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The Role and Functionality of a Clinical Trial Management System

EDC Today is an independent publication on current information and issues in Electronic Clinical Systems (ECS) strategies and technologies for the Biotechnology and Pharmaceutical (Biopharma) industry. Each month we examine topics related to ECS theory, technology, practice, or implementation.

EDC Management understands that many companies are looking for a Clinical Trials Management System (CTMS) to provide a single unified system for the management and oversight of clinical trials. With the prevalence of networked desktop computers and coming of age of powerful yet inexpensive servers, it would seem that the time has come for adoption of a CTMS. What isn't clear to many is just what should or should not be included in such a system.

In this issue, we discuss what a CTMS might consist of and the possible benefits of deploying a CTMS. We also stress that a CTMS should not be viewed as a panacea for trial management woes, and the adoption of complex software with many features is at best a time consuming, expensive endeavor that may take some time to payoff, and at worse a sure recipe for costly failure, if not implemented properly.

I. Introduction

Many people involved with Clinical Trials know that Electronic Data Capture (EDC) and Clinical Data Management Systems (CDMSs) are computer systems designed to capture, store, and manage clinical trials data. Less familiar to some, is an integrated Clinical Trials Management System (CTMS). In the past, the functionalities found in a CTMS were typically “home-grown”, stand-alone systems that hopefully helped clinical project managers and others develop and conduct their trials.

In the next issue of
EDC Today:

Why is Clinical Software
so Difficult?

About EDC Management:

EDC Management is the leader in Clinical and Data Management and Electronic Data Capture (EDC) consulting services for the biopharmaceutical industry. EDC Management publishes well-researched and timely information about Electronic Data Capture technologies and processes through EDC Today[®] and EDC In Depth. We do not sell or endorse any specific EDC software application or vendor. Improve process today; position for tomorrow.

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In Issue 11 of EDC Today,® “EDC and Legacy Clinical Data Management System Integration”, we discussed many of these stand-alone legacy systems, which included: Assay Samples/Results Tracking Management, Central Laboratory Samples/Results Tracking/Management, Back-end Edit/Discrepancy Checking/Tracking, Serious AE and SAE Reconciliation, Auto Encoding of Coded Items, Laboratory result standardization, high-low flagging, and other quasi-typical data transformations, Patient Randomization, Study Agent Accounting and Tracking, Investigator/Site Accounting and Tracking, Patient Tracking, Page Tracking, Study Monitoring, and Ad-hoc and other Reporting.¹

While some legacy systems filled many of the business needs of their users, recent pressures to streamline operations, as well as increasingly burdensome regulatory requirements, have led many to search for more comprehensive solutions to their requirements while also attempting to address compliance issues.

Functionalities now found in some CTMS’s include tools that help with managing information about clinical trials for sponsors. A CTMS might assist the project manager with the development and management of project budgets and inventories as well as provide tools to manage clinical trial workers when they create, review, approve, release, track, and control documents. EDC Management believes document management might well be functionality required in a CTMS.

In this issue we start by discussing clinical trial management, what it entails and what some of the problems many encounter trying to manage a trial. Next, we present a method for a biopharma to evaluate their requirements for a CTMS. Then we present a discussion of the typical functionalities found in different CTMS packages. (It should be noted that different vendors offer a subset of the functionalities included in this issue of EDC Today.®) Next we list the potential benefits of using a CTMS. We then discuss software complexity, how that impacts the cost of implementation, and considerations for performing a cost/benefit analysis. Finally we conclude our discussion with a build versus buy discussion and how one might go about deploying an implementation.

II. Management

Defining management is not a straightforward task. Management means different things to different people. One potential definition of management would be the following:

Traditionally, the term "management" refers to the activities (and often the group of people) involved in the four general functions listed below. (Note that the four functions recur throughout [an] organization and are highly integrated):

- 1) Planning, including identifying goals, objectives, methods, resources needed to carry out methods, responsibilities and dates for completion of tasks. Examples of planning are strategic planning, business planning, project planning, staffing planning, advertising and promotions planning, etc.
- 2) Organizing resources to achieve the goals in an optimum fashion. Examples are organizing new departments, human resources, office and file systems, re-organizing businesses, etc.

