

**A qualitative study identifying the cost categories associated with Electronic Health
Record implementation in the UK.**

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Keywords: [MeSH terms]

Barriers; Information Technology; Value; Secondary Care

ABSTRACT [Max 250 words]

Objective

We conducted a prospective evaluation of different forms of EHR systems to better understand the costs incurred during implementation and the factors that can influence these costs.

Materials and Methods

We selected a range of diverse organizations across three different geographical areas in England that were at different stages of implementing three centrally procured applications i.e., iSOFT's Lorenzo Regional Care, Cerner's Millennium, and CSE's RiO. Forty-one semi-structured interviews were conducted with hospital staff, members of the implementation team and those involved in the implementation at a national level.

Results

Four main overarching cost categories were identified: infrastructure (e.g., hardware and software), personnel (e.g., training team), estates / facilities (e.g., space), and other (e.g., training materials). Many factors were felt to impact on these costs, with different hospitals choosing varying amounts and types of infrastructure, diverse training approaches for staff, and different software applications to integrate with the new system.

Discussion and Conclusion

Improving the quality and safety of patient care through EHR adoption is a priority area for

U.K. and U.S. governments and policy makers worldwide. With cost considered one of the most significant barriers, it is important for hospitals and governments to be clear from the outset of the major cost categories involved and the factors that may impact on these costs. Failure to adequately train staff or to follow key steps in implementation has preceded many of the failures in this domain, which can create new safety hazards.

BACKGROUND AND SIGNIFICANCE

Electronic health record (EHR) systems hold the promise of improving the safety, quality and efficiency of health care in hospitals.(1) Despite this promise and the existence of EHRs in U.K. primary care for several decades, hospitals have been slow to implement and adopt such systems.(2) This is due, in part, to the inhibitory cost of EHRs and the uncertainty in relation to whether they can achieve a return on investment. As the core component of England's £12.7 billion (approximately \$20 billion U.S. dollars) National Program for IT (NPfIT),(3) EHR systems were procured centrally rather than locally; the complexity of their implementation posed an immense evaluative challenge. With almost no previous research specifically looking at the rollout of nationally procured EHRs (known as the National Care Records Service (NCRS)),(4) our team conducted a £1.8 million (approximately \$2.8 million U.S. dollars) prospective evaluation of these different forms of EHR systems and found that they had difficulty fulfilling user and organizational needs.(5, 6) Implementation proceeded at a much slower pace than expected with numerous challenges.

Some useful insights on the costs of implementation can be gleaned from related evaluations of computerized physician order entry (CPOE) systems. A previous U.S. evaluation used internal documents and interviews with developers to determine the capital costs of an internally developed CPOE system with clinical decision support.(7) Other U.S. studies have obtained data from hospitals' financial units and accounting records in order to determine the capital costs of implementing CPOE and hospital pharmacy bar-code systems, respectively.(8, 9) Other studies have used a modified Delphi technique to obtain an expert group consensus on the estimated costs that were unavailable from the published literature or from primary data.(10) This consensus-based work has, however, not captured all relevant

cost categories – for example, unforeseen costs associated with productivity loss during unscheduled system or network outages. Walker et al. have suggested that a phased approach to EHR implementation may reduce costs, although this assessment was based on only limited evidence.(11) In addition, the size and complexity of organizations may mean greater implementation costs associated with system integration.

The widespread adoption of EHRs depends, in part, on the availability of financial incentives such as the U.S. Meaningful Use Program(12) and the ability to make a business case for the financial benefits that will accrue to an individual health care institution or provider. There is no standard evaluative framework in place categorizing the costs of implementation and the factors that can influence these costs. With more and more health care institutions considering implementation of EHR systems worldwide, the purpose of this evaluation was to provide potentially transferable insights into the costs of simultaneously implementing different EHR systems in a range of diverse hospitals as part of the NPfIT.(13)

