

HEALTHCARE: ENGINEERING SOLUTIONS FOR THE NHS.

Institution of
**MECHANICAL
ENGINEERS**



Improving the world through engineering

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**THE UK SPENDS OVER
£115BN EACH YEAR ON
THE NHS, WHICH IS
RANKED AS ONE OF THE
MOST EFFICIENT AND
COST-EFFECTIVE HEALTH
SERVICES IN THE WORLD.**

DR HELEN MEESE
HEAD OF HEALTHCARE
INSTITUTION OF
MECHANICAL ENGINEERS

This campaign document has been produced in the context of the Institution's strategic themes of Education, Energy, Environment, Healthcare, Manufacturing and Transport, and its vision of 'Improving the world through engineering'.

Published February 2016
Design: teamkaroshi.com

Foreword

For nearly 70 years, residents of the UK have enjoyed the security of a national healthcare service, providing 'free at the point of service' universal care to all members of the population, regardless of income, social status or illness.

Although the National Health Service (NHS) has a number of issues which need addressing in the coming years, especially in terms of its funding against an ever-growing and ageing population, it is still one of the most admired services in the country. Indeed, the services provided by the NHS, and the commitment and dedication of its 1.6M employees, are particularly valued by people across the UK, with the public consistently voting the NHS as the thing that makes them most proud to be British. Globally, the NHS is the envy of many nations in terms of service and delivery. In 2014 the Commonwealth Fund reported that the NHS, when compared to many of the leading healthcare services in the world, such as Australia, France, Sweden and the United States, was "the most impressive overall". In particular, the NHS was rated as the best system in terms of efficiency, effective care, safe care, co-ordinated care, patient-centred care and cost-related problems.

However, offering this universal healthcare service comes at a price. Today the NHS costs the UK over £115bn a year. This cost is inevitably going to grow as we experience a changing population demographic, our life spans increase and more advanced, and expensive, treatments become available. As Government continues its efforts to tighten the national budget, it is becoming increasingly difficult for the NHS to fulfil these obligations.

Engineers and technicians play a vital, if hidden and undervalued, role within the NHS and the wider UK healthcare industry. Technological developments by engineers enable the diagnosis of illnesses, facilitate better treatments, can provide independent and remote monitoring of patients, and have the potential to play a huge role in relieving the pressure on stretched staff, resources and budgets.

Outside the NHS, the UK medical technology sector employs over 80,000 people with an estimated annual turnover of about £18bn. We are recognised globally as leading innovators of biomedical engineering, from Sir Godfrey Hounsfield and Sir Peter Mansfield, the early pioneers of CT and MRI scanning, to Professor Chris Toumazou and his pioneering advances in DNA sensing and vital-signs monitoring, the latter of which is estimated to reduce hospitalisation by up to four days and save over £3,000 per patient.

Professor Toumazou is just one of many people working at the cutting edge of engineering to improve people's lives. It is clear that engineers and technicians have, and will continue to make, a huge contribution to the NHS and UK and global healthcare.

It is because of this contribution to people's well-being that the Institution has chosen healthcare as its latest theme, joining the established subjects of education, energy, environment, manufacturing and transport. This will complement the work of the Institution's Biomedical Engineering Association to provide an unified voice and expert guidance in the area of engineering and healthcare.

It is our aim over the coming years to promote to society, Government and the media the value and contribution that engineers and technicians make to our healthcare services, the significant impact that they have in helping to get the most from the NHS's budget, and the many new and developing technologies which will help people live longer, healthier and more independent lives.

Dr Patrick Finlay

Chairman, Biomedical Engineering Association
Institution of Mechanical Engineers

Dr Helen Meese

Head of Healthcare
Institution of Mechanical Engineers

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NHS in numbers

Founded in
1948

The NHS is the largest and oldest single-payer healthcare system in the world

Treatment

It employs:

1,600,000

people, including 150,000 doctors, 377,000 nurses, and 155,000 scientists and technicians



Who treat:

243,000,000

patients each year, including undertaking:

82,000,000

Outpatient appointments

15,400,000

Hospital admissions

22,000,000

A&E visits

9,600,000

Operations

Costs

Costs the nation:

£115,000,000,000



Broken down into:

60%

Salaries

20%

Medicines

20%

Infrastructure & equipment

Which accounts for:

8.5%

Of total government spending. Equivalent to:

£1,994

Per person in the UK

Costs to patient:

£0

at point of service, regardless of class, income or illness

NHS Key Challenges

The NHS, in comparison to many other health services around the world, is an efficient and cost-effective operator. However, with lower annual increases in its budget set against a changing population demographic, the NHS needs to find ways to lower its costs. There are a number of challenges consistently highlighted by the NHS which need resolving or addressing.

