# 1. Introduction

The NHS Referral to Treatment (RTT) pathway measures patient waiting times for elective care. This project focuses on delays in referral to treatment and patterns within acute NHS trusts between **April 2024 and February 2025**, aiming to uncover key insights and trends.

Under the NHS Constitution, patients have the right to start treatment within 18 weeks, with a historical operational standard of **92% compliance**. However, multiple challenges in recent years, including the COVID-19 pandemic backlog, staff shortages, and rising healthcare demand and have led to significant breaches of this standard.
Today, many NHS trusts operate with more realistic goals of **60–70% compliance**, making breach management a critical operational priority.

This project specifically examines **Incomplete Pathways** and subsequent patterns across acute trusts. I recommend you to go through the interactive version of this report:
**https://rpubs.com/Abhishek1880/1305134**
For reference on data collection methodologies and system limitations, the latest NHS RTT monthly report (February 2025) is attached: England NHS RTT Statistics - February 2025

# 2. Data Sources and Methodology

This project draws upon two primary data sources. The first is the published NHS Referral to Treatment (RTT) monthly datasets, covering April 2024 to February 2025. These datasets contain detailed records of patient waiting times across different NHS trusts, segmented by treatment status and duration bands. The second source is the ODS register of Acute NHS Trusts, which was manually cleaned to isolate relevant providers for analysis, ensuring a focus exclusively on acute hospital trusts.

Data preprocessing involved cleaning and structuring the raw RTT data, including standardizing column names, correcting data types, and removing irrelevant records. The analysis primarily targeted patients recorded under the “Incomplete Pathways” and “Incomplete Pathways with Decision to Admit (DTA)” categories, which are critical indicators of ongoing demand and delayed access to care.

Several key metrics were developed during this process. These included the calculation of total patient backlog, the proportion of patients breaching 18-week and 52-week thresholds, and trust-level average performance metrics. Delay impact measures were created both at the national (monthly) and provider (trust) levels to support detailed insights into waiting time dynamics.

To explore underlying patterns in trust performance, two complementary approaches were applied. Hierarchical clustering was conducted to group trusts based on their breach rates, providing a similarity-based segmentation. Separately, a typology framework was developed, categorizing trusts by their overall treatment volumes and delay severity to create more interpretable and strategic groupings.

It is important to note several limitations. This analysis covers only an 11-month period, rather than a full multi-year view. The study is restricted to acute trusts, with community and specialist trusts excluded for consistency. Additionally, the share of patients with a decision to admit (DTA) within incomplete pathways was found to be relatively stable during the period and has been documented but not deeply modeled in this report.

# 3. Key Metrics and Analytical Focus

Unlike generic RTT reporting, this project emphasized a layered analytical framework, building custom metrics to surface operational and clinical insights:

- **Category-Wise Patient Volumes:**
  Patients were separated into three core RTT reporting categories — *Incomplete Pathways*, *Incomplete Pathways with Decision to Admit (DTA)*, and *Completed Pathways (Admitted Patients)*. This distinction enabled parallel analysis of treatment progress and residual backlogs.
- **Delay-Specific Breach Rates:**
  Rather than using standard cumulative counts, the project calculated separate breach percentages:
  – *% Over 18 Weeks* (patients breaching the initial NHS RTT target)
  – *% Over 52 Weeks* (patients waiting over a year),
  with rigorous logic ensuring non-duplication between breach bands.
- **Backlog Delay Impact:**
  At system-level, monthly shares of over-18-week and over-52-week patients were

calculated relative to total backlogs, highlighting systemic delay patterns and deviation from expected norms.

- **Trust-Level Delay Profiles:**
  For Acute Trusts, trust-wise breach percentages were derived by precisely aggregating weekly band columns, not by simple monthly averages. This approach preserved trust heterogeneity and made clustering meaningful.
- **Cluster-Based Operational Typology:**
  Using hierarchical clustering (Euclidean + Complete linkage) on breach metrics, trusts were grouped into operational clusters, aiding in comparative analysis.
- **Volume-Delay Typology Framework:**
  Beyond clustering, trusts were categorized based on total backlog volumes and breach severity into actionable typologies such as:
  *Leading Large Performers*, *Mid-Sized Steady Performers*, *Small Trusts Managing Well*, etc.

