

Introduction

The Academy of Medical Sciences welcomes this study into the role of science, technology, engineering and maths (STEM) in service sector innovation. In this response, we draw on our previous published material to emphasise the role of innovation in the NHS and the very great importance of STEM for delivering effective health services. These issues are important for developing the NHS' own evidence-based culture and for the core role of the NHS in promoting innovation by other bodies. We would be happy to provide further information on any point covered.

A) The nature and extent of links between STEM and service sectors***Case study: innovation in the NHS***

Overall, the UK has a good track record in using STEM for biomedical innovation in industry and academia. However, this has not always been the case in the NHS. In the past, it was recognised that R&D in the NHS had suffered through the diversion of money intended for research into other areas.¹ Moreover, there has been a lack of incentives for R&D in NHS performance targets. Some specific areas have been particularly weak: the design and delivery of health services research and, more generally, poor links between research and policymaking, leading to delays in translating STEM advances into patient benefits.

Historically, the NHS has experienced difficulties in valuing innovation and in identifying and protecting its Intellectual Property. Its 'Innovation Hubs', which offer legal and commercial support to NHS staff who have a pre-market product, have enjoyed only limited success. There are lessons for the NHS to learn from other research funders, including MRC Technology, Cancer Research Technology and some universities, who have considerable experience in supporting knowledge transfer; this will be facilitated by the closer partnerships that are now possible within the Office of Strategic Coordination of Health Research (OSCHR).

The more systematic approach that has now been taken by the NHS to share best practice in innovation should also begin to translate into improved health services.² The Academy greatly welcomes recent efforts by the NHS to inculcate a more effective research culture and to seek to capitalise on new opportunities arising from progress in STEM, e.g. experimental medicine, clinical trial design, and public health science. We acknowledge that significant progress is being made in tackling the barriers to innovation. The Department of Health's 'Best Research for Best Health' strategy has been a timely and valuable initiative, and the establishment of OSCHR is a vital step in building partnerships to use STEM among the NIHR, MRC and other private, charitable and public sector funders. The creation of new mechanisms to coordinate the translation of research into better healthcare, such as the OSCHR translational research board, promises to be fundamental to the progress of NHS innovation.

¹ Department of Health (2006) Best research for best health. Department of Health. London.

² For example, inception in 2005 of the NHS Institute for Innovation and Improvement, www.institute.nhs.uk

Below is a brief summary of ongoing NHS reforms required to build an increasingly effective innovation culture:

- Ensuring transparency of research funding allocations, high quality peer review, governance and decision-making.
- Developing a culture of inquiry with a sense of ownership of the research and innovation agenda by NHS staff, health professionals and Trust managers.
- Maintaining engagement by other major research funders from the charitable and commercial sectors.
- Avoiding barriers to interdisciplinary work between different types of health researcher and between different scientific disciplines.
- Coordinating NHS in England and the Devolved Administrations to harness existing STEM for innovation and to identify gaps and opportunities.
- Identifying new STEM areas that may lead to innovation for pump-prime funding, while avoiding the temptation to be prescriptive in selecting priorities and targets. Identifying areas for strategic support will be influenced by scientific opportunity – creative ideas, the availability of talented researchers and advances in technology. It is vital to invest in basic research to fuel the pipeline for translational exploitation.

In key respects, NHS support and use of research, built on excellence in STEM, can be regarded as a model for other government departments that provided public services (see Appendix 1). We now highlight two key areas where there is considerable potential for health services innovation to be influenced by STEM: 1) improving regulatory, governance and IT structures; and 2) implementing policy objectives.

1. Improving regulatory, governance and IT structures

The NHS is both a research resource and test-bed in which to develop, monitor and optimise healthcare products and services. The introduction of Connecting for Health (CfH) and the Electronic Patient Record offer unparalleled opportunities as a research resource. However, the Academy has been concerned that a number of factors, including confusing legislation and professional guidance, bureaucracy of process and an undue emphasis on privacy and autonomy, are having a detrimental effect on UK research activity in this area.^{3,4} We expect the Department of Health to take a leadership position, both in engaging the public to explain the innovative value of research using health care records and in ensuring that CfH and associated activities underpin the research mission of the NHS.⁵

2. Implementing policy objectives

Special Health Authorities (in particular, the National Institute for Health and Clinical Excellence - NICE) and the Medicines and Healthcare Regulatory Authority (MHRA) as an Executive Agency, are also of great importance in taking forward departmental objectives. The Academy's views have been presented in detail elsewhere.^{6,7} Of particular relevance here is our analysis of MHRA strategic priorities, which noted the opportunities for building partnerships between the NHS, academia and industry to facilitate safety assessment, support innovation and promote public health. Our analysis of NICE raised

³ Academy of Medical Sciences (2006) Personal data for public good. <http://www.acmedsci.ac.uk/p48prid5.html>

⁴ Academy of Medical Sciences (2007) Evidence to the House of Commons Health Select Committee on the electronic patient record. <http://www.acmedsci.ac.uk/p100puid111.html>

⁵ Nature (2008) In rude health. *Nature*, **454**, 1-2.

