White Paper

# Future-Proofing Long-Term Follow-Up in Cell & Gene Therapy

## *A patient-centered, data-driven approach*

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# Introduction

As cell and gene therapies (CAGTs) advance toward curative potential, long-term follow-up (LTFU) has become a regulatory cornerstone for ensuring sustained efficacy and safety. CAGTs carry uncertainties that only years of observation can resolve.[1] When a patient receives cell or gene therapy, the treatment marks the beginning of a long-term journey. Regulators worldwide mandate that patients treated with gene therapies are monitored for 5 to 15 years to track delayed side effects and sustained efficacy.[2,3] Tracking patients over extended periods can become costly and lead to operational challenges if not managed efficiently. With over 3,000 cell and gene therapies in development globally and dozens of new launches expected each year[4], the stakes are high for companies to optimize the design of their LTFU studies.

Long-term patient follow-up is not just a regulatory checkbox; it's a scientific, operational, and ethical imperative in the era of CAGTs.[5] Regulatory authorities and pharmaceutical companies must be able to answer critical questions:

- Do the therapeutic benefits persist over time?
- Are there delayed adverse effects that only emerge years later?

Addressing these questions is essential to validate the long-term safety and efficacy of CAGTs and to uphold public confidence in these innovative treatments.

However, executing LTFU studies is inherently complex. Monitoring patients for a decade or more presents significant logistical and financial challenges. It is also often of limited interest to busy investigators and patients.[6]

Sponsors must balance stringent safety oversight with the realities of patients' lives post treatment. Traditional clinical trial approaches, anchored to short-term site-based engagement, struggle under this scale of time and scope. It's clear that LTFU programs demand a modernized playbook that is patient-centered, data-rich, and accommodates long-term variability.

This paper is structured in three parts: first, we outline the key challenges in executing LTFU for CAGTs; second, we describe IQVIA's current strategies to address these challenges; and third, we present a future vision for scalable, patient-centered LTFU. The overarching theme is that **by rethinking follow-up through the eyes of patients and leveraging real-world data and technology, we can ensure these studies protect patients and advance science while also being operationally and financially sustainable**.

# Challenges in executing CAGT long-term follow-up studies

LTFU studies for CAGTs present a perfect storm of operational and scientific hurdles. Some of the major challenges that sponsors face when designing and implementing these programs include:

- **Sustaining engagement over a decade or more**. Keeping patients and investigators committed to a study for 5–15 years is inherently difficult. Patients who experience therapeutic success may disengage, while those with poor outcomes may drop out due to illness or discouragement. Investigators and site staff may lose interest once the trial's active phase ends.[6]

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The result is high risk of attrition, e.g. missing data, and lost patients, which can bias outcomes if those doing well are the most likely to be lost to follow-up.[7] Maintaining motivation and contact requires continuous effort, thoughtful engagement strategies, and often, creative incentive models.

- **Geographic dispersion and continuity of care**. It's common for rare disease patients to travel great distances to receive a one-time gene therapy at a specialized center. After treatment, expecting them to travel back to that center regularly for years is often impractical.[6] Patients resume their normal lives, return to local healthcare providers and may even move to new cities or countries over time. Pediatric patients may transition to adult care during the follow-up window, requiring re-consent and new doctor relationships. These changes complicate consistent data collection and increase the risk of patient loss, which can undermine the statistical power and validity of LTFU findings.

  Since CAGTs target rare diseases or niche cancers, LTFU studies already have limited sample sizes, leaving little room for missing data. Additionally, rare disease patients may not be captured within a single healthcare system or registry, making comprehensive follow-up a difficult exercise of finding and connecting records across multiple databases and provider networks. The challenge is how to "meet patients where they are," gathering required data through healthcare touchpoints they naturally engage with, or through direct contact, without losing them in the process.[6]

