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A toolkit to support the implementation of electronic prescribing systems into UK hospitals: preliminary recommendations

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Introduction

Hospital electronic prescribing (or ePrescribing) systems have the potential to reduce drug-related morbidity and mortality.[1,2] However, their implementation and adoption has been slow to date,[3] despite the considerable service interest in implementing systems[3] and the long-standing policy drive towards computerization.[4] The underlying reasons may include the demise of the National Programme for Information Technology; a lack of change management expertise and capacity in the National Health Service (NHS); the relatively immature and fragmented market; limited standards guiding procurement, functional specifications and expected benefits; and lack of resources.[5–7]

We are currently undertaking a programme of work to inform and support national deliberations on the safe, effective and efficient procurement and implementation of ePrescribing systems in England.[8] A key dimension of this work is the development of a toolkit to support and promote implementation. Here, we present our preliminary work, which we hope will provoke critical discussion and debate.

Introducing the toolkit

We discuss salient considerations that those implementing the technology, clinicians and other users, and evaluators of systems may wish to consider when planning, implementing and maintaining ePrescribing systems (Figure 1). We have drawn on various sources for the development of the toolkit including the published and grey literature, our own experiences and preliminary data from hospitals we are working with.

However, it is important to note that although depicted in a linear manner, the categories discussed are not likely to be discrete entities; rather, they are dynamic in nature and interrelated. As a result, design- and implementation-related activities need to take the evolving nature of systems into account.[9]

Toolkit categories

Conceptualization of the change

Establishing the need for a system based on local requirements must be based on a thorough understanding of existing workflows of pharmacists, doctors and nurses affected by the implementation, and should involve identifying potential areas for improvement relating to the medicines management processes. There are wide variations in functionality of existing ePrescribing systems and a formal scoping of functionalities can help in managing expectations. This can be achieved through networking with system suppliers. For example, anticipated benefits and drivers for change may include improving the quality of prescribing and medicines administration processes, as well as a reduction in errors and adverse events.[10] Many organizations will seek reassurance that these benefits will also be associated with an appreciable return on investment. The conceptualization output could, in part, be the vision of what is being aimed for over the short, medium and longer term.
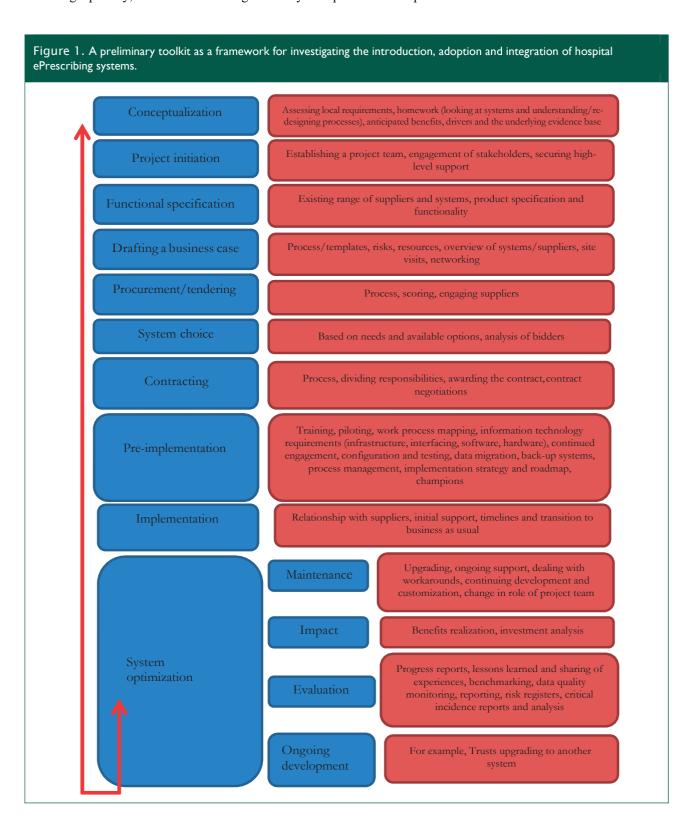
Project initiation

Once the requirement for a system is identified, a hospital needs to establish a designated project team responsible for managing the planning and, in due course, implementation and maintenance of the ePrescribing system. The role and composition of this team is likely to change with the transition to normal organization functioning, but it

should initially, at a minimum, include a project manager, a lead pharmacist and end-user representatives from a variety of clinical professions (as many problems come from clinical staff not understanding the importance of the roles they need to play in the design and implementation). Ownership should, therefore, not lie exclusively within the pharmacy department.

