

HERDING CATS: THE CHALLENGES OF EMR VENDOR SELECTION

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ABSTRACT

The selection of an enterprise-wide electronic medical record (EMR) by a medical center is a major undertaking that will define its future clinical processes for many years. The parameters that drive the selection include the clinical requirements, the financial needs of the medical center, the geographic setting, the need for outreach into the community, and an analysis of the existing and predicted flow of information and work within the clinical systems.

KEYWORDS

*Electronic medical record (EMR)
Selection
Methodology
Enterprise-wide
Clinical processes*

The evolution of an electronic medical record (EMR) in a medical center varies depending on the preexisting medical record system. In some instances, the process may represent only an incremental change in a partially developed computerized EMR. In other cases, it comes closer to a revolution, as it is part of a complete overhaul of a minimally computerized medical record system.

In the latter circumstance, the implementation of the EMR involves much more than simply automation of preexisting processes. Strategically it requires analysis of, and change to, the underlying clinical information processes. Tactically, the transformation from a mixed, predominantly paper record to an

enterprise-wide EMR consists of three main stages:

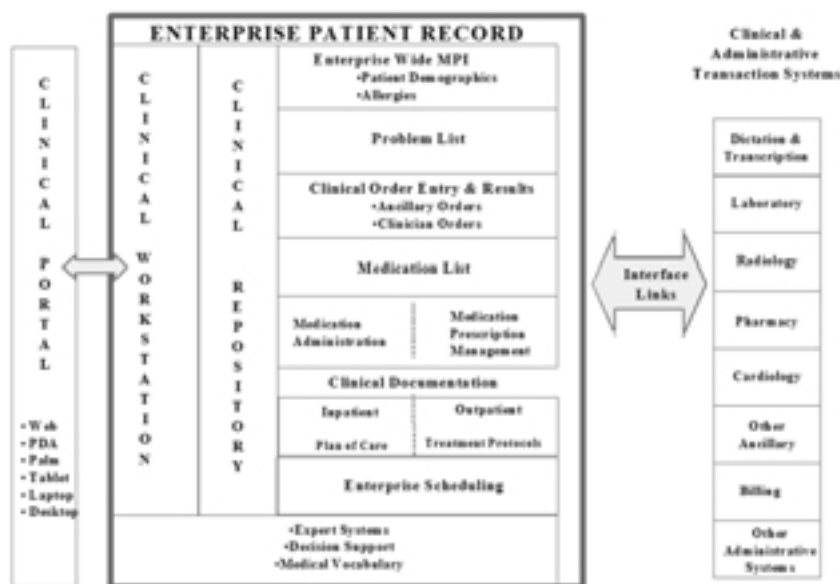
- First, and most important, is the enlistment of the medical center community in the process. The management level (clinical chiefs, administration) and staff level (physicians, nurses, ancillary medical, clerical) personnel must be involved in developing the strategic goals and the implementation process.
- The second tactical objective is selection of a vendor for the EMR.
- The final tactical goal is the successful implementation of the new EMR. This article describes this development process, with an emphasis on critical generalizable components/milestones of the process and potential barriers to success.

Current Situation Analysis

Fletcher Allen Health Care (FAHC) is a tertiary care academic medical center, located in Burlington, Vermont. The service area includes most of Vermont, fringes of New Hampshire, and portions of upstate New York. Fletcher Allen in the last year had approximately 23,000 inpatient visits and 398,000 hospital outpatient visits. FAHC employs approximately 6,000 employees, which includes 700 medical staff and 2,000 nurses.

Fletcher Allen Health Care's core clinical information system is primarily an in-house developed legacy system, with results review provided through OACIS (Open Architecture Clinical Information System). It has interfaces to

Figure 1. FAHC Clinical Information Systems Strategy



current technology ancillary systems such as IDX-Rad in radiology and SunQuest in the laboratory.

The existing systems are highly interfaced, and poorly integrated. Real-time clinician performance monitoring is lacking, and system conformance is highly manual and redundant. There is no significant integration among these information systems, with separate log-ins required for each. In addition, the vendor of OACIS has ceased supporting their product due to company dissolution following bankruptcy. There is no computer-based clinical documentation system for outpatient care, and only a semi-automated legacy system exists in the inpatient setting.

