

White Paper

# Navigating the Shift to Sustainable Clinical Trials

*Balancing clinical science, speed and safety with the environment*

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# Table of contents

<b>Executive summary</b>	<b>1</b>
<b>Introduction</b>	<b>2</b>
<b>The role of clinical trials in lowering healthcare's carbon footprint</b>	<b>3</b>
<b>Quantifying greenhouse gas emissions</b>	<b>4</b>
<b>A Risk-based monitoring framework is an effective tool from which to begin reducing emissions</b>	<b>5</b>
<b>The RBM framework can be enhanced to boost sustainability</b>	<b>10</b>
<b>Conclusion: Five recommendations to advance the environmental sustainability of clinical trials</b>	<b>15</b>
<b>Acknowledgements</b>	<b>16</b>
<b>About the authors</b>	<b>16</b>

# Executive summary

Clinical trials are a core component of advancing medical progress in a safe and ethical manner. As they involve complex manufacturing, a globalised supply chain and in-person monitoring, they generate a substantial quantity of emissions, of which IQVIA calculates at 2.0mn tCO<sub>2</sub>e in 2023.





A balanced approach should be taken to optimise trial emissions whilst recognising that medicines prevent downstream carbon emissions through greater use of energy-intensive care.

Despite a growing awareness of sustainability across major healthcare systems, heightened by WHO initiatives, inconsistent data and a lack of relevant tools to drive insight hinder targeted action. Enhancing existing state-of-the-art frameworks, such as Risk-Based Monitoring, which is designed to optimise for efficiency, is a good anchor from which to add on sustainability considerations.

Areas of investigation include gaining a deeper understanding of the sources of trial emissions, exploring the pattern of remote monitoring visits over time, examining the supply chain and investigating the regulatory environment that facilitates decentralised clinical trials.

By rethinking existing processes, immediate success can be had that aligns clinical research with climate goals while maintaining scientific, regulatory and commercial integrity.

## Challenges

-  Regulations requiring in-person visits and incongruous guidance across geographies
-  Supply chain inefficiencies, including overages of high-emission materials
-  Lack of consensus over data standards and insufficient communication across the supply chain
-  Laboratory energy use, especially on the long-term storage of ultra-low temperature samples

## Recommendations

- 1. Digitise to enable centralised monitoring.**  
This reduces the need for in-person visits while enhancing patient safety and data quality.
- 2. Minimise unnecessary travel of staff, patients, and goods.** Decentralised Clinical Trials (DCTs) offer a promising avenue for reducing unnecessary patient travel, although further research is needed to understand the net effects.
- 3. Procure sustainable trials.** Sponsors can advance sustainability through procurement and collaborate with partners to implement effective solutions to reduce emissions.
- 4. Engage regulators to advocate for remote operations.** Adapt regulations to enable DCTs and perform a larger proportion of visits remotely.
- 5. Reduce energy expenditure and waste from labs.** Reduce physical waste and certify labs to recognised sustainability standards.





## Introduction

The environmental impact of human activity has come under increasing scrutiny in recent years, with both private and public organisations facing mounting pressure to align with climate goals. Global healthcare, responsible for approximately 4.4% of annual greenhouse gas emissions,<sup>1</sup> will not only have to reform, as all sectors will, but is also at the forefront of caring for future populations impacted by climate change.<sup>2</sup>

Over the past few decades, the science and global reach of medicinal therapies have become increasingly sophisticated, and as such, the scale and complexity of clinical trials have expanded dramatically. This has brought with it a host of challenges, including the need to recruit participants across multiple geographies, extensive in-person monitoring, and energy-intensive manufacturing of investigational products. Each of

these activities contributes to the carbon footprint of clinical trials, prompting a growing recognition of the need to align these with broader sustainability goals.

Yet, the lack of precise data on emissions associated with clinical trials has prevented a unified and targeted strategy for emissions reduction. Emerging tools, such as carbon calculators and greater reporting, offer promising routes to achieve this goal, but their adoption remains inconsistent across the industry to date.

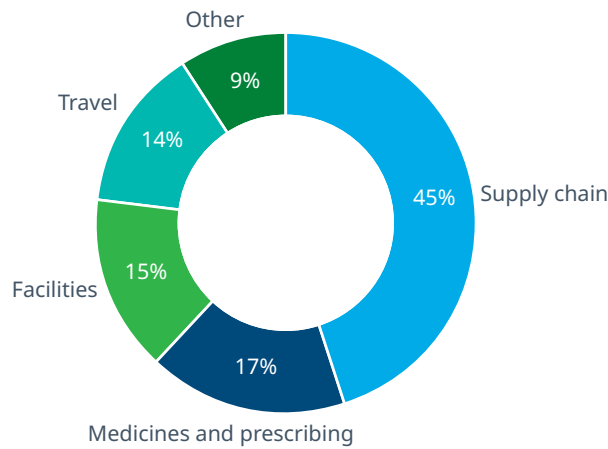
In this report, we delve into the environmental impact of clinical trials, exploring how digitisation, telemedicine and operational efficiency can pave the way for future clinical research without compromising on a trial's core objectives of clinical science, ethics, safety and speed.

# The role of clinical trials in lowering healthcare's carbon footprint

The sustainability case for clinical trials needs to be framed carefully. Clinical trials should not be seen only as a source of carbon emissions to minimise; they can also be an important lever for reducing the overall carbon footprint of healthcare. NHS England estimates that prescribing and medicines account for 17% of emissions,<sup>3</sup> while facilities, travel and the supply

chain account for 74% of the NHS Carbon Footprint<sup>4</sup> (see Figure 1). This matters because medicines that prevent deterioration, avoid complications or reduce acute episodes can shift care away from higher-carbon settings such as emergency admissions, inpatient stays and surgical procedures.

**Figure 1: A breakdown of NHS England emissions (2025, 27.3 MtCO<sub>2</sub>e)**



Source: IQVIA Thought Leadership; Greener NHS data (NHS Carbon Footprint Plus), Updated 29 Sep 2025

In this context, the speed with which high-value clinical trials are carried out and translated into clinical practice is itself a consideration for sustainable healthcare delivery. A balanced objective should be to

lower the carbon intensity of research where possible, while accelerating the development of interventions that can deliver larger downstream sustainability gains across the healthcare system.

