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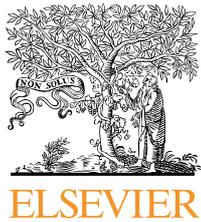


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NHS information: Revolution or evolution?

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Abstract

The UK's coalition government has proposed an 'information revolution' to underpin its National Health Service (NHS) reform in England. The core of this proposal focuses on boosting the flow of information throughout the NHS and improving information management and exploitation by use of integrated electronic health records (EHR). In this light, we consider the history of health information systems in England's NHS, and also draw upon our findings from a longitudinal evaluation of implementation of EHRs in English hospitals. We propose important lessons that can be learned, and on this basis present a set of principles for actions in support of the revolution. Our account emphasizes envisioning the information revolution as a long-term journey, part cultural shift and part cultural reaffirmation.

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Introduction

The Department of Health in England has proposed an 'information revolution' [1] and the 'power of information', as the key strategy to set a ten-year framework for transforming information for the National Health Service (NHS), public health and social care [2]. The information, it is claimed, will be beneficial for patients and other users of health services (booking appointments and repeat prescriptions online; communicating electronically with health and care professionals; using IT and online services to improve health and better care); carers (accessing services and health and care records online, helping carry out responsibilities safely, conveniently and effectively); health and care professionals (greater and better use of IT to improve the efficiency and quality of care, prioritizing time for those who need face-to-face care);

commissioners; healthcare organizations; information specialists (treating the provision of online access to records and other services for patients and service users as of equal importance as professional access to electronic records; and system suppliers [2]. Their wider reform, introduced under the banner of 'liberating the NHS', made heavy weather as it debated in Parliament and the current form of the act is far from that initially proposed. But the liberation of health and social care information as a means to drive forward change and deliver both better care and better use of limited resources is firm policy. Indeed this is echoed in other areas of government and in the government's wider commitment to open data policies [3]. At the heart of this proposal of an information revolution is the goal of boosting the flow of information throughout the NHS and improving information management not least by exploiting integrated electronic shared health records.

As might be expected of any revolution, this policy reflects history, both recent history and longer established themes including diagnoses of inadequate flows of information through the NHS [4,5]. The revolutionary remedy now proposed is founded on the adoption of seven new principles

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Table 1 Seven pillars of the 'Information revolution' [1].

Away from current policy	Towards a new future
1. Information belonging to the system	Information enabling patients and service users to be in clear control of their care
2. Patients and service users merely receiving care	Patients and service users being active participants in their care
3. Information based on administrative and technical needs	Information based on service user consultation and on good clinical and professional practice
4. Top-down information collection	A focus on meeting the needs of individuals and local communities
5. A culture in which information has been held close and recorded in difficult to compare forms	One characterized by openness, transparency and comparability
6. The government being the main provider of information about the quality of services	A range of organizations being able to offer service information to a variety of audiences
7. An approach where every organization is expected to use the same system	One that various systems are connected and joined up

for information flow and information management (see Table 1) that together embody fundamental change which, it is argued, directly addresses enduring and urgent NHS priorities [6]. The proposal is also a direct riposte to the turbulent and technology-focused National Program for Information Technology (NPfIT) [7-9], launched in 2002 by the New Labour administration and formally abolished in September 2011 by the Conservative-Liberal Democrat coalition government [10]. With estimated budget of US\$20 (£12.7) billion, NPfIT was a strategic initiative to move the English NHS towards an integrated set of electronic systems and data infrastructures that would transform healthcare. Much of NPfIT, including EHR, was originally planned to be delivered in five, then three geographically-based implementation regions (also known as clusters) by Local Service Providers (LSPs) [11]. LSPs for the London and Southern cluster planned to deploy sequential releases of Cerner Millennium software for acute trusts and RiO software for mental health and social services, while the North, Midlands and East (NME) area was to deploy sequential releases of iSoft Lorenzo software.

In this paper we rehearse recent history of health information systems in England's NHS, and draw out a core critique and useful lessons that can be learned, what has been achieved and how this might yet help shape the intended revolution.

Drawing on findings from a longitudinal national evaluation of NPfIT efforts to implement electronic health records in English hospitals [12,13], this essay proposes practical ways to realize the revolutionary aspirations. Our evaluation work undertaken in 2008-2010 [13,14], focused on the implementation of above-mentioned selected EHR software in secondary care settings across England. This work confirmed the by now widespread feeling that the Department of Health (DH), its implementing agency NHS Connecting for Health (NHS CFH), and the contracted commercial service providers were far too ambitious at the outset, and lacked insight and expertise in judging the complexity of the task of implementing national information projects across and between multiple NHS settings. NHS CFH also overestimated their own and local

NHS Trusts' capabilities and preparedness.² Even more damaging perhaps was underestimating the cultural change implied and the managerial efforts and financial resources required to start the transformation of the fragmented and still largely paper-based secondary care services of the NHS into a collaborative ecology based around a shared digital record [15].