In part due to the impending demise of the results-reporting system support, FAHC began in the summer of 2000 to explore the options for introducing an enterprise-wide EMR. From a clinical perspective, such an EMR had to fulfill three strategic goals:

- The first goal was to select a vendor that will provide the core clinical systems necessary for Fletcher Allen to achieve its clinical and strategic objectives. These were: (1) supporting the

work of Fletcher Allen clinicians; (2) supporting the work of non-Fletcher Allen clinics and hospitals, some of whom are affiliated, the remainder of which are primarily referral sources of patients; and (3) supporting the Vermont community with a statewide longitudinal patient healthcare record.

- The second goal was to create an enterprise clinical patient record with the attributes (Figure 1) identified by the Computer-Based Patient Record Institute for content and functionality. It was understood that any plan for implementing the system would encompass significant capital requirements, operating requirements, and process changes over a long-term rollout.
- The third goal in selecting and implementing a system was to initiate a change management process within the clinical arena. By this, we are really talking about two different issues: First, the identification of critical clinical process flows so they can be modeled, replicated, and improved; and second, the actual management of implementing the workflow changes necessary to launch the EMR. To a great extent, Fletcher Allen has a man-

ual, paper-based clinical care process. We did not want to simply replicate the existing paper processes on the computer. In analyzing the workflow processes, a balance has to be struck between fulfilling the perceived needs of the users and actually changing those processes for the better. Doing so requires the active involvement of all the constituencies concerned so that the best possible design is achieved, and to ensure the acceptance of the final product by all the major groups of users.

Return on Investment Expectations

As with any such expensive undertaking, it was necessary to explicitly address the issue of the expected return on investment (ROI) for an enterprise-wide EMR. ROI analysis fell into three categories — financial, clinical, and operational.

The financial returns are tangible, but difficult to measure. Financial improvements are related to: (1) reduced length of stay, (2) cost reductions associated with risk reduction of adverse drug events, (3) reduced pharmaceutical costs derived from having information available at the time it is needed, (4) expanded technical capability and support of specialty services as needed, (5) improved case-mix analysis to improve reimbursement that is based on average severity index of cases treated at FAHC, (6) improved billing accuracy and charge capture, and (7) improved materials management and supply chain management.

The second category of ROI expectation is clinical, which has two components: improved patient care and standardized care. Reduced adverse drug events and improved decision making can directly demonstrate improved patient care. An underlying decision support (DS) capability that evolves over time should provide a substantial improvement in care delivered, both in terms of quality and cost. The second clinical component, standardized care, is a way of managing outcomes by use of evidence-based clinical guidelines embedded in the decision support component of the EMR.

The third ROI expectation is operational, which is specific to FAHC. Fletcher Allen has two clinical systems — one legacy system and OACIS. Both products need to be replaced due to their inability to provide adequate clinical support in the present healthcare environment. While this is not an overriding driver of the replacement decision, it is a strong justification for investing in an integrated core clinical information system.

Underlying Assumptions in Selection of an EMR

Before considering any vendors or products, considerable effort was expended developing the overall structure of an EMR that would fulfill our functional requirements. What resulted (Figure 1) defined the elements critical to our concept and the inter-relationships that were necessary. The core of the EMR is an enterprise-wide clinical data repository that is closely linked to the major documentation, order-entry, and scheduling components. This permits dissemination of timely, accurate data throughout the medical care process, and provides the opportunity for effective decision support.

Data, in the form of text and images, is fed into the core through standard interfaces to laboratory, radiology, pharmacy, and other systems. In many cases, the data exchange between the ancillary systems and the core is bi-directional in order to provide for clinical alerts, decision support, clinical task creation, etc. The clinical core is accessible to clinicians through multiple modalities (workstations, PDAs, etc.).

The initial stages of this process highlighted the fact that the success of an implementation strategy would be dependent on clearly articulated clinical/organizational objectives. Identification of these aims would keep the organization focused and help guide the vendor selection process. The prime clinical goal is to improve care. Commitment to this resulted in the functional requirements of core clinical system integration to facilitate the provision of accurate, real-time clinical data, as well as a decision-support mechanism to identify and promote optimal clinical decisions.

