NATIONAL HEALTH SERVICES (NHS) DATA ANALYSIS REPORT

LSE Data Analytics Career Accelerator

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Background

The NHS (National Health Service) seeks to optimize resource allocation amid conflicting views on capacity. To inform recommendations accordingly, I will analyse internal and external data, including Twitter, focusing on capacity usage, and missed appointments. The goal of this data analytic project is to identify trends, extract insights, and suggest data-driven potential solutions to improve NHS system's efficiency.

There are 2 initial questions:

1. **Has there been adequate staff and capacity in the networks?**
2. **What was the actual utilisation of resources?**

Further questions will be asked during the data analysis process.

These questions serve to help the NHS reach 2 goals:

1. **Decide if the NHS should put more resources in hiring more staff.**
2. **Reducing or eliminating missed appointments, which incur significant financial costs.**

Python will be used for analysis and visualization.

Analytical Approach

1. Data Exploration

Metadata Review
Begin with a thorough review of the metadata_nhs.txt file to understand the structure, content, and relationships between the datasets (actual_duration.csv, appointments_regioal.csv, and national_categories.csv).
Data Loading
Load all data files into Pandas DataFrames.
Data Overview
Perform initial data inspection, including data types, missing values, and basic statistics for each dataset to fully understand the datasets.

2. Data Cleaning

Missing Data
Identify and handle missing values, ensuring no critical data is lost.
Data Integration
Merge datasets where appropriate to facilitate comprehensive analysis.

3. Data Analysis

Capacity and Staffing Analysis
Assess the distribution and trends in staff numbers and available resources across locations and service settings. Identify patterns of capacity utilization, focusing on different periods.
Utilization of Resources
Calculate the actual utilization rates by comparing the number of appointments with the available capacity. Investigate appointment duration patterns and their impact on resource utilization.
Trend Analysis
Examine monthly and seasonal trends in appointment data, breaking it down by service setting, context type, and national category. Visualize trends to identify any gaps or inefficiencies in service provision.

4. Insights and Recommendations

Key Findings
Summarize insights on staff adequacy, capacity utilization, and other trends.
Missed Appointments
Analyse the impact of missed appointments on resource utilization and service efficiency.
Recommendations
Based on the analysis, provide data-driven recommendations on whether to increase capacity or optimize existing resources.

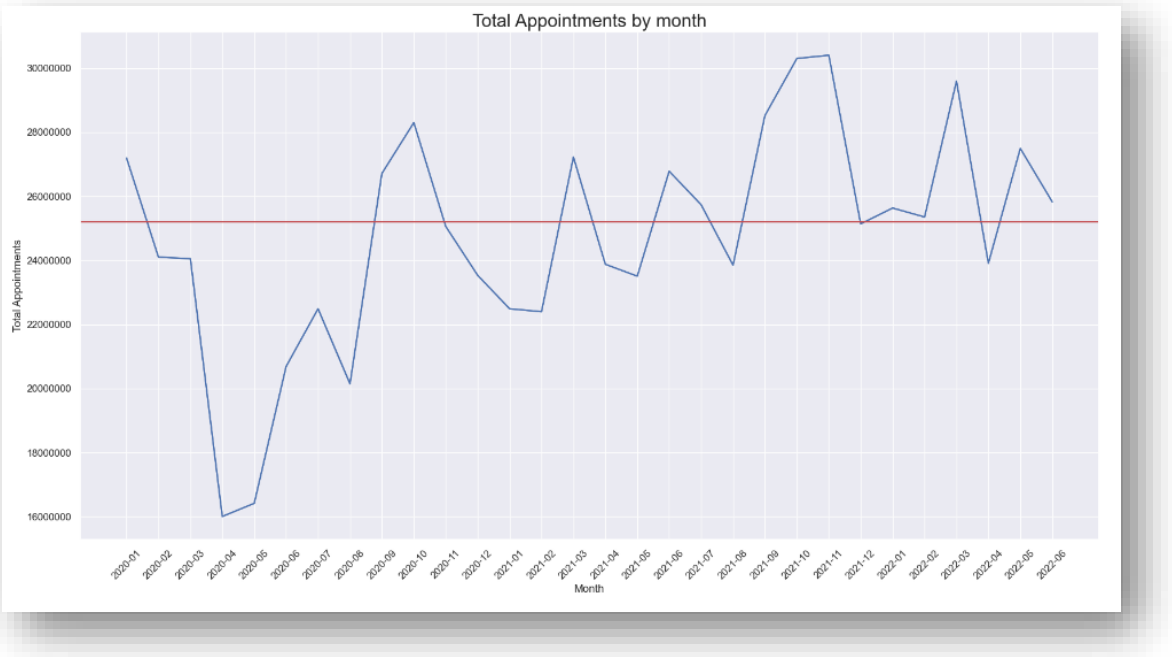
Results

Highlights

In response to the two key questions, the below two findings are highlighted, as well as seasonality.

1. Staffing and Capacity Shortage

Post-pandemic, the NHS has faced staffing and capacity challenges. As suggested in the graph below, from August 2021 on, the numbers of appointment surpass the reference threshold (1.2 M per work day as provided by the NHS guidance).