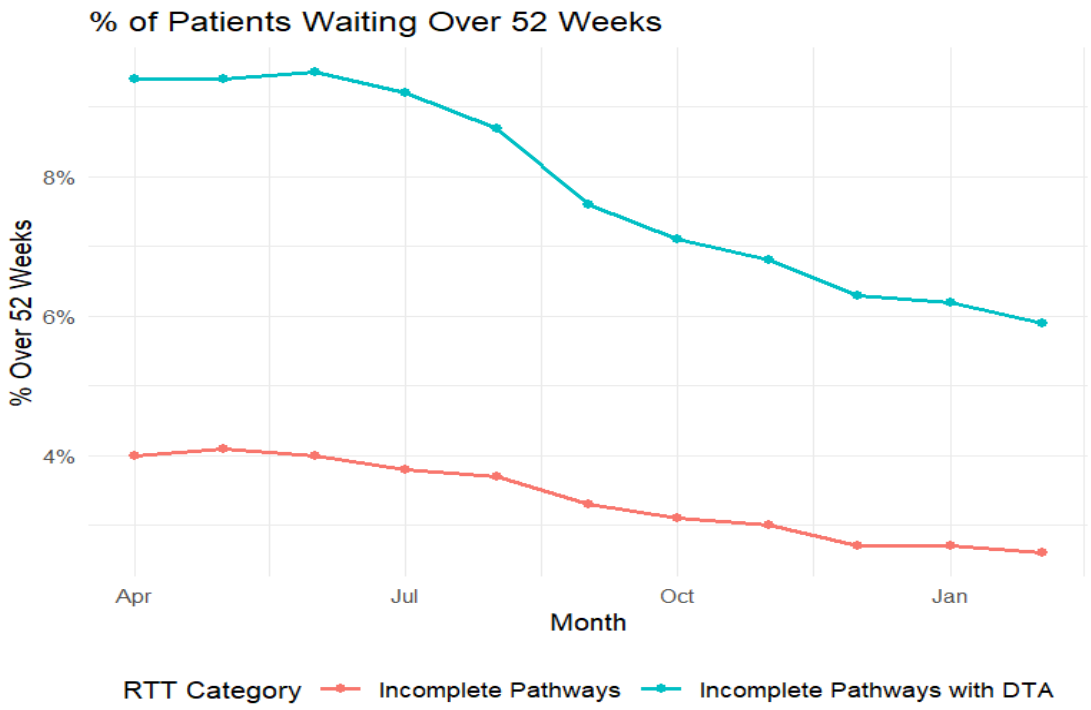
Each metric and model aimed not just to describe performance but also to surface actionable narratives around NHS backlog management, patient access delays, and operational resilience at trust level.