Figure 2. Voting Table

Vendors (across and down)	A: Vendor 1	A: Vendor 2	A: Vendor 3	How many B's? (total across)
B: Vendor 1		A	A	0
B: Vendor 2			B	1
B: Vendor 3				
How many A's? (total down)		1	1	

Individual Totals Table					
	Number of A votes	+	Number of B votes	=	Total votes (add 2 columns)
Vendor 1	0	+	0	=	0
Vendor 2	1	+	1	=	2
Vendor 3	1	+	0	=	1

Other important clinical goals include improving the satisfaction of patients with their encounters at FAHC, improve the ease of clinical documentation and system use by the clinicians, improve cost accounting methodology with respect to clinical (e.g., critical pathways, best practices implementations) and non-clinical functions (e.g., supply chain management, revenue cycle management), and develop an effective mechanism to deliver healthcare to a geographically dispersed community.

Initiation of the EMR Selection Process

Once the medical center leadership identified the potential need for a significant change in the health information management system, the Information Services Department was tasked to develop a conceptual framework for an EMR that would be appropriate for FAHC. The first activity following this was a presentation of the program scope to corporate officers of FAHC. Corporate officers are the executive committee of Fletcher Allen consisting of chief executive officer, chief nursing officer, chief medical officer, chief operating officer, chief information officer, senior vice

president of human resources, and senior vice president of business and planning, who make all policy and significant operational decisions.

Once approved by the corporate officers, the concept was presented to the Strategic Management Committee, which consists of the corporate officers plus the department chairs of the medical departments. Fletcher Allen, as an academic hospital, is affiliated with the University of Vermont College of Medicine. The medical faculty has joint responsibility to the College of Medicine and to Fletcher Allen. It was important to engage the clinical and business leadership as early as possible in the decision-making process to enlist their aid in progressing with the project.

A small decision team was established, which would be the focus of the ongoing analysis and vendor selection decision process. It consisted of a representative team of leadership from within the organization, which included the chief medical officer, the chief nursing officer, the chief information officer, and several physicians spanning inpatient and outpatient practices, specialty, and general medicine. Two of the physicians also had training in informatics. In addition, the

Table 1. RFP Subject Areas

1.0	Description of System
2.0	Technical Section
3.0	Application Section
4.0	General Questions
5.0	Specifications and Warranties
6.0	Scope of License
7.0	Deliverables and Site Requirements
8.0	Implementation 9.0 Training
10.0	Support
11.0	Personnel
12.0	Preliminary Cost Estimate
13.0	Payment
14.0	Due Diligence
15.0	Contract Issues

team had a registered nurse informaticist, a senior technical architect, and a senior project manager to ensure adherence to budgets, schedules, and project objectives. The project had continuing high visibility with the corporate leadership throughout the selection process.

Three other groups within Fletcher Allen worked with the key leadership, and provided analysis as they participated in the process. First there was a nursing informatics group, consisting of approximately 15 Fletcher Allen nurses whose primary objective was to review the clinical aspects of the vendors' products. Second, there was participation from business and clinical department leadership as needed. In addition to clinical leaders, leadership from human resources, budget and finance, patient financial services, registration, and scheduling were also involved in the process. Third, all Fletcher Allen employees were invited to, and participated in, various presentations. While it was understood that this was not a voting process,

employee feedback was strongly encouraged and presented as a way for everyone involved to contribute to the decision as well as help outline the clinical and functional requirements for the recommended system.

As a complement to the expertise within Fletcher Allen, a number of external resources were used. Among those were VHA Consulting, who provided high-level insight about clinical vendors; The Gartner Group, who provided domain expertise as well as process advice; Accenture (formerly Andersen Consulting), who helped with implementation strategies and domain expertise; and KLAS, who provided extensive analysis of vendors' service and support capabilities. On an ad hoc basis, FAHC also discussed its directions and mutual opportunities with other OACIS customers.*

The value of identifying the strategic issues at the inception of the project had two major benefits. First, it highlighted existing process issues necessary to be resolved prior to implementation. Second, it generated an initial implementation strategy consisting of pro forma project plans, which remained a useful baseline against which to evaluate vendor proposals throughout the selection process.

