

IGR Report: Understanding and Improving the Design, Deployment and Use of Electronic Health Records

Background

The Electronic Health Record (EHR) lies at the heart of NHS plans for integrated patient care (Jones, 2004). Building on the partners' studies of medical record keeping practices and inter-organisational communication (Hartwood et al., 2003), methodologies for user-led development (Hartwood et al., 2002), the use of paper in knowledge work (Sellen and Harper, 2001), pattern languages (Martin et al., 2001), legacy systems (Hartwood et al., 2001; Randall et al., 2001) and distributed information management (Hughes et al., 1996), this project examined fundamental assumptions surrounding the EHR, and explored strategies and tools for its design and deployment.

The Case Studies

We used ethnographic studies of EHR projects, interviews with stakeholders and workshops to examine fundamental assumptions surrounding EHRs, and explore the fit with existing and emerging practices, technologies and regulatory requirements. The case study design enabled examination of factors such as project scale, clinical setting, professional and organisational boundaries, and the different integration strategies adopted by NHS England and NHS Scotland. Because EHR projects are closely linked with other systems (e.g., patient administration systems, electronic drug prescription, clinical decision support) and are seen as being instrumental for the delivery of patient care innovations (e.g., integrated care pathways), we inevitably encountered issues which had relevance to this broader healthcare integration agenda and which it did not make sense to try to separate out.

Setting	Technology	Ostensive purpose
Rural NHS Community Mental Health Teams, NHS Scotland	Bespoke, in-house development of an electronic care record	Support for care pathways, coordinating team work
Health Board Clinical Information Integration Team, NHS Scotland	Integration of an ensemble of systems from a variety of suppliers	Sharing information across organisational boundaries
Urban General Hospital, NHS Scotland	Customisable-off-the-shelf (COTS) Hospital Information System	Hospital wide access to records; support for processes, admin functions, etc
North England General Hospital, NHS England	COTS Hospital Information System	Hospital wide access to records; support for processes, admin functions, etc
South England General Hospital, NHS Trust	Bespoke, in-house development of an electronic patient record	Integrating patient records with hospital PAS

Edinburgh University undertook research in three settings that were involved in projects under the NHS Scotland 'Partnership for Care' programme. The first comprised three Community Mental Health Teams undertaking deployment of an electronic care record to support an Integrated Care Planning Pathway (ICPP). Observations were made of the CMHT's record keeping practices, meetings, face-to-face discussions and phone calls over the period Nov 2002 – Sept 2003. The second study was of a Clinical Information Integration Team in a Scottish Hospital Trust charged with providing systems and services to make clinical information available across organisational boundaries (e.g., between primary and secondary care) using a suite of integration products commissioned specifically for this purpose (SCI). Between October 2003 and March 2004, we followed the team's work on integrating legacy systems, attended design meetings, workshops, meetings with stakeholders as well as with project management committees. The third study was of a Hospital Information System project at a large Scottish Infirmary serving a urban population. This ended prematurely owing to the cancellation of the project.

Lancaster and Surrey Universities focused on projects in the context of the NHS England and Wales 'Connecting for Health' programme. Lancaster University undertook research at the North England General Hospital, conducting a 2 year ethnographic study of the work of the IT project team during phase 1 of a 3 phase project to deliver a comprehensive EHR system. Phase 1 focused on delivering the core administrative and reporting system, as well as delivering specialised systems for A & E, theatres, order communications, radiology and integration with legacy laboratory applications. Surrey University undertook research at the South England General Hospital, an acute NHS Trust treating over 260,000 patients a year and employing 2,300 staff. An ethnographic study was conducted in the Medical Records Department, followed by 21 in-depth interviews with members of staff and then two case studies of electronic patient information systems currently in use. Data was collected from February 2003 to March 2004.