METHODS

After obtaining the necessary ethical and institutional approvals, we conducted a qualitative study to explore the views and perspectives of a diverse range of relevant hospital staff (e.g., Directors of Information Technology and Finance, consultants, nurses, ward managers), and members of the implementation team (e.g., change managers, project managers, program managers). These semi-structured interviews were conducted at 12 “early adopter” hospital sites located in three geographical implementation areas in England, namely: London; North, Midlands and Eastern; and Southern England,(6) which were

undergoing different stages of implementation. To understand the wider contextual landscape, we also approached individuals involved in the implementation of the NCRS at a national level e.g., staff from NHS Connecting for Health (whose primary role was delivery of the NPfIT), strategic health authorities, and system developers, for their insights at relevant national conferences. Forty-one semi-structured interviews were conducted between February 2009 and January 2011 with a total of 36 different participants; these lasted from 20 to 135 minutes.

We use the term “early adopter” in a broad sense to refer to those hospitals that were among the first to receive these systems as part of the NPfIT. Our sampling and recruitment strategy has been discussed at length in our previous paper,⁽⁶⁾ but in short we selected diverse organizations (teaching versus non-teaching; more autonomous versus less autonomous; and acute versus mental health settings) planning to implement three centrally procured NCRS applications i.e., iSOFT’s Lorenzo Regional Care, Cerner’s Millennium, and CSE’s RiO. An interview schedule was used and consisted of open-ended questions underpinning the study aims and objectives. We obtained informed consent from all participants, and interviews were audio-recorded with permission. A selection of illustrative quotes from Site B and E is used in this paper to highlight these main themes; further quotes and the interview schedule are both available from the corresponding author on request.

We adopted an iterative approach to analysis, which enabled us to refine questions, investigate specific cost categories in greater depth, and pursue emerging themes and concepts during subsequent data gathering.⁽¹⁴⁾ Saturation was achieved when the themes suggested by interviewees began to repeat themselves and subsequent participants’ interviews yielded no major new insights. Any personal details which could lead to a participant being identified were removed at the data transcription stage and an identification

code applied. Care has been taken to ensure that these data presented here are neither attributable to particular individuals or sites to protect anonymity. A workable list of main- and sub-themes was developed inductively and applied systematically to these data with the aid of the computerized qualitative data analysis software QSR N-Vivo version 8.(15) This approach of reduction, ordering and collation enabled the field researchers (SPS, CQ) to concentrate on each overarching cost category in-depth and the factors that may influence these costs. The researchers moved backwards and forwards between the data, using the ‘constant comparison’ technique,(16) and evolving explanations, until a fit was clearly made. Financial, planning and other resource-use documents from hospitals were also analysed to ensure that all cost categories relevant to particular hospitals had been included. During analysis, emphasis was placed not only on the content of the documents, but also on the context they were describing.(17) Identified cost categories were fed back to individual participating hospitals, members of the Project Advisory Board, Independent Project Steering Committee, and NHS Connecting for Health, to help formally verify these findings for deployment of diverse systems, different sets of functionality, and hospitals commencing from dissimilar starting-points. Words in square brackets [] and ellipses (...) were added to the quotes presented below; the former to clarify meaning, the latter to indicate the removal of unrelated text.

RESULTS

We identified four main overarching cost categories associated with implementing an EHR system: infrastructure; personnel; estates / facilities; and other materials. We discuss each of these categories in turn, before considering the factors that might possibly have

influenced these implementation costs.

Infrastructure

We divided infrastructure into hardware and software costs (**Box 1**). Hospitals purchased and deployed different types of hardware, including standard Personal Computers (PCs), computers on wheels (COWs), wall-mounted computers, keyboards, tablet PCs and printers (mobile and heavy duty). A range of software applications were purchased including: integration engines; data warehouses (enhancement); operating systems (e.g., Windows); disaster recovery systems; service desk systems; and anti-virus software and licenses. As part of the NPfIT, Lorenzo Regional Care, Millennium and RiO software applications were provided free of charge to early adopter hospitals; this is in contrast to the U.S. where software licensing represents a major expense. Some U.K. hospitals chose to develop their own additional software at an extra cost.