Selection Milestones

Seven significant milestones were identified in the selection process:

1. Establishing the decision team. While the membership of the team evolved over time, the core of the team remained constant.
2. Establishing and agreeing upon the selection criteria. This had been done at the beginning of the project, but it was not until toward the end of the project that serious consideration was given to the relative ranking of criteria. Establishing the importance of each criterion, along with refining the criteria, permitted meaningful comparisons between vendors.
3. Developing a pro forma clinical strategy as well as an implementation

strategy. This helped to substantially focus the team's thoughts and gave the team a baseline against which to evaluate the vendor offerings.

4. Conducting product demonstrations. Demonstrations occurred at several junctures throughout the process, each with a different focus.
5. Distributing requests for proposal. Five addenda to the RFP were issued for further clarification on significant issues, requiring documented responses and cross-vendor comparison. As the vendors became accustomed to the format of the RFP, they were able to respond rapidly, frequently within a few days.
6. Conducting site visits. There were several types of site visits, including visits to customer sites and vendor headquarters.
7. Recommending a vendor. The final milestone was a recommendation to the corporate officers with the vendor of choice.

Preliminary Vendor Screening Criteria

The initial screening of vendors was aimed at getting to a short list as quickly as possible. A request for proposal (RFP) was distributed to only four vendors. FAHC started with a small group of vendors, each of whom met five key requirements:

1. Product employed current technology
2. Product was a fully integrated suite of core clinical components
3. Applications were available for inpatient, ambulatory, and outreach environments
4. Vendor demonstrated financial and management stability
5. Vendor had experience with large tertiary care and academic customers

A short list of five vendors was developed using the five criteria, with the assistance of the external consultants. Each of the consultants had vendors that they felt met our criteria. By comparing all the recommendations from all the

*OACIS is a product that is substantially a development tool used for developing clinical information systems. The OACIS vendor made a business decision to no longer develop or support their product. Fletcher Allen worked with other OACIS customers who had similar needs, to share experiences and better prepare us for the vendor analysis and selection process.

consultants, it was fairly easy to identify the five vendors who were represented most often.

A comprehensive RFP was issued early in the process. The RFP was very directive in the format in which the vendors were asked to respond, and very directive in the time frame for turning the RFP around. The vendors did respond to the RFP in a very short period of time (six weeks), and they all responded exactly to the format and structure that was requested. In so doing, FAHC's comparison of vendors' responses across proposals was facilitated.

At the same time a detailed technical RFP was issued as an addendum to the original RFP. Over the course of the following months several RFP addenda were issued when fairly specific questions /issues required a lengthy and/or written response.

Product Demonstrations

Three types of product demonstrations occurred. The first type of product demonstration was called a "drive-by." This was held at Fletcher Allen in the employee cafeteria. Over a five-day period, each vendor had one day where they were allowed to set up in one corner of the cafeteria and essentially hold a one-vendor exhibit. The exhibits were unstructured, in that the vendors were allowed to conduct product demos, demonstrate product futures, distribute promotional materials, and display banners. The exhibits resulted in a number of key benefits, including: (1) it allowed FAHC employees to see, hear, and touch what a new system might look like, and (2) it facilitated building a comfort level and relationship with the vendor at the start of what would be a long process. Note that these demonstrations were the vendor's first and last unstructured sales presentations.

The second type of product demonstration was a controlled on-site presentation at Fletcher Allen. The presentations were two-day sessions. The first day was a scripted corporate presentation. FAHC provided the vendor with a script, which they were required to follow. Although it allowed them to make a

