



Scanning for Emerging Science and Technology Issues
The SESTI project is funded under the European FP7 and researches the application of weak signals and emerging issues for improving the anticipatory intelligence of the European Commission and the EU Member States on future developments and issues



SESTI working paper

D5.1 Paper on emerging issues

Major trends, challenges and emerging issues in Health

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1. Introduction

Health and social services are set to become increasingly important commodities as European society grows older. But a growing demand for services that are provided in many Member States by the public sector is creating unprecedented pressures on health systems. Despite differences in political approaches and institutional frameworks health sector in Europe in all European Union (EU) face similar challenges, notably the need to adjust to demographic ageing and to changing employment and family patterns. At issue is the increasing level of resources devoured by health and social care systems year on year. Moreover, the prospect of social and demographic changes anticipated over the coming 20 years leaves many in despair as to how existing systems will cope.

Beginning with a brief overview of the European healthcare sector, this report goes on to examine some of the trends and issues that are driving developments and reforms in the health sector in Europe. The report takes a closer look at some of those issues and drivers of change that are likely to have significant implications for the future of health. Given the variety of drivers at play, it is rather difficult to be precise in imagining what these services may look like in 10-15 years time. Therefore, a set of scenarios will be presented compiled from respected sources. The report will then identify a set of emerging issues and related early weak signals in line with the objectives of the SESTI project. The report is rounded off with an account of some of the policy measures being implemented by the EU and Member States in addressing several of the issues addressed as important for the future of the sector.

2. EU Health policy context - Major trends, challenges and issues

2.1 EU Health Policy Context

The healthcare sector refers primarily to those services provided by hospitals, general practitioners and community clinics in the prevention, diagnosis, and treatment of illness. It is a major activity in the European countries which consumes significant fractions of GDP and accounts for the employment of millions of people. It is also a very complicated sector composed of not just of healthcare service providers, but also funders (both public and private) and consumers (patients). In addition, important economic sectors are associated with healthcare services, most notably pharmaceuticals and medical equipment suppliers.

There are marked differences between EU countries on the way that healthcare is funded and delivered. European Commission discerned two main models:

1. Countries that offer a national health service free at the point of delivery (the Nordic countries, the UK and Ireland), where expenditure is funded mainly through general taxation
2. Countries in which there is an insurance-based system, usually the other Member States, where contributions are levied specifically for access to healthcare and where people are reimbursed for the services they purchase (CEC, 2002, p.41)

Though these systems may be different, all are subject to similar pressures such as rising costs and ageing population. In virtually all countries, healthcare spending as a proportion of GDP is on an upward track.

In Europe, countries have faced increasing pressure on health service budgets over the years, not only because of an ageing population, but equally importantly because of growing level of real income and advances in know-how which have expanded the demand for treatment. While technology and automation have the potential to lower costs, those downward pressures are more than offset by the impact of an aging society, health consumerism and medical breakthroughs.

2.2 Major trends and drivers of change

Trends and drivers of change affecting the healthcare sector are diverse. The most significant ones are:

- Demographic and societal change
- Rising expectations and consumerism
- Health informatics and telemedicine
- New medical technologies, and
- Spiralling costs of healthcare provision

Demographic and societal change: We live in ageing societies. But this is not just a matter of an ageing population – it also concerns the ageing of the workforce and “elder ageing”, i.e. the rapid increase in the number of people aged 80 and over. This phenomenon is described as “triple ageing”. The implications of triple ageing for health and social services are profound. For example, it is estimated that healthcare costs for 65-75 year olds are 2.5 times greater than those for people under 65, while the costs for those over 75 are estimated to be 4.5 times greater (Coomans, 1999, p. 14).

The doomsayers predict fiscal catastrophe, with too few people in the workforce to cover the costs of pensions, healthcare, and long-term care for the elderly – known as the demographic dependency ratio. In this scenario, even intergenerational solidarity is under threat. Optimists, on the other hand, argue that technological advances will result in healthier elderly populations, the possibility of more home-based caring (a less expensive alternative to institutional care), and an overall increase in the productivity of the economy that will generate resources to fund increasing levels of health and social care.

An ageing society also has implications for recruitment to health and social services jobs. These sectors must compete with others for a shrinking pool of talent and young recruits. Many European countries are already experiencing acute shortages of doctors, nurses, and social workers. This situation has intensified the recruitment of migrant workers within the healthcare sector in Europe. Nevertheless, it is certain that Europe will witness an increase in the age-profile of the professional workforce in the health and social service sector over the next decades.

Rising expectations and consumerism: The term “consumer patient” reflects the notion that people are increasingly expecting to receive the health services they require at an affordable price. Linked to developments in information and communication technologies (ICT), patients are increasingly informed about healthcare services. This reduces their dependence on professional “gatekeepers”. The number and influence of vocal patient groups is likely to increase and the trend towards internationalising health interest groups is set to grow. For example, in 1998, the International Alliance of Patient Organizations (www.patientsorganizations.org/) was formed, bringing together 40 patient groups from across the world. Such developments mean that patients are now better informed about their conditions and are less deferential to healthcare professionals.

Health informatics and telemedicine: It is already apparent that ICTs are changing the face of healthcare. For example, the Internet already offers society the opportunity to become better informed on health issues. This could eventually result in major changes in the relationship between doctor and patient. But ICT systems are also set to revolutionise information sharing between health professionals, e.g. through the development of seamless electronic patient records. It is widely anticipated that clinicians will have access to ICT-mediated information and decision support at the point of care. In turn, changing patterns of information sharing and new patient/doctor relationships will bring some fundamental changes to health organisations and the working relationships of health personnel. They will also bring various security concerns onto the health agenda. The security of health information is likely to be provided by a range of procedures and technologies, such as smart cards or biological identifiers.

Another area where ICTs are anticipated to have a major impact is in the remote delivery of health and care services, i.e. telemedicine. This is expected to lead to improvements in the speed and cost of health and social care services as well as an expected increase in the quality of patient care. Other applications of ICTs include “telesurgery”, defined as remote surgery via telepresence and haptic (touch) feedback. In the near future, doctors will be able to perform and complete medical operations remotely from anywhere in the world with the help of high-speed data lines and advanced robotics.

New medical technologies: The desire to cut health costs, extend life and increase quality of life is often cited as a key driver for technology developments in health. In recent years and for the foreseeable future, genomics and the new biotechnologies have become important focus areas for health innovation, followed closely by nanotechnologies and robotics. Many believe that these new technologies could totally revolutionise healthcare, despite concerns about spiralling costs and ethical issues. Genomics is expected to open markets for diagnostic testing, preventive medicines, follow-up treatments and even support services such as lifestyle counselling. However, many of the more exciting developments in the area are not expected to be routine until after 2015. The earliest gains are likely to come from the use of genetic information to predict the effectiveness and side effects of drug therapies. Hence developments in pharmacogenetics may be the first to deliver real therapeutic benefit. Taking a more pessimistic view, it is possible that the costs for such treatments, required to allow pharmaceutical companies to recoup research and development costs, would adversely affect their use in some healthcare systems.

As well as genomics, there is a wide body of research in the biotechnology area that could lead to profound changes in healthcare. Some of the technologies being developed include biomaterials and tissue generation, biosensors and bioinformatics. Biomaterials and tissue generation are potentially very significant. It is anticipated that those with heart disease may have the option of cardiac vessel regenerative tissue implants, thereby replacing clogged arteries without bypass surgery or angioplasty. Effective preventive strategies could reduce demand but technological and other changes may result in the increased use of services. For example, the uncoupling of mortality and morbidity seen in coronary heart disease and stroke is likely to result in multiple episodes of intense usage of healthcare services (OST, 2001, p. 10).

Spiralling costs of healthcare provision: When the UK National Health Service was founded in the 1940s, politicians and the medical profession believed that it would become progressively cheaper to

run as the national population became healthier. In fact, the reverse occurred. The growth in demand, which is projected to accelerate over the coming 10-20 years, has focused attention in all countries on ways of limiting expenditure without reducing the quality of services or their accessibility. Some believe that the situation will call for radical solutions that could threaten the commitment of Member States to universal availability of a high level of health and social welfare. Indeed, many national healthcare funders are already trying to define the core elements that will be covered by tax or social insurance funding. If they are unwilling or unable to fund certain therapies, individuals will have to pay for these themselves. Clearly, not everyone will be able to meet these co-payment costs, so socio-economic inequalities could translate into health divides between the haves and have-nots.

3. Future Health Scenarios

Given the uncertainty surrounding the way the trends and drivers are likely to play out over the next 10-15 years a number of scenarios that attention to alternative plausible futures. Saritas and Keenan (2004) reviewed six existing scenarios¹ that explicitly address the healthcare sector. The healthcare scenarios they selected have their origins in four countries – Germany, Sweden, the UK, and the USA – as well as Europe more generally.

Looking at the scenarios, there is high level of agreement on the issues important for the future of health. These issues have a high level of certainty and are therefore considered to constitute a “baseline” situation common to all visions. These include:

- an ageing society and ageing workforce;
- increasing life expectancy;
- changing family forms and an increase in single-person households;
- new disease threats linked to, for example, an ageing society (more chronic and degenerative diseases), environmental change (skin cancers, tropical diseases, etc.), growing antibiotic resistance, and modern living (addictions, obesity, depression, etc.);
- growing health awareness and consumerism;
- growing ubiquity and power of ICTs;
- an increased understanding and medical
- exploitation of genomics and other
- biomolecular fields; and
- continuing (and increasing) politicisation of health and social care

In addition to the baseline situation factors, there are several indicators around which there are variable degrees of uncertainty. Saritas and Keenan (2004) identified nine such indicators:

1. Health status of the population: life expectancy; morbidity rates, especially among the elderly; health divides and health tiering.
2. Lifestyles and values: individualism vs collectivism; standing of expert knowledge; consumption; intergenerational harmony and/or ageism; lifestyle drugs.