Personnel

Different teams were employed to implement the EHR systems including, for example, project management, training, data migration and integration, configuration and testing, IT service management and operations teams (**Box 2**). Staff were needed to undertake a range of procedures including data cleansing (the identification and ‘cleaning up’ of any anomalies in the legacy data prior to migration), integrating (the building and testing of interfaces to integrate data from other systems), data migration (the accurate transfer of data), testing (the testing of the new system post data migration), networking (the optional

procurement and installment of a wireless network and/or configuration of a Virtual Private Network (VPN)), and training and supporting end users.

Estates / facilities

Key estate costs included space to accommodate the activities of various teams: project management, data migration, integration and testing, and training, as well as IT management, clinical and administrative support (**Box 3**). Estates costs were likely to be generated by scale; the more project management, data migration and other teams grew, the greater number of computers and rooms that were required. The installation of a secure wireless network was considered by some hospitals as an estate cost, as too was the refitting of nursing stations and desks on the wards.

Other materials

Other materials included, for example, consumables and printed training documents (**Box 4**). There was some overlap with the other three main cost categories discussed above (e.g., servers for data cleaning and migration).

What factors might have possibly influenced these costs?

The amount and type of *infrastructure* implemented was dependent on five main factors: (1) the stage of hardware maturity within the hospital; (2) the requirements of the software application being implemented; (3) the products currently available on the market;

(4) the budget (if predetermined); and (5) the physical requirements of the wards or office rooms.

The stage of hardware maturity within the hospital

Some hospitals had already invested in the necessary infrastructure prior to EHR implementation. According to the Director of IT at one hospital “...*virtually every outpatient clinic now has got a PC, all the reception areas are covered with PC equipment, so there’ll be very little cost to actually start to actually roll this thing out into those sorts of areas*” (Interview, IT Manager, Site B). Hospitals usually had an ongoing program of ‘*desktop printer type replacement*’, either purchasing or leasing the hardware from a technology provider. It was “*difficult to be precise*” about the specific cost of EHR implementation according to one IT Manager, as hospitals were constantly ‘*refresh[ing] the kit*’ as part of “*business as usual*” (Interview, IT Manager, Site B).

The requirements of the application

In order to run a particular software application, hospitals needed to ensure that their hardware satisfied certain requirements. These requirements were set down by the software provider and were known as the Warranted Environment Specifications. According to the implementation team at one hospital site, PCs were required to have between 512 MB – 1GB of Random Access Memory (RAM) in order to run the new EHR system. This meant that 450 PCs needed to be replaced and the memory of another 450 machines upgraded, as the Finance Director explains:

“We put in 450 new PCs or replacements if you like and we upgraded the memory of another 450, and if we’d been using iPM [iSoft Patient Manager] or a thin client system we wouldn’t have had to have done any of that that was purely driven by the new requirements of the application” (Interview, Finance Director, Site B).

The head of IT at another hospital felt that the Warranted Environment Specifications were set too low, as other packages normally running alongside the new EHR system, e.g., anti-virus, resulted in machines sometimes not working. Others managers at different hospitals also shared this view and felt that they ending up spending more to overcome these problems with performance than they had originally anticipated.

“...they just didn’t spec it out right (...) the anti-virus sucks power like nobody’s business, all the memory and CPU [Central Processing Unit] and everything, and they didn’t really think of that. So what they said was “you only need this to run (name of EHR system)” which was absolutely true, what they didn’t think about was all the other factors” (Interview, IT Manager, Site E).

Hardware products currently available on the market

Interviewees expressed mixed feelings about the products currently available on the market. Some tablet PCs were considered very poor for viewing or entering information into, while others were felt to be too heavy to use. The Director of IT at one hospital decided not to invest in tablet PCs at a cost of £1,500 each (approximately \$2,300 U.S. dollars), explaining how the tablet device trialed contained a SmartCard slot that did not pass infection control standards; a further concern was that staff could easily burn themselves

when the battery got too hot.