Table 2. Vendor Assessment Summary Subset

	Vendor 1	Vendor 2	Vendor 3
2.1 Expert Engine	<ul style="list-style-type: none"> ▮ Rules/alerts (assumes OE) - Yes ▮ drug-allergy = + ▮ drug-drug = + ▮ drug-disease = + ▮ critical paths = + ▮ clinical guidelines = + ▮ usability of clinical workstation = good 	<ul style="list-style-type: none"> ▮ Smartsets ▮ Rules/alerts (assumes OE) - pre-made Smartsets ▮ drug-allergy = + ▮ drug-drug = + ▮ lab results = + ▮ critical paths = + ▮ clinical guidelines = + ▮ Health maintenance notification engine = + ▮ usability of clinical workstation = excellent 	<ul style="list-style-type: none"> ▮ CA-DB Expert ▮ Rules/alerts (assumes OE) - Simple only ▮ drug-allergy = + ▮ drug-drug = + ▮ lab results = + ▮ critical paths = +/- ▮ clinical guidelines = +/- ▮ Health maintenance notification engine = +/- ▮ usability of clinical workstation = fair
2.1 Expert Engine Rating	1	7	4
2.2 Medical Dictionary	<ul style="list-style-type: none"> ▮ SNOMED/RT, ICD9, CPT, LOINC, Medcin ▮ clinical chart = + ▮ OE = + ▮ billing/E&M coding = + 	<ul style="list-style-type: none"> ▮ Medcin, SNOMED, ICD9, CPT, NIC, NOC, NANDA, UMLS, LOINC ▮ clinical chart = + ▮ OE = + ▮ billing/E&M coding = + 	<ul style="list-style-type: none"> ▮ UNMC (12k), ICD9, SNOMED, NANDA, DRG. Note: Medcin, etc cannot be incorporated ▮ CPT add-on ▮ OE = - ▮ billing/E&M coding = 3rd party
2.2 Medical Dictionary Rating	4	7	1
2.3 Research	<ul style="list-style-type: none"> ▮ Database structure/ language = Oracle ▮ Query language = SQL 	<ul style="list-style-type: none"> ▮ Database structure/ language - M/Cache ▮ Query language - SQL ▮ Ease of custom reporting = good, Crystal reports 	<ul style="list-style-type: none"> ▮ Database structure/ language - proprietary ▮ Query language - (proprietary) ▮ Ease of custom reporting = Poor
2.3 Research Rating	4	7	1
2.4 FAHC Nursing Informatics group – overall assessment	597	485	449
2.5 FAHC Physician group – overall assessment	524	623	457

sales presentation, the structure and duration was similar for each vendor. This led to a very controlled and structured presentation. Interruptions were not allowed during the presentation; questions and answers were held to the end. Each presentation was repeated three times throughout the day to accommodate schedules of the invited clinical and business staff.

The components of the presentations were established to address some of the key issues in the RFP as well as focus on the key criteria. Asking the vendors similar questions in different venues allowed for checks of internal consistency of the vendors' proposals. Key topics included vendor viability, strategic technology

planning, and conformance to FAHC functional requirements and objectives.

The second day of the session was the scripted clinical scenario. Several days before the session, the vendor was given a clinical scenario. The vendor was requested to fulfill the requirements of that scenario using their current, commercially available products. The clinical scenarios were multidisciplinary. For example, it is important to note that the clinical scenarios were available to the audience during presentations to allow them to follow the script, take notes, and provide feedback to the decision team.

The audience for the two-day presentation was open to a wide range of leadership. However, it was by invitation

Table 3. Overall Functionality

Clinical Workstation	Clinical Functionality	Clinical Documentation Workflow	Expert Engines/Decision Support & General Items
Overall system is intuitive & easy to use; Minimal Training will be required for clinicians	Supports transcription of dictated patient information	Assessment (Physician and Nursing) process fully integrated to other clinical documentation	Expert systems fully integrated to order entry process using end user prompting/reminders/alerts
Response Time Acceptable to the requirements of FAHC	Order process integrated to clinical documentation process	Assessment data captured drives list of potential problems/diagnoses	Links with clinical practice guidelines
Overall system design supports the workflow of practicing clinicians	Order sets/protocols easily modified	Problems/diagnosis identified from initial & ongoing assessments automatically update patient problem lists	System supports identification of patient outcomes and prompts user for progress towards outcome
Data captured once and flows seamlessly to other required areas	Supports different views for different users	Orders/protocols selected automatically creates the Patient Plan or Critical Path	Decision support integrated with diagnosis development
System supports structured and coded data capture in an easy intuitive manner	Supports use of graphics for clinical documentation/interpretation	Support of configurable patient progress notes (charting by exception; SOAP;ROS etc.)	Cost, quality, and severity information integrated with decision support technology and presented to clinicians.
Coded data entry supports E&M coding compliance	System design supports link between clinical documentation and insurance DBs to comply with regulatory agencies requirements (ex. ABNs)	Functional process supports the use of any standard language sets as selected by FAHC	Development teams integrated (MDs, RNs, etc.) for integrated solution development
Clinical documentation linked with charge capture	Patient progress note automatically updates Patient Plan for Problems & Orders	Discharge summary automatically generated from data captured on patient	Supports multiple, simultaneous users concurrently on a single EMR

only, and not open to the FAHC public. The attendees were invited by name based on their involvement in clinical systems or the selection process. Overall there were approximately 30-50 attendees at each presentation.

