

OVERCOME

THE COMPLEXITY OF
DRUG DEVELOPMENT

Trends shaping increasingly complicated clinical trials

Understand the impact of trial complexity and
unlock strategies that address the intricacies of
today's clinical development landscape.



Navigating rising complexity in modern clinical development

In today's clinical development environment, increasing complexity is one of the most significant challenges facing drug developers. As studies grow more intricate, driven by novel modalities, diverse patient populations, expanding data requirements, and evolving regulatory expectations, sponsors must navigate a landscape that is more multifaceted and demanding than ever before.

This rising complexity affects every aspect of the clinical development process. It extends timelines, drives up costs, and heightens the risk of inefficiencies that can threaten overall trial success. Managing these pressures requires new ways of thinking, more agile operating models, and a careful balance between innovation and operational control.

To help drug developers stay ahead in this fast-paced environment, the PPD™ clinical research business of Thermo Fisher Scientific, publishes *The Pulse*, our annual survey of 150 leaders in biotechnology and pharmaceutical organizations worldwide. *The Pulse* provides valuable insights into the trends and strategies shaping clinical development, focusing on key areas like trial timelines, operational efficiencies, and strategies for overcoming barriers.

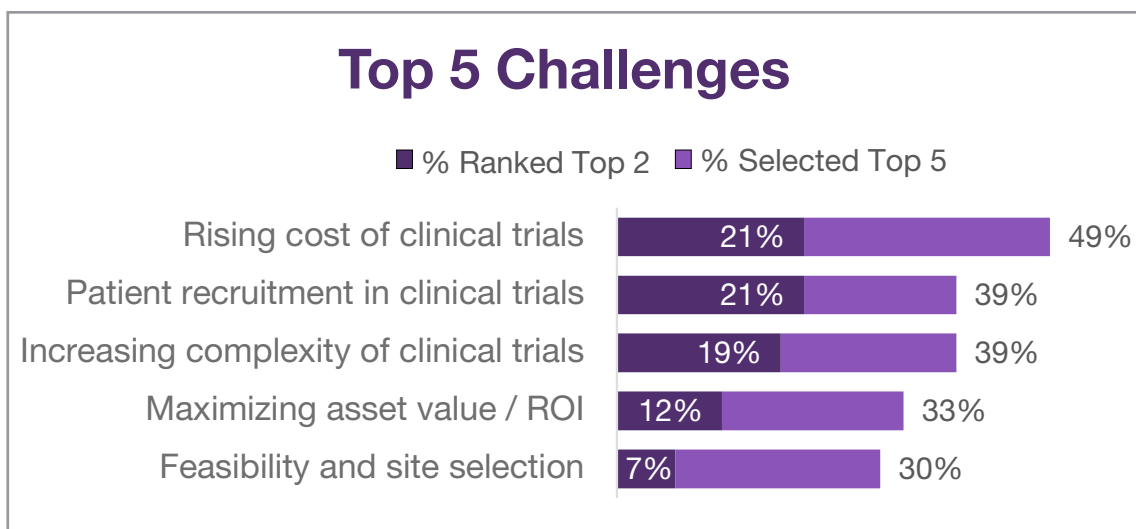
As a companion to *The Pulse*, this report serves as a guide for drug developers navigating the growing complexity of clinical trials. Use it to:

- Understand the key factors driving complexity in modern drug development.
- Discover practical approaches to simplify patient recruitment, trial design and operations.
- Explore strategies to build flexibility, efficiency, and resilience throughout the clinical development life cycle.

The findings reveal how the industry is responding to the growing challenges of increasing complexity. They show where complexity is most pronounced, how it intersects with cost and timelines, and what leading organizations are doing to manage it effectively. The following sections explore these insights in detail, providing a clear view of the forces shaping today's clinical development landscape and the strategies driving progress.

Complexity now rivals recruitment as a top trial challenge

Complexity consistently ranks among the top challenges facing drug developers. In *The Pulse* survey, 39% of respondents identify the increasing complexity of clinical trials as one of their top five challenges, and 19% rank it among their top two. Overall, the increasing complexity of clinical trials emerged as a top three concern across respondents, tied with patient recruitment, underscoring its widespread and growing impact on development success.