Summary of Findings

Our studies reveal the challenges of delivering on time a EHR project that fulfils its promises – e.g., standardisation, better quality more timely information, best practice – while fitting well with, and not disrupting, 'systems' of work, work practices and legacy technologies. For example, at the North England General Hospital services and functions associated with the EHR – e.g., clinical pathways, electronic drug prescription, decision support and integration with primary care – are still to be delivered, and phase 1 was delivered a year late and experienced problems upon go-live. We expand on our findings below and conclude with some recommendations.

Understanding the Social Context of Use

Team Work

Our study of interdisciplinary teamwork in Community Mental Health Teams shows how the introduction of an EHR to support teamwork can sometimes overlook the ways in which teams can work collaboratively to formulate diagnosis and care plans (Hardstone et al., 2004). By examining the transition from a paper to an electronic record we observed how the teams used the paper documents to formulate provisional or candidate plans that were subject to revision and/or ratification as part of a number of consultations held with team members leading to a consensual decision as to an appropriate course of action. While the paper documents were able to afford

the sharing of provisional assessments, the electronic ones supported only the sharing of the final outcome (it makes an assumption of certainty). This is not to say that the sharing of a final outcome is not a useful function, but rather to say that not supporting the sharing of provisional formulations, or indeed expressions of uncertainty, is a missed opportunity, and one that will in all likelihood exclude various sorts of documents from a working shared corpus.

Integration

Current health and social care policy initiatives emphasise the reliance of patient-oriented services on integrated information. However, our findings show that producing systems that integrate information can actually be quite disruptive to service delivery in the short term. Some of the impediments to integration simply reflect the scale of the organisations and services involved. For large organisations with complex information systems, achieving even modest levels of integration can be difficult in practice.

The case studies document some of the difficulties of integrating new IT systems with existing and developing practices, technologies and regulatory requirements. They highlight 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 that particularly impact on the way in which the system supports important current work practices. Integration of healthcare records activities often involves a number of separate integration activities: technical integration of systems, procedural integration, integrating work-practices, integration with wider NHS requirements (Martin et al., 2005; Martin et al., forthcoming: c). This can lead to programmes that are over-ambitious in that they seek to undertake what are really multiple programmes of work (the different forms of integration). Our studies show that while it may seem to be an attractive goal to undertake all integration work at once we find that in reality this leads to a greater prioritisation of technical concerns and wider NHS organisational requirements to the detriment of developing processes that stakeholders are satisfied with, and delivering a system that meshes well with the way staff currently organise their work. This can lead to negative staff perceptions of the EHR. This suggests that different elements of integration work should be separated. Most obviously the work of designing integrated processes could be undertaken prior to deploying a system, and that these should be developed with stakeholder agreement. This would also have the knock on effect of allowing a better assessment of whether a proposed system would actually support these processes well.

Standardisation

It is well understood that the requirement of integration also generates a requirement for standardisation (again including technical standards, standardised practices, procedures etc). Standardisation in a variety of contexts is also seen as a means to ensure a consistently high level of healthcare delivery across the country. A counter-argument is often made that heterogeneity is also important in the context of healthcare delivery – diagnosis and care delivery have to be sensitive to the needs of individuals and local populations which, in turn, may depend on the judgement of healthcare professionals, rather than on the close adherence to protocols. Rather than taking one or other side in this debate, we draw attention to the impact of EHR on standardisation as demonstrated by our research. While 'standards' are often embedded within EHRs in the form of care pathways, standard procedures and so on (what we might call programmatic standardisation), it is important to recognise that computer systems generally – and EHRs specifically – often come with 'rigidities' that are not necessarily mandated by the programmatic standard but are there because of the cost of creating computer systems that are flexible in a number of ways. Thus, when one is working to a protocol, the protocol itself will still allow various degrees of freedom which may get closed off by the introduction of an EHR. An example from one of our case studies was the order of how patients are displayed on the screen in A&E. Thus, while it may be necessary to mandate various ways that patients are dealt with in A&E, the protocols and procedures embedded in the system do not mean to specify the order in which the list of patients in A&E should be read, yet this is also, but unnecessarily, mandated by the system, leading to a mismatch with the criteria A&E staff apply when prioritising patients. Thus one might feel that the introduction of EHRs is synonymous with the imposition of 'standardised practice' – but the impact of parts of practice that it is deemed necessary to standardise might actually be much the smaller part of the overall 'standardising' effect of such systems.

