Success for a new U.K. national health care system depends on clinical context and scale, along with the capacity to emphasize interpersonal communication.

The health care sector has explored how information and communication technology might improve patient service for the past 50 years [8], but there is evidence that many, even most, health care information systems are failures [5]. Nonetheless, in the U.K., the National Health Service (NHS) has started to build a modern, dependable ICT infrastructure through an expenditure of £12–£20 billion over the next several years [9]. The unprecedented scale of the U.K. development, along with the scope and breadth of the NHS remit in providing universal cradle-to-grave health care for all U.K. subjects and the questions raised about the underlying models used in applying ICT to health care, suggests the U.K. experience has global applicability. We therefore explore the U.K. experience here as exemplar for our study of health care and ICT.

The National Programme for IT (NPfIT, run by the government agency NHS Connecting for Health) envisages a package of services across the U.K., including secure email, patient e-bookings, e-prescriptions, integrated care records, picture archiving and communications systems, a service for general practitioners, and a public health
The “enterprise” is too small a building block for health care, and models that start with national context, scale, and complexity might serve health care better.

Secondary sector: In the secondary sector (hospitals), IS investment and attention has focused on management rather than on clinical issues, though pathology and, more recently, radiology have quickened the pace on the clinical front in the U.K. There needs to be much more holistic (systemic) thinking with regard to IT/IS provision; and

Primary sector: The primary sector has done better clinically (particularly in general practice surgeries), with electronic information exchange with hospitals involves patients who travel and the exchange of letters among doctors. This communication is not adequate for real-time care delivery.

Figure 1. Areas of concern in high-profile NHS IS projects

Regional Information Systems Plan (RISP). In the mid-1980s the Western Regional Health Authority pursued this smaller-scale version of the current national vision to integrate health care IS. The ambitious aim at the time was to link every ward, surgery, and district nurse through the WRHA. The scale of the budget matched the scale of the vision. Unfortunately, it was also matched by the scale of mismanagement and pur- chasing failures [1]. For instance, the £33 million mainframe purchased for the project remained unused until its value had declined by over 75%. The failure to gain support from clinicians—in this case due to the system’s management rather than clinical focus—is a recurring theme in health care IS [1].

Resource Management Initiative (RMI). RMI, an initiative in the late 1980s, cost hundreds of millions of pounds to put IT systems into almost every U.K. hospital. This relative failure was analysed in [2] in terms of the cultural problems of importing a U.S.-designed system—with its strong emphasis on cost recovery and specific clinical practices—into the U.K. environment. They note that less than “30% of hospitals ever got their nursing information fully operational, and many of these were never fully used.”

Also worth asking is whether the system was ever likely to support the clinical side of care. An interesting, though proach would be to review the mission statements used by the different levels of management. The overall mandate was to enable the NHS to provide “a better service to its patients.” However, most of the objectives focused on improving the services to their managers and clinicians [10]. It could be argued that RMI was not a failure at all, but that it subverted the top-level aspiration, which had a strong patient-centered element, to more manager-oriented goals (such as managing patient throughput).

In terms of helping managers, these managers were very keen on resource management [10]. Even clinicians favored it as a management tool, the approval rating (“strongly agree” or “agree”) was high: 68% of responding doctors and 76% of responding nurses felt it encouraged good working practice. The question of whether this would convert into better care was more mixed, especially for doctors, only 50% of whom approved the proposition that it would improve patient care. On the proposition that it provided care at lower cost, the approval rating of responding doc- tors was down to 34%.
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Primary sector: The primary sector has done better clinically (particularly in general practice surgeries), with improved record keeping and some decision support [3]. However, these applications have required a much greater degree of interaction in health care than in other sectors, accentuating the need for interpersonal communication relative to the need for information services.

