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# Learning lessons from electronic prescribing implementations in secondary care

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**Abstract**

*This paper reports a study undertaken in the UK to gather lessons learned from hospital sites that have implemented electronic prescribing systems. The work was commissioned by NHS Connecting for Health, the UK Department of Health agency responsible for the implementation of the National Programme for Information Technology. The aim was to capture front-line experience of the project and systems implementation, and to share it with staff who will in the future participate in other implementations. Data were drawn from detailed interviews with staff and a survey in 13 hospitals in England, as well as a review of published studies of implementations. The study output is a report and six user-facing briefing documents targeted at key stakeholder groups; nurses, pharmacist, doctors, senior executives, implementation team members and IM&T staff.*

***Keywords:***

Electronic prescribing, Implementation, Evaluation research, Lessons learned.

## Introduction

Prescribing and administering medicines is a core activity in modern medicine. Doing it intelligently and safely is one of the most significant measures of the quality of the care that patients receive. Maintaining and managing information about drugs prescribed, dispensed and used is a significant element of a patient's medical record which itself underpins good care at the point of delivery. For the managers of health care systems, from the ward or clinic up to the national level, knowing about how medicines are used is important for pinpointing areas for improvement, managing budgets and reacting to new circumstances. Electronic prescribing (eP) systems, found increasingly in both primary and secondary care settings, can support the delivery of care and the management of health care systems.

However, the level of implementation and use of electronic prescribing systems does not seem to match the potential they seem to offer and despite the substantial research evidence for their beneficial outcomes, and many official endorsements of electronic prescribing systems as a core clinical technology, it is still that case that not very many hospitals in the UK or other countries have achieved comprehensive systems in hospital-wide use. There are of course some notable exceptions and, for example, the Royal Hampshire County Hospital, Winchester in the UK became probably the first hospital in Europe to replace one eP system that had been in use for over 10 years with another. Still, the implementation of ePrescribing (eP) in acute care in the UK has been limited to a small though growing number of sites. This is in direct contrast to primary care in the UK where computer prepared prescriptions are now the norm and the electronic transmission of prescriptions from general practitioners to high street pharmacies is in use and being upgraded in England to a service with electronic repeats and full electronic signatures under the Electronic Prescription Service[1].

Existing secondary care implementations in the UK include some that have developed out of specialist clinical needs and may be localised to a single ward, (ICU, oncology, renal), some out of pharmacy systems, and some as part of a wider implementation of hospital information systems. In prospect for all hospitals are electronic prescribing modules as a part of large whole hospital electronic patient record (EPR) systems to be implemented under NPfIT, as well as more implementations of specific eP systems.

The relatively modest scale of electronic prescribing in the UK acute care setting might be explained by a number of factors. These include a perception that electronic prescribing is technically difficult and challenging, that available systems are not sufficiently well developed to deliver benefit, that other sibling systems need to be in place *before* electronic prescribing is rolled out, or that the culture change required for adoption into clinical practice is too hard to achieve. The proposed roll-out of EPR under NPfIT has suffered many delays and may have caused some 'planning blight' making it harder to secure a budget for separate eP implementations.

The work reported here was commissioned by NHS Connecting for Health, the UK Department of Health agency responsi-

ble for the implementation of the National Programme for Information Technology. The work addressed some of these impediments by synthesizing the lessons learned by staff in hospitals that had implemented electronic prescribing, and passing them on to other front line staff and managers. The aim of this study was then to help build confidence among such staff that hospital-wide electronic prescribing was achievable, and to help people to prepare for the implementation of such systems.

This study is in this respect rather different from most evaluations undertaken in health care, having as its objective a focus on the processes of implementation themselves, seeking an *emic* account, rather than a focus on outcomes of an intervention *per se*. Further, the main audience for the work was intended to be the peers of those reporting their experiences from within the hospital culture, rather than policy makers, senior managers or technical staffs.

**Study background**

The systems used for prescribing inpatients medications and recording administration in UK hospital are based on a model established in the 1960s. Doctors write medication orders directly onto a paper drug chart or medication Kardex, and the same document is used by nurses to find out the doses due and record administration to the patient. The drug chart is also used by pharmacists to clinically screen and supply medication, as well as by other healthcare professionals when they need to view a patient's current medication. The single document has great advantages in that everybody looks at the same version of information, but there are some known problems with this system. UK studies show that:

- prescribing errors occur in 1.5-9.2% of medication orders written for hospital inpatients [2-6]
- dispensing errors are identified in 0.02% of dispensed items [7-8]
- medication administration errors occur in 3.0-8.0% of non-intravenous doses [3, 9-11] and about 50% of all intravenous doses.[12-13] (These figures exclude errors involving wrong time of administration).