Policy

As alluded to in the section above, one possibility afforded by computer records systems is a closer coupling of documents with policy than is routinely the case for paper-based records. Thus, while it might be the case in a paper form that certain sections should be completed by certain staff, in a certain order or that a piece of paperwork has a restricted circulation, it is also the case that adherence to these policies depends upon the conduct of those handling the documents. In a computer system it is possible to more strongly mandate these policies. In one of our case studies, an electronic solution was implemented where policy and documents were loosely coupled, in another they were much more tightly coupled. While in the first case there were many examples where newly introduced systems failed to match work-practices (e.g., to support what were routine changes in who was responsible for the current phase of the client's care), these could be worked around as the system did not tightly enforce the policy embedded within it (Hardstone et al., 2004). Thus, while the system meant to record the client's 'key worker' for the duration of the client's care, it did not object if this data was changed. The system was able to represent the current state of affairs – but not the historic states (without access to an audit trail). The system was not able to support directly the representation of a change in responsibilities – but this could be ad-hoced (by typing over prior entries) in ways that meant that the system's information stayed relevant to those providing care. On the other hand, the rigidities introduced into the second system by a strict mandating of policy sometimes created considerable difficulties again where it turned out that the system did not meet real world demands when deployed. (For seemingly good reasons, one EHR system studied instantiated strict rules for such matters as where and by who processes could be initiated and how they should proceed, as well as strict security profiles for all users. Unfortunately, post go-live the system became quite unworkable for some staff. For example, samples were turning up at the pathology laboratory that had not been logged properly on the system but lab workers were barred from working round this and logging them themselves. In general, the system was poor at allowing easy recovery from error or exception handling and there were no local users with sufficient security clearance to rectify these problems.) One would not want to suggest an 'anything goes' approach to policy, but rather make some suggestions as to how when introducing a new system the effects of ratchetting up policy can

be ameliorated. First, we would suggest that policy should be tightened gradually – particularly given that there will always be some mismatch between the functions of a newly deployed system and the real world demands made upon it. Second, because one can more tightly enforce policy, then one often feels an imperative to do so, since if there was an adverse event that could have in principle been avoided by the mechanical application of policy then one may be held accountable for it. However, in specific cases one might think about how to balance available measures – for example, by balancing strength of auditing with strict enforcement of policy.

Security and Confidentiality

We have found both in this work, and building upon prior work, that security and confidentiality considerations are of the utmost importance to healthcare professionals who have to make situated practical judgements about what information to share with whom and when. They will judge what might happen to information once it is placed within a given information system (be it a computer or paper-based record) concerning who might subsequently have access, how widely it would then be circulated, and consequently the sorts of risks to the patient associated with its dissemination. They may then choose a particular records system as appropriate for certain sorts of information and tailor their entry choosing a particular level of detail as appropriate for a specific audience. Sometimes, health care professionals' understandings of who might have access to a specific record are not accurate but, on the other hand, systems encountered as part of our research rarely make available an account of the security policies they enforce at the point of use (Hartwood et al., 2005). There is a tendency for approaches to security and confidentiality to be concerned with enforcing policy, for example, using a role-based access system to ensure that information is shared on a 'need to know' basis. Given that health care professionals (HPCs) are profoundly concerned with issues of patient confidentiality, and they are also in a position uniquely to understand the confidences involved in individual episodes of care, it makes sense both that security issues should not be treated as non-functional requirements of a system, and that systems should provide the resources for the HPC either to make informed decisions about whether committing information to this system in these circumstances is appropriate, or to provide the HPC with the resources to control the subsequent dissemination of information committed to a shared records system.

