Using Technology to Streamline Clinical Data Management

Clinical trials can take advantage of cloud-based applications and today's analytics technology to centralise all trial data and increase real-time analytics access across their organisation, but only with appropriate management and inter-departmental collaboration can this prove successful

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Clinical trial success depends on both operational efficiencies and high-quality submission-ready data. Data management plays a key role in ensuring that both are achieved. Yet, departmental silos within companies, coupled with the common expectation that data are only the responsibility of data managers, hinder the access and use of operational data by the teams responsible for decisions around study management and trial execution. When combined with the industry's hesitance to embrace technological innovation, along with disparate data collection and storage systems, gaining actionable insights from study data can be a challenge. Additionally, many solutions lack an option for sites to monitor their own operational performance, leading to disconnects between the sponsor and sites.

By modernising clinical trials and leveraging cloud-based applications and advanced analytics, organisations can harmonise their use of data across departments, gain greater insights into data and trial status, and provide sites with a greater level of independence.

Clinical Data Management

As an essential discipline in clinical research, a primary objective of clinical data management (CDM) is to assess the safety and efficacy of the therapy under investigation while adhering to regulatory standards. To accomplish this, large volumes of data must be collated, reviewed, standardised, and reviewed again – repeatedly throughout the study. The sources and volume of clinical data are growing with the increasing complexity of clinical trials, due in part to the increasing use of adaptive designs and real-world data. Comparing the five-year period of 2000-2005 to 2011-2015, the number of planned visits during Phase II and Phase III trials increased by as much as 25%, accompanied by up to a 70% increase in the total number of trial procedures (1). With the incorporation of sensors and wearables in many of today's studies, the number of data points from the available sources can easily reach into the millions (2).

Study Management

The management of clinical data is only one facet of data management in a clinical trial. A primary goal of study teams is to monitor the progress and operational health of the clinical trial. This is achieved by reviewing site-entered data, monitoring visit results, recruitment and retention efforts, site performance, and metrics such as key performance, risk, and quality indicators. While clinical data management ensures that the data required to prove drug safety and efficacy is collected, study management ensures that the data are collected most efficiently, on time, and according to the protocol. With the increase in planned visits and trial procedures, tracking trial status has also become more complex.

The Current Model of CDM and Study Management

While CDM and clinical operations are often structured as separate functions, both roles ultimately leverage similar data to carry out their respective tasks, both of which benefit from access to a common data source and cross-departmental communication. However, this is often not the case in many organisations.

The continued reliance on paper-based processes or multiple disconnected systems for data management and review contributes to the siloed use of data while limiting advances in CDM and study management commensurate with advances in clinical trial designs. The minimal implementation of new technologies over the past few decades might be attributed to the fact that new technologies often increase the complexity and cost of CDM, without significant improvement in data quality or a reduction in the time to database lock (2). Similarly, electronic data capture (EDC) systems have only been widely adopted in the past decade, despite having emerged on the market over two decades ago, possibly because early implementations were merely electronic versions of outdated paper processes, while a perception of clunky, inefficient systems still lingers within the industry (2-3). Clinical trial management systems (CTMS) remain the traditional electronic management tool for study management purposes; however, the analytic capabilities of these systems limit the actionable outcomes that can be drawn from the data, and many organisations have chosen to continue using their in-house systems built on spreadsheets rather than invest in an integrated solution that offers more current EDC and CTMS functionality in the same platform (4). The lack of integration between these systems creates its own challenges for timely access to accurate data and inter-departmental collaboration.

To minimise costs and ensure success, clinical trials would benefit from improved transparency across study teams, coordination of related efforts within and between departments, and the ability to identify potential issues sooner.

Centralised, Real-Time Data

In the current digital age, cloud-based applications and mobile technologies have simplified tasks and centralised data across all facets of daily life. Clinical trials have the opportunity to do the same – for both clinical and operational data – and take advantage of shorter study durations and reduced costs associated with data centralisation (3, 5). Gaining efficiencies across all facets of clinical trial conduct is key, particularly as the cost to bring a drug/device to market has increased 67% in the last 10 years, resulting in steadily declining returns on R&D investments over the same time period (6).

