

How is health information technology changing the way we deliver NHS hospital care?

Authors: Harpreet S Sood^A and Keith McNeil^B

ABSTRACT

As NHS England and the health system makes further investments in the deployment of health information technology (HIT) across NHS sites, this review article considers some of the benefits HIT can provide in secondary care, including the potential of creating innovation ecosystems.

KEYWORDS: Health information technology, hospital care, informatics, innovation, training and education

Introduction

The NHS is the largest semi-integrated health system in the world, but it remains fragmented in how it organises the delivery of care. Boundaries between primary and secondary care, which made historical sense, are no longer sustainable. The changing patient demographic is challenging traditional acute models of care and there is now an increasing focus on patients being treated in the community and closer to their homes. The challenges that this shift poses are well articulated in the NHS *Five Year Forward View*,¹ which proposes an approach to achieve the triple aim of healthcare – better health, better care and lower cost.² Quite appropriately, achieving this proposition is underwritten by the effective use of technology, the stimulation and adoption of innovation, and the role of informatics. However, it will be the people, enabled by health information technology (HIT), that will change the system and effectively respond to these emerging challenges in healthcare systems.

Looking back

The use and deployment of HIT in the health and care system is not a new phenomenon in the NHS (in England). In the mid 2000s, the National Programme for IT (NPFIT) was an ambitious programme that intended to drive digital capability across the NHS. The key aim was to enable the joining up of information systems and datasets to better inform the direct provision of care, and achieve both improved patient outcomes

and the sustainable business models needed to achieve those outcomes. This programme did not achieve its aim because of multiple factors; a key reason was it did not fully engage the workforce, particularly clinicians, from the onset. However, the programme did leave behind a number of highly successful initiatives, including the picture and archiving communication system, the Summary Care Record, the Electronic Prescription Service and significant legacy infrastructure (the Spine and NHS mail capability).³

Now the Wachter review,³ which looked primarily at the digitisation of secondary care, has given the NHS a fresh impetus to move away from the era of NPfIT and into a new era where technology and informatics are considered a critical part of achieving the *Five Year Forward View*. The recommendations highlight a number of initiatives and investments to accelerate the deployment of electronic health records and HIT systems across hospitals with a subsequent cascade into primary care and the wider healthcare system. Most importantly, the review highlighted the pivotal need to engage clinicians, the end users of any system deployed, from the outset.

The use of technology in secondary care

On a global level, HIT adoption rate in the NHS secondary care still remains very low. Using the Healthcare Information and Management Systems Society (HIMSS) criteria, only 2% of NHS hospitals have achieved HIMSS level 6 digitisation compared with nearly 30% of hospitals in the USA.⁴ The highest is level 7, which is comprehensive digitisation right across an organisation. The USA has seen widespread adoption of electronic health records across secondary care in the last decade with current adoption rates of around 96% of hospitals compared with an historical 12% in 2009.⁵ This was primarily achieved through the Health Information Technology for Economic and Clinical Health Act, which set aside nearly 30 billion in incentives for HIT adoption.⁶

Through learnings from the USA and other countries, such as Australia, Canada and Germany, we are starting to understand the benefits HIT can provide and ways it can directly improve care in the NHS.⁷ HIT in hospitals has the potential to transform care delivery through three broad areas:

- 1 re-design of disease and care pathways
- 2 better coordination of care through information sharing
- 3 utilising data in improving quality, safety and efficiency of care provided.

Authors: ^Aassociate chief clinical information officer, NHS England, London, UK; ^Bchief clinical information officer, Health and Social Care, NHS England, London, UK

Through the National Information Board *Personalised Health and Care 2020*⁸ portfolio and with the launch of the Global Digital Exemplar programme in England,⁹ there is an opportunity for the NHS to achieve these benefits and conduct large-scale transformation enabled by technology and informatics. The programme, which has identified a number of high-performing trusts, is accelerating HIT deployment across the acute hospital sector, with mental health and community health trusts to follow. NHS England is co-funding the deployment of HIT with the trusts to develop a level of digital maturity, improve the processes of care and utilise the information gathered by these systems to better inform decision making.

There is significant evidence supporting the premise that when HIT is appropriately deployed and used, the systems in place can enable safer and higher quality care than paper-based systems.³ The reasons for this include improved communication and better handovers through various tools, real-time monitoring of vital signs that can signal deterioration in a patient, decision support and rapid response to and tracking of adverse events. Further benefits of HIT can include:

- > using the information to monitor clinical conditions and inform decision making in chronic disease management
- > improving the processes of care based on evidence of effectiveness
- > conducting real-time documentation in both structured and unstructured formats to allow viewing of information in real time
- > patient access to their health record and clinical interaction functionality
- > order entry and results reporting
- > medicines management and optimisation
- > innovative workflow pathways
- > automated clinical alerting aligned with clinical decision support
- > patient access to self-management tools
- > common approach to data sharing agreements and consent
- > analysis of large population datasets aimed at improving population health.

