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Specific questions

The working group would particularly welcome responses to some or all of the questions below.

Identifying relevant future technological developments

1. **What relevant technology trends are likely to impact on health and healthcare in the next ten to fifteen years?**

Nanotechnological developments will impact on ICT in healthcare in multiple and complex areas. For example, the detection of cancerous cells, detection of wide range of pathogens in blood, tissues, fluids, and water; medical imaging will be enhanced using nanoparticle based materials; diabetes treatment may be delivered by nano-sensing of an imbalance in blood glucose level; cancer treated with external light/heat source on quantum-dot type nanoparticles; tissue regeneration and neurological repair and enhancement; *in vivo* monitoring by nanoscale devices; real-time molecular pathology; ICT-enhanced diagnosis and monitoring of a range of diseases and sophisticated health care in remote locations by means of telemedicine. A broad range of wireless technologies are increasingly being used for example, technologies that allow the sensing and monitoring of patients and the collection of data on a wireless basis and the presentation of the data in a virtual environment to remotely located health professionals who can collaborate to provide treatment. This may also involve the collection and distribution of medical imaging data. Key technologies include: Sensors: nanotechnology plays a role with non invasive sensors such as synthetic skin patches. Body area networks: the communications from a body mounted sensor network to central body mounted node. This brings in wireless propagation around the body and new protocols designed for low power sensors as well as routing algorithms such as ad-hoc networking. Personal Area Networks: communication from patients to a localised server which may require very high bandwidths. Ultra Wide bandwidth systems play a part using pulse rather than continuous wave transmissions. Virtual and immersive environments: allowing remotely located healthworkers to meet in a virtual environment to access patient data and work on it. It is envisaged that wireless systems will become extensively involved in hospitals to automatically process vast quantities of data reflected on pop up displays at the bedside. This is possible with WiMax systems but issues of security on the radio bearers need to be resolved before implementation.

ICT developments in healthcare involve *inter alia* massive data storage capability; extensive data analysis capability (cross-matching, data-mining, etc.); extensive potential for networking, data exchange, information-sharing, etc.; interception, encryption and decryption techniques; monitoring, surveillance, inspection and sampling techniques; integration with other new technologies in communications, imaging (fingerprints, face, iris and voice recognitions, etc), and forensic work. ICT developments in healthcare will interface with new digital technologies now entering other areas such as policing, e.g. the identification of suspects, victims and witnesses in relation to health and social care related areas such as child abuse.

Assessing the potential positive and negative impacts of relevant future technological developments

2. What areas in the provision of health and healthcare could be positively or negatively affected by these developments?

The technologies outlined above all have the potential to impact positively on developments in healthcare. However, there are also many potential negative consequences of such developments. For example, professionals are deeply concerned about the complexities of sharing information e.g. Accident & Emergency Departments, Social Services and Police, especially issues of information sharing and confidentiality, consent, professional values and autonomy, human rights, organisational accountability, staff safety and public interest collaboration. An emerging

specific issue is the extent of A&E disclosure to the police and to the social services and its legal and ethical parameters (Hunt & Arend, 2002).
The greater reliance on modern ICT technology and the greater participation of the older patient cohort raises issues that have already been addressed in the 'digital-divide'. Specific needs exist for this sector as for the disabled and will need to be addressed separately.
Increasing ICT may result in greater distancing of the health carers and managers from the community, its needs and values, by creating a technological intermediary of 'information' rather than ongoing negotiated understanding. This may be exacerbated by a resultant tendency to neglect non-digital (or non-digitizable) sources of information and communication.
Security and trust remain issues for acceptance of many new procedures enabled by modern ICT. Trusted systems need to be addressed as well as security in the special context of healthcare systems.

