The Total Cost of Ownership of Electronic Health Record Systems
Executive Summary

In response to the American Recovery and Reinvestment Act (ARRA) of 2009, which provides $30 billion in financial incentives for U.S. healthcare providers to implement electronic health records (EHRs), hospitals and health systems are undertaking the largest mass adoption of major information systems in recent memory. With excessive healthcare costs already in the spotlight, many of the nation’s most prominent healthcare organizations have made headlines with EHR projects that are projected to run into the high hundreds of millions of dollars. In this environment, Peer60 decided the time was ripe for research designed to develop a standardized total cost of ownership (TCO) model that hospital chief financial officers (CFOs) and other operational executives could use to analyze and project overall costs for acquiring, implementing, and maintaining an EHR system. This white paper introduces the process of developing the model and shares key results and conclusions from the research.

Our initial research revealed a surprising finding: In the vast majority of large capital information technology (IT) purchases, CFOs rarely, if ever, constructed a full TCO model to independently project total lifecycle costs for the entire project. Most of the CFOs we spoke with complained that they had no models on which to base such an analysis. Not surprisingly, they also expressed excitement at the prospect of assisting us in creating, and in gaining access to, a usable, comprehensive TCO model for major IT purchases.

To begin the process, we gathered an initial list of TCO elements from publicly available sources. This list included all of the common elements one would expect to find in today’s status quo costing models, including software costs, server hardware, and licensing fees. Armed with this baseline of current thinking around IT project cost estimation, we hoped to discover what CFOs believe is missing from today’s TCO models, with a specific focus on elements that have emerged due to new trends in technology, regulation, and/or delivery methods. In short, we set out to create a unique financial model, based in today’s new realities, which would take into account the short-term and long-term costs of enterprise IT projects. While this model would be relevant for any major technology purchase, the current high rate of ARRA-driven EHR implementations convinced us to focus this initial exercise specifically on that technology.

The key component of our research entailed soliciting feedback on the initial model from a representative group of hospital CFOs. Thanks to the generosity of many CFOs who contributed their time and energy to this initiative, we were able to develop a TCO model that is both simple to use and comprehensively accounts for an EHR project’s total life-cycle costs. In our work with CFOs, a very interesting set of findings emerged. Among them were:

- **Basic Assumptions Must Be Adaptable:** While financial (cost) inputs are expected to change under differing circumstances, hospital CFOs insisted that truly useful TCO models must have the flexibility to adapt to changing market trends and new operational realities. Hence, any useful TCO model will need to be regularly reviewed and updated, as a static model quickly becomes outdated.

- **Today’s Models Miss Key Components:** CFOs mentioned certain aspects of TCO that are consistently missing in today’s cost-estimation models. These typically included more ways to divide macro costs into specific categories, such as staffing, infrastructure, separate software modules, and security. Parsing out these components would allow hospital executives to better reflect today’s IT environment and concerns.

- **TCO Varies with EHR Environment:** The experiences CFOs shared with us described different 10-year TCO expectations based on their installed EHR vendor. Among the most important differentiators was not the upfront costs, as might be expected, but the cost of a major system upgrade, which typically happens 4-5 years post-install and is therefore outside the scope of most hospital financial considerations.

- **It’s All About What a Hospital Values:** CFOs acknowledge that the TCO hospitals experience is a direct reflection of what the hospital values, whether integration, interoperability, scalability, or functionality.

This white paper will describe the development of the TCO model.
Methodology

Key Considerations

As with any project, development of this TCO model required overcoming several constraints. The following were the primary considerations in developing the model:

- **CFO Participation**: The TCO model was created as a resource for hospital CFOs and other operations executives in the healthcare industry. As such, gaining the participation of this group was absolutely critical. This was the major focus of the project and was by far the most important element of it.

- **Confidentiality**: The CFOs who participated in this effort did not share specific financial details about their facilities and operations. Rather, they graciously gave of their time and expertise to help evaluate and provide feedback on the TCO model as it was developed. In addition, it is important to note that as a matter of stated policy, Peer60 adheres to a strict level of confidentiality when publishing documents for public consumption. All sources and parties involved with the creation of this and other public documents are kept strictly confidential unless a participating party specifically requests otherwise and such request does not violate the confidentiality of other involved parties.

Developing the Model

Peer60 first assembled an initial TCO framework by researching publicly utilized models, as well as from corporate partners and our own clients. After gaining a firm understanding of today’s status quo models, Peer60 analysts were asked to answer the question, “What is missing?” To find that answer, they held multiple discussions with industry professionals about current technical and pricing trends that would impact a modern TCO model. Once the initial set of criteria was gathered, representing conventional thinking on cost projections, we embarked on the next stage of research to extend that understanding to create a truly comprehensive TCO model.