The turbulent history of NHS informatics

The National Program for Information Technology (NPfIT) was born in response to frustrations felt through the 1990s at the lack of progress with computerization of the NHS, particularly in secondary care [16,17], and reflected a renewed belief in the transformative potential of technology, a belief nurtured by the millennial dot.com boom [18-20]. When NPfIT was established it was spoken of the largest civilian IT deployment ever undertaken [21]. Central to NPfIT's ambition was the successful delivery of a national, integrated (or integratable), electronic health record (EHR)—the NHS Care Record Service (NHS CRS). Detailed care records were to be locally generated and potentially be shareable across all healthcare settings and NHS providers. An underpinning national broadband network (N3) and core databases (the Spine), were specified as well as a centrally held Summary Care Record (NHS SCR). The scope of NPfIT included other national services such as Choose and Book for referrals to secondary care, and the Electronic Prescription Service for primary care. The vision was comprehensive and on a grand scale.

NPfIT attracted limited concern at the outset, often relating to its contractual structures [22], indeed many applauded this bold vision and the commitment of resources that it represented. But before long, NPfIT came to face

²The local organizations that deliver NHS care to patients, be it a hospital site or in a community setting, are designated as Trusts—each with their own independent management. In this essay we use the term Trust interchangeably with hospital, though one Trust might include more than one hospital or service.

substantial problems as it struggled in core areas to deliver useful and usable technical systems, ensure their implementation and generally meet NHS staffs' expectations [7]. We can learn from this history of ambition and struggle. In-depth appreciation of the challenges NPfIT faced, and recognition of what was and was not achieved, can allow better choices for the future. Such reflections need to encompass consideration of how NHS informatics policy is made, the establishment of robust and credible technology supply chains, understanding of the multiple stakeholders, the practices of implementation and of change management. More fundamentally we need to appreciate the deeper processes of institutional adoption of new ways of working with information.

Despite the NPfIT being prioritized by the DH [23], the strategy was never adequately integrated with other key concurrent policy initiatives, particularly the move towards Foundation NHS Trusts with new freedoms to make decisions and spend money. The wider environment of the NHS, then as now, was of low-IT expenditure (2% of acute hospitals budget is allocated to IT in the UK (2011) compared with, for example, 4% in the US) [6]. Indeed most Trusts had plenty of other priority areas to spend their money on. Within NPfIT itself there were only limited direct financial incentives offered to Trusts to engage with the NPfIT projects (other than the provision of software). Overall NHS organizations' reluctance to embrace IT (or find the finance for such an embrace), combined with real concerns about holding and sharing digital versions of patients data [15], meant that many NHS Trusts did not prioritize these initiatives.

NPfIT had its own distinctive structure and mode of operation. At the outset, and in the face of overwhelming international evidence [24,25], the decision was made to choose and procure software centrally and deliver it to users on a regional basis as part of comprehensive contracts awarded to large commercial systems integrators. This approach of choosing standard software for a whole region short-circuited much of a process of organizational and user (i.e. clinical and administrative) engagement. The resulting non-transparent and centrally-held contractual relationships frustrated many early adopter Trusts as they attempted to work blindfold with their technology-service partners, unsure what services to expect or demand. Unsurprisingly, the frustration felt by early adopters led others to hesitate to follow [12,14,15]. Bureaucratic and convoluted communication channels between NHS CFH, the contracted service providers, software developers and local NHS organizations led to unrealized expectations of achieving short-term benefits and direct cost savings from EHR investments.

Over time many of these issues were identified and to degrees addressed, but severe delays in delivering software still persist (as of December 2011, 82% of acute and 63% of mental health Trusts had not received nationally procured software) [13]. The continued lack of EHR software within individual hospitals, let alone the inability to share detailed clinical information across NHS settings, contributes still to a cycle of promised but unrealized benefits, leading to diminishing faith and support among managers and healthcare staff [12,13]. Erosion of commitment is also linked to continuing high profile media criticism that undermines public trust in health IT and

NPfIT.³ Worse still, NHS Trusts, clinical staff and patients, those who should have gained most benefits from NPfIT, became more and more uncertain of their commitment to the overall vision, a view compounded by shifts in the political and economic landscape [14].

