Managing Integration Work in an NHS Electronic Patient Records (EPR) Project

David Martin, John Mariani and Mark Rouncefield

This article uses an ethnographic study of the design and deployment of an electronic patient record (EPR) system in the UK NHS to document some of the difficulties of integrating new IT systems with existing and developing practices, technologies and regulatory requirements. It highlights that ‘integration’ in this situation, produces a variety of different, but connected and potentially competing requirements that create difficulties in achieving artful and successful system deployment.

Keywords: Electronic Patient Record; Integration; Design; Ethnography

Introduction: NHS Modernisation, Computerisation and Integration

Current health care policy initiatives in the UK make significant claims about the desirability of integrated services for better health care, i.e., more patient-centred healthcare delivery, improved resource utilisation and management of information. Plans for implementing these initiatives appear to be largely predicated on information integration being a necessary precondition to service integration. The electronic patient record (EPR) is a foundational element of this strategy, yet as research documents, its implementation presents formidable challenges [1,2,3,4,5]. Indeed deploying EPRs is particularly complex as this process is occurring when:

1. The systems are envisaged to support multiple medical, administrative and reporting processes and activities while also supporting best practice and encapsulating regulatory frameworks, rather than just providing administrative support [2,3].
2. The technologies incorporated in EPRs are more complex and sophisticated – e.g. utilizing imaging and visualization technologies, decision support and Internet-based applications, and are supported by innovative platforms and technologies.
3. Requirements as dictated by the NHS are emerging, developing and changing as successive programs are put into place and defined, meaning that system development needs to be flexible and responsive to future requirements.

In this paper we focus on moves to provide comprehensive, integrated computer support through developing and deploying EPR systems, which it is believed will support and facilitate clinical and administrative work and provide ‘better’, and more accessible and timely information. The integration ‘issues’ for EPRs are generally conceived of as (1) how to make new and legacy systems interoperable, and, connectedly, (2) how to achieve a standardisation of data (items, types, names, formats, flows etc.) across the organisation. We do not dispute the importance of these issues, however, our research suggests that during the deployment of EPR systems technical, data and regulatory requirements may be necessarily focused on to the detriment of producing a system that successfully supports the work of those delivering care.
The Setting
The setting for this research is an NHS Hospital Trust (comprising 2 hospitals) that is currently in Phase 2 of a three phase comprehensive £8.3 million EPR project, delivered as a public private partnership (PPP). Phase 1 went live in February 2005 (after a years delay) and involves the core administrative system and connected reporting system, A & E, theatres, order communications, and pathology systems, and is designed to be integrated with existing legacy systems. In the PPP arrangement a Customizable-Off-The-Shelf (COTS) system is to be configured to fit the needs of the Trust. COTS systems offer the possibility of a ready-made design solution, which can also be ‘tweaked’ to fit individual customer requirements. However, there is a big question as to how ready-made the solution is, how much it will have to be tweaked and how ‘tweakable’ it is? This creates a key set of design and integration problems concerning how to configure the system to fit with current endogenous work practices, existing legacy systems and new technologies and regulatory requirements. This involves working out and deciding how the COTS system can and should be configured, and reciprocally, how existing patterns of work practice should be maintained or transformed.

Method
Our research uses ethnographic (observational) methods [6,7], 'shadowing' the project team as they went about their everyday work as well as observing project meetings of various kinds over a period of 18 months, and the 'go-live' of the system in February 2005. We collected a wealth of materials (field notes, tape recordings, transcriptions, and documents) and analysed them with an ethnomethodological orientation (see [8,9] for comparable studies of system design). Ethnomethodology eschews theorising and instead takes an approach to field studies whereby ‘work’ is analysed and explicated in the terms in which it is organised as a recognisable social accomplishment by the participants in that setting. Consequently, here our focus is on the everyday work, documenting how and in what ways issues of integration were addressed; how were forms of integration conceived, reasoned about, prioritised, worked upon and so on? We would suggest that while some of our findings are specific to this Trust, issues related to implementing COTS systems and the multi-faceted nature of integration are pertinent to a wide range of systems design projects. This is especially true for the deployment of EPR systems in the NHS since most of these projects will be undertaken in similar situations and have a similar configuration of players and technologies involved.

