MEETING OF THE PARLIAMENTARY AND SCIENTIFIC COMMITTEE ON MONDAY, 23RD JANUARY

Hospitals of the future will revolutionise the way in which hospital care is delivered and hospitals will develop new procedures and processes as some existing ones shift to primary care. New healthcare technologies, including robotic surgery, wearable and implantable monitors exploiting wireless communication and new IT systems will require multi-skilling of staff and purpose-designed buildings which will be funded by the Private Finance Initiative. The roles of general hospitals and the national, often university-linked, hospitals can further differentiate. The latter will often become the points of adoption and development of potentially revolutionary new technologies and systems. The adoption of new technologies will become more solution-based with academia, industry and the NHS working together on aligned objectives

Introduction

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Major changes in roles and service delivery within the whole spectrum of healthcare will occur in the future. Hence we really have to consider the primary healthcare and hospital sectors at the same time. We are already feeling the impact of several new technologies such as structural biology, genetics, cell and tissue engineering, hi-tech vaccines, bionics, and it is necessary for us to respond to the rapid pace of scientific and medical innovation. Many of these technologies are highly disruptive and will totally change current concepts of medical intervention. Some of these will entail expensive once-off procedures which improve quality of life and which greatly decrease later dependence on healthcare resources. Current taxation or payment models may not cope with such redistributions of cost within the overall healthcare budget, causing certain disruption.

Multidisciplinary research leads to new capabilities eg mechanical engineering research combined with both computing and medical research has led to much improved forms of robotic surgery with exquisite precision and significantly diminished trauma to patients. If we are to apply such technologies effectively, new skills – often very specialised skills, within our health services, are needed. This may result in the disappearance of old roles which will be replaced by new ones and may even mean that more medical care is delivered by specialist technicians and less by generalist physicians.

Accurate and rapid point-of-care diagnostics could bring great efficiencies to healthcare if widely adopted and coupled to targeted drug therapies. But roles have to change – the primary care physician needs to reassume the role of blood-letting whilst engaging in a different type of conversation with the potential for greater patient involvement whilst the symptoms are extant. Also, the dependence on distant laboratories, often in hospitals, is changed. The availability of such new approaches typifies an aspect of healthcare in the future – the confluence of information from different sources in real time or near real time.

IT systems, responsible for bringing information together, are already having a significant impact. IT will continue to revolutionise healthcare and must be helped to do so. IT will enable data from many different sources to be brought together simply for viewing at a single point. It will also allow for regional or even international boundaries to be crossed in treating mobile individuals or bringing scarce medical expertise to less-developed or skill-poor environments.

The roles of the primary care and hospital sectors must continue to change if we are to make full use of new potential capabilities. Primary healthcare is now more than a gate-keeper to the wider health environment. It is itself a core provider of services and will continue to grow this role. Increasing adoption of new technologies and access to comprehensive medical record data could increase the role of the primary care sector even further and relieve hospitals of certain types of demand. It is not clear, for example, why most diabetic or asthmatic patients should ever have to call on hospital care.

The number of hospital beds in the UK has decreased dramatically in the last 50 or so years. In 1950, UK hospital beds were 550,000 and in 2003, UK hospital beds were 230,000. This continuing trend is largely due to two factors: the increased potential for health management within the primary sector and the increased productivity of hospital healthcare provision as reflected in the average number of days patients occupy beds as part of their hospital attendance. New surgical techniques with earlier transition to ambulatory care are a key factor here. There is, however, still much room for improvement as inpatient stay in countries such as the USA is around 2 days shorter than in the UK.

Making full use of remote monitoring will also be a key to helping patients with chronic diseases to enjoy good health care without requiring long periods of hospitalisation. At present chronically ill patients account for around 60% of bed spaces and 80% of NHS costs. Another emerging theme is that of preventive medicine – essentially managing people's medical future – which will hopefully also have a major impact on need for hospitalisation. This also will represent an area for significant investment and will again challenge the current compartmentalisation of budgets. However, decreasing demand on beds should make available at least some of the funds needed for re-investment in community care and preventive medicine.

So, hospitals in the future will develop new procedures and processes as some existing ones shift to primary care. And within the Hospital Sector, the roles of general hospitals and the national, often university-linked, hospitals can further differentiate. The latter will often become the points of adoption and development of potentially revolutionary new technologies and systems. The adoption of technologies in the future will become more solution-based with academia, industry and the NHS working together on aligned objectives.