“...it gets very, very hot behind and the concept of those tablets is, you put your wrist behind and there’s a piece of elastic at the back of it and we thought you’d walk around with it, well if you had your wrist on the back of that you’d burn yourself. (...) Now if you hold it around the plastic it’s okay but they’re not there yet” (Interview, IT Manager, Site E).

The predetermined hardware budget

The amount and type of hardware implemented also depended on whether a predetermined budget had been set. With a budget of £500,000 (approximately \$782,000 U.S. dollars), one hospital purchased 150 standard and 100 wall-mounted PCs, 50 COWs, and around 300 infection-controlled keyboards at a cost of £110 (approximately \$172 U.S. dollars) each. The Director of IT at this hospital explained how they could easily have spent their ‘one-off’ budget (i.e., an exceptional, start-up amount) twice over because certain pieces of hardware, e.g., label printers were very expensive. Each ward at this hospital could choose between five and eight different devices, with one COW considered the cost equivalent of three PCs.

“We had half a million and then we decided what kit we liked IT wise and we had a COW, a wall mounted or a normal PC, and we said okay come to the shop and that’s what they could choose and they all chose their own. (...) I think we bought 50 (COWs) and that’s for 47 wards, so some wards haven’t got any and some wards have got three, it’s just what they wanted” (Interview, IT Manager, Site E).

The physical requirements of the ward or room

With limited space in some wards and consulting rooms, wall-mounted computers were considered the most suitable option. However, the finance director explained that it would be very expensive to put this type of hardware in each small consulting room, and therefore a computer on wheels would be used as they could be shared between different areas. The Director of IT at the same hospital acknowledged how the current level of technology would still not satisfy the demands of ward staff at peak times.

Data migration

According to the National Approval to Proceed documents (formal approval to begin go-live in the ‘early adopter’ sites), it was the responsibility of the hospital to develop the interfaces necessary to migrate the patient record information to the interim system provided by the Local Service Providers or LSPs (contractors responsible for delivering the systems). If these data could be migrated in a similar format to that already existing in the hospital (e.g., exactly the same records, same fields), the costs were likely to be less. In addition, the more systems the new application replaced, the higher the costs. Once migrated, it became the responsibility of the LSP (e.g., CSC) to transfer it from the interim solution (e.g., iPM) to the final system (e.g., Lorenzo). Study hospitals developed their own interfaces on site, with others (outside this study) reportedly paying an external company to do it.

“...even if you go into iPM for six months (...) it just makes things easier because it allows you to bring forward your data cleansing, your Spine connectivity [part of the national infrastructure], you satisfy the requirements around data migration. But the big thing is you’ve got it in a CSC data centre, boxed up (...) And it then becomes CSC’s responsibility not mine to migrate it from there into Lorenzo, it’s CSC’s responsibility to deliver all the interfaces that I had to deliver when we went into iPM” (Interview, IT Manager, Site B).

“...some of the costs would depend, I mean, if it was just the same, exactly the same records, same fields, you know, but if they wanted some additional information for example that we had to pull in from somewhere else that’s where it (the cost) starts to get (high)” (Interview, Finance Director, Site B).

Testing

Some hospitals incurred significant costs in testing the software. Although it was the responsibility of the software suppliers to test the systems prior to ‘go-live’, some hospitals chose to test the system themselves as they felt that the commercial testing was inadequate. The system provider had *“hand[ed] over stuff that you know you could see clearly that didn’t work”* (Interview, IT Manager, Site E).

“...we just wasted so much [Hospital] Trust time saying “No, that doesn’t work” and then pass back (...) since go-live we’ve taken on the testing ourselves cause we don’t trust them” (Interview, IT Manager, Site E).

This testing was carried out in parallel to the testing conducted by the Single Instance Board for Lorenzo (SIBL) Group, a group that was responsible for testing Lorenzo software for hospitals.

“...We’re allowed to run it parallel to SIBL so we are incurring quite a significant cost in testing but [Hospital] Trust B next door I don’t think would be allowed to do what we’re doing so they would make a saving” (Interview, IT Manager, Site B).

