



White Rose HIP Health Technology Bulletins

The White Rose Health Innovation Partnership (WRHIP) aims to accelerate new health-related technologies by facilitating interactions between academia, industry and the NHS using an *open innovation* approach.

The new projects funded as part of this initiative are built upon a foundation of excellence in health innovation by the Partnership's members. This series of Health Technology Bulletins offer an introduction to this research excellence and cover a broad range of clinical and technology areas.

Each bulletin is written to give a general introduction to the topic area along with short case studies of clinical applications of new knowledge. Information is also presented on where to learn more about these new technologies and health challenges, and how to access the network of health innovation professionals established by the Partnership.

E-Health

The growing digital economy has seen innovative technologies such as digital marketplaces, mobile communication, next-generation games consoles and social networking becoming more ubiquitous in our everyday lives. The "mashing up" of data across the World Wide Web through web services has given consumers greater control over all kinds of information. Advancements in commercial applications such as *Wii Fit* – an exercise and fitness video game developed by Nintendo and released in mid-2008 in the UK – are only the tip of the iceberg when it comes to achieving fully pervasive healthcare where the aim is to "make healthcare available to anyone, anytime, and anywhere by removing location, time and other restraints". Developments in mobile computing such as the Apple *iPhone* using haptic (touch) technologies, electronic tagging through Radio-Frequency Identification (RFID), miniaturisation of laptops such as the ASUS *Eee PC*, and mobile broadband are making information more accessible than ever before. A Grand Challenge is to achieve the level of interoperability championed in the commercial sector within healthcare delivery in a way that is convenient to both consumers and providers. The role of e-health is to integrate the complex networks of people and technologies ideally utilising standardised guidelines and practices to empower the delivery, governance and management of innovative information-sharing products and services amongst healthcare consumers and providers.

The coupling of public sector services and the UK Government have slowed many "big-bang" adoptions achieved in the commercial

sector due to issues including increased accountability and bureaucracy. However, the "joining up" of public services as part of *Transformational Government* policies – aimed at designing and delivering public services around the needs of citizens – and new integration opportunities created through the Electronic Patient Record (EPR) and Summary Care Record (SCR) are sure to provoke interesting technological innovations. For example, *Google Health* is experimenting with sharing personal health information, such as medical records and prescription histories, to authorised web sites – something which is strived for by the NHS incarnation of *HealthSpace*. Lord Darzi's (2007; 2008) *NHS Next Stage Reviews*, which were commissioned by the Prime Minister, Chancellor of the Exchequer, and Secretary of State for Health, put e-health into context. To deliver the vision of a fair, personalised, effective and safe NHS the focus must be to: give patients and the public better quality of service by treating them with dignity as individuals; increasing the transparency of services through single points of access to healthcare information; and, giving them more 'clout' through better choice and personal control of their care; look beyond increasing the capacity of the NHS by improving the effectiveness, efficiency and quality of care through locally-led, patient-centred and clinically-driven change.

In this bulletin we will investigate two areas of healthcare innovations, consumer health informatics and professional clinical informatics, discussing some of the applications being developed. We will then look at future directions and draw some conclusions on where we feel healthcare delivery will be supported by information technologies in the future.



Consumer Health Informatics

The role of e-health in consumer health informatics has been around for over two decades primarily concentrating on the old or vulnerable. With innovations in technology and ways of working in public health there is a paradigm shift that is moving health information management at home from curing into caring and supporting. Improved accessibility of digital media channels such as interactive television, next-generation games consoles and the WWW has, and will continue to, lead us towards new partnerships of trust between consumers and providers.

Communication tools such as *HealthSpace* – a secure online health organiser similar to commercial products such as *Google Health*, *Microsoft HealthVault* and *Practice Fusion* – are attempts by the NHS to give patients and the public greater visibility of their healthcare information. This is achieved by giving them access to personalised services through integrations with *Choose and Book* and the *NHS Care Records Service*. Research at early adopter sites has shown that the public's awareness, perceptions and uptake of *HealthSpace* and the Summary Care Record (SCR) varies greatly. More work is required to raise their profile and to educate the public of the potential benefits of such innovations.

