics of agriculture becoming increasingly marginal (Marsden 2000). As food production is increasingly big business, the emphasis on growth, rather than well-being, may mean consumer health or sustainability issues remain an externality, outside the buyer-seller relationship, that future taxpayers have to bear.

Governments will certainly play an ongoing role in food supply (producer support in OECD countries was \$279 billion in 2004, Rayner et al Forthcoming); this may further perpetuate cheap food and overconsumption, with negative health implications. While there is nothing in the medium-term to indicate this will change, this level of subsidy may not be guaranteed in the long-term.

However, for some, nutrition information appears to be a key determinant of their food choices. Sales of functional foods (such as the Yakult yoghurt drink) represented 2.4% of global food and drink sales in 2003 and are reckoned to be the fastest growing food market (Curry and Kelnar 2004, Wenstromm 2005). Consumer attitudes have shown increasing awareness of nutrition and consumption of nutritious foods (for example, consumption of '5 a Day' has risen from 26% in 2000 to 51% in 2004) and greater concern over food labelling accuracy (FSA 2005). These trends are behind investments by some of the major suppliers of energy-dense foods into healthier product lines, for example Pepsi's acquisition of Quaker Foods. Could these indicators of the growing interest in healthy and functional foods be the forerunners of Kummer's proposed paradigm shift?

Advertising/ marketing

"It is largely through their choices of brands that 'tweens' (8-12 year olds) distinguish themselves from one another" (Barnardo's 2004).

The food industry in the USA now spends over \$30bn each year on direct advertising and promotions, more than any other industry, and Coca Cola spends more on advertising (\$2.2bn) than the entire budget of the World Health Organisation (Chopra et al 2002). The WHO considers the marketing of fast foods a key factor in worsening diets and adverts are thought to be particularly affect children (Dalmeny et al 2003).

The UK Government supports self-regulation by the advertising industry, but has committed to review the position of advertising food to children in 2007 (Department of Health 2004a). Their reluctance to impose outright bans is thought to be mainly on the basis that it limits individual choice, but it also may reduce revenue to children's programming and affect programming quality (Freedland 2005).

Reductions of UK salt levels in bread, down 22% between 1998 and 2001, and saturated fats may indicate a willingness by food manufacturers to produce healthier foods (DKW Research 2004). Obesity has been labelled an 'alarm call', giving food companies forewarning of changing demand patterns caused by rising health awareness and possible taxation or litigation (Curry and Kelnar 2004). Analysts believe responsive companies will choose to upgrade brand portfolios to more nutritious products and avoid the bad press and falling share prices associated with sale of fattening foods and perceptions of deceptive marketing practices or misrepresentation. The UK food lobby has stated they "*welcome the initiative to encourage science-based health claims about the health benefits of food products*" (JP Morgan 2003), so we may see more promotion of nutrition and health messages, marketing, for example, dairy, , organic, tea and vegetables (JP Morgan 2003).

Insurance companies

In the UK, population mortality levels are improving each year. While insurers may be watching obesity trends, standard life insurance questionnaires do not currently segregate people by weight. This seems to run contrary to the data, reported in the introduction of this report, that obesity reduces life expectancy and raises annual expenditure on healthcare. It is underpinned by the overall picture of the population living longer every year. The RAC states that heavier people are twice as likely to die in a car crash, as seatbelts and air bags are designed for average-sized people (Globalist 2004) and obese bodies are less able to deal with severe trauma. In the US, 90% of insurers offer discounts to people with healthy lifestyles (Futurist 2005b). This suggests a future where obese people may be charged higher premiums or unable to get insurance, which may leave government supporting an underclass of the poor and obese. It could also see obese people demanding higher annual pension payments, as they are expected to die sooner.

Energy constraints on food supply

Food supply consumes a huge amount of energy in food production and transportation, processing, packaging, retailing, restaurants/ catering, refrigeration and meal preparation. It is estimated to emit over a fifth of UK's greenhouse emissions (Church 2004). Food travelled 50% further in 1999 than in 1978 and supermarkets are now thought to be responsible for one third of the heavy vehicles on Britain's roads (Curry and Kelnar 2004). In September 2005, Tate & Lyle, the world's largest industrial starches manufacturer raised prices 10-15%, due to "*rocketing energy costs*" (Food Navigator 2005). As we face ecological limitations on non-renewable inputs, it is possible that price rises may reduce demand for energy-dense foods. On the other hand, it may push production to higher efficiency and further concentrate the supply chain.