⁶ Academy of Medical Sciences' (2007) Response to the House of Commons Health Select Committee inquiry into the National Institute for Clinical and Public Health Excellence. <http://www.acmedsci.ac.uk/p100puid102.html>

⁷ Academy of Medical Sciences (2007) Response to the Medicines and Healthcare Regulatory Authority call for evidence on its challenges and priorities for the next five years. <http://www.acmedsci.ac.uk/p100puid113.html>

some generalisable issues that are broadly relevant to the use of STEM in health services innovation: (i) the need for greater public engagement to improve understanding of processes and restore confidence in policies emerging from those processes; (ii) the need for better external scrutiny of basic assumptions and models used; (iii) the need to employ evidence more swiftly in decision-making and to compare with equivalent systems elsewhere to ensure consistent adoption of best practice; (iv) the need to improve procedures for gathering evidence.

Nature of influence of STEM and types of engagement

The Academy and our Fellows have, of course, many different types of contact relating to STEM within health services. In the particular case of health services research, a report of a meeting co-organised by the Academy and the Health Services Research Network provides a detailed perspective on the nature and scope for such research, on methodological challenges, on building engagement with the user community and on a range of issues for improving the quality, relevance, evaluation and impact.⁸

The use of STEM to inform decision-making in public policy was also extensively discussed in the recent Academy report '*Identifying the environmental causes of disease*' and we suggest that some of the recommendations emerging from that work are relevant to this study (see Appendix 2).⁹

In characterising the broader responsibility of the STEM community to engage with the Government we highlight two vital needs:

- The importance of having an appropriate means of horizon scanning for identifying future science-related issues – we have welcomed the continuing commitment by government to its Foresight programme.¹⁰
- The Government must make best use of scientific advice, whether derived from its commissioned research or from other sources. Government faces critical societal issues where it must draw on expert, *independent*, sources of advice, particularly in clarifying what is known and what is uncertain in the evidence base. As the House of Commons Science and Technology Committee observed, learned societies have a key part to play in this process.¹¹

Mechanisms to support engagement

The Academy has been involved in multiple ways in engaging with the Department of Health/NHS: at the corporate level; through the work of individual Fellows; in the joint initiative to build the UKCRC; on specific projects; and in large programmes to support capacity building. We would be pleased to provide further information on any of these.

We take the opportunity here to highlight an additional issue relating to engagement between public health service organisations and their partners – the role of public procurement in supporting innovation. Promoting a culture of innovation within procurement provides incentives to reward commercial investment in R&D and, thereby, expand business innovation. Detailed discussion is beyond the scope of this response but it is important to ensure that government objectives to renegotiate the Pharmaceutical Price Regulation Scheme – to achieve greater efficiency in NHS expenditure – do not inadvertently impede pharmaceutical sector investment in R&D by significantly weakening

⁸ Academy of Medical Sciences (2005) Strengthening Health Services Research www.acmedsci.ac.uk/download.php?file=/images/publication/Strength.pdf

⁹ Academy of Medical Sciences (2007) Identifying the environmental causes of disease: how should we decide what to believe and when to take action? <http://www.acmedsci.ac.uk/p47prid50.html>

¹⁰ The Academy's recent project 'Brain science, addiction and drugs' (2008) followed a Foresight report in 2005 'Drug Future 2025?' and was supported by the Department of Health.

¹¹ House of Commons Science and Technology Select Committee (2006) Scientific advice, risk and evidence-based policymaking. HMSO. London.

the reward for innovation. Public health services must also build the flexibility to cope with an uncertain future: new pricing challenges will emerge if the promise of better therapeutic targeting of patients is to be achieved and new forms of expedited regulation of innovation introduced.¹²

B) STEM, people, service sector innovation

Movement of people between academic science environments and the NHS

Previous work by the Academy has described the importance of encouraging career mobility between the NHS, academia and industry sectors and we have made specific proposals to achieve the desired movement.¹³ The Academy continues to be directly involved in identifying skill needs and in supporting skill development, for example through our mentoring schemes.

It should also be noted that other policy developments can inadvertently damage efforts to secure the next generation of medical scientists and this is a concern to all sectors. The initial introduction of changes via the Medical Training Application Service, as part of Modernising Medical Careers, imperilled the future supply of first-class, mobile, clinical academics. The Academy welcomed the proposed solution in the Tooke report¹⁴ and we emphasise the need for diversity, flexibility and excellence in medical training.

C) Enhancing the contribution of STEM to service sector innovation

The main barriers to further innovation

To enhance health services innovation, it is necessary to continue tackling challenges across a broad front:

- Redoubling efforts to use the NHS to grow partnerships across the public, charitable and private sectors.¹⁵
- Building innovation capacity by developing, recruiting and exchanging staff.
- Facilitating NHS uptake of innovation from outside.
- Taking a leading international role, e.g. in the European Innovative Medicines Initiative.¹⁶
- Developing UK coherence in policies to support innovation. The Health Innovation Council is an important new entity with a core responsibility for overseeing innovation. This body must ensure that its objectives and actions are well integrated with other functions, particularly the Technology Strategy Board, which has recently adopted enhanced roles following the Sainsbury Review, and the sector-specific Long-term Strategy Groups and Innovation Teams created by government departments for pharmaceuticals, diagnostics and other medical devices.