Hospital of the Future

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There are many powerful forces for change in our population's health and the way we deliver health care. We were fortunate to be able to draw upon work undertaken by the DH Strategy Unit on future health care trends, details of which are available at http://www.nhsconfed.org/influencing/strengthening_local_services_resource.asp. This section summarises the key findings of the Strategy Unit's work in this area.

The population is ageing. The balance between young and old is shifting. Life expectancy is increasing, as premature mortality rates fall. The average family size of 1.77 (2004) sits below the replacement level of 2.1. The number of single person and single parent households is growing. The number of people over 60 is expected to grow by nearly a third by 2021, while the number of young people under 16 will fall. The ethnic population is also ageing. However, there is significant uncertainty about the net impact of the ageing population on health care demand. The workforce is also changing and ageing. The national and international competition for skilled staff will grow, and the workforce is demanding a better work/life balance.

Current lifestyles present major risks to the future health of the population. Obesity, sedentary lifestyles, sexually transmitted disease, and alcohol consumption are growing, especially amongst the young. This is driving increased incidence in diabetes, osteoarthritis, heart disease and kidney disease. Over a quarter of the population still smoke. This creates a significant burden of respiratory disease and cancer. The disease profile is changing. Previously fatal acute conditions such as cancer and heart disease can now be treated. Ageing related and chronic diseases, such as diabetes, respiratory illness, renal disease and arthritis, are becoming much more significant. More people are living with long term illness, and with multiple conditions.

Health inequalities continue to present a challenge. People from lower socio-economic groups are much more likely to adopt risk taking lifestyles and yet are frequently handicapped in accessing health services and taking on board positive health messages – 40% of those from social classes D&E have poor literacy skills.

Medical advance can improve health outcomes, but will create budgetary pressures. Significant advances in medicine and surgery are anticipated, supported by the increasing insight offered by genetics. The "capacity to treat" is increasing, especially the older frail. This magnifies the potential demand of an ageing population. At the same time, the expectations of society are changing. Rising education and income levels are helping to drive higher public expectations of health and health care services. The future old are expected to be much more demanding than their current counterparts.

Advances in information technologies enable improved models of care. The capacity to share clinical information and expertise between professionals and patients offers many opportunities for patients to take a positive and active role in their care and improve the quality of patient care and outcomes.

There is significant debate about the impact of an ageing population. The incidence of chronic disease grows markedly in those over 60, but there is also evidence that the old of today are fitter than the old twenty years ago, postponing the onset of chronic disease. As chronic conditions are diagnosed earlier, treatment is likely to be more effective. One of the greatest uncertainties is that of the impact of current lifestyles on the population over the next two decades. Will the young of tomorrow have even greater levels of obesity, sexually transmitted disease and drug misuse than the young of today, and will the old be sicker and more dependent? A lot will depend on society's attitude and response to risk-taking behaviours. We have the opportunity to live longer and healthier lives than ever. Will society grasp that opportunity, or will we see health inequalities increase as some do and some don't, or perhaps can't.

These forces bring threats and opportunities to the health of the population and health care services. The impact on health care demand and our capacity to meet that demand is very difficult to foretell, emphasising the vital importance of retaining flexibility in the healthcare workforce and asset base to respond to uncertain future developments. However, the Department of Health's Strategy Unit has attempted to identify the likely impact of demographic change and medical advance on key disease areas; their conclusions are summarised below:

- **Musculoskeletal disorders** - Rising incidence rates due to ageing population and rising obesity. Few currently effective primary or secondary prevention strategies. Increased capacity to treat surgically. Anticipate large growth in demand.
- **Respiratory Disease** - Future demand will be very dependent on capacity to reduce smoking in the population. No major treatment improvements on the horizon. Drug resistant infection could reduce treatment capacity. Demand likely to be sustained.
- **Heart Disease** - Future demand for care is likely to increase as a result of ageing population and rising rates of diabetes and obesity. Secondary prevention measures and new therapies are shifting treatment from inpatient to ambulatory care setting.
- **Cancer** - Future demand for care will grow as the population ages, but demand will vary according to type of cancer. The treatment model is changing from acute to chronic disease management as mortality rates fall. New treatments likely to have significant costs. Demand is likely to grow with significantly growing demands in primary care settings.
- **Diabetes** - Future demand for care will grow significantly unless obesity trends can be reversed. Cell therapy, better monitoring and new pharmacological treatments should reduce mortality and disease complications in the longer term.
- **Kidney Disease** - Future demand for care is expected to rise steeply over the next ten years. The link to age and some ethnic groups will mean that demand patterns will vary significantly across the country. Medical advance holds no immediate prospect of addressing this steeply rising need, but in the longer term should provide means of stopping or delaying disease progression and reducing complications.