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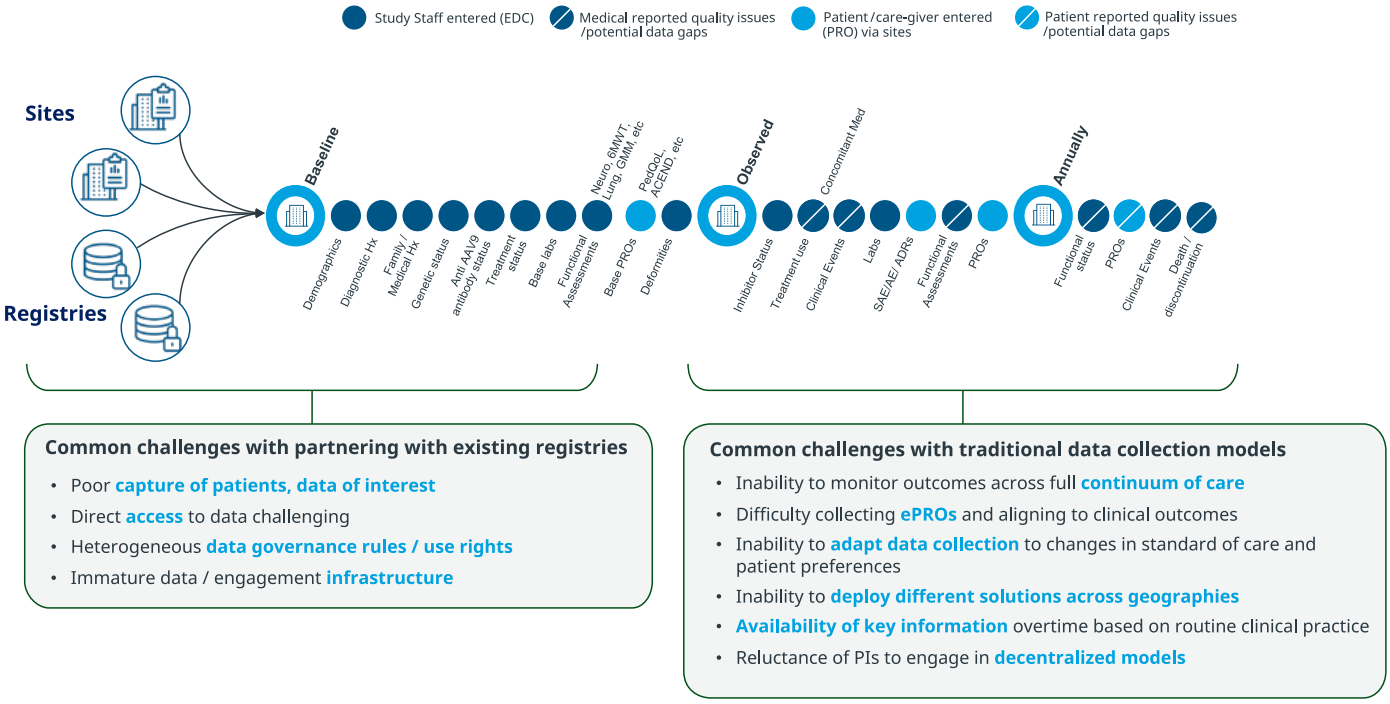
- **Data collection is fragmented and burdensome**. LTFU means capturing a wide range of data across multiple healthcare systems and providers over many years. Unlike a controlled trial, where every data point is collected per protocol, LTFU blurs the line with routine care: some data comes from scheduled study visits, but the rest might come from patients' regular doctor visits or personal reports. Data can end up being fragmented across different clinics, electronic health record systems, or registries.Furthermore, medical guidelines are subject to continuous development and refinement.[6] The burden placed on sites and patients by repeated data entry and extra visits can strain goodwill and resources if not managed carefully. All of this creates a significant data collection challenge: how to assemble a coherent, high-quality dataset from so many disparate pieces?

- **Patients age and their health evolves**. Over a follow-up period of more than ten years, a patient's circumstances will inevitably change. New health issues unrelated to the original disease can emerge which could confound interpretation of long-term safety or effectiveness signals. For example, if a patient treated with gene therapy later develops cancer, was it caused by the therapy or by other risk factors? Untangling causality in the presence of comorbidities and natural aging is challenging. It requires collecting detailed medical history over time and often comparing it to appropriate control data to contextualize the outcomes and support causality assessments.[6]

- Similarly, the effectiveness of a therapy may wane as patients age or as the disease progresses naturally; distinguishing treatment failure from expected disease course or age-related decline is an analytical hurdle. These considerations require that endpoints and comparison metrics in LTFU studies be chosen with particular care, often involving the integration of epidemiological data into evaluations.

**Figure 1: Common challenges with long-term data collection in CAGT and Rare Disease studies**




- **Technology and data access standards will change midstream**. Over the past five years, there have been notable developments in digital health technologies, connected devices, and tools used across consumer health, research, and healthcare delivery. We are currently only beginning to see the power of Artificial Intelligence (AI) when applied to remote monitoring systems. These changes have occurred alongside ongoing policy initiatives aimed at allowing patients to access and use their own health data worldwide (e.g. the 21st Century Cures Act and European Health Data Space). A 15-year study that starts in 2025 and concludes in 2040 will likely encounter significant changes in technology over this period. New digital health tools will appear, data privacy laws may shift, and regulators might update their guidance or expectations for data collection.[8] These shifts could require continued changes to a study protocol overtime to enable studies to adapt to these changes and exploit these advances in tech and data. Incorporating new technology or measures into an ongoing study is challenging, as consistency and data compatibility issues arise, but not keeping up can mean missed opportunities or non-compliance with evolving standards. Thus, LTFU studies face a moving target and must be designed from the start with adaptability in mind, a concept that is not traditional in clinical trial systems and operations.

- **Integrating trial and post-commercial follow-up**. An often-overlooked issue is that LTFU obligations can span the pre-approval and post-approval phases. Running separate parallel long-term studies for "trial patients" and one for "post-market patients" is inefficient and could double the burden on organizations, as well as on patients who transition from one to the other. The challenge is how to merge these efforts, allowing all patients to be followed in a unified program that meets regulatory obligations for both clinical development and post-marketing surveillance. Today this often requires creative protocol designs (rollover studies, registries) and negotiation with regulators to accept a combined approach. It's an area in need of more streamlined solutions to handle the full product lifecycle of a therapy.