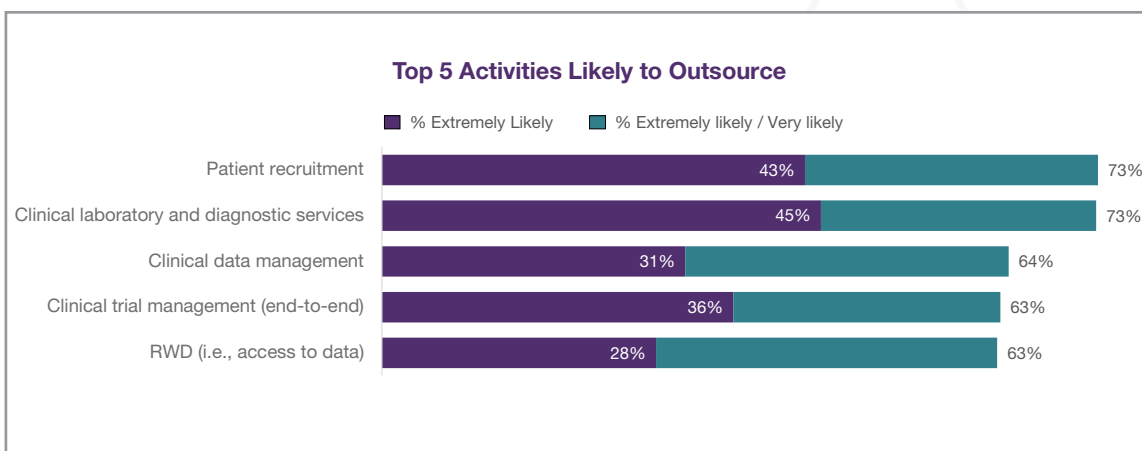
Finding the right patients in a competitive landscape is complicated

Patient recruitment is one of the leading contributors to the growing complexity of clinical trials. Identifying, engaging, and enrolling the right patients has become increasingly difficult as study designs evolve, eligibility criteria tighten, and target populations become more specific. Nearly one in four respondents name patient recruitment as a top challenge, reflecting its outsized impact on trial timelines and success. Small and mid-sized drug developers report greater difficulty in this area than larger companies, often due to limited internal resources and smaller site networks. Because of its operational and logistical demands, patient recruitment is also one of the most frequently outsourced trial activities, with many sponsors relying on external partners to help manage its complexity and keep studies on track.

Patient Recruitment Difficulties (number of mentions)	Total (n=58)	Large (n=22)	Small / Mid (n=36)
Identifying the right patients	27	7	20
Competition with other trials or sites	20	12	8
Patient willingness and retention	9	2	7
Identification of sites	7	3	4
Diversity requirements	6	3	3
Lack of funding/resources	5	2	3
Timelines for recruitment	5	1	4