¹ Health and Care in 2022 (WHO Europe), The Wanless Review of the UK NHS (HM Treasury), The Madingley Scenarios (UK NHS), Health and Healthcare 2010 (The Institute of Future), Futur (Federal Research Ministry – BMBF), and Teknisk Framsyn Health Panel Report (Vinnova).

3. Health and social care funding regimes: dependency ratios; public vs private/market provision; cost containment measures; co-payments and self-rationing; incentives (e.g. reduced insurance payments) to encourage self-care.
4. Prevention and self-care: health promotion and prevention initiatives; engagement with health and self-care; expansion of the concept of “health” to a broader “wellness” in body and mind; impacts on health divides.
5. Growing and changing demand on services: health-seeking behaviour; consumerism, e.g. direct-to-customer advertising by the pharmaceutical industry; organisation and activities of patient groups; responsiveness of health and social care systems to new demands, e.g. ageing populations, and opportunities, e.g. new technologies; productivity and use of resources.
6. Widespread use of ICTs: clinical support; remote diagnostics and therapies; performance monitoring and evidence-based interventions; health and social care budgeting; widespread access to information; self and planned care programmes; security and privacy; costs and savings.
7. Genomics and biotechnology: genetic testing and pharmacogenetics; tissue engineering; biosensors; security and privacy; ethical concerns; costs and savings.
8. Primary and community care: integration of health and social care – whole systems approach; institutional reform and/or replacement; variety of health and social care providers; role of hospitals; specialists in primary and community care; home care v institutional care; internationalisation of healthcare provision.
9. Employment organisation and workforce skills: supply of health and social care personnel; professionalisation of traditional care-giving roles; labour conditions and relations; workforce skills mix; training and skills for new technologies; emergence of new roles and positions.

Using these indicators, three visions have been elaborated:

1. A best guesstimate
2. Problem-plagued
3. Visionary

Brief summaries of each vision are also given below.

Integrated vision 1 – a best guesstimate

In this vision, many of the targets set today are met by 2020. Life expectancy moderately increases, with some of this increase spent in good health. Individualism and consumption are stronger than today but society still holds together. Dependency ratios deteriorate as expected, but are manageable, and health costs increase only slightly more than GDP growth. Health divides widen slightly, with an increase in co-payments and the availability of some therapies only privately. Divides are exacerbated in part by an uneven adoption of self-care and preventative measures. The welfare system slowly adapts to new and emerging health and care demands, while patient groups are rather powerful at lobbying for resources. ICTs have a large impact on health and social care delivery and management. Genomics and other advances in biotechnology are also widely applied. There is improved integration of health and social services, with less time spent in hospital. The health and social care workforce has a good mix of skills and is comfortable with using new technologies.

Integrated vision 2 – problem-plagued

In this vision, today's reforms are essentially ineffective and health and social services are in a state of perpetual crisis. Increases in life expectancy are low and are spent in bad health, with the elderly viewed as a burden on society. Dependency ratios increase, meaning that significantly more is spent on health and social care as a proportion of GDP than is the case today. Despite this increase in funding, the welfare system is inefficient and wasteful, partly as a result of its fragmentation. It also fails to meet new health and care demands and is unable to make the most of opportunities offered by ICTs and genomics. This leads to conflict between health and social service funders, providers and users. Rampant individualism and consumption extend to health and social care, with unregulated use of lifestyle drugs and therapies for those who can afford them. Health promotion and prevention initiatives are largely ignored, with people expecting health funders to provide "technological fixes" to their healthcare problems. Health and social care professionals are in chronic short supply, while difficulties exist in developing the necessary skills of an ageing workforce.

Integrated vision 3 – visionary

In this vision, life expectancy increases by ten years, well beyond current projections. This increase can be attributed to people taking more responsibility for their own well-being, as well as the development of new radical technologies, such as tissue engineering and anti-ageing therapies. Poorer sections of society particularly benefit from health awareness campaigns, reducing slightly health divides. Dependency ratios remain stable as more women and the elderly take up employment, while "wellness" costs grow significantly but only slightly outstrip GDP growth. ICTs and genomics transform the welfare system, offering new products and services. While individual consumption is high, greater local activism on a range of issues breeds a stronger sense of community. This benefits primary and community care, with various agencies and groups better networked and responsive to local needs. Many more people than present use social services, given their central role in community care. The health and social care workforce has a good mix of skills and is comfortable with using new technologies.

4. New emerging issues and related early warning signals

The SESTI project searches in a systematic way for new emerging issues that may be influential on the future research and innovation agenda in relation to policy agenda. The search uses different approaches as internet scanning, surveys, wiki, twitter and text mining, which are described in the Methodological Report "*SESTI Deliverable 3.1: Scanning for early recognition of emerging issues; dealing with the unexpected*" and a first report on Methods and Approaches "*SESTI Deliverable 3.2 (1) Methods and approaches used in scanning the environment for weak signals and emerging issues*" in a greater detail. The search frame for the scanning of energy relevant new emerging issues is also given in the same report. The search delivered an enormous amount of small and larger potential new issues for health research and policy which were assessed on their potential impact and plausibility.

After synthesis of the most impact rich and plausible issues for health, the SESTI team has selected the following issues:

1. Deepening the gap between health services? Diversity in medicine
2. Happy aging? Mental health in ageing society
3. Obesity: The global epidemic marches on
4. Is prevention better than cure? Re-prioritising health research for an ageing society

5. Personalised medicine: Luxury good for few?

4.1 Deepening the gap between health services? Diversity in medicine

A wide range of new approaches beyond conventional medicine and beyond the public health system is dealing with health issues and offer health related services. There are three very different areas of transformation: Emerging technologies may lead to new approaches, alternative methods are gaining more attention and new health related service markets rare emerging.

Emerging technologies could change the landscape of medicine: On the one hand new technologies such as nanotechnology and advanced biotechnology promise to provide new ways of tackling health problems. As for example the development of biotechnology methodologies compliments chemistry for new drug development, the types of drugs being developed are changing. Nanotechnology is another example, were applications are expected to affect almost every route by which drugs are delivered into the human body, with improvements ranging from incremental to revolutionary.

Nanotechnology is also seen as a potential science and technology driver for regenerative medicine² to repair, replace or regenerate lost or damaged tissues and organs in vivo through techniques that stimulate them into healing themselves. Synthetic biology³ is expected to take genetic engineering one large step further and may lead for example to the construction of bacteria that would mass-produce drugs that currently have to be painstakingly harvested from rare plants.

Diminishing trust in conventional/academic medicine, the debate on cultural diversity in medicine and the rising use of complementary and alternative medicine constitute new fields of medical knowledge and may lead to new requirements in regard to regulation. A growing number of people in Europe (more than 100 million) are turning to complementary and alternative medicine (CAM) for disorders they feel cannot be treated with conventional therapy. CAM encompasses therapies including herbalism, meditation, acupuncture, yoga, hypnosis, biofeedback, and Traditional Chinese Medicine (TCM).⁴ Complementary and alternative medicine is together with other practices of informal providers and with the growing market for health related lifestyle products part of a broader picture. These three developments together lead to the question how to compare the impacts and results of the different approaches, to address the health system as a whole and how to monitor the different parts of the system to compare benefits and risks.

4.2 Happy aging? Mental health in ageing society

Europeans are living longer than ever before in history. With age comes an increased risk for chronic mental health disorders. One in four older adults lives with depression, anxiety disorders, or other significant mental health disorders. More than 10 percent are expected to be diagnosed with Alzheimer disease. The prevalence of mental health disorders among the elderly is often

² <http://www.observatorynano.eu/project/catalogue/2HM.FU/> (SESTIweak signal ID R5)

³ <http://www.physorg.com/news197887610.html> (SESTI weak Signal ID T97)

⁴ <http://www.technologyreview.com/biomedicine/25237/?a=f> (SESTI Weak Signal ID T 38)

⁴ http://ec.europa.eu/research/infocentre/article_en.cfm?id=/research/headlines/news/article_10_01_08_en.html&item=Infocentre&artid=14453

unrecognized. In many EU Member States suicide rates of older people are higher than in any other age group.

Different groups are becoming more aware of the aging of the population and the difficulties that are expected in regard to the lack of services and limited access to mental health services in the future. Furthermore, the psychosocial consequences of an aging society and the related problems are widely unknown.

Amongst them are ageism, suicide, and euthanasia. There are some weak signals for innovative micro-level initiatives to tackle the problem by social innovations such as "communities of care" where elderly people live together in "care-communities" and live in multi-generation houses to be taken care of and to look after each other.

In a global perspective older people experience isolation, poverty, violence and abuse and have limited access to health services, education and legal protection. These factors have a negative impact on mental health. Creative engagement, positive social interactions and the strengthening of social networks give persons a sense of control and seem to be associated with brain health. The combination of a lower share of people in working age and a higher share of retired people with (mental) health problems will intensify the problems of the welfare systems. On the other hand there are studies arguing that the happiness-success link exists not only because success makes people happy, but also because positive affect engenders success including successful economic and social activities (Lyubomirsky, King et al. 2005). Improving the mental health and wellbeing of the elderly could therefore lead to a sustainable aging society.

4.3 Obesity: The global epidemic marches on

Currently more than 1 billion adults are overweight - and at least 300 million of them are clinically obese. Obesity has reached epidemic proportions globally and is a major contributor to the global burden of chronic disease and disability.⁵ In the European Region, obesity affects 20-30% of adults, and obesity rates are escalating in children.⁶ The rise in obesity rates is a result of changes in the environment that have simultaneously lowered the cost of food production, lowered the time and monetary cost of food consumption responding to consumers' demand for labor-saving technology and convenient, affordable food. To combat obesity need to recognize and address these realities.⁷ Despite the variety of existing research and measures there is a need for transdisciplinary approaches to tackle obesity.