Fieldwork Introduction: Forms of integration
From a technical perspective issues of integration concern how to integrate specific technologies so they can communicate and exchange data effectively. However our fieldwork (as is shown in our examples) revealed that integration is not merely a ‘technical’ problem. The Trust had not previously operated with a set of formally described, standardised and integrated procedures. Therefore, ‘integration’ for the

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1 Due to the costs of developing and maintaining a ‘generic’ system (i.e. code base), COTS systems are typically not ‘openly’ configurable but exhibit a ‘designed for’ configurability that anticipates the ways in which the settings in which they might be deployed can vary.
Trust was also about instantiating formally integrated processes on the EPR system, where previously integration had been achieved via talk and the manual passing of documents. Integration, too, for the project team was clearly about how to integrate the COTS system with pre-existing (and potentially transformed) work practices, and it was also clearly a matter of making sure that the new system fully integrated with emerging NHS requirements. Thus our fieldwork brought 4 types of ‘integration’ work to our attention:

- **Technical integration of disparate systems**: the integration of the core EPR system with modular systems for certain specialities such as accident and emergency, with the legacy applications used in pathology and with new imaging applications.
- **The integration of workplace procedures**: by implementing generic process models in the system. This immediately introduces a tension between standardization and supporting local variants in practice.
- **Integrating the system with work practices**: considering the desirability/importance of relating the design of the new system to specific aspects of work practices.
- **Integrating the system with wider organisational and NHS concerns and requirements**: satisfying NHS commissioning data set (CDS) requirements, and those of the Trust as a teaching institution.

The fieldwork suggested that these different integration activities possess complex interdependencies. While these might sometimes be anticipated and attempts made to manage them, it was just as likely that the consequences of one sort of integration upon another emerged as problems for the design team as the design of the EPR progressed.

**Integration, Regulation and Reporting**

System design in a NHS Trust is a complex, messy business, dealing with emerging and competing requirements, and searching for the successful compromise. If we consider the 4 types of ‘integration’ as outlined above and notions of ‘successful overall integration’ we can see problems looming; success according to which criteria, at which point in time? Successful technical integration of systems is a pre-requisite for computer supported integration of processes, but what if these are unworkable in practice? Conversely, the endless configuration of the COTS system to fit (maybe idiosyncratic, inefficient) local practices may hit technical and cost barriers, and undermine any gains got from standardisation. Even in a situation where design was clearly re-oriented around supporting best practice as a priority, deploying a ‘successful’ system would still be difficult. However, it soon became clear in our fieldwork that requirements other than supporting practice gained priority. The following quote (extract 1) came from the Trust’s project manager (Helen) during an analyst’s project meeting some months prior to go-live:

**Extract 1:**

Helen – “I did meet with XXX yesterday to discuss some of the issues ... because the reports we hand into the NHS are crucial to our funding, as a Trust and obviously we have to get the reporting right and there’s a huge risk to the Trust because we’re going live six weeks before the end of year, and ... all of our end of year reports we have to make sure are right.”

The government and public desire for transparency, league tables etc. places a strong reporting focus on the EPR, therefore making sure the new system both integrates with NHS requirements and can be used to present the hospital work, statistically, in the best light, is a priority Helen is clearly aware of.
Problems in collecting information to design the ‘right’ integrated process

Large organisations exhibit complexities related to scale, roles and processes, and the richness and inter-relatedness of information in the organisation. Information exchange practices and systems are rooted in time-honoured local work processes as part of wider patterns of coordination and communication. Attempts to change practices, and redefine roles and relationships may lead to resistance [3], but it may be very unwise to simply work around tensions and problems as they appear. In this example (extract 2), again drawn from an implementation team meeting, Barney (a senior Trust analyst) relates his difficulty in getting the information he requires to build the clinic scheduling application. He acknowledges the diversity of his user group and the need to include ‘many different users’ in testing but goes on to describe his design problem - that he does not have the required information on current process and practice on which to base a new design and instead is having to fall back to using the current data models on the patient administration system (PAS) as the resource for building the new system.

Extract 2:

Barney – Talking about clinic scheduling: “For this area we need many different users to test as it is different for different areas. I’m basing the build on call centre information. There’s a problem that the build comes from either PAS or how you do it. Information has not been provided in full or in a format to be used so I think I will just have to go on how PAS does it.”