# Quantifying the carbon footprint of clinical trials

In 2009, an academic study declared that the average emissions per clinical trial amounted to 78.4 tonnes of CO<sub>2</sub> equivalents (tCO<sub>2</sub>e).<sup>5</sup> When this figure is applied to the 350,000 trials registered on ClinicalTrials.gov between 2000 and 2021, it results in an annual average of 1.3 million tCO<sub>2</sub>e.<sup>6</sup>

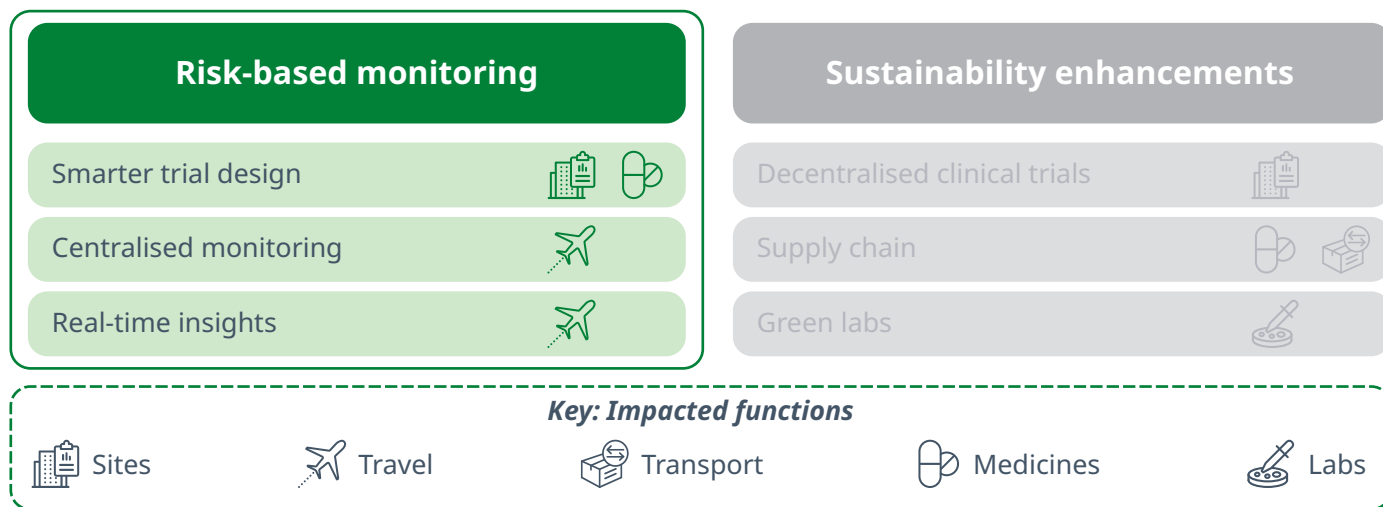
Another method involves utilising the Sustainable Healthcare Coalition's and Sustainable Market Initiative's Carbon Calculator,<sup>7</sup> we can estimate the principal sources of emissions originating from clinical trials in 2023. At a high level, the method involves coupling data from publicly disclosed trials (13,200 trails and 1.9mn participants) with default values embedded in the calculator. The resultant output amounts to 2.0 million tCO<sub>2</sub>e, which aligns with the estimates derived from the 2009 study discussed in the previous paragraph, providing a consistent finding.

To put these figures into perspective, they approximate the annual emissions of nearly half a million people in the UK (2024 basis)<sup>8</sup> or under 1% of all healthcare emissions worldwide. While seemingly marginal at a system level, this footprint is strategically significant: it reflects one of the most carbon-intensive activities per patient in healthcare and lies within cutting-edge research, delivering outsized impact and setting the standard for broader system decarbonisation.

Future refinements to this calculation could incorporate a more nuanced understanding of the trials. For instance, distinguishing between participants in in-patient versus out-patient centres or identifying trials with decentralised components could yield even more precise emission estimates.



# A Risk-based monitoring framework is an effective tool from which to begin reducing emissions



Risk-based monitoring (RBM) is a modern approach to overseeing clinical trials designed to enhance efficiency by reducing costs while simultaneously maintaining the core tenets of patient safety, methodological completeness and data integrity.

It does so by identifying key risks, for example complex study protocols or sites with a history of data inconsistencies, and proactively mitigating these risks by enhancing monitoring and training. At the same time, areas of low risk are streamlined and are less resource-intensive, for example where trusted sites (those that have a strong track record of working with trial startup monitors) undergo a higher proportion of remote monitoring and a simplified data review or limiting data collection to the most relevant variables for trials that have well-defined endpoints.

Throughout the trial, risks are continuously monitored and reassessed centrally, where anonymised data is analysed in real-time to allow for timely interventions. This balanced approach allocates resources optimally and reduces waste. In the following section, we explore existing elements of RBM that also benefit clinical trial sustainability.

## Smarter trial design

### SITE SELECTION

When selecting trial sites, prioritise locations that are in close proximity to patient populations to minimise travel-related emissions where not only environmental

impact can be minimised, but also patient convenience and participation can be enhanced. For example, IQVIA collects data on patient burden to try and minimise participation barriers that correlate with lower emissions, such as having to travel between sites.

Trial sites that either meet or can be retrofitted to comply with green building standards should be elevated from a low priority metric to increase visibility on site performance. The large, and continuous energy expenditure by clinics are clear areas to optimise.

### SUSTAINABILITY IN PROTOCOL DESIGN

Incorporate sustainability considerations into trial protocols and ethical reviews. This approach ensures that environmental impacts are evaluated and mitigated from the outset, promoting more sustainable clinical practices. For example, the RBM approach attempts to perform actions only when necessary to expedite the trial or ensure patient safety which is a departure from current convention where many trials often capture more data than required. IQVIA's Data-Informed Protocol Assessment (DIPA)<sup>9</sup> has shown that over \$250,000 in real savings per protocol can be achieved by removing extraneous procedures and addressing inconsistencies, in addition to reducing patient burden by 32% through reduced procedures and travel.

Protocols that increase virtual visits and utilise technology to capture data directly, such as wearables, can reduce travel from both patients and monitors and previous IQVIA experience shows that monitor travel can be reduced by 30%.<sup>10</sup> Smarter trial design can reduce inefficiencies and waste upstream before they compound later on during trial execution.

### Centralised monitoring

At the core of RBM, as well as the proposed strategies to mitigate trial emissions, is the imperative to digitise data capture, storage, and transmission throughout clinical trial operations. Digitising health delivery would allow for advances in telemedicine and the further adoption of clinically relevant wearable devices, facilitating remote patient monitoring and consultations. This not only enhances patient convenience, data accuracy and speed but also simultaneously reduces physical and energy waste and consequently, emissions.

Electronic Data Capture (EDC), Electronic Trial Master Files (eTMFs) and Electronic Health Records (EHRs), for instance, play pivotal roles in minimising the reliance on physical paper and manual data entry for data capture, storage and transmission, which are all susceptible to human error.

EHRs aim to capture a patient’s medical history, which is useful to enhance interoperability across multiple systems, and are important beyond trial boundaries as they have been identified in a previous IQVIA study as a foundational component of a digitised healthcare system.<sup>11</sup> Much work is yet needed to fulfil

the promise of these networks as they do not currently capture full medical history due to systemic and technological barriers.