A systematic review demonstrated over 60% of studies associated HIT with improvement in one or most aspects of care, especially in the effectiveness and efficiency of care.¹⁰ Reed *et al* found that using HIT was associated with improved recognition of diabetic patients in need of greater drug treatment as well as better control of disease risk factors among sicker patients.¹¹ Another study highlighted that those using comprehensive electronic health record systems reported better care and outcomes and encountered fewer patient safety issues and adverse drug reactions.¹² In one study, remote monitoring in an intensive care unit reduced mortality by 68% and 46% when compared with the baseline periods, while also reducing both average length of stay in the unit and related costs by about a third.¹³ A patient safety study found that a HIT tool was associated with a 55% reduction in serious medication errors in the hospital setting. A follow-up study by the same team found that by adding a clinical decision support system to an order entry system, medication errors could be reduced by as much as 86%.¹⁴ There is also evidence that HIT has guided doctors to

provide evidence-based treatments leading to improvements in quality of care.¹⁵

The majority of the studies cited above are based in the USA because much of the available high-quality research regarding the benefits of HIT comes from there, although evidence from other countries is slowly emerging. We acknowledge generalisability of these studies to the UK may be a limitation; however, efforts have been made to contextualise the research for the current NHS environment.

With the deployment in HIT systems also comes the added benefit of utilising data and information to make informed decisions for direct patient care purposes, clinical decision making and informed business intelligence. It also provides us with the ability to enhance coordination and integration between primary, secondary, specialist and social care. Whether it is the accident and emergency doctor having an up-to-date medication list when seeing a delirious patient or the nurse being alerted when a patient's changing vital signs may represent early sepsis, information in the right form, in the right place and available at the right time is key to the provision of safe, high-quality clinical care.

Additionally, research has shown that the human mind is able to process a maximum of seven facts at a time in a decision-making process.¹⁶ Modern medicine is already past the point where the number of facts and factors that need to be considered for accurate clinical decision making can be managed consistently by the unaided human mind.¹⁶ This will only amplify as our ability to gather data from an increasing number of sources continues to grow. Cognitive overload is one of the reasons why we overuse, underuse and misuse information in healthcare.¹⁷ HIT systems can provide clinical decision support tools to aid decision making from structured and unstructured data to ensure the right information is presented in the right way to optimise the decision-making process.

The use of HIT across the system combined with an increasing capacity to engage patients through digital channels is changing the way we coordinate and provide care. This engagement of patients and their consequent involvement in their care provision is critical not only to the sustainability of healthcare, but it has also been shown, time and again, to improve patient outcomes across a wide spectrum of disease states.

So from all of this, the biggest benefits the NHS will reap from HIT will be attributable to the interoperability service that modern HIT systems allow. When properly applied, 'joining up' the system will not only improve direct patient care and outcomes, but will also reduce administrative costs, allow us to address unintended variation and effectively utilise data for research and development.

The people

However, HIT solely will not improve care. It is the people working in healthcare that use HIT as an enabler to change and improve the way care is delivered. Therefore, when implementing and using HIT systems and reimagining care pathways, we need to take into account the workforce, especially clinicians.¹⁸

An observation made by the Wachter review was that the NHS lacks a cadre of these clinical professionals that can

help change behaviours and drive the transformation agenda enabled by informatics and technology.³ As a system, we need to accelerate the development of these professionals in leadership positions. Known as chief clinical information officers, these individuals are credentialed clinicians who have expertise in informatics, transformational leadership, research and analytical skills and also understand the complexities of the healthcare context they are operating in.¹⁹ These professionals need to ensure that they are positioned as authoritative leaders in their organisations with the appropriate resources to drive this agenda.

Although many clinicians have a deep insight into ways that can improve the inconsistencies in care pathways, workflow processes or other aspects of the health system, only a limited number have the training to analyse data and thus convert their ideas into a workable solution. Added to this, even fewer have the capability to lead the transformation agenda and engage workers to change their behaviours and work patterns.¹⁸ Changing behaviour and culture is seen as one of the biggest barriers to the successful implementation of HIT.¹⁸ Additionally, poorly designed and implemented systems create opportunities for errors and can result in frustrated healthcare professionals and patients, which will make it increasingly difficult to change behaviours.¹⁸

Creating innovation ecosystems

Looking ahead, we should consider the added benefits of deploying HIT and the longer-term opportunity this presents for the NHS. When the USA accelerated the adoption of HIT, it also stimulated the consumer-facing IT world, including companies like Google and Apple, as well as start-ups, accelerators and investors, to become more involved with designing and providing innovative technological solutions. Although none of the government funding went directly to these companies, the entire Silicon Valley 'ecosystem' was given a signal that healthcare was now a digital business. When this signal became unmistakable, significant amounts of investment flowed into the digital healthcare.³

As the Global Digital Exemplars mature, they have the potential to create innovation ecosystems.²⁰ These ecosystems need to give individuals the freedom to conduct rapid experiments in simulated or real clinical settings to test and fail quickly if necessary.¹⁸ A mature technology infrastructure provides the opportunity for third party providers to interface with health systems under appropriate technical and information governance standards, further strengthening the proposition of technology-enabled care. In this respect, the transformative potential of HIT is no less powerful than we see in other industries. As technologies evolve and mature, for example smartphones with apps, patient portals, internet of things, telehealth, incorporation of genomics into the medical record and improvements in data and predictive analytics, they will all contribute to providing better information for decision making.¹⁹ Smartphones allow access and convenience and can also reach out to individuals who would not usually use healthcare or who have limited access to healthcare, thus improving the issue of access and also potentially reducing cost.

