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A qualitative analysis of an electronic health record (EHR) implementation in an academic ambulatory setting

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ABSTRACT

Objectives To determine pre-implementation perspectives of institutional, practice and vendor leadership regarding best practice for implementation of two ambulatory electronic health records (EHRs) at an academic institution.

Design Semi-structured interviews with ambulatory care network and information systems leadership, medical directors, practice managers and vendors before EHR implementation. Results were analysed using grounded theory with ATLAS.ti version 5.0.

Measurements Qualitative data on perceived benefits of EHRs as well as facilitators and barriers to successful implementation.

Results Interviewees perceived data accessibility, quality and safety measurement, improvement and reporting as benefits of EHR use. Six themes

emerged for EHR implementation best practice: effective communication; successful system migration; sufficient hardware, technical equipment, support and training; safeguards for patient privacy; improved efficiency; and a sustainable business plan.

Conclusions Achieving the benefits of EHRs identified by our interviewees depends on successful implementation and use. Further identification of best implementation practices for EHRs is required, given the financial and clinical consequences of poor implementation.

Keywords: ambulatory care, electronic health records, information systems

Introduction

The use of electronic health records (EHRs) has been suggested as an important intervention for improving patient safety and the quality of health care.¹⁻⁴ The Healthcare Information and Management Systems Society defines an EHR as an electronic record of patients' medical information, including patient demographics, progress notes, medications, past medical history, immunisations, laboratory data and radiology reports.⁵ EHRs can improve efficiency by simplifying information retrieval processes, and they can enhance safety and quality and potentially reduce costs of care.^{1,6,7}

Adoption of EHRs in the USA has been slow due to several factors including the expense of these systems⁸ and the difficulty of integrating them with the existing workflow.⁹ Funding sources have so far been insufficient with return on investment from EHR use for practitioners not clearly demonstrated.¹⁰⁻¹² There is also a lack of consensus on best practice for EHR implementation, yet studies elucidate the pitfalls of poor implementation, such as increased medication error risks and higher mortality.¹³⁻²⁰

Recent studies have often focused on computerised physician order entry (CPOE), a component of EHRs that allows practitioners to enter medication, laboratory and radiology orders electronically, and therefore offers limited generalisability to EHR implementations.²¹ EHR implementations are particularly challenging due to their workflow effects as practitioners are required to perform clinical documentation electronically, a time-consuming task. Also, studies have not focused on the ambulatory setting, where the majority of health care is provided.

Therefore, we conducted this study to determine perspectives of office practice, vendor and institutional leadership on best practice for an ambulatory EHR implementation, as well as perceived benefits of future EHR use, at a large academic institution in New York City. We intentionally conducted this study before and around implementation to obtain real-time data about leadership perspectives.

Methods

Setting

Our academic institution is the product of a merger of two teaching hospitals in 1998. The institution's ambulatory care network (ACN) provides outpatient

primary care services, including family medicine, internal medicine, geriatrics, paediatrics and obstetrics and gynaecology (see Table 1). Practices at one of the institution's two main campuses have primarily used a home-grown EHR developed by an on-site physician. In contrast, practices at the other campus use a mix of paper-based systems and home-grown electronic systems, except for one practice that uses a vendor-supplied EHR. These systems combined offer only partial electronic functionality, none of it extensively integrated with billing.

Executive leadership decided to implement vendor-based EHRs throughout the ACN. Different vendors were selected for each of the two main campuses: one vendor had previously supplied the institution with an inpatient EHR, the other had provided the institution with a product used mainly in specialty outpatient clinics. Implementation activities commenced in August 2005, with rollout targeted for March to November 2006.