*Cell and Gene Therapies are fundamentally different from typical clinical trials. They require a long-term mindset, creative design strategies, and often, a willingness to break from traditional research paradigms.*

- **Unique endpoints and assessments for each therapy**. Unlike traditional drugs, each cell or gene therapy can be very different in mechanism of action and in what "long-term success" looks like.[6] One gene therapy might integrate into the genome, requiring years of monitoring for genomic changes, while another might be a gene edit that could have off-target effects — and a cell therapy might persist in the body and potentially cause late-onset immune reactions. Consequently, LTFU studies must be tailored as there is no one-size-fits-all set of assessments. Choosing the right clinical outcome assessments (COAs), biomarkers, and visit frequency is critical and difficult. It must balance thoroughness (to not miss important signals) with feasibility and patient burden. This places a heavy load on the LTFU study design process.

These challenges underscore that LTFU studies for CAGTs are fundamentally different from typical clinical trials. They require a long-term mindset, creative design strategies, and often, a willingness to break from traditional research paradigms. Sponsors must navigate not only medical uncertainties but also human factors (patient lives, behaviors) and an evolving external environment. The key to success lies in proactively addressing these issues upfront by building flexibility into studies, leveraging every available data source, and keeping the patient experience front and center.

# How to overcome LTFU challenges

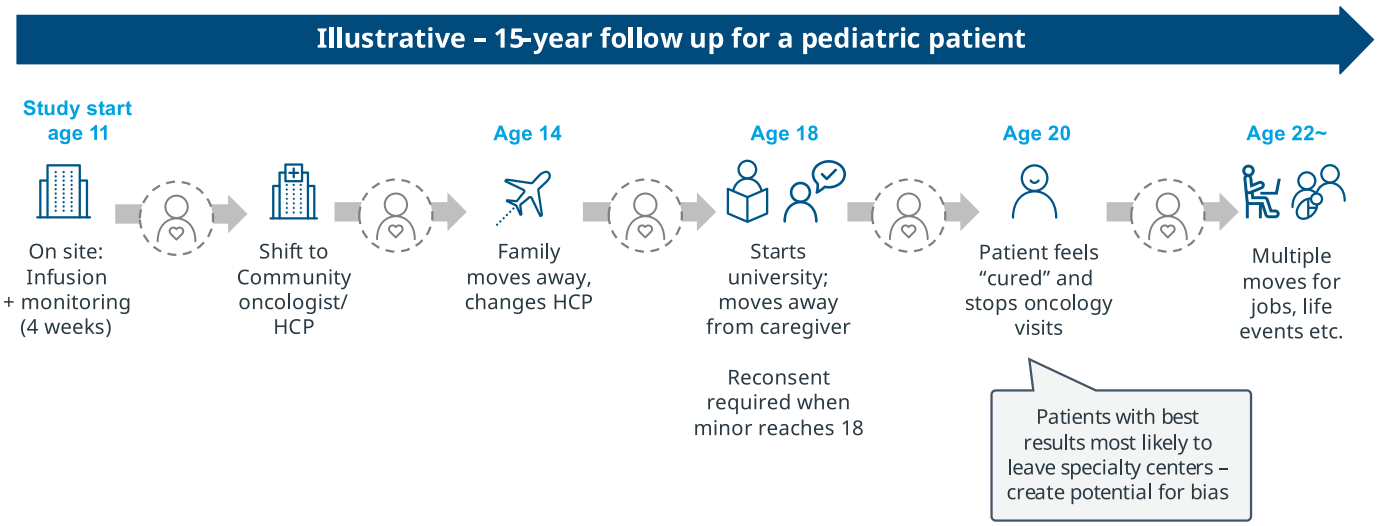
IQVIA draws on experience in clinical trials and real-world evidence to craft patient-friendly and data-efficient approaches to directly address the pain points of LFTU. At a high level, our strategy centers on four pillars designed to optimize compliance, data quality and patient retention while minimizing operational burden and cost. Below, we break down how each pillar works in practice.

## Patient-centered, journey-driven design

The foundation of a successful LTFU study is a patient-centric design. Every long-term follow-up challenge should be approached with a simple question: *What will these patients' lives look like after treatment, and how can we fit the study into that reality?* This mindset moves away from traditional site-centric models, where follow-up is anchored to the treating institution, and toward a dynamic, patient-centric framework that aligns with real-world care pathways.[9] In practice, this involves mapping out the "patient journey" after therapy administration and designing the study around that map. This approach is not just about improving retention, but about ensuring data completeness, reducing operational friction, and future-proofing the evidence base for regulatory and commercial success.

Take, for example, a gene therapy administered at a specialized center in New York to patients traveling from across the United States. Post-treatment, these individuals return to their local communities. Expecting them to return annually to the original site is impractical and unsustainable. Instead, IQVIA designs LTFU protocols that incorporate localized solutions that address the challenge of geographic dispersion by partnering with community physicians to conduct assessments, deploying home health nurses for sample collection and physical exams, and leveraging telemedicine for virtual consultations.