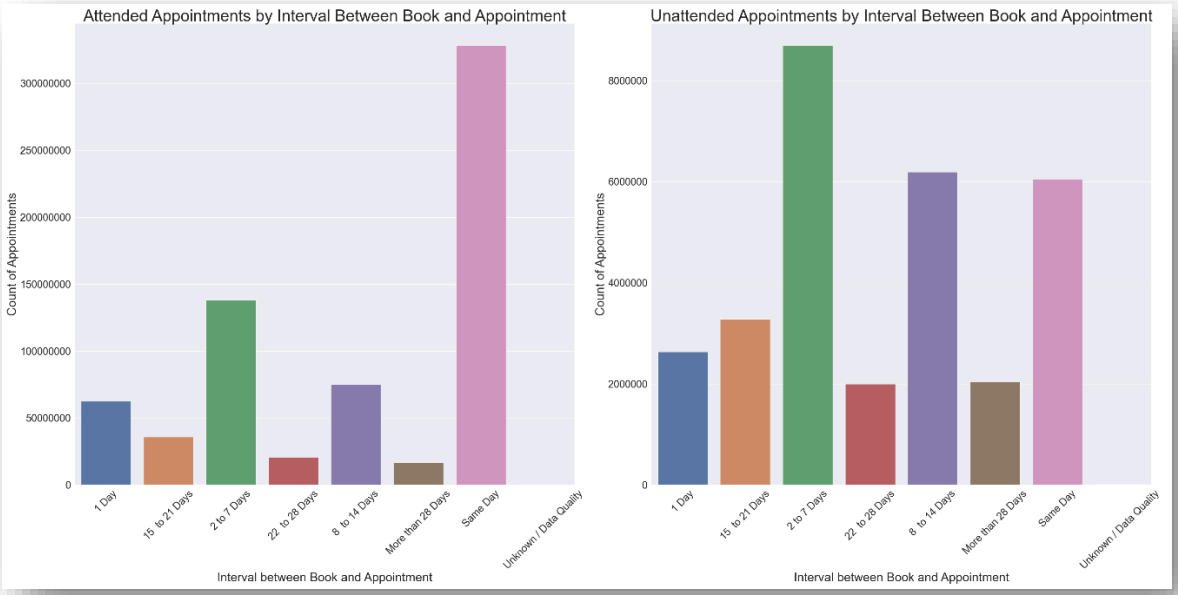


2. Missed Appointments

By analysing how different variables impact the unattended appointments, I found out some interesting hidden insights. To sum up, missed appointments are influenced by the wait time between booking and the appointment, as well as the type of healthcare professional. Besides, some regions seem to have a different DNA (Did Not Attend) pattern, which deserves further investigation.

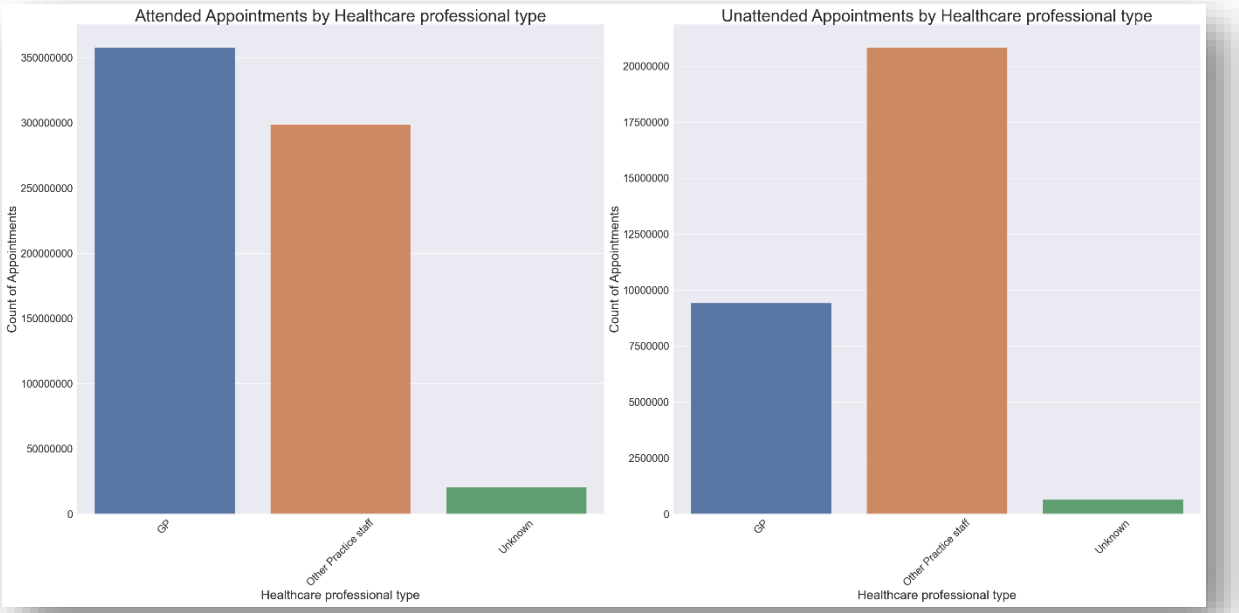
Wait time between booking and the appointment

From the graph below, a very clear difference can be perceived in people's attendance patterns. Most people attend same day appointment. However, the DNA number skyrockets when people get told to wait between 2 to 14 days.