Important roles of the project team include the engagement of doctors and nurses (for example, by communicating the vision and inviting feedback) and securing necessary high-level support to ensure that the implementation is a local strategic priority; this work should begin as early as is possible in the process.

Figure 1. A preliminary toolkit as a framework for investigating the introduction, adoption and integration of hospital ePrescribing systems.

Stage	Description
Conceptualization	Assessing local requirements, homework (looking at systems and understanding/re-designing processes), anticipated benefits, drivers and the underlying evidence base
Project initiation	Establishing a project team, engagement of stakeholders, securing high-level support
Functional specification	Existing range of suppliers and systems, product specification and functionality
Drafting a business case	Process/templates, risks, resources, overview of systems/suppliers, site visits, networking
Procurement/tendering	Process, scoring, engaging suppliers
System choice	Based on needs and available options, analysis of bidders
Contracting	Process, dividing responsibilities, awarding the contract, contract negotiations
Pre-implementation	Training, piloting, work process mapping, information technology requirements (infrastructure, interfacing, software, hardware), continued engagement, configuration and testing, data migration, back-up systems, process management, implementation strategy and roadmap, champions
Implementation	Relationship with suppliers, initial support, timelines and transition to business as usual
System optimization — Maintenance	Upgrading, ongoing support, dealing with workarounds, continuing development and customization, change in role of project team
System optimization — Impact	Benefits realization, investment analysis
System optimization — Evaluation	Progress reports, lessons learned and sharing of experiences, benchmarking, data quality monitoring, reporting, risk registers, critical incidence reports and analysis
System optimization — Ongoing development	For example, Trusts upgrading to another system

Functional specification

Scoping the existing range of systems can help to draw up a functional specification describing the desired functionality, although these technical requirements may be replaced by more clinical requirements as part of an output-based specification specifying expected outputs. Visiting other hospitals that have already begun implementation and engaging in system demonstrations and associated clinical test scenarios by suppliers in order to enable scoring the different systems can facilitate this process. This can be governed by clarity on desirable and essential functionality (e.g. drug ordering alone or in combination with clinical decision support), as well as reviewing evidence of efficiency and benefits.

Much work relating to such ePrescribing specifications has already been conducted by NHS Connecting for Health.[11] The critical choice in this respect is likely to relate to deciding between complex integrated systems providing advanced computerized decision support, and stand-alone systems (as well as associated benefits and trade-offs). Although the exact course of the implementation journey is likely to emerge over time, systems choice is an important first step and needs to be closely related to the overall vision.

Developing a business case

Hospitals often do not have sufficient internal expertise to enable robust costing of business cases, evaluation of benefits, and therefore reliably estimate returns on investments of ePrescribing systems. In addition, the immaturity and fragmentation of the existing supplier market makes it challenging to obtain an overview of options available and there is a lack of good evidence of benefits.[10] Collating and sharing existing knowledge between hospitals is therefore essential, but this is often overlooked. Quantifying the expected benefits realization from the introduction of ePrescribing has been attempted on a national basis using disparate data sources, but these estimates require close scrutiny particularly when applied to individual hospital sites.[12]

Tendering and procurement

Given the sums of money involved, most ePrescribing tenders need to comply with European legislation.[13] Convening an evaluation panel, and specifying robust evaluation criteria based on functional (or output-based) specifications of the system in advance, is vital. This will allow reviewing and comparing functionalities against locally defined 'essential' and 'desirable' criteria.[11] As part of the tendering process, the project team may ask suppliers to undertake a pre- qualifying questionnaire to assist in the evaluation.

System choice

The eventual decision on which ePrescribing system to implement is likely to be restrained by available options and resources. Sometimes it is driven by other factors such as: co-creation of new systems with a supplier (as many ePrescribing systems are still in development or need to be tailored to the UK market); existing contracts with preferred/mandated information technology suppliers (e.g. according to regional contracts); or requirements for integration with existing systems (for example, pharmacy stock control systems). It is essential to involve and listen to as many local users from different professions as possible in the final decision in order to engender a feeling of co-ownership. User participation is vital, although hard to achieve as it can be resource-intensive – only a system that is used will deliver the desired benefits.[14,15]

Contracting

Drafting the contract with a supplier will involve dividing responsibilities such as the extent of supplier support (for example, in providing options for customization of specific functionality such as decision support), and is likely to be preceded by some degree of negotiation. During this process, building a strong foundation for an effective working relationship is extremely important.[16] Sometimes suppliers are closely involved and share responsibilities with the project team during the pre-implementation and implementation phases.