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- 3) Leading, including setting direction for the organization, groups and individuals and also influencing people to follow that direction. Examples are establishing strategic direction (vision, values, mission and / or goals) and championing methods of organizational performance management to pursue that direction.
- 4) Controlling, or coordinating, the organization's systems, processes and structures to effectively and efficiently reach goals and objectives. This includes ongoing collection of feedback, and monitoring and adjustment of systems, processes and structures accordingly. Examples include use of financial controls, policies and procedures, performance management processes, measures to avoid risks, etc.²

One problem with the above definition is that it does not describe where the goals and objectives originate. Generally speaking, only at the highest level within an organization does the self-definition of goals and objectives of the planning step take place. The further down one goes in an organization, the more often the goals and objectives are dictated from higher up in the organization.

A second problem with this definition is that it does not cover the boundaries of the organization nor does it describe how it needs to interact with different groups within a larger context.

For example, a clinical trials organization would likely be a part of an overarching product development organization that also includes drug discovery, pre-clinical, clinical, regulatory, marketing, and others such as manufacturing organizations. As such, the product development department would define some of the objectives for the clinical trials department, and the clinical trials department will have interdepartmental boundaries laid out by upper management.

For a clinical trial manager, a typical list of objectives would likely be the successful completion of clinical trials; the documentation, execution, and submission of trial results to regulatory authorities; and ultimately obtaining marketing approvals for all of the suitable study/drug compounds the biopharma can create and/or discover.

The clinical trial manager's task is no easy one as one can see these objectives are difficult to achieve. However, an additional complication for the clinical trial manager is compliance with the regulatory requirements. Compliance adds a significant administrative burden to an already complicated job.

Performing the four functions listed above can be difficult, and thus it is easy to see why clinical trial managers (and indeed, managers at all levels above them) would like extensive computer assistance and automation.

III. Reasonable Biopharma CTMS Requirements

A discussion about how to fully develop a set of CTMS requirements would require a small book and is beyond the reach of this issue of EDC Today. However, we will begin the analysis of what might be needed.

A clinical trial manager should be able to list the major tasks he or she performs in carrying out his job and from this, build up a list of requirements for a CTMS. If one uses the definition of management above, one could define major categories of requirements, and then determine which of these categories it makes the most sense to computerize.

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Planning

For a clinical trial manager, planning means defining when, how and by whom, clinical trials will be executed. This requires knowledge of what trials are currently being run and what trials are expected to begin in the near future. Planning also requires knowledge of the tasks that are required to conduct a clinical trial, the time needed to complete each task, which personnel have the ability to perform which tasks, and which personnel are actually available to them.

There are more requirements than these, so one can see there is a lot of thinking that needs to take place to make sure everything falls into place in a timely fashion. Planning also involves people and resources that may be external to ones organization and often beyond the clinical trial manager's control. Planning the number of investigator sites is one such task that is often difficult.

A possible CTMS requirement might be a scheduling program that shows what trials are in progress, who is working on which trials and which tasks, how much time has been taken and how much more time is expected to be taken, and when new trials might start.

Organizing Resources

A clinical trial manager not only needs to have personnel who can perform the tasks that are necessary to achieve his objectives, but also must make sure these people have everything that they need to do their job. Things that might be needed include approved investigator sites; available experimental drug product; printed forms such as CRFs, consent forms, and instructional materials; broadband Internet connectivity and access, and much, much more.

A possible CTMS requirement for this category might be an easy to maintain, access controlled, audit trailed system to manage an investigator database, a drug product inventory database, and/or a vendor supply database.

Leadership

A clinical trial manager must be able to lead the clinical team in accomplishing the trial objectives. Of the four categories, this is probably the most difficult for which to implement a computer-based solution.

What can be computerized to some extent is the communication required to help make managers effective leaders. As such, a possible CTMS requirement for this category would be an electronic mail system that supports definition of mailing groups (by role) and also tracks responses and follow-up(s) to managerial queries. Another possible requirement would be a portal where the manager could publish or even broadcast information to the intended recipient(s).

Controlling

A clinical trial manager can only control a clinical trial (i.e., the processes within the organization) when he or she knows what should be happening and what is actually happening.

A manager must have documentation of all the tasks and processes as they are accomplished. He/she must have information on how much of the processes are completed, how long it has taken to complete them, and who is tasked with completing them. Furthermore, they will also need to be aware of any problems and bottlenecks as they arise in order to successfully address them in a timely (and hopefully, cost effective) manner.