4.4 Is prevention better than cure? Re-prioritising health research for an ageing society

An aging society faces a number of major challenges and pressures, including the ageing population itself, rising costs of care and in parallel, rising citizen/consumer expectations and demands. In the future, rising resource burdens may force a re-think of health research. For medical research the

⁵ <http://www.who.int/dietphysicalactivity/publications/facts/obesity/en/>

⁶ <http://www.euro.who.int/en/what-we-do/data-and-evidence/environment-and-health-information-system-enhis/health-effects-of-the-environment/overweight-and-obesity>

⁷ Finkelstein, Eric A and Kiersten L Strombotne (2010). "The economics of obesity." *Am J Clin Nutr* 91(5): 1520S-1524.

experimental laboratory continues to be the main paradigm, in part due to a new economic dynamic from emerging technologies such as nanobiotechnology, genetic and molecular research. Most research funding goes to conventional medical research, not to prevention and health services. Social interventions at policy level have a high impact on health and may become of great interest to public health policy. Nevertheless the outcome can't be measured in the way the outcome of clinical trials or health-behaviour interventions on individuals can be measured.⁸

For example there are findings suggesting that societies with large income differences and low levels of trust may lack the capacity to create the kind of social supports and connections that promote health and successful aging.⁹

4.5 Personalised medicine: Luxury good for few?

Personalized medicine is a health care approach to tailor interventions to individual variation in risk and treatment response. Although medicine has long made efforts to achieve this goal, advances in genomics promise to facilitate this process. Today the use of genomic information is relevant to classify individuals according to disease susceptibility or expected responsiveness to a pharmacologic treatment and to provide targeted interventions.¹⁰ The challenges and opportunities posed in translating advances in molecular medicine into clinical practice are recently emerging. The recent developments raise questions in regard to regulatory policy, technology assessment, and especially the financing and organization of medical innovation. Personalized medicine is seen as a strategic scientific area in Systems Medicine for European collaboration.¹¹

Further details on the issues described above are given in the appendix of this report. This include the potential impacts of issues, their research (or factual) basis, their controversies, their conflicts or coherence of interests and their emotional or ethical aspects which together make the issues candidate as potential emerging issue with "great" impact.

During the workshop on 30 November 2010 we will discuss the issue descriptions to improve the descriptions and to assess the different aspects in a more inter subjective setting with electronic voting.

Following the presentation of the new emerging issues and related early weak signals, we will discuss their implications for health policy and research and the ways the issues can be monitored further and brought forward to the policy arena.

5. Associated implications for Health policy and research

According to a recent WHO report on funding options for European healthcare:

European national policy-makers broadly agree on the core objectives that their health care systems should pursue. The list is strikingly straightforward: universal access for all citizens, effective care for better health outcomes, efficient use of resources, high-quality services and responsiveness to

⁸ Aileen Clarke, Mark McCarthy, et al. (2007). "New directions in European public health research: report of a workshop." *J Epidemiol Community Health* 61: 94-197.

⁹ Elgar, Frank J. (2010). "Income Inequality, Trust, and Population Health in 33 Countries." *Am J Public Health* 100(11): 2311-2315.

¹⁰ Conti, Rena, David L. Veenstra, et al. (2010). "Personalized Medicine and Genomics: Challenges and Opportunities in Assessing Effectiveness, Cost-Effectiveness, and Future Research Priorities." *Medical Decision Making* 30(3): 328-340.

¹¹ ftp://ftp.cordis.europa.eu/pub/fp7/health/docs/final-report-systems-medicine-workshop_en.pdf

patient concerns. It is a formula that resonates across the political spectrum and which, in various, sometimes inventive configurations, has played a role in most recent European national election campaigns (Mossialos *et al.*, 2002).

Health and social service provision are mostly the concern of national (and in some cases, regional) governments, with little responsibility traditionally residing at the European level. This is changing, however, as recognised by Article 152 of the Amsterdam Treaty, which states that “A high level of human health protection shall be ensured in the definition and implementation of all Community policies and activities”. This means that proposals in other key areas of community activity (internal market, social affairs, research and development, agriculture, trade and development policy, environment, etc.) should actively promote health protection. The Commission’s communication of 1999 (European Commission, 1999) had already called on Member States to:

- Contribute to improve the efficiency and effectiveness of health systems so that they achieve their objectives within available resources. To this end, ensure that medical knowledge and technology are used in the most effective way possible and strengthen cooperation between Member States on evaluation of policies and techniques.
- Ensure access for all to high quality health services and reduce health inequalities.
- Strengthen support for long-term care of frail elderly people by, inter alia, providing appropriate care facilities and reviewing social protection cover of care and carers.
- Focus on illness prevention and health protection as the best way to tackle health problems, reduce costs and promote healthier lifestyles.

Accordingly, reform programmes have been introduced by Member States, aimed at increasing the efficiency of resource use and the cost effectiveness of the care provided. These include:

- Improving the information available on the cost of treatment of different ailments to ensure that the cost factor is included in determining and rationalising healthcare services. One example is a new database recently established by the Ministry of Social Affairs in Belgium: this database contains medical and financial information on the use of services of various kinds across the country (the consumption and cost of drugs, the number and duration of hospital stays, etc.). This will enable comparative data to be grouped by 600 different types of pathology, encouraging hospitals and practitioners to examine their own costs in relation to others and to look for ways of reducing them (CEC, 2002, p. 42). Similar initiatives have been implemented in most Member States.
- Introducing market mechanisms as a means of increasing efficiency. Such measures include the clearer demarcation between supply and demand and the contractualisation of services.
- Taking direct action to reduce expenditure on pharmaceuticals, both by encouraging the use of generic drugs and by restricting or prohibiting the use of expensive branded pharmaceuticals (CEC, 2002, p. 43).
- Devolving responsibility to the regional and local levels and, in some cases, to individual hospitals or general practitioners. This shift to primary care focus is underpinned by a belief that health and social services need to be more responsive to local needs and that better coordination can be achieved between needs and resources at this micro-level.
- Increasing the development of home-based services to support older people in their own homes rather than through – often more expensive – institutional care
- Tackling health divides and health tiering through targeted measures that address health determinants, such as diet, smoking, stress, and poverty. For example, in the UK, the

government has established scores of Health Action Zones in the most deprived areas of the country in order to tackle the determinants of poor health.

- Developing an adequate supply of appropriate categories of personnel with the requisite skills. The development of these skills increasingly involves changes in the way in which training is delivered, in curricula, in educational funding, and governance of health professions, with implications that go beyond the healthcare system to affect higher education and research.

6. Discussion themes and areas of reflection

This report has sought to draw together information on key trends, drivers, emerging issues and related early signals affecting the health sector. In this section we aim to provide a set of discussion theme and some areas of reflection.

Annex 1

Deepening the gap between health services? Diversity in medicine

Domain of relevance: Health

Subdomain of relevance: Public Health system, private health markets

Keywords: Emerging Technologies, Nanotechnology, Synthetic biology, complementary and alternative medicine, health related markets

Impacts /Implications

The interrelated developments of high-tech medicine coming from emerging technologies, alternative methods and new health related markets have the potential for prevention and earlier and more efficacious treatment of diseases.

Growing demand for alternative therapies may have an impact on the public health services. People may not seek conventional treatments until their condition is severe, if at all, resulting in poor outcomes for individuals and additional cost to the taxpayer. Or the growing demand could support a healthy lifestyle that could lower the public health costs in the longer run.

Evidence base / storyline

The public and private health sector becomes more diverse with a variety of new actors and stakeholders involved.

Plausibility

Is the issue plausible? For whom?

Novelty

There is a mix of new developments (in high-tech medicine) and established trends such as the growing interest in alternative and preventive medicine and the rise of private health care markets (including wellness, reproductive medicine, health tourism).

Critical/open questions...

How to increase innovation and to further understand the complexity of health related issues? How to regulate the intersections and blurring borders between sectors of nutrition, prevention, medicine and the use of drugs for optimization/enhancement?

How to get technological possibilities, public health systems and citizen/consumer interests in-line?

Drivers & Inhibitors

Drivers: Advances in emerging technologies and medical science and corresponding increase in treatment costs. Increasing use of CAM. The promotion of health as a product in a growing private market of health good.

Inhibitors:

Separation of the different fields and actors.

Desirability aspects

Interests at stake

Different and controversial interests of the stakeholder in the health system including conventional medical research, Complementary and alternative medicine, pharmaceutical industry (new markets in functional food, use of drugs for 'enhancement' purposes).
Different approaches in regard to the future public health system development.

Emotional aspects

-

Changeability aspects: Policies

Policy measures relating to the health system as a whole will be required to avoid a medical divide between those citizens who have access to a wide range of advanced medical advice and services and those who do not.

Source of inspiration / Initial discovery point

conversation, conference, website, book expert interviews, movie article etc
Additional discovery points and linkages to other emerging issues
Scanning data
Search string followed:

Signals /Early Indicators

Sigmatcan:

Customisation of Drugs Through Biotechnology:

<http://www.sigmascan.org/Live/Issue/ViewIssue.aspx?IssueId=474&SearchMode=1>

Better Drug Delivery Through Nanotechnology

<http://www.sigmascan.org/Live/Issue/ViewIssue.aspx?IssueId=528&SearchMode=1>

Synthetic Biology - beyond evolution

<http://www.sigmascan.org/Live/Issue/ViewIssue.aspx?IssueId=284&SearchMode=1>

Happy aging? Mental health in the aging society

Domain of relevance: Health

Subdomain of relevance:

Keywords: Mental Health, aging society, dementia

Impacts /Implications 1

Ageing is likely to impact mental health in several ways. The rise of chronic mental health disorders is associated with rising costs while the aging society in general could lead to reduced savings, negative impacts on investment and will worsen the current account balance and lower the tax take.