The second perspective is that the enterprise sets the scale of the model for IS in business sector. Conventional IS is also designed to fit the inter-enterprise infrastructure, but the focus of the application is usually the enterprise itself or one of its subsets (such as factory, office, or headquarters building). Health care, on the other hand, is (or should be) a national-scale issue in the U.K. for which reason the focus should not be hospital, surgery, or clinic. This thinking is reflected mainly in the concept of integrated care pilots [2], cutting across the divide between primary and secondary care.

Attempts to build solutions around smaller units (such as hospital, surgery, and clinic), then connect them later, even if they share a common infrastructure or services, following the inter-enterprise model, inevitably leads to suboptimal usage and communication barriers due to fragmentation of the infrastructure. The interesting U.K. development in this context is that the newly funded infrastructure is deliberately driven at a national level, a vision we view as positive.

To complete the picture, we note the following:

- Lack of fit between ICT applications and the work practices, environment, and cultural expectations to support; and
- Lack of robust, widely accepted evaluation methods, particularly with respect to cost; and
- Pressure to roll out new ICT services before the pilots sufficiently validated, as, for instance, with the Resource Management Initiative in the U.K. in the late 1980s [1];
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Ambulance failure [1] echoes the failings of the RMI with, for instance, its poor fit with organizational culture and processes of management. Alarming, some failure signs around cultural fit have been evident in NPfIT since 2005 [6]. Clearly, cultural fit and clinical buy-in are long-term issues for ICT in health care.

Underpinning Concepts
While the examples we’ve considered are selective, they do provide the scope to review the need for an understanding of data and information, but many management processes and clinical pathways require the support of the kind of information access validated above. A, B, C, and D in Figure 2; also see Table 1.

These information services and the processes they support have clear analogies in manufacturing, distributing, buying, selling, and other sectors as part of various enterprise models. This territory is well understood, though the enterprise level is subsumed in the NHS as a whole. There is a range of international communication requirements unique to health care (arrow E in Figure 2). We define an “enterprise line” as an economic line to divide between the conventional services that may be adapted for health care from business and those that need fresh development for application to health care.

Yet even in these more traditional areas for IS, health care IS failure reflects, at least in part, a failure to adopt good practice in other sectors. Adapting good practice from other disciplines includes understanding the culture of the organization, capturing operational procedures, gaining buy-in of key stakeholders, specifying changes and managing the process to result from the new information infrastructure, and designing and managing accordingly. None of this way of working is new, and applying best practice in other sectors should improve the record of IS in the health sector.

Notwithstanding this omission, two elements of this model—above the enterprise line and below the enterprise line—require discussion in building health care information infrastructure over and above what is best practice elsewhere. With respect to the enterprise line in Figure 2, the more straightforward issue is above the line and the more complex one below.

Above the line. Is a national infrastructure simply a large example of the enterprise we think not. The size and complexity of health care delivery systems and the breadth, scale, and sophistication of the services they offer make the two very different. The nature of the national infrastructure is a much more complicated proposition than even, for instance, multi-site manufacturing, where components and subassemblies are shipped from place to place along their journey. Table 2 identifies characteristics where health care might be similar or different from other sectors. It is clear that differences outweigh similarities and that these differences are crucial.

From a patient’s perspective, the problems of scale might involve having to coordinate the care of multiple disciplines through the general practitioner. For instance, the patient’s diabetes might require annual checks at a local hospital; the patient’s cataract surgery might be a service offered through a treatment center; and the patient’s heart problems might relate to the diabetes but need to be treated through a tertiary referral center.

From a provider perspective, distributed patient care involves delivering highly integrated, personalized care requiring multidisciplinary teams located in different places. Coordination is much more complex than, say, shipping and assembling components around a distributed supply chain.

This suggests that a more systemic model is required to better address the issues of scale and perspective. In the NPfIT initiative, the national scale has, for instance, been addressed, but a major issue concerning whether it will enjoy local uptake and improve clinical care remains. The early signs are not encouraging [6]. Below the line. The discussion in [11] began with the observation that one of the challenges of the design of computer systems to assist health care providers is how to support collaboration while not requiring that people meet face-to-face. But supporting this position is not enough; it is vital that support be given to below-the-line issues as well. Many communication issues (such as collaborative diagnosis of complex pathologies and bringing a specialist into a consultation between patient and physician) are below the line.