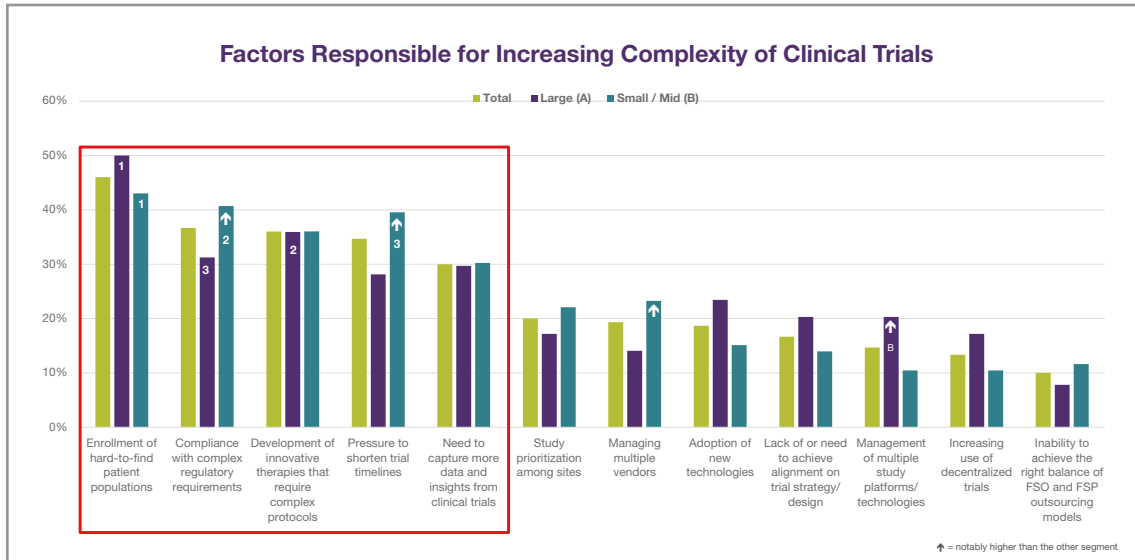
“Additional competitors within rare disease therapeutic areas limits the overall population of clinical trial amenable patients. Additionally, with new therapies that are novel and not approved globally, inclusion and exclusion criteria are increasingly complex thus limiting amenable patients for long term clinical trials. Success within rare diseases increases difficulty for any future therapy.”

– Respondent from a small/mid biopharma



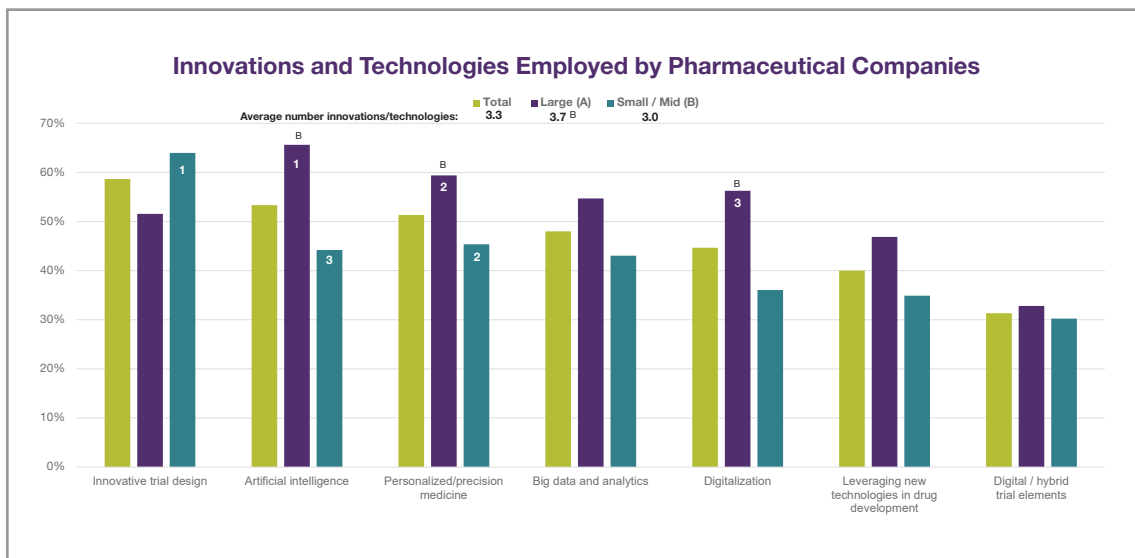
Regulatory complexity is accelerating faster than many sponsors can manage

Complex regulatory requirements are another major contributor to the rising complexity in clinical development. More than 35% of respondents identify evolving regulatory expectations as a key factor affecting the complexity of clinical trials. Like patient recruitment, this concern is especially pronounced among small and mid-sized biopharma and biotechnology companies, which often have fewer dedicated regulatory resources to manage the growing number of global requirements. As regulations continue to change across countries and regions, sponsors face increasing difficulty keeping pace with new standards, maintaining compliance, and aligning submissions across multiple authorities, all of which add to the intricacy of clinical development.