Evidence base / storyline

The aging of the society is well known trend whose implications are also widely known but not addressed in all its dimensions. Despite better health and increases in wealth in the last five decades, there is evidence that many older people are increasingly dissatisfied, lonelier and more depressed, many living with low levels of life satisfaction and wellbeing.¹²

Plausibility

Is the issue plausible? For whom?

Novelty

Despite of the well known trends the issue of mental health in the aging society is not addressed in its different and interrelated dimensions.

Critical/open questions...

Could the improvement of the mental health of the elderly effect the aging society as a whole by including elderly people in a wide range of social and economic activities?

Drivers & Inhibitors

Drivers in regard to mental health problems in the aging society:

Lengthening life spans;

Inhibitors in regard to mental health problems in the aging society:

Greater morbidity (including from epidemics);

Inward migration of young workers;

A new baby boom.

Desirability aspects

Addressing the issue of mental health in an aging society is beneficial for the whole society in the future, where the share of older people is rising.

Interests at stake

Emotional aspects

Changeability aspects: Policies

Improving mental health could be an effective way of addressing the problems of the aging society in general: If social inclusion and participation is key for mental health of the elderly, new models of social inclusion and economic activity can serve as a starting point for policies addressing mental health in the aging society. Later retirement and increasing participation in the economy and society throughout the life course may prevent mental health problems of people in the aging society.

¹² Ageing: Future planning

Report "Horizon scanning for those aged 65+",

http://www.liv.ac.uk/PublicHealth/obs/publications/report/Horizon_Scanning_latest.pdf

Mental health is addressed in many European Initiatives¹³ without necessary focusing on the aging society.

Only by an early investment – starting now – in research and cost-effective approaches to care can future societal costs of dementia (especially Alzheimer disease) be anticipated and managed. Policy-maker together with health and social care systems need to be adequately prepared for the future by exploring ways today to improve the lives of elderly people with chronic mental disease and their caregivers in the future.

Source of inspiration / Initial discovery point

conversation, conference, website, book expert interviews, movie article etc

Additional discovery points and linkages to other emerging issues

Scanning data

Search string followed:

Signals /Early Indicators

Obesity: The global epidemic marches on

Domain of relevance: Health

Subdomain of relevance:

Keywords: Obesity, overweight, policy, economic, public health, intervention

Impacts /Implications 1

A future growth in the already substantial proportion of those classified as obese could have a wide range of social, economic and health impacts. Obesity-related problems are already placing a heavy burden on public health system and this is expected to increase substantially.

Evidence base / storyline

What is the evidence base for the emerging issue and is the story line plausible – from the point of view of related scientific communities? Are there controversies within scientific communities? Are there new developments in regard to scientific discoveries mentioned? What sources are they coming from?

Plausibility

Is the issue plausible? For whom?

¹³ <http://www.mhe-sme.org/>

COM(2005) 484 final, Green Paper. Improving the mental health of the population. Towards a strategy on mental health for the European Union, http://eur-lex.europa.eu/LexUriServ/site/en/com/2005/com2005_0484en01.pdf

Novelty

The issue is not new, but emerging.

Critical/open questions...

The following questions might be of further interest:

Drivers & Inhibitors

Drivers: Reduction in physical activity; rise of options for alcohol and fast food consumption: Psychologically and physically addictive qualities of refined, sugary, fatty foods; Increasing affluence coupled with declining food costs as a percentage of gross earnings; Poor parenting strategies

Inhibitors: Government healthy eating campaigns;; Reduction in cost of nutritious, unprocessed food; Public awareness of the causes of obesity; particularly among parents, an understanding of what constitutes a 'balanced diet'; Fashion, consumer culture and media-driven messages extolling weight loss and ideal-type imagery; Regulation of food advertising and labelling; Cost-competitive healthier alternatives to fatty foods, marketed as reasonable and satisfying options as opposed to the 'alternatives' that they are.

Desirability aspects

Which long and short term interests are at stake who will lose, who will win, which tensions or win/win situations may evolve?

Interests at stake

Emotional aspects

Which emotional aspects may be involved, Will the issue evoke emotional response or is it driven by emotions? The emotional aspects are linked to the justified and unjustified fears and opportunities that the issues brings.

Changeability aspects: Policies

Transdisciplinary approaches require long-term strategies that span several generations and normal planning cycles because it will take considerable time to establish new habits and build new structures to support healthy diets and to enhance physical activity in individuals and across populations. Also applying taxes/subsidies could be useful to combat obesity, even though a the recent study suggests that many stakeholders in Europe still need to be convinced of the viability and acceptability of taxes/subsidies when compared with other measures.¹⁴

One strategy for tackling obesity and related diseases in adults now and for the future is the implementation of integrated interventions focusing most particularly at today's younger generations.¹⁵

¹⁴ In the project structured interviews were conducted (with 189 interviewees drawn from 21 different stakeholder categories across nine members of the EU) to value 20 predefined policy options aimed at reducing obesity. They included 'taxing obesity-promoting foods' and 'subsidising healthy foods.' González-Zapata, Laura Inés, Carlos Alvarez-Dardet, et al. (2010). "The potential role of taxes and subsidies on food in the prevention of obesity in Europe." *Journal of Epidemiology and Community Health* 64(8): 696-704.

¹⁵ Kopelman, P. (2010). "Foresight Report: the obesity challenge ahead." *Proceedings of the Nutrition Society* 69(1): 80-85.

The evidence for specific actions to tackle obesity is neither complete nor perfect and the debate is controversial by the reason of different interpretations of the scientific literature. The consequence is a failure to act – or to act consistently over time. Different foresights have shown the need to take a very broad perspective and to take social and cultural norms and practices into consideration. The complexity of determinants of obesity calls for action on different areas of public policy and emphasises the need for an integrated approach.

Source of inspiration / Initial discovery point

Recent foresight activities

[Presentation on the UK Foresight report 'Tackling Obesities: Future Choices'](#)

Signals /Early Indicators

Are there references to what could be considered as early warning signals for the emerging of the issue?

Which are already visible for a broader audience?

Which are not yet take into consideration but should be monitored?

Is prevention better than cure? Re-prioritising health research for an aging society

Domain of relevance: Energy/health

Subdomain of relevance: Health Research

Keywords: Public Health, aging society

Short description

An aging society faces a number of major challenges and pressures, including the ageing population itself, rising costs of care and in parallel, rising citizen/consumer expectations and demands. In the future, rising resource burdens may force a re-think of health research. For medical research the experimental laboratory continues to be the main paradigm, in part due to a new economic dynamic from emerging technologies such as nanobiotechnology, genetic and molecular research. Most research funding goes to conventional medical research, not to prevention and health services. Social interventions at policy level have a high impact on health and may become of great interest to public health policy. Nevertheless the outcome can't be measured in the way the outcome of clinical trials or health-behaviour interventions on individuals can be measured.¹⁶

For example there are findings suggesting that societies with large income differences and low levels of trust may lack the capacity to create the kind of social supports and connections that promote health and successful aging.¹⁷

Impacts /Implications

¹⁶ Aileen Clarke, Mark McCarthy, et al. (2007). "New directions in European public health research: report of a workshop." *J Epidemiol Community Health* 61: 94-197.

¹⁷ Elgar, Frank J. (2010). "Income Inequality, Trust, and Population Health in 33 Countries." *Am J Public Health* 100(11): 2311-2315.

New directions in public health research are needed to anticipate the main needs in regard to the aging society.

Evidence base / storyline

Plausibility

Is the issue plausible? For whom?

Novelty

For whom is the issue new emerging?

Critical/open questions...

The following questions might be of further interest:

Drivers & Inhibitors

What are the drivers and inhibitors?

Desirability aspects

Which long and short term interests are at stake who will lose, who will win, which tensions or win/win situations may evolve?

Interests at stake

Emotional aspects

High hopes in high-tech medicine

Changeability aspects: Policies

To re-prioritise health research for an aging society it is necessary to increase understanding of the strengths and weaknesses of current (public) health research by both researchers and policy makers and to strengthen links between the two. The health related innovation system and the funding of research in Europe could be organized to be able to support new research fields and issues in regard to the aging society, and to contribute to policy development and public health practice.

Source of inspiration / Initial discovery point

conversation, conference, website, book expert interviews, movie article etc

Additional discovery points and linkages to other emerging issues

Scanning data

Search string followed:

Signals /Early Indicators

Are there references to what could be considered as early warning signals for the emerging of the issue?

Which are already visible for a broader audience?

Which are not yet take into consideration but should be monitored?

Personalized medicine: luxury good for few?

Domain of relevance: Health

Subdomain of relevance:

Keywords:

Impacts /Implications

What are the impacts and/or of the issue?

Evidence base / storyline

What is the evidence base for the emerging issue and is the story line plausible – from the point of view of related scientific communities? Are there controversies within scientific communities? Are there new developments in regard to scientific discoveries mentioned? What sources are they coming from?

Plausibility

Is the issue plausible? For whom?

Novelty

For whom is the issue new emerging?

Critical/open questions...

The following questions might be of further interest:

Drivers & Inhibitors

What are the drivers and inhibitors?

Desirability aspects

Which long and short term interests are at stake who will lose, who will win, which tensions or win/win situations may evolve?

Interests at stake

Emotional aspects

Which emotional aspects may be involved, Will the issue evoke emotional response or is it driven by emotions? The emotional aspects are linked to the justified and unjustified fears and opportunities that the issues brings.

Changeability aspects: Policies

Which policy issues are connected to the issue? Which policies will be influenced or have to adapt to the issue? Are there new research areas lines that that need to be funded? Are there organizational changes needed to handle the issue? New legislation? Financial instruments? Is there need for further consultation or public debate?