The relative impact of these trends will be different over time. It is possible to estimate the time at which particular trends will have the greatest impact, but when reading this it should be borne in mind that predictions of the future are frequently right about the type of change but are often wrong about the pace of change.

0 – 5 Years

In the next five years, the drivers of most significant impact are likely to be the increasing use of IT and the rise of consumerist behaviour in health care. Surgical technology will continue to make more minimally invasive surgery possible. Health care training and careers will be changing and becoming more flexible. Expert patients could increase the amount of self care, but could lead to higher demands and wide access to health information over which there is no quality control could also result in misinformed patients. New cancer treatments become available.

5 – 10 Years

In the next five to ten years, "intelligent technologies" eg automated analyses, medical devices that can self monitor and call upon expert/professional help automatically will play an increasing role in care. Miniaturisation of diagnostic and monitoring tools is likely to be significant, making these available in local or home settings. Professionals could be making much greater use of "intelligent devices" expert systems software to support clinical decision making, for example. There will be increased use of "data mining" and systems that can infer "rules" based on experience of previous events. The use of genetic screening will become widespread and pharmacogenetic drugs will appear.

10 – 15 Years

In ten to fifteen years, the ageing of the workforce and population could create significant service pressures. Chronic disease will be increasing. We could see the (re-)emergence of infectious diseases as a result of global warming and increased population mobility. We might be seeing a mainstream use of some genetic therapies. There might be a major pharmaceutical innovation in one or two disease areas.

15 – 20 Years

In fifteen to twenty years, the pressures on the workforce may mean the idea of retirement might start to change. We could see further medical advance such as use of stem cells to regrow body parts and/or correct/repair injury.

This overview emphasises that there are major threats to health in the future, from rising rates of obesity, alcohol consumption and high levels of smoking. These combined with growing numbers of older people could put significant burdens on services unless current trends are reversed. There are also opportunities to provide better and more effective healthcare, as conditions which were once fatal can now be cured. The capacity to treat is growing, but so are costs.

A sustainable health care system will need to maximise its impact on health down stream, and focus on primary and secondary prevention across the whole life course. Given the rate of change and uncertainty about the future, health care providers will need to be able to constantly adapt their services to this rapidly changing environment. Some commentators have predicted that the next twenty years in medicine will see as much change as the last two hundred.

HOSPITALS OF THE FUTURE

Information Technology in Healthcare

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Introduction

Clinical Information Systems (CIS)[1] have developed rapidly over the last decade. Much of this development has involved various imaging modalities, coupled to image viewing systems known as Picture Archiving and Communications Systems or PACS[2]. The universal availability of medical information, including images, waveforms etc, will become increasingly important. This paper addresses some of the key issues relating to the development of new technology for medical information in the context of more general clinical information systems. With the increasing importance of molecular and cellular biology, a new type of medicine, molecular based