In the past decade there have been a number of significant changes in the ways in which medicines are used in secondary care [17]. For example, prescribing roles have expanded to include nurse and pharmacist prescribers, the use of patients own drugs (POD) help to manage waste and to allow patients more participation in the processes of medicines use. More attention is now focused on the consequence of adverse drug events (ADE), where the medicine use process breaks down, and patients suffer, as when allergy information is not sought or is not used or when prescribing data is unclear, incomplete or in error. Various estimates have been made as to the cost of such errors, and while the exact detail may be disputed, the overall impact of ADEs is clearly significant.

Against this background, and drawing in particular on the concern with preventing errors, there has developed a strong movement that advocates using the computers to help deliver new means of managing drugs. Influential reports from the U.K, USA and other countries have suggested that computerised medicines management should become an essential part of modern medical practice[14-17] Such systems are discussed under various names. In the United States the most common name used has been the abbreviation CPOE, though its exact definition has shifted from 'Computerised Physician Order Entry', to 'Computerised Provider Order Entry', in line with the expansion of prescribing authority. In the UK the term CPOE has not been so commonly used since UK practice in hospitals has been to separate the orders for drugs from other medical orders such as physical therapy, tests or imaging. It is more common in the UK to speak about electronic prescribing systems, abbreviated to eP, and to separate them from systems that support other types of clinical orders. NHS Connecting for Health's formal definition of ePrescribing is as follows:

> The utilisation of electronic systems to facilitate and enhance the communication of a prescription or medicine order, aiding the choice, administration and supply of a medicine through knowledge and decision support and providing a robust audit trail for the entire medicines use process [18]

Thus the phrase 'electronic prescribing' should not be taken to indicate that the only purpose is to help in prescribing activity. Prescribing is of course an important aspect of eP systems, and the use of decision support for prescribers, alerts for allergies or drug-drug interactions, or order sets, can offer significant improvements in care. But contemporary eP systems serve wider purposes in prescribing, supply, administration and recording functions, as well as audit and review. Indeed it is exactly *because* such systems can integrate these distinct activities that they are seen as useful and able to contribute to improved patient care. For example, if a drug is prescribed, and the eP system knows that it is not currently on the ward in sufficient quantity, an eP system may be able to generate a supply order in the pharmacy.

## Materials and Methods

The objectives of this study were: to accumulate and summarise the varied experiences of NHS hospitals in the UK as they have implemented (or failed to implement) various versions and styles of electronic prescribing (eP), to review relevant international literature on the implementation of eP, commenting on the messages that can, and cannot, be extrapolated to the UK, and to develop a set of short and informative practitioner facing briefs that address key aspect of eP.

Data were collected by interview, through a detailed questionnaire for key personnel from eP sites, and by review of published materials. The work drew on the input from over 50 staff in 13 NHS hospital trusts, representing the implementation of 20 different systems.

The study resulted in a report but given its aims other important outputs were six user facing briefing documents (leaflets) targeted at key stakeholder groups; nurses, pharmacist, doctors, senior hospital executives, implementation team members and IM&T staff. These outputs form the basis of a toolkit including a PowerPoint presentation that can be adapted for use

in a variety of settings. The final results can be found online [19].

## Results

Of course, not all people reported the same experiences, and sometimes the reported 'Lessons Learned' were contradictory. However, most often people who had experienced eP implementations told a similar story, and seemed to draw similar conclusions. Given that the focus of the study was on implementations of sophisticated IT systems we found, as expected, a number of well established themes that are associated with implementing any type of information system in a health care setting. For example, most people expressed the need for senior managers' support from the initiation of an eP project and throughout its progress, emphasised the role of champions, the importance of user involvement and the need for (and problems achieving) 'clinical engagement'.

These are undoubted necessary conditions for a successful eP project. However, there are also some subtleties that need to be added, placed within a discussion of the specifics of the implementation of eP. We explore here the critical and context-specific themes that emerged as making eP projects different or distinct, and which can help to identify specific actions and attitudes needed. Thus we reflect here an experiential, 'bottom-up', view – eP as seen by the main stakeholder groups that have to absorb the new technology and release its benefits as they develop their own new ways of working.