**Figure 2: Best practice — tailor the approach to the patient journey**




A patient-centric design also pays attention to transitions in care, such as pediatric patients aging into adult healthcare.[10] That means engaging both the pediatric and adult healthcare providers in the study and planning for a new consent process to ensure continuity. In cases where re-treatment may be necessary, we design the study to capture pre- and post-intervention data, integrating new therapy providers into the follow-up framework.

Critically, we embed decentralized trial elements from the outset. Each LTFU protocol is structured as a hybrid data model: while some data will still need to be collected at the original treatment site (e.g., specialized lab tests) for a certain period of time, a significant portion can be gathered through direct-to-patient collection methods.[6] This flexibility ensures that patients remain engaged and under observation even if they relocate, change providers, or experience shifts in their health status.

From a sponsor's perspective, this design philosophy delivers measurable benefits:

- **Improved retention and compliance**, reducing the risk of missing data and bias
- **Lower operational costs**, by minimizing travel reimbursements, site coordination, and redundant assessments.
- **Greater scalability**, enabling global execution across diverse geographies and healthcare systems.
- **Enhanced regulatory alignment**, by demonstrating a proactive approach to patient engagement and data continuity.

To support this model, IQVIA often deploys "concierge" services for patients in LTFU programs such as travel coordination for in-person visits and dedicated patient liaisons who maintain regular contact, schedule appointments, and address concerns.[10] We also actively engage patient advocacy groups when appropriate, leveraging their networks to reinforce the importance of long-term participation and to foster a sense of community among study participants.

By starting with the patient's perspective, the study is made more convenient, and data completeness is improved.[9] This approach is rooted in empathy and operational pragmatism. Patients are less likely to drop out if the follow-up process feels like a natural extension of their care rather than a burdensome series of extra visits & tasks.

In summary, our current LTFU studies are designed with patient needs as the central consideration: we design flexible protocols that follow each patient arc through life, rather than expecting life to bend around the protocol.[11]

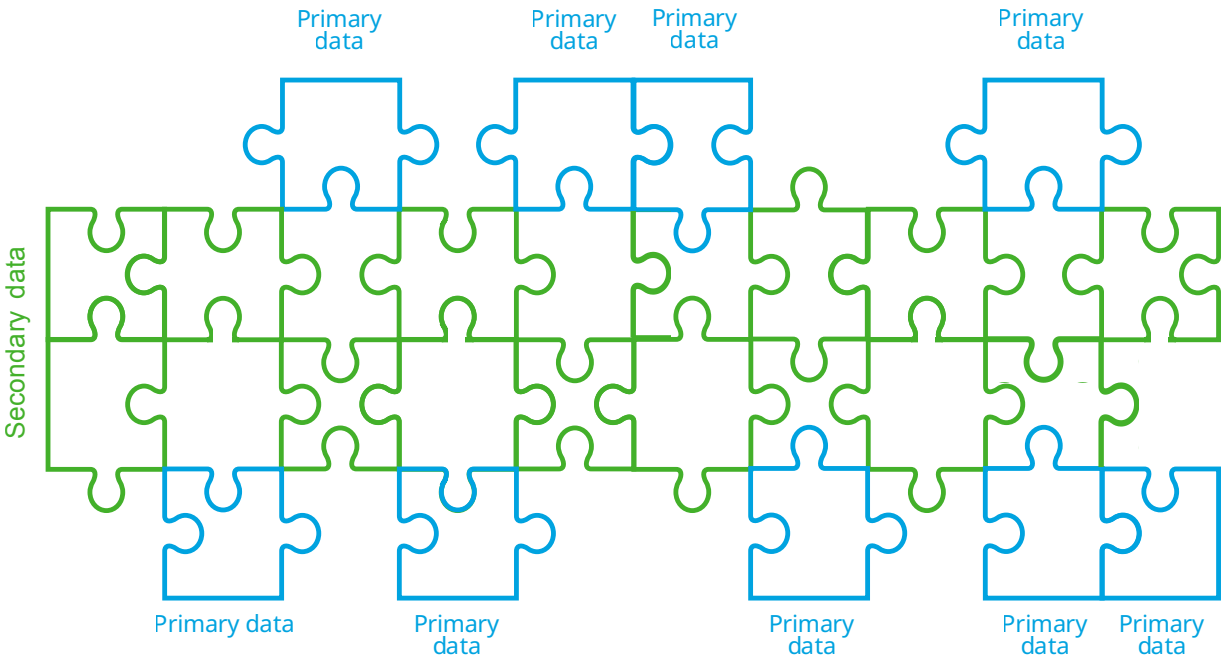
## Enriched data collection using real-world sources and registries

IQVIA uses an enriched data strategy for LTFU to address fragmented data across time, systems, and care settings. In other words, we leverage existing real-world data (RWD) from patients' routine healthcare to the maximum extent possible and then fill in the gaps with study-specific data collection where needed. This approach offers a cost-effective way to meet regulatory obligations without duplicating efforts through redundant study-specific assessments.