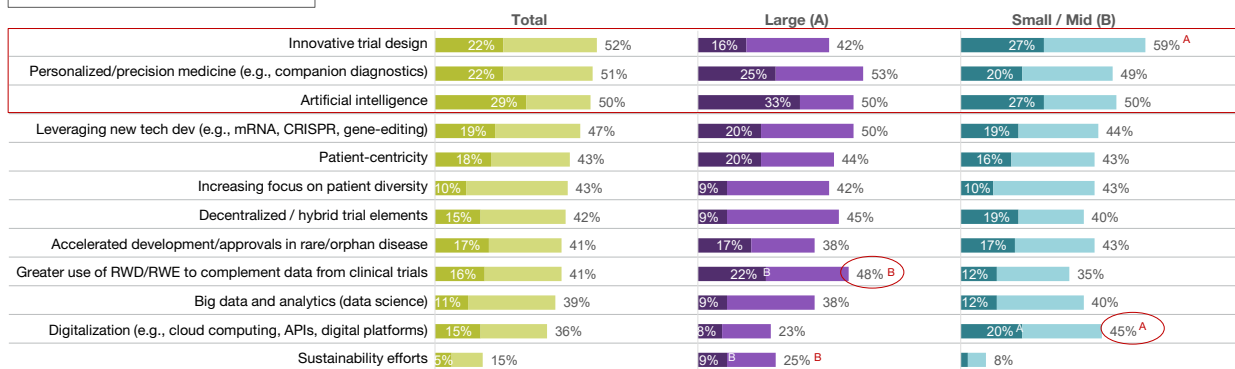
Innovation breeds new solutions and new complex protocols

Innovation has become a defining focus in clinical development, with drug developers under more pressure than ever to bring advanced therapies to market. Innovative trial design ranks as both a top innovation employed by sponsors and one of the leading trends driving transformation in clinical trials. This emphasis on innovation is critical to advancing science and improving patient outcomes, yet it also introduces new challenges. The development of cutting-edge therapies often requires complex study designs and specialized approaches that add layers of operational and regulatory difficulty. About 35% of survey participants identify the development of innovative therapies requiring complex protocols as a key contributor to the growing complexity of drug development.



Trends^A Driving Transformation in Clinical Trials

Key: ■ % Ranked Top 2 ■ % Selected Top 5



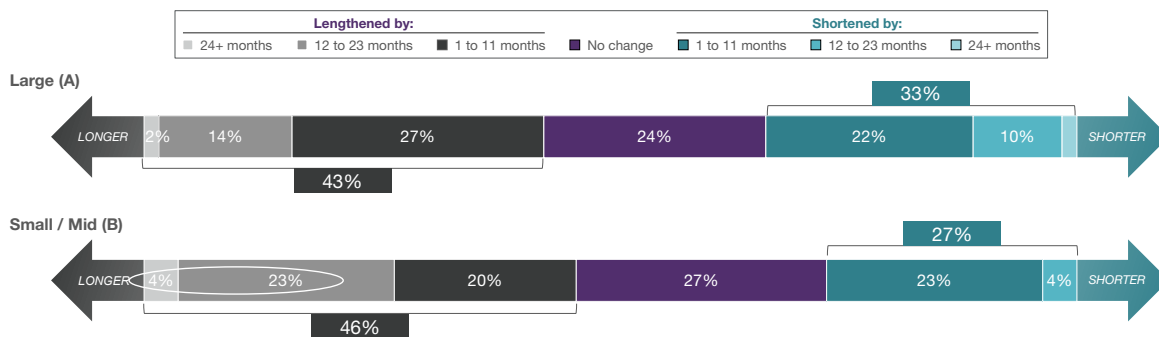
^ASee Appendix for full trend descriptions provided in the survey.