Hospital Selection

The most critical step in developing a complete TCO model was gathering feedback from hospital CFOs and others in hospital financial/operational leadership. These individuals are both the primary audience of this research and the most essential element in developing the model. Figure 1 represents the demographics of participating hospital executives:

![Figure 1](image1)

We purposely weighted our sample towards community and mid-size hospitals, which account for the bulk of current and expected EHR purchases.

Rather than attempt to gather data on every major EHR vendor environment in the market, Peer60 targeted a specific group of EHR vendor environments that we believe are representative of the overall market dynamics. Figure 2 highlights the EHR environments represented in this research:

![Figure 2](image2)
Several key issues and market trends factored into the decision to include these EHR environments in the research. Among them are:

- **Trends toward Integration**: A large number of hospitals are selecting integrated clinical platforms. Epic hospitals are included in this research because Epic’s solution is built around a single, integrated database that has proven popular with large and mid-sized hospitals. Likewise, Cerner is built around an integrated philosophy and is among the most popular choices for hospital EHRs. Given the incentives (and penalties) associated with the adoption of healthcare information technology (HIT) in ARRA, an increasing number of hospitals have looked to integrated platforms to help their organizations meet federal requirements as outlined by the legislation.

- **Rise of Interoperability**: Other hospital executives and healthcare IT experts maintain that the future for effective clinical IT revolves around standards and interoperability. Allscripts environments are included in this research as the company is the first of the major hospital EHR vendors to make a push towards interoperability. A related trend is the use of “open” architectures based on application programming interfaces (APIs) and web services, which are widely utilized by technology companies in other industries to enable the integration of externally developed technologies. Open systems contrast with the traditional model of innovation, or “closed innovation,” in which a company develops its products without regard for cross-platform interoperability.

- **Vendors Moving Downstream**: The three vendors mentioned above are moving aggressively into smaller hospitals. This fact necessitated inclusion of a vendor whose solution was built expressly for community hospitals. McKesson’s Paragon was selected as it is among the most talked about solutions for this space and has made recent progress moving upstream to larger hospitals as well.

**Primary Research**

Peer60 conducted multiple discussions with each of the participating CFOs and operational executives in order to gather their insights in two key areas:

- **Vetting the TCO Model**: The hospital executives gave Peer60 specific feedback regarding changes they wanted made to the model to make it more comprehensive and usable. As previously stated, this process was the most important step in the initiative, as the final TCO model will be used by these same CFOs and their peers. Their changes were incorporated into the final TCO model.

- **EHR-Specific Financial Experiences**: In addition to soliciting feedback on the TCO model, Peer60 also inquired about each hospital’s financial experience with their EHR projects. Specifically, to provide additional context to the discussion, participants were asked whether or not their projects were executed on-time and on-budget as specified in their contracts. Additionally, the CFOs shared experiences about the ongoing costs of their EHR projects. However, it is important to note that the primary purpose for gathering these additional data points was not to provide a head-to-head assessment of the TCO of EHR vendors. Rather, the objective of this document is to highlight the essential elements of a comprehensive TCO model, and these experiences were used to help identify any patterns that may have arisen due to the specific environment of the hospital.

**Findings**

**Changes to the Status Quo**

CFOs are aware that the HIT market is changing, and that the basic assumptions they have used for decades to build accurate financial forecasts for their organizations must also change. In order to cope with these evolutionary forces, CFOs need a TCO model that takes into account emerging concepts in managing enterprise IT projects and ensures that all essential aspects of total cost are considered. While virtually every TCO model takes into account factors such as servers and software licenses, most CFOs felt traditional financial models were weak in addressing the following key issues:

**Staffing**

- **Why staffing is important**: Hospital environments are highly complex, and that complexity is only expected to grow as advanced healthcare information technologies such as the EHR become ubiquitous. The technology mix in the environment will impact the staffing mix and level required; for example, an IT network with applications from multiple vendors on different databases may require more personnel with a wider variety of skills than a network with
fewer vendors and a single database. Acquisition costs will differ depending on the type of staffing required. Staffing costs would be higher for skills that are harder to find, such as for older technologies and programming languages, versus the cost of hiring for far more common skills, such as Windows-environment training. Additionally, there is an increasing reliance not only on technical support personnel, but also consultants and systems integrators who combine technical skills with clinical knowledge. Today’s IT projects are as much about workflow and processes as they are about software. As a result, hospitals must dedicate budget to acquire and maintain a skilled staff to train other users and implement new processes required by government standards such as those outlined in ARRA.

- **How it impacts long-term costs:** The acquisition and maintenance of necessary staff is a massive expenditure for hospitals. This essential expenditure naturally limits funding available for other projects. Larger hospitals can better absorb these costs and are better able to retain IT talent. Staffing consumes a higher percentage of community hospital budgets. This is especially evident when a hospital must consider bringing on additional staff to augment internal resources during system upgrades.