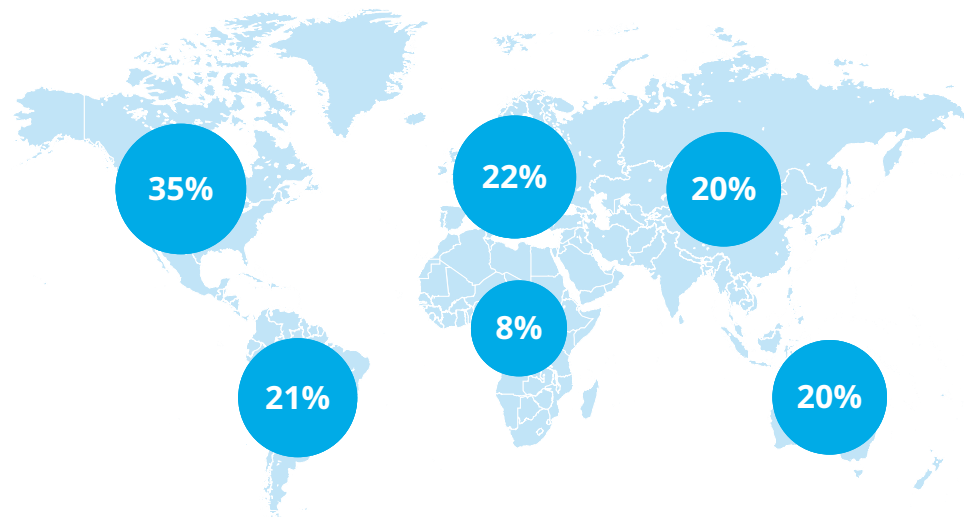
eTMFs streamline document management and provide rapid oversight and analytics for management and oversight purposes. The centralisation allows for the convergence of various clinical systems and can act as a useful source for extracting the relevant data required to calculate emissions and waste.

### UNLOCKING THE BENEFITS OF REMOTE MONITORING VISITS

A key activity in managing a trial’s day-to-day operations are the monitoring performed by Clinical Research Associates (CRA). CRAs are typically tasked with the startup of a trial, which includes site selection and initiation, its continuous monitoring and the closeout at the trial’s conclusion. These activities are mostly done in-person, with a large amount of travel conducted by the CRA, often flying between various sites on a weekly basis.

North America is at the forefront of adopting remote site visits, leading the charge with 35% of all visits performed remotely, followed by rest of the world excluding Africa at ~20% (Figure 2). This trend underscores a significant shift towards digitisation within these regions’ healthcare systems. In stark contrast, the African continent currently records the lowest proportion of remote visits, standing at 8% in 2025 which highlights the increasing need to enhance the level of digitisation in the African continent.

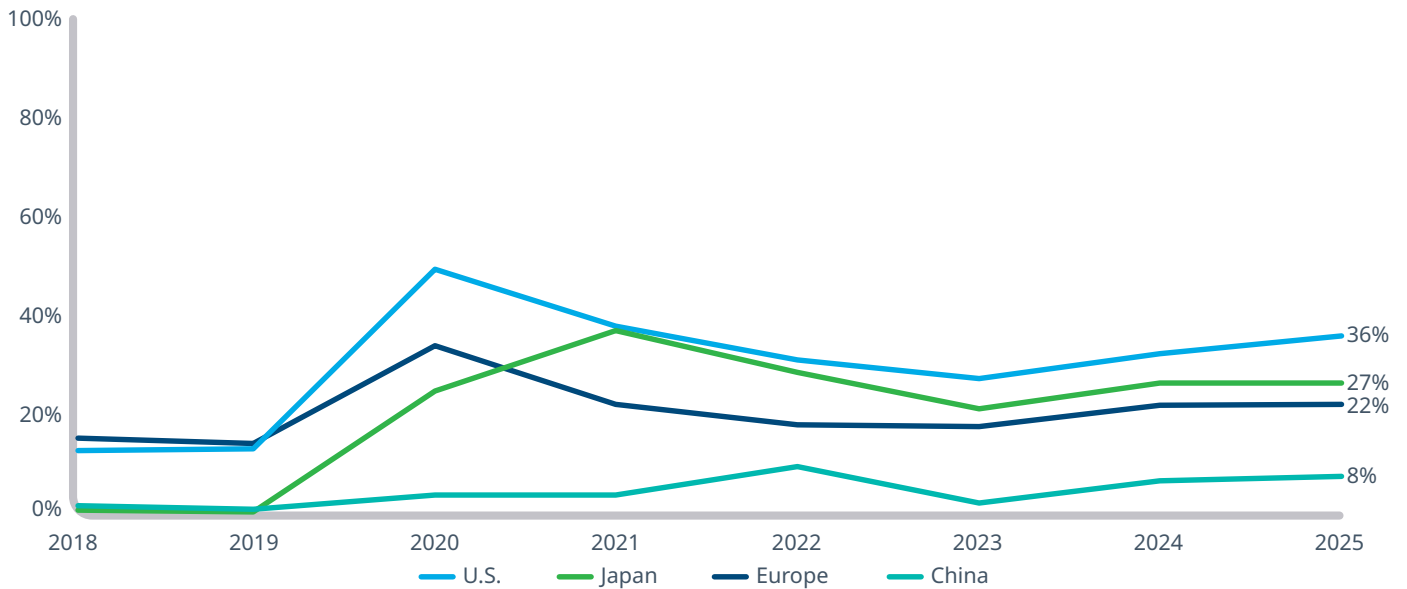
**Figure 2: Global overview of remote monitoring visits (percent of all site visits, 2025)**



Source: IQVIA Thought Leadership; IQVIA proprietary data on Monitor visits

If we consider North America as having set the benchmark for remote site visits, it is reasonable to infer that there is potential for at least a 10% increase in the implementation of remote visits globally and an even greater amount if historic patterns are taken into account (Figure 3) where the U.S. approached half of all its visits remotely during the COVID-19 pandemic. This projection suggests a considerable opportunity for other regions to enhance their remote monitoring capabilities, thereby driving efficiencies and improving the overall sustainability of clinical trials.

**Figure 3: Evolution of remote monitoring visits (percent of all site visits, 2018-25)**



Source: IQVIA Thought Leadership; IQVIA proprietary data on Monitor visits

The impact of the pandemic on the adoption of remote monitoring in clinical trials had been significant, with a notable shift towards higher levels of remote site visits across major markets that have persisted beyond the initial crisis. This shift has resulted in a new baseline that exceeds pre-pandemic levels, indicating a lasting transformation in trial operations that continued to show signs of picking up from 2023 to 2025.

In the U.S., the proportion of remote monitoring visits surged during the pandemic and has remained the highest of all major countries, surpassing the levels observed in Europe. This trend highlights the US's regulatory flexibility and willingness to embrace remote methods.