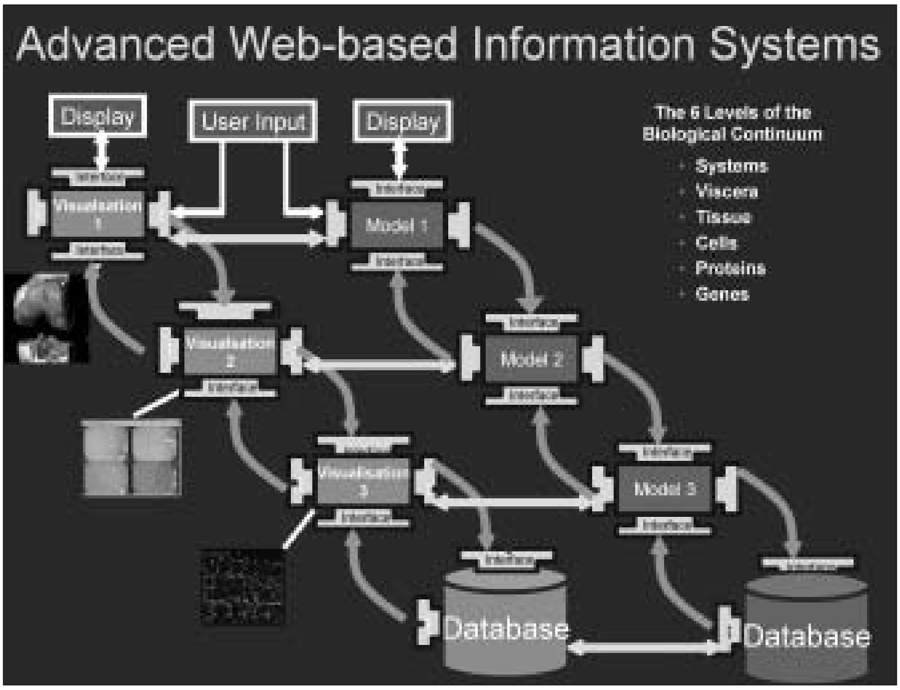

Figure 1. Schema of an Advanced Web-based Clinical Information System

medicine, is now developing. This will significantly alter the way in which medicine is practised. The view that will be presented here is that in future CIS and PACS will need to operate seamlessly across the Biological Continuum[1] ie, the hierarchy of the human organism comprising systems, viscera, tissue, cells, proteins and genes.

The important international clinical trends will lead to a world in which imaging systems and PACS will be used routinely – and directly – across a range of clinical specialties (eg cardiology, oncology, surgery, pathology etc). Image data acquisition already takes place in many of these specialties, but the images are often only viewed on technology associated with the acquisition device. A good example of this is the acquisition and viewing of arthroscopy images (minimal access surgery knee images). In many specialties imaging is currently where Radiology was in the 1980's, ie viewing on individual machines. This situation will significantly alter in the near future largely, both directly and indirectly, through changes in technology. These changes will allow universal access to data, images, waveforms etc across the Enterprise (eg the hospital) and beyond.

Four key components which make the universal image and data access achievable are:

- The price and power of computers – for example, Pentium computers have the processing power of the Unix workstations previously used for CIS and PACS at a fraction of the price
- The availability, use and price of industry standard hardware. This moves CIS and PACS from being based on specialist hardware and operating systems to standard hardware and operating systems – with all the associated cost savings which can be achieved through economies of scale.
- The presence of a comprehensive international standard for imaging (DICOM), together with other standards (eg HL7 and XML).
- The ability to provide fully web-based (ie Internet Protocol based) clinical information systems (CIS), including PACS. These systems use specialist application software which runs on standard IP hardware and standard operating systems.

Clinical Needs

Clinical needs must be thought of in terms of different time scales.

(a) The Immediate Future

In the immediate future there will be a need to provide much more universal web-based access to primary clinical information (including images), which have been traditionally associated with