### Getting Started

Many of our respondents had been involved from the start of their hospital's eP project. Their views, with the benefit of hindsight, were often that the 'vision' of eP needed to be established and communicated first, both in terms of the big picture (patient safety, modernisation, e-health strategy, eP's role as an innovative clinical system), but also in terms of the significant details that would shape the eP system in that particular hospital's context. Such details include identifying the benefits that eP offers to the multiple stakeholders. Is there something positive for everybody? Where are the most receptive parts of the hospital? Which specialties can be relied upon to embrace eP with enthusiasm? Which ones, once convinced, will carry the message loudest? And which ones will be most problematic?

An almost universal finding from our respondents was that eP projects must be multi-disciplinary. No one professional group can carry a successful system into widespread use. If significant professional groups are missing, excluded or unenthusiastic, then this is storing up problems ahead. As one project lead said; "Undertake lots of visits and talks, if need be grovel, go everywhere and sponsor events. Do everything to build up visibility." Many of our respondents reported a desire for more clinical participation at the outset, in particular from doctors, but they also noted the importance of support from IM&T members who really understand what is being demanded. Management backing is vital too. eP projects, inevitably raise some resistance, perhaps quite a lot from some clinical quarters. If senior managers are other than fully committed, then eP projects may be wounded or even fatally challenged. Of course, to attain the backing (and sufficient budget) from senior management requires that they are well briefed and confident both of the eP team's ability both to effect the implementation and then to deliver real benefits.

One responded advised; "If possible implement X-ray and lab test ordering before EP: this helps users realise the benefits of electronic orders". This may not be a feasible recommendation in some situations, however, the wider point is valuable –eP is best seen as part of a broader programme of implementation of innovative clinical information systems, and success in one area can reinforce success in others.

### The Build up

Successful eP implementations are not just multi-disciplinary in their project team, but also reach out across the range of healthcare professionals both to communicate the benefits of eP and to bring out into the open any fears, concerns or areas in which eP may be problematic.

Planning the implementation of eP requires quite careful reconnaissance. Identifying people who can support and develop eP is important: people who can deal with information and communication technology, are happy to change the way they work, and who can enthuse and support others. Of course, not everybody falls into this category, and almost all sites studied had their stories of resistance. Nevertheless, a successful eP implementation can go ahead.

The respondents had learned from experience that eP is less easy to incorporate in some clinical specialities, and that some drugs have specific regimens that challenge the simple logic of most eP systems. For example, paediatric prescribing raises many distinctive problems; A&E work practices may require that prescribing be undertaken in different ways – e.g. using patient group directions (PGDs). And medicines such as insulin, warfarin or heparins each pose problems of how exactly they should be incorporated into eP procedures. Many eP systems struggle with these and other medicine's variable dosing, and often some paper charts must be retained. The eP system then needs to reference these paper charts and incorporate key information such as administration schedule.

In addressing such tricky problems, and thinking through the ways in which to safely accommodate them in eP, broader confidence can be built up. Certainly the early adopting eP sites had faced these problems and found acceptable solutions that work for them.

It may be surprising, but the most common 'lesson learned', and sometimes learned the hard way, was that hardware and software can be a problem! In particular, a number of the sites studied had significant problems with their wireless networks. These manifest themselves in terms of 'dead spots' where no network coverage is available, or underspecified networks that could not cope with the volume of traffic once substantial amounts of prescribing transactions were taking place. These kinds of problems are particularly troublesome and difficult as they had in more than one case meant having to withdraw an eP system when it had already been established on several

wards. Such problems also emphasised the need for a sound back-up plans so a system can fail safely, and be restarted safely too.

Building a good relationship with software and database suppliers was seen as important. In the early set-up phase of an eP project interactions with suppliers can help to solve problems, and tap into other sites with previous experience of the same software. That said, in order to take ownership of the system, and make it fit into the specific context, staff did need to work on configuring the software and making it look and feel appropriate for *their* needs. This work takes time, and some may be optional ahead of roll-out. That is, a basic system might be rolled out sooner, and extra functionality added to it as time goes by. However, in order to provide the most positive experience of eP to new users providing a rich set of features in the initial roll-out may be important.