Respondents

Participants included leaders whose influence and oversight responsibilities during the EHR implementation process were vital to its success. We interviewed four main groups of system leaders: ACN leadership, information systems (IS) leadership, practice leadership (medical directors and practice managers) and vendor leadership (Table 2). Interviews were scheduled based on respondents' availability and most were conducted in person (three by telephone). Investigators interviewed until thematic saturation (i.e. when assigned codes and themes are repeated in subsequent participants' interviews, yielding no new themes) was achieved, which occurred with a sample of 15 and continued to interview double that number.²²

Semi-structured interviews

From January to May 2006, 45-minute interviews were conducted by two or three investigators (KY, SZ and DL). One investigator (KY) took detailed notes that were reviewed by the other investigators. The institutional review boards of the participating institutions approved this study.

We developed a semi-structured interview instrument for our leader respondents, tailored to the type of respondent (see Table 1). Each interview elicited respondents' expectations of the new EHR and barriers as well as facilitators to its successful implementation.

Table 1 Practice site characteristics*

Practice type	Patient visits/year	Electronic treatment	Electronic ordering	Documentation method
Family medicine	25 000	Yes	No	EHR-based
Geriatrics	9000	Yes	No	Paper-based
Internal medicine	76 000	No	No	Paper-based
Internal medicine	60 931	Yes	Yes	EHR-based
Multi-specialty**	44 498	Yes	No	Paper-based
Multi-specialty**	34 000	No	No	Paper-based
Multi-specialty**	29 102	Yes	Yes	Paper-based
Multi-specialty**	16 500	Yes	No	Paper-based
Multi-specialty**	37 000	No	No	Paper-based
Ob/gyn	14 454	Yes	Yes	EHR-based
Paediatrics	14 949	Yes	No	EHR-based
Geriatrics	6900	Yes	Yes	EHR-based

* All practices currently use separate computerised systems for billing and patient scheduling.

** Multi-specialty practices provide services in internal medicine, paediatrics, obstetrics/gynaecology and geriatrics.

Qualitative analysis

In accordance with grounded theory, after independent analysis two investigators (KY and SZ) reviewed and coded interviewee responses, then conducted an iterative process which began with a description of the data and code assignments and ended with identification of the six domains for implementation of best practice.^{22,23} Disagreements on code assignments and domains were reconciled through discussion with senior investigators. ATLAS.ti version 5.0 software was used to extract and re-contextualise these codes. We examined 527 quotes and phrases: 136 quotations from institutional (ACN and IS) leadership, 358 from practice leadership and 33 from vendors leadership. Then line-by-line examination of each sentence served as the unit of analysis for coding purposes, with respondents' own words guiding the development of codes. For example, one institutional leader stated, 'a good EHR will help achieve clinical quality and improve our ability to do research'. This phrase was given three codes, 'EHR', 'quality' and 'research.' In total we assigned 45 codes and created six major domains from our respondents' perceptions on vital issues needing to be addressed in order to successfully implement an EHR.

Results

We interviewed 31 system leaders: four institutional leaders (ILs) consisting of two ACN leaders and two IS leaders; 24 practice leaders (PLs) consisting of 13 medical directors and 11 practice managers; and three vendor leaders (VLs).

Perceived benefits of EHR use

Respondents cited improved access to patient data as a significant perceived benefit of EHR use, as well as consequent improvement in communication among practitioners and enhanced efficiency. Respondents found patient care fragmented because of missing charts. This was a problem that EHRs could address. One respondent commented:

'With automated systems, there is no loss of information. Ultimately this will be time-saving, since current systems take a lot of manpower ... Charts get misfiled. With a system that depends on people, there is always a chance that something will get lost.' (PL1)

Second, respondents perceived that EHRs could improve quality measurement and reporting abilities, facilitating regulatory compliance. Third, EHR functionalities