Assistive technologies are used to aid people with difficulties in activities of daily living, for monitoring and rehabilitation. These include blood-glucose monitoring systems for diabetes sufferers and projects such as the alcohol education tool, *Unitcheck*, being developed at the University of Leeds. Gaming technologies such as the *Nintendo Wii* are shifting healthcare monitoring to preventative and "healthy lifestyle" applications with games such

as *Wii Fit* which build upon other fitness technologies such as pedometers. Country-wide healthy-living schemes such as *Feel Great Britain* headed by Nintendo are becoming commonplace and yet are working independently from the NHS who could benefit from the attitudes of participants and provide incentives for better health.

In commercial sectors there is a growing interest in healthy living and well-being information. Adoptions of social networking sites such as *Facebook* and *MySpace* have influenced start-ups of social networking sites dedicated to personal healthcare such as *iMedix*, *MedHelp*, *trusera* and *WEGOhealth*. Such sites offer virtual communities enabling users to share experiences with *real* people locally and across the world. Social networking is a growing area of healthcare innovation and has been the topic of a masterclass headed by the *NHS Faculty of Health Informatics*, features in the *Armchair Involvement* programme at the *NHS Institute for Innovation and Improvement*.

Consumer health informatics is a rapidly expanding field of e-health which will continue to grow and mature alongside commercial innovations. Currently there is a poor connection between the commercial and specific "healthy lifestyle" uses of technology but with appropriate integration with *HealthSpace* and the SCR users could begin to see *Wii Fit* scores being directly linked into their personal health records and made available to their GP during consultations. The key to success will be to harmonise working between commercial and public sectors. This will create innovative pervasive healthcare products that work "out-of-the-box" rather than requiring additional effort on behalf of consumers.

Professional Clinical Informatics

Contemporaneous to the advances in consumer health informatics is the application of technologies to complement traditional and innovative models in the delivery and management of healthcare organisations. Environmental complexities call for more process-driven and qualitative perspectives in addition to current functional areas, tasks and roles models. Innovative models such as business process re-engineering; Six Sigma/change acceleration process; and, total quality management are seen as the way forward for healthcare management thinking. It would be advisable for technology providers offering professional clinical informatics tools to support these more flexible models in their applications.

The implementation of the NHS-wide broadband network, *N3*, as part of the *National Programme for IT* has enabled many new data and voice communications opportunities. The "spine" facilitates the *Choose and Book*, *Electronic Prescription Service*, *Care Records Service* and the *Picture Archiving and Communication Systems (PACS)* as well as tools such as e-mail directory service *NHSMail*. Successful innovations include the *Yorkshire Air Ambulance* which has cut average response times by 6 minutes and *Cornwall and Scilly Isles PCT* which provides telecare and telemedicine applications such as video-conferencing across their *Community of Interest Network (CoIN)*.

Clinical decision aids and management tools are well-documented, especially computerised physician order entry (CPOE) or 'order comms' and systems such as the *PACS*. Advantages include increased compliance with guidelines, eliminating the time gap between point of care and point of

service, and cost and efficiency gains from the digitisation of image processing. Clinical decision support systems (CDSS) such as *AAPHelp* have yet to penetrate in the UK – due to lack of access to IT resources, location of access points and poor diffusion – but have shown promising results in trials in India when used as an education tool for young graduates.

With the exception of *PACS*, which has revolutionised radiology, the diffusion of clinical informatics systems has been poor outside of primary care. The reasons for this are complex but include the: lack of cost-benefit models for estimating financial implications of systems. These are exacerbated by the difficulty in quantifying savings of improving quality of care; lack of understanding of new risks generated by implementing systems; need for staff involvement and adequate training and understanding to operate new systems; and, perceptions of new technology increasing staff workloads. Developments need to be made to tackle each factor to improve the rate of adoption of new innovations.

Unlike consumer health informatics professional clinical informatics relates to the workflows of professionals. It may be more difficult to penetrate this market unless thorough cost-benefit analyses are conducted with staff involvement; even then ideas may be rejected if not suited to clinical practice and can be shown to improve patient safety and quality of care. Developments in clinical decision aids have the potential to become good education tools for junior professionals but have proved less successful when used to mimic day-to-day professional knowledge. Systems must be responsive to the way clinicians and hospitals work rather than focusing on the accompanying technology.