- **How to calculate:** The simplest way to calculate total staffing is to consider the composite number of full-time employees, or FTEs, (including outside personnel) necessary to support the system. Another useful method is to compare the total IT department spend vs. staff dedicated to a particular platform. Whichever approach is used, hospital leadership will want to consider staff acquisition costs, staff costs for implementation, normal ongoing maintenance costs, and future upgrade costs.

**Security**

- **Why security is important:** Security is a global IT concern across every industry. Healthcare has the added burden of protecting personal health information (PHI). CFOs cited specific security breaches publicized in the media as a reason for heightened awareness about enhanced security. Monetary concerns are directly attached to those breaches in the form of lawsuits, fines, and lost trust. At present, hospitals have less experience with the nuances of security than companies in other industries, whether the topic is effective encryption and active network monitoring or physical onsite security.

- **How it impacts long-term costs:** CFOs expect security costs to rise due to heightened regulatory requirements, more robust security needs (from increasing threats), and the multiple layers required for persistent vigilance and comprehensive security.

- **How to calculate:** While security is a more nebulous concept for which to calculate total costs, the best approach is to view the issue as any other IT project – first, consider the costs for acquiring the necessary software and hardware, then add costs for staffing needed to implement and maintain the security strategy. The “X factor” in the equation is in first determining the level of security required.

**Infrastructure**

- **Why infrastructure is important:** Costs for infrastructure are not a new consideration, but current trends are changing how CFOs view these costs. While costs per volume of memory continue to decrease, hospitals must contend with an explosion in stored data, necessitating an increase in server capacity due to factors such as ICD-10 and the exponential rise in demand for medical imaging in recent years. Additionally, cloud environments are changing the equation. Hospitals are committing, incrementally, to the cloud, and those costs must be accounted for. An organization’s infrastructure is no longer housed completely within the walls of that organization, as is evident with remote-hosted models.

- **How it impacts long-term costs:** Like everything else, infrastructure has a discreet lifespan. There will need to be hardware refreshes (new purchases or refurbishment), and system upgrades over the lifecycle of an EHR project. Onsite hosted software will require greater onsite infrastructure, whereas cloud models could offload significant cost and burden from the hospital’s shoulders. Older technology may utilize an older infrastructure scheme, which could be more costly than utilizing current technologies and standards-based architectures. As the nature of infrastructure continues to evolve, so too must the associated cost-estimation assumptions.

- **How to calculate:** As infrastructure covers a wide range of assumptions, total cost calculations for infrastructure will need to account for all those assumptions and variables. Hospitals must consider preferred technology stacks, software, hardware data center costs, onsite vs. remote-hosted deployments, as well as the uptime monitoring and maintenance associated with varying delivery models.
The table at right gives a sampling of elements currently included in the TCO model. Those elements which were added or changed are indicated in italics.

It is important to remember that the model covers essential clinical modules and accounts for 10 years of life-cycle costs. All of the data fields in the model can be entered individually for each applicable module that is part of the EHR project.

One of the key lessons of this exercise is that a financial analysis tool must change and evolve with current and emerging trends. While the TCO model created during this project takes into account today’s market trends, we recognize that it must be revised regularly in order to evolve with the changing market.

The TCO Model

All dollar figures are arbitrary and for illustrative purposes only.
Evaluating TCO: Drivers of Differentiation

Using the completed model as a roadmap, Peer60 conducted a preliminary evaluation of the TCO of select EHR environments. That analysis identified three principal areas of cost differentiation among those EHR environments. Those three areas also happened to represent the core lifecycle phases of major IT projects: implementation, ongoing staff requirements, and upgrades. These phases cover the major cost centers of a project, from acquisition and installation to ongoing maintenance and upgrades to the system. Next we will discuss each area of cost differentiation in more detail, and how even across similar hospital sites, differences emerge.

Implementation Costs

- **Why a differentiator**: There are real differences in implementation costs. The cost is not only evident in the acquisition cost of necessary software, but also in the staffing levels required to implement the solution and the type of staff required. Differences are to be expected when discussing subscription pricing models versus capital costs, the impact of modularity (the ability to pick and choose modules versus an all-or-nothing approach), etc.

- **Included**: The essential elements that are part of the TCO model include staff head count (internal staff, vendor personnel, consultants, systems integrators), software licensing costs, fees for professional services, process change management, and other change fees.

- **Calculation**: There are two vital calculations which can be used to determine TCO for implementation: the upfront purchase costs (the price tag) and the total number of FTE days to go-live. The calculation using FTE days is very helpful in rounding out the total cost to the facility, especially when contract pricing is not available for comparison.