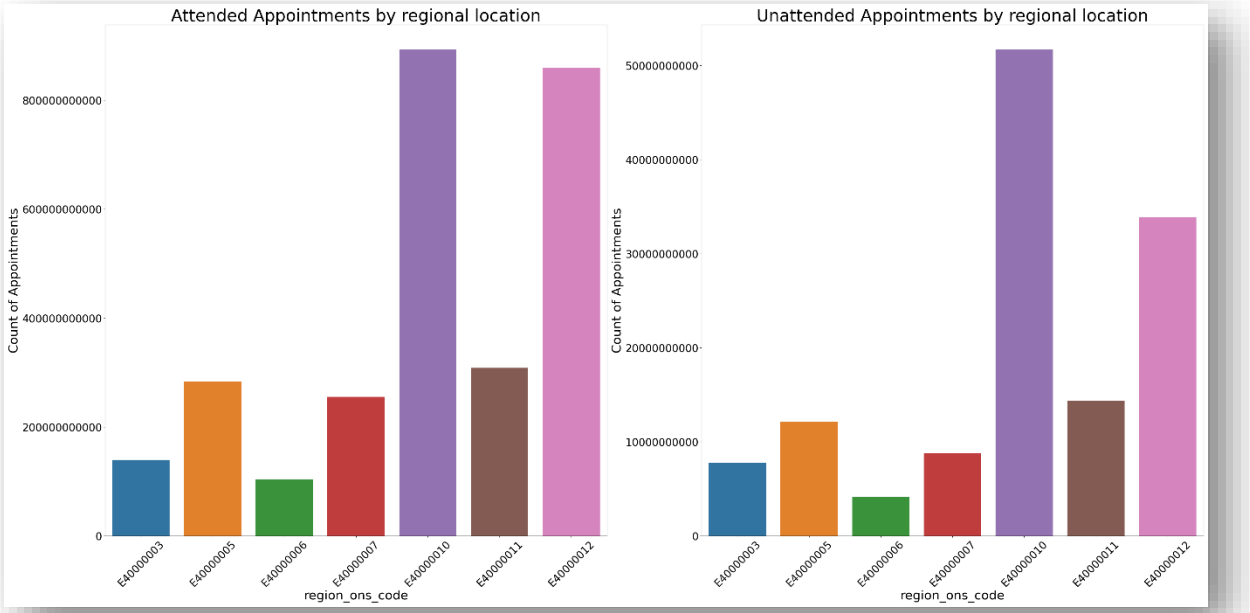
Healthcare Professional Type

Another interesting trend behind unattended appointments is that people tend to miss other practice staff's appointments more frequently than others.



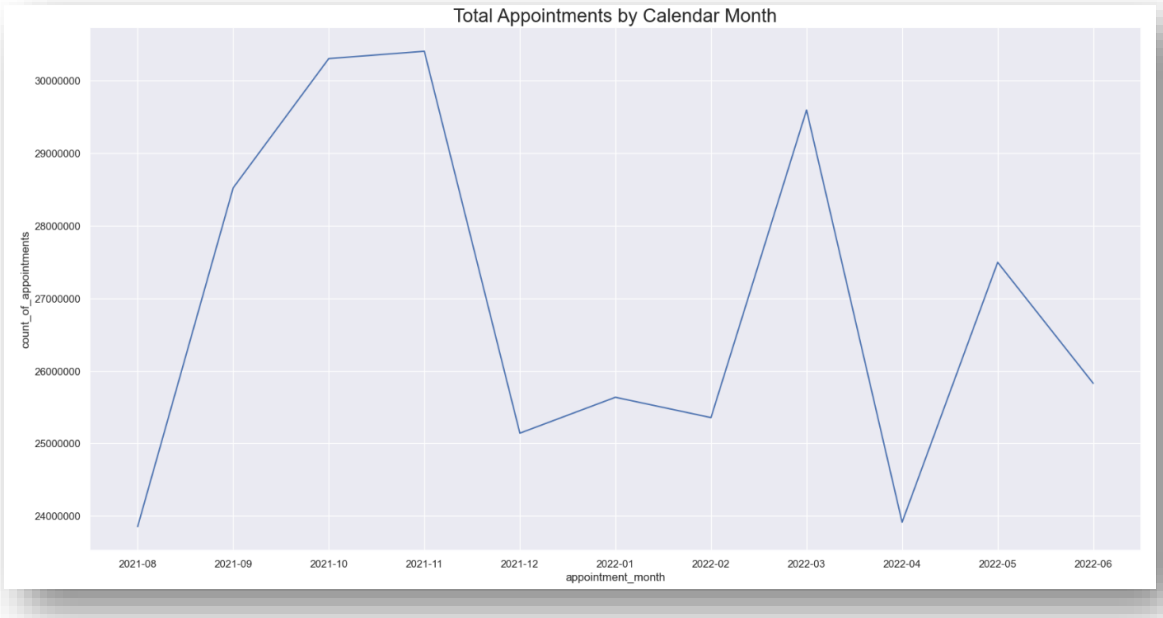
Regions

The region coded E40000012 seems to have a lower ratio of DNA. It'd definitely be interesting for further investigations.



