Editorials
Information flow to enable integrated health care:
integration or interoperability

Integrated care systems, supported by electronic information exchange, are seen as key enablers to the future of the NHS.[1,2] The failure of a centralised NHS IT programme[3,4] has been followed by a move to local and regional solutions that provide an opportunity for clinicians to influence strategy and design. However, although primary care has been at the forefront of electronic care record use, connectivity outside the practice environment remains challenging internationally.[5] A recent World Health Organization report on digital connectivity highlights the need to inform clinicians by sharing experiences of developing electronic information exchanges if we are to come to an understanding of what is needed and what is possible.[6]

Successful information flow requires that information be recorded electronically, managed, governed, regulated, linked via a master index, and be made available to users through one or more interconnected software applications. Clinician input has helped provide solutions to most of these challenges[7,8] but technological solutions to connectivity remain a mystery to most clinicians and yet are a key determinant of how data can be used for patient care. A broad understanding of the issues can promote clinician engagement in the choices that need to be made to support nascent integrated care systems.

There are two main technological approaches for sharing information:

- interoperability, where one software application makes use of data that have been stored in a separate software application and the data transferred have a common meaning, for example, transactions between a bank and an online vendor; and

- integration, where a single software system has been developed to cover all activities occurring in an organisation or healthcare system, such as that used by Kaiser Permanente.[9]

Each solution brings different challenges and benefits, and requires both technological and organisational cultural shifts. We describe how we explored both options in new clinical services and illustrate the clinical implications of technological choices.

RESOLVING INFORMATION FRAGMENTATION IN OUTER NORTH EAST LONDON
Under the Prime Minister's Challenge Fund

> *"... although primary care has been at the forefront of electronic care record use, connectivity outside the practice environment remains challenging ..."*

in 2016,[10] NHS Barking and Dagenham, NHS Redbridge, and NHS Havering Clinical Commissioning Groups (BHR CCGs) set out to pilot two new models of integrated care. The first was an enhanced primary care practice — Health 1000 — for complex patients (those with five or more long-term conditions), and the second a number of urgent care hubs (UCHs) operated by local GPs. Health 1000 was to be set up as an integrated practice with GPs, nurses, social workers, pharmacists, physiotherapists, occupational therapists, and a specialist consultant all working under the same contract. This brought with it the opportunity to develop an integrated health and care system based on a single patient record and information flowing between different professionals.

For the UCHs, where the service was required to interface with multiple primary care providers and UCHs, the opportunity to develop and test an interoperable system was selected.

HEALTH 1000 — AN INTEGRATED ELECTRONIC SYSTEM
Development of the clinical system was undertaken with Vision (In Practice Systems Ltd, London, UK), a primary care clinical software supplier. The aim was to expand the capabilities of Vision's existing system and integrate functions across primary, community, and social care into a single software application. In effect, the aim was to design a single care record encompassing all health and social care data within a single software application.

Vision, a single-vendor application to provide all software application functionality, was the base programme, with additional modules developed around the existing primary care system. These enabled remote working, prescribing in the community, support for multidisciplinary team meetings, support for clinicians to track patients at any point in the pathway with real-time information, and access for patients to view their own summary record.

Having a single record for the patient meant that not only all the professionals involved in the patient's care, but also the patient, had access to the same information in real time.

Through the development of the software for Health 1000 it became clear that this approach overcame issues around sharing data across numerous settings with numerous records for a single patient. However, because of the complexity of processes inherent in professional working from varied organisations, for example, multiple record-keeping methods, it became very difficult to design, build, and maintain a single software application that could fulfil the diverse needs of different professionals and organisations. This requirement also included a variety of external systems, for example, radiology and community providers. Consequently, compromises in data fields were required to reduce that complexity to a useable format.

URGENT CARE HUBS — THE INTEROPERABLE SOLUTION
A second team worked with the same software application supplier on interoperability between organisations. NHS interoperability developments typically focus on read-only provisions or the use of portals. The development for the UCHs was different as it focused on real-time read/write interoperability between the hubs and the patient's registered GP practice. Further, to avoid additional fragmentation and the existence of multiple records for a single patient, the data were always stored in the GP practice's system with an audit log stored in the hub enabling all transactions to be viewed when necessary.

Three key themes emerged during the development: information governance (IG), user experience, and the commercial interests of software suppliers. Delays in software deployment are usually a result of design and testing, but in this case IG agreements were the limiting factor.

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The interoperable solution required interorganisational permissions for data flows. For example, to share data between organisations, a master index of patients with definition of common record terms was required. This could only be achieved by combining each GP practice's registered list. Resolving these issues across 137 practices and UCHs took 2 years, and a number of major concessions to the functionality had to be made that included the level of data sharing.

Clinicians had a strong preference for a single application interface with a common look and feel that required significant development time and funding. This meant clinicians from different sites and organisations have to adapt to a totally new front-end system with the need for bespoke training.

Finally, interoperability relies on the willingness of software suppliers to work with each other and with client NHS organisations to enable them to share data stored within their systems. Although BHR CCGs partnered with a clinical systems supplier, convincing other suppliers to share their data required national support and a compromise that limited the level of interoperability possible at the hubs. For example, the agreed functionality allowed clinical information to flow between organisations, but administrative information, such as appointment bookings, could not be accommodated due to the complexity of negotiations and potential cross-charging between suppliers.

CONCLUSION

The NHS is at a tipping point where the development of more integrated health and care systems is seen as essential not only to the provision of better care to patients but also to the economic survival of the NHS. An essential enabler will be the free passage of clinical and administrative information between health and care staff, patients, and organisations. Although progress to a national system within the NHS has been abandoned, there are now emerging technological solutions that support the transfer and sharing of information at scale. If we are to learn from the past failures we must ensure that clinicians are central to key decision making around the implementation of new information technology solutions.[11,12] For this to be an effective process, clinicians must develop an understanding of the issues they need to engage in. The learning experience of real-life case studies such as those described here can help inform that necessary dialogue.

Further information on the entire programme of work, including clinical and financial outcomes, can be found at https://www.nuffieldtrust.org.uk/spotlight/barking-and-dagenham-redbridge-and-havering-evaluation-project.

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