Summary of economic drivers

NAO and WHO suggest that government investment in health promotion can be effective in reducing population obesity and associated rising morbidity, mortality and treatment costs. Monopoly corporate control and vertical integration of food supply chains are expected to prevail, which will tend to keep profit, rather than health, at the core of food supply. In the longer term, ecological constraints may drive up prices of livestock-based and processed foods, and reduce demand; equally, they may drive further corporate concentration of food supply to deliver extra efficiency. Optimists believe that ecological and nutritional awareness may pre-empt a ‘paradigm shift’ away from volume and price towards wholesome, local foods. The current fast growth of functional foods may be an early indicator of this trend, as may the trend towards well-being and greater expenditure on higher quality food (higher cost per calorie, lower saturated fat and salt levels).

Environmental drivers

“The environment, in its widest sense of societal, ecological and biological parameters of life, is the infrastructure on which human health draws and depends” (Lang and Rayner 2005).

Urban environment and physical activity levels

The proportion of people living in urban areas, worldwide, has grown from below 30% in 1950 to 50% today and is forecast to be over 60% by 2030 (UN 2003). The World Health Organisation states that urbanisation creates, *“conditions in which people are exposed to new products, technologies, and marketing of unhealthy goods, and in which they adopt less physically active types of employment”* (WHO 2005a). Globally, living in urban areas is positively correlated with chronic disease, high blood pressure, arthritis, headaches and breathing difficulties (RAND 2004b). The CIA predicts that the trend towards urbanisation will continue unless we have: a major international conflict; a new pandemic of infectious disease that kills millions; or government clampdowns driven by significant terrorist attacks on ICT (CIA 2004).

The BMA concludes that *“modern inactive lifestyles ... possible represent the dominant factor”* driving obesity (BMA 2001). Urban lifestyles are typified by high levels of car use, 24-hour food availability, abundant desk jobs and low levels of physical activity (WHO 2005a, Joint Colleges 2004, BMA 2001, Sturm 2002). US style suburban town design may also contribute to obesity, by encouraging higher levels of car use (Building Futures 2004, RAND 2004a). Maio concludes that decreasing obesity may only be achieved if we adapt our built environment to make it easier for us to regularly be more active in our everyday activities (Maio 2005). There are many initiatives exploring efficient urban design. A challenge will be to ensure that personal and community health considerations are included as future infrastructure is designed and built.

Transport

Walking and cycling in the course of daily life are an important component of population activity levels. Where pedestrians and cyclists have little fear of collision or injury to themselves and their children, they are found to be more active. Overall, maintaining activity levels in cities seems to require avoiding complete reliance on cars and ensuring urban design promotes active transport (BMA 2001, Sturm 2002). This may also stimulate a sense of community (Livingstone 2005), which may be an important component of good health (Maio 2005).

OST's Foresight Unit has undertaken a project on Intelligent Infrastructure Systems for transport, which concludes that people's desire to spend time travelling has not changed over the past century (at roughly one hour per day). As a result, people have chosen to travel greater distances as technology has allowed it, which raises congestion pressure and fuel use. Finding alternatives to hydrocarbon fuels and developing intelligent transport systems to manage traffic and inform people's decisions will be key to determining the amount of active travel undertaken in future.

One possible future scenario sees investment in safe green spaces for recreational activity subsidised by congestion charging and other road pricing arrangements (Curry and Kelnar 2004). Another possibility in a similar scenario outlines a fiscal system that makes car-dependent lifestyles unattractively expensive and encourages high-density urban life over the relative isolation of suburbia or rural living. It foresees a *"neo-Victorian scatter of bicycles and small service vehicles serving thriving, self-sufficient local communities"* (Building Futures 2004).

An alternative possible future predicts that suburbs adapt through intensification to different social and community needs; while the urban renaissance fails due to middle class preferences for the countryside. This could bring about higher urban crime and anti-social behaviour and deteriorating public services in town centre 'ghettoes' populated only by the poor and the obese (Building Futures 2004, RAND 2004a).

Workplace

The UK workforce is increasingly sedentary. There seems little likelihood that workers will ever be as active as a generation ago, when well over a quarter of the workforce was employed in the primary or manufacturing industry jobs. These now account for fewer than 15% (McCormick and Stone unpublished). Corporate social responsibility incentives at many companies inform and provide incentives to staff to eat better and exercise more, but the overall trend seems to foresee less activity in the workplace (Department of Health 2004a).