Source of inspiration / Initial discovery point

conversation, conference, website, book expert interviews, movie article etc
Additional discovery points and linkages to other emerging issues
Scanning data
Search string followed:

Signals /Early Indicators

Are there references to what could be considered as early warning signals for the emerging of the issue?
Which are already visible for a broader audience?
Which are not yet take into consideration but should be monitored?
Turning personalized medicine into a common good

Annex 2

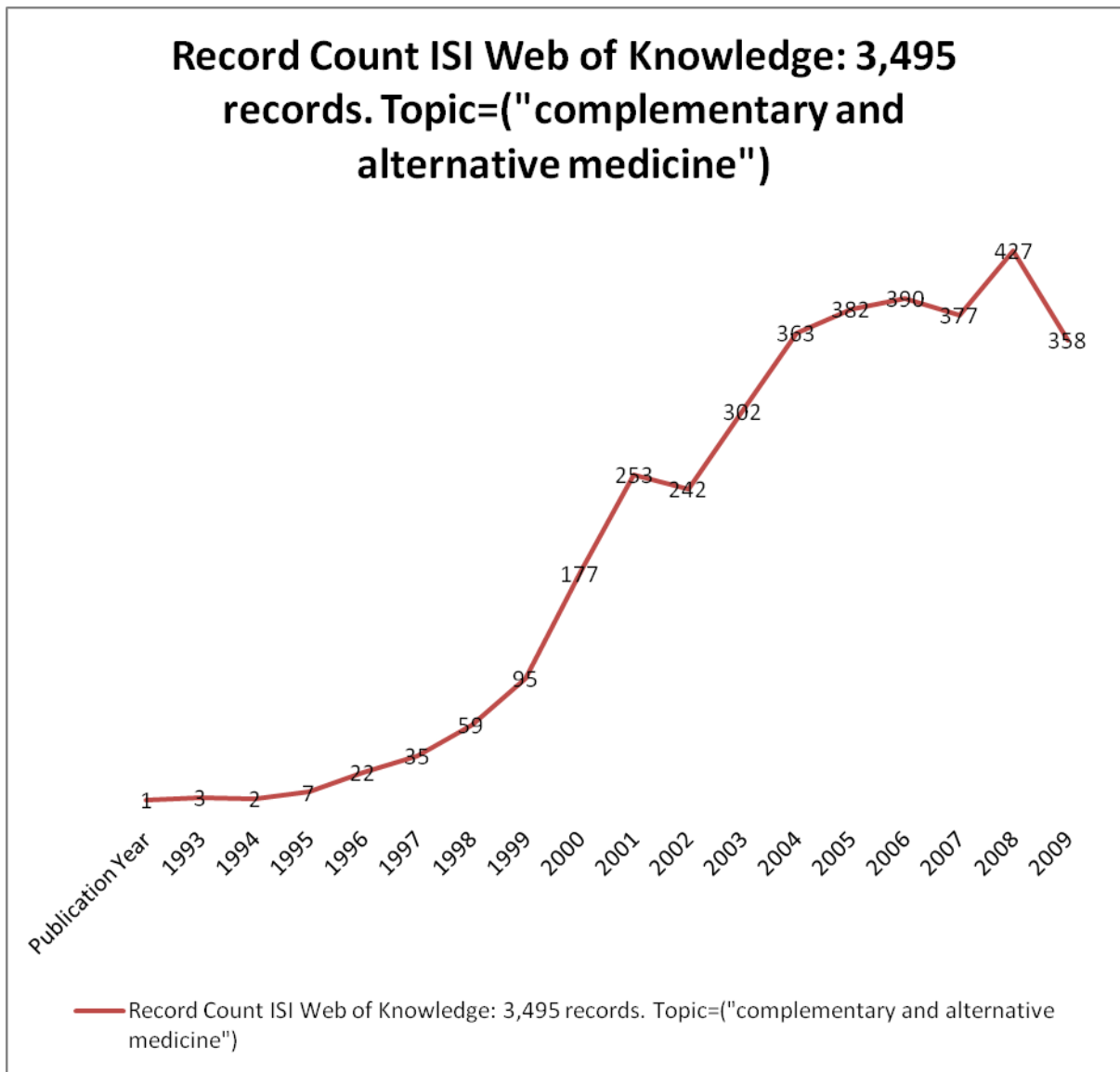
Material in regard to the emerging issues

Background material: Diversity of Medicine

Are the different dimensions of the issue are increasingly discussed in science?

Are the different dimensions of the issue an emerging issue in science?
The three dimensions of the issue are an emerging issue in science with rising attention in the last years.

Complementary and alternative medicine



Sigmascan: Better Drug Delivery Through Nanotechnology

528

Last updated: 15/01/2009 09:00:26

Science &
Technology >
Nanotechnologies
> Issue ID:

Criteria: ▶

Impact:



Likelihood:



Controversy:



Where: Global
When: 3-10 years
How Fast: Yearly

Keywords: ▶

Nanotechnology - medicine, drugs, drug delivery, health care

Abstract ▶



Summary ▶

Developments in nanotechnology are expected to affect almost every route by which drugs are delivered into the human body, with improvements ranging from incremental to revolutionary.

Nanoscale engineering promises to improve methods of drug administration. The size reduction that could be enabled by nanomanufacturing methods plus the potential of nanoparticles to cross the blood-brain barrier could bring about improvements in delivering injectable drugs, oral drugs, topical and transdermal drugs. Implants are often considered a particularly effective route for efficient drug delivery, and use of nanostructured materials in implants makes them more effective in the gradual release of drugs into the system, reducing the frequency of dosing and the risk of adverse reactions. Nanoshells are a more revolutionary development in implantables; it is possible that physicians could targeted infrared rays directed at a metal-coated nanosilicon ball to create heat that affects malignant tumors tagged by the nanoshells while passing harmlessly through regular tissue.

Implications

Reduced cost, enhanced solubility, improved bioavailability, and reduced toxicity of drugs

Early indicators

Johnson & Johnson's reformulation of an injectable schizophrenia drug to smaller than 200 nm under the Elan NanoCrystal brand

Current work by pSvidia of Perth, Australia, on developing a biosilicon implantable delivery system to treat inoperable liver cancer

What To Watch:

The size of nanoshell-drug combinations drops into the hundreds-of-nanometers range.

For those techniques that have only been tried in the lab, successful tests are done first on animals and then in human trials.

Leaders:

Institutions:

University of Melbourne, Australia (progress in reducing the size of nanoshell-drug combinations)

Altair Nanotechnologies (research on nanospheres)

University of Texas, Austin (work on developing polymer nanospheres for oral drug delivery)

University of Nottingham, Nottingham Nanotechnology Centre

University of Bradford, Drug Delivery Group

Imperial College, London

University of Limerick, Ireland

National Cancer Institute

Institute of Bioengineering and Nanotechnology, Singapore

National Institute of Advanced Industrial Science and Technology, Japan

The Nanotechnology Institute, Drug Delivery team

Drivers & Inhibitors ▶

Continuing basic research in creating nanoscale materials

Advances in medical and chemical research focused on compounds that affect conditions in the human body

Parallels & Precedents ▶

[\[1\]](#)[\[2\]](#)[\[3\]](#)[\[4\]](#)[\[5\]](#)[\[6\]](#)

Sources ▶

Ref.	Publisher	Date	Title	Category	Evidence	Stimulus
1	Other		Cindy H Dubin, Small Steps for Mankind: Controlled-Release Gets Smarter Thanks to Nanotechnology, Formulation Forum, no date	Tech	?	?
2	Other		H Onyuksel et al, Nanotechnology in Drug Delivery, NSTI, Nanotech 2005 conference	Tech	?	?
3	Other		Nano-Enabled Drug Delivery Market to Pass \$1.7 billion in 2009, Nanomarkets, March 2005	Tech	?	?
4	Other		Dubin, Cindy H. Special Delivery." <i>Mechanical Engineering Nanotechnology</i> September 2004."	Tech	?	?
5	Other		Nanoscience and nanotechnologies: opportunities and uncertainties," London: The Royal Society & The Royal Academy of Engineering, 2004."	Tech	?	?
6	Other		Nano Drug Delivery: The Impact of Nanotechnology in Drug Delivery: Global Developments, Market Analysis and Future Prospects." NanoMarkets, March 2005."	Tech	?	?

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Link
Imperial College, London
Institute of Bioengineering and Nanotechnology, Singapore
NAIST, Japan
Nanotechnology Institute
National Cancer Institute
Nottingham Nanotechnology Centre
University of Bradford
University of Limerick

Synthetic Biology - beyond evolution

Science & Technology > Body and mind sciences >

Issue ID: 284 Last updated: 13/02/2009 11:55:11
 Criteria: ▶ Impact: ★★★★★ Likelihood: ★★★ Controversy: ★★★ Where: Global When: 3-10yrs How Fast: Years



Keywords: genetic engineering, biotechnology, genetic manipulation, genes, personalised medicine, synthetic biology, biomimicry, biomimetics

Abstract ▶

Inexpensive tools to read and rewrite the genetic code could allow us to manipulate biology at the level of DNA. We may be able to re-engineer existing life and even create new life forms with a specific purpose in mind. Applications already being worked on include new biofuels and pharmaceuticals, manufactured with the help of synthetic microbes. But more radical visions aim to be able to, for example, 'grow a house.' [1] In the last 20 years, science has learned to directly manipulate genes outside the breeding process. Meanwhile, the DNA make-up of myriad organisms, from rice to worms to humans, has been sequenced.

Summary ▶

We are discovering the role genes may play in diseases from cancer to depression to cystic fibrosis. Some day we may be able to read our unique genetic code to see the implications for our future health. While this could lead to better therapies and personalised medicine, human genomics also raises strong ethical questions. Knowledge of the human genome is likely to run ahead of our ability to influence it, so scientists are likely to be confronted by the ethical dilemma of being able to identify a propensity towards certain illnesses while lacking effective gene therapies or other treatments.