Bed Blocking

Bed Blocking, or delayed discharge, is when a patient is judged clinically ready to go home but continues to occupy a hospital bed while plans are made for appropriate follow-up care. It is costing the NHS over £670M a year.

Ageing Population

The population is ageing with average ages now at 78.9 (M) and 82.7 (F) years. Older people require more medical and healthcare services. The percentage of over 65s will increase from 10.84M in 2012 to 17.79M by 2037. Over 85s will increase from 1.22M to 3.64M over the same period.

Growing Population

The population of the UK is growing and will continue to rise over the next few years with increased immigration. Budgets therefore have to go further to meet increasing numbers of patients.

Lifestyle

Conditions such as diabetes are costing the NHS about 10% of its annual budget; that's over £10bn a year, or £1M every hour. In England the proportion of men classified as obese in 2013 was 26% and 23.8% for women. Lifestyle changes to the population need to be addressed to reduce the number of medical and healthcare interventions.



Radical Changes in Healthcare

The NHS will be profoundly influenced in future years by technical innovations that have the potential to deliver improved healthcare at lower cost. Engineers have a vital role to play in developing and implementing these changes.

Big Data

The ability to process enormous amounts of data allows connections to be made that might otherwise not have been noticed. People with rare disorders can be identified and linked; hotspots of disease, possibly caused by an environmental issue, can be pinpointed. And personal medical records will be instantly accessible electronically whenever needed, without the delays and errors associated with sharing hard copy notes and images.

Precision Therapy

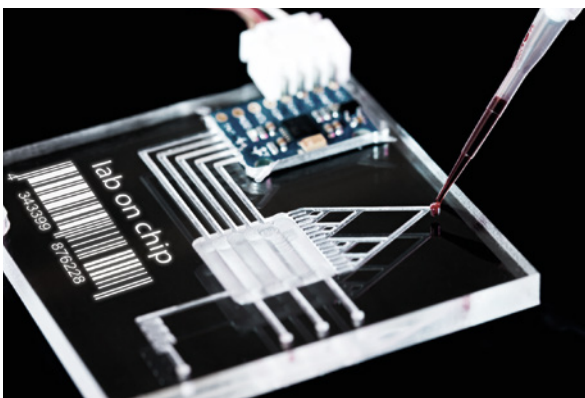
The development of micro and nano scale sensors and robots mean that surgery will be increasingly conducted by tiny manipulators that navigate to a target deep inside the body. This avoids the risks and complications of traditional open surgery, and will allow even complex interventions to be treated as day cases.

Remote Diagnosis and Treatment

The development of smart phone apps and body-worn measurement systems for healthcare is exponential. Simple fitness monitoring applications are now ubiquitous, and more sophisticated systems for assisting in the monitoring and control of diabetes, heart disease and management of medication are becoming common. These put the patient in first-line control of their own health, with access to expert support when needed.

Personalised Treatment

Advances in genomics will allow an individual's personal genome to be read, identifying disease risks even before any symptoms appear. Medicines and lifestyle regimes can be tailored to suit each person's profile.



The Biomedical Engineer

Biomedical engineering is one of the fastest-growing, most innovative and exciting branches of engineering. Its growth is being driven by an increasingly ageing population, expanding global healthcare coverage in developing nations, an ever-increasing public expectation of continuing fitness and health, and advances in medical technology that enable previously intractable conditions to be treated.

Biomedical engineers are responsible for the development of devices which diagnose, treat and rehabilitate patients. They develop technologies which help measure, model and simulate human physiology and anatomy, helping doctors make ever-more precise treatments and improving patient care. They are the pioneers of artificial joints and organs, robotic surgical equipment allowing minimal invasive procedures, and the growing area of personal health devices via mobile communications, helping people and doctors stay connected 24/7, even when the patient is at home.

Today, medical technology is one of the fastest-growing sales areas in life sciences, conservatively estimated at over £256bn globally. Many predict this sector will soon overtake pharmaceuticals in size and value. The UK is well placed to capitalise on this marketplace, having some of the most innovative and pioneering biomedical engineers already developing the technologies of tomorrow.