Food environment and diet

From a young age, children learn to eat what they are served; physiological satiety cues may be overridden by environmental cues. Evidence shows that when served larger portions for an extended period of time, people consume more food. As mentioned earlier, parental restrictions may be weaker than advertising and peer pressure in determining the choices of many children. As the UK moves towards 24-hour food availability through supermarkets, kiosks, vending machines and sandwich shops, increased temptation may well underpin higher consumption of energy-dense foods (US Food and Nutrition Board 2005, Fletcher 2005). At the same time, the

number of shops selling nutritious food has been declining (US Food and Nutrition Board 2005); there are thought to be entire wards of London with no shop selling fresh fruit and vegetables (Livingstone 2005).

The government currently provides free school fruit to millions of children, in an attempt to engender a liking for fruit and basic awareness of nutrition (Department of Health 2004b). One future scenario sees access to nutritious food viewed as equivalent to, say, the right to electricity in the home (DCMS 2005), with much greater levels of regulation and standardisation of supply.

Sustenance and sustainability

Energy-dense foods may well become the world's staple fuel, as the 'nutrition transition' foresees. As meat production requires up to 20 pounds of grain for every pound of beef produced, higher crop production may ultimately reach ecological limitations (Molitor 2003). Pesticides and fertilizer may also poison soils and excessive world demand for water may increase 'water stress' and reduce output (Molitor 2003, RWE Thames Water 2003, Horizon Scanning Centre 2005). While this may not have an impact on the UK in the short term, scarcity and rising price may shift diet patterns, with meat returning to being a luxury consumed in moderation by most of the world's population, and possible ongoing scarcity for the poorest (International Forum on Globalisation 2002). A World Bank report states that by 2020, *"80% of the world's arable land will be used to support livestock for the rich, raising the danger that the poor will be crowded out, the environment eroded, and global food security and safety compromised"* (World Bank 2001).

A more optimistic, neo-agrarian future sees greater public awareness of food origins, soil depletion, water contamination and climate change; this in turn may alter people's understanding of food origins and nutrition and bring about healthier food choices and land use.

Summary of environmental drivers

WHO believes that urbanisation creates conditions which promote poor eating habits and inactivity. Over half the world's population now live in cities and in the UK, we are increasingly car- and desk-bound, and exposed to temptations to buy and consume energy-dense foods at all hours of the day. In the longer term, ecological limits on hydrocarbon fuels might increase levels of walking and cycling; however, alternative fuels may well become mainstream. Improved transport infrastructure and ICT may enable people to travel further and faster and reduce levels of active transport.

Political drivers

"Political structures ... are critical to ensuring food, agriculture, trade, media advertising, transport, urban design and the built environment enable people to make healthy choices" (WHO 2005a).

Given the huge number of influences on individual diet and activity choices, government structures and interventions may play an important role in helping consumers make healthy choices. We consider the possibility of individual and

government litigation of companies that could impact food supply, as well as other possible areas of government legislation. WHO has suggested that an independent national institution focusing on nutrition policy might effectively bring together future interventions and support across government. While this section focuses mainly on food, such an institution could also help coordinate strategies promoting physical activity in the future. The WHO's suggested governance model is attached in Appendix 1.

Threat of litigation

"Is fat the new tobacco?" (Parloff 2003)

Diet may be only one risk factor contributing to obesity, but smoking is just one risk factor for diseases for which the tobacco companies had to pay. The link between each and increased levels of chronic disease are well-established. The tobacco industry, after years of denial, in 1998 agreed advertising curbs and a \$246 billion liability to the 50 US states, payable over 25 years. This litigation showed that deceptive marketing practices and misrepresentation may be punished the most severely by the courts (Landon 2003), and the companies' large marketing budgets used as proxies for damages and compensation (DKW Research 2004).

However, the relationship between health and food is more complex than the relationship between health and tobacco. The WHO states an obvious difference, *"unlike, tobacco, which kills half its regular users if consumed as intended, foods are not deadly products"* (Derek Yach in Landon 2003). Other differences include: no evidence that consumers are not fully responsible for their actions when they over-eat; lack of an equivalent in food terms to the harm caused by second-hand smoke; and changes to product contents being made by the food industry, which the tobacco industry could not (Landon 2003).