Table 2 Interviewees, sample size and key questions

Key informant	Sample size	Key questions
Institutional leadership (IL) consisting of both IS leadership (2) and ACN leadership (2)	4	Institutional IT goals Perceived benefits of new EHR Barriers and facilitators to new EHR and other IT goals Current satisfaction with documentation system Current clinical quality and efficiency Institutional decision regarding EHR product Personal role in decision Characterisation of implementation process (e.g. provider and staff productivity; economics, privacy, confidentiality, migration from legacy EHR issues) Communication issues
Office practice leadership (PL)	24	Institutional IT goals Perceived benefits of new EHR Barriers and facilitators to new EHR and other IT goals Current satisfaction with documentation system Current clinical quality and efficiency Experience with old EHR Characterisation of implementation process (e.g. provider and staff productivity; economics, privacy, confidentiality, migration from legacy EHR issues) Communication issues
Vendor leadership (VL)	3	Institutional IT goals Perceived benefits of new EHR Barriers and facilitators to new EHR and other IT goals Role of vendor Communication issues Comparisons with other institutions

would allow practitioners to 'retrieve population-based data' (PL2) and maintain registries of patients – a feature that was desired in order to enhance quality of care. Lastly, respondents thought that continuity of care would be improved through referral management and the remote access abilities of EHRs.

Six important themes for an EHR implementation

Communication

Clear communication was identified by every respondent as important to EHR implementation. Three levels of communication were targeted prior to implementation: between executive leadership and practice leadership; practitioner-to-practitioner; and among executive leadership, practice leadership and vendors.

Practice leadership stressed the importance of executive leadership communicating clearly with providers regarding the implementation. Some preferred a top-down approach, in which executive leadership would outline specific plans for providers to follow, while others were more interested in a bottom-up approach, in which providers could influence implementation. One practice leader commented that

'pushing the implementation rather than pulling, and creating incentives rather than forcing the providers [was important]'. (PL18)

Another preferred

'somebody to take ownership of the [implementation] project'. (PL19)

An institutional leader perceived that their role was to do both:

'I see myself as a clinical leader whose job is to push in both directions.' (IL3)

Respondents also stressed the importance of communicating expectations regarding productivity. One practice leader commented:

‘Providers will need support and assurance that leadership is okay with, and expects there to be, a decrease in the patient volume, at least at the beginning.’ (PL14)

Many practice leaders feared that modifying an EHR product originally designed for inpatient use without clear communication from executive leadership would not adequately address ambulatory care needs:

‘a one-size-fits-all model is not good’ (PL16)

Clear practitioner-to-practitioner communication was also considered important for EHR implementation. Most institutions customise EHRs to adapt to specific institutional and practitioner needs. Physician health information technology (IT) champions are often designated to lead this effort. Without clear practitioner communication, efforts may be duplicated. Institutional leaders stressed that:

‘users will have to use the system and communicate with us what works and what does not’ (IL2)

Our respondents viewed this communication as necessary to maximise efficiency and improve the quality of the end-product.

Finally, respondents stressed communication between vendors and executive and practice leadership. In particular, our vendor leaders valued standing meetings with executive and practice leadership to accomplish specific institutional goals.

‘Our team has direct access to IS leadership in terms of communicating any developmental needs. It has been a healthy, learning experience.’ (VL2)

System migration

Respondents raised concerns about plans for system migration, particularly for patients with chronic diseases.

‘Management of information flow is an already identified problem.’ (IL3)

Anticipated methods for transfer of clinical data also varied across practices, including scanning, abstraction of paper charts and electronic transfer. Some practice leaders expected to maintain a dual system initially while transferring old patient records and learning how to use the new system:

‘Providers will need to be able to refer back to [the old system] for a period of time.’ (PL19)

Other practice leaders preferred to adhere to only one system to avoid any confusion or duplication of efforts in data entry:

‘A complete switch to [the new] EHR is necessary for there to be a success – keeping a dual system will not be good.’ (PL7)

Technical equipment, support and training

Respondents viewed appropriate equipment, support and training as pivotal for successful EHR implementation. Adequate levels of equipment and support prior to implementation were especially important.