Within the NHS, biomedical engineers undertake a crucial role in the development, selection, use, maintenance and decommissioning of technologies for Trusts. However, unlike many other NHS professions, there is little uniform recognition of the biomedical engineer. NHS biomedical engineers are often assigned to different departments, operate at different levels of authority and have varying input into critical decision-making, depending on which Trust they are employed at. This inconsistency not only undermines the work of engineers, but hampers connectivity between Trusts on the development, procurement, maintenance, and sharing of medical equipment. At a time of financial constraints, this lack of cooperation and coordination between expert NHS engineers is preventing huge cost savings and efficiencies related to medical equipment, which could be made without affecting front-line services.

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Our Campaign

Today, the NHS is undergoing major reforms to ensure it is fit for purpose, yet affordable. Its biggest issue is servicing a growing, ageing population with increased expectations about what the NHS can do against a tightening budget, rising costs and a commitment not to affect front-line services. Efforts to reduce inefficiencies in services and management have helped reduce costs. However, the NHS is still struggling to live within its means, recording a £2bn deficit in 2015. The current system, fractured between Trusts, is preventing savings from being made, as well as hampering the deployment of new technologies. With the Government's expectation to find £22bn of additional efficiency savings by 2020, the NHS needs to find new solutions that will reduce costs but provide the services we all expect.

The importance of technology and engineering in the NHS has never been greater. Medical equipment can not only provide solutions to problems such as bed-blocking, but with equipment and infrastructure accounting for 20% of the entire NHS budget, an integrated strategy for the procurement and use of medical equipment alone could generate huge savings. However this can be achieved only if the NHS has a more consistent and coherent approach to the role of biomedical engineers, the adoption, procurement and use of technologies, and better communication and collaboration between clinical and engineering departments, as well as between Trusts.

The Institution of Mechanical Engineers is calling for the creation of a Chief Biomedical Engineer position in each acute Trust, working alongside roles such as the chief nurse and chief pharmacist; with consistent qualifications, level of authority, decision-making abilities and connectivity with other Trusts. This would not only increase the opportunity for cost savings but also encourage best practice in the procurement, maintenance and use of medical equipment.

In many Trusts, this position and role will already exist, albeit under different titles, departments and levels of authority. The costs of this change would be negligible, but the benefits to patients, services, budgets and the NHS would be significant. It is estimated that including engineering into this process has the potential to save the NHS over £700M each year.

In an ever-more technical environment, we need highly-qualified engineers to ensure the NHS is able to make the best decisions possible regarding medical equipment, which can facilitate early diagnosis, provide better and cost-effective treatment for patients, and help improve safe independent living, while reducing costs to the NHS in the short and long term.

Key Benefits of a Chief Biomedical Engineer

The six key benefits of having a Chief Biomedical Engineer in every Trust are:

- 1. Patient safety** – Overseeing the quality of clinical care by analysing and reporting on incidents involving medical devices, thereby helping to improve patient safety.
- 2. Value for money** – The National Audit Office states that value for money in the planning, procurement and use of high-value equipment, such as MRI scanners or linear accelerator machines, is not being met across all Trusts due to a lack of comparable information about performance and cost of machine use.
- 3. Equipment management** – The National Audit Office states that there is a lack the information and benchmarking data required by Trusts to secure cost-efficient procurement and sustainable maintenance of key elements in modern diagnosis and treatment.
- 4. Calibration and validation of equipment** – Currently there is a lack of consistent responsibility for this function. A recent Medical Device Equipment Alert relating to dangers of mis-calibrated scales was addressed to Risk Managers, H&S Officers, Estates Managers, Nurse Directors and Clinical Directors. It is unlikely that many, if any, of those people would have the training or equipment to calibrate even a simple set of scales. Mis-calibrations of more complex items, such as medical scanners, can result in life-threatening complications.
- 5. Research, development and translation** – As designers and assessors of equipment, biomedical engineers have an invaluable role working with clinicians to produce customised medical devices for individual patients. They contribute to the design, monitoring and analysis of clinical trials of new equipment, and support the translation of new products into clinical practice.
- 6. Long-term technology strategy** – Biomedical engineers are able to deliver a sustainable and well-defined plan to maximise patient safety, clinical safety and overall value from medical technology through understanding the needs of clinicians, patients and the wider NHS.

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