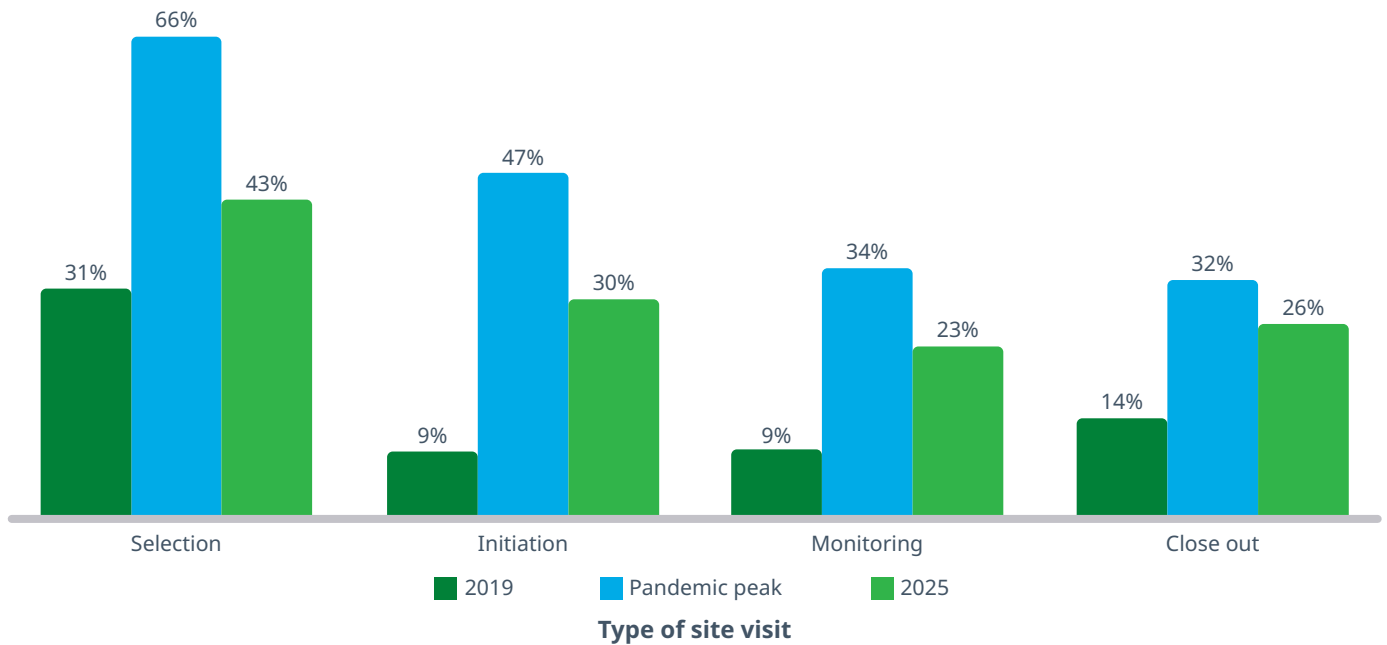
Across Europe, a uniform, moderate increase in remote visits was experienced. However, many European countries face challenges due to sweeping data protection laws (GDPR) that restrict data from crossing international borders and dissonance between member states with localised regulations. These hurdles have tempered the extent of remote adoption across the European continent as a whole.

Japan, starting from a low base, was catalysed by the pandemic in adopting remote visits, which have now become a persistent feature and has surpassed Europe in the past couple of years. Historically, Japan's Pharmaceuticals and Medical Devices Agency emphasised a strict adherence to in-person monitoring as outlined by Japan's Good Clinical Practice guidelines for activities such as source data verification and site audits. During the pandemic, temporary measures were introduced<sup>12</sup> to allow for remote monitoring of these activities, including electronic signatures, and then gradually formalised through revisions<sup>13</sup> to make these remote activities permanent. Japan now outperforms other countries, particularly in start-up visits, where more than half of all site selection and initiation visits are conducted remotely. This is in contrast to other regions, which have yet to reach 50% remote start-up visits.

China, on the other hand, began with a low proportion of remote visits and has largely sustained this level. The challenges to centralised monitoring in China are multifaceted, including low interconnectivity across the vast countries different administrative regions, cultural preferences towards in-person meetings, and regulatory constraints that prevent data from leaving the country.

These regional variations demonstrate the complexities in implementing remote monitoring across trials that span different countries, each with their unique regulatory environments, cultural attitudes and digital maturity. The proportion of remote monitoring not only depends on geography, but also on the lifecycle of a clinical trial, which is shown in Figure 4.

**Figure 4: Proportion of remote visits by type (Global, 2019-25)**



Source: IQVIA EMEA Thought Leadership; IQVIA proprietary data on Monitor visits

Site Selection Visits (SSVs) exhibited the highest incidence of remote visits (43%) in 2025 and also the type of visit that had the greatest proportion that could be delivered remotely during the pandemic at 66%. This large proportion is driven by the reliance on trusted sites, those that are known to monitors through prior experience and with assured quality. These sites often have established startup contracting templates that speeds up time to enrolment and can obviate the necessity for in-person visits.<sup>14</sup>

In contrast, Site Initiation Visits (SIVs) involved a higher proportion of in-person visits pre-pandemic due to the need for careful supervision when training study staff on protocols and standard operating procedures. Nevertheless, SIVs experienced the greatest elasticity during the pandemic, jumping fivefold in the proportion of remote visits from 9% to 47% and settling to a respectable 30%. As with SSVs, this shift is primarily attributed to the feasibility of conducting remote visits at trusted sites where monitors have had prior experience with staff on site initiations.

Monitoring and close-out visits followed a similar trend, peaking during the pandemic when one-third were conducted remotely, before stabilising at approximately a quarter. Given that periodic monitoring constitutes the bulk of site visits, this area remains a critical focus for future improvement.

The pandemic saw a doubling of the proportion of remote visits across most types of visit which begs the question on whether these levels can be sustainably maintained in future without compromising patient safety, data integrity and speed of trial operations. There is a careful balance to be maintained between emissions reductions, trial efficiency and scientific rigour.

### Challenges of increasing remote visits MONITORING VISITS

Regulatory requirements often mandate in-person visits for critical processes, such as the first patient's initial visit. This necessity is compounded by institutional inertia, where resistance to change

stems from established practices, the costs associated with modifying processes, and a desire to maintain operational stability. The size and nature of the trial also play a significant role. For instance, Phase I trials and those focused on rare disease indications are more likely to necessitate full in-person monitoring due to the imperative to promptly record and respond to adverse events. However, the smaller scale of these trials means that the absolute costs and emissions remain manageable, even if all monitoring is conducted in-person.

Reducing the reliance on monitors who are familiar with local sites and standards of care can introduce risks to quality, but this is well understood and can be mitigated by conducting a thorough risk assessment and employing experienced monitors who possess a pragmatic understanding of both local and centralised monitoring requirements.

### PATIENTS AND CLINICIANS

Patient preferences and cultural attitudes significantly influence the adoption of remote monitoring. Many patients still favour in-person consultations, particularly those who are hard of hearing or struggle with the technology required for remote visits. Social factors, such as the need for human interaction among isolated patients, further supports this preference.

Digital exclusion and inequality present additional challenges. Not all patients possess the resources

or knowledge to effectively access and utilise digital tools, a situation that is particularly prevalent among older demographics and those in lower- and middle-income countries.

Remote consultations also face communication barriers. Diagnosing patients remotely can be more challenging, as it often relies on self-reported diagnostic inputs rather than direct visual inspections. The absence of body language cues and the need for additional preparation time frequently result in longer remote consultations compared to in-person visits. Furthermore, technological limitations such as connection dropouts and faulty equipment can disrupt the flow of consultations, adding another layer of complexity to remote patient care.