Ongoing Staff Costs

- **Why a differentiator**: Some systems require more care and feeding than others, and this impacts the level of staffing required to maintain that system. Specialty skills may need to be acquired (MUMPS versus SQL), and those costs will fluctuate depending on rarity, demand, and expected wages. System stability is also a critical factor, as a more stable system should require less staffing.

- **Included**: Critical items included are in-house staff (both permanent and temporary), vendor personnel, consultants, systems integrators, recruiting/hiring costs, and costs that vary by role or skill.

- **Calculation**: The most straightforward ratio for considering ongoing staff costs takes into account the total number of FTEs to support the system. This number provides a reliable proxy for looking at a facility’s ongoing system costs, outside of contract service fees.

Upgrade Costs

- **Why a differentiator**: Costs vary between the vendors, and the way the cost is administered impacts the upgrade expenditure. Obviously, the largest differences are those dealing with major system upgrades (i.e., version upgrades).

- **Included**: The essential items in the TCO model for upgrade costs are the upgrade software fees and associated upgrade support costs.

- **Calculation**: In the absence of available upgrade fees, the straightforward measurement we use is how the upgrade costs compare to the original contract value (or license fees) as a percentage of those original values.

One Example: The Impact of Upgrades on TCO Forecasting

Among the many areas of evaluation that Peer60 conducted with hospital CFOs, the subject of system upgrades delivered unexpected deviations. Given that hospital financial executives were not asked to share actual prices and costs, they were asked to express their upgrade costs, both minor and major upgrades, as a percentage of the original contract cost for their EHR. This approach was fortuitous, because expressing upgrade costs as a percentage of original contract costs compensates for the fact that Epic and Cerner customers typically deploy a wider variety of applications from the vendor across their enterprise than the other vendors, thereby raising overall costs. We found that, even after correcting for the breadth of vendor deployment, there were significant disparities in the costs associated with these upgrades, particularly if they were major (or version) upgrades.
These findings illustrate the importance of long-range financial forecasting. The CFOs we interviewed acknowledged that many hospitals only look at purchase prices and costs associated with implementations, and that looking five and 10 years down the road is a challenging prospect – so challenging, in fact, that most do not approach the exercise with adequate rigor. Upgrades are a common element of any enterprise IT project, and a TCO model would be incomplete if it did not take these large costs into account. The primary drivers in cost differentiation in major upgrades were the pervasiveness of the upgrade and the resources needed to implement those upgrades. Integrated platforms such as Cerner and Epic have consistently higher upgrade costs due to the fact that a major system upgrade affects the entire ecosystem. While hospital executives are quick to point out a number of benefits derived from an integrated platform, they also acknowledge that upgrades which have wide-ranging effects across an entire organization often require considerable resources to implement. In the case of Epic hospitals, for instance, they typically report the need for at least one additional FTE from their vendor in order to successfully implement system-wide changes.

Conclusions

The purpose of this project was to develop a TCO model that hospital CFOs could use to analyze and project overall costs for acquiring, implementing, and maintaining an EHR. In the course of developing the model in conjunction with CFOs, important lessons were learned:

• CFOs overwhelmingly support the idea of using a full TCO analysis in evaluating enterprise HIT purchases. However, the reality is that few have a framework or the staff to complete such an analysis, leaving them to rely solely on the vendor to supply prices and costs. CFOs are keenly interested in having access to a financial tool they could have in hand to conduct their own independent TCO exercises.

• TCO models need regular attention to be kept current. Market trends such as cloud computing, evolving staffing practices, changing regulations, and alternative strategies (such as integration versus interoperability) necessitate updated TCO assumptions. These constantly changing assumptions will affect cost structures. In the course of this research, the most important additions suggested by CFOs were provisions for security, flexibility in accounting for many different types of staff, and the need to update infrastructure analysis for today’s solutions.

• Major system upgrades became readily apparent as an area that impacts a hospital’s long-term TCO forecasting for enterprise IT. Data reflected a huge disparity in upgrade costs, from 10 percent of a system’s original contract cost, up to nearly 50 percent. In order to properly plan for the lifecycle of an EHR, hospitals must be able to effectively forecast and plan for such costs.

For more information and to access the TCO model, visit www.HospitalTCO.com.

About Peer60

Peer60 helps healthcare organizations grow through a unique mix of cloud-based software solutions, strategic consulting, and business development and optimization. Our clients are found in North America, Europe, and Asia. The principals of Peer60 have worked with hundreds of healthcare organizations, vendors, and other consulting firms across the globe. The opinions expressed here are our own and are not intended to promote any specific vendor and do not reflect those of any other organization.
## Appendix

### Participant Hospitals - Demographics

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