The threat of litigation is thought to be an important means to shift industry towards better practices or self-regulation (Landon 2003). The US is expected to lead the way: *"well capitalised law firms with a wealth of expertise in tort action lawsuits (in tobacco and asbestos) will continue to target the deep pockets of the food, beverage and restaurant companies"* (JP Morgan 2003). The first salvo of what may be a continuing battle was from two obese New York teenagers who brought a case against McDonald's in 2002/3 claiming false advertising and failure to warn of the dangers of eating fatty food. This case was thrown out and under pressure from the food lobby to prevent *"frivolous litigation"*, the US government passed the 'Cheeseburger Bill' limiting the cases which may be brought to those of *"false advertising, injuries from food consumption and illegal behaviour"* (DKW Research 2004).

Subsequent surveys found that a significant minority (24%) of potential jurors in the US would award damages to an obese plaintiff who sued a fast-food chain. While this is well short of the number needed to change the law, it does indicate a large degree of support, and it may take only a relatively minor trigger, such as dramatic deaths of youngsters from over-consumption, to take the numbers over 50%. Food industry analysts believe that media attention and developments in scientific research are *"softening the landscape for future litigation"* (UBS 2005, JP Morgan 2003, DKW Research 2004). As an indication of growing popular awareness, over 9,000 mentions

of the phrase ‘obesity epidemic’ were recorded in US newspapers in 2004, over twice 2002 levels (UBS 2005).

While public health authorities have been urging Americans to eat less, the message may have been thwarted by food industry lobbying and advertising (Parloff 2003). Critics claim that snack companies and restaurants target people's weaknesses and “fail to intercede when customers choose to harm their health” (Siemering 2004). Analysts have identified a wide range of industries potentially at risk from obesity-related claims, including agriculture, food processing, beverages, food distribution and retail, restaurants, advertising, media (TV, magazines and newspapers), toy makers and even sporting and entertainment event organisers (DKW Research 2004). Each is involved in some way in marketing potentially harmful food products to obese people. Some analysts have concluded that a credible threat of litigation exists, and that in coming years, it will serve, at the very least, to encourage companies to launch initiatives to increase the healthiness of their products and promote more active lifestyles (UBS 2005). Potential liabilities from over-enthusiastic marketing are outlined below; which provide legal boundaries that courts may, in future, interpret more onerously.

<i>Liability</i>	<i>Description</i>	<i>(Source: DKW Research 2004)</i>
Product liability	Product was dangerous/ defective and caused a health hazard.	
Personal injury	Consumption caused obesity and subsequent diabetes, cancer or stroke.	
Negligence	Producer knew product was hazardous to health or addictive.	
Failure to warn	Producer failed to disclose that consumption of product is associated with various diseases.	
Breach of warranty/ misrepresentation	‘Healthy eating’ product not as healthy as purported.	
Negligent/ reckless marketing or distribution	Marketing product without stating full list of potential health risks; especially to children.	
Advertising liability	Advertising misled consumers, especially children.	

Legislating for change

"If the public becomes convinced that obesity is a problem that needs governmental regulation, or that companies are somehow to blame, the courts and politicians will likely follow" (UBS 2005).

In 2004, WHO reviewed international regulatory structures of food marketing to children. There are many examples of legislation against TV advertising, but only three places where outright bans on advertising to children are enforced by government. These are Quebec (since 1980), Sweden (since 1991) and Norway (since 1992), but there is no clear evidence of their efficacy. This may be due to the complicating influences of cross-border advertising and extensive use of non-TV

marketing, and the author concludes that, “*more objective research on the effects of marketing regulations on dietary patterns is warranted*” (Hawkes 2004).

The UK experience of seat-belt legislation is that well-timed legislation can be highly effective in changing behaviour; front seatbelt use rose from 40% to over 90% within a year (Wanless 2004). Recent high levels of media attention on obesity and nutrition in schools may have laid good foundations for legislating on diet and physical activity (UBS 2005). One scenario envisages an event such as the deaths of two obese teenage brothers could trigger a major shift in public sentiment and bring about legislation, including for example, arresting parents for neglect (Curry and Kelnar 2004).

As suggested earlier, Japan appears to have successfully decoupled weight gains from economic growth or urbanisation. While this may be due to any number of social factors, the nutritional standards they have had on school food since 1954 may also play a role. These set strict limits on calories from fat in meals, ban adverts and vending machines and restrict students from eating or buying food, drinks or chewing gum while at school or travelling between school and home (Dalmeny et al 2003). The contrast to the UK and USA’s more democratic approach to children’s nutrition is stark. Proof of the success of such policies could be a powerful incentive to future legislation.