### Real-time insights

The ability to predict and react rapidly to potential risks is an important aspect of RBM. Underpinning this, is the selection of Key Performance Indicators (KPIs) that provide clear, actionable insights through modern user-friendly mediums such as visual dashboards. Developing sustainability KPIs are critical in aligning processes and systems throughout an organisation to provide relevant metrics that ensure goals are being met consistently throughout the trial process.

At the time of writing there is little consensus on a standard set of KPIs that pharma companies and CROs can align to, but as a guide, a core minimum set of KPIs are listed below in Table 1.

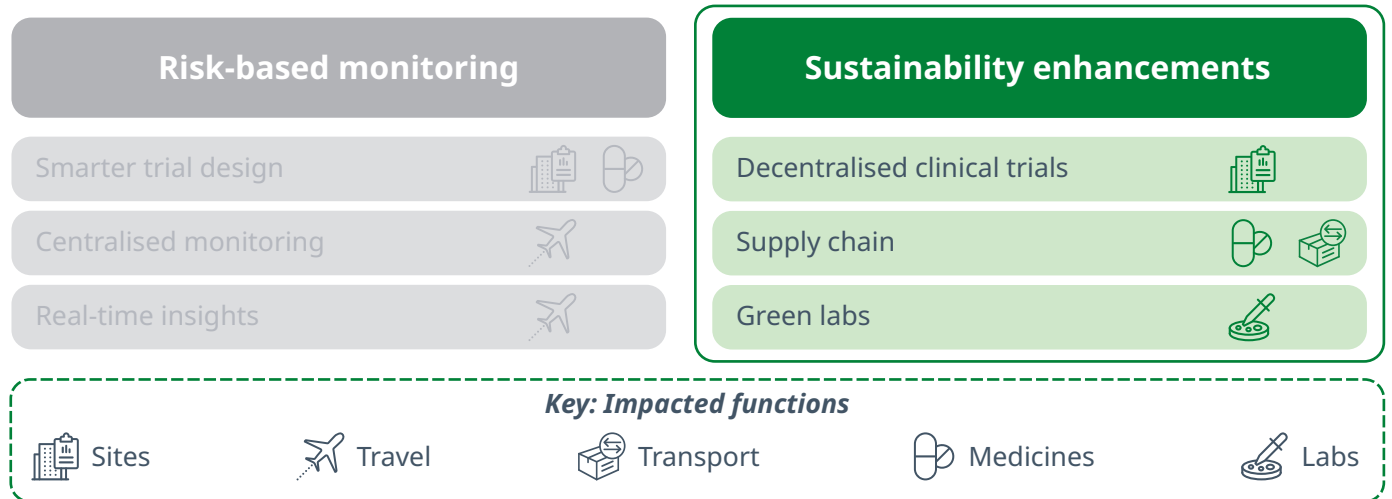
**Table 1: Example set of core KPIs that could be considered to track sustainability progress**

ACTIVITY	AIM	KPI
<b>Study design</b>	Reduce patient travel, introduce RBM principles, minimise overages and samples	<ul style="list-style-type: none"> <li>Average patient travel distance and mode of transport</li> <li>Number of test kits</li> </ul>
<b>Investigational Product (IP)</b>	Identify contribution from drug supply chain, optimise transportation and labelling	<ul style="list-style-type: none"> <li>Type of therapy, whether biologic, small molecule or other</li> <li>Quantity of IP used</li> <li>Shipping distance and mode of transport</li> </ul>
<b>Monitoring</b>	Encourage centralised monitoring, provide alternatives to frequent air travel	<ul style="list-style-type: none"> <li>Distance travelled by monitors and overnight stays</li> <li>Type of monitor visits (Remote vs F2F)</li> </ul>
<b>Kits and samples</b>	Reduce the number of samples and the time they are stored	<ul style="list-style-type: none"> <li>Number of samples</li> <li>Storage conditions and time stored</li> </ul>
<b>Devices</b>	Reduce overages, encourage reuse and recycling, digitise monitoring	Number and type of devices used

Transparent reporting on sustainability efforts and outcomes is vital for building trust with stakeholders and the public. By openly sharing the results of sustainability initiatives, organisations can demonstrate their commitment and allow others to build upon this knowledge to further advance sustainability across the healthcare sector.

However, collecting the data necessary to build these KPIs measure carbon emissions presents several challenges. Manual effort is often required, making the process time-consuming and prone to human error. Not everything is easily tracked or fit-for-purpose, and organisations frequently rely on multiple and disparate systems, which complicates data aggregation and analysis. These challenges further the need for data standardisation and enterprise data management solutions to assist with accurate and comprehensive reporting.

## The RBM framework can be enhanced to boost sustainability



RBM alone may not be sufficient in comprehensively addressing sustainable activities in clinical research. The following areas can be combined with RBM to provide greater coverage of sustainable action.

### Decentralised clinical trials

The assessment of the carbon emissions from the NHS England<sup>15</sup> showed that patient and visitor travel accounted for 6% of total emissions of the health service. Decentralised Clinical Trials (DCTs) have the potential to significantly reduce this impact by minimising patient and visitors travel, enabling participation from home or local clinics through the use of telemedicine or homecare. This not only helps emissions, results of the Centre for Information and Study on Clinical Research Participation (CISCRP) 2025 survey show that travelling to the study clinic ranks as the second highest burden for participants (28%; consistent with previous years) with a quarter of respondents stating their travel time was over an hour.<sup>16</sup>

This approach leverages digital platforms for data collection and monitoring, thereby reducing the need for physical paperwork and the associated environmental footprint from printing and shipping documents which has shown evidence for lowering

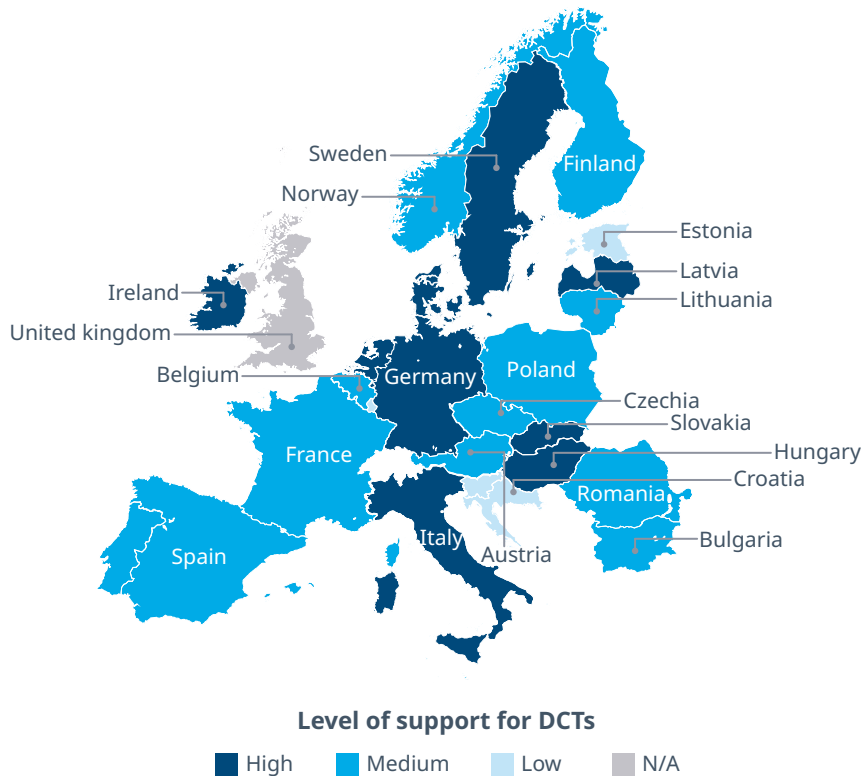
emissions.<sup>17</sup> Utilising wearables and remote monitoring devices allow for the collection of patient data directly from their homes. This not only enhances patient convenience but also reduces the energy consumption associated with large clinical sites, as it decreases the need for patients to visit these facilities.