Alice – “I think this has to go to the IM & T steering group”

Barney – “We wanted to set up clinics the way they work, it would have been magnificent, but have to go to PAS instead. No-one in this hospital is capable of providing a list of clinics.”

Alice – “Enterprise wide scheduling would be full integration of a series of procedures, bringing resources together in the ‘correct’ order to support care, the system would automatically work out what can be done, when, indicate what is required, as opposed to scheduling that is not seamless across procedures.”

Alice (an analyst from the supplier – ‘OurComp’) suggests that the problem should be escalated as a means of putting pressure on hospital staff to cooperate. Barney formulates the problem as one in which the users are ‘shooting themselves in the foot’. This then prompts Alice to describe this problem as an instance of a more general difficulty in the design – that the current situation is one where departments or areas operate as ‘silos’ and that this is having a knock on effect in achieving the desired integration of work processes to produce ‘enterprise wide scheduling’:

Of particular interest in this example is the insight it gives us into the tensions involved in different forms of ‘integration’ work. The COTS system contains a particular model of integrated processes – ‘enterprise wide scheduling’ and Alice clearly aspires to a situation in which work is transformed by the adoption of this model. Barney, however, while not explicitly disagreeing with Alice, is actually suggesting that he would have liked to have configured the system to integrate with current practice, but that he had been unable to collect the information required to do this. Whether the work practices should be transformed to fit the system (and what the effects would be) or vice versa is an on-going tension with little clear understanding of what would be the best outcome. In this case the situation is exacerbated by the fact that work that should be preliminary to answering this question – work to get a clear view of current operation, and then an agreed upon understanding of how to formally integrate processes before considering whether the COTS system can support this – is not, or cannot be achieved.
Integrating the system to the social structure of work (or vice versa)?
As the previous example showed, analysts (particularly those employed by the Trust, rather than OurComp) are concerned with getting the system to integrate with existing work practices. However, just how easy this is to do, how to get users to participate in deciding how to their processes should formally integrate, and whether the practices or the COTS system should be adjusted is a problem for them. We observed many discussions in project meetings during system development and configuration that concerned how well the emerging system fitted with the current social structure of work, and if it did not, whether it was important, and whether it should be solved by adjusting the system (technically) through training (socially). The following ‘log out’ example (extract 3), involving Bob (the Trust’s A & E analyst) and Helen nicely illustrates these points:

Extract 3:

Bob – “Because if they’ve got to log out people will not log out of it they don’t now.”
[Bob goes on to clarify the potential log out problem]
Helen – “Mm hm it is a problem”
Bob – “And in A & E, in that chaotic, you know, environment, they will not log out”
Helen – “Well and again, this is one of the reasons why we’ve asked for the IT trainers here as well so that this is ... yesterday I met with the IT trainers and we started talking about some of the issues that we need to make sure that everyone is aware of, this is one of the key ones, making sure that people log out and understanding the implications because in a fact it’s an electronic signature, and that’s going to give a print, of where you’ve been on the system and if you don’t log out you’re allowing someone else to use that signature”
Bob – “But it’s not a training issue, the fact is that the log out procedure will not be looked upon as important as treating a patient”

Bob, as the analyst ‘on the floor’ in A & E should be in the best position to understand the potential problems concerning whether the emerging system will support existing work practices. The log out problem demonstrates some of the ways in which the system is related to the social structure of work. Bob has begun by highlighting that given the current way work is organised (omitted talk) – A & E workers are often interrupted in their work, especially on computers, as they orient more to the seriousness of the case (the patient) in front of them than to the system administration process – they often forget to log out first. Work in A & E does not consist of discrete serial processes, one after the other.