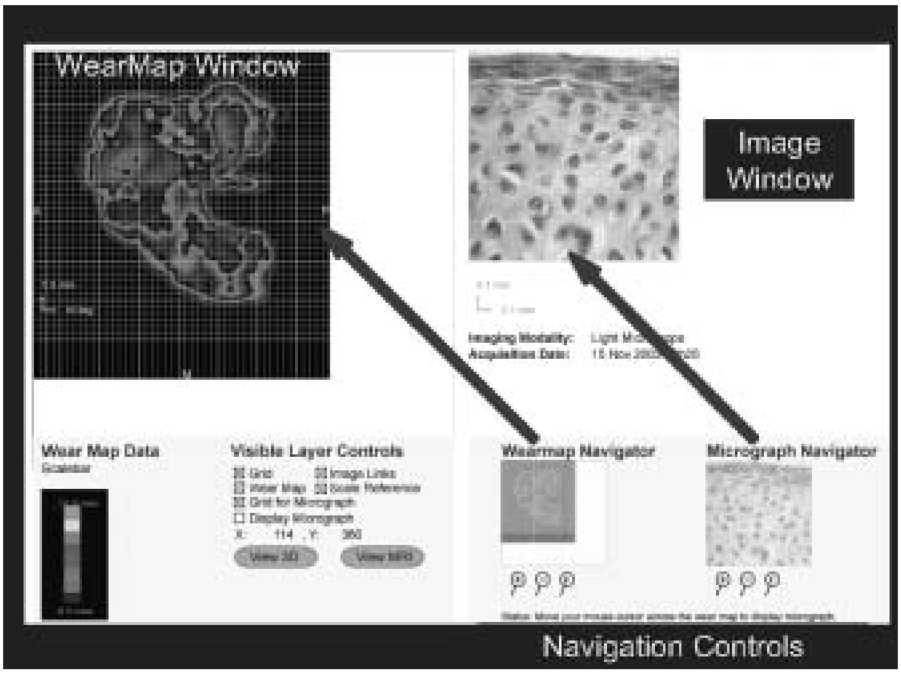

Figure 2: An example of our prototype CIS being used to study Human Knee Cartilage Damage at the Visceral and Tissue Levels

Radiology (eg magnetic resonance imaging, MRI; computed tomography, CT; ultrasound; X-ray; angiography etc) across different clinical specialties, within the hospital. However, there is also a rapidly developing need to provide universal web-based access to a wider range of images from procedures such as general breast screening; minimal access surgery (eg arthroscopy and laparoscopy); the recording of physiological waveforms (eg ECGs, blood pressure, heart rate variability etc); as well as histological and haematological images. In addition, CIS and PACS will need to incorporate photographic images eg retinal images; dermatological images and more general clinical photography. It is important to note that all of these image types are already defined within the DICOM standard.

(b) The Next 5 to 10 years

Over this period the landscape of medicine is set to change radically. These changes are important because the PACS which will be installed in the future must be able to accommodate the changes in clinical practice which are likely to occur over this time frame and beyond.

February 2001 was an important date in the history of medicine. This was the date of the publication of the paper in Nature which reported the initial sequencing of the Human Genome[2]. In many ways this date represents the dawn of the "New Medicine", ie molecular based medicine. From now on there will be a rapidly developing trend away from a data poor to a data rich healthcare environment, and a move away from treating clinically evident disease to diagnosis and treatment based on an understanding of the disease mechanisms. Both of these trends will have a profound effect upon the way in which medicine is practised. There will be an increasing reliance on information technology (CIS and PACS) across many medical specialties involving integrated care.

Central to these developments is the concept of the Biological Continuum ie the hierarchy of the human organism comprising:

- Systems
- Viscera
- Tissue
- Cells
- Proteins
- Genes

Medicine today is often practised at one or two of these levels, ie there is generally no vertically integrated approach. This is set to radically change. The ability to store, view and analyse information at all of these levels will become central to the practice of medicine. Because of the amount and scope of the information, this can only be done effectively by the use of advanced web-based Clinical Information Systems (CIS). Although these systems use web-based technology, in healthcare they usually work on some form of Intranet within the hospital and/or the health system.

Figure 1 illustrates schema for an advanced web-based CIS. In the figure only three of the six levels of the Biological Continuum are shown, for convenience. The schema is divided into two halves. The left half comprises visualisation (ie imaging and 3D reconstruction, as well as items such as physiological waveforms – blood pressure, respiration etc – which in this context can be thought of as images), whilst the right half of the diagram comprises modelling. It should be noted that there are strong interconnections down the levels, as well as interconnection between visualisation and modelling at each level. Modelling refers to computer modelling or simulation (which might well include various types of data analysis of various kinds). For example, computer models can be used to compare patient state in relation to different types of data, either against a population or against the patient's own data – in this case the test for deviations from normality.

Visualisation and imaging across levels often involves using different modalities (ie imaging techniques). Figure 2 illustrates an example of the study of knee damage using our prototype advanced CIS. Referring to the figure, the WearMap window shows a reconstruction of magnetic resonance (MR) images of one surface of a human knee. The colours of the WearMap represent different thicknesses of cartilage across the surface of the joint. By inspecting the WearMap a clinician can detect damaged areas. However, by using the prototype advanced CIS it is possible to examine the damage at the tissue level. Geometric integrity is preserved, even though the tissue images for the patient are light micrographs. The system locks the two sets of images together so that the damage can be studied at different levels of the Biological Continuum.