Pre-implementation

The pre-implementation phase is the most time-consuming part of the journey. A training needs analysis of all types of users who will interact with the ePrescribing system is required, as the training strategy will depend on the current use of IT. Certain users may be identified to become 'super users' who can provide expertise during implementation and beyond. These are often from professional backgrounds that lack input in the decision to procure an ePrescribing system (e.g. nurses), or from professions that have frequent contact with a range of system functionalities (e.g. pharmacists).

The implementation strategy needs to be developed, future work processes incorporating the technology need to be mapped and re-designed (e.g. prescribing, ordering, review or administration), and pharmacists, doctors and nurses need to be actively engaged in this process. This might also include system configuration, data migration plans, back-up arrangements and testing of software and hardware (for example, response times, server configuration, wireless infrastructure). Additional requirements including infrastructures, interfaces with existing systems (e.g. stock control, paper-based charts), as well as necessary software and hardware, such as portable devices also need to be put in place to allow the system to operate effectively and efficiently. Effective project management is important to co-ordinate these activities and ensure that deliverables are met, while maintaining a certain degree of flexibility in strategy and planning. It needs to be characterized by effective working relationships with suppliers and users, as well as recognition that the change process required is significant and ongoing.[5]

Implementation

Hospitals may choose to 'go-live' with certain functionality in a limited number of wards/specialty areas initially (a pilot) and then roll out throughout the hospital incrementally (often after a short pause to review the implementation process before the subsequent roll-out), or they may decide to implement the system throughout the whole hospital simultaneously.[5] Pilot wards for ePrescribing systems tend to be chosen based on the fact that they have either relatively straightforward medication-related processes (e.g. general medical wards) or because they are exceptionally complex (e.g. intensive care).[17] A fast roll-out pace is generally preferred in order to minimize potential risks associated with parallel paper and electronic systems.[17] Initial support from 'super-users', management, information technology departments and suppliers is likely to be extensive, decreasing over time. Alterations to staff mix and availability, working hours and leave arrangements may be required. A period of disturbance to service delivery and initial difficulties are par for the course and should be anticipated in project planning.

System optimization

The implementation and adoption of systems in organizations needs to be viewed as a process or a journey, which is never truly completed. System iteration is integral to this, requiring continuous work to maintain systems, including upgrading/development of software and hardware, and providing ongoing support to users.[18] Other ongoing activities may also need to include continued learning and development, as well as exploring workarounds that users may employ to get around perceived difficulties in the system.[5] These may, for instance, include using the free-text functionality in ePrescribing systems to prescribe, which may create new areas of risk.

Evaluating an implementation will allow hospitals to monitor progress, assess whether anticipated benefits and returns on investment have been realized and are seen by end-users.[19] In doing so, it is crucial that unintended and unanticipated consequences (such as new prescribing and administration errors) are continuously explored, collated and addressed[20]; and that opportunities from extending ePrescribing use or introducing new associated functionality (e.g. reporting systems, clinical documentation) are not missed. Potential techniques include data quality monitoring, critical incidence reports, analysis and clinical audit. It is very important to be seen to respond to end-users' ideas as this will further sup- port buy-in and effective dissemination of innovative uses. Similarly, it may be worth considering the needs and expectations of patients in more depth, as problems during the journey can have potentially negative consequences for experiences of care, for example, reduced face-to-face contact with pharmacists.

Conclusions and ways forward

In light of the substantial interest but limited capacity to implement ePrescribing systems in England and elsewhere,[4,12] we have begun to map out a toolkit describing the most important aspects of the implementation journey. We outline how this may be utilized in Box 1.

Direct implementation-related activity is only a small part of the journey towards realizing the potential benefits. Significant work is required both before (including conceptualization, project initiation, functional specification, drafting a business case, tendering and procurement, system choice, contracting and other pre-implementation activities) and after the actual implementation phase (system optimization) (Box 2). However, this is in stark contrast to current political strategies that are incentivizing direct implementation-related progress.[4] Such an approach, with associated very rapid implementation timelines, fails to recognize the substantial work that is likely to be required as hospitals prepare for implementation and promote successful adoption.

Our outline toolkit is presented as a starting point for stimulating critical discussion and debate, which will contribute to further development and refinement. Ultimately, we hope that it will prove useful to hospitals as they strive to enhance the quality and safety of prescribing and medicines management for the patients they serve.

Box 1. How the toolkit may be utilized to inform ePrescribing system implementation.

- Provide a set of recommendations/questions relating to each stage outlined in the toolkit. This will allow hospitals at various stages of implementation to extract information relevant to them.

- Provide details of the context of on-going implementations, strategies and approaches used, outcomes, lessons learned and best practice.

- Provide users with downloadable tools or links to other toolkits. These can then be tailored to local requirements without having to 're-invent the wheel'.

- Facilitate networking and systems choice through listing suppliers and ongoing implementations.