The easiest path to achieving this is a holistic movement to digital technology, rather than piecemeal implementations of several technologies – a common approach in the clinical research industry (3). Regardless of data source (e.g., wearables, mobile phones, tablets, computers, electronic health records), unified technology increases real-time data access, assessment, and review across the organisation and, further, to sites. Bringing together frequently disparate platforms (EDC, electronic patient-reported outcomes/electronic clinical outcome assessment, and eSource for study participant data collection and query management; eConsent and randomisation and trial supply management [RTSM] for participant enrolment, randomisation, and inventory/supply management; and CTMS for study management) into a comprehensive, centralised solution solves many problems associated with data management:

- Eliminates redundant data entry and the associated time and errors
- Eliminates need to compare data between sources (e.g., RTSM enrolment vs EDC enrolment)
- Provides a single source of data for all departments and stakeholders, including clinical data managers, clinical operations, investigators, and sites
- Increases communication between the sponsor, CRO, and site staff
- Provides immediate access to data
- Facilitates centralised monitoring, resulting in less travel and fewer on-site monitoring visits
- Improves transparency across studies, resulting in more immediate identification of issues before they become larger, more costly problems
- Reduces the stress related to auditing because audit trails and ready data make it easier to remain in a state of preparedness
- Facilitates data cleaning throughout the study
- Enables a risk-based monitoring strategy, which can reduce the need for 100% source data verification (2)

Via centralised monitoring of real-time data, monitors can easily identify and address missing and inconsistent data, data outliers, and potential protocol deviations throughout the entire study – not when all data entry has been completed – facilitating real-time monitoring that focuses only on the primary efficacy and safety variables instead of data that will not impact the study results. Clinical operations teams can access the same data source to identify poorly performing sites/investigators, quality issues, and document status.

Reporting and Advanced Analytics

Getting the data into one location, as they are collected, is just the first step – for the data to be useful, they should be actionable. This realisation within the industry has prompted more activity recently to try to more efficiently collate data from various data sources and enable analytics through a single, centralised repository, where data resides regardless of the collection source (i.e., web-based application, wearable device, electronic health record, or native mobile app) (4).

Intuitive, real-time reporting can provide role-based insights into study performance based on operational milestones such as first site initiation visit, first patient in, last patient, last visit, database lock; data status including the number of outstanding

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queries, data completion timelines, outliers; and metrics such as the number of sites activated, percentage of sites meeting planned enrolment goals, number of patients enrolled/randomised. Visualisations can provide CDM, operations, and site staff a quick method of tracking status and identifying issues, saving significant time usually spent manually generating reports. With all data in a centralised platform, all stakeholders have access to the same dataset, and comparisons can be made across sites and studies.

A major advantage of having access to centralised data is the ability to incorporate advanced analytics, enabling even greater insights into trends and the ability to plan, forecast, and generate recommendations, allowing even non-data scientists to understand and use the data to:

- Expedite patient enrolment, improve retention, and increase the diversity of the patient population
- Uncover data trends such as the range, consistency, completeness of data, or unusual distribution of data across clinical research sites
- Monitor trends to determine if key milestones and projections will be met based on number of sites activated, number of site visits (initiation, close-out), number of participants screened and enrolled, etc.
- Identify unproductive sites for early intervention or shutdown based on site performance metrics such as high screen failures, withdrawals, a high number of participant eligibility violations, and/or study delays
- Identify training or retraining needs
- Identify equipment issues based on statistical analyses of equipment measurements
- Identify unexpected variability or unexpected homogeneity in study data
- Use thresholds as signals for taking action on items that require attention
- Monitor portfolio performance (sponsors can view data across studies)

This analytics-enabled view into data and trial status empowers study teams to make more informed, proactive decisions and develop an end-to-end trial strategy. Time previously spent trying to collate and format data for reporting purposes can be redirected to the important tasks of study design and improving study efficiencies.

Technology-Enabled Clinical Trials

Trials are taking longer than ever to execute, partially because study teams are overwhelmed with the increasing amount of data and attempting to provide data and study oversight using inefficient tools (3). By adopting technologies that are commonly used in other industries to centralise and analyse data, the wealth of data collected during a typical clinical trial can be leveraged by the entire team – from study start to study completion.

References

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Jeff Rogers, President of **Crucial Data Solutions** (CDS), leads and optimises CDS' business to meet the industry's evolving technology requirements and drive new growth. He directly supports the ongoing development and introduction of CDS' TrialKit platform that is being used today by sponsors and CROs to manage thousands of clinical trials around the world. With 25 years of industry experience, including leadership roles at multiple clinical technology companies, Jeff has been instrumental in developing and promoting technology solutions that help life science companies become more efficient, reduce costs, and get new drugs to market faster.