# 3. Key Insights

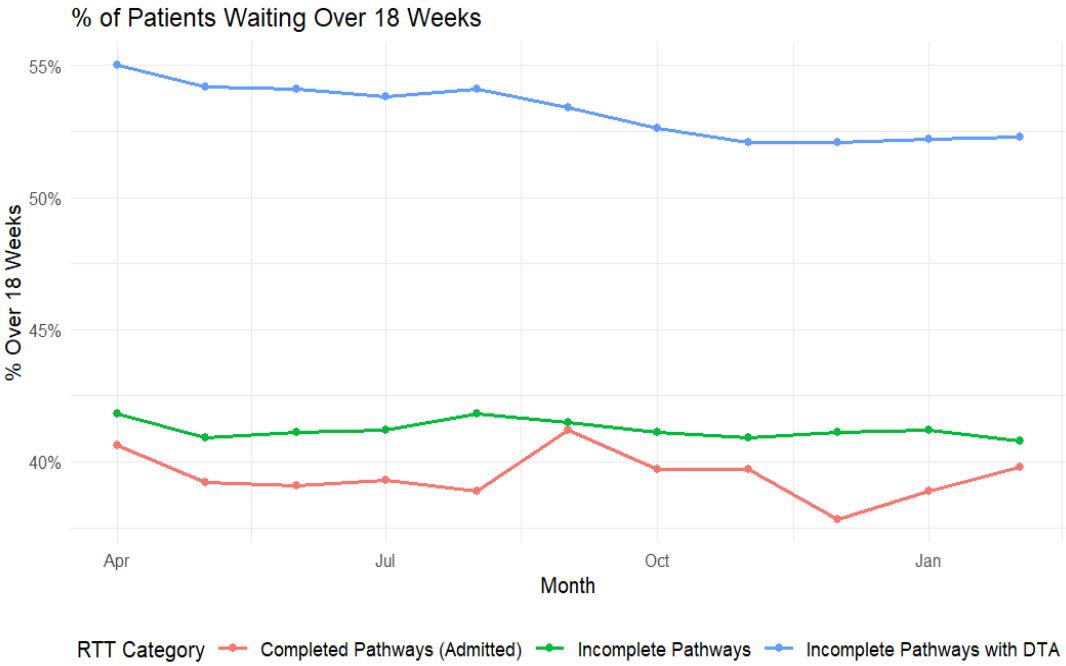
## 3.1 Delay Stability Over Time

The analysis of referral to treatment (RTT) waiting times over the past year reveals a mixed picture:

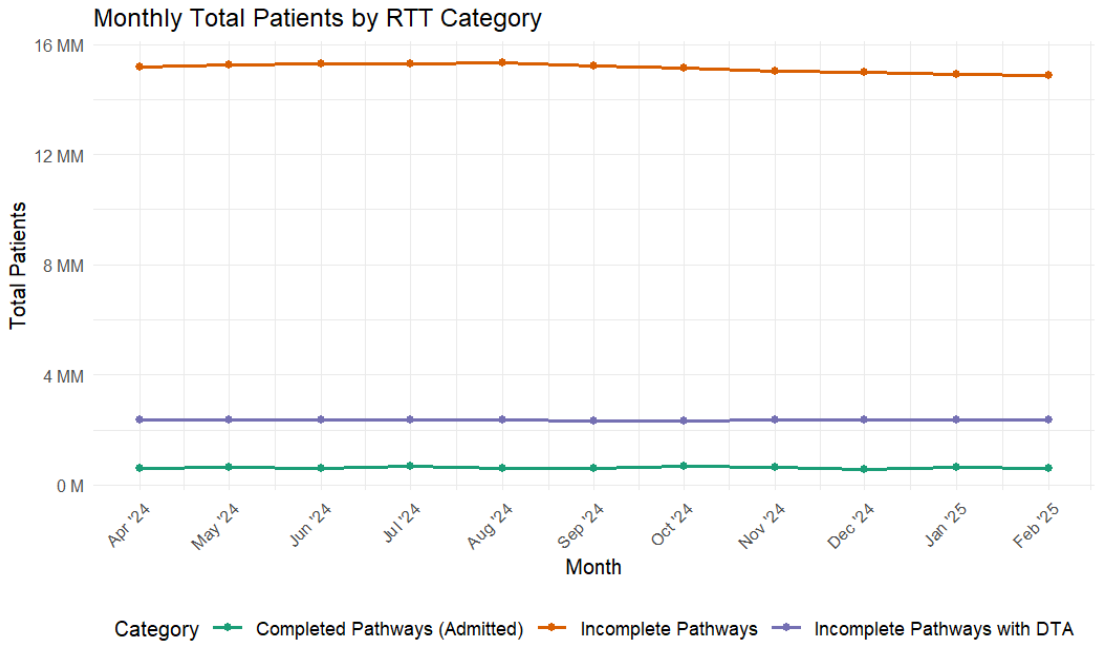
- **Long-term breaches (over 52 weeks)** have shown steady improvement, with both "Incomplete Pathways" and "Incomplete Pathways with DTA" reducing their share of extreme waits. This indicates a gradual clearing of the COVID-era backlog for the longest-waiting patients.




- **Shorter-term breaches (over 18 weeks)** have remained persistently high, fluctuating between 40% and 50% across all three RTT categories. Despite efforts to manage treatment times, many trusts continue to struggle to meet the NHS 18-week standard for most patients.



- **Total patient volumes** across pathways have remained relatively stable, suggesting that the pressure of incoming referrals has neither dramatically worsened nor eased.