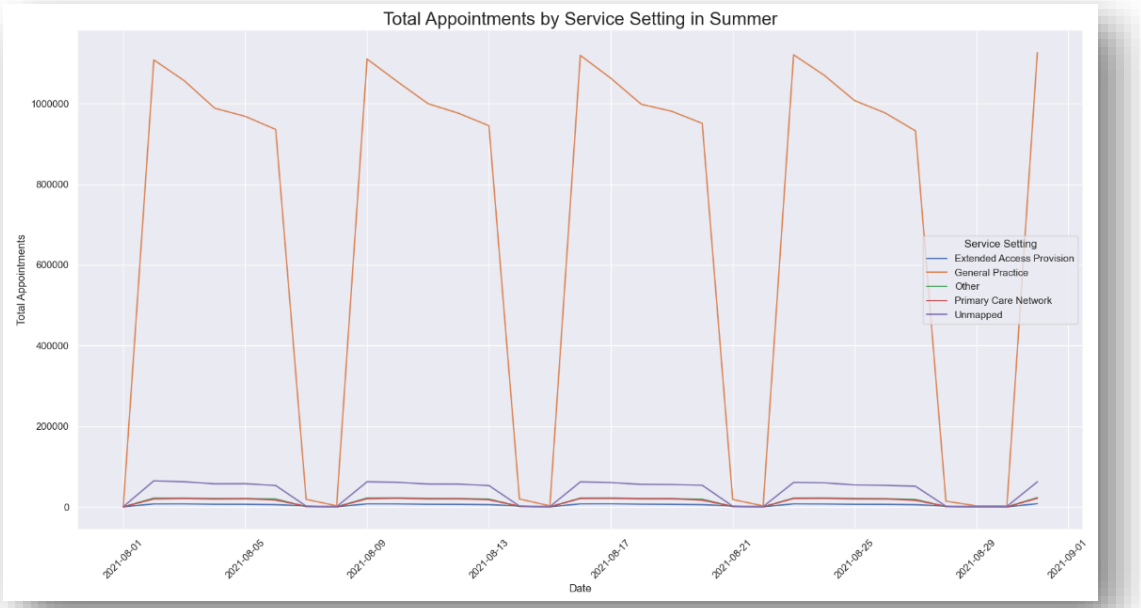
3. Seasonality

The total number of appointments is lower than other period in summer and winter, presumably because people tend to go on holidays in those seasons. Autumn is the busiest season across the NHS.

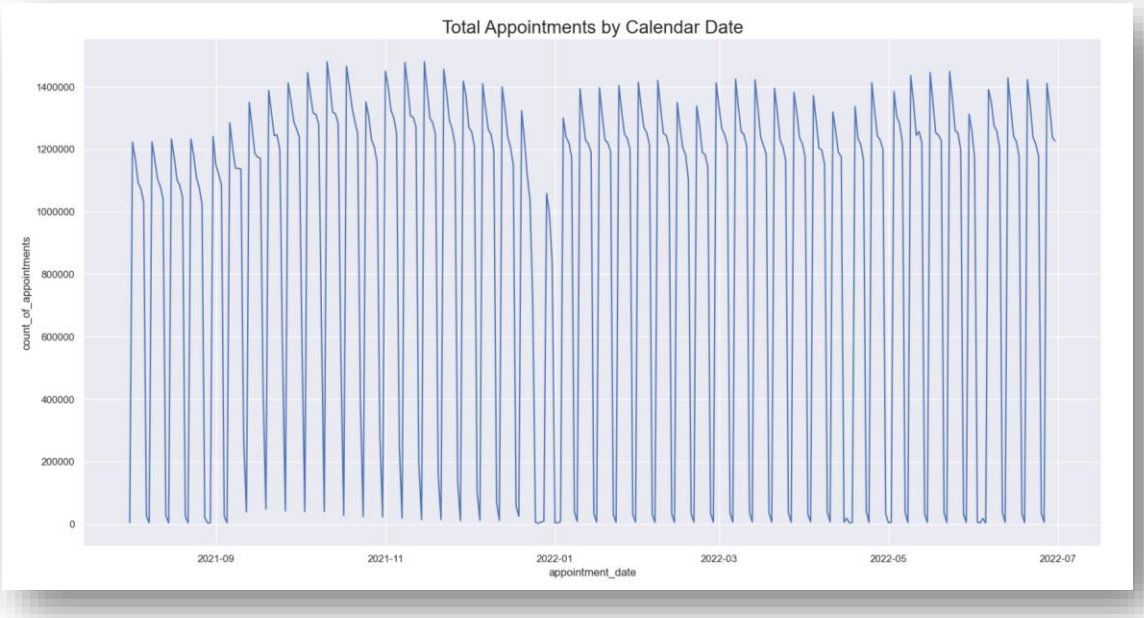


4. Weekly Trends

There are always the most of appointments on Mondays, and Fridays are usually the least busy day of the week. In the following graph, we can see this trend clearly. Besides, it seems that most NHS locations are release almost no appointment during the weekend.



The same trend can be seen throughout the year in the graph below as well.