‘We need to work with a national based vendor who will have the financial resources to invest.’ (IL3)

Practices migrating from a paper-based system to EHR generally had fewer workstations than practices migrating from an older EHR system. Some practice leaders identified themselves as ‘uncomfortable’ with IT and desired ongoing technical support and training. Institutional leaders recognised this and stated:

‘the amount of technical support provided (or not provided) by hospital IT has been one of the important issues’ (IL4)

Development of technical contingency plans was also perceived to be important in EHR implementations. Many practitioners had been unable to practice during the North-East blackout in the summer of 2003 and desired specific guidance for such scenarios from the technical support staff. One practice leader explained:

‘what happens if the system goes down? What if there is another blackout or we experience a total system failure, without the current paper-chart system? There needs to be a uniform, system-wide approach to deal with such possible scenarios, [uniform] at least for the ACN practice sites. Everyone needs to be clearly educated about this.’ (PL3)

Patient privacy

Maintaining patient privacy in the EHR setting also ranked high among our respondents’ concerns. One vendor stated that EHRs ‘increase HIPAA compliance’ (V1).

Similarly some practice leaders perceived that electronic data storage safeguards patient privacy:

‘every decision can be tracked by a sign-in process.’ (P13)

However, other respondents expressed concern that the new EHR would be more prone to security vulnerabilities and emphasised the need for a specific plan to limit access to patient data and sufficient tracking of data queries. One practice leader asked:

‘Who will be able to access data? Will the access be limited to only physicians? Will there be a limitation on how many people will be able to access records on the same patient concurrently? How will the system limit access to sensitive medical information?’ (PL12)

Efficiency

Changes in workflow efficiency and patient–practitioner interaction resulting from the EHR implementation were concerns for our respondents. While some practice leaders could enumerate their expectations of changes in their efficiency, others wanted data published by the academic community or provided by vendors regarding efficiency changes. One practice leader commented:

‘What exactly was the decrease rate in efficiency (patient volume, etc) in other institutions that implemented EHR in the past? Have any institutions utilised the new [product]? Are we to cut back on physician hours and patient volume in order to prepare for this implementation?’ (PL1)

Another commented:

‘I don’t think that the new implementation will affect the total productivity too much beyond the initial period. Learning the program and adapting to it may lengthen the days for physicians to complete all daily tasks, but it is difficult to assess how productivity will be affected.’ (PL5)

Some respondents were afraid that, for those practitioners who were less comfortable with health IT, use of computerised systems could lengthen the visit time and hinder interactions between patients and providers. Most respondents were also concerned that the learning curve for the new EHR would have a substantial impact on efficiency. Accordingly, some practice leaders expected a notable decrease in efficiency:

‘I expect there to be a slowdown at the beginning and the flow in the practice will definitely be affected negatively at first ... [I] expect there be a 20–30% decrease in efficiency in the first three months of implementation.’ (P13)

Another stated:

‘I expect about 50% decrease in patient load in the first week and about 25% decrease for the second and third weeks. After that I expect a normal load – but I don’t know if this expectation is feasible or not.’ (PL5)

Financial considerations

Lastly, the financial considerations of an EHR implementation raised questions with our respondents. Although the institution had allocated funds for initial capital expenses during implementation, respondents were concerned about operating expenses. Some were uncertain if EHR use would result in a financial benefit for practices and providers. Others believed:

‘that there would be savings from non-duplication ... and saved time and money by allowing practitioners to easily track patient histories ... no matter where care was provided.’ (IL4)

Questions about financial effects on providers’ personal incomes were raised. One practice leader whose compensation and productivity were linked summarised:

‘In order to convince physicians to fully embrace this [EHR] product, someone should assure them that lost efficiency they will incur will be covered – in other words, expected amount of lost revenue should be calculated using previous data, and the institution should offer some sort of an incentive to cover [that cost]. Attending physicians are paid according to their efficiency level and therefore this financial aspect definitely needs to be worked out on the institutional level.’ (PL7)

In general, our respondents desired more specific data on the financial implications of EHR implementations. One respondent commented:

‘I hope that the financial result of this implementation will not be negative but I don’t really know.’ (PL12)

Discussion

Our study found that system leaders perceived benefits from implementing EHRs including improved access to patient data, improved measurement and reporting of quality measures and maintenance of patient panels. Further, we identified important considerations for an EHR implementation, as well as some potential best practice for EHR implementation, including: clear communication, careful planning for system migration, appropriate IT support, adequate protection of patient privacy, attention to efficiency and a sustainable business plan.