Trust, responsibility and control are very important issues in these matters. One can see in a shift away from local paper based archives has an impact on where trust, responsibility and control are (re)located. For example, employing a central database repository (such as the NHS Spine) as a way of implementing a shared health record requires that one trusts the persons who administers the spine to enforce agreed upon security policies (since one no longer has direct control over whom gets to examine the information once it has been committed). One also has to understand those policies and their implications, and trust that those policies will not change in the future. A federated approach that assembled a record on the fly from participating systems would make it much easier to maintain a degree of local control over implementing policies concerning what information might get shared with whom. The NHS spine is a national service, whereas the data repository employed in Scotland (SCI Store) is based regionally. This makes the confidentiality and security issue smaller since: (1) the data is not so widely shared, (2) local parties can reach local agreements about what data to share and when, amongst people they know and trust, (3) the problem of national integration is postponed – but presumably sharing data locally is more important than sharing nationally. Everyone gets a chance to acclimatise to greater sharing before this happens.

Linking Ethnographic Fieldwork to Design and Development Practice

The link between ethnographic findings and pattern templates for communicating aspects of social and technical interaction is addressed in Martin et al. (2006). The 'Hazards' website¹ is a collection of incidents or problems and their solutions ('war stories') that were observed during various stages of the EHR deployment process. The web site was designed to be used as a reference for anyone involved in the development or deployment of any socio-technical system within a healthcare setting. The war stories are arranged according to the stage in which they arose during deployment and can also be accessed by keywords/types of hazards. The aim is that they will serve as a useful resource for those involved in similar projects. We also encourage others to submit their own war stories on similar projects (we have provided the facility to do this). The sharing of war stories has been shown, as an informal and ad hoc activity, to be useful for designers (Orr, 1996). We assembled a resource of war stories relating to deployment for use by all stakeholders involved in the EHR deployment process with the aim of helping stakeholders to get an idea of the types of problems that may arise in a deployment process, when they may arise and how they were dealt with at the time.

The web resource is organised according to stages of deployment and types of hazards. The stages of deployment at which hazards have been identified include: Procurement; Award and Signing of Contract; Data Collection; Database Build and Configuration; Integration; Testing; Transition Management; Domestication and Evolution; Maintenance. The types of observed hazards include: Access; Bespoke or Off the Peg?; Communication; Configuration; Incomplete Data Sets; Integration; Local Verses Global; Outside Commitments; Participation; Relationships; Schedules; Security; Suppliers; Support; Training. These form one component of the 'EHR design and evaluation toolkit'.

The project contributed to the development of 'Scavenger' (Lock, submitted; Mackie and Lock, 2003), a tool for supporting the direct recovery or "reclamation" of data from ethnographic reports and original source materials and to enhance and augment the activities of a human analyst. The aim of Scavenger is to ease the processes of ordering, structuring and tagging the content of digital material. Support is provided for the importation of electronic texts, hand written notes, photographs, diagrams, scanned artifacts and audio files. Scavenger is a part of the 'Strider' tool (see below).

Project Management in Delivering an EHR System

This theme focused on a consideration some of the everyday practicalities of delivering an EHR project within an NHS Hospital Trust. Using ethnographic, observational, data we documented how and in what ways the orderly character of project work is achieved against a background of battles and negotiations to deliver the project within and despite various organisational contingencies and constraints

¹ <http://www.comp.lancs.ac.uk/computing/users/mackie/WarStoriesWeb/hazards.php>

(Martin et al., 2004; Martin et al., forthcoming: a). We were particularly interested in how the 'formal' tools of project management – scheduling, phasing, modularisation of tasks, documentation etc. – were made to work in real everyday situations, and how they serve to divide the project up and are used in various assessment activities. Also of special interest was the work carried out around the 'contract' as a series of negotiations and trade-offs. It is surprising how rarely 'the contract' appears in research on user-designer relations given our routine observations that reference to it is a persistent feature of the design and deployment process. The 'contract' – the formal, legal stipulation of work and responsibilities – gets dragged into everyday work and used in a number of ways. The contract provides a formal framework within which and in reference to which user-designer relations get worked out in practice, for, as with any 'plan' how the contract gets worked out in a contingent and rapidly changing world is a product of intense negotiation. In this project, a continual feature of the relationship between designers (and designers and users) is the on-going negotiation over where work is, what work is required, and who should undertake it by reference to the contract.