Networking

Views varied extensively between hospitals on whether a wireless network was needed as part of the implementation of EHR systems. One hospital installed a wireless network from the third floor upwards (where all the clinical wards were located), but insisted that this was *“nothing to do with Cerner”* (Interview, IT Manager, Site E). In contrast, the Director of IT at a different hospital *“would argue strongly the opposite [Wi-Fi is needed] (...) we couldn’t really be operating a clinical record in a ward environment without a proper, robust, secure wireless network”* (Interview, IT Manager, Site B). He explained that this would have been included in the original business case if they did not have a reliable wireless network already in place. One possible explanation for the difference in opinion may lie in the perceived scope of the new EHR system, with one finance director explaining how it was possible to run a Patient Administration System (PAS) without a wireless network, but not an EHR (automating both clinical and administrative processes).

Training and support

The amount of resource spent on training clinicians and administrative staff to use the new EHR system depended on four factors, namely the: (1) number of users at each site; (2) training methods employed; (3) decision to backfill staff; and (4) level of support provided.

Each hospital decided on their own training strategy, which consisted of either one-to-one, classroom, or ‘mass’ training sessions, or different combinations of the above. Recognizing how difficult it was for clinicians to participate in group sessions, one hospital employed extra trainers to coach clinicians and other staff on the ward, both by day and night. Another hospital chose to run 10 classroom-style training sessions simultaneously, each session accommodating up to 10 members of staff (mainly administrative), to train 5,000 members of staff. The training strategy was then changed six weeks before go-live to one-to-one training for frontline staff. Web-based training was also offered to staff at some sites.

The decision to backfill staff on the wards varied between hospitals. A ‘once off’ cost of £750,000 (over \$1.1 million U.S. dollars) was spent *“to back-fill clinical staff to support that training exercise”* (Interview, IT manager, Site B) at one hospital. No money was spent to back-fill staff at another hospital. One might hypothesize, however, that the reason why staff ‘couldn’t be spared’ to attend the training sessions in this hospital (as mentioned above) may have been due to the lack of money spent on staff backfill. Skilled trainers were also in short supply, with contractors’ fees approximately £500 (approximately \$782 U.S. dollars) a day each for one hospital. Floorwalkers were provided free of charge to ‘early adopter sites’ by the LSP and NHS CFH to help support users at go-live.

The level of support provided to clinical users also varied extensively, with one

hospital extending its service desk hours to run from seven o'clock in the morning until 11 o'clock at night, at a cost of £250,000 (approximately \$390,000 U.S. dollars) per annum. Lost productivity was felt to be a substantial cost in the implementation of EHR systems, although this was generally recognized by the hospitals as being difficult to measure.

DISCUSSION

This evaluation identified four main cost categories associated with the implementation of EHR systems, namely: infrastructure (e.g., hardware and software), personnel (e.g., project management and training teams), estates / facilities (e.g., furniture and fittings), and other (e.g., consumables and training materials). Many factors were felt to impact on these costs, with different hospitals choosing varying amounts and types of infrastructure, diverse training approaches for staff, and different software applications to integrate with the new system.

Drawing comparisons with existing literature,⁽⁸⁾ the success of an IT intervention ultimately depends as much on the implementation as on the system itself. Some hospitals may choose a different combination of lease, buy or build options. There are also important distinctions to be made in our study between the costs of implementing an EHR system in hospitals that chose to be 'early adopter' sites, and those who have also agreed to be beta-testers of the product (using very incomplete software). The costs incurred were not tractable in this regard, although the extraordinary development costs tended to consist of increased expenditure on testing. The relative scale of start-up costs compared to recurring costs, and the associated duration and distribution of each, is also uncertain. This is due to varying delays in implementation and the consequent lack of available data: none of the

systems studied or their implementations had reached a state of stable maturation. All data should therefore be considered to represent either start-up costs, or potential recurring costs – but not stable recurring costs. We also note how ongoing maintenance of EHRs and vendor support fees can be costly.(18)

In this study, we sought to categorize implementation costs that have a direct implication on processes and workflow. Productivity losses were found to be very difficult to track. For example, completion of a paper order form was routinely held to be faster than the new EHR system equivalent; however comparative completion times will vary by: individual; EHR software system; clinical functionality involved; level of training; and by level of staff performing the task. No hospital in this study monitored the task completion time of its staff; however complementary time motion studies, for example, may be useful.