The types of data long-term follow-up typically needs are safety outcomes and efficacy/durability outcomes. Many of these are captured in the course of regular medical care. For example, if a patient is hospitalized or undergoes a diagnostic test as part of standard care, that information is already captured in electronic health records (EHRs) or claims data.[10] Rather than duplicating those efforts, an approach that taps into routine clinical data streams can mean programmatic extraction of data from electronic health record (EHR) systems, with appropriate patient consent and in full compliance with privacy. In regions with established health system integration, we implement secure, consented data sharing mechanisms that enable routine care lab results or procedures to feed directly into the study database.

In addition to EHRs and claims data, disease registries are a valuable resource. Many rare diseases have registries set up by academic consortia, patient organizations, or governments to track patients over time. These often contain baseline natural history data and can continue to capture outcomes for patients who receive new therapies. IQVIA often works with such registries in LTFU studies by integrating the LTFU study into an existing registry.[5] For example, we might collaborate with a registry so that our follow-up data points align with theirs, allowing seamless integration into both programs. In some cases, if a

**Figure 3: IQVIA uses an enriched data strategy for LTFU to address fragmented data across time, systems, and care settings**




**PRIMARY DATA:**
- Electronic case report forms (eCRF)
- Patient reported outcomes (PRO)

**SECONDARY DATA:**
- Electronic medical records (EMR)
- Claims data
- Research cohorts

robust registry exists, regulators even encourage sponsors to utilize it for post-approval follow-up to minimize duplication.[10] However, registries rarely fulfill all needs out-of-the-box: they may not capture certain specialized tests or may update infrequently.[26,27] To address this, IQVIA can implement an "extended registry" models, essentially adding a module to a registry to capture additional data of interest under the same research umbrella.[13]

Despite heavy use of real-world data, there are always critical pieces of information that routine care or registries won't provide.[14] These might include specific research-grade assessments (e.g. a quality-of-life questionnaire, or a sensitive lab assay done only in research labs) or simply more frequent monitoring than standard care would dictate. For these, the study will include dedicated data collection points such as annual follow-up visits (virtual or in-person) solely for study purposes, or periodic patient-reported surveys via an app. This targeted approach means we ask for extra effort only when necessary.

Tailoring data sources to the question at hand dramatically cuts down the burden on patients and sites. Strategic investment in data integration capabilities make enriched data collection work effectively.[15] For example, using interoperable platforms and common data models bring together disparate sources, e.g. clinical trial databases, EHR feeds, registry exports, and patient-entered data, into one cohesive data set.[16,17] Our real-world data specialists curate and clean incoming data to ensure it aligns with study definitions. For instance, using a claims database to track medical events helps map diagnosis and procedure codes to adverse events of interest in the study so we can auto-generate potential safety report. We are mindful of data latency and plan accordingly by supplementing with more real-time sources for critical safety monitoring.

In summary, **IQVIA's approach treats real-world data as a cornerstone of LTFU**. By combining healthcare records, registries, and direct data collection, we create a 360-degree view of patient outcomes to deliver:

- **Higher data completeness**, by capturing events that occur outside scheduled study visits.
- **Lower operational burden**, by reducing redundant assessments and site workload.
- **Improved regulatory alignment**, through validated data sources and transparent methodologies.
- **Greater scalability**, enabling global execution across diverse healthcare systems

It's an efficient, patient-centric way to gather long-term evidence, aligning study efforts with what's actually happening in patients' lives and in the healthcare ecosystem.

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## Digital and decentralized tools to reduce burden

Digital and mobile technology are critical enablers to keep long-term follow-up studies manageable and engaging for patients, caregivers, and research staff supporting them. Decentralized trial techniques and digital health tools are integrated into IQVIA's LTFU study solutions to streamline participation, reduce site burden, and enhance data capture.

On the digital side, IQVIA has leaned into the emergence of integrated digital research platforms through our Health Research Space (HRS).[18] The HRS platform is designed to meet the needs of real world decentralized and hybrid studies by providing an intuitive, all-in-one direct-to patient data collection and engagement platform.[19]

It empowers patients with self-onboarding capabilities, digital consent, and seamless access to study participation from their own devices. The platform integrates with electronic medical records (EMRs) to streamline data collection and enhance clinical relevance. Virtual site support and real-time monitoring tools enable sponsors and researchers to maintain study oversight while reducing operational burdens.

By expanding geographic reach and reducing barriers to entry, HRS improves participant diversity and retention. Its modular design allows for tailored study configurations, supporting both simple and complex protocols. The platform also facilitates longitudinal data capture, enabling deeper insights into patient outcomes over time. With built-in compliance and security features, it ensures data integrity and regulatory alignment. Ultimately, HRS accelerates evidence generation, improves patient-centricity, and supports the evolution of clinical research into a more inclusive and efficient paradigm.