The third type of presentation occurred during vendor or customer site visits. These presentations were semi-structured. When the FAHC decision team attended a customer site or the vendor headquarters, the vendor was provided with a list of specific questions. The vendors were instructed to respond only to those questions.

The multidisciplinary site visit team conducted the site visits. The site visit team was a smaller subset of the group that was involved in the decision-making

process. It included physicians, nurses and technical people. Site visits were made to each vendor's headquarters, plus one or two of each vendor's customers that were similar in makeup and requirements to Fletcher Allen. A specific goal of the site visits was to facilitate contacts between the visiting team members and their peers at the visit site. Informal discussions at this level were quite informative as they bridged the gap between theory and practice for actual software implementation and usage. Prior to a final recommendation, the corporate officers made a site visit to what each vendor identified as their preferred customer.

The process that was undertaken to develop a recommendation was very well

defined. It was a controlled process that allowed FAHC to effectively evaluate the vendors on quantifiable data. A key point is that the process that was followed was very participative. It included physicians, nurses, business leadership, corporate leadership, as well as general staff and employees throughout the organization.

Analytical Tools

The analytical tools that were used during the evaluation and selection process included an RFP, structured presentations, clinical scenarios, vendor assessment summary, functionality analysis, CPR attributes and subattributes, technology assessment, cost of ownership, paired comparison analysis, decision analysis, and risk analysis. The

value of the tools to each person of the decision team varied. For example, some decision makers focused on the quantitative decision tools, while others used the more qualitative vendor assessment summary. Descriptions of analytical tools follow, except for the structured presentations and clinical scenarios, which were discussed in previous sections.

Request for proposal (RFP). The RFP consisted of 15 subject areas (Table 1). The vendors were asked to respond by including the question in their response, and by using the same numbering sequence as the RFP. This made it very easy to compare responses.

Vendor assessment summary. A vendor assessment summary was used as a working document for the decision team (a subset of this summary is in Table 2). Rankings were done by each evaluator on a scale of 1 to 7 for consistency across vendors and criteria. The summary also contained narrative on which the rankings were based. This supported the individual qualitative or quantitative decision modes of each member of the team.

The vendor assessment was based on a summary compilation of data that compared the three vendors. While the analysis was presented as objectively as possible, the decision process is substantially a subjective process. For instance, although the presence or absence of any given expert engine methodology is objective, the importance of its being present is a subjective judgment.

Functionality analysis. The functionality analysis was based on functional requirements that were most important to Fletcher Allen. These clinical criteria encompassed 77 items distributed into five broad categories (Table 3). The requirements focused on workflow, process, and outcomes functionality, as opposed to specific detail features. This allowed for feature variability among the vendors while fulfilling the functional requirements.

CPR attributes and subattributes assessment. The RFP requested each vendor to self-assess their product's ability to fulfill functionality of the computer-based patient record as described by the

Table 4. Vendor Assessment

3-Year Cost of Ownership					
Vendor One	3 Year NPV* (\$)	Estimated Initial Cost (\$)	Year 1 (\$)	Year 2 (\$)	Year 3 (\$)
Core Clinical	—	—	—	—	—
Equipment	—	2,000,000	0	0	0
Software	—	3,000,000	0	0	0
Services	—	3,000,000	1,000,000	1,000,000	1,000,000
Subtotal	15,000,000	8,000,000	1,000,000	1,000,000	1,000,000
Ancillary	—	—	—	—	—
Application 1	1,000,000	500,000	60,000	60,000	60,000
Application 2	1,000,000	500,000	50,000	50,000	50,000
Subtotal	2,000,000	1,000,000	110,000	110,000	110,000
Total	17,000,000	9,000,000	1,110,000	1,110,000	1,110,000