While DCTs could offer considerable environmental benefits, decentralising should be balanced against quality. Remote data collection (wearables, ePRO) introduces greater variability versus standard site-based measurements and can increase divergence in protocol adherence, factors which can reduce the signal-to-noise ratio if not controlled. This need active management to avoid, and understanding the consequences of DCTs are an important factor in trial design.

In addition, the overall trial design would need to balance the trade-offs between outpatient visits and homecare. For instance, if nurses, kits, and other equipment need to be delivered to patients, particularly in rural areas, the additional transport could offset the environmental gains from reduced patient travel. This impact can be mitigated by deploying electric vehicle fleets and public transport for nurses and monitors in urban areas where multiple patients can be visited in one trip.

A common obstacle is that guidelines need to be updated to allow for increased use of remote processes. The reality is that the regulatory environment in Europe remains fragmented<sup>18</sup> (see Figure 5) complicating the execution of large multi-country trials.

**Figure 5: Propensity of European countries in adopting DCT-friendly policies (2025)**



Source: IQVIA Thought Leadership; Recommendation paper on decentralised elements in clinical trials, European Commission, Version 02 1 October 2025

Examples of this friction include the slow implementation of electronic informed consent and signatures, which can significantly cut down on the use of paper and physical resources. The CISCRP survey also showed a 40% of respondents stated they received electronic consent forms, an increase from 2023 (32%) but a drop from 2021 (44%). This apparent lag over 4 years is unfortunate as the same survey showed that electronic consent forms scored higher on ease of understanding (Very Easy 57%) than paper consent forms (Very Easy 44%)

Underpinning incentives for continuing to use paper forms is a general preference by some countries for face-to-face interactions, examples include the guidance outlined in the Model Professional Code for Physicians in Germany stating that digital communication media can be used if “medically justified”, or that hand-written signatures are a requirement in Switzerland.<sup>19</sup>

Italy and Hungary are examples of countries with some of the highest scores for a DCT-friendly environment particularly because it allows flexibility in shipments of the IMP from the manufacturer, non-affiliated pharmacies or from other EU member states.

Regulators are increasingly adapting to accommodate DCTs to and continued advocacy for flexibility and harmonisation to allow remote healthcare is an important step to fully realise the benefits of DCTs in driving operational efficiency and sustainability.

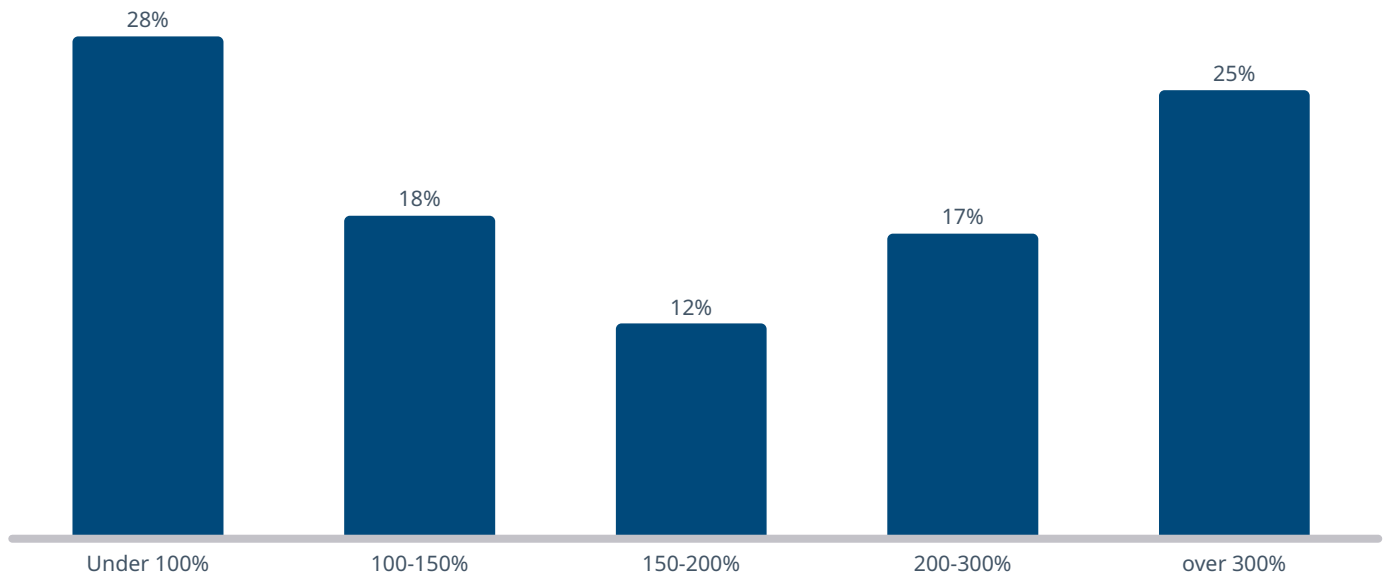
## Supply chain

### OVERAGES

There will always be a compromise between increasing the redundancies of particular items, which increases resource inefficiency, and ensuring continuity of supply that essentially for minimising delays.

IQVIA data on 200 completed studies show that over 60% of medicines were not used which represents an average overage of over 160%, with a quarter of studies requiring overages over 300% (see Figure 6).

