UK COMPUTING RESEARCH COMMITTEE

Developments in Information and communication Technology relating to Health and Healthcare in the next ten to fifteen years

Comments to the Royal Society

This response to the call for evidence by the Royal Society on the developments in information and communication technology relating to health and healthcare in the next ten to fifteen years is made on behalf of The UK Computing Research Committee (UKCRC).

UKCRC is an expert panel of the Institution of Electrical Engineers (IEE), British Computer Society (BCS) and Council of Professors and Heads of Computing (CPHC) for computing research in the UK. Its members are leading computing researchers from academia and industry.

1. UKCRC have given attention to those specific questions within its remit, most particularly those relating to future technological developments and their attendant benefits (see 4 to 8 below). We have also given some attention to the potential risks in realising these benefits (see 9 to 10 below). UKCRC is willing to provide more detailed technical advice should it be required.
2. In framing our response we have recognised the potentially enormous scope of the study that you are engaged on. It is difficult to identify an area of health and healthcare that will not be profoundly affected by developments in computing, and it is difficult therefore to stop short of providing a comprehensive tour of health informatics. We have, for example, identified computing developments in fields as diverse as language and speech (automated 'home companions') and network analysis (modelling of viral behaviour) that have clear implications for health and healthcare. In place of a comprehensive analysis we have sought to identify a small number of key trends each of which encompass a range of computing technologies. We believe these trends reflect our broadly positive view of the impact of information and communication technology.
3. Research in computer science will improve the information technologies that support the delivery and management of healthcare through better information, communications and automation. This has been true for the past 30 years and there is no evidence to suggest it will cease to be true for the next 10-15 years. In particular we anticipate that we will be able increasingly to deliver high quality, well-engineered and easily useable, distributed information systems that provide accurate information at the point of healthcare delivery.
4. A national patient record system capable of providing selective relevant information to doctors, social workers, emergency paramedics and researchers with nationwide access is technically feasible. However the success rate in the UK and elsewhere for implementing such large-scale systems has been notoriously low. It requires early involvement of all users, detailed requirements analysis, incremental prototyping and the use of sound software engineering approaches throughout the system life-cycle. This does not seem to have been the case with past healthcare IT systems. There is a need for process & culture change, within the healthcare services, which IT can enable. It is also essential to have a good understanding of Computer Science research as well as products.
5. The continuing development of mobile and portable consumer information technology suggests that people may be able to take more responsibility for and control of their own health. Health monitoring and diagnosis through the use of personal information systems, implanted sensors and home monitoring systems may permit care to be increasing community-based rather than delivered through hospitals, surgeries and health centres. Access to medical and healthcare information and expertise, tailored to the needs of the individual, will become increasingly ubiquitous. These technology developments can be used to monitor and improve the life-style for the elderly as well as patients with chronic illness.
6. Experiments have shown that information processing based on multi-cellular neural recordings can be used to correctly interpret and control bodily movement. This research, which integrates sophisticated computing with the physiology of motor cortex, may have significant impact on the design of prosthetic devices.
7. From the growing area of computational science we can expect significant developments in computer modelling of human biology, accelerating drug discovery and making possible a more 'personalised' medicine. For example, computational models of the heart can be used for drug testing without the need for animal experiments. Foundational computer science has an important role to play in this respect, delivering novel modelling schemes and analytical tools. The fusing of

information resources from genes through to clinical trials, including complex imaging information will accelerate the pace of medical science and the expectations that people will have about the ability of medical science to maintain their health and well-being. Fundamental advances in the life sciences will be accessible to practitioners enabling increasingly scientific, evidence-based healthcare.

8. These trends are interlocking. Take for example the care of diabetes: implanted diagnostic sensors and actuators might incorporate new models of glucose homeostasis that depend on advances in molecular biology; these same devices might also be seamlessly integrated into the healthcare management infrastructure and with the electronic healthcare record.
9. In taking a positive view we are conscious also of the risks that are entailed in realising the potential of information and communication technology. These risks include the 'system risk' associated with the dependability of complex software systems and the UKCRC is an Expert Panel of the BCS, the IEE and CPHC 'project risk' associated with the difficulty of managing large-scale software engineering projects in cost-constrained settings. In both these areas we would expect research to deliver new techniques that can alleviate some of the risks. We are however conscious that changing organisational practices and adopting these techniques can itself be a difficult and risk prone process. Improvements in engineering disciplines that underpin the successful delivery of new computing systems can make a significant contribution to surmounting the resourcing challenges referred to in the call.
10. We note the concern of the study with issues related to data confidentiality and availability. These are profoundly difficult issues in which the needs of the individual and those of society can sometimes be opposed. There are obviously important technological issues that need to be tackled in this area. It must be stressed that advances in information and communication technologies do not necessarily lead to a reduction in privacy. On the contrary, advances in computer security technologies and in the mathematics on which they are based can do much to empower the individual to make informed decisions and control access to their personal information.
11. If, as we believe, information and communication technologies are to have a major impact on health and healthcare then we must be concerned with access to the benefits that these technologies will yield. Many of the most profound health challenges lie in the less developed countries. HIV/AIDS, Malaria and the effects of malnourishment are global health challenges that we must collectively face. The widespread reach into Africa and Asia of devices such as mobile phones shows that advanced technologies need not necessarily be a barrier to access but at the same time we need to be conscious that poverty and a poor technological infrastructure are serious roadblocks to improvements in health and healthcare.
12. We believe that it will be important for engineers, life scientists, healthcare professionals and computer scientists to develop new partnerships to realise the benefits discussed above. These partnerships will need to be fostered by scientific societies and professional institutions. Education has an important role to play in ensuring that there are qualified professionals and researchers to engage in such multidisciplinary work.