

Fifth, more tangible incentives will be needed – whether through tax regimes, capital grants or seed funding, or a combination of all of the above. These incentives will work best when they are transparent and accessible to small companies as well as large ones.

Sixth, government should recognise its influence as a customer in supporting new technologies and enabling new companies to grow. Public procurement must be used as much as a tool for encouraging innovation as for driving down costs.

And seventh, all of this must be rolled into a coherent policy framework, managed, measured and continually refined.

On the other hand, there are some areas where it makes less sense for government to take a lead. For instance, it is important that policymaking draws on this country's rich vein of scientific and engineering expertise. Technology councils, businesses and, of course, the national academies are full of people with skills in management, research and problem solving. The government should make full use of these outstanding human resources.

There is also an issue of culture. Young people still view science and engineering as somehow quite boring – something that uninspiring people do behind a desk or laboratory table. This is an area where the scientific

community must take a firmer lead, encouraging its great people to get out there and communicate: through the media, in schools and colleges. We are doing this at The Royal Academy of Engineering, but we can – and will – do more in the future.

Great innovation occurs when science and engineering meet business and enterprise – where people can face in two directions at once, translating the fruits of scientific research into opportunities to create wealth and jobs. That is not a job for government, but it is an area where government can play a useful leadership role, fostering an environment that harnesses the natural power of business to innovate.

The state of the UK economy is the overwhelming concern of government and the nation, and the available Science and Research budget should be targeted where it will have most impact in the foreseeable future, as far as possible without compromising unforeseen developments. Future potential will never be realised if the nation has not created the means to exploit it.

That is how to create an innovation economy. The seven-point plan delivers this and I wholeheartedly recommend it to our government.

WHY SUSTAINABILITY IS THE KEY TO EFFECTIVE, INTEGRATED HEALTHCARE



Robert Verkerk BSc MSc DIC PhD
Executive and scientific director,
Alliance for Natural Health
International, The Atrium, Curtis
Road, Dorking, Surrey RH4 1XA.

OUR DISEASE BURDEN

There is a fundamental disconnect between the healthcare needs of individuals in our contemporary society and that which, in the main, is presently being delivered. Derek Wanless, in his 2004 report to the UK Government on the future needs of the National Health Service (NHS), commented that the NHS had become a 'national sickness service' rather than a 'national health service'.¹

Wanless upheld that the NHS remained medically driven and preoccupied with inpatient services. He also said that the

low level of patient engagement in personal health was unsustainable. He proposed three possible models for the reform of healthcare, the most efficient being one in which the individuals are 'fully engaged' in relation to their health. Such a scenario was claimed, amongst other things, to extend life expectancy beyond current forecasts, as well as lead to a dramatic improvement in health status. Aside from this, Wanless' fully engaged scenario was considered the cheapest to implement, and the only one that might be described as sustainable.

It is clear that the overall direction of the NHS has changed little since 2002. Among the multitude of reasons for this is the fact that the primary burden on healthcare is caused by chronic, noncommunicable diseases, notably heart disease, cancer, diabetes, obesity and osteoporosis, all of which are multi-factorial in nature and strongly associated with diet and lifestyle patterns.² The World Health Organization (WHO) estimated that mortality, morbidity and disability attributed to the major noncommunicable diseases



would account for about 73% of all deaths and 60% of the global burden of disease by 2020.³ In developed countries, such as the UK, the burden would be higher still given the lower incidence of infectious diseases.

The WHO has also opined that these chronic diseases, being strongly correlated to diet, lifestyle and physical activity, are largely preventable.² Their rapidly increasing rate is attributed particularly to factors such as recent changes in food production and processing, as well as to shifts in agricultural and trade policy. Additionally, alterations in living and working patterns, born out of the 'computer age', have led to less physical activity and less physical labour for the vast majority of people in our society.²

Despite the WHO's recommendations to governments, heralded by its launch in 2004 of the Global Strategy on Diet, Physical Activity and Health,³ there has been negligible change at governmental or societal levels to address the identified failings in healthcare policy.

PROBLEM 1: DRUGS AS THE KEY TOOLS IN CONVENTIONAL HEALTHCARE

Drugs are licensed medicinal products used to prevent or treat disease. Most, however, treat only symptoms rather than the cause of disease. For the last few decades, most drugs used have been patented by one of only a small number of transnational corporations, and most can also be characterised as being 'new-to-nature'. Accordingly, given our lack of evolutionary adaptation to such chemicals, serious side effects

are the norm rather than the exception.

It has been estimated that in the UK, adverse drug reactions cost the NHS £2 billion annually.⁴ A recent Swedish study has revealed that 3% of Swedes die from adverse drug reactions, making them the seventh most common cause of death in the country.⁵

In the USA, deaths from preventable medical and surgical injuries,⁶ preventable infections in hospitals⁷ and adverse drug reactions which follow the non-error prescription of drugs⁶ combine as the third leading cause of death. The situation appears more or less similar in most other western countries.

Aside from the deleterious effects of many drug-based treatments, ongoing evaluation by BMJ's Clinical Evidence group currently suggests that only 11% of orthodox medical treatments have been shown to have beneficial effects.⁸ These data are submitted at 6-monthly intervals directly to the NHS Health Technology Assessment Programme (HTA). Furthermore, Dr Allen Roses, vice president of genetics for the UK's largest pharmaceutical company, GlaxoSmithKline, admitted in 2003 that: "...the vast majority of drugs – more than 90 per cent – only work in 30 or 50 per cent of the people"⁹.