Alongside a growing ability to read genomes, scientists' growing ability to manufacture them has attracted interest. "Synthetic biology" takes genetic engineering one large step further by aiming to specify every bit of DNA that goes into an organism to determine its form and function in a controlled, predictable way. Within a decade some researchers believe that bacteria, for example, could be designed that would mass-produce drugs that currently have to be painstakingly harvested from rare plants. [2] The fusion of nanotechnology and biology may also allow us to grow products such as solar collectors and liquid crystal displays from living material. Altering living species and creating special-purpose organisms raises new regulatory and ethical questions, especially if designed organisms become so advanced as to be considered conscious. It is also possible that such creatures might reproduce in an uncontrolled manner - generating visions of "Green Goo" just as nanotechnology envisaged "Grey Goo". [3] As with the science, most consideration of the ethical and social aspects of synthetic biology has taken place in the USA, [4] but UK organisations are starting to address such questions. [5] A 2008 meeting at the Royal Society brought together the rapidly growing UK synthetic biology community, concluding that the science had huge potential benefits, but that ethical and regulatory oversight was required. [6]

Implications ▶

Understanding how genes function and are expressed has begun to transform our approaches to medicine, agriculture, energy, and the environment. However controversy will continue over the safety of genetically modified food, the potential impact of GMOs on wildlife and the environment, and the business impact on farmers of patented genetically modified seeds. Synthetic biology, driven by genomics and computational biology, may now allow us to build organisms that never existed in nature. The combination of biology and nanoscience may mean hybrid systems that borrow from both worlds. Evolution has produced great features in nanoengineering. Some are universal, such as DNA's self-assembly, and others are very specific, such as the forest of sticky fibres on geckos' feet that enable them to walk up walls. Biomolecular nanotechnology takes inspiration from these natural designs and takes advantage of them as prefabricated components which can be borrowed to

construct useful systems at the nano scale. Advances in biochemistry and molecular genetics are producing the tools to isolate these biological components, copy their function, and deploy them in molecules and devices that combine the natural and the artificial. Viral motors could propel nanobots. Solar cells could generate energy using photosynthetic proteins from plants.

One approach to Synthetic Biology takes an open source engineering approach, using “biobricks,” genes, proteins, and cells that can be assembled like toys to build living systems. [7] The annual IGEM competition brings together teams of students from universities around the world who compete to build synthetic biological machines. [8] There could be microbial factories that produce anti-malaria and cancer-fighting drugs, or, bacteria control pollution. [9] The US Government's Energy Secretary, Spencer Abraham, spoke in 2003 of the possibility 'in the not-too-distant future, of a colony of specially designed microbes living within the emission-control systems of a coal-fired power plant, consuming its pollution and its carbon dioxide...and the possibility of employing microbes to radically reduce polluted waters or to reduce the toxic effects of radioactive waste'. [10], [11] Craig Venter, the human genome pioneer, has claimed that Synthetic Biology will provide such effective biofuels that the oil industry will cease to exist. Venter says he is "going from the gene king to the oil king." Venter's claims, if they are realised, will not only rewrite the rules of industry, but also of politics and international relations.

Scientists and engineers might also develop microbes, plants and animals that are adapted to living in areas that are currently inaccessible to life - planets such as Mars for example. In a more distant scenario such organisms could be used to develop these planets such that they become hospitable to human life - or perhaps they might provide radical solutions to the more extreme predictions of climate change. [12] If synthetic biology becomes sufficiently advanced its biggest applications might be in construction - biological systems are after all very adept at producing large-scale structures from small beginnings. Some commentators suggest that a seed could be programmed to grow into a house. [2]

If the tools of genetic engineering do drop in price and complexity, as is expected over the long-term, then biotechnology could become increasingly "domesticated". Examples in the extreme might include, do-it-yourself kits for gardeners who might use genetic engineering to breed new varieties of rose; or dog breeders creating new types of pet. [12] Could designing genomes become the newest art form? What limits should be put on such developments - and will limits be possible to enforce? Researchers have already demonstrated the possibilities of DNA synthesis by re-creating the polio virus from building blocks of DNA and a broth of chemical compounds. This generates fears of potentially lethal diseases being synthesised from their genetic sequences by people with malicious intentions. [13]

Synthetic biology has been characterised by interdisciplinarity. It has seen computer scientists and engineers turning their attention towards biological questions and biological tools. The field has the potential to create an exciting and genuinely new form of science, but this interdisciplinarity raises challenges. Engineers who are used to creating new things and testing them may have less understanding of the complexity of their creations than biologists, who traditionally start from a deep knowledge of the systems themselves. The use of computer science language of "hacking" suggests a playful attitude within the synthetic biology community that may well prove dangerous. If synthetic biology becomes so accessible that anyone can synthesise genes and simple organisms on their desktop, it will be almost impossible to police, introducing new possibilities for biological terrorism.

Early indicators ▶

- * Large sums of capital raised by biotechnology firms, with major investments in research and many important patents.
- * Gene therapy for single-gene diseases such as cystic fibrosis.
- * Development of bacteria to produce anti-malarial drugs cheaply and in bulk.
- * Many university spinoffs such as Biotica and Amyris working in this field. [\[14\]](#), [\[15\]](#)
- * Craig Venter (human genome pioneer) [\[16\]](#) has plans for an artificial genome.
- * Falling cost of DNA synthesis. In 2000 the costs of assembling sequences to order was \$10-12 per base pair, in 2005 it was down to approximately \$2. [\[2\]](#)
- * A tropical fish, engineered to fluoresce bright red under ultraviolet light, sold legally in the US. [\[17\]](#)

Drivers & Inhibitors ▶

Drivers:

- * Demand to limit or cure disease;
- * Desire to understand the link between genetics, environment and the organism;
- * New and improved foods;
- * Cleaner environment and reduced resource use;
- * Invention of table-top genome sequencers and synthesisers.

Inhibitors:

- * Arguments about 'interfering with nature'; [\[18\]](#)
- * Revulsion over use of experimental animals;
- * GM seen as example of science and capitalism combined at their most destructive;
- * Environmental unknowns and other uncertainties.

Parallels & Precedents ▶

- * Thousands of years of successful plant and animal breeding.
- * Velcro - invented by George de Mestral in imitation of burrs that stuck to his clothes and his dog..[\[14\]](#)[\[15\]](#)[\[18\]](#)[\[16\]](#)[\[17\]](#)[\[12\]](#)[\[2\]](#)[\[13\]](#)[\[3\]](#)[\[19\]](#)[\[10\]](#)[\[11\]](#)[\[9\]](#)[\[4\]](#)[\[5\]](#)[\[1\]](#)[\[7\]](#)[\[8\]](#)[\[6\]](#)

Sources ▶

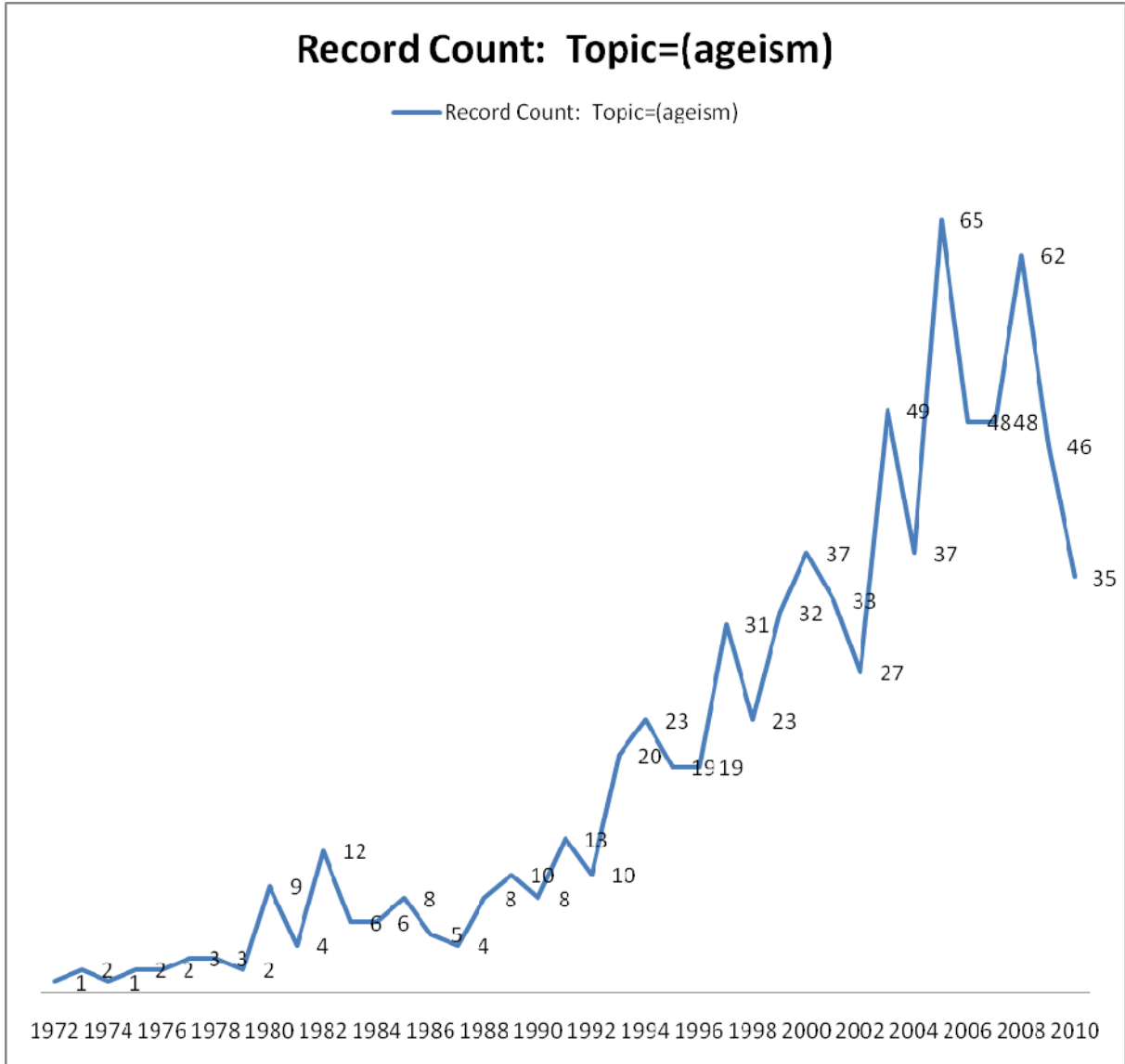
Ref.	Publisher	Date	Title	Category	Evidence	Stimulus
1	The New York Times		[16] Wade, Nicholas (2007) Genetic Engineers Who Don't Just Tinker", New York Times, 8th July" 	Tech	?	?
2	Wired Magazine		[7] Morton, Oliver (2005) 'Life, Reinvented' Wired Magazine, Issue 13.01" 	Tech	?	?
3	Other		[9] ETC Group 'Green Goo: Nanotechnology comes alive!' January/February 2003 Issue 77" 	Tech	?	?
4	Other		[14] Garfinkel, M.S., Endy, D., Epstein, G.L. and Friedman, R.M. (2007) Synthetic Genomics: options for governance", J Craig Venter Institute" 	Tech	?	?
5	Other		[15] Synthetic Biology, Social and Ethical Challenges, BBSRC" 	Tech	?	?
6	Other		[19] Synthetic Biology, scientific discussion	Tech	?	?