The system needs to facilitate productive collaborations between users and developers to ensure that new and innovative solutions are developed so that they further improve the delivery of healthcare.

Conclusion

HIT provides the NHS with an opportunity to deliver safer, higher quality and more efficient care and also improve patient outcomes and experience. It will be impossible for the NHS to become a modern, effective and efficient healthcare system without wholly embracing the digital agenda.

However, in order to make the most of the implementation of and investment in HIT, a few things need to be taken into consideration. Firstly, we must avoid being impatient or overpromising the benefits. Secondly, we must focus on the transformation journey of re-engineering and reimagining workflow processes and pathways. This is not about digitisation because it may make sense, but about the complex changes required to realise the benefits of digitisation on quality, safety and efficiency, which all lead to improved patient outcomes. Finally, we must be mindful that this is just as much about people as it is about the technology and the workforce must remain at the front and centre of this whole change agenda. ■

Conflicts of interest

Both authors work for NHS England.

References

- 1 NHS England. *Five Year Forward View*. London: NHS England, 2014.
- 2 Berwick DM, Nolan TW, Whittington J. The triple aim: care, health and cost. *Health Aff* 2008;27:759–69.
- 3 Wachter RM. *Making IT work: harnessing the power of health information technology to improve care in England*. London: Department of Health, 2016.
- 4 Healthcare Information and Management Systems Society. Electronic medical record adoption model (EMRAM). www.himss.eu/healthcare-providers/emram [Accessed 20 April 2017].
- 5 Charles D, Gabriel M, Searcy T. *Adoption of electronic health record systems among US non-federal acute care hospitals: 2008–2014. ONC Data Brief No 23*. Washington, DC: Office of the National Coordinator for Health Information Technology, 2015.
- 6 Blumenthal D. Wiring the health system – origins and provisions of a new federal program. *N Engl J Med* 2011;365:2323–9.
- 7 Jha AK, Doolan D, Grandt D, Scott T, Bates DW. The use of health information technology in seven nations. *Int J Med Inform* 2008;77:848–54.
- 8 National Information Board. *Personalised health and care 2020 – a framework for action*. London: NHS England, 2014.
- 9 NHS England. *12 NHS hospital trusts to trail blaze NHS's digital revolution*. London: NHS England, 2016. www.england.nhs.uk/2016/09/digital-revolution/ [Accessed 20 April 2017].
- 10 Buntin MB, Burke MR, Hoaglin MC, Blumenthal D. The benefits of health information technology: a review of the recent literature shows predominantly positive results. *Health Aff* 2011;30:464–71.
- 11 Reed M, Huang J, Graetz I *et al*. Outpatient electronic health records and the clinical care and outcome of patients with diabetes mellitus. *Ann Intern Med* 2012;157:482–9.
- 12 Kutney-Lee A, Kelly D. The effect of hospital electronic health record adoption on nurse-assessed quality of care and patient safety. *J Nurs Adm* 2011;41:466–72.

- 13 Rosenfield BA, Dorman T, Breslow MJ *et al*. Intensive care unit telemedicine: alternate paradigm for providing continuous intensivist care. *Crit Care Med* 2000;28:3295–31.
- 14 Menachemi N, Collum TH. Benefits and drawbacks of electronic health record systems. *Risk Manag Healthc Policy* 2011;4:47–55.
- 15 Jones SS, Rudin RS, Perry T, Shekell PG. Health information technology: an updated systematic review with a focus on meaningful use. *Ann Intern Med* 2014;160:48–54.
- 16 Stead WW. Rethinking electronic health records to better achieve quality and safety goals. *Annu Rev Med* 2007;58:35–47.
- 17 Olsen L, Aisner D, McGinnis M (eds). *The learning healthcare system*. Washington, DC: National Academies Press, 2007.
- 18 Rudin RS, Bates DW, McRae C. Accelerating innovation in health IT. *N Engl J Med* 2016;375:815–7.
- 19 Kannry J, Sengstack P, Thyvalikakath TP *et al*. The Chief Clinical Information Officer (CCIO). *Appl Clin Inform* 2016;7:143–6.
- 20 Jackson D. *What is an innovation ecosystem?* Arlington, VA: National Science Foundation, 2011.

**Address for correspondence: Dr Harpreet Sood, NHS England, Skipton House, 80 London Road, London SE1 6LH, UK.
Email: hsood@nhs.net**