The clear lack of relative effectiveness of new-to-nature drug-based modalities, their high cost, the scarcity of new drugs in the pharmaceutical industry's R&D pipeline and the fact that most patents for 'blockbuster' drugs will expire by 2013,¹⁰ strongly point to the need for a radical change in our society's approach to the management of our health.

PROBLEM 2: HEALTHCARE SERVICES

Given that chronic diseases disproportionately impact older populations and in turn take many years, often decades, to manifest, it is deeply inefficient to focus the bulk of the 'healthcare service' on the chronically diseased population. Disease prevention, as proposed by Wanless, WHO and numerous others, is a substantially more efficient and effective approach. In order to implement preventative healthcare as the primary approach, the existing system of primary care, particularly as applied by physicians in general practice, would need to be abandoned.

Even from a disease management perspective, the existing average 10-minute consultation provided by a single medically-trained practitioner is simply not sufficient to deal with complex diseases and disorders, especially given that older patients typically present with co-morbidities. There is presently no capacity for the provision of disease prevention services, nor is there adequate training in this area among mainstream healthcare providers.

It is well recognised that healthcare providers in the field of integrated healthcare (sometimes also considered as 'complementary and alternative medicine' [CAM]), are generally much more concerned with disease prevention than orthodox healthcare providers. Most integrated or 'unconventional' healthcare providers will integrate nutrition and lifestyle advice as adjuncts alongside any other modality or modalities which they are specifically trained to offer. Face-

to-face consultations between integrated healthcare providers and patients or clients are often substantially longer than those in general practice. Based on limited data, extending the time of primary care physician's consultations alone appears not to yield significant improvements in diagnosis or patient outcomes.¹¹ This is likely to be the result both of deficiencies in diagnostic capabilities as well as treatments offered.

The perceived lack of an adequate evidence-base, coupled with powerful resistance to integrated healthcare modalities by a highly vocal, media-savvy minority of opinion leaders in the field of orthodox medicine, continues to provide a barrier to better integration of multi-factorial, non-drug approaches to healthcare.

Even more fundamentally, the disconnection that exists between healthcare policy, lifestyle and food production technologies means that only very small sectors of the population are truly able to embrace sustainable, 'fully engaged' approaches to healthcare that dramatically reduce disease incidence. The paucity of studies on the effects of high levels of engagement in personal health, along with the effects of appropriate dietary choices and lifestyles, have not been prioritised in research. A major reason for this is the lack of commercial incentive to fund such research.

THE GULF IN VIEWPOINTS

The huge gulf in opinion between protagonists of conventional and unconventional approaches to healthcare does nothing to facilitate better integration of

non-drug based healthcare and preventative healthcare approaches into the mainstream.

In fact, if anything, these contrasting viewpoints have become increasingly polarised. One reason for this is a misrepresentation of 'unconventional' approaches by those adopting a restricted approach to evidence-based medicine (EBM). Such a limited approach to evaluation of unconventional therapies is epitomised in Singh and Ernst's 2008 book *Trick or Treatment? Alternative Medicine on Trial*.¹² The approach is deficient scientifically.¹³ Although discussion of the scientific deficiencies of methods of evaluation used is beyond the scope of the present article, the results of experimental trials relied upon cannot be applied to the effectiveness of a given modality in real life. The positive experience among members of the public of alternative medicine modalities, along with nutritional approaches (that have never been evaluated by Professor Ernst and colleagues) is one reason why a large sector of the public fails to be discouraged from using these modalities despite adverse media reports.

It should also be recognised that the originators of the EBM concept have complained that the concept has been misused through its over-reliance on randomised trials, to the exclusion of other forms of evidence, such as observational evidence and, in particular, clinical experience.¹⁴

TOWARDS A SUSTAINABLE HEALTHCARE PARADIGM

The concept of sustainability has been applied to agriculture, forestry, energy and an increasing number of other areas of human endeavour. Generally, sustainable approaches are those that work in accordance with, rather than against, natural processes. Lip service has been applied to sustainability in healthcare, but, as yet, there has been no major effort from either government or industry to instigate an approach to healthcare that, in the broadest sense, is sustainable.

The first step in developing such an approach is full recognition of the lack of sustainability in existing approaches. A second step is the identification of those factors that contribute to the most unsustainable aspects of the healthcare system. Thirdly, an appropriate scientific and regulatory framework is needed.

In the present article, six such factors contributing to lack of sustainability have been identified, these being:

- Inadequate emphasis on disease prevention among primary care providers;
- Lack of engagement in personal health management by individuals;
- Lack of adequate education and training of the public and healthcare providers in methods of disease prevention;
- Over-reliance on expensive, relatively ineffective and harmful (biologically incompatible) drugs;
- Lack of an adequate and appropriate evidence-base

for sustainable, integrated (and biologically-compatible) healthcare;

- Diametrically opposed and firmly entrenched viewpoints on conventional versus alternative medicine approaches.

To increase the sustainability of our healthcare system, it is necessary to address all of these issues, among others. It is proposed that criteria for sustainable approaches to healthcare are developed so that any approach meeting these criteria, whether it involves dietary advice, use of licensed drugs, alternative modalities, nutrient or herbal supplementation, be deemed acceptable. It would be expected that such an approach would help to dissolve the existing antagonism between conventional and alternative medicine factions.

In the long term, for our healthcare system to become truly sustainable, massive shifts in critical aspects of our food and healthcare systems are required. This includes a transformation of the medical curriculum, reduced dependence on processed foods, increased reliance on regionally and locally produced whole foods, increased physical activity among all age groups, especially the young, and changes to the school curriculum to allow inclusion of nutrition, health and lifestyle training.

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