Managing User Participation

This work considered some of the everyday practicalities of achieving user participation and delivering an electronic health record project within an NHS Hospital Trust. Again, our studies show how those responsible for delivering a working configuration of an off-the-shelf system are keen to work with users but often find it difficult to locate and engage with user communities within the hospital and struggle to prioritise user involvement where these activities compete with the pressing technical difficulties associated with the production of a functioning system (Martin et al., forthcoming: b). Throughout the project there was an obvious need to keep 'users' in mind – though this may get submerged in the myriad demands of keeping a project on track. Of course, 'users' come in various forms and, on occasion, it may be that the interests (or convenience) of one set of users, say administrative staff, may clash with those of another, say clinical staff or patients. Tensions (professional and design related) exist between different user groups. Even within the clinical user group there are many different sub groups; consultants, doctors, nurses, physiotherapists, occupational therapists, radiologists, lab staff, etc. Each has different work oriented perspectives on the same patient and this can have implications for the design of the EHR. Nevertheless the EHR system, as an infrastructural backbone to the organisation requires a close match with organisational structure, process and practice. The system is inextricably linked to all work activities, so it is of crucial importance to understand and take users' everyday activities into account. One problem that arises therefore is in considering the relationship of the EHR to other organisational changes, where there may be a lack of understanding of just what the implications of the EHR are on everyday organisational workings. In these circumstances the problem emerges of human factors effectively being downgraded, being dumped (perhaps by necessity in this type of project) down the schedule, or treated as 'other' types of problem and perhaps not adequately addressed.

Achieving Dependability

Our studies highlight the practical work involved in developing and deploying dependable EHR systems. They show how dependability is a thoroughgoing practical, contexted achievement (Martin et al., forthcoming: a). Of particular interest was our finding that dependability is an outcome of reasoning and argumentation processes that stakeholders engage in, in situations such as design and testing. What becomes relevant during these interactions then stands as the dependability criteria that must be achieved. Our studies examined the way in which different dependability criteria need to be managed and even prioritised and draw attention to the types of work this provokes at the boundaries of organisations, particularly when integrating work and technologies.

Devising and experimenting with appropriate strategies for integration

The strategies adopted by 'Connecting for Health' (England and Wales) and 'Partnership for Care' (Scotland) differ significantly. The former takes a radical, 'top-down' approach of creating a new information infrastructure, whereas the latter has pursued an incremental, 'bottom-up' approach which builds on existing systems. Both approaches have their problems as recent events and our own findings confirm. Connecting for Health is running significantly behind schedule and over budget. Partnership for Care has experienced uneven progress of deployment across healthcare regions and it is now modifying its strategy by introducing nationally approved systems.

Our studies furnish plentiful examples of the problems faced by both programmes and also enable us to advance understanding of their causes. Technical strategies need to be more appropriate in different settings: expecting a single solution to work across contexts is unreasonable. Our findings suggest, however, that the relationship between strategy and outcome is complex. Factors such as the type of solution (implemented in-house, local or national COTS procurement), scale (local, regional, national) and scope (single or multi-function) are relevant but projects that are small-scale and developed in-house can exhibit many of the problems associated with large-scale COTS systems (inability to match working practices, falling behind schedule and so on). The issue is not necessarily one of top-down versus bottom-up, but rather of choosing methods and technologies that can help avoid the pitfalls that either approach may encounter – e.g., paying insufficient attention to local practices, being too ambitious, not staging adequately the separate forms of integration work needed and so on. It is more over ambition, or at least, a lack of appreciation of the complexity of the task being undertaken that is the principle hurdle to successful EHR deployment (Martin et al., forthcoming: a-c). While large scale, top down deployment as currently undertaken exacerbates these problems (especially given the potential rigidities of such systems), where resources are in short supply, the problems are apt to resurface in much more modest settings.