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A big part of controlling a clinical trial team is having documented processes, allocated work, and effective status reports. As such, a possible CTMS requirement could consist of document management, defined workflow and collaboration methods, as well as the automatic collection of performance metrics that go into status reporting.

IV. Sampling of CTMS Software Functions and Features

A CTMS can be an all-encompassing software application, or it may be a suite of integrated applications.

Some of the clinical trial management systems that are on the market today provide at least some of the following features:

1. Investigator relationship management
2. Investigator / Site identification and recruitment
3. Site management (grant payment management, financial disclosure, monitoring enrollment relative to plan, and IRB approval and decision status)
4. CRO relationship management (including the monitoring of revenue, profitability, and contract milestones)
5. Protocol and study documentation (e.g., investigator training materials) preparation
6. Case report form (CRF) development and electronic data capture (EDC) system design
7. CRF planning and distribution (whether electronic or paper)
8. Financial management including tracking study costs, reimbursing investigators, and paying claims related to study activities
9. Construct budgets at the site level
10. Clinical supply management including supply tracking, storage, and shipment
11. Monitoring sites and reporting site visits
12. Adverse event (AE) reporting, tracking, and documentation
13. A "dashboard" or similar environment to track enrollment and study progress across multiple sites and/or studies for a particular drug, a therapeutic area, or an entire corporation
14. Enable the efficient management of multiple trials at different stages, with different sponsors and multiple researchers
15. Coordinate patient visits and procedures
16. Follow recruitment activities and conduct analysis of their effectiveness
17. Facilitate activities of the institutional review board
18. Staff allocation
19. Management of change order issues
20. Clinical data archiving/warehousing and management
21. Data analysis³

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V. Benefits

Benefits of a CTMS might be multitudinous, but every biopharma will have considerably different functionalities more or less beneficial based on how well or efficiently their existing processes and business methodologies deal with the tasks for which they were deployed.

A cost benefit analysis for a CTMS might consider the importance of the following possible benefits:

1. Elimination of duplicated and sometimes conflicting data from disparate systems which could result in less data entry and maintenance, as well as in fewer errors and more consistency across trials. This data might include IRB approvals, investigator payments, 1572s, patient enrollment and status, contact information, study planning, investigator recruitment and status, regulatory documents, investigational product inventory, CRF page status, vendor, CRO and CRA payments.
2. Controlled document management and workflow processes that address regulatory compliance issues.
3. The establishment or improved workflow resulting in uniform and repeatable business processes and metrics on those processes.
4. Access for all clinical trial workers to accurate and up to date study information distributed in a controlled manner. Access might be provided to workers located in geographically separated sites via web-based Internet portal.
5. The ability to track, assign, resolve, and identify action items for any business process employed during a clinical trial, including protocol issues, CRF design, EDC issues, enrollment problems, data cleaning and discrepancy management, and analysis reporting.
6. Controlled access to up to the minute financial information including investigator payments, trial budget, and resource allocations.
7. Tracking, publication, and notification of clinical trial workers of study milestones which may result in improved project management tools (and or utility) as well as communication of how the study is progressing with timely feedback on issues and their resolutions.
8. Ability to support geographically separated clinical trial workers employed on the same clinical trial. With the increased use of outsourcing, not only to Contract Research Organizations, but also to workers in other countries such as India, coordinating a clinical trial has become a more complicated task.⁴

A large task associated with a cost/benefit analysis is associating a value (e.g., a monetary amount) with each of the above listed potential benefits, and other benefits that might not be listed above. Whether or not a biopharma has collected suitable metrics that can enable a realistic computation of the benefit (e.g., monetary savings) differs case by case. Many biopharmas realize the critical importance of collecting sound metrics.

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VI. Software Complexity and Implementation and a Cost/Benefit Analysis

The other half of the cost/benefit analysis is ascertaining the true cost of purchasing, implementing, and using a CTMS. The purchase of the software license and maintenance contract is only part of the true cost. In the case of a complex system like a CTMS, implementation costs are likely to be high.

Bonnie A. Neuhardt, M.S., Chief Information Officer, Averion nicely describes evaluating the cost of a CTMS:

Once you have evaluated your options and determined the system that best fits your needs, review the costs involved in implementing the system. Consider software costs, consultant services, infrastructure costs, labor costs for the internal implementation team, training, validation, annual software maintenance and license fees, infrastructure support, and costs to start up each study.