**Figure 6: Studies per drug overage (n = 200, 2023)**



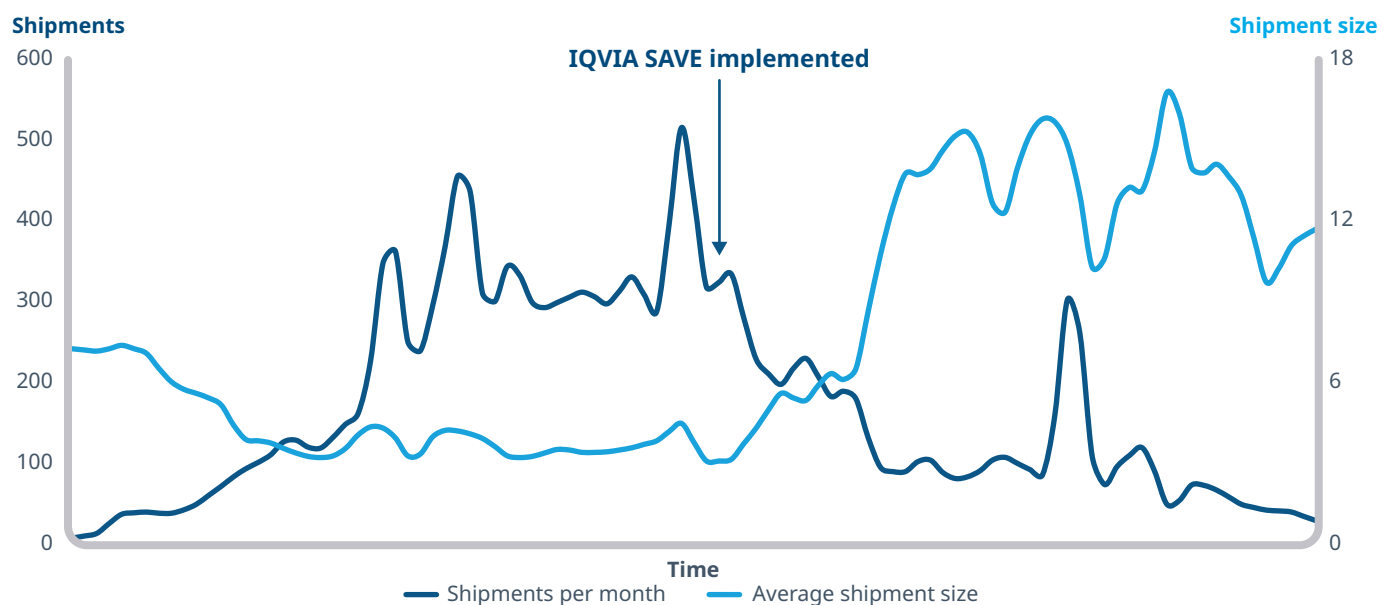
Source: IQVIA EMEA Thought Leadership; IQVIA proprietary data

There is likely plenty of optimisation that can be performed by eliminating over-supply that goes beyond a safe margin through accurate forecasting of product requirements. This approach minimises cost and waste, ensuring that resources are used efficiently and sustainably.

Reducing the shipments to sites is a complex process, but this can be aided with an effective Interactive Response Technology (IRT) system that regularly

reviews supply plan assumptions with incoming data and forecasts multiple scenarios. A clear example of reduction in individual shipments can be seen in Figure 7, a real case study where IQVIA's SAVE (Supply Automation Value Engine) technology reduced shipments by two-thirds, primarily by optimising site supply strategy on a daily basis and increasing shipment size.

**Figure 7: IQVIA SAVE reduced monthly shipments for a study (Europe, 2023)**



Source: IQVIA Thought Leadership; IQVIA proprietary data

For another real IQVIA case, the avoidance of over 1,300 shipments for a study meant that 8.6 tCO<sub>2</sub>e could be avoided.<sup>20</sup> In summary, reducing shipments not only provides cost benefits, but also less medicines and kits wastage, as well as drastically reducing emissions from the supply chain.

## WASTE REDUCTION

Clinical operations generate a distinctly large amount of waste, from nitrile gloves to sharps and biohazards. This waste is diverse and its disposal highly regulated, but a concerted effort should be made to reduce the reliance on disposable items where possible. Design protocols to leverage sustainable alternatives, for example multiple-use drug devices, propellant-free inhalers (of which there is a turning point in use in the UK)<sup>21</sup> and anaesthetic gases with lower global warming potentials to minimise waste from the start.

Further downstream, implementing recycling programmes for non-hazardous waste, particularly for materials that can be easily sorted, can significantly mitigate the waste mass from trial operations.

## SUPPLIER ENGAGEMENT

Engaging supply partners provides the ability to align on common standards, reporting cadence and sustainable goals which helps build a “suppliers network” that provides a useful conduit for information between third parties across the supply chain.

The procurement function is one of the most effective departments in an organisation to incentivise suppliers to enhance their offerings by giving weight to those that adhere to sustainable practices.

Where possible, procuring renewable energy for powering research facilities and data centres is a common way of minimising emissions but this depends wholly on the country’s renewable mix across its national grid to provide renewables in the first place, and the company’s ability to change the energy contracts, where this could be restricted by being the landlord’s responsibility for instance.

## Green labs

Laboratories are a significant contributor to the overall emissions of clinical trials. This is due to their energy-intensive processes, the assembly of multiple kits per patient, the global transportation of these kits, and the long-term storage of samples in temperature-controlled environments.

To enhance the sustainability of lab operations, several key areas can be addressed:

### LAB FACILITIES AND EQUIPMENT

IQVIA’s internal studies<sup>22</sup> shows laboratories consume 10-15 times more electricity than office spaces, primarily due to the equipment used, HVAC systems, and cold storage units. Transitioning to renewable energy sources can make a large impact, given the high energy demands of these facilities. Recycling old equipment and upgrading to more energy-efficient alternatives can yield long-term energy savings. Additionally, participating in industry-recognised schemes such as the “My Green Lab” certification<sup>23</sup> provides a benchmark for labs to reduce emissions and promotes a culture of sustainability.

### TEST KITS

Laboratories produce millions of trial kits each year, typically assembling cardboard boxes, single-use plastic pipettes, needles, and other packaging materials. The contents and quantities are dictated by the trial protocol, and so future protocol design could help minimise unnecessary kit production by embracing principles of circularity. Examples include reducing a reliance on single-use plastics, increasing the proportion of recycled materials, and adopting measures to cut waste, such as including short-expiry items as ancillary supplies. Reducing overages in non-critical processes can also help minimise waste without compromising patient safety or trial efficiency.

## TRANSPORTATION

The transportation of samples to and from testing sites is a substantial contributor to emissions. In 2023, upstream transportation and distribution accounted for up to 17% of IQVIA's Scope 3 emissions,<sup>24</sup> largely due to the cold-chain requirements for returned samples. Incentivising transport providers to electrify their fleets can help minimise these emissions. Centralisation of lab operations can enhance consistency in standards and transparency and reduce energy intensity through economies of scale. However, this may result in suboptimal transport distances for materials. A balanced approach, blending localisation and centralisation by strategically locating centralised labs globally, can offer both flexibility and reduced environmental impact. Additionally, exploring more

sustainable alternatives to materials like Expanded Polystyrene (EPS) used during transportation can further reduce the overall environmental footprint.

## SAMPLE STORAGE

Cold storage is an energy-intensive process, where trial protocols at times dictate samples must be stored for a decade at  $-80^{\circ}\text{C}$ . Research<sup>25</sup> has shown that Ultra-Low Temperature (ULT) storage can be adjusted from  $-80^{\circ}\text{C}$  to  $-70^{\circ}\text{C}$  without compromising sample integrity, potentially reducing energy consumption by 30-40% and extending the lifespan of freezers. The disposal and destruction of samples, often through incineration, are carbon-intensive processes that also require careful consideration.