Starting revolution from an information strategy

Despite many examples of mistakes and failure [26,27], 'Information Revolutions' are changing the delivery of health services in many countries including in the UK [28]. Over-interpretation of the nine turbulent years of the NPfIT, and damning all that was done, may be misleading and counter-productive for three reasons. First, some of the problems encountered were experienced by 'early adopters'. Many of these were or will be resolved so that subsequent implementers will not suffer the same problems and will be able to draw upon a body of experience. Viewing NPfIT as an opportunity for learning, and not simply as either success or failure, is therefore sensible [13,29]. We highlight two examples of learning experiences here: the follower NHS hospitals that learned from the experience of early adopters of EHR [30], as well as policy makers, IT managers, and healthcare professionals who revised their vision and approach to move NHS IT forward and to 'work out' the turbulent inheritance of NPfIT, the effects of which may be traced in the 'information revolution' and 'power of information' proposals [1,2]. Second, most NHS stakeholders still support most of the original aims and aspirations even as they are critical of specific aspects or the delivery [12,14]. Capturing this commitment, and responding directly to it, is an opportunity to move forward. Finally, the NHS is changing. The paradoxical monolith of numerous competing entities is reshaping itself, most notably as commissioning is restructured and as NHS Trusts providing secondary care achieve foundation status with increased autonomy and budgetary control. These moves suggest that it would be inappropriate, even impossible, to repeat the strongly centralized and technology-focused NPfIT type of policy in the future. But it also emphasizes the potential benefits in the future of collaboration between and among NHS Trusts in general and in IT matters in particular.

Thus, instead of using NPfIT's history as evidence in support of a simple switch from centrally-driven NHS information strategies to local or market-led initiatives, it is sensible to think carefully and creatively about how to make information policy work for the NHS as a whole and to serve its traditional mission of delivering care free at the point of delivery. Indeed, revolutions are often about continuity—returning to or restating longer-term political, cultural or economic traditions. In this spirit, revolutionary intent must accommodate lessons from recent history and reflect the NHS' history and the deeply ingrained culture. This was endorsed by the various stakeholders who

³See for example <http://www.dailymail.co.uk/news/article-2071594/Failed-NHS-fiasco-costs-taxpayers-ANOTHER-2bn-12bn-modernisation-project-scrapped.html>. Or for a rare alternative view (written by a television comedian!!) <http://www.guardian.co.uk/commentisfree/2011/dec/11/nhs-it-computer-david-mitchell>.

Box 1 Seven foundation stones for a new NHS-IT policy [12]. (Numbers in front of each item maps into the items in Table 1.)

1. Build on the vision of shared electronic records to improve provision of integrated patient-centred care (1,2,7)
2. Retain achieved knowledge from early adopters at both national and local level and use skills and expertise across NHS settings (1,2,4,6)
3. Involve users in decision making, especially in selection of standards and software systems; to ensure a clear local rationale that is aligned (but not driven by) national purposes (3,4,5)
4. Transparency for procurement and commercial contracts, stakeholder communication structures, and lines of accountability and responsibility (3,5,6)
5. Prioritize clinical applications that deliver better care and support patient flows. (1,2,3)
6. Incentivize and support the implementation of systems of choice (financial, material and expert support) (2,4,6)
7. Reject technology-driven implementation models; refocus on adoption as an ongoing working-out between staff and technology; technology as an enabler of improved care processes rather than an end in itself (1,3,4,7)

responded to the government consultation that followed the publication of the 'Information Revolution' [31]. Thus, in the response, it is not surprising that the question of 'ensuring that the information revolution benefits everyone and does not increase inequalities', had the highest response rate followed by 'information for improved outcomes' [31].

Drawing on our research and the analysis presented above, we suggest here some 'foundational principles' to draw upon in taking the revolution forward (Box 1). Close attention to these is, we argue, important for fulfilling the seven pillars of the 'information revolution' described earlier (Table 1).

There is clearly a need to re-balance ownership of development of NHS information policy and systems between the central and the local, the system and the people. This must retain commitment to the goal of nationally integrated or integratable systems (items 1-4, Table 1). Unsurprisingly, the respondents to DH's consultation on the information revolution proposal generally endorsed the need for integrated information across health and social care as well as primary and secondary care, making it their third major concern [31]. This suggests the need for some system wide incentives to boost inter-organizational information flows, and associated collaborative learning, a core element of the policy now in place in the USA by incentivizing doctors and practices through Medicaid and Medicare contractual arrangements [32]. To support this each NHS organizations' requirements and capabilities must be first and foremost understood and articulated within their own local health environment and in relation to patient flows and patient needs. But most NHS organizations, if acting alone or even with their direct peers, do not have the skills or staff to effectively procure, implement and manage IT or to develop and exploit information resources in ways that are meaningful for patients. Failure to recognize this will rapidly compromise patients' safety and quality of care, and lead inevitably to poor value for money, contrary to the intention of the 'information revolution'.