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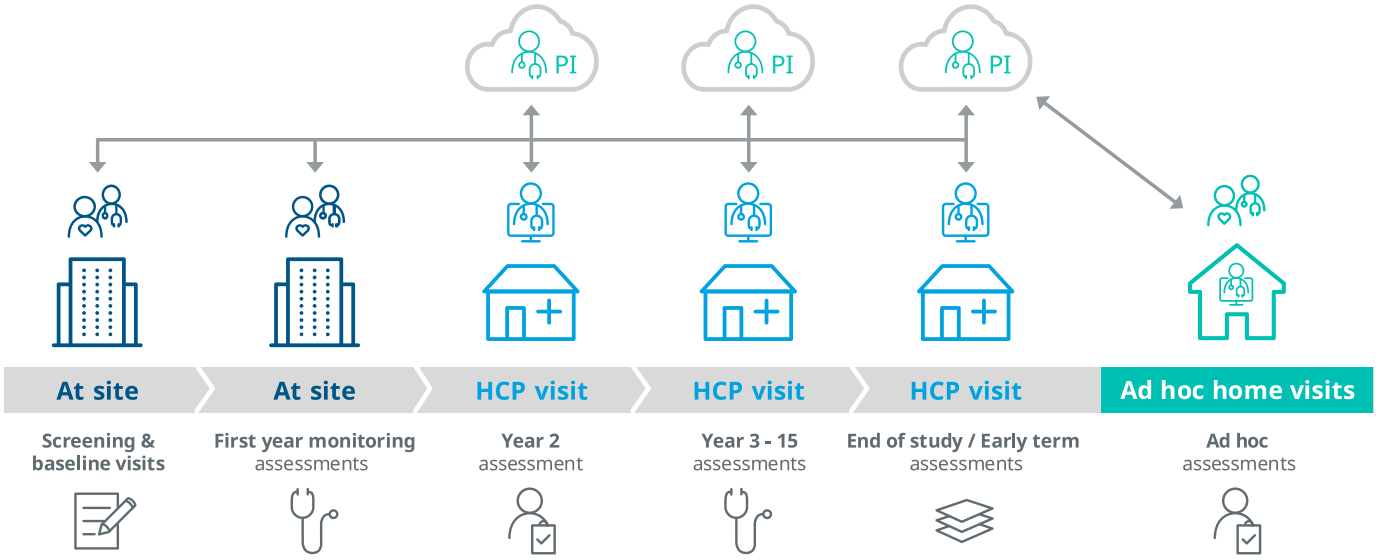
As outlined in our patient-centered design approach, decentralized methods are embedded early in protocol development. A prime example is the use of telehealth and remote monitoring. Many follow-up visits that were traditionally conducted in person are now handled via secure video consultations.[20] During these virtual visits, study physicians or nurses can conduct symptom interviews, observe physical indicators, and guide patients through basic functional assessments. This model removes barriers like travel, time off from work, and logistics that often cause missed visits. Experience, particularly during the COVID-19 pandemic, demonstrated that telemedicine not only sustains study continuity but also increases patient willingness to remain engaged over the long term.

Mobile research nurses are another valuable asset to help patients. If a protocol requires a blood draw, biopsy, or specialized exam that can't be done via telehealth, a traveling nurse is often deployed to the patient's home or nearby clinic. These trained professionals, embedded within the study team, perform procedures on-site and ship samples to central labs for analysis. This "home visit" model ensures that even complex assessments can be completed without requiring patients to return to distant treatment centers. For sponsors, this reduces dropout risk and ensures protocol adherence across geographically dispersed populations.

Additionally, wearable devices and remote sensors can obtain objective, long-term data. Depending on the therapy and condition, devices may track heart rate, activity levels, blood glucose, or other metrics that serve as supplemental endpoints or safety indicators. These technologies mean less reliance on episodic clinical measurements but richer, more continuous and lower burden longitudinal data.[10]

**Figure 4: Decentralized trials can decrease burden for Clinical Trial LTFU**




While not all patients opt to use these devices, even partial adoption enriches the dataset and provides a more nuanced view of long-term outcomes.

From an operational perspective, these digital and remote tools also reduce the burden on sites.[6] Whenever possible, we aim to implement a centralized follow-up team model: after the initial treatment study, the responsibility for ongoing follow-up shifts from the dozens of investigational sites to a small, central team of physicians and coordinators who oversee all patients going forward.[6] The central team uses our integrated study application and associated features to monitor data, follow up on events of interest, and engage patients' overtime aligned to their personal preferences. They also assume responsibility for following up a patients' local healthcare providers for any medical issues and reporting needs. This model reduces variability and takes the burden off the original trial sites, who may be busy enrolling for new studies.

All these decentralized tactics serve one mission: **to make long-term follow-up sustainable and patient friendly**. By reducing travel, minimizing extra clinical visits, and using familiar communication channels, we aim to improve retention. Patients can participate without constantly disrupting their work or personal life, and sites/providers aren't overburdened with endless follow-up appointments. In short, technology and innovative trial design go hand in hand to keep long-term follow-up efficient. These tools are designed to support data completeness and reduce burden on both patients and sites, contributing to improved study continuity and data quality.[21]

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## Designing for adaptability and longevity