Table 1. Typical health care IS applications similar to those of any enterprise.

<table>
<thead>
<tr>
<th>Differences</th>
<th>Similarities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management</td>
<td>Process orientation</td>
</tr>
<tr>
<td>– Limited in most sectors, but health care has clinical and operational reporting</td>
<td>– All sectors assess improvement in quality care and delay through integrated processes.</td>
</tr>
<tr>
<td>Customer</td>
<td>– Clear customer in most sectors, but health care involves written including e-mail, personal care providers, government, service, provider, and user.</td>
</tr>
<tr>
<td>Variants</td>
<td>– Few industries exceed tens of thousands of variants. Health care typically uses tens of variants.</td>
</tr>
<tr>
<td>– Systems integration</td>
<td>– Although health care is typically larger: more complex, employ more people from other systems. Systems benefit from whole-system analysis.</td>
</tr>
</tbody>
</table>

Table 2. Characteristics of health care and other sectors compared.

<table>
<thead>
<tr>
<th>Systems identical in health care and in other sectors compared.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finance Payroll HR/Personnel</td>
</tr>
<tr>
<td>Records Scheduling Decision Support Image Processing Ordering</td>
</tr>
<tr>
<td>Pharmaceuticals</td>
</tr>
<tr>
<td>Joint decision making among individuals who are remote from one another (such as for diagnosis, referral, treatment planning, consultation, and review)</td>
</tr>
</tbody>
</table>

Support for below-the-line issues appears to be missing from much of the analysis within the U.K. health service. Face-to-face contact is fundamental to medicine and nursing. There is scope for the research needed to enable systems architects to understand the interpersonal dimension of care delivery (arrow E in Figure 2). Face-to-face contact can be between patient and doctor, patient and nurse, specialist and generalist, and specialist and specialist. It is not, in general, joint diagnosis and plannings or evaluation of treatment options. Again, this discussion is fundamentally different in type from that between, say, a production line worker wanting to speak directly to the production manager about a crisis. These circumstances suggest that a more systemic model is required to better address the issues of scale and perspective. In the NPfIT initiative, the national scale has, for instance, been addressed, but a major issue concerning whether it will enjoy local uptake and improve clinical care remains. The early signs are not encouraging [6].

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UNDERPINNING CONCEPTS
While the examples we’ve culls are complete and the analysis is comprehensive, they do provide the scope required to review the underpinning concepts about IS in health care. Otherwise, there is a danger of history repeating itself. Figure 2 points to questions related to health care IS by considering where the information resides or originates. You may disagree with our constituents of “data” and “information,” but many management processes and clinical pathways require the support of the kind of information access validated in many enterprises. A, B, C, and D in Figure 2; also see Table 1.

These information services and the processes they support have clear analogies in manufacturing, distributing, banking, retail, and other sectors as part of various enterprise models. This territory is well understood, though the enterprise level is suboptimal for the NHS as a whole. There is a range of informational communication requirements unique to health care (arrow E in Figure 2). We define an “enterprise line”—the yellow line—to divide between the conventional services that may be adapted for health care from business and those that need fresh development for application to health care.

Yet even in these more traditional areas for IS, health care IS failure reflects, in part at least, a failure to adapt what would be good practice in other sectors. Adapting good practice from other disciplines includes understanding the culture of the organization, capturing operational procedures, gaining buy-in of key stakeholders, specifying the changes in process expected to result from the new information infrastructure, and designing and managing accordingly. None of this way of thinking is new, and applying best practice in other sectors should improve the record of IS in the health sector.

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addressing health care. This may not stop altogether the history of IS failure in health care, but once the more obvious failure mechanisms are addressed, clinical communities may be more positive about IS generally, making them more likely to benefit from its potential to help deliver the kind of service patients need most and win the public’s trust.

References

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