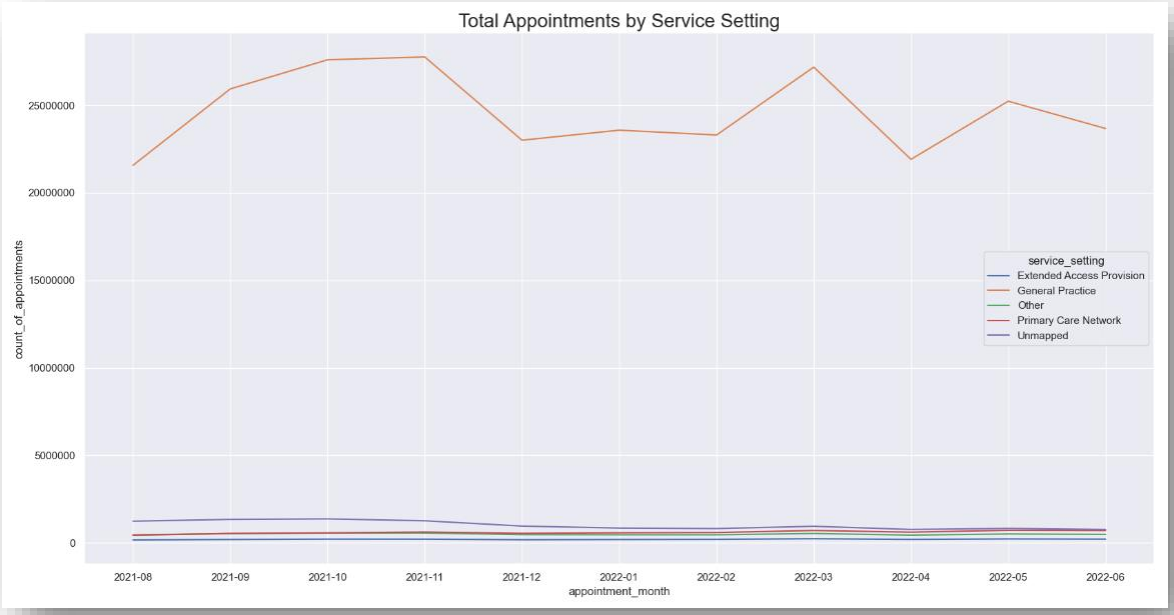


General Findings

Some other insights are shown as below, supported by data visuals.

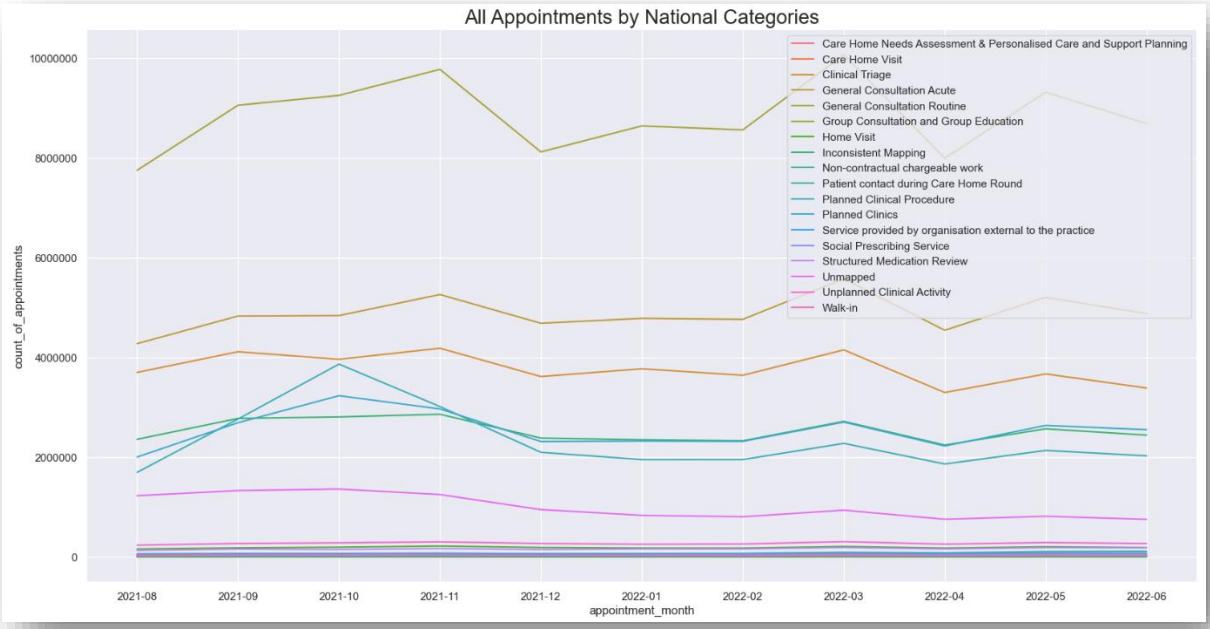
1. Service Settings

The most popular service setting is General Practice. No clear difference can be seen in the change of time. It follows the general changes in the total number of appointments.