Timeline creep is accelerating as protocol complexity continues to rise

Respondents report that clinical development timelines are lengthening, and these elongations are closely tied to rising costs. Leaders from both large and small or mid-sized biopharma companies note increases in the length of their development timelines compared to two years ago, with the challenge more pronounced among smaller organizations. Twenty-seven percent of participants from small and mid-sized companies say their timelines had extended by more than a year, and 16% of larger companies said the same. In parallel, 40% of drug developers identify increasingly complex protocol designs as the top contributor to higher clinical trial costs, reinforcing the clear link between longer timelines and growing financial pressure across the industry—both being driven by increasing complexity.

Change in Timeline to Produce a Drug Compared to 2 Years Ago

(from first in-human trials through regulatory submission)



The five biggest drivers of complexity in clinical trials

Managing the growing complexity of clinical trials is no small task in today's rapidly evolving research environment. However, when sponsors fully understand the main drivers of complexity, it enables them to navigate this intricate landscape and keep development on track.

By getting to the root of each of these drivers, drug developers can anticipate and address challenges early, ensuring that promising therapies reach the patients who need them, efficiently and effectively.

- ## 1 Competition for hard-to-find patients

For many sponsors, patient recruitment presents a significant challenge, with 39% of respondents naming it a top issue.

Root cause: Identifying and enrolling the right patients is increasingly competitive, especially in rare disease and precision medicine trials. These studies face complex enrollment requirements and smaller, hard-to-find patient populations. Sponsors also must ensure diverse representation. Together, these factors create significant challenges for successful patient recruitment.
- ## 2 Innovation breeds new complexities

Innovative therapies and methodologies in clinical development, which are propelling the industry forward, are a major contributor to increasing complexity.

Root cause: While innovative approaches offer significant promise, they can reduce agility during implementation and often require complex protocols that raise clinical trial costs. New digital tools and modalities can generate larger data volumes and add system complexity, creating new hurdles for sponsors. Without preparing for the technical, ethical, and regulatory challenges of these innovations—including AI and machine learning—sponsors risk delays, increased costs, and greater chances of failure.
- ## 3 Pressure to shorten timelines and reduce costs

Sponsors face increasing demands to shorten timelines and manage costs. Increasing complexity only adds to this pressure, often resulting in extended timelines and higher costs.

Root cause: These setbacks often stem from limited visibility into the challenges of complex study processes. Added procedures, endpoints, and restrictive criteria slow enrollment, require more sites, and increase screen failures and data management costs. Such complexity also drives costly and time-consuming mid-trial amendments. As a result, many developers struggle to balance efficient, cost-effective drug development with the complexity of a competitive and evolving global landscape.
- ## 4 Compliance with regulatory requirements

Nearly one in five respondents say regulatory compliance drives up clinical trial costs, while 21% cite the evolving regulatory landscape as a major challenge. Additionally, 39% report that shifting regulations significantly contribute to rising industry complexity.

Root cause: Keeping up with evolving global standards and differing country requirements adds significant complexity to drug development. Because regulatory compliance affects nearly every stage, underestimating it can derail timelines and budgets. To avoid compounding challenges, sponsors should integrate regulatory strategy early, streamline processes, and work with experienced partners to stay ahead of changes and maintain efficiency.
- ## 5 Uncertainty in the global landscape

Fallout from changes global landscape—including uncertainty and instability—is amplifying challenges for clinical trial sponsors.

Root cause: Macroeconomic factors such as inflation, currency shifts and regulatory changes add significant complexity to clinical research. Sponsors cannot control these forces, but they must plan for their impact on costs, timelines, and resources. Many lack the experience or agility to manage such volatility, making effective scenario planning critical. Building resilience into each stage of development and strong contingency planning enable sponsors proactively manage external complexity.

Three solutions to combat the complexity of clinical trials

To effectively overcome these challenges and implement lasting solutions, sponsors need strategies that allow them to plan for and respond to both expected and unexpected issues. Each area requires tailored solutions built on a solid foundation of resources, knowledge and adaptability.