From the technology perspective, our findings suggest consideration should be given to how toolkits or components could lower the technical barriers associated with matching work practices more closely. These would comprise flexible, customisable software components that aim to support informal and collaborative working practices but that can be made part of large scale (inter-)organisational systems such as EHRs. An important benefit of a component-based approach is that it naturally ends itself to being user-led. It provides users with the opportunity to appropriate systems to their specific needs by controlling the selection and customisation of components deployed in the local context of use; that is, precisely where it can have the greatest impact on the usefulness and usability of organisational IT systems (Anderson et al., 2006; Hardstone et al., 2004).

As the project progressed, we became aware of the work on data integration being undertaken within the UK e-Science research programme. The Grid does not yet feature strongly in EHR delivery plans but our investigations of this rapidly developing suite of

technologies lead us to conclude that its impact on the healthcare sector will be significant. For this reason, our second workshop aimed to bring e-Science and clinical communities together to explore what they might have in common, and what they may learn from each other.

Initial exploration suggested that developing an integration demonstrator as originally conceived would be infeasible due to the complexity of patient data. We decided to adopt a more 'low fidelity' approach based around the 'Strider' tool (Lock, 2004) being developed within the DIRC project² for modelling socio-technical system configurations. Strider models are lightweight and quick to construct, can incorporate data from ethnographic reports, manuals, documents and other source materials, and can help to promote understanding by the various stakeholders involved in system development, operation and evolution. Drawing on our observational studies, we used Strider to create representations of healthcare processes and the uses made of information artefacts which can be used to explore different patient data integration options. Further work on this is continuing under the auspices of the DIRC project.

Recommendations

Our findings raise a number of issues that must be seriously considered as NHS programmes continue:

- The NHS has seriously underestimated the scale of the task involved in deploying EHRs. Constantly changing government and NHS policies has led to EHR procurement being very protracted: requirements have to be continually re-drawn and re-shaped and often leads to unsatisfactory compromises. Procurement is also made problematic because these systems will be used as instruments of significant organisational change. However, the Trusts (and the NHS itself) do not have a concrete idea of what the results of those changes will lead to, consequently it is very difficult to assess system suitability.
- Although 'supporting medical practice' and 'patient centred' are twin mantras of EHR design in the NHS, an over-riding design emphasis is on implementing 'proper' process, and on coding medical and administrative procedures 'correctly' so they may be standardised, counted and reported on. These 'other' requirements that stem from the need to provide fully technically and organisationally integrated systems can actually disrupt current medical practices. Standardisation implies that some features of local practice will be re-configured around new models that may run contrary to the way staff organise and understand their work; technical constraints can reduce flexibility. Since these 'other' requirements must be met, support for tried and tested local work routines may be removed with serious consequences later down the line.
- Currently, NHS hospitals have a poor understanding of exactly how they function in any kind of overall, comprehensive manner. Processes, if they are documented, are done so on a departmental or speciality basis, so particularly achieving 'integrated, computer-supported' working represents a massive organisational challenge that consideration might have been better paid to before the purchase of systems. Addressing this problem calls for better management of stakeholder – and local user – participation in EHR projects but this is very difficult to achieve. Identifying the 'right' stakeholders is problematic in such large and diverse organisations, they will likely have some competing versions of current practice and competing ideas about where they want the design to go. Managing this effectively is a big challenge.
- Many criteria are relevant to properly assessing the suitability and dependability of EHR systems. This is exhibited throughout our material. However, the testing metrics and criteria specifically employed during testing tend to be narrow and there is a question mark over, even in these cases, whether tests are properly passed, as many elements are deferred. There is a need to more comprehensively address dependability in the design of these systems and to work at developing the type of testing regimes that will actually allow you to do this.
- Both 'top down' and 'bottom up' approaches to delivering the EHR present major challenges. The former needs to have the flexibility to make sure local issues are addressed while the latter needs to ensure there are adequate mechanisms in place to provide coordination and convergence around common solutions. The issue, then, is not necessarily one of top-down versus bottom-up, but rather of choosing methods and technologies that can help avoid the pitfalls that either approach typically encounters.