Above-mentioned points imply, among other things, the need for establishing locally owned (in the sense of chosen and committed to) technical and data standards and better appreciation of the multiple and dynamic issues of real interoperability for service delivery, as was also underpinned in

the responses to the public consultation [31]. These standards need to be actively 'curated', through an inclusive and transparent process. By so doing they will not be allowed to bias markets or freeze innovation. The often proposed strategy of 'mandate interoperability standards and then wait for local action' is too naïve and fails to understand that such standards are as much social and organizational practices to be learned and refined as they are invariant technical statements to be adhered to. This is one of a number of areas where maintaining a shared-learning environment is vital (item 7, Table 1). These issues of data standards and interoperability matched by learning and sharing, occur also at the regional and national level, but a careful balance has to be struck as to what level is most appropriate for coordination measures and the balance of governance between directives and incentives. The spirit of open innovation requires that the local has the opportunity to 'do different', and that their innovations can potentially be the basis for the wider system.

In the absence of creating such an environment the 'information revolution' could take us back to the same situation that led to NPfIT, namely patchy implementations of mainly patient administration systems with limited and fragmented clinical functionality and with scant regard for system wide or patient concerns.

This leads us also to argue that, to serve the interests of patients and clinical staff, early introduction of clinical functionality is pivotal and should be prioritized over comprehensive EHR systems or (unrealistic) expectations of administrative cost-savings or short-term returns on investment (Item 5, Table 1). This too was endorsed in the consultation with 'information for professionals' as the fourth most commented area [31]. This includes placing a priority on in the interface between primary and secondary care, for example in support of patient discharge from hospital to the community, and matching this with accurate, timely and comprehensive patient information. Our fundamental view is that, while better information resources that are creatively shared may well at times save money or serve critical needs of management and allow better decision making, the real transformative power of information is in changing the relationships between patients and clinical stakeholders and the way they organize their work. The clinical-first approach advocated here also implies a move away from seeing NHS informatics policy as a sequence of

discrete periods of prescribed change (projects, programs) driven by the arrival of new technical systems. The revolution's driving core must be found elsewhere in the on-going "working-out" of an accommodation between enhanced accountability and autonomy for people undertaking health-care activities (staff and patients), and dynamic information flows (items 1,3,7), on the basis of what is referred to in the 'information revolution' as democratic legitimacy [31].

Achieving this means that there is much work to do to change attitudes and to reconfigure and reform technology platforms that underpin information flows. This starts with a more transparent customer-supplier commercial architecture (reflected in part as the 'clearer channels to information' requested by respondents to the 'information revolution' proposal) [31]. Multiple smaller contracts can support a lively and innovation led market (item 6, Table 1). This should allow more diversity and give NHS organizations more opportunity to shift and adjust strategy when they want to. Increased involvement with and consideration of open source software and platform technologies (as exemplified in the smart phone app market) may also support such a move. The UK's new government has similar views and has proposed a cap of lifetime contractual value of less than £100 million for public IT procurements. While in a few cases this may need to be breached, the principle stands [33].

Maintaining such a market is principally about the NHS being a good customer with transparent and proportionate procurement requirements. Such requirements are based around minimum agreed interoperability standards that are open, non-proprietary and license free. In some areas a kite marking scheme or some minimum level of benchmark for usability, clinical safety and technical validity is appropriate. Indeed NPfIT pioneered some useful models for such standard's making in areas such as electronic prescribing and user interfaces. And, for example the OpenEyes open source EHR project has adopted the NPfIT sponsored common user interface standard (CUI). In this way, intelligently managed and promoted standards help reduce the need for customization of systems for individual health settings and promote usability and information sharing.

More generally we see a fundamental need for relationship building and the establishment of good lines of communications between technology suppliers, service companies, patients and carers, clinical and administrative users, managers, professional bodies and healthcare commissioners. Here too, the experiences of NPfIT are useful. In some areas it clearly shows how not to do it, but in others it offers insights that suggest very workable models—for example GP Systems of Choice (GPSoC).⁴

Finally, any information revolution has to be about new ways of working together exploiting new and appropriate technologies and information resources [34]. This requires mapping and re-mapping of work processes, patient pathways and professional jurisdictions, as well as the wider adoption of user-centered organizational design [35]. Without being prepared to work at redesigning services or

actively seeking out new ways of improving healthcare delivery, the revolution will simply freeze in place or magnify existing problems.

Conclusion

The 'information revolution' is well-intended, timely, and we should endorse it. But, the baby of a new and innovative NHS informatics policy must not be thrown out with the NPfIT bathwater. Nor should policy makers forget the degree of anxiety and mistrust that frequent or abrupt changes bring to NHS staff and the users of its services. This revolution is a long-term project, part cultural shift and apart cultural reaffirmation. At least a decade is needed to cultivate it and to harvest its benefits.

Authors' contributions

AT conceived the first draft of this manuscript. AT & TC both contributed equally to the development of this article.

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⁴A scheme, through which the NHS funds the provision of GP clinical IT systems, including all the leading systems in use in England. [See: <http://www.connectingforhealth.nhs.uk/systemsandservices/gpsupport/gpsoc/summary>].

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