Other areas of possible future legislation include Health Impact Assessment, currently only used in isolated cases, such as new airport runways (Joffe and Mindell 2002). At the inter-governmental level, WHO is limited to promoting non-binding international legal instruments by resolutions of its intergovernmental assembly, and Codex Alimentarius restricts itself to matters of food safety. The World Trade Organisation does have a role in ensuring trade is not harmful to public health role, but is not widely forecast to legislate in a manner that would be of significance to obesity (Chopra et al 2002).

Tax

The Food and Agriculture Organisation’s economist Josef Schmidhuber believes that increasing producer or farm prices through taxation would be ineffective in altering food preferences, due to the length and complexity of supply chains. He suggests direct taxes on fat people might prove more effective, and that this approach is already being used by health and car insurance companies that offer discounts for clients with normal body weights (Schmidhuber 2005).

There is evidence that halving prices of fruits and vegetables in vending machines and school cafeterias may lead to a doubling of sales. UK precedents for fiscal intervention exist, for example, the variable rates applied to alcohol, which might be extended to certain foods, as well as televisions, video equipment and cars (Nestle and Jacobson 2000, Rayner in House of Commons Health Committee expert examination 2003). The future political acceptability of taxing certain foods is uncertain, but it is possible, for example, the deaths of youngsters from over-eating or press interest along the lines of Jamie Oliver’s school food exposé, could pave the way for a range of measures to reduce consumption.

Summary of political drivers

US litigators have led the way in creating a credible threat of litigation influencing companies to produce healthier food and label and market their health claims more clearly. This threat may become more significant in the UK future. The government is currently committed to review in 2007 whether to legislate against advertising to children, and we are likely to see new regulations on school activity levels, food and product marketing. Similarly, it is possible that tax of either energy-dense foods or obese people may be imposed, just as we have started to see rationing of some health services and differential pricing in insurance. These approaches may be effective in altering people's behaviour when public support is good and healthier alternative behaviour is relatively easy to adopt (as, for example, in buckling a seatbelt). However, there are no proven, national-level examples of interventions that have reversed obesity trends either in the UK or overseas, so predicting future trends in political intervention is uncertain.

Emerging future trends in obesity

“When trends start to combine with others in unpredictable ways they become turbulent and even dangerous. So it has proved with the issue of obesity” (Curry and Kelnar 2004).

This section presents again the summaries of emerging trends among the underlying drivers of obesity, and tries to identify areas where combinations of these factors may be additive.

Social: Studies indicate that obesity is negatively correlated with education and socio-economic status, and that the obese face considerable discrimination. There may also be a correlation between mental illness and obesity. Obesity may continue to reinforce social inequality, as the least well-off are also the least well. Individuals, including young children, seem to be making diet and physical activity choices without positive parental or social pressure, which may be ingraining unhealthy behaviour for the future. Additionally, the commoditisation of sport into a ‘fan experience’ and a continued decline in physical activity and participation in team sport among young people may raise future rates of obesity.

Technological: The underlying trend in the UK over recent decades (indeed, centuries) has been for advances in technology to reduce the need for labour. This is at the core of increased inactivity of the population. New technologies may continue to make life generally ‘easier’, and it may also offer breakthroughs in specific areas. As we come to understand the science underpinning metabolism and behaviour, obesity may come to be treated as an ailment we fix through pharmaceutical or medical intervention, just as we might take vitamin supplements or undergo therapy to stop smoking today. Companies are already offering simple gene-testing and personalised healthcare; analysts predict significant advances in nutrigenomics. GM foods may become recognised for having added nutritional benefits, and become more widespread. Nanotechnology may allow us to change the way the body works at the molecular level, enabling us to better monitor and manage weight and its health consequences. Questions of equality and ethics and cost are likely to arise.

Economic: NAO and WHO suggest that government investment in health promotion can be effective in reducing population obesity and associated rising morbidity,

mortality and treatment costs. Monopoly corporate control and vertical integration of food supply chains are expected to prevail, which will tend to keep profit, rather than health, at the core of food supply. In the longer term, ecological constraints may drive up prices of livestock-based and processed foods, and reduce demand; equally, they may drive further corporate concentration of food supply to deliver extra efficiency. Optimists believe that ecological and nutritional awareness may pre-empt a 'paradigm shift' away from volume and price towards wholesome, local foods. The current fast growth of functional foods may be an early indicator of this trend, as may the trend towards well-being and greater expenditure on higher quality food (higher cost per calorie, lower saturated fat and salt levels).