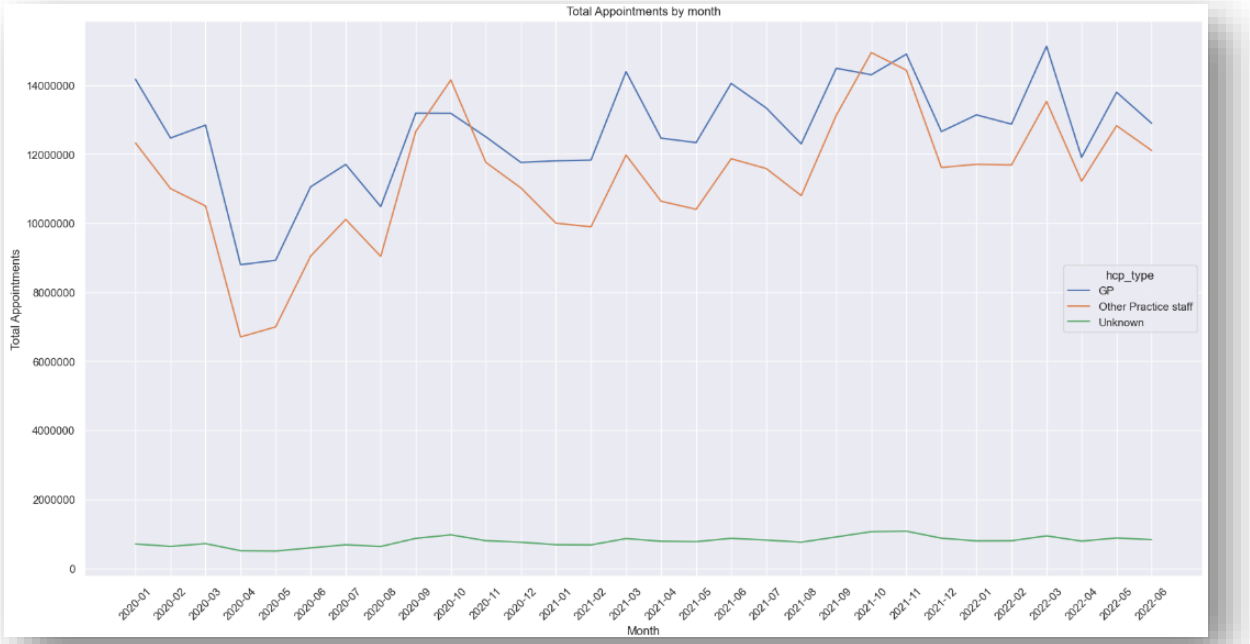
2. National Categories

The most used national category is General Consultation Routine, following by General Consultation Acute. No clear difference can be seen in the change of time. It follows the general changes in the total number of appointments.



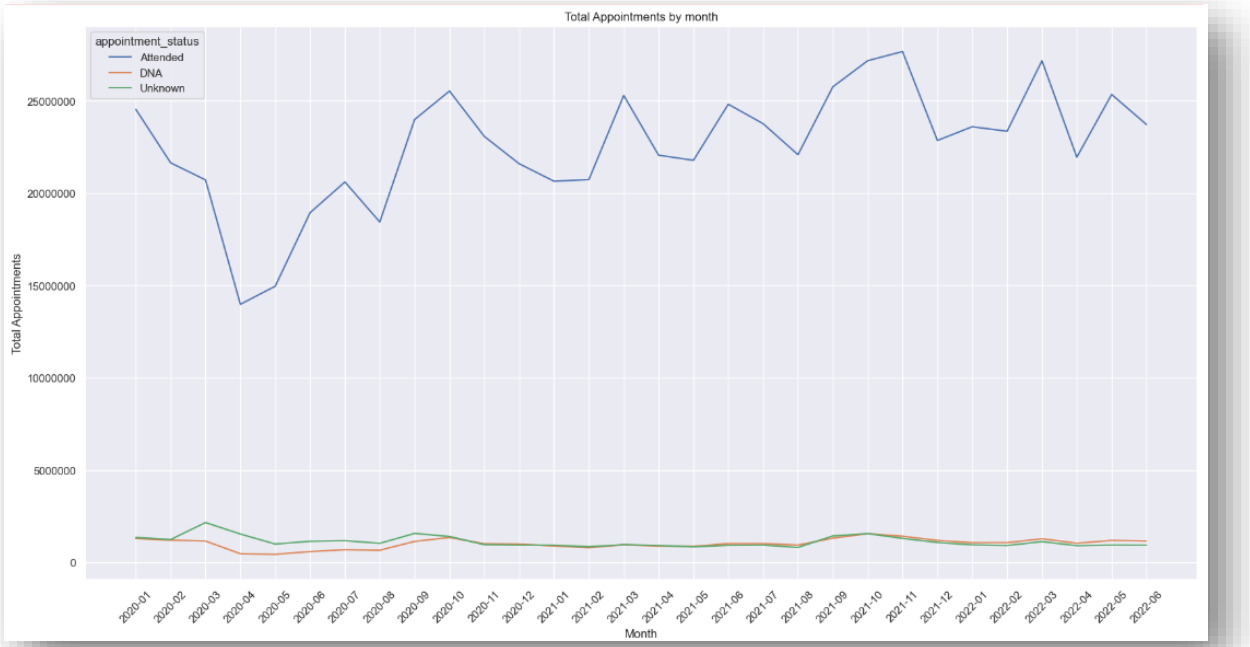
3. Healthcare professional type

Most appointments are with GP or other Practice staff. In both Octobers, the number of appointments for other Practice staff is higher than that for GP.