1. Resources: Access to global teams and innovative technologies

To effectively manage the growing complexity of clinical trials, drug developers must leverage both global resources and innovative technologies. Access to a broad network of sites and diverse patient populations enhances recruitment efforts, shortens enrollment timelines, and improves overall trial outcomes. Global reach not only supports patient diversity but also enables teams to better target specific populations and streamline operations. Equally important is the use of advanced data capabilities, which drive efficiency across every stage of development. Real-time data dashboards allow sponsors to monitor costs, track enrollment progress, and identify early signs of risk, such as rising screen failure rates or the potential for protocol amendments. While the increasing volume, diversity, and interconnectivity of data contribute to trial complexity, these same elements can also be harnessed to reduce inefficiencies. When applied strategically, innovations such as AI enable sponsors to transform complexity into an advantage by predicting challenges, optimizing resources, and improving decision-making throughout the trial process.

2. Knowledge: Experts who have been there before

Successfully managing clinical trial complexity requires deep, specialized knowledge that spans scientific, operational, and regulatory domains. Teams must understand how to implement new innovations quickly and efficiently, transforming dynamic and often fragmented systems into cohesive, executable operations. Therapeutic area expertise is essential, as is a firm grasp of evolving global and country-specific regulatory requirements. The ability to maintain compliance amid shifting regulations and to engage effectively with regulatory bodies can determine whether a trial advances smoothly or encounters costly delays. However, building and retaining this level of expertise internally can be challenging. The shortage of specialized knowledge often leads to coordination difficulties, rework and information loss over time. Partnering with an experienced contract research organization (CRO) enables sponsors to overcome these barriers. A qualified CRO partner brings a wealth of accumulated knowledge, a proven record of regulatory and operational success, and the ability to stabilize the inherent complexity of drug development through well-coordinated, knowledge-driven execution.

3. Adaptability: A solid plan with flexibility

Managing clinical trial complexity requires a proactive and flexible approach that begins long before a study launches. Sponsors need to be able to design trials around adaptability,

balancing a strong foundational plan with the ability to adjust as challenges arise. Real-time performance tracking plays a critical role, allowing teams to monitor progress and identify potential issues before they escalate. Designing for operational efficiency starts with simplifying wherever possible: streamline endpoints and assessments to include only what is essential for regulatory approval and scientific validity, and simplify eligibility criteria to expand the eligible patient pool while avoiding unnecessary geographic expansion. Conducting feasibility assessments or pilot testing with experienced sites and patient advocacy group input helps ensure that protocols are practical and achievable. Adaptive trial designs allow sponsors to gather more information per patient and make informed protocol adjustments without requiring full amendments. This leaner approach reduces site burden, shortens recruitment timelines, and minimizes data management overhead, leading to measurable cost savings.

However, building systems and protocols around adaptability can be difficult for those that lack experience. Sponsors must create frameworks that are modular, flexible and resilient to unforeseen disruptions. Partnering with an experienced CRO from the earliest stages of development can make this possible. A skilled CRO can identify unnecessary procedural and operational complexity before it becomes systemic, provide specialized insight into adaptive design implementation, and offer tailored solutions such as functional service partnership (FSP) models that reduce costs while enhancing agility. In this way, the right partner enables sponsors to transform adaptability from a reactive necessity into a strategic advantage.

A CRO partner that's been there

When it comes to managing complexity, the PPD clinical research business of Thermo Fisher Scientific delivers the experience, scale, and agility sponsors need to stay ahead of change. As a partner that has successfully guided countless programs through evolving scientific, operational, and regulatory challenges, we know how to anticipate obstacles and adapt quickly to new innovations and shifting conditions. Our teams are skilled at building flexibility and risk management directly into vendor and site contracts, ensuring stability even when uncertainty arises. Acting as a true complexity buffer, we provide the specialized knowledge, integrated technologies, and global regulatory expertise needed to simplify the path forward. With the PPD clinical research business of Thermo Fisher Scientific as your partner, you can transform complexity into clarity, and move with confidence toward the ultimate goal of bringing life-changing treatments to patients around the world.

Handle complexity with ease.
Start your partnership with a
qualified CRO partner today.

■ **Get started today** with a partnership that pays off.

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