- Provide hospitals with relevant documents, e.g. business case templates, work process mapping documents, engagement strategies and academic publication lists.

Box 2. Key messages emerging from this work.

- There is substantial interest but limited capacity to implement ePrescribing systems into English hospitals.

- We postulate that the most important stages of the implementation journey include conceptualization, project initiation, functional specification, drafting a business case, procurement/tendering, system choice, contracting, pre-implementation, implementation and optimization.

- Direct implementation-related activity is only a small part of the journey towards realizing the potential benefits.

References

1. Huckvale C, Car J, Akiyama M, et al. Information technology for patient safety. *Qual Saf Health Care* 2010; 19(Suppl 2): i25–33.
2. Kaushal R, Shojania KG and Bates DW. Effects of computerized physician order entry and clinical decision support systems on medication safety: a systematic review. *Arch Intern Med* 2003; 163: 1409–16.
3. Crowe S, Cresswell K, Avery A, et al. Planned implementations of ePrescribing systems in NHS hospitals in England: cross-sectional study. *JRSM Short Rep* 2010; 1: 33.
4. NHS England. *Safer Hospitals Safer Wards – Achieving and Integrated Digital Care Record*. See http://www.england.nhs.uk/wp-content/uploads/2013/07/safer-hosp-safer-wards.pdf (last checked 23 July 2013).
5. Sheikh A, Cornford T, Barber N, et al. Implementation and adoption of nationwide electronic health records in secondary care in England: final qualitative results from a prospective national evaluation in ''early adopter'' hospitals. *BMJ* 2011; 343: d6054.

6. NHS Connecting for Health. *Electronic Prescribing in Hospitals: Challenges and Lessons Learned*. See http://www2.lse.ac.uk/LSEHealthAndSocialCare/pdf/information%20systems/eprescribing_report.pdf (last checked 28 October 2012).

7. Greenhalgh T, Stramer K, Bratan T, et al. Introduction of shared electronic records: multi-site case study using diffusion of innovation theory. *BMJ* 2008; 337: a1786.

8. The University of Edinburgh. *Investigating the Implementation, Adoption and Effectiveness of ePrescribing Systems in English Hospitals: A Mixed Methods National Evaluation*. See http://www.chs.med.ed.ac.uk/projects/eprescribing (last checked 23 July 2013).

9. Henderson A. A development perspective on interface, design and theory. In: Carroll J (ed). *Designing Interaction*. New York: Cambridge University Press, 1991, pp.254–268.

10. Black AD, Car J, Pagliari C, et al. The impact of eHealth on the quality and safety of healthcare: a systematic overview. *PLoS Med* 2011; 8: e1000387.

11. NHS Connecting for Health. *An Outline Approach for Identifying the Local Minimum Requirements for an ePrescribing System*. See http://www.connectingforhealth.nhs.uk/systemsandservices/eprescribing/refdocs/minreqs.pdf (last checked 28 October 2012).

12. PricewaterhouseCoopers LLP. *A Review of the Potential Benefits from better use of information and technology in Health and Social Care (Independent Report Commissioned by the Department of Health*. See https://www.wp.dh.gov.uk/publications/files/2013/01/Review-of-use-of-Information-and-Technology.pdf (last checked 28 January 2013).

13. OJEC. *Tender Search and Alert Service*. See http://www.ojec.com/Default.aspx (last checked 28 October 2012).

14. Greenhalgh T and Stones R. Theorising big IT programmes in healthcare: strong structuration theory meets actor-network theory. *Soc Sci Med* 2010; 70: 1285–94.

15. Greenhalgh T and Russell J. Why do evaluations of eHealth programs fail? An alternative set of guiding principles. *PLoS Med* 2010; 7: e1000360.

16. Cresswell K and Sheikh A. The NHS Care Record Service: recommendations from the literature on successful implementation and adoption. *Inform Prim Care* 2009; 17: 153–60.

17. Cresswell K, Coleman J, Slee A, et al. Investigating and learning lessons from early experiences of implementing ePrescribing systems into NHS hospitals: a questionnaire study. *PLoS ONE* 2013; 8: e53369.

18. Hendy J, Fulop N, Reeves BC, et al. Implementing the NHS information technology programme: qualitative study of progress in acute trusts. *BMJ* 2007; 334: 1360.

19. Catwell L and Sheikh A. Evaluating eHealth interventions: the need for continuous systemic evaluation. *PLoS Med* 2009; 6: e1000126.

20. Ash JS, Berg M and Coiera E. Some unintended consequences of information technology in health care: the nature of patient care information system-related errors. *J Am Med Inform Assoc* 2004; 11: 104.