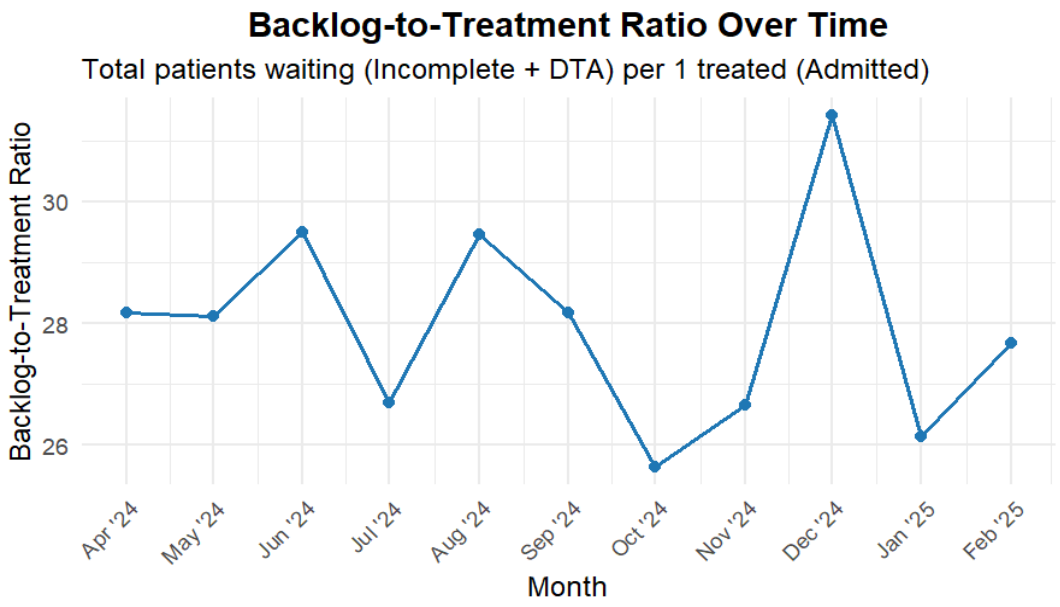



While there are encouraging signs of improvement for very long waits (>52 weeks), the challenge of delivering faster treatment for the wider patient base remains unresolved. Sustainable improvement will likely require both structural reforms and expanded capacity.

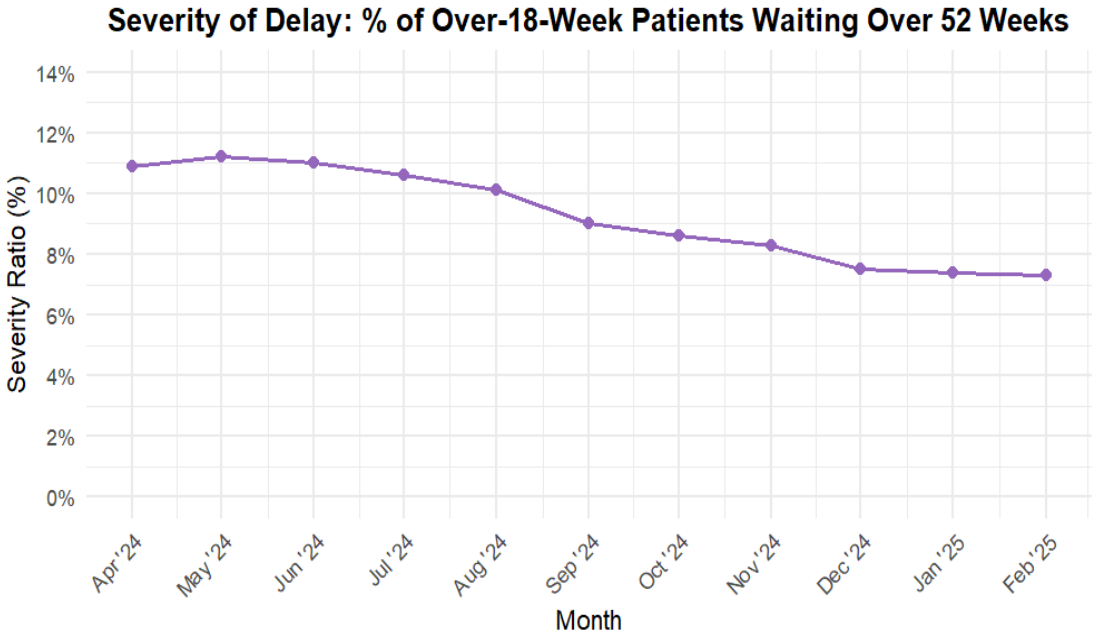
## 3.2 Delay Dynamics: Additional Operational Insights

While the primary focus of this report is on trust-level delay patterns, broader RTT system dynamics also provide useful context:

- **Backlog-to-Treatment Ratio**
  Over the analysis period, the ratio of patients waiting (Incomplete + DTA) to those treated (Admitted) remained structurally high, fluctuating between 26 and 32. These highlights persistent pressures in the NHS system, with occasional spikes (e.g., December 2024) linked to seasonal demand.