2 What actions should be undertaken now to maximise positive impacts, or to prevent or minimise adverse effects?

There is a real risk of difficult-to-control and unpredictable cascades of information through networks and sub-networks, risking harms to individuals, groups, corporate bodies and governments. The social consequences may extend beyond an invasion of privacy. For example, opportunities in employment, insurance, and financial credit, etc. may be affected. Stakeholder groups need to reach agreement on the technological devices and the ethical and legal instruments and standards for dealing with the 'cascading' of information between agencies and networks.
Dedicated research programmes which address some of the short comings now need to be initiated by research councils in collaboration with NHS and other stakeholders.

Evaluating the wider implications of relevant future technological developments

4 Do you have any concerns associated with the generation, release and subsequent use of personal data?

Diagnostic and monitoring devices may be linked to data storage and transmission devices, themselves linked to other such devices (some of them remote) raising ethical and legal issues about what, where, why, and who, as well as technical problems of limiting access (encryption, quantum encoding, etc.) (Hunt & Mehta, 2006).

5 What medico-legal and ethical issues merit consideration when introducing new technologies, such as the responsibilities, processes and liabilities for decision making?

Healthcare professionals and managers will need to address ethical questions of confidentiality, many of them traditional but in new settings, and new in application, requiring new thinking. Some of the questions which may arise relate to 'trespass' by accessing other communications networks, systems, files, accounts etc; potential breach of confidentiality. E.g have the implications of Human Rights legislation (Esp. Art. 8) been considered? Have the implications of local and national privacy legislation been considered? Have strict enough technical and procedural measures been taken to protect the data from unauthorized access? Is there a policy on retention, review and disposal of information?
Questions of consent may include: does the data subject have the right to review or correct this data? Is there a presumption in favour of consent of the data subject? Have the implications of Freedom of Information Legislation been considered? Have the implications of the data manipulation been considered in relation to public confidence in the health service?
Professional questions related to 'ethical justice' will also arise and may include: Is the gathering, storage, analysis, interpretation, application of this data discriminatory on the basis of gender, race, religion, age, disability, nationality, or in any other way?
Who should the data be shared with, and on what ethical basis? E.g.internal to the organization, associated with the organization, other agencies/individuals outside the organization, public

inquiries. Has the communications legislation in all the nations involved in the data manipulation been considered?

6 What regulations or other mechanisms (including standards) would facilitate the responsible development of relevant technologies?

The principles of public accountability need to be better understood, publicly negotiated, promulgated and implemented by large organizations. The development of ICT in healthcare will probably require extension of the Freedom of Information Act, which gives the public a (limited) right to know. At the same time, ICT will make possible an informed accountability, in which the public as well as professionals have easier, more extensive and faster access to trend and comparative data on treatments, alternatives, performance indicators, etc.

Within the ICT world standards are key to the future systems development. When setting future ICT standards there needs to be realization of special healthcare needs in the applications of systems and technology. If these are not incorporated into standards it could block the use of future systems for these applications.

Many future ICT systems will be radio based and the complex radio environment in which healthcare usage exists needs to be further investigated and in particular the interference environment. The regulatory environment under which OFCOM manages future radio spectrum needs to appreciate and to consider such future scenarios.

7 What infrastructure would be required to allow any new technologies to be used effectively?

Within the context of the responses given to the specific questions addressed by this consultation key infrastructure issues will include the mechanisms for ensuring compatibility and monitoring of ICT health-care related devices across the range of evolving (and rapidly changing) care sectors (including the individual's own home) and potentially the wider community environment, such as Schools, Colleges, workplaces etc.

Standardisation and approval of use of all future equipment needs to be carefully considered as does the agencies that provide the approvals.

8 What are the most likely promoters and barriers to the take up of new ICT devices and systems?

Economic drivers are powerful promoters of ICT developments and are often inter-related in multiple and complex ways with fundamental social change. This is likely to continue into the forseeable future with a rapidity not always matched by effective evaluative processes which often constitutes a barrier to effective developments. Many of the issues addressed in the responses to other questions will also act as promotors/barriers to ICT developments as outlined in the responses given (e.g. ethico-legal, education, infrastructure and societal developments).