Of the main categories, hospitals may be most likely to withhold on training and implementation costs. Our qualitative analysis suggests that certain topics are systematically under-appreciated in traditional software project planning e.g., back filling of staff due to lost productivity, hospital testing of the system due to inadequate vendor testing. Organizations faced hard compromises relating to cost, e.g., the infrastructure implemented may not satisfy the demands of ward staff at peak times, and should therefore consider devoting specific attention to these areas in the planning phase. Failure to train adequately or to follow some of the key steps in implementation has preceded many of the failures in this domain, which can create new safety hazards.(19, 20)

This study had several limitations. We faced a number of challenges collecting actual expenditure data from hospitals. Hospital staff were reluctant to divulge this information when interviewed, or provide any financial or resource-use documents which were viewed as confidential in nature. There may have been many reasons for this, including the highly

publicised losses reported by some hospitals.(21) A strength of this study is that we used a range of approaches to validate data quality and credibility, including checking for face validity, looking for disconfirming evidence, data triangulation by data source and seeking informant feedback.(22) This process not only provided considerable insight into the various costs associated with national EHR implementations, but it also added 'weight' to findings by revealing similar factors that impacted on costs. Supplementary data, in the form of detailed field notes and documentary evidence (e.g., business cases, project initiation documentation and interim financial reporting), also offered the ability to triangulate methodologically. It is also essential to note that this study focused on the EHR systems being implemented as part of the NCRS, which were all vendor-based systems. Clearly, the costs of implementing such systems may differ from those of a home-grown system, thus limiting generalizability. The financing of EHRs is also very different between the U.K. and the U.S. Finally, the English government announced the dismantlement of the Program on the 22nd September 2011, following a Cabinet Office review which stated that it was *"not fit to provide the modern IT services that the NHS needs"*.(23-25) The unprecedented, nationally imposed system would now be superseded by locally chosen and implemented solutions, which in turn creates huge challenges around the secure exchange of confidential clinical information among disparate systems and health care settings.

To conclude, improving the quality and safety of patient care through advances in health IT and EHR adoption is a priority area for U.K. and U.S. governments and policy makers worldwide. With cost considered one of the most significant barriers to EHR adoption, it is important for hospitals and governments to be clear from the outset as to the categories of costs involved and the factors that may impact on these costs. We believe that the cost categories identified in this study can assist hospitals in the development of their

business plans.

Ethical approval: This study was reviewed by an NHS ethics committee and classified as a service evaluation (ref 08/H0703/112).

Acknowledgements: We are grateful to all interviewees who kindly gave their time and participating hospitals for supporting this work. We also acknowledge the helpful support from colleagues in our National NHS Care Records Service Evaluation Team.

Contributorship Statement: AS and AJA conceived and designed this study, and secured the funding for this work. SPS and CQ conducted the data collection, analysis and interpretation. DWB also contributed to the analysis and interpretation of data. SPS led the writing of this manuscript with all coauthors commenting on drafts of the paper. All authors gave their approval for the final version to be published. SPS is guarantor.

Funding Statement: This work was supported by the NHS Connecting for Health Evaluation Program, grant number NHS CFHEP 005. The views expressed in this publication are those of the authors and not necessarily those of the NHS, the NHS Connecting for Health Evaluation Program, or the Department of Health.

Competing Interests Statement: The authors have no competing interests to declare.