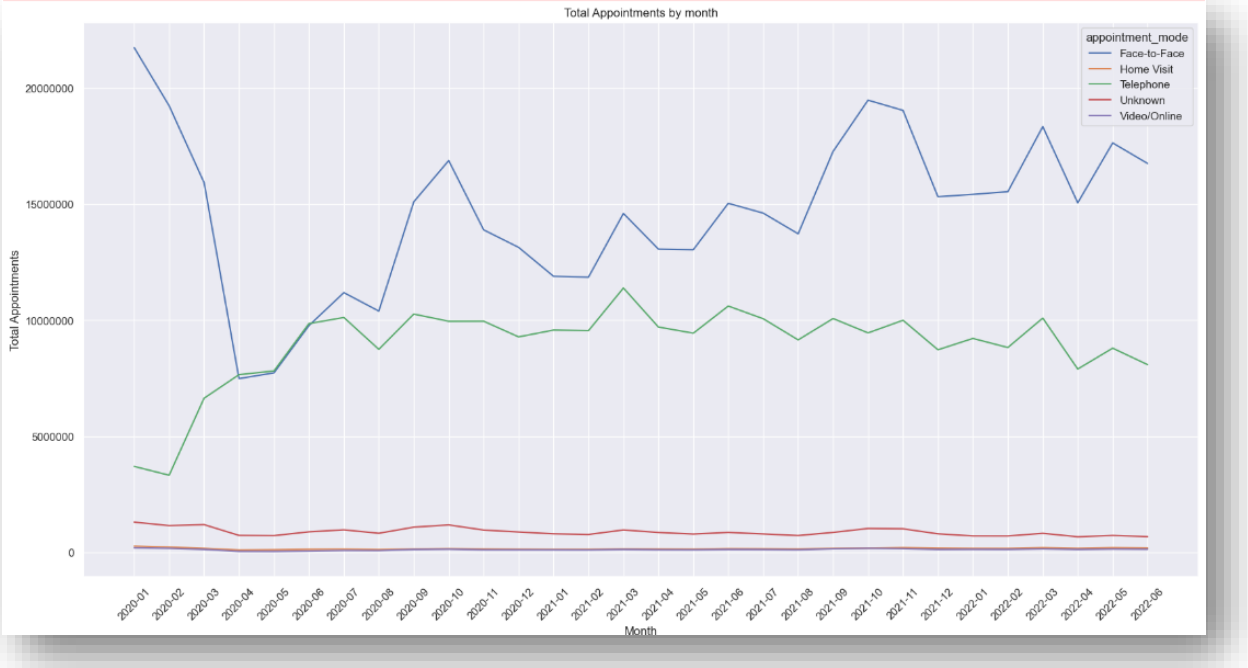
4. Appointment Status

Most people would attend their NHS appointment.



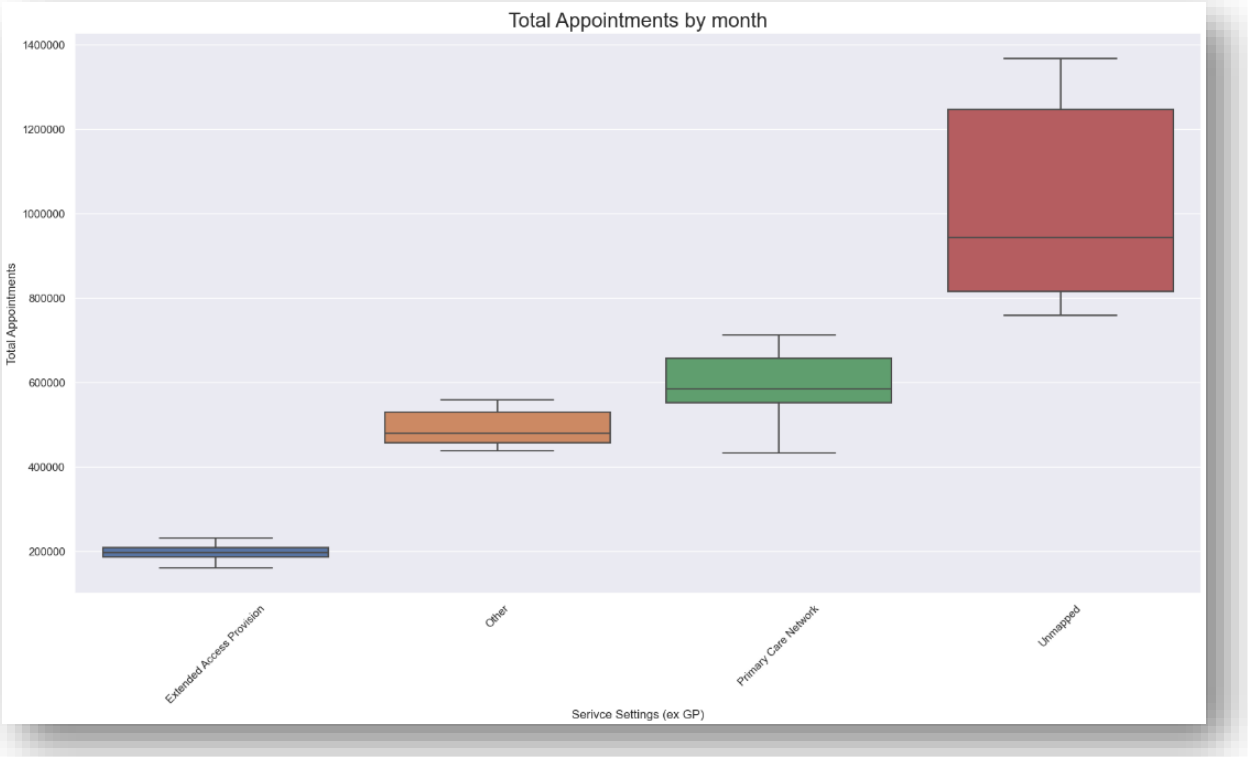
5. Appointment Mode

A clear increase in telephone appointment started after 2020 due to the pandemic. Following the end of the lockdown, the telephone appointment started to decrease.