- **Severity of Delay**
  The proportion of patients breaching 52 weeks among over-18-week waiters declined from approximately 11% to under 8%, indicating some improvement in managing the most extreme delays.



## 3.3 NHS Trust Clustering Analysis and Typology

To uncover patterns in waiting time performance across acute NHS trusts, a clustering analysis was performed using trust-level aggregates of referral to treatment (RTT) delays between April 2024 and February 2025.

Two key indicators were used for clustering:

- **Percentage of patients waiting over 18 weeks**
- **Percentage of patients waiting over 52 weeks**

These metrics were scaled to enable comparison, and hierarchical clustering was applied to group trusts with similar delay patterns.

Although hierarchical clustering is computationally intensive for very large datasets, the method was suitable here because the input was aggregated to the trust level. This allowed us to preserve meaningful trust-wise relationships without imposing rigid clustering assumptions.

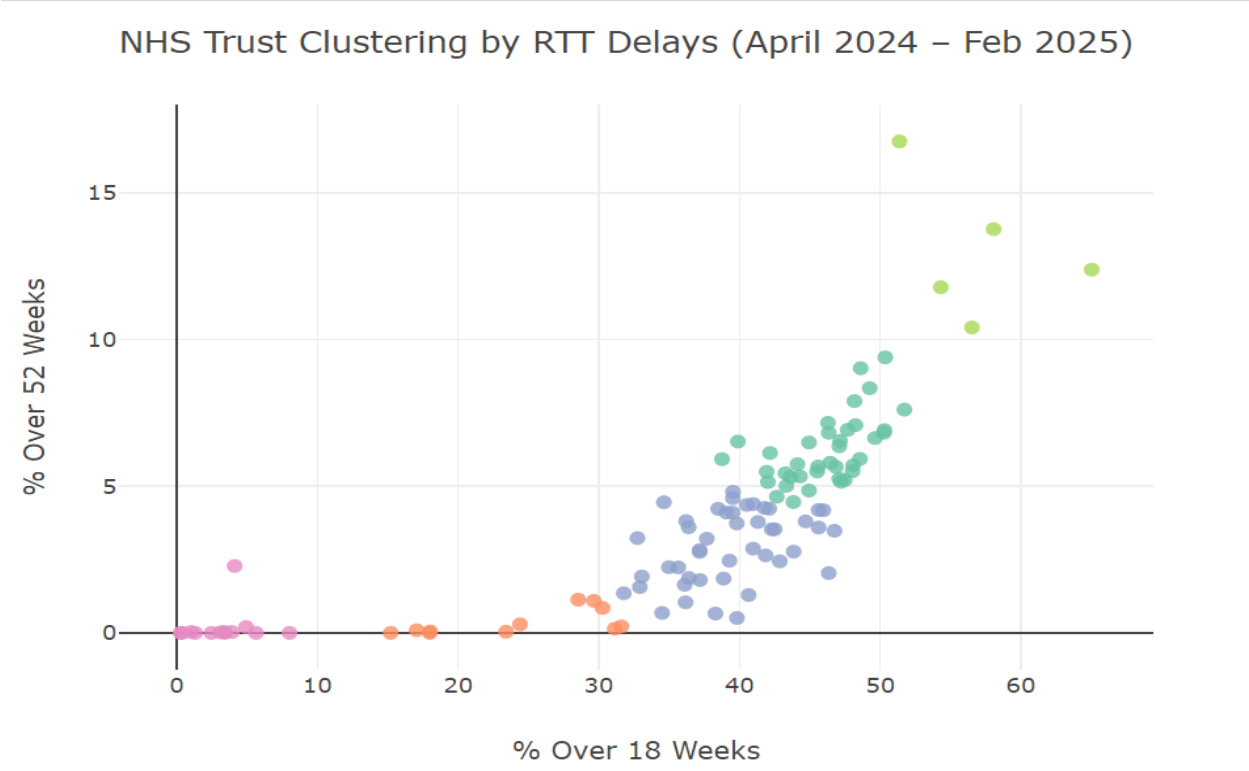



**Figure 5.3:** *Clustering of Acute NHS Trusts by Referral to Treatment (RTT) Delays (April 2024 – February 2025). Each point represents a trust, plotted by percentage of patients waiting over 18 and 52 weeks. Color indicates cluster membership based on delay profiles.*

The resulting scatter plot categorizes trusts into five broad clusters:

- **Cluster 1 (Dark Green)**: Trusts experiencing **high overall delays** and **higher proportions of severe waits**. Examples include *Liverpool Women's NHS Foundation Trust and Manchester University NHS Foundation Trust*.
- **Cluster 2 (Pink)**: Trusts with **low backlog rates**, often smaller or specialist organizations, such as *Midlands Partnership NHS Foundation Trust* and *Mersey Care NHS Foundation Trust*.
- **Cluster 3 (Light Blue)**: The **largest group**, characterized by **moderate delays** and **better management of long waits**. Trusts such as *Royal Free London NHS Foundation Trust* and *Cambridge University Hospitals NHS Foundation Trust* belong here.
- **Cluster 4 (Orange)**: Trusts with **lower volumes** and **variable delay management**, sometimes reflecting specialist or community care settings.
- **Cluster 5 (Light Green)**: A set of **high-risk outliers**, combining **very high breach rates** across both metrics. Notable examples include *Milton Keynes University Hospital NHS Foundation Trust* and *University Hospitals Sussex NHS Foundation Trust*.

In the interactive version of the scatter plot, users can explore individual trust names, backlog percentages, and patient volumes via tooltips. In this PDF version, selected representative trusts have been mentioned to aid interpretation.

Following clustering analysis, a secondary classification was created to categorize NHS trusts based on two key metrics: total patient volume and delay severity.

A 3x3 matrix approach was used:

- **Volume**: High, Medium, or Low total patients handled.
- **Delay**: High, Medium, or Low percentage of patients breaching the 18-week standard.

Each trust was assigned a typology label based on its position in this grid:

| **Volume \ Delay** | **Low Delay** | **Medium Delay** | **High Delay** |
|---|---|---|---|
| **Low Volume** | Top Performing Small Trusts | Small Trusts Managing Well | Specialist or Small Trusts Under Pressure |
| **Medium Volume** | High Performing Mid-Sized Trusts | Mid-Sized Steady Performers | Mid-Sized Trusts Facing Challenges |
| **High Volume** | Leading Large Performers | Large Trusts Managing Backlogs Steadily | Large Trusts Struggling to Manage Delays |

This typology provides a structured lens to identify trusts excelling under different pressures versus those requiring operational improvements.

# 4. Limitations and Considerations

While the analysis offers valuable insights into RTT delays and patterns across NHS acute trusts, certain limitations should be noted:

- **Data Scope**:
  The project focused on national-level RTT monthly datasets between April 2024 and February 2025. Trust-specific nuances, specialty-level variations, and short-term operational factors (e.g., seasonal surges) were outside the current scope.
- **Assumptions in Delay Calculations**:
  Delay metrics were based on total patients and breach counts provided in the RTT datasets. Complexities like patient prioritization, emergency admissions, or multiple referrals could not be modeled.
- **Clustering Constraints**:
  Hierarchical clustering was applied on a trust-level summary dataset (~112 trusts), not on individual patient records (~2 million rows), due to computational practicality and the need for interpretability.
  As a result, cluster boundaries are indicative and should be interpreted qualitatively rather than rigidly.
- **Typology Generalization**:
  The typology categories (e.g., "Large Trusts Managing Backlogs Steadily") were created to assist in interpretation and strategic thinking, but trusts within the same typology may still differ significantly based on local factors.
- **Data Reporting Variations**:
  Some trusts had missing or inconsistent reporting in the monthly RTT data, meaning their inclusion in summary analyses reflects only available submissions.

These considerations are important when applying the findings in real-world NHS operational contexts.

# 5. Conclusion

This project explored patterns of delay across NHS acute trusts by analyzing Referral to Treatment (RTT) data from April 2024 to February 2025. Through trend analysis, backlog categorization, clustering, and trust typology creation, the report uncovered key variations in waiting time performance, backlog management, and operational strain across trusts.

The findings demonstrate that while national RTT performance has shown signs of stabilization, significant differences persist at the trust level. Trusts with high patient volumes and high breach rates require targeted operational interventions, while smaller trusts performing well can offer valuable examples of effective backlog management strategies.

Both the clustering results and typology segmentation offer structured frameworks to identify trust groups facing similar challenges, supporting deeper comparative analysis and resource planning.

Overall, the project emphasizes that achieving sustainable improvements in RTT performance requires a nuanced understanding of local trust dynamics rather than one-size-fits-all solutions.