		meeting summary, Royal Society, June 2008			
7	Other	[17] The BioBricks Foundation (BBF) is a not-for-profit organisation founded by engineers and scientists from MIT, Harvard and UCSF	Tech	?	?
8	Other	[18] The International Genetically Engineered Machines Competition (2008)	Tech	?	?
9	Other	[13] Endy, D. (2005) Foundations for Engineering Biology Nature Reviews 438: 449-453; The Biobricks foundation, bbf.openwetware.org	Tech	?	?
10	Other	[11] MSNBC (2003) 'Progress in creating artificial virus' November 13th	Tech	?	?
11	Other	[12] Remarks by Secretary of Energy Spencer Abraham (2003) Genomics, Forrestal Auditorium, November 13	Tech	?	?
12	New Scientist	[6] Dyson, Freeman (2006) 'Make me a hipporoo,' The New Scientist, February 11th	Tech	?	?
13	Other	[8] Travis, John (2002) 'Do-it-yourself: virus recreated from synthetic DNA' Science News, July 13, 2002; Vol.162, No.2, p.22	Tech	?	?
14	Other	[4] Venter Institute	Tech	?	?
15	Other	[1] Amyris	Tech	?	?
16	Other	[3] Greenpeace International 'Say no to genetic engineering'	Tech	?	?
17	New Scientist	[5] Bhattacharya, Shaoni (2003) 'Glowing red GM fish to sell in US,' The New Scientist, November 24	Tech	?	?
18	Other	[2] Biotica	Tech	?	?
19	Other	[10] Zimmer, Carl (2003) 'Tinker, Tailor: Can Venter Stitch Together a Genome from Scratch'. Science, February 14	Tech	?	?

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Link
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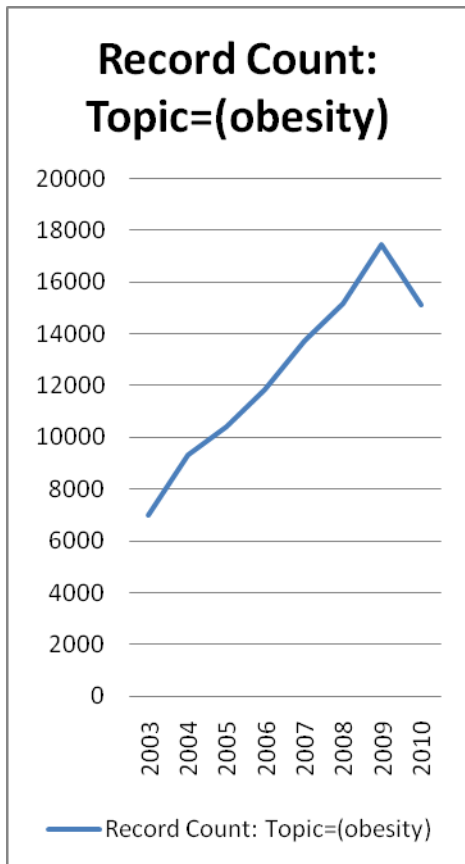
Is ageism an emerging issue scientific literature?



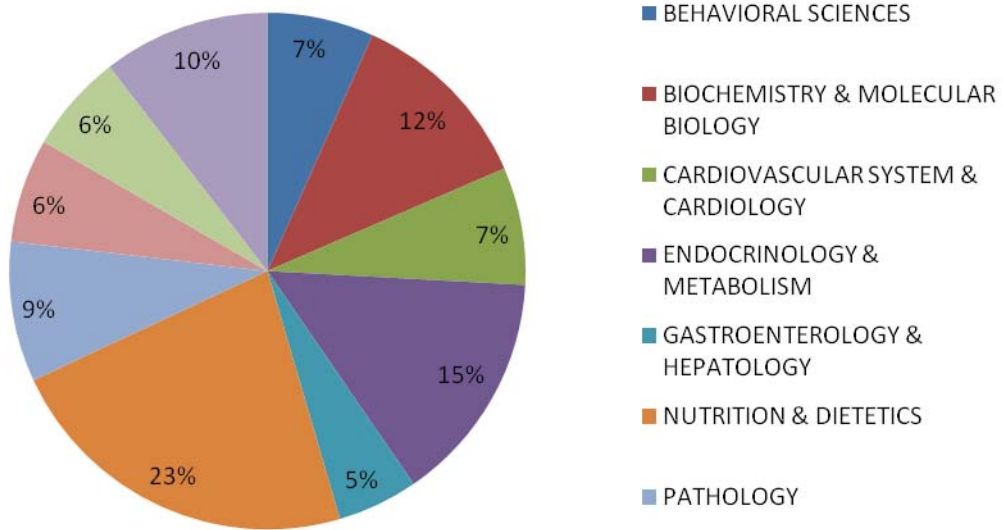
Background Material: Tackling obesity transdisciplinary

Is obesity an emerging issue scientific literature?

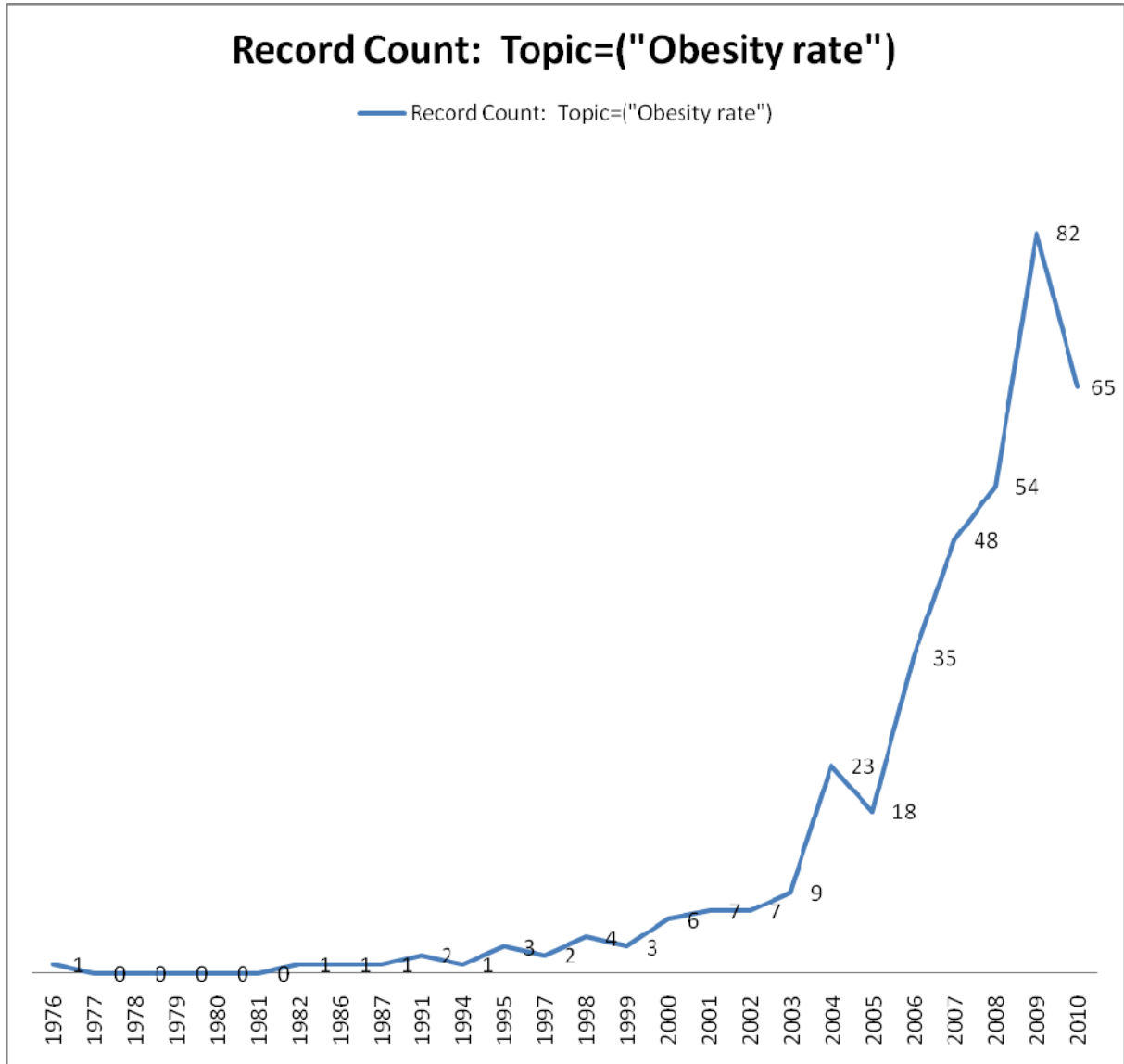
Obesity is an emerging issue in science.