Future Projections

The applications of today should be used as a stepping stone for creating the innovations of tomorrow. There is a long way to go to achieving interoperability between systems which stems from a lack of understanding of standards already available to health technology providers. Future-proofed and well-researched standards are being ignored in favour of bespoke solutions to issues such as coding and user interface design. These solutions may seem appropriate in the short-term but may lead to problems in the future when it comes to linking systems between suppliers. As authors, we have provided some tips as a guide for future innovations.

There are a multitude of resources available from the NHS relating to data models and dictionaries to aid system designs. The *NHS Data Model and Dictionary* provides an excellent resource which describes programmable objects using the industry-standard Universal Modelling Language (UML) including up-to-date object validation procedures for each object. Other useful resources are provided such as National Administrative Codes Service (NACS) and the Terminology Reference Data Update Distribution Service (TRUD) which provide standard data sets for structures such as SNOMED-CT – a clinical coding standard which facilitates communications between healthcare professionals in clear, unambiguous terms and supersedes the legacy Read-coded nomenclature. Global standards are also available including HL7 – an international clinical messaging standard – and ICD10 – an international standard for disease classification adopted by the World Health Organisation. Design tips are given by the Microsoft *Common User Interface* programme which is striving towards a common look and feel for all NHS systems.

In conjunction with systems resources, there are also interesting developments in design methodologies which can be used to improve involvement between technology providers and healthcare professionals. The role of agile software development is one that is well-suited to the complex nature of healthcare interactions. Agile working increases the interactions between stakeholders and provides timely feedback on the validity of ideas. In addition, allocating local “clinical champions” to manage projects at each stage should help increase rapport between professionals and providers increasing the positive perceptions and usability of new systems. While there are no strong cases either for or against agile working practices, it is essential to adopt a flexible work ethic and to constantly review and amend elements that are not working as well in the current environment. An iterative approach is essential to ensure time is not wasted; rather it is used as a building block for future developments.

These are just a summary of resources which should act as a springboard for future research. It is essential for technology providers to keep abreast of the cutting-edge in standards and thinking as it is an area which has been poorly understood in the design of current systems. Adhering to well-researched standards and responding to external pressures will help provide better, future-proof e-health applications. The adage of not re-inventing the wheel has never been truer in today's connected world and it is essential to support rapid application development which increases interoperability and improves patient safety.

Conclusions

E-health is more than just information technologies. E-health should be envisaged as a new way of working which integrates complex networks of people and technologies to provide a more consumer-centric healthcare system where information is accessible, relevant and reliable. As the commercial world continues to push the boundaries of innovation with ubiquitous technologies health informaticians must also explore new ways to implement the vision of pervasive healthcare. E-health will continue to expand and its role in the public domain will mature, as a recent study by Pew Internet shows that 75% of Internet users searched for healthcare information in the US between October and November 2007. Insights into gaming industry participation and Healthy People programmes are gaining increased media attention and are slowly becoming part of our everyday lives.

What makes the transition so difficult is the lack of maturity and research into the benefits of new paradigms such as Web 2.0. As with any technological project, change is the only constant factor. The lack of knowledge of potential benefits of innovations must be addressed by improving information technology competencies and links between academic research and healthcare practice. This will be a two-fold process: increasing the literacy of health professionals should better enable them to highlight areas where new technologies could support their workflows; and technologists must improve their knowledge of the healthcare domain so they are able to create more effective healthcare innovations. Advancements in the commercial world will continue to drive rapid innovation and it will be up to health professionals and technology providers to push the boundaries of healthcare and make it more accessible to all regardless of location, time and other constraints.

Founding partners in the Programme include:

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Regional Centres of Expertise

Yorkshire Centre for Health Informatics

Based within the Leeds Institute of Health Sciences in the Faculty of Medicine and Health, YCHI is the focal point for health informatics and provides world-class facilities and the capacity to host a large number of research and development projects. The international reputation of the academics within YCHI has also attracted collaborative activity with the NHS and industry, and has led to partnerships with leading IT companies.

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Google Health: <http://www.google.com/health/>

HealthSpace: <http://www.healthspace.nhs.uk/>

Microsoft HealthVault: <http://www.healthvault.com/>

Feel Great Britain: <http://www.feelgreatbritain.com/>

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NHS National Programme for IT: <http://www.connectingforhealth.nhs.uk/>