In terms of log out, this now presents some problems. Firstly, since it is proposed that terminals will now be placed (spatially) in public areas not logging out represents a security risk. But, secondly, and related, if log out works on a timer staff will have to begin again input of interrupted tasks from the start, meaning no easy solution is to hand. We can see here, some of the ways in which aspects of the developing system are related to how work is socially organised, how it temporally and sequentially unfolds and how it is spatially distributed. When we join the example we see Bob getting his problem accepted by Helen and re-stating that it is a problem due to how work is currently organised. Helen’s next move, however, is an interesting one – she attempts to reconstrue the problem away from that of a technical problem requiring a technical solution.
(as it had previously) to a problem of practice (a social one) requiring training as a solution. Bob rejects this, but here we see an instance of a common practice. Even when a problem concerning how the system does not fit well with practice is highlighted and accepted, it may be turned into a problem in practice because no easy solution can be found.

**Prioritising Types of Integration**

In this section we shift focus from situations in which Trust analysts stand proxy for users to testing, a situation in which users are clearly present. This takes place later in design, when more of the technical design is ‘set’ so it is interesting to look at situations where users highlight instances of ‘bad fit’ between the system and the current work practices. The following excerpt (extract 4) highlights many of the common types of user concerns and how they were answered. In this situation two of the OurComp analysts (Vic and Brad) are ‘walking’ two of the A & E expert users (Jenny and Brian) through clinic bookings for their department. The excerpt begins with Jenny questioning the fact that to go from one step to another in the workflow ‘you have to go through seven screens’.

Brad, currently demonstrating the process on a computer, responds stating that there is a shortcut to avoid the long sequence of key strokes. Jenny replies by re-stating the problem as one where complex sequences of interaction are required for simple tasks. Brad replies by saying ‘that’s the way it is’. This comment is taken up by the senior analyst (Vic) who provides an explanation of why the interaction proceeds as it does – for the purposes of collecting the data they are required to by the NHS (i.e. integrating with the NHS spine). He also describes why a series of alternative solutions to this problem were tried, listing why they were not adopted.

**Extract 4:**

**Jenny** – “There’s one field to fill in but you have to go through 7 screens to get to it.”

**Brad** – “But you can just F7 to get to the field.”

Jenny again voices their concern about the amount of time it takes to carry out actions and complains about “having to do x clicks to carry out simple tasks”.

**Brad** – “That’s the way it is”

**Vic** – “It’s required for the A & E CDS (Commissioning Data Set)...A & E visits need to be counted as clinics.”

[Note: In this way A & E visits will mirror other aspects of hospital work in their recorded form (i.e. there will be a generic process). Vic then explains why the other options (for scheduling and recording A & E patients) would not work and why they were vetoed].

Next Helen adds to Vic’s point about NHS requirements by stating that another part of the reason for the design is to ‘fit in with the Trust’, i.e. for the purposes of having integrated, standardised, Trust wide processes. Brian then responds to this by stating what might be considered the classic problem between designing to support local practice and the constraints placed by needing to generically integrate processes – meeting the demands of this form of integration is seen as a problem when it means extra effort by local users. The old system simply took the user through a series of screens which they filled out item by item in a definite sequence. The new system requires navigation back and forward and in and out of menus – the implication from Jenny and Brian is that the new system is harder to learn, less straightforward and easier to get confused with. Helen responds firstly, in a placatory manner by promising future efforts to ‘streamline’ things before again stating the case for Trust wide integration:
As a ‘Trust wide’ (i.e. organisationally integrated) system, the extra information people gather is described as being of benefit elsewhere, and that this is important since the hospital is a teaching hospital required to do research. Helen then intimates that since there are no A & E people on the PAS (administrative) team they have not really understood this angle or its impact on the project.

In this long example we can see how the analysts try to sort through different types of problems as they take the expert users through their workflow for the purposes of user testing. When expert users single out aspects of the design and workflow that manifest as more work for those inputting data – they involve more steps of interaction or more data collection – these are presented as unfortunate by-products of the constraints placed on the design by requirements for integrating processes and for satisfying new NHS requirements. This may also be given as reasons when the project team of analysts believe the problems to be clinically insignificant and as something that may be dealt with by training during the domestication of the design. It is clear that having an integrated computer-based system of processes, that conform to (or integrate with) NHS requirements, has greater priority than having a system that meshes well with existing practice.

Integration: Who does the adjusting?
Continuing along similar themes to those of the previous exchange the following examples are quotes from Christine who is a PAS expert user, taken from discussions during user testing for the patient administration system (PAS) team. Both quotes (extracts 5 and 6) highlight important features of user perceptions of the presented system, and in many ways echo those of Brian and Jenny. How do they evaluate a system under construction? Why does it fit so badly with their work? Are they going to have to adjust or is the system going to be reconfigured?