Training people to use eP was essential. However, opinions differed somewhat as to how much training is needed and the extent to which it should be on the job or in the classroom. Classroom training was reported as being useful but only if the classroom is suitable with equipment and software that is the same as in use on wards. The counter argument some people made was that if a system is sensibly designed, and if staff have sufficient IT skills, perhaps from other clinical systems, then the training needed should be minimal – just training to deal with site-specific elements such as logons, passwords etc. But training has other roles than just imparting information. It can build up confidence, reveal concerns or pick up important bugs or problems with a system. For this reason trainers were seen an essential element of the eP team – not just teaching the system, but also feeding back changes to make it safer and easier to use. Thus the training role can extend well beyond the initial roll-out and sites with a hospital wide system in use maintained a fully staffed training team throughout the systems working life because new staff arrive, locums can appear late at night and at weekends, new upgrades of software are made, systems are improved and changed, and people may need refresher training or training for new roles.

**Implementation and use**

Those who had implemented eP across a hospital were almost universal in their view that, once a system has been set-up and tested in one chosen area – perhaps one or two wards with particularly supportive staff - then the full implementation should proceed quite fast. Two reasons are proposed for this. First having two systems (paper and eP) in use in the same hospital makes a lot of work when patients cross these boundaries, and second because it is as a result less safe. In any case, almost all sites studied acknowledged the need for dedicated staff to support eP going live in each location, converting medications orders from the old to the new system, providing on the job training and support, and picking up other nursing tasks as ward staff take time to learn to use eP. A number of sites had used locum pharmacists and extra nurses to bolster the staffing levels during eP implementation. One suggestion from an experienced site was by agreement to draw staff from other local hospitals during the key change-over period. In this way experienced people are available, and mutual learning can occur. This might be even more useful if local hospitals are on track to use the same or similar software in their eP plans.

Reported experience of initial use of eP was of a period of intense activity and support, with mixed reactions by clinical staff, followed perhaps after 2 or 3 months by a more positive feeling, and after 6 months by a feeling of "I would not want to work without eP". Nevertheless, support activity continues to be needed. Indeed it is needed throughout the life of an eP system since problems will keep on emerging as well as new ideas for improvements and new understandings of the possibilities. For example, in the early stages of eP use clinical staff are unlikely to think about the management potential of the data held by the eP system. But a year later, when available data is substantial and covers a period of time, reporting, trend analysis or safety audits may be attractive options. Trainers or other designated people also still need to pick up peoples' concerns and suggestions, and then do something with them. An active and positive support system that feeds back progress on fixing bugs, implementing new features or just answering question is an important part of sustaining eP, and the basis for obtaining full benefits.

eP support is an important task that demands a mix of skills, some IT related, some clinical, and some specific to pharmacy. How to set up and staff such a support operation is not straightforward, and things will not work well if technical questions go to clinical staff or vice versa. eP sites solved this problem in different ways, but perhaps the most successful was to designate a team approach with clinical and technical staff working together.

Using eP has consequences, intended and emergent. Some of these are directly related to the benefits that they offer. For example clear, legible and complete medicines orders mean that pharmacists need to spend less time making simple corrections, they may also spend less time supporting the supply of medicines. On the other hand the work involved in supporting the eP system – keeping it up to date, improving usability, implementing prescribing policies etc, will probably eat up, and may well exceed (depending on Pharmacy's role) the time savings created elsewhere. This may also lead to some consequential changes. For example if TTO (discharge) orders are sent direct to the pharmacy, then expectations will be that they are processed immediately. Meeting such enhanced expectations may not be easy. eP was reported as having consequences for staffing policy too. For example, agency nurses or locum doctors that have not been trained to use a system are less useful. A number of eP sites explained that they had become more concerned to build up a bank of part-timers who were trained, had passwords, and could use the eP system directly.

## Conclusions

Our respondents involved in eP implementation in NHS hospitals shared many common insights - different sites often yielded very similar 'lessons learned'. Unsurprisingly, traditional project success factors were as relevant to eP as to any other area of IT, requiring senior management backing, good

project management and user commitment. In particular, in establishing an eP project it was seen as essential to pay attention to building the supporting network. Champions needed to be found and encouraged, and the strong backing of senior mangers obtained. Often, as reported, it is the technology and infrastructure that proved to be the weakest link. These need close attention from the earliest days. And IM&T staff must understand the scale of what is being attempted and the key safety concerns.

It was also recognised that it is important to 'sell' eP's benefits widely, but also early on to flush out potential problem areas and people with doubts. Respondents emphasized the importance of communicating clearly that eP is a major clinical system and demands that everyone involved is prepared to leran new things and change the way they work.

Overall, the key messages that were reported to us can be summarised as follows; build a multi-professional team, plan for early success and to build momentum.; maintain substantial resources to manage develop and grow the system in use.

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