Project Plan Review

The Surrey part of the project was handicapped by changes in staff. The original PI, Professor Richard Harper, left academia in August 2002, just as the project was starting.

Research Impact and Benefits to Society

We have published prolifically (5 journal and 6 conference papers, 4 book chapters) and engaged with a wide range of audiences. In addition, we are preparing summaries of our findings for each of our healthcare partner organisations. The workshops³ drew health service practitioners as well as academics and so provided both an opportunity to promote the results of this project to practitioners, and for practitioners and academics outside of this project to make new contacts.

Cognate concerns regarding Connecting for Health have recently been raised in an open letter to the Health Select Committee.⁴ Issues of scale, robustness and fitness for purpose were highlighted and it was proposed that the programme be opened to professional scrutiny. This project contributes to that aim and provides an empirical foundation upon which to assess the claims made.

Explanation of Expenditure

Edinburgh salary budget was overspent by £2.7k owing to Mark Hartswood's promotion to AR2. This was funded through the T&S and consumables budgets which were underspent, so the overall overspend is £74. Lancaster T&S and equipment budget were both more than 20% underspent. The underspend on both Edinburgh and Lancaster T&S was because the National e-Science Centre provided

² <http://www.dirc.org.uk>

³ <http://www.nesc.ac.uk/esi/events/324/> and <http://www.nesc.ac.uk/esi/events/648/>

⁴ Anderson et al., 2006. Available at <http://www.dawba.net/healthselectcommittee20020327.pdf>

workshop facilities and some visiting NHS staff expenses were covered by their respective Trusts. Surrey budget was underspent by some £5K, entirely on non-staff costs, because of the decision to undertake fieldwork locally rather than in Leeds.

Workshops were held in December 2003 and March 2006 under the auspices of the Project. Project funds were used to pay for invited speaker expenses and printing of proceedings. Delegates paid a fee sufficient to cover the per-head costs.

Further Research and Dissemination Activities

The project has contributed to new work at Edinburgh focusing on developing infrastructures to link clinical and research practices, including Edinburgh NTRAC, Scottish Family Health Study⁵ and NeuroGrid⁶ projects. Edinburgh is also working with the National e-Science Centre to develop a 'HealthGrid' research agenda with data integration as a principal focus. The project has provided a number of fieldsites which feature in follow on ethnographic studies at Lancaster of healthcare settings, including an investigation of how customer-focused software test scenarios can be derived from workplace studies ('Ethnography and Software Testing', EPSRC EP/C005805/1). Lancaster is also involved in a proposal with Lancashire Teaching Hospitals NHS Trust for a NIHR Research Centre for NHS Service Quality & Safety.

Additional publications are in review or in progress and reports to our healthcare collaborators are in preparation. The case studies contribute to the bank of experience of our ethnographic teams which then feeds as additional exemplary materials for ongoing and future projects, for example, the EPSRC funded IRC DIRC of which Edinburgh and Lancaster are partners. The work on patterns and modelling is one focus of this.