Environmental: WHO believes that urbanisation creates conditions which promote poor eating habits and inactivity. Over half the world's population now live in cities and in the UK, we are increasingly car- and desk-bound, and exposed to temptations to buy and consume energy-dense foods at all hours of the day. In the longer term, ecological limits on hydrocarbon fuels might increase levels of walking and cycling; however, alternative fuels may well become mainstream. Improved transport infrastructure and ICT may enable people to travel further and faster and reduce levels of active transport.

Political: US litigators have led the way in creating a credible threat of litigation influencing companies to produce healthier food and label and market their health claims more clearly. This threat may become more significant in the UK future. The government is currently committed to review in 2007 whether to legislate against advertising to children, and we are likely to see new regulations on school activity levels, food and product marketing. Similarly, it is possible that tax of either energy-dense foods or obese people may be imposed, just as we have started to see rationing of some health services and differential pricing in insurance. These approaches may be effective in altering people's behaviour when public support is good and healthier alternative behaviour is relatively easy to adopt (as, for example, in buckling a seatbelt). However, there are no proven, national-level examples of interventions that have reversed obesity trends either in the UK or overseas, so predicting future trends in political intervention is uncertain.

Some possible interactions

As these drivers overlap, outcomes will be uncertain, and we have no way of predicting how obesity trends will develop over time. Complex patterns may emerge, or may fail to emerge. Below, we touch on some issues that our research has suggested may be of particular interest or concern.

Stopping the nutrition transition: The cultural and economic aspects of the historic link between economic growth and populations getting fatter is a broad area of potential study. In the UK, BMI has increased steadily in recent decades, while in nearby European states (with similar growth in affluence) the rise has been much slower. Why?

Obesity and low socio-economic status: We have been struck by the stratification of obesity in society by socio-economic group. It seems to be the rich in poorer countries and the poor in developed countries that are worst afflicted. Standard awareness

raising interventions may serve to enhance the socio-economic divide in the UK, as it is thought to have done for smoking. A targeted political direction to ensure that poorer groups benefit from obesity interventions may be required. However, an indication of the complexity of this challenge is that in some middle-income countries, as many as one in two households with an obese member also have an underweight member. Does this suggest that solutions need to be tailored to the individual?

Technological advances: Developments in pharmaceuticals, genomics, nanotechnology and neuroscience may make use of drugs and manipulation of our bodies more commonplace. As our ability to manipulate molecular responses improves, demand for interventions to alter body shape may increase. This is likely to come at a cost, which may further exemplify the divide between socio-economic groups. One challenge is that this may serve to mask 'genuine' health (ie active, well nourished individuals). Another is that consumers' desire for a fast fix to their own obesity could fuel an increasingly litigious, pill-popping society, where opportunist corporations profit from growth of drug sales (Curry and Kelnar 2005).

Government's response: Social trends indicate there may be continued polarisation of the population, into the junk-food eating, less-educated poor and functional food eating, better-informed higher classes. The negative correlation between education and obesity may suggest that improving education for the poorest groups is an intervention could help reduce obesity. Government may need to adopt new approaches to informing consumers and encouraging people to manage sometimes conflicting initiatives and information. It seems clear that obesity won't be resolved through healthcare interventions alone; this raises questions of 'joined-up government'. While some will dislike nanny-state intrusions, WHO has suggested independent national institutions be created specifically to promote nutrition and coordinate health messages, policy development, legislation and taxation.

Emerging queries

While attempting to be comprehensive, this review of futures has inevitably encountered many areas of uncertainty, and we present some questions below. Understanding and collating the drivers of obesity, let alone foreseeing emerging trends, is a challenging task.

System complexity: How can we influence causal sequences, where multiple causes act simultaneously (independently or interactively), with potential for "*unintended consequences from well-intended interventions*" (US Food and Nutrition Board 2005)? Can we ever understand these sequences? If we believe that effective solutions emerge, rather than being prescribed centrally, what is government's enabling role?

What works? To maintain healthy and change unhealthy behaviour, we may need to understand what has been effective in a number of different environments. Individuals and groups have differing cost/ benefit analysis, assessment of risk, etc. Might there be challenges of 'emergent behaviour' from too many interventions? How have Scandinavia, the Netherlands, etc been so successful in keeping obesity down relative to the UK?