The recent Darzi report on the strategy for the NHS in England rightly observes that the consideration of innovation should not be confined to research but is rather 'a *broader*

¹² These issues are discussed in detail in the Academy report on Stratified Medicines (2007).

¹³ Academy of Medical Sciences report, Research careers in the biomedical sciences: promoting mobility between academia and industry (2007).

¹⁴ Academy of Medical Sciences (2008) Response to the report of the independent inquiry into modernising medical careers 'Aspiring to Excellence' <http://www.acmedsci.ac.uk/p100puid123.html>

¹⁵ The initiative in Scotland involving partnership by the NHS, universities and a pharmaceutical company together with the Scottish government, to support R&D in translational medicine, denotes one model that merits broader application in the UK.

¹⁶ Further information is provided in a meeting organised by the Academy to raise awareness in the STEM community about this Joint Technology Initiative, www.acmedsci.ac.uk/forum

concept encompassing clinical practice and service design'.¹⁷ Among the specific recommendations in the Darzi report, relevant to points made earlier in this response, are:

- Establishing Health Innovation and Education clusters bringing together partners from the NHS, academia and industry.
- Requiring Strategic Health Authorities to have a legal duty to promote innovation.
- Ensuring that clinically and cost effective innovation in medicines and medical technologies is adopted.

We commend this growing recognition of the importance of innovation in public health services.

Appendix 1: Model attributes of NHS

There is evidence to show that the underlying processes required for the effective transfer of knowledge from different sources into improved services are shared across different types of service. An analysis of the common features of key service systems was provided recently by the University of Cambridge Institute for Manufacturing; a commentary by the Foundation for Genomics in Public Health observes the particular application in health care services systems.¹⁸

This commonality detected between different service systems reinforces the points made in a recent contribution by the Academy to the Office of Science and Innovation Review of Science in the Home Office, where we suggested that in several areas the recent research and innovation practice already accepted by the Department of Health provides a model for other government departments. This was based on a 2006 Academy symposium on 'Science of Violence', which brought together biomedical scientists, policymakers, legal professionals, the media, the general public and law enforcers to discuss ways in which epidemiological, medical and public health sciences could contribute to the evidence base underpinning policymaking about violence.¹⁹

The meeting drew attention to the opportunities medical science can offer improve public service delivery in the Home Office. Key messages relevant to role of STEM, particularly medical science, in innovation in the service industry include:

1. Increase the use of randomised controlled trials in research into services provided by the Home Office. This could be achieved through the establishment of a dedicated fund for such applied research, as well as a field trials unit.
2. Establish an 'Institute of Excellence' to guide delivery of public services in the Home Office based on the NICE model.
3. Develop a national cadre of crime analysts for Crime and Disorder Partnerships whose role is to root Home Office policy in quantitative and experimental methodology.
4. Develop police and offender management schools based on the medical school model, where service delivery, research and training are undertaken in close conjunction.

¹⁷ Darzi A (2008) High Quality Care For All – NHS Next Stage Review Final Report. Department of Health. London.

¹⁸ Brice P (2008) Report calls for new support and funding for service innovation. www.phgfoundation.org/news/4228

¹⁹ See <http://www.acmedsci.ac.uk/p48prid44.html>

Appendix 2: 'Identifying the environmental causes of disease: how should we decide what to believe and when to take action?'

A report by the Academy (2007) exploring the use of research evidence in public health decision-making offers several recommendations to government that are relevant to the use of STEM in promoting innovation:

Report Recommendation 1

Government should build upon their recent efforts to integrate science into policy making by further increasing capacity building by means of:

- Embedding researchers into policy teams
- Providing senior civil servants with scientific training
- Seconding scientists to government
- Building a cadre of "evidence brokers" within government who are trained in both science and policy.

Report Recommendation 3

The Department of Health and other relevant government departments should ensure that there is greater emphasis on both pilot studies and systematic rigorous evaluation of the effects of interventions in developing and implementing health policy.

Report Recommendation 5

The Department of Health, Research Councils and charities funding research into the environmental causes of disease and interventions to prevent or treat disease should continue to involve the public and patient organisations by inviting them to participate in their expert scientific advisory committees.

We are grateful to Dr Robin Fears for preparing this response.

The Academy of Medical Sciences

The Academy of Medical Sciences promotes advances in medical science and campaigns to ensure these are converted into healthcare benefits for society. Our Fellows are the UK's leading medical scientists from hospitals and general practice, academia, industry and the public service.

The Academy seeks to play a pivotal role in determining the future of medical science in the UK, and the benefits that society will enjoy in years to come. We champion the UK's strengths in medical science, promote careers and capacity building, encourage the implementation of new ideas and solutions – often through novel partnerships – and help to remove barriers to progress.

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