

# The future of electronic health records

Computer-based technologies have become an everyday part of modern life. They offer great potential to improve health-care delivery, but integrated systems are rare in UK hospitals. This article outlines the current state of information technology in health care in the UK and potential future avenues.

## Developing technology

The evolution of technology has ensured that computing power and capacity have exponentially increased while the costs have decreased. An Apple Mac cost \$662 per MHz of processing power in 1984 compared to \$0.34 per MHz in 2009. This trend will continue, and microprocessors and computing power are embedded into many everyday medical devices such as syringe drivers and anaesthetic machines. Computers can store and process data and, via networks, allow multiple access points to this data as well as remote access and data sharing.

During the last decade of the 20th century and continuing to the new millennium a range of industries such as retail and wholesale sales, banking and telecommunications invested heavily in computerized systems. As consumers this is evident to us in bar codes, automated cash machines, and online shopping and banking. These industries have experienced 6–8% productivity improvements annually over the subsequent 10 years. At least half of this productivity gain has been estimated to be accrued as a result of this information technology investment (Bower, 2005). These industries serve as a model for potential gains that investment in health-care information technology could bring.

Communication networks are in widespread use in the NHS to facilitate cross site multidisciplinary meetings and in remote areas for telemedicine allowing speedier access to specialist services. Implementation of computer-based storage systems of patient data in an electronic health record has the potential to change the way we work. Most hospitals still rely on paper-based records, but electronic health records can be used to coordinate

care, reduce errors and allow for automated outcome data collection for audit and research. Electronic health record systems also can reduce administrative costs, particularly with automated billing and also enable new modes of care – facilitating telephone clinics by generating automated reminders for clinicians or patients. There is a consensus that adoption of these types of systems will increase efficiency, reduce costs, improve outcomes and enhance patient safety. However, there is a paucity of evidence to support that consensus.

Evidence demonstrating enhanced quality of care almost exclusively relates to primary care and involves screening and other reminders for chronic disease as well as decision support tools which rely on diagnostic algorithms. These systems help deliver increased compliance with guidelines or protocols. They can generate automatic reminders and target services to patients based on their level of risk, monitor their condition and adjust their therapy to minimize complications as well as attempt to modify their behaviour. Patient information tools can be integrated into the system and can help improve compliance and help patients in making treatment decisions. Holbrook et al (2009) demonstrated that implementation of a clinical decision support system for diabetic care in Canada resulted in statistically significant improvement in diabetic outcome measures and was associated with an increase in patient satisfaction.

Data demonstrating improved patient safety rely mainly upon studies evaluating electronic prescribing which can identify allergies and potential drug interactions. There are some data showing that a system integrating computerized provider order entry can minimize unnecessary repeat tests, but the resultant cost savings are minimal when compared to implementation costs (Bates et al, 1999). Garrido et al (2005) looked at use of radiological or laboratory tests post implementation of an electronic order system for the Kaiser Permanente group and did not demonstrate decreased use of these following electronic health record implementation.

## Financial implications

Data on cost are even more limited. Most systems were developed and evaluated incrementally, using existing infrastructure and often offered at a discounted price to early adopters. Any data regarding cost for system implementation are at best estimates. Improvements in productivity and efficiency are even harder to demonstrate, there is no universally agreed productivity outcome measure in health care.

Data on efficiency are equally elusive, as doctors vary in their adaptation to new technology. Introduction of new systems for accessing patient information tends to cause an initial reduction in efficiency. If the electronic record system functions well then efficiency improvements will accrue, but after a prolonged interval and so be difficult to demonstrate. Krall (1995) evaluated the effect of implementation of an electronic health record system for the Kaiser Permanente group and found physicians took 30 days on average to return to their baseline level of productivity following implementation.

The limitations of paper-based information management are intuitively apparent. Leafing through bulky sets of notes in outpatients, looking for records of previous consultations and missing results should all be things of the past. The gradual diffusion of computers and electronic health records looks set to continue, yet the pace of change is glacial when compared to that achieved in other industries. The UK government's project National Program for Information Technology (NPfIT) was an attempt to accelerate the process of adoption of electronic health record. It represented the most ambitious information technology health-care projects to date, but also demonstrated some of the potential perils of health-care information technology investment. The aim was to create an electronic health record for every NHS patient and allow all NHS facilities and providers access to these records 24 hours a day. The sheer scale and complexity of this project as well as data security concerns led to spiralling costs. Over £11 billion was invested in the

project by the Department of Health and in 2011 the National Audit Office concluded the project would not deliver on its central vision.

### Linking primary and secondary care

Currently, in the UK, most northern European countries and Australia, electronic health record systems are commonplace in primary care. Communication between primary care and secondary care tends to be paper based and few hospitals have implemented electronic health record systems. In the United States Medicare and Medicaid have defined meaningful use criteria for electronic health record systems in order to qualify for incentive payments. There are fourteen core objectives including computerized order entry, electronic prescribing, summary patient records, demographics and crucially capability to share key patient information between providers.

Poor information exchange between primary and secondary care is a frequent contributor to substandard patient care and poor outcomes as well as often leading to wasted consultations, lost time and unnecessary repeat tests and investigations.

Standalone electronic health record systems which share common standards and have the ability to intercommunicate represent the future of health-care information technology. Picture archiving and communication systems (PACS) are an excellent example of this. These systems produce digitized images which are centrally stored and can be accessed throughout the institution as well as shared with other health-care facilities or viewed remotely. Each institution has ownership of its own system and data, but common standards allow easy exchange of information between institutions. Satisfaction rates with PACS systems among clinicians are consistently 90% or more.

We need electronic health record systems like these which save time and have the potential to improve patient care. Most crucially each hospital or trust can implement a system which suits local users, providers and patients, but common standards will allow systems to intercommunicate and share patient information. The United States government has set up a certification process for electronic health record systems and offers incentives to health-care providers for take up of certified electronic health record systems. This

helps to ensure common standards in order to enable future interconnectivity and so facilitate data sharing.

### Conclusions

Electronic health record systems have the potential to confer great benefits for clinicians and patients alike. Twenty four-hour access to a detailed health record for every patient has obvious advantages for all clinicians, minimizing potentially hazardous and costly unnecessary repeat investigations and thus saving time and money. **BJHM**

#### Andrew Russell/Giles Hellawell

*Specialty Doctor/Consultant  
Department of Urology  
North West London NHS Trust  
Harrow HA1 3UJ  
(andrew.russell3@nhs.net)*

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### KEY POINTS

- Health care has been slower than most other industries to implement computerised systems.
- There are significant upfront costs and an absence of evidence demonstrating potential cost savings or improved efficiency resultant from information technology investment.
- The failure of the UK government's National Program for Information Technology was costly and delayed progress towards implementation of electronic health-care records in UK hospitals.
- Progress is likely to involve standalone electronic health record systems for each trust with potential to intercommunicate with one another to allow future integration.



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