# Conclusion: Five recommendations to advance the environmental sustainability of clinical trials

Healthcare and life sciences, by its highly complex and regulated nature, has so far prioritised the delivery of therapies and care to patients above other matters. The pressing focus of sustainability across all sectors has nevertheless drawn interest in reforming healthcare, of which clinical trials is a core component of future clinical practice. By adopting the below five high-level recommendations, trial sponsors, CROs, and clinical institutions can make significant strides towards sustainable clinical trials while maintaining high standards of patient care, data integrity and execution speed.

## 1. Digitise to enable centralised monitoring

Digitisation facilitates centralised monitoring, which reduces the need for in-person visits while enhancing patient safety and data quality. In addition, tools such as a clinical trial carbon calculator can aid in decision-making when designing trial protocols or reviewing performance.

## 2. Minimise unnecessary travel of staff, patients, and goods

The pandemic showed that remote interactions can replace many in-person visits. Trial sponsors should aim to expand the use of remote visits wherever feasible. Decentralised Clinical Trials (DCTs) offer a promising avenue for reducing unnecessary patient travel, although further research is needed to understand the net effects, particularly when considering the transportation of drugs and services to patients. A better understanding of travel distances and modes of transport can help tackle this issue.

Regulations regarding DCTs are currently fragmented across Europe, necessitating efforts to harmonise these regulations and support the establishment of DCTs when requested. Implementing sustainable travel policies, particularly concerning air travel, and encouraging virtual meetings can significantly reduce the need for in-person gatherings. For unavoidable travel, carbon offset programmes should be considered, although these should be a last-resort option due to broader concerns about the effectiveness of carbon credits.

## 3. Procure sustainable trials

Sponsors must commission sustainable trials and collaborate with partners to implement measures to reduce emissions. This collaborative approach is essential for identifying the appropriate KPIs, and building tools that will achieve a long-term shift towards sustainability.

## 4. Engage regulators to advocate for remote operations

Japan serves as a clear example of a country changing their regulations to perform a larger proportion of visits remotely and formalising it.

China is becoming an increasingly important location to run clinical trials. IQVIA reports trials that select sites in China have surged 66% between 2019-24 compared to declines in Europe and only 7% increase in North America — powered in part by a high focus from biotech and an increase in domestic companies.<sup>26</sup> As such, greater regulatory engagement to advocate for flexibility should be made to increase remote monitoring in the country in an effort to target areas of future growth.

## 5. Reduce energy expenditure and waste from labs

Efforts should be made to reduce physical waste, for example in packaging, improving energy recovery such as in refrigeration temperatures, and reducing long-storage samples. Certifying all labs to recognised sustainability standards, such as My Green Lab, will provide a standard to align to.

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# References

1. Peter-Paul Pichler *et al* 2019 *Environ. Res. Lett.* **14** 064004; <https://doi.org/10.1088/1748-9326/ab19e1>
2. <https://www.weforum.org/stories/2022/11/3-ways-healthcare-systems-carbon-footprint/>
3. <https://www.england.nhs.uk/long-read/five-years-greener-nhs-progress-forward-look/#medicines>
4. <https://www.england.nhs.uk/long-read/five-years-greener-nhs-progress-forward-look/#methodology>
5. Lyle K, Dent L, Bailey S, Kerridge L, Roberts I, Milne R. Carbon cost of pragmatic randomised controlled trials: retrospective analysis of sample of trials. *BMJ*. 2009 Oct 30;339:b4187. doi: 10.1136/bmj.b4187
6. A strategy to reduce the carbon footprint of clinical trials; Adshead, Fiona *et al.*; *The Lancet*, Volume 398, Issue 10297, 281-282
7. <https://clinicaltrialcarbon.org/>; Accessed Jan 2025
8. <https://ourworldindata.org/grapher/co-emissions-per-capita?country=~GBR>
9. <https://www.iqvia.com/library/fact-sheets/iqvia-data-informed-protocol-assessment>
10. <https://www.appliedclinicaltrials.com/view/sustainability-in-clinical-trials-purposeful-digitalization-is-key>
11. <https://www.iqvia.com/library/white-papers/switching-on-the-lights>
12. <https://www.pmda.go.jp/files/000266886.pdf>; pp.8, "Handling of implementation guidelines for document-based conformity inspection and GCP on-site inspection for the time being associated with COVID-19 (Administrative Notice dated May 12, 2020)" <https://www.pmda.go.jp/files/000235011.pdf>
13. Procedure for Remote Inspection as a Part of Compliance Inspection on Drugs and Regenerative Medical Products <https://www.pmda.go.jp/files/000264404.pdf>; <https://www.pmda.go.jp/files/000248622.pdf>
14. <https://www.iqvia.com/locations/emea/library/white-papers/optimizing-clinical-trial-startup-times-competing-on-contracting-efficiency>
15. Health care's response to climate change: a carbon footprint assessment of the NHS in England  
Tennison, Imogen *et al.*; *The Lancet Planetary Health*, Volume 5, Issue 2, e84-e92;  
[https://doi.org/10.1016/S2542-5196\(20\)30271-0](https://doi.org/10.1016/S2542-5196(20)30271-0)
16. <https://www.ciscrp.org/2025-perceptions-and-insights-study-dashboards>; Participation Experiences survey
17. [Impact of Telemedicine Use on Outpatient-Related CO2 Emissions: Estimate From a National Cohort](#)
18. [https://health.ec.europa.eu/latest-updates/recommendation-paper-decentralised-elements-clinical-trials-2022-12-14\\_en](https://health.ec.europa.eu/latest-updates/recommendation-paper-decentralised-elements-clinical-trials-2022-12-14_en), V02 1 October 2022

19. [https://swissethics.ch/assets/studieninformationen/guidance\\_e\\_consent\\_e.pdf](https://swissethics.ch/assets/studieninformationen/guidance_e_consent_e.pdf); Accessed February 2025
20. Based upon airline travel and calculated average shipment distance between depot country or origin and country for site. Considering cold-chain shipments with average 5kg consignment weight. Using CO2(e) calculation from carboncare.org CO<sub>2</sub> emissions calculator
21. <https://www.iqvia.com/locations/united-kingdom/library/white-papers/the-inhaler-market>
22. IQVIA's own emissions data, comparing labs vs standard offices; "IQVIA Emissions Summary 2019-2023" provided by Incendium Oct 2024
23. <https://www.mygreenlab.org/green-lab-certification.html>; accessed April 2025
24. <https://www.iqvia.com/newsroom/2025/02/iqvia-releases-2024-sustainability-report>
25. <https://www.mygreenlab.org/-70-is-the-new--80.html>
26. <https://www.iqvia.com/insights/the-iqvia-institute/reports-and-publications/reports/global-trends-in-r-and-d-2025>

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