The biggest promoters are the increased efficiency of operation and hence the reduction in costs. The biggest barriers are likely to be the trust/security and friendliness of the new systems as well as their cost.

9 What education and training would need to accompany the introduction of any technologies, and who would need to be involved?

Technical education and training will be required at the range of levels appropriate to developing professional roles as well as new knowledge and skills required by the public to effectively utilise ICT developments. This will mean all elements of the formal education sector will have a role in preparatory and continuing education; and workplace development will become increasingly significant. Public education through professional support as well as informal approaches and mechanisms will need to mirror the developments which are changing the health care approaches available to our population, including access to care (and it's monitoring) in the home. In particular, it will be important to include the development of transdisciplinary approaches in

university education and CPD to generate ethical awareness of the implications of what may sometimes appear on the surface to be 'neutral' technical enhancements of existing technology.
We see the need for new courses across the board that are focused on these aspects of healthcare. By definition they will need to be multidisciplinary involving communications and computing, psychology, ethics, healthcare practice and management.

10 How are professional roles and responsibilities likely to be affected by the increasing use of ICT?

This will encompass many of the issues outlined in the responses throughout this consultation, including greater technological sophistication and engagement, and an increasing emphasis on ethical and legal frameworks which will impact on the range of health and social carers in ways not currently embraced within the workplace. Professionals will increasingly move to greater technological and skilled roles with 'caring support' being provided by other workers. This approach is fundamentally altering the shape of professional roles into the future.

11 How can the development of technologies that meet patients' and informal carers' needs and are practically useable be best facilitated?

To a large extent this must reflect our developing society in all areas related to lifestyles and quality of life. Service users and carers needs must be one of the key components considered as an integral part of complex decision-making processes related to ICT developments. This will inevitably include ethico-legal issues as well as infrastructure, education and support issues.
The research in this area must be multidisciplinary based and involve users from the outset. It should not be left to technology push but involve user pull. This means setting up multidisciplinary teams to address the problems and iterative techniques with users in the path.

12 What are the potential impacts of the costs of any of these new technologies?

Health economic analyses need to be undertaken on an 'on going' basis as the technologies develop in order to assess the overall 'cost benefit/value added' component to health outcomes and quality of care/life. The resource impacts will affect all areas of health care including diagnostic and treatment options, prevention, screening and professional, social and informal caring. ICT in its broadest sense has the potential to fundamentally change the way in which the health and social care to our population is provided. Like any other radical technology Healthcare ICT is not just a set of techniques that have appeared independently of society and about which we can now make application-based decisions. It is emerging within an *existing* nexus of decisions, relationships and values, not all of them consistent or non-contentious. It is emerging within a network of relationships and processes that manifest the choices we have already made over history and are currently living with. No technological development can be socially neutral, but increasingly requires precautionary social and ethical understanding, and the cost effects must become an integral part of the assessment and evaluative process.

13 What are the implications of the international use of future technological developments, such as global use of health data, variability of ICT-enabled support, and interoperability?

Within the context of the questions posed for this consultation exercise the implications for the international use of ICT will often mirror those already outlined in response to earlier questions (e.g. use of health data, variability of ICT enabled support/interoperability for those travelling etc.). In particular, ethical-legal issues are likely to be of considerable significance in relation to international ethical and legal frameworks which differ widely worldwide as will technological literacy and sophistication.

Here also standards for systems and equipment are key to the integration and support of ICT equipment. We see an increasing need for the development of healthcare related IT standards and need to investigate the bodies that are best suited to take these forward.

References

Hunt, G. & Van der Arend, A. (2002) ‘Treatment, Custody, Support: An Exploratory Qualitative Dialogue to map the ethics of interagency co-operation in hospital emergency departments in the UK and Netherlands'’ Journal of Interprofessional Care 16:3 (2002) 211-220.

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