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Box 1: Infrastructure Costs (referring to the key IT architecture required)

Domains	Examples
Hardware	<i>Standard Personal Computers; Computer on Wheels; Wall-mounted computers; Keyboards (Infection Control); Tablet PCs; Printers (Wrist-band Printers, Paper Printers, Label Printers (Mobile), Label Printers (Fixed)); Scanners; SmartCards & peripherals; Servers (Domain control (log in), Printers, Software application); Power source (Power sockets (per PC), Data sockets (per PC), Cabling, Switches (network electronics)); Batteries, docking.</i>
Software	<i>Additional applications including: Project management software; Change management software; Reporting software; e-learning application; Data quality dashboard; Discharge summary application; Business continuity application; Corporate dashboard; Integration engine; Training database; Data warehouse (enhancement); Operating system (e.g., windows); Disaster recovery system; Service desk system; Anti-virus; Licenses (Machine licenses (per computer), Intermediate systems).</i>

*Hardware and software maintenance and support costs were included in personnel costs.

Box 2: Personnel Costs *(staff costs related to the implementation of the EHR)*

Teams	Example of Roles
Project management team	<i>Project Executive; Program Lead; Senior Project Lead; Project Manager; Project Administrators; Finance Lead.</i>
Change management team	<i>Change Lead; Organization Development Lead; Business Change Analysts; Benefit Lead.</i>
Training team	<i>Training Lead; Trainers; Floorwalkers; e-learning developer.</i>
Data migration & Integration team	<i>Data Migration Manager; Data Migration / Entry Group (Coders, Keyers); Data Quality Assurance Lead; Interface expert.</i>
Configuration & testing team	<i>Build manager; Product specialists; Software developers; EPR advisors; Test manager; Test script manager; Testers; Quick test/Load runner analyst.</i>
IT service management/operations team	<i>Service-desk Manager; Service-desk operators; IT engineers; Application support.</i>
Business transformation team	<i>Communications Lead; Issues Management Lead; Business Continuity Lead; Risk Lead; Cutover Manager; Caldicott Guardian.</i>
Registration authority team	<i>RA Lead / Manager</i>
Clinical team	<i>Medical Director; Clinical Lead (Pathology Lead, Radiology Lead, Pharmacy Lead); Nursing Lead; Champion users.</i>
Administrative team	<i>Back Office Manager; Back Office Staff.</i>

* Costs associated with the backfill of staff involved in training and staff overtime (for rehearsals prior to go-live) were included in personnel costs.

Box 3: Estate / Facilities Costs (*costs incurred while installing an appropriate environment for EHR*)

Domains	<i>Examples</i>
Project management estate	<i>Project management room; Furniture / fittings (desks, PCs, printers, wall-mounts).</i>
Change management estate	<i>Change management room; Furniture / fittings (desks, PCs, printers, wall-mounts).</i>
Training team	<i>Training rooms (Inc. lecturer theatres, training buses); Furniture / fittings (desks, PCs, printers, wall-mounts).</i>
Data migration & Integration team	<i>Data migration and integration room; Furniture / fittings (desks, PCs, printers, wall-mounts).</i>
Configuration & testing team	<i>Configuration and testing room; Furniture / fittings (desks, PCs, printers, wall-mounts).</i>
IT service management/operations team	<i>IT service management and operations room; Furniture / fittings (desks, PCs, printers, wall-mounts).</i>
Business transformation estate	<i>Business transformation room; Furniture / fittings (desks, PCs, printers, wall-mounts).</i>
Registration authority team	
Clinical and administrative estate	<i>Clinical and administrative room; Furniture / fittings (desks, PCs, printers, wall-mounts).</i>
Storage space	<i>Server Storage Space</i>
Wi-Fi network	<i>Secure wireless network installation (Cabling, Router); VPN Connectivity.</i>
Wards	<i>Furniture / fittings: Nursing stations (Refitted), Desks.</i>

Box 4: Other Costs and Materials

Domains	Examples
Data migration	<i>Server</i>
Consumables	<i>Catering (incl. staff)</i>
Training materials	<i>Printed materials (manuals, fan folds)</i>
Other training	<i>Transport, accommodation</i>
Routine service provision	<i>Cleaning</i>
Miscellaneous	<i>Security, parking</i>