An additional, important aspect of advanced clinical information systems is that they represent a rich source of data which can be used for epidemiological and management purposes. In the foreseeable future data for a single patient, across the Biological Continuum, will form part of a health system database; which in the case of the UK could comprise the majority of the population. This will enable much more detailed epidemiological and associative studies which, in turn, should lead to much more effective molecular based medicine for the individual.

References:

[1]R. I. Kitney, "The Role of Engineering in the Post-Genomic Age," *The Royal Academy of Engineering*, ISBN. 1-903496-09-8, pp. 1-32, 2003.

[2]E. S. Lander, L. M. Linton, and B. Birren et. al., "Initial sequencing and analysis of the human genome," *Nature*, vol. 409, pp. 860-921, 2001.

Hospitals for the Future:
An Architect's view on effect of new technologies and healing aesthetics

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New Hospital design like all architecture is a reflection of the society in which it is set. One measure of any society is how well it treats its old and sick.

In two decades time, our UK population will grow to approximately 65 million, of which near a quarter will be pensioners, with 1.6m over 85. This demographic shift, together with ever increasing expectations of a consumer culture, and the free availability of information will place ever increasing demands on our NHS systems and staff.

Innovations in technology will require to be fully explored if the NHS of the future is to meet the many challenges it will face. Advances in IT, video conferencing and medical equipment will enable the cascading of care out of the traditional hospital into care settings nearer to where people live. This affects not only IT requirements, but also the NHS estate of the future. Discussion of the sort of hospital that there'll be in 30 years time needs not only to focus on questions of location, size and travel times, but also what it will look like.

The Medical Architecture Research Unit identified four levels of healthcare settings which reflect the New NHS Models of Care. At the top level, handling fewer but very intensive and complex cases, are Specialist Care Centres. These new Specialist Care Centres will have a different role from hospitals at present as much of their previous case load will have been moved out to the appropriate local care setting eg Community Health Centre; Social Care Centre; or Home monitoring. The Specialist Care Centre will have fewer beds but provide a higher level of specialist treatment. Centrally located in urban conurbations with good transport links, they will serve large centres of population and will require higher technology capability. They will be physically smaller than the current generation of hospitals but they will be supported by off-site industrial and support zones, which will be more efficient at a larger scale serving several hospitals.

Good hospital design encompasses a great many integrated elements and factors. Even in 1859, Florence Nightingale observed in her prescient "Notes on Nursing" that many symptoms are based on reactions to poor environmental conditions. Her answer was the "pavilion" type ward and hospitals. These had tall windows and ceilings around a single open plan room thereby enhancing good hygiene, lighting and ventilation. This was the model for a century, and many of these buildings are still part of the NHS current estate. Today, however, these wards are obsolete: expectations have changed and patient-centred care puts privacy, dignity and most importantly the safety of the patient first.

Current acute hospital trends are for 25-50 per cent single patient rooms, all with ensuite WC and showers. This is in line with recent infection control guidance. But in the future, we will see 100 per cent single bedrooms, all well-designed and acuity-adaptable, and, of course, all with ensuite WC and shower. We will see patient rooms that are designed to feel light and calm, each incorporating views of art and nature. Patients will have full control of their own environmental conditions directly from their bed. And the bed itself may be used to monitor and record the patient's condition. These new hospitals will also include comfortable family space, designed to improve social support for patients throughout their stay.

As with evidence-based medicine, continual advances in Evidence Based Design research will allow us to evaluate and scientifically quantify environmental design factors and whether they measurably enhance or diminish patient safety, the healing process, staff retention and running costs. The 100% single patient bedroom example above is proven by evidence to result in reduced clinical errors, complications, drugs and improved patient recovery rates. The consequential improvement for a patient's experience, in an "hotel" style room, is a side benefit.

Treatment and diagnostic rooms will evolve too. These technically sophisticated rooms are currently designed to accommodate specialist fixed medical equipment and its operators. They are expensive to construct and expensive to run. They tend to be non-standard, bespoke rooms, located for ease of access in the centre of the hospital complex, resulting often in no views, natural light or ventilation. But things are changing. There is now a trend to make these rooms mobile, to have theatres and MRI scanners that can be "plugged" into a local health centre for a day or a few weeks, thereby enabling specialist clinical equipment, staff and services to be provided in otherwise uneconomic locations.