Bibliography

- Anderson, S., Hardstone, G., Procter, R. and Williams, R. (2006). Supporting the Evolution of Organisational Information Systems. In Ackerman, M., Erickson, T. and Halverson, C. and Kellog, W. (Eds.) *Evolving Information Artefacts*, Kluwer.
- Hardstone, G., Hartwood, M., Procter, R., Rees, G., Slack, R. and Voss, A. (2004). Supporting informality: Team working and Integrated Care Records. In *Proceedings of the ACM Conference on Computer-Supported Cooperative Work*, November.
- Hartwood, M., Procter, R., Rouncefield, M., Slack, R., Voss, A. and Williams, R. (2001). Building Information Systems as Universalised Locals. In Dittrich, K. and Egyedi, T. (Eds.) special issue on Standards, Compatibility and Infrastructure Development, *Journal of Knowledge, Technology and Policy*, vol. 14(3), p. 90-108.
- Hartwood, M., Procter, R., Rouchy, P., Rouncefield, M., Slack, R. and Voss, A. (2002). Working IT Out in Medical Practice: IT Systems Design and Development as Co-Production. *Methods of Information in Medicine*, 42, 392-7, 2003.
- Hartwood, M., Ho, K., Procter, R., Slack, R. and Voss, A. (2005). Etiquettes of Data Sharing in Healthcare and Healthcare Research. In *Proceedings of the 1st International Conference on e-Social Science*, Manchester, June.
- Hughes, J., King, V., Mariani, J. and Rodden, T. (1996). Lessons from Paperwork: Designing a Cooperative Shared Object Service, Information and Process Integration in Enterprises: Rethinking Documents. In *Proc. International Working Conference on Information and Process Integration in Enterprises*, USA, Kluwer Academic Publishers.
- Jones, M. (2004). Learning the lessons of history? Electronic records in the United Kingdom acute hospitals, 1988-2002. *Health Informatics Journal*, 10(4): 253-263.
- Lock, S. (2004). The management of socio-technical systems using configuration modelling. *Human Systems Management Vol 23(1)*, pp. 29-47.
- Lock, S. (submitted). The Scavenger Approach for Supporting the Qualitative Analysis of Mixed Media Original Sources. Under review for the *International Journal of Qualitative Methods*.
- Mackie, J. and Lock, S. (2003). Supporting the Development of Healthcare Systems Through Situation Modelling. 3rd International Conference on The Management of Healthcare & Medical Technology, Warwick, September.
- Mackie, J., Martin, D., Clark, K., Ramduny-Ellis, D., Lock, S., Hartwood, M. and Hardstone, G. (2005). Risks and Dependable Deployment. *Proceedings of 5th Annual DIRC research conference*.
- Martin, D., Hartwood, M., Slack, R. and Voss, A. (forthcoming: a). Achieving Dependability in the Configuration, Integration and Testing of Healthcare Technologies. *Journal of Computer Supported Cooperative Work*, Special Issue: CSCW and Dependable Healthcare Systems. Springer, Dordrecht, NL.
- Martin, D., Mariani, J. and Rouncefield, M. (forthcoming: b). Practicalities of Participation: Stakeholder involvement in an electronic health records (EHR) project. In Voss et al. (Eds.), *Configuring user-designer relations: an interdisciplinary perspective*. Springer, Dordrecht, NL.
- Martin, D., Mariani, J. and Rouncefield, M. (forthcoming: c). Managing Integration Work in a NHS Electronic Patient Records (EPR) Project. *Health Informatics Journal*.
- Martin, D., Mariani, J. & Rouncefield, M. (2004). Implementing a HIS Project: Everyday Features and Practicalities of NHS Project Work. *Health Informatics Journal*. Vol 10 (4): 303-313. SAGE Publications, London.
- Martin, D., Rouncefield, M., O'Neill, J., Hartwood, M. and Randall, D. (2005). Timing in the art of integration: 'That's How The Bastille Got Stormed'. In *Proceedings of the ACM Conference on Groupware*, November 6-9th, Florida, USA, pp.313-322.
- Orr, (1996). *Talking about machines: An Ethnography of a Modern Job*. Cornell University Press.
- Sellen, A. and Harper, R. (2001). *The Myth of the Paperless Office*, MIT press.
- Randall, D., Rodden, T., Rouncefield M. and Sommerville I. (2001). Remembrance of Designs Past: Legacy Data, Organisational Memory and Distributed Design. In Henderson, P (Ed.) *Systems Engineering for Business Process Change*. Volume II, London. Springer-Verlag.

⁵ <http://129.215.140.49/gs/sfhs.htm>

⁶ <http://www.neurogrid.ac.uk>