Despite potential clinical and financial benefits, practitioners are often reluctant to adopt EHRs in the ambulatory setting.⁸ Reluctance to adopt EHRs is often more significant than with other clinical IT applications, such as laboratory result viewing or CPOE, as the effects of electronic practitioner documentation on workflow are significant and the clinical benefits are more difficult to observe (e.g. the benefit of electronic laboratory result viewing is more immediate than the benefit of electronic documentation viewing).²³ In addition, EHRs are often more expensive than other clinical IT applications.²⁴ Therefore, identifying and implementing best practice is particularly important with ambulatory EHRs to avert wasted time, money and effort.

Clear communication is critical for EHR implementation. To date, some unsuccessful implementations of CPOE have been at least partially attributed to communication failures. For example, Cedars–Sinai

Medical Center in Los Angeles reported that physicians voted nearly unanimously to suspend their CPOE use after many practitioners disagreed on whether the 100% compliance requirement with CPOE certification and use by practitioners was realistic.¹⁸ Another study documented withdrawal of an EHR at Kaiser Permanente, Hawaii after physicians vocalised their resistance to the institution's decision to select a particular software without their input.²⁵ Clear communication among all involved can ensure adequate needs assessment and conflict resolution, and avoid duplication of effort.

Planning for a system migration is another crucial point to be addressed in an ambulatory EHR implementation plan. Transferring patient data from paper-based medical records to an EHR is a gradual process and may take an extended amount of time, effort and personnel.²⁶ One study examined the EHR implementation in a solo paediatric practice and found that it took at least four months for providers to convert to the new EHR system.²⁷ Customised migration plans are also necessary to address differences in baseline practice settings, particularly when a practice is making the transition from an electronic or paper-based documentation system. Such plans need to be devised very early in the planning process.

Despite evidence that IT may improve quality of care, many institutions are reluctant or unable to invest in costly IT interventions.²⁸ Capital and operating expenditure estimates need to be appropriately refined and adequate hardware, training and technical support must be provided. Many studies to date have pointed out the importance of continuous and substantial funding for IS needs.^{3,28,29} Office practices need to develop a sustainable business plan to support their EHR implementation.

A recent national survey estimated that 67% of US residents are at least somewhat concerned about the privacy of their personal medical records.³⁰ Ensuring patient privacy and confidentiality has both clinical and legal ramifications.³¹ Since May 2006 the American Health Information Community (AHIC), under the US Department of Health and Human Services, has created a workgroup of privacy and security experts to develop actionable confidentiality, privacy and security recommendations.³² While one function of an EHR is to promote easier data accessibility for providers, institutions must have safeguards in place to protect sensitive data from being available to unauthorised parties.

Our study has limitations. Since we studied an academic institution, our findings have limited generalisability, although this was mitigated by the bi-campus setting of our institution, where the majority of one campus moved to EHR from a paper-based system while the other campus made the transition from an existing EHR. In addition, our study was conducted during the planning and early implementation

phases, and therefore the actual success level of the implementations cannot yet be determined. Another limitation was that we did not record and transcribe interviews due to associated costs. However, we took extensive notes, which were reviewed by all investigators present at the interviews. Lastly, while all efforts were made to conduct all interviews in a consistent manner, three of our interviews were conducted via telephone rather than in person, due to scheduling issues.

Conclusion

While there have been a few previous studies characterising clinical IT application implementation, our qualitative study was unique because we interviewed multiple parties from an academic ambulatory setting early in an EHR implementation process.^{25,33} Our study offers a number of important aspects of implementation planning and suggests some potential best practice that other institutions may find useful in adopting EHRs.

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CONFLICTS OF INTEREST

None.

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