Reality? How can we connect obesity drivers and trends with the political process and policy levers that we have? How can we engage with, influence or coordinate the roles and reactions of major influencers in individuals' lives: media (eg. Jamie Oliver), business, parents, GPs, teachers or peers? Does the business case for investment in health promotion need to be made better, or in new ways, reaching new audiences?

Wild cards: In all our research, we rarely found consideration of wild cards, perhaps as obesity could be very low on the list of priorities in any 'emergency' situation, and possibly even of benefit for short-term survival. To ensure our system is robust, "*we need to expect the unexpected. We need to plan to be shocked*" (OST Foresight 2004). Many things could interrupt the food supply chain: climate change; a major food scare; widespread cereal disease; bird flu; an abattoir superbug; war; an asteroid hit; significant petrol shortages. Wildcard changes in 'fashions' might also include doctors/ science losing credibility, fat being the new slim (over 50% of the developed world is overweight; when will we come out of the closet about liking 'the fuller figure'?). How can consideration of wild cards be included?

Fat vaccine: While people may be hoping that medical interventions will 'get them out of jail', is there any real possibility that these will be effective and safe? Would they make people healthier, or just thinner, given the lack of diet and activity improvements?

Household complexity: Some countries (not the UK) have high level of simultaneous overweight and underweight within households; eg: Brazil (44%), China (23%) and Russia (57%) (Popkin 2001). Can we tailor messages to such a diversity of situations?

Managing downsizing: What happens when energy or finite resource shortages start to bite? How might food supply be affected as the world reaches ecological limits? Will capitalism be able to adapt to sustainable, resource-neutral growth? Will our governance systems (national and international) cope?

Recommendations for Foresight

One challenge seems to be for Foresight to take a truly long-term view. Very few analysts look beyond 2025 and most forecasts seem to be linear projections of current trends. Projections for obesity were surprisingly rare and relatively unscientific. The list above of emerging questions provides some possible areas for study. A challenge is to understand how the many drivers inter-relate. As we look to the longer-term, the importance of feedback loops and the impact of multiple, additive and dynamic interventions may be critical. Foresight might consider developing a complex model in a systemic way to understand and forecast outcomes of these drivers. It could also explore the potential impacts of previously unrecognised technologies and processes, policy interventions to address them, and the wider consequences of their interaction. There could be an added component of welfare economics measuring costs and benefits of possible interventions to help identify possible areas for action.

Our analysis attempted to look at social, technological, economic, environmental and political drivers, and the arbitrary delineation between these categories was evident to us as we did our research. Determining what is a driver, an influence, a trend or a sub-

factor a difficult process. Another approach sees 'cultural' drivers as predominant, with the economics, technology, etc... as merely the mechanical expression of underlying cultural decisions. This might suggest exploring how different societies' expectations about food, diet and physical activity are formed, shared and changed.

Most of the research we reviewed focused on identifying and defining problems. We found insufficient evidence of effective programmes that have reduced obesity, from which learning might be extrapolated and applied to other situations. Indeed, we were told that these do not exist. Finding (or if necessary creating) practical examples of successful national-level programmes or structures might be a fruitful area of further work.

The growing incidence of obesity may reflect changes in individual's choices and behaviour. It is unclear whether it is the environment that is abnormal and people's behaviour that is normal or vice versa, but most commentators believe the upward trend in weight is damaging human health. Further study into the circumstances that support healthy behaviour in different environments and at different life stages, or facilitate behaviour change across the social spectrum, might be useful. This could include analysis of individuals, families, communities, and the role of GPs/healthcare, government and media.