Main Subject Areas of publications: Topic=(obesity)



Interest in obesity rates



ForSociety: Food for thought: Obesity on the rise

Society > 63 Last updated: 17/02/2009 15:53:05
Health
Care >

Issue ID:

Criteria: ▶ Impact: ★★☆☆ Likelihood: ★★★ Controversy: ★☆☆ Where: Regional When: 3 How Fast: Yearly
al -10yrs rs

Keywords: ▶ public services, health, government, community, food, consumption, design,

Abstract ▶

Obesity rates in the UK are steadily increasing, as more and more people live off a diet of fatty, sugary, fast foods and fizzy drinks and have a lethargic lifestyle involving little to no exercise. Rather than being restricted purely to affluent Western countries, evidence suggests that this is becoming a global problem. This presents a number of challenges to society, principally in terms of the capacity of public services to deal with the extra burden.

Summary ▶

British obesity rates amongst children have tripled in the last two decades, from 5% in 1990 among 6-15 year olds to 16% in 2001. 10% of six year olds and 17% of fifteen year olds are obese [1]. Given that overweight youngsters have a 50% chance of being overweight adults these statistics indicate that a significant challenge lies ahead. A lifelong pattern of obesity is a high predictor of premature death and The House of Commons Select Committee concluded in 2004 that “this will be the first generation where children die before their parents as a consequence of childhood obesity”.

According to the World Health Organisation, there are over one billion overweight and obese individuals in middle to high earning countries. As a result of poor diets and exercise regimes, 19% of British people were classed as clinically obese in 2002, with a further 39% overweight (based on BMI). [12]

A future growth in the already substantial proportion of those classified as obese could have a wide range of social, economic and health impacts.

A major literature review of the available data, drivers and future projections relating to obesity in the UK and beyond has been undertaken by the UK Office of Science and Innovation as part of their Foresight programme [2]

Implications ▶

Obesity-related problems are already placing a heavy burden on public services and this is projected to increase substantially.

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 being overweight (but not officially 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). [2]

It is thought that obesity will soon supersede tobacco as the most common cause of premature death. Obese people are far more likely to suffer from heart attacks, strokes, some cancers - particularly colon cancer - thyroid problems, diabetes, hypertension and coronary heart disease amongst others [3]. An increase in body weight can also exacerbate limb and joint problems, and affect sexual health, reducing fertility and thus increasing the burden on health services for IVF and other treatments – to combat this, a proposal which denies IVF treatment to women with a BMI of more than 36 is currently being considered [4].

Such an increase in the numbers needing medical treatment would place the NHS under unprecedented stress, forcing private health insurance rates up or seeing the institution of schemes and plans possibly more strictly tied to existing health. New and more extensive channels for collecting revenues to pay for public health care may have to be found and radical weight loss alternatives such as surgery or appetite suppression drugs could become more common.

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. [2]

Questions of equality and ethics and cost are likely to arise. Obesity-rights groups may be established and put pressure on the Government, health professionals, media and the fashion industry to end their perceived stigmatisation of those deemed overweight.

The Government and public health bodies may increase the proportion of public money spent on actively combating the problem - health and weight loss programmes could become a massive business, but greater publicity of the health risks of obesity might lead to many more people using fad diets which can be damaging to health in the long-run. Basic manufacturing standards may have to be changed, and the revenue earned from certain food types penalised [5].

Even the structure of public facilities would have to be adapted, with public seats, turnstiles, size of cars and space on public transport increased to accommodate a population of bigger people.

City and town planners and architects might need to rethink their designs, with more demand for low-rise living, compact urban centres and car parks located immediately outside shopping areas, restaurants and attractions to minimise walking time. However some pressure may be brought to bear against the encouragement of such "obesogenic" environments.

If changes are not made, litigation against public services and claims for personal injury caused by lack of facilities for the overweight may be mounted. High levels of obesity would affect productivity, and professions which rely on fitness - such as the armed forces, fire service, and other industries such as construction, fisheries and agriculture - may struggle to recruit people as fitness declines and the average BMI rises.

Greater average consumption could increase demands on energy, water and food resources and increase levels of waste, potentially leading to problems and higher associated costs.

More positive social, cultural and commercial phenomena and opportunities could emerge in response to the shift such as more engaging and stimulating ways to undertake exercise, involving use of virtual reality and social networking.

Optimists also believe that ecological and nutritional awareness may pre-empt a 'paradigm shift' away from volume and price in the sale of food 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). [2]

Early indicators ▶

Significant increase in the proportion of younger children developing diabetes/other obesity related diseases/afflictions;

Significant reduction in the percentage of people who regard obesity as a serious health risk (currently 9/10) [6];

Quantifiable change in the sizes of clothes sold by retailers but no change in the labelling;

Proliferation of retailers for larger women e.g. Evans, Simply Be; A "Fat Pride" march held in London;

A radical group established in the style of "Fathers for Justice"; Raised sexualisation of the overweight; Banning of skinny models at fashion shows;

Drivers & Inhibitors ▶

Drivers:

Reduction in physical activity including a decrease in those walking to/from work/school;

Ever more options for alcohol and fast food consumption:

Psychologically and physically addictive qualities of refined, sugary, fatty foods:

Long-hours culture leading to increasing sedentary lifestyle;

Increasing affluence coupled with declining food costs as a percentage of gross earnings;

A growing "eating out" culture and greater proportion/variety of restaurants;

Poor parenting strategies;

Proliferation of values proclaiming that weight is a personal choice/statement of character and not something for external intervention.

Inhibitors:

Government healthy eating campaigns: Campaigns such as 'Jamie Oliver's School Dinners' placing emphasis on the importance of healthy eating;

Reduction in cost of nutritious, unprocessed food;

Public awareness of the causes of obesity; particularly among parents, an understanding of what constitutes a 'balanced diet';

T.V programmes such as 'You are What you Eat' demonstrating the benefits to health/appearance from eating/exercising correctly;

Maintenance of school playing fields and P.E lessons for children;

Fashion, consumer culture and media-driven messages extolling weight loss and ideal-type imagery;

Regulation of food advertising and labelling;

Cost-competitive healthier alternatives to fatty foods, marketed as reasonable and satisfying options as opposed to the 'alternatives' that they are.

Parallels & Precedents ▶

Largely unprecedented – it is only relatively recently that a vast proportion of the population has been afforded the opportunity to exceed its basic nutritional needs. However there are obvious parallels in particular cultural contexts of the cultural valorisation of obesity/excessive weight, e.g. c. 19th European association of fatness with success; Cook-era Samoa; Ice Age European sculpture; Rubens' artwork.

[3] [6] [1] [7][8] [5] [9][10] [4] [11] [2]

Sources ▶

Ref.	Publisher	Date	Title	Category	Evidence	Stimulus
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2	Other		[11] WHO (2006) 'Obesity and overweight', Global Strategy on Diet, Physical Activity and Health	Soc	?	?
3	The Observer		[1] Revill, Jo (2004) 'Desparate Slimmers flock to Clinics' The Observer, 24th October	Soc	?	?
4	Other		[9] Mark Henderson (2006) 'Overweight women may lose right to free IVF' Times Online	Soc	?	?
5	The Institute for Fiscal Studies		[6] Leicester, Andrew and Windmijer, Frank (2005) 'The Fat Tax: Economic Incentives to reduce Obesity' The Institute for Fiscal Studies Briefing Note no. 49	Soc	?	?
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8	National Health Service		[5] National Health Service Encyclopedia 'Obesity: an introduction'	Soc	?	?
9	Other		[7] House of Commons Third Health Report 2003-2004	Soc	?	?
10	Other		[8] Outsights/MORI interviews with Dr. Frank Trentmann and Dr Sarah Harper, 2005	Soc	?	?
11	Other		[10] Foresight 'Trends and drivers of obesity: A literature review for the Foresight project on obesity'	Soc	?	?

Other Sources ▶

Link
Healthcare Commission
National Health Service
Number Ten Downing Street
Policy Hub
Sport England
The Department of Health
UK Sport

ForSociety: Obesity - Policy and economic context

Socio-Economic Policy

Issue ID:	32 8 30/04/2007 12:09:44	Last updated:	Criteria :	Impact ★★★★★ Where Domestic/National	Likelihood ★★★★ When 11-20yrs	Controversy ★★★ How Fast Unknown
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Keywords: Obesity, overweight, policy, economic, public health, intervention

Source: Ipsos-MORI

Summary: The obesity policy environment has historically been fragmented without a long-term perspective. The complexity of cause and effect, the lack of policy-orientated research and evidence for effective interventions along with the difficulty in bringing multiple strands of action together have hampered efforts. The time lag to seeing the impact of an intervention on weight may mean that we are still waiting to see the impact of some policies. It is clear that a focus on a single intervention in isolation is not effective and joining up of multi-layered interventions is critical for success. The gaps in the evidence base mean that obesity is an example of policy development in advance of a perfect evidence base. Policy makers must rely on the best available evidence and remain flexible to respond and adapt as understanding changes.

Implications: The cost of obesity and its consequences in England have been estimated at around £3.3 – 3.7 bn but this is unlikely to reflect the full cost. Analyses tend to be conservative and do not provide sufficiently broad estimates of where costs may be incurred. The challenge of costing the wider implications of obesity remains however estimates of the health costs alone emphasises the importance of this challenge.

Early indicators:

Drivers & Inhibitors:

Parallels & Precedent

s:

Themes:

Name
Obesity papers

Sources:

Title	Type	Origin	Subscription
Economic cost of obesity and the case for government intervention	Professional publication	Other	No
Overcoming policy cacophany on obesity: an ecological public health framework for policymakers	Professional publication	Other	No

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30/04/2007 12:08:38	Peter Thompson
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