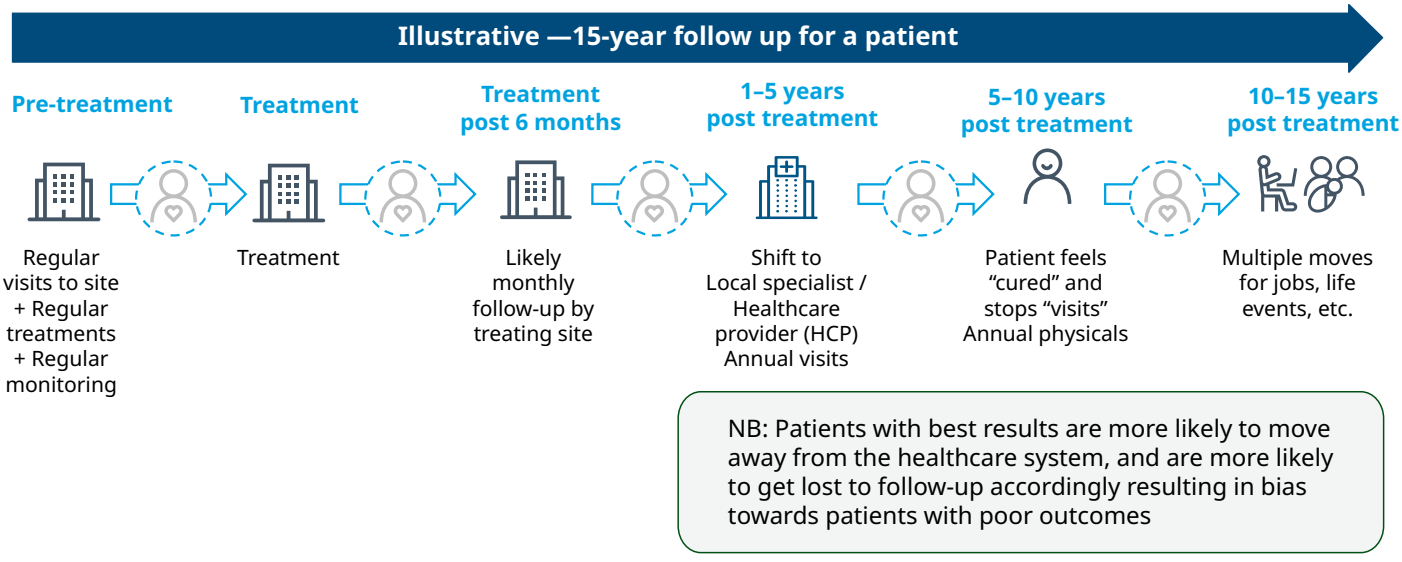
Given the long horizon and the evolving landscape of CAGT follow-up, adaptability should be treated as a foundational design principle and not as a contingency. Over the duration of these studies, scientific knowledge, regulatory frameworks, and technological tools are all likely to evolve. In such a dynamic environment, inflexibility in study design becomes a liability. The idea is to "future-proof" LTFU studies as much as possible, ensuring that studies remain relevant, compliant, and operationally viable throughout their lifecycle.

Adaptability in LTFU studies involves several aspects. Our approach begins with designing protocols that are inherently flexible. Rather than locking in rigid schedules and static assessments, we build frameworks that allow for calibrated adjustments over time. As new risks are identified or mitigated, study protocols may need to adapt to include new endpoints, biomarkers, or monitoring strategies. By anticipating different scenarios, the protocol becomes a living document that can adapt without needing a complete rewrite. One tactic is implementing interim review points, such as a formal review with experts and possibly regulators after 3 years of data to determine whether the follow-up plan should be adjusted. Building in these milestones makes adaptation an expected part of the process, rather than an ad-hoc reaction.

Operationally, the tools used to collect, manage, and analyze data are advancing quickly, so keeping data systems and platforms as modular and interoperable as possible is key. If new data sources, data collection instruments, or devices become available in the future that could greatly reduce data burden and enhance data collection, we want to be able to add it into the study. Using open data standards and scalable cloud-based platforms ensures the ability to integrate new data streams mid-study with minimal friction. Without inherent flexibility, such transitions can lead to inconsistencies, introducing biases, data loss, or compliance issues

Regulatory adaptability is just as crucial. Agencies like the FDA, EMA, and others are always actively updating their guidance documents. These updates may impact the duration of follow-up, the nature of required assessments, or the expectations for patient retention and data completeness. A study designed without the ability to accommodate such changes risks non-compliance or necessitating costly and time-consuming amendments. By cultivating an

**Figure 5: Challenges of long term follow up**



ongoing dialogue, we can propose amendments or methodological changes and gain alignment more smoothly. The key is to present a solid rationale and ensure patient safety is maintained. Not treating the protocol as untouchable, allows for incorporation of regulatory feedback throughout the study's life.

Finally, adaptability is about a mindset that sets expectations with all stakeholders that change will happen. Sites and patients are told upfront that the study may evolve since the way data is collected might shift as new technologies become available, or some visits might be replaced with remote methods later. This transparency helps avoid confusion or mistrust when modifications occur.

In the end, **a 15-year study that looks exactly the same in year 15 as it did in year 1 is probably an opportunity missed**. By contrast, a study that intelligently adapts to changes will yield more relevant data and will be easier to execute. IQVIA's approach ensures that evolution is not only possible but planned. By making LTFU programs adaptable to changes, studies are prepared to address new safety concerns and adjust to new analytic techniques or other external circumstances that force a shift. This adaptability, as well as the provision of stability and expert guidance to navigate the long and evolving journey, is key to successful partnership.