* NPV - Net Present Value

Table 5. Vendor Decision Analysis

Criteria	Rank
A) Execution of Vision	7
B) Function	6
C) Technology	5
D) Service/Support	4
E) Relationship	3
F) Vision	2
G) Cost	1

Total Weighted Scores	
Vendor One	2035.00
Vendor Two	2525.00
Vendor Three	1870.00

Vendor	A	B	C	D	E	F	G
Vendor One	5	6	5	4	3	5	4
Vendor Two	5	6	5	7	5	6	5
Vendor Three	4	4	4	4	5	4	5

Institute of Medicine. The vendors were also requested to cross-reference the fulfillment of these attributes to a specific product in their proposal. This provided a tool for cross-vendor evaluation, and also provided documentation that can be used contractually to bind a vendor's commitments to actual functionality.

Technology assessment. A FAHC technology architecture committee completed the technology assessment. They established 16 technical criteria against which the vendors were evaluated. The assessment was done in a summary nar-

rative plus a color-coded ranking, i.e., a green circle corresponded to a favorable assessment, an amber triangle corresponded to a neutral assessment, and a red square corresponded to an unfavorable assessment. The color format plus the short narrative made it relatively easy to discriminate among the vendors.

Cost of ownership. Table 4 presents the total cost of ownership and net present value cost analysis. The net present value allows for a single point comparison across vendors for total cost. Secondly, it consolidates the annual sup-

Table 6. Overall Totals Table

Vendors		Vendor 1	Vendor 2	Vendor 3
Ability to Execute	Rating Weight	7	7	7
Functionality	Rating Weight	6	6	6
Technology	Rating Weight	5	5	5
Service and Support	Rating Weight	4	4	4
Relationship	Rating Weight	3	3	3
Vision	Rating Weight	2	2	2
Cost	Rating Weight	1	1	1
Totals				

and functionality.

The paired comparison analysis was effective because it eliminated this diffuse commentary from the discussions and forced everyone to focus on the vendor and criterion. The relative importance of the selection criteria was similarly ranked by paired comparisons (Table 5). Vendors' ranks on each criterion were then weighted according to the ranks of the criteria to come up with a total weighted score (Table 6). While the weighted score did not determine the final decision, the process was useful as a sensitivity analysis. It was easy to see from the table where vendors seemed to be most similar, where they seemed to be most different, and where it made sense to continue with additional detailed analysis.

Risk analysis. After spending several months on the data collection and analysis phase, it became evident that an explicit comparison of the potential risks (not related to the clinical functionality of the products) associated with each vendor would provide a balancing counterpoint to the previous assessment of attributes. In particular, the specific risks for each vendor could be objectively identified, providing an opportunity for further objective analysis. A complementary risk analysis was therefore undertaken (Table 7). The purpose of the risk analysis was to identify which of the vendors would be the least risky to FAHC in the long term. Combining minimum risk with satisfactory fulfillment of the criteria provides an assessment that resulted in a vendor recommendation.

Lessons Learned

Five significant lessons were learned from the process.

1. While this initiative was established as a project (with a start and an end date, milestones, project plan, and so on), it was actually a discovery process. Learning about the vendors almost always seemed to lead to more questions. The discovery process ultimately led to a much longer project. It became evident at a certain point in time that the value of new information was marginal to

Table 7. Risk Analysis

Severity	Risk	Mitigation*		
		Vendor 1	Vendor 2	Vendor 3
High	Response time > 2 seconds	V		
High	Ability to install	V,C,F		
High	Ability to deliver a complete Inpatient solution in a large teaching facility		V,F	
High	Clinical influence into design process		V,F	V,F
High	Web strategy	V		
High	Product development methodology			(V)
High	Management focus and impact on development and implementation (integrated governance, strategy, and finance)			V
High	Integration with other vendors	V,F		
High	Expert engine			V
High	Implemented medication administration process in core system		V	
High	Size of company		V	
Medium	Service and support	V,C,F		
Medium	Technology reliability (availability)	V,F		
Medium	Distributed development organization			V
Low	Proprietary hardware, software and database			V,F

*Significant ability to mitigate risk determined by: V - vendor, C - contractually, or F - FAHC

port requirements, which are often difficult to compare across vendors. In addition, the estimated initial cost can be segregated fairly easily into capital and operating costs.