Over the next 30 years, evolving medical science is going to push this trend still further. Developments in areas like gene therapy and stem cell regeneration will reduce our reliance on surgery and new medical devices, previously in the realm of Star Trek and science fiction, will become commercially available. This may include hand-held diagnostic scanners; biobeds with built-in biometric sensors and monitors; needle-free injections administered by hypospray, a fine aerosol of medication forced under the skin; and CyberKnife "surgery", a blade-free tool currently being developed by Stanford University.

The mobility and non-invasive nature of these new medical devices means we will need fewer bespoke rooms. The hospital of the future will be able to combine treatment rooms with intensive care bedrooms, creating a single patient-centred space and reducing the need for patient transfers with its attendant risks for these generally fewer but highly intensive patients.

In hospital design, change is the norm, not the exception. This means that the hospital of the future will require increased flexibility and efficiency to accommodate medical advances. Universal functions and increased standardisation will permit increased modularisation of specialist rooms. This could mean that the whole building could simply be exchanged for a newer model when desired (say after 40 years, or even five), or that the modules themselves could be upgraded on a regular basis, rather like computer memory slots.

Designing these hospitals of the future will require a much more holistic approach. For instance, there will be greater emphasis on the healthcare environment, and on the need to create therapeutic environments that enhance the healing process for patients, and that create clinical/staff environments that better support and improve morale, recruitment, retention and safety.

There will be greater awareness of the resource efficiency that good design can bring about. For example, good design can save clinical staff up to two hours a day in walking time, a huge efficiency gain that has been conjectured but which now has been scientifically proven through Evidence Based Design research undertaken by Professor Roger Ulrich and others.

Underpinning all elements of the design will be sustainability – social and economic sustainability as well as environmental sustainability. Currently in the UK, funding for new healthcare facilities is divided up according to the following ratios: design – 0.1; construction – 1; facilities maintenance – 5; operational costs – 100.

But good design contributes significantly to sustainability and the argument for reviewing these weightings is strengthening. With more funding put towards the initial design and towards assessing the sustainability of a proposed layout at design stage our future hospitals will gain significant cost savings and resource efficiencies across their whole life. The operational ratio is likely to be significantly lower than 100.

So what of the building envelope that will encase these new-look and new-feel hospitals? Our future hospitals have the potential to utilise entirely new architectural forms and materials. This will reflect their high tech nature, their more flexible use, and their higher level of intensive patient care, as well as their reduced massing, human scale and enhanced patient-centred design. Innovative sustainable design principles will undoubtedly be key, as will the requirement to ensure that the design not only addresses healthcare needs, but also makes a significant contribution to the pride and civic architecture of the local community.

No-one can predict the future with certainty, nor the challenges and opportunities it will bring. One thing is clear though, the challenge of making sure that the NHS's estate is fit for the future is one which requires serious thought, today, as we embark on a vast expansion in healthcare building.

In discussion the following points were made:

As this meeting was about the future, more questions were asked than answers provided. There is no doubt that there will be an enormous increase in the amount of digital data of every type generated, circulated and ultimately approved for storage and later use. The question is how is this to be stored and how quickly will it be retrieved when required? The ownership of the data should be decided on the basis that if the NHS generate the data, then it is their data and they can re-use it in future research when studying the underlying causes of disease which is essential if medical science is to progress. Indeed patients to whom this has been explained have raised no objection to data concerning them being re-used in this way. Standard storage media are now widely used which increase the flexibility and availability of the data to those with a need to know such as the A and E Department for example.

Wards will be replaced by single bedrooms which can be individually ventilated and managed to reduce greatly the potential cross-infections such as SARS and hospital-generated diseases such as MRSA. Their usefulness in dealing with a pandemic however was questioned as they would be swamped by the large numbers of people requiring treatment. The training of hospital managers, or lack of it, was perceived as being the primary cause of differences in the utilisation of hospital resources between the independent sector and the NHS. Indeed much more attention should be paid in future to the specific needs of top quality management by the NHS, which should be streamlined, so that it can achieve its full potential and deliver the service that it is already equipped to do from the staffing, technical and intellectual points of view. The physicians themselves are the best people to communicate this change as they understand what is proposed, know the importance of it and have the authority to carry it through.