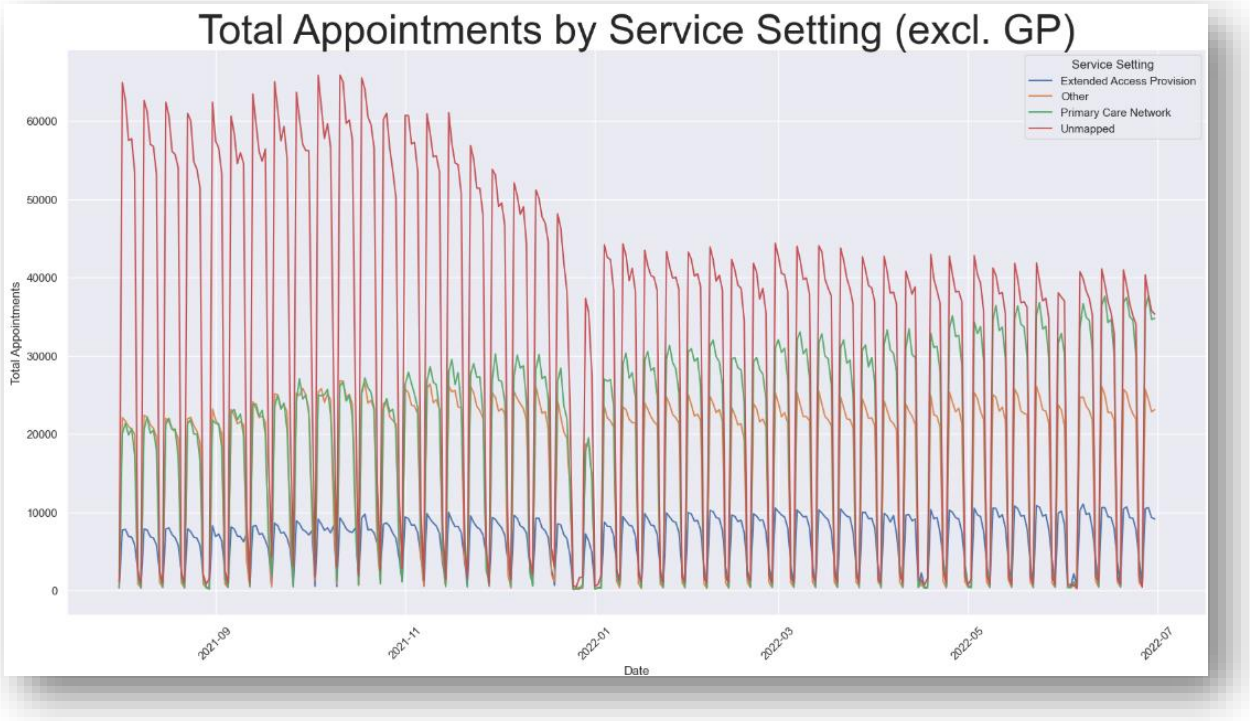


6. Uncategorized Data

A significant portion of the data remains uncategorized, unknown, or unmapped, indicating a need for data cleaning and remapping. For example, when looking at total appointments by Service Setting excluding GP, unmapped data stand out.



On the other hand, from early 2022, the count of unmapped service setting data seems to have dropped slightly, reflecting the continuing improvement in the data recording and categorisation.



Recommendations

Based on the findings and trends mentioned above, these recommendations would be helpful in responding to the issues in the NHS highlighted in this analysis project:

1. **Increase the Number of Staff**
Gradually hire more healthcare professionals to meet the increased demand post-pandemic.

2. **Optimize Resource Allocation**
Consider flexible staffing or temporary solutions during these peak periods.
Even out appointments on less busy days like Thursdays and Fridays.
Encourage non-urgent appointments to be scheduled during this time to balance the workload.

3. **Improve Appointment Management**
Prioritize same-day appointment to reduce the likelihood of missed appointments.
Hide the healthcare professional type at the time of booking to reduce potential biases.

4. **Enhance Data Quality and Consistency**
Establish SOPs for data entry and data management.
Improve the data system to ensure data accuracy, consistency, and reliability in future data analysis.

5. **Introduce Penalties for No-Shows**
Implement penalties for patients who repeatedly miss appointments without acceptable reasons.
Consider nominal cancellation fees on no-shows.
Learn best practices from regions with less no-shows.

Conclusions

In this data analysis project, multiple dimensions were explored to address the NHS's concerns. The analysis yielded key findings, highlighting issues such as staffing shortages, missed appointment patterns, seasonality, weekly trends, and data quality problems.

Key suggestions include:

- Increasing staffing levels
- Implementing strategies to reduce appointment no-shows
- Encouraging bookings on quieter weekdays
- Enhancing the data system and quality.

While some crucial data, like staff numbers and financial details, were unavailable, this report provides valuable insights and actionable recommendations for improving NHS service efficiency.