*IQVIA envisions an ecosystem where long-term follow-up is seamlessly integrated into the fabric of therapy development and post-market care, supported by collaborative frameworks, advanced data analytics, and patient-empowering technologies.*

## Future vision: Toward more efficient and scalable LTFU

As challenging as LTFU studies are today, the future holds promise for making them more streamlined and powerful. IQVIA envisions an ecosystem where long-term follow-up is seamlessly integrated into the fabric of therapy development and post-market care, supported by collaborative frameworks, advanced data analytics, and patient-empowering technologies.

## Industry collaboration and shared registries

One key element of our vision is greater collaboration and data sharing across the industry. Today, each company might run their own follow-up study, even for therapies addressing the same disease. This fragmentation leads to duplicated effort, potentially inconsistent data, and unnecessary burden on patients and sites.

In the coming years, IQVIA advocates for a shift toward multi-sponsor or consortium-based LTFU registries for certain conditions.[22] In rare diseases where multiple gene therapies are in development, pooling resources into a common long-term registry can deliver value across stakeholders without exposing sensitivities between manufacturers. Unified registries that track all patients treated with gene therapies for a given indication can streamline data collection, improve comparability, and reduce site fatigue. Sponsors would still meet product-specific obligations, but core assessments, enrollment logistics, and data governance could be centralized. Payers and regulators would also benefit from these efforts, as they generate larger comparative datasets. We are already seeing early examples of such approaches in regulator-mandated registries that cover multiple therapies and expect this to expand.[23]

## Seamless integration with routine care

Another future development is the full integration of LTFU with routine patient care in a way that makes the distinction between "study" and "healthcare" less stark. As healthcare systems become more digital, we foresee a time when patients consent to long-term research follow-up as part of their treatment process, and then much of the data collection happens automatically through electronic health records and patient portals. The role of the "study" will be to plug any intentional data gaps and analyze the information, rather than to actively chase every data point.

IQVIA's ongoing collaborations with health systems and investments in real-world data platforms are paving the way for this, building pipelines that can continuously, securely, and compliantly feed and link de-identified outcome data into research databases.[10] With appropriate patient permissions, this could enable near real-time safety surveillance on a population level. This initiative also aligns with regulatory interests, and our team has provided input on utilizing EHR networks and digital technologies to support this objective.[6]

## Smarter analytics and AI

Technologically, the future will bring smarter implementation and insight generation into LTFU using advances in AI. With more data flowing in from disparate sources, advanced algorithms can help detect signals that a manual review might miss, e.g. patterns that precede a late adverse event. Machine learning algorithms could be used to identify early warning signals, predict non-compliance and lost to follow-up risk, and simulate different follow-up durations to inform regulatory guidance. While we will always need human oversight and medical judgment, these tools will enhance decision-making and efficiency in long-term studies. IQVIA continues to invest in these advanced analytical capabilities, utilizing our Human Data Science approach that combines large-scale data and expertise in healthcare and embeds them into our study tools and technology compliantly and securely.

## Lifecycle-based LTFU models

From an operational standpoint, we see further convergence of clinical trial and real-world evidence teams. By treating LTFU as a life-cycle platform rather than a single study, sponsors can maintain continuity.

We anticipate more use of master protocols for LTFU that allow new cohorts (from new trials or new indications of the therapy) to join the ongoing follow-up, creating an ever-growing knowledge base. This aligns with the idea of continuously learning healthcare systems where every patient's journey, in trials or in standard care, adds to the evidence that improves treatment for the next patient.

## Regulatory leadership and advocacy

IQVIA contributes to shaping industry standards by collaborating with regulatory bodies on decentralized trial designs, registry integration, and data governance. These engagements help inform evolving guidelines and promote pragmatic, patient-centered approaches to long-term follow-up.[10] By contributing to the discussion at a policy level, we help ensure that future regulations remain pragmatic and open to innovation, which will benefit all sponsors and patients. We advocate for a vision of efficient, patient-friendly LTFU in industry workgroups and partnerships, helping to inform regulatory changes.

Amid these advancements, IQVIA is uniquely positioned to lead and support the industry in making the future of LTFU a reality. Our extensive experience across hundreds of CAGT studies and global follow-up programs and a dedicated Cell & Gene Therapy Center of Excellence concentrates our expertise from regulatory strategists who understand the latest guidance, data scientists skilled in merging clinical and RWD, and project leaders who have run global LTFU studies from start to finish.

In conclusion, long-term follow-up studies are an essential companion to the breakthroughs happening in cell and gene therapy. By addressing the challenges with creative, patient-centric strategies and embracing the power of real-world data and technology, we can make these studies not just a regulatory must but highly successful. The future of LTFU will likely see more collaboration, smarter data use, and seamless integration with patient care, all aimed at ensuring that every new therapy truly delivers lasting benefits.

IQVIA continues to invest in approaches and technologies that support this evolving vision for LTFU. We are continually adapting our approaches and tools to set new benchmarks for what long-term follow-up can achieve. The aim is to ensure patient safety and generate long-term evidence that supports the sustained impact of cell and gene therapies, not just in the short term, but for years and decades to come.[6]

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