Ask your vendor to provide a detailed cost proposal including all software costs, customization, deployment services and training. Review all assumptions used to estimate consultant/vendor costs. Is the cost for deployment services realistic? Did your vendor assume best-case scenario or worst-case scenario in estimating costs?

If the contract is time and materials, what situations could drive up the cost? Be sure that all services are well defined. Any software customization cost should include very specific requirements so both you and the vendor have the same expectations and can determine if each requirement has been met. Infrastructure costs include all required hardware and required software including the operating system license, back-end database costs, report writers, backup agents, anti-virus software, etc. Consider the cost for your IT team to install and validate the server and workstations in preparation for installation of the CTMS or whatever system is being implemented.

Even if your vendor is deploying the system, internal resources will be required to manage the project, develop new processes, revise SOPs and provide input to the configuration of the system. Training costs include training services, development of training materials and internal labor costs for the trainees.⁵

EDC Management's experience with software implementation and configuration has shown us that the cost associated with implementing an application grows exponentially as the complexity of the software grows. A CTMS has the potential to be a very complex application. Because of this, EDC Management recommends purchasing a modular CTMS system and implementing it in phases. However, if the CTMS is a single unified application, EDC Management still recommends implementing the application in phases.

VII. Conclusion

The management of clinical trials is a very involved job that includes a large number of different tasks and responsibilities. As a result, it is often considered desirable to attempt to automate as many of the different managerial tasks that one can. However, as with the implementation of any software application, a clear understanding of the business requirements is essential.

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The requirements for a CTMS need to be developed in conjunction with a full evaluation of the tasks that the clinical trial manager performs. As a result, a complete description of the manager(s) jobs is essential.

Once an evaluation of the requirements is completed, the full scope of acquiring and implementing a software application can be accessed. A cost/benefit analysis can be undertaken if appropriate metrics have been developed to allow a monetary figure to be assigned to the benefits of the CTMS application.

Further, a full cost assessment can be made on the purchase and implementation of the application. Due to the complexity of the CTMS application, it may make sense to purchase a modular CTMS or if that is not possible, to take a phased implementation approach. It may even make sense start with some of the components of a CTMS that a biopharma already has in place in the form of legacy systems and replace them with compliant applications that are bought “off-the-shelf” or revised and/or enhanced by in-house programming staff so that they meet one or more of the overall requirements. In this manner, the biopharma can build more comprehensive functionality as well as become increasingly compliant over time.

A buy versus build analysis should be performed if an existing knowledgeable programming staff exists or can be obtained. This analysis is usually far more involved than a cost/benefit analysis since it will additionally entail planning a software development project – whose true cost will be harder to assess. However, it may make sense if the programming staff is talented and fully imbued with the biopharma’s business processes and a piecemeal approach is planned whereby the projects are kept relatively small with the intention of integrating the smaller application(s) into a larger application with a more comprehensive set of functions.

In an upcoming issue of EDC Today, we’d still like to present users’ experiences with EDC. To help us more fully understand your experience with EDC, we’ve developed an online questionnaire. If you’ve used EDC, we hope you’ll take a few minutes to answer our questions. Just click the link below or type “<http://www.edcmanagement.com/questionnaire.asp>” into your browser to access the questionnaire. Your participation is appreciated!

**YES, I'd like to participate
in your online survey**

Resources

¹ EDC Today®, Issue 11, “EDC and Legacy Clinical Data Management System Integration”.

² <http://www.managementhelp.org/mgmtnt/defntion.htm>

³ http://www.oracle.com/industries/life_sciences/IDC_CTMS.pdf

⁴ http://www.averioninc.com/articles/Bonnie_article.pdf

⁵ http://www.averioninc.com/articles/Bonnie_article.pdf



Who's behind the research?

Our lead researcher, Kirk Mousley, PhD received BS and MS degrees in Electrical Engineering from MIT and a PhD in Computer Science from Lehigh University. He has been the President of Mousley Consulting, Inc. since its founding in 1993 and has directed the company's efforts in the areas of clinical database design, data editing/cleaning, document management, and submissions.

Karl Mousley received his BS in Mechanical Engineering from Rose-Hulman Institute of Technology and a MS in Computer Science from Villanova University. He has been a senior member of the technical staff at Mousley Consulting, Inc. since 1993. Among his significant accomplishments are the investigation, evaluation, and implementation of new computer technologies for clinical data management systems and developing strategic plans for integrating these technologies into current systems. He has extensive experience preparing Standard Operating Procedures (SOPs).



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