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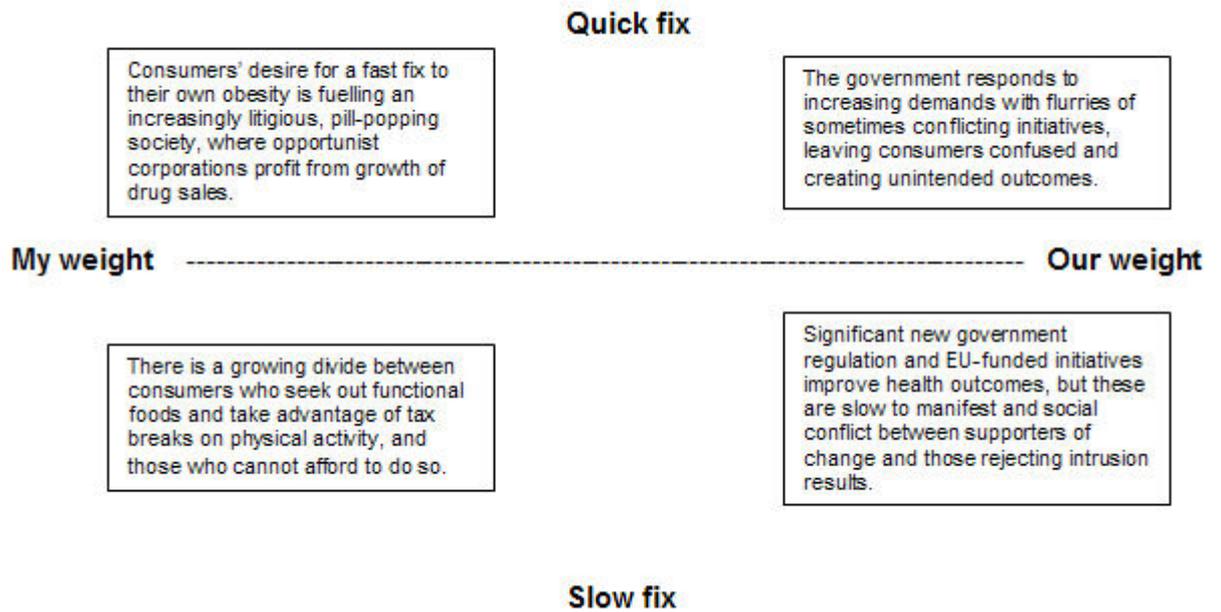
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Appendices

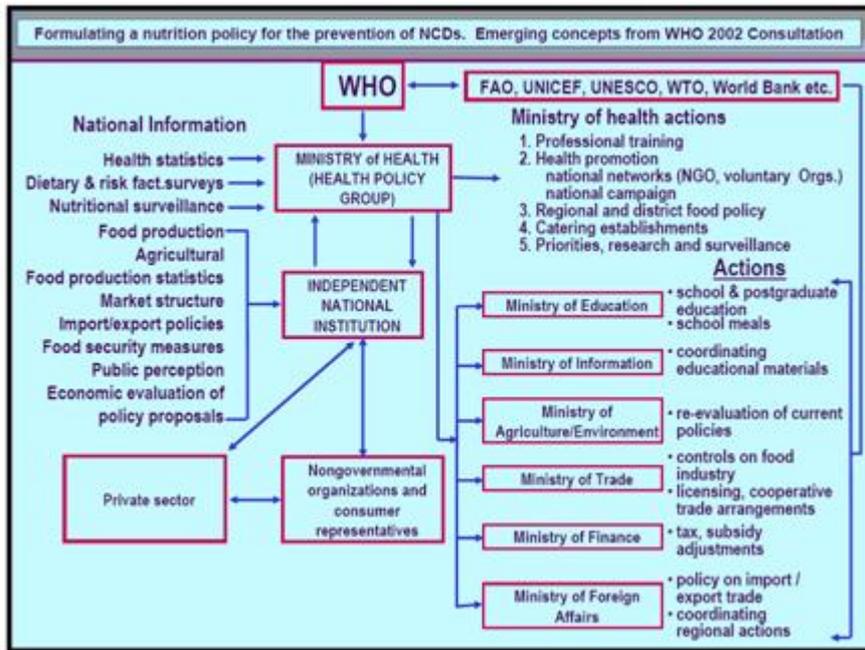
Appendix 1: Henley Centre scenarios

Source: Curry and Kelnar 2004



Appendix 2: Health-centred political structure

National or European institutions, working with existing public and private bodies, could help review policy, experience and evidence from interventions, and help generate policies which are more appropriate to the challenges of the 21st century. Table below taken from *Obesity: a growing issue for European policy?*, Lang and Rayner 2005.



[1] The usual proxy indicator for obesity is Body Mass Index (BMI), calculated as mass (kg) divided by square of height (m). BMI above 25 is considered overweight, over 30 obese and over 35 severely obese. However, at the individual level, age, race and muscle bulk will affect BMI but not health risk. NB: The nature of this method of measurement is that a steady increase in BMI may lead to rapid growth in numbers of obese or morbidly obese.

[2] Defined by Tim Lobstein as “an environment full of stimuli that encourages us to eat, to take less exercise, and to consume in fact not just food but a wide variety of products. This is very much a commercially run environment” (BBC 2004).