Paired comparison analysis. The paired comparison analysis proved to be an effective tool (Figure 2). The benefit was due to the structure required in per-

forming a single vendor-to-vendor comparison on a specific criterion. Very often and throughout the decision process, there were discussions among the decision team comparing the vendors. Generally, the discussions did not focus on a specific criterion. The discussions tended to focus on vendor pros and cons that cut across criteria, time,

- the decision process, and that it was necessary make a recommendation.
2. Although there was acceptance of the evaluation criteria at the beginning of the project, it would have been beneficial to have formal corporate buy-in of the criteria right from the start. It also would have been beneficial to have the criteria ranked at the beginning. A ranked set of criteria would have allowed the decision team to focus the investigations on data where discrimination among the vendors was most important.
 3. Consensus may not occur. After all is said and done, when all the rankings and analyses are completed, there is still a substantial component of subjectivity even within the quantitative analyses.
 4. The initial goal was to discriminate the best vendor from the others. Eventually the goal was expanded to identify the vendor that was least

- risky, given reasonable equivalence across all evaluation criteria.
5. Begin the contract development and negotiation during the sales process. This is when the vendor is willing to make commitments to gain new business. Quantify these commitments, so they can be incorporated into the final contract.

The most important activity undertaken during the selection process was change management. This philosophy existed at the beginning of the project, with the expectation that the selection process be both an analysis and an education. For this reason it was a participative process, evidenced by a vendor “drive-by,” structured presentations, and extensive and open communication throughout the process.

After 11 months of analysis, a vendor was selected. The next steps to be undertaken were a continuation of the

efforts that were initiated during the selection process. For example, the vendor analysis included pro forma gap analyses and needs requirements. It was important that these activities be continued and formalized during the vendor negotiations and implementation.

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Appendix: Criteria for Evaluation of Electronic Medical Record System Vendors

I. Ability to execute (due diligence)

1. Vendor viability — R&D investment
2. Growth strategy
3. Revenue \$M
4. Net income \$M
5. Net margin %
6. Total assets
7. Total liabilities
8. Number of installations similar to proposed solution
9. Quality of project plan for new product development
10. Quality of project development methodology
11. Gartner Group execution of vision rating

II. Functionality

1. Expert engine
2. Medical dictionary
3. Research
4. FAHC nursing informatics group — overall assessment
5. FAHC physician group — overall assessment
6. Gartner Group product maturity rating

III. Current technology architecture

1. Hardware
2. Software
3. Network
4. Personnel
5. Database
6. Directory services
7. Automation monitoring
8. Middleware
9. Internet/intranet
10. Maintenance and support
11. Planning
12. Implementation
13. Security
14. Reliability/performance
15. Manageability
16. Interoperability
17. EMPI
18. HIPAA
19. Gartner Group architecture rating
20. Gartner Group install, conversion, support rating

IV. Service and support

1. 3rd party product works with vendor product
2. Enterprise commitment to technology
3. Executives interested in you
4. Good contracting experience
5. Helps your job performance
6. Lived up to expectations
7. Product works as promoted
8. Quality of implementation
9. Quality of interface services
10. Quality of telephone support
11. Quality of training
12. Quality: money’s worth
13. Service: proactive
14. Vendor is improving

V. Relationship

1. Risk sharing
2. Development relationship
3. Pricing
4. Research
5. Strategy development
6. Communication
7. Public relations

VI. Company vision for future technology architecture

1. Clinical and financials
2. Acute and ambulatory products
3. Core clinical products
4. Departmental products
5. Primary vision
6. Gartner Group vision rating

VII. Pricing and products

1. Purchase core clinicals
2. Average annual operating expense
3. ADT/Registration / (5 year maint.)
4. Web access — affiliates / (5 year maint.)
5. Web access — non-affiliates
6. Web access — community (patient)
7. Professional billing
8. Hospital billing
9. Pharmacy
10. OR scheduling
11. ICU
12. Emergency
13. Cardiology
14. HIM chart tracking
15. Call center/nurse triage