Extract 5:
Christine - “There’s a problem of doing QA’ing when you’re QA’ing something but you don’t actually know what you’ll be getting… ‘cos they don’t have a PAS system in the States. It’s like fitting a square peg in a round hole. In America they just go ‘have you got the money, bang’… at the end of the day it’s our managerial problem so we need to start thinking of workarounds. We have to rely on the Trust when they emphasise the clinical suitability of the system.”

In this first example, Christine conceives the problem of lack of fit between the system and their work as to do with the fact that the COTS system is American, and as such
badly suited to being configured for the UK, or at least the administrative aspects of UK healthcare. She is also clear that it is her workers who will have to adjust to integrate their work with the system rather than vice versa. Her second comment builds on this and highlights one of the big problems of implementing an integrated system when previously workers have used dedicated systems (and ones with command line interfaces, where details were input in a restricted sequence). Since the new system has a number of generic applications that dictate, for example, how resources are ordered and activities scheduled, local practice must integrate with these. This means that users often complete some details on one screen then move to these generic applications. This means that the flow through the system appears more complicated as screens and menus are logged into and out of. Christine explains the process of learning a new system to her user group by using an analogy to describe the interaction sequences:

Extract 6:

Christine: “I imagine it’s like the map of the tube, [she gestures as she speaks] you go along and sometimes you get off here, go up there, and back, to get to there… it’s not a completely linear process”

Again, Christine sees that it is up to her workers to adjust to the system, rather than the system being adjusted to fit well with their work practices! It appears inevitable that problems, particularly when deemed clinically unimportant, and technically difficult to fix, have to end up being ‘solved’ by training, workarounds etc. However, it is important to question whether they can always be successfully solved by training, and it is important that users do not feel that everything is being shoved down to ‘a training issue’ for reasons of convenience.

Conclusion: Integration and Design

Our research suggests that understanding issues related to different forms of integration is essential, and that achieving artful and successful overall integration is about successfully managing different types of integration in the face of the fact that requirements for one form may have preference over another. NHS and regulatory requirements must be met, the new EPR system must integrate electronically with legacy applications and previously informally integrated processes must be integrated on the new system, while leeway pertains to successfully integrating the system with current work practices. Consequently, our research highlights that in the flow of design work, while analysts are aware of the need to try to get the system to integrate well with current work practices they have problems in understanding (a) whether the system fits well with practices, and (b) when practice can or should be transformed, or when the system should be reconfigured. Secondly, and related, we have shown that: (1) tailoring the system to integrate better with current practice is complicated by the need to organisationally integrate processes using this particular COTS system (with its inherent models), and with the need to technically integrate the system with other applications, and with NHS data collection requirements; (2) that requirements for better integration with working practices are given less priority that other integration requirements; and (3) that this means that when straightforward technical solutions to usability problems cannot be found they are inevitably turned into training issues.
The EPR presents a means to provide timely access to comprehensive patient data, providing the conditions for the imposition of greater discipline and structure on record-keeping, and facilitating the drive for standardisation. This standardisation is expected to lead to better treatment and the realisation of ‘joined-up’, ‘seamless’ healthcare. However, the problems are numerous and complex and there are doubts whether the EPR can actually deliver improvements in information collation, distribution and use [4,5]. To be useful systems such as the EPR also need mesh well with local circumstances of use. The difficulties of meeting several ‘integration’ demands, means that integrating the system to fit with local work practices becomes more difficult. Indeed this paper in many ways simply attests to the fact that as design becomes more entwined with the complexities of organisational work, the challenges facing systems designers increase [10]. The ‘design problem’ becomes not so much concerned with the simple creation of new technical artefacts or the ‘computerization’ and replacement of work practices as it is with the effective integration of computer systems with existing and developing localised work practices. Consequently, what we learn here is that organisations like the Trust studied here need to find better ways to understand current work practices and better means to understand how and whether they might be evolved or transformed in relation to an emerging design. And in this process users need to be involved and their requirements should not simply be considered as lower in priority, or something that may be bypassed.

References:
