Utilisation and Capacity Analysis

By Eloise Farmer

Business Context:

The NHS must make informed decisions about whether to expand its healthcare capacity or focus on improving the utilisation of existing infrastructure. Key challenges include understanding current trends in appointment utilisation, the root causes of missed appointments, and whether existing staff and resources are meeting population demand.

The report will consider two primary questions provided by the NHS:

- Has there been adequate staff and capacity in the networks?
- What was the actual utilisation of resources?

The business problem is further explored via a Five Why's Framework and PESTLE Analysis in Appendix 1.

Analytical Approach:

The first steps included extracting and backing up the data, followed by reviewing the metadata for context and data quality insights. Two key findings from the metadata:

1. The dataset was not initially intended for analytical purposes. With no national standards guiding data entry and considerable variation in how practices manage appointments, data quality is inconsistent. These limitations introduce risks to the reliability of any analysis and highlight the importance of implementing standardised data recording practices (Appendix 2).
2. The data has already been cleaned

Appendix 3 discusses the exploration of joining the datasets which was not required to answer the business question, nor appropriate given the data provided.

Before beginning my analysis, I set up the environment by importing key Python libraries including Pandas and NumPy for data manipulation, and configured the notebook to suppress unnecessary warnings for a cleaner workflow. I then imported the primary datasets into DataFrames. To support readability and analysis, I also created and imported a custom lookup file (icb_region_names.csv) containing region and ICB names. This was especially useful during early data exploration, as it allowed me to replace location codes with more intuitive labels. This process is explored in Appendix 4.

Import libraries, NHS files (ad, ar and nc) and ICB/Region names file

```
# Import the necessary libraries
import pandas as pd
import numpy as np

# Ignore warnings
import warnings
warnings.filterwarnings('ignore')

# Import the files to DataFrames using aliases
# Import 'actual_duration.csv' as ad_original
ad_original = pd.read_csv('actual_duration.csv')

# Import 'appointments_regional.csv' as ar_original
ar_original = pd.read_csv('appointments_regional.csv')

# Import 'national_categories.xlsx' as nc_original
nc_original = pd.read_excel('national_categories.xlsx')

# Import file of NHS region and ICB names
# I made this lookup file to merge with the DataFrames to access names of regions and ICB locations
# This made early data exploration more clear with intuitive labels, rather than using NHS codes.
icb_region_names = pd.read_csv('icb_region_names.csv')
```

Later in the notebook, an external dataset (reg_patients.csv) was imported and merged to source the number of registered patients at the Sub-ICB level. This allowed calculation of appointments per 1,000 registered patients, enabling more meaningful comparisons between regions by normalising appointment volumes based on Sub-ICB population size (Appendix 5).

Duplicate records were removed from the appointments_regional (ar) dataset, this process is outlined in Appendix 6.

Structure of the Jupyter Notebook:

- Import, sense check and descriptive statistics (Appendix 7 outlines procedure)
- Exploration of datasets (organised via key exploratory questions)
- ICB level analysis with registered patients data and NHS capacity metric
- Time based analysis (monthly, seasonal and daily)
- Twitter analysis
- Final visualisations, key insights and recommendations

Visualisation and Insights:

Below outlines the analytical journey, highlighting key insights. Additional detail and supporting research are included in Appendix 8. Certain sections were selected for the presentation, as they were most relevant in addressing the core questions.

Addressed Capacity:	**Included:**
Analysed capacity using the NHS daily capacity benchmark (Appendix 8A) - Average capacity at 65% - This data focuses on an unprecedented time (Appendix 9) - Despite setbacks, it continues to increase over time	✔
Total appointments within the date range (Appendix 8B) - Trend line mirrors the above capacity chart	✘
Analysed the percentage of ICBs exceeding their expected monthly appointment capacity, where capacity is calculated proportionally based on the number of registered patients in each ICB (Appendix 8C). - Several months where over 80% of ICBs exceeded their monthly appointment capacity - While the overall system appeared to remain within capacity, many local networks were overstretched	✔
Addressed Utilisation: Findings grouped by key themes	
Region level - Total appointments vary across the 7 regions but broadly align with population size, highlighting the need for relative capacity assessment and granular analysis (Appendix 8D) - Time between booking and appointment is relatively consistent across regions	✘
Service Setting - A decline in unmapped appointments and an increase in primary care network appointments, likely reflect improvements in data recording and ongoing PCN policies (Appendix 8E)	✘
Booking-to-appointment time - 88% of appointments are within the 14 day target - The other 12% accounts for 91 million appointments (Appendix 8F) - Telephone appointments have a shorter wait, compared to face to face: over 60% of telephone appointments are delivered the same day	✔

Attendance rates - 91% attended - 4% that did not attend from Jan 2020 - June 2022 cost the NHS around £924 million (Appendix 8G)	✔
Health Care Professional usage - 51% of appointments by GPs and 46% by Other Practice Staff - Likely that given only 5% behind, NHS are already dealing with demand by utilizing Other Practice Staff (Appendix 8H)	✔
Appointment delivery - 59% of appointments are face to face, while 36% are telephone - Other Practice Staff complete the most face to face appointments - GPs complete the most telephone appointments (Appendix 8I)	✔
Appointment length - Data quality issues affect 24% of appointments (Appendix 8J) - 52% of appointments reach the target of < 15min, 24% are > 15min	✔
Daily Trends - Highest appointment volumes at the start of the week, with a downward trend from Monday to Friday; Monday figures are slightly skewed by Bank Holidays (Appendix 8K)	✔

Additional Attendance Factors
- Attendance and booking-to-appointment time
    - Attendance increases with reduced time between booking and appointment
- Attendance and mode
    - Greater attendance rates for telephone appointments (95%)
    - Face to face 89%
- Non attendance rate
    - DNA rate for Other Practice Staff is just over double that of GPs (6.5% vs 2.56%) (Appendix 8L)
	✘

Twitter - The Twitter data did not yield useful insights; however, potential value could be uncovered with more targeted data collection (Appendix 8M)	✘

Patterns and Predictions:

When addressing NHS capacity challenges, two key options emerge: improving the efficiency of existing resources or investing in the expansion and enhancement of overall capacity. It's important to acknowledge that this data is somewhat outdated and that the NHS has since made significant efforts to address these issues as explored in Appendix 10.

Capacity

Capacity is highly dependent on individual practice characteristics, staff availability, and operational capabilities, making it difficult to assess consistently across regions. To enable more accurate analysis in the future, data collection should include maximum capacity limits at multiple geographic levels of granularity (e.g. practice, ICB, region), as well as for each national appointment category.

→ Allocate resources to icb_level to address those relative demands and not rely on one national capacity metric.

→ Collect and report at the ICB level on a complete monthly basis.

As demonstrated in this report, increasing capacity is important; however, simultaneous improvements in resource utilisation will amplify the overall benefit to the service. Sustained annual workforce growth is critical to keep pace with increasing service demand and population expansion (Appendix 11).

→ Consider moving away from traditional GP models and capitalize on the demand from non-FTE staff.

General Practice Utilisation

Findings:

- Other practice staff account for 46% of appointments
- Most patients (88%) are seen within the recommended 14 days
- The shorter the wait for an appointment, the greater the attendance rate
- The start of the week sees the most appointments
- 52% of appointments reach the target of < 15min
- Phone appointments are provided with a faster turnaround (65% are same day)
- Phone appointments have greater attendance - 95% vs F2F 89%
- 91% of appointments are attended, however the 4% DNA costs the NHS around £900 million

Make general practice more efficient by:

- Decrease face-to-face (59%) and increase telephone appointments (36%), aim for a more even split in order to improve utilisation.

- Support other practice staff to take on more telephone and F2F appointments to free up GPs time. This is a way to keep time between booking and appointment short, and that way, appointments are more likely to be attended.
- Tighten operational standards to ensure appointments start and end within a strict 15-minute window, to fully realise the benefits.
- Ensure more staff are available at the start of the week to cope with the evident higher demand
- Explore the decline in telephone appointments - is it driven by patients or GPs? Consider a patient education campaign highlighting that telephone consultations and Other Practice Staff can reduce their wait times and improve their health outcomes.
- Other practice staff account for 46% of total appointments - a significant proportion. More granular categorisation is needed to accurately assess workforce distribution and resource utilisation.

Key Appointment Focus: Increase same-day, telephone appointments with Other Practice Staff. They are more likely to be attended and are a more efficient use of resources.

Appendix:

Appendix 1: Five Whys and PESTLE

5 Why's Framework

Why is the NHS facing challenges in meeting patient demand?

Because there is a growing mismatch between healthcare service demand and available capacity in the system.

Why is there a mismatch between demand and capacity?

Because staffing levels and infrastructure may not have scaled in line with population growth and post-pandemic demand patterns.

Why haven't staffing and infrastructure scaled effectively?

Because there are not enough resources or the resources are not being used efficiently.

Why aren't resources being used efficiently?

Because decision-making has not been consistently supported by detailed, real-time analysis of service utilisation trends.

Why is detailed analysis missing from decision-making?

Because the NHS needs targeted data insights - which our team has been brought in to provide.

PESTLE Analysis

Factor	Explanation
Political	Government pressure to reduce NHS waiting times and improve GP access. Public scrutiny on availability post-COVID.
Economic	Missed GP appointments cost the NHS an estimated £216 million annually (pre-COVID) (NHS, 2019b). Economic strain post-pandemic has increased cost sensitivity.
Social	Ageing population, increasing chronic illness, digital exclusion, language barriers, and growing health inequalities.
Technological	Rapid digital transformation (e.g. remote triage, online booking) not equally accessible or adopted. Mixed effectiveness of digital communication tools.
Legal	Data privacy, consent, and ethical use of patient and social media data. The NHS must comply with GDPR and patient confidentiality laws.
Environmental	Seasonal pressures (e.g. winter illness), pandemics (e.g. COVID-19, flu), and transport disruptions affect attendance.

Appendix 2: Data Limitations

This is a list compiled throughout the analysis process and is important to be aware of when considering recommendations. The next stage needs to focus on improving data quality. Many of these are already mentioned throughout.

Data quality issues

- A significant portion of the dataset is incomplete or ambiguous. For example, 24% of appointment duration entries are missing or labelled as 'unknown', limiting meaningful analysis of time-based efficiency.

Inconsistent data entry across ICBs and practices

- There is no national standard for how appointments should be recorded, resulting in considerable variation across practices and Integrated Care Boards. This inconsistency reduces the comparability and reliability of local-level insights.

HCP type is not properly disaggregated

- The dataset groups many healthcare professional types under the umbrella of "Other Practice Staff". Due to inconsistencies in how HCP type was extracted from some systems, only GP data is considered reliably recorded.

Overrepresentation of GP appointments

- General Practitioners account for over 91% of recorded appointments, making it difficult to assess activity in other service settings. This skews insights and limits the usefulness of the service setting breakdown.

Experimental status of the dataset

- The publication is classified as experimental statistics, indicating that the methodology and data collection are still under development. As such, conclusions drawn from this data should be considered exploratory rather than definitive.

Inconsistent supplier participation

- Not all GP IT system suppliers contributed data consistently across the entire time period. Some practices started or stopped participating at different times, which may cause artificial variation in trends.

Variation in appointment categorisation

- Despite attempts at standardisation, many practices still use local codes or custom mappings for appointment types. This means that seemingly comparable appointment categories may represent different things across sites.

Online consultation system variability

- Data from online consultation systems is influenced by how practices configure their platforms. This leads to inconsistent interpretation and reporting of appointment modes such as telephone, online, or in-person.

(NHS Digital, 2024b)

Appendix 3: Joining the datasets

Joining the three datasets posed too great a risk of duplication and data integrity issues, due to overlapping timeframes, differing aggregation structures, and the absence of a unique appointment ID to reliably link records. Merging would have likely inflated counts and added unnecessary complexity.

Instead, each dataset was used strategically and selectively, depending on which best addressed the specific question at hand. This approach ensured analytical efficiency while maintaining accuracy and avoiding inappropriate assumptions across sources.

Appendix 4: Introducing icb_region_names.csv

To improve the interpretability of geographic identifiers in the datasets (ad, ar, and nc), I created a reference lookup file called icb_region_names.csv. This file maps coded location fields (like icb_ons_code and region_ons_code) to their corresponding human-readable names. This enabled clearer visualisation and geographic analysis.

Integrated Care Board (ICB) codes and official names were sourced from Office for National Statistics (2022a). Region codes (region_ons_code) and their corresponding NHS England region names were obtained from the Office for National Statistics (2022b). To align each ICB with its correct NHS region, I used the NHS England Integrated Care Boards map (NHS England, 2023e) to manually cross-reference based on geography. The final CSV file included the following columns:

- icb_ons_code
- icb_name
- Region_name
- region_ons_code

Integration into Datasets: Using the pd.merge() function, I joined this file with each of the three main datasets (ad, ar, and nc) based on the icb_ons_code, to add both icb_name and region_name columns for geographic clarity.

Snapshot of excel file: converted to csv for import

	A	B	C	D
1	**icb_ons_code**	**icb_name**	**region_name**	**region_ons_code**
2	E54000008	Cheshire and Merseyside ICB	North West	E40000010
3	E54000010	Staffordshire and Stoke-on-Trent ICB	Midlands	E40000011
4	E54000011	Shropshire, Telford and Wrekin ICB	Midlands	E40000011
5	E54000013	Lincolnshire ICB	Midlands	E40000011
6	E54000015	Leicester, Leicestershire and Rutland ICB	Midlands	E40000011
7	E54000018	Coventry and Warwickshire ICB	Midlands	E40000011
8	E54000019	Herefordshire and Worcestershire ICB	Midlands	E40000011
9	E54000022	Norfolk and Waveney ICB	East of England	E40000007
10	E54000023	Suffolk and North East Essex ICB	East of England	E40000007
11	E54000024	Bedfordshire, Luton and Milton Keynes ICB	East of England	E40000007
12	E54000025	Hertfordshire and West Essex ICB	East of England	E40000007
13	E54000026	Mid and South Essex ICB	East of England	E40000007
14	E54000027	North West London ICB	London	E40000003
15	E54000028	North Central London ICB	London	E40000003
16	E54000029	North East London ICB	London	E40000003
17	E54000030	South East London ICB	London	E40000003
18	E54000031	South West London ICB	London	E40000003
19	E54000032	Kent and Medway ICB	South East	E40000005
20	E54000034	Frimley ICB	South East	E40000005
21	E54000036	Cornwall and the Isles of Scilly ICB	South West	E40000006
22	E54000037	Devon ICB	South West	E40000006
23	E54000038	Somerset ICB	South West	E40000006
24	E54000039	Bristol, North Somerset and South Gloucestershire ICB	South West	E40000006
25	E54000040	Bath and North East Somerset, Swindon and Wiltshire ICB	South West	E40000006
26	E54000041	Dorset ICB	South West	E40000006
27	E54000042	Hampshire and Isle of Wight ICB	South East	E40000005
28	E54000043	Gloucestershire ICB	South West	E40000006
29	E54000044	Buckinghamshire, Oxfordshire and Berkshire West ICB	South East	E40000005

Appendix 5: Importing Registered Patients Data

To support the analysis of localised service delivery, I incorporated an external dataset: NHS Digital - Patients Registered at a GP Practice (January 2025) (NHS Digital, 2025c). This file was used to calculate appointments per 1,000 registered patients at the Integrated Care Board (ICB) level.

This population-normalised approach allows for more meaningful interpretation of appointment volumes by accounting for population size within each ICB. It supports system-level insights into demand, delivery, and capacity pressure, and is particularly useful for answering stakeholder questions such as:

- *"Has there been adequate staffing and resource delivery?"*
- *"Which ICBs are exceeding or falling short of expected capacity?"*

This enabled the following:

- Calculated each ICB's share of the national registered population
- Estimated expected appointment delivery per ICB using the NHS benchmark of 1.2 million appointments per working day (Fourthrev, 2025)
- Compared actual vs expected appointment delivery across the 30-month analysis period
- Identified ICBs potentially over-performing (indicating system strain) or under-performing

Cleaning was conducted to ensure consistency with other datasets:

- Renamed ONS_SUB_ICB_LOCATION_CODE → sub_icb_location_ons_code to ensure consistency with existing datasets and made merging easier
- Renamed NUMBER_OF_PATIENTS → registered_patients
- Removed irrelevant or redundant columns including:
    - Publication, Extract_Date, Type, Sex, Age which were identical for all rows
    - The 'Code' field as I was planning a merge using the sub_icb code

Further detail on the calculations are outlined in Appendix 7C.

Snapshot of the cleaned data file:

	A	B	C	D
1	sub_icb_location_code	sub_icb_location_ons_code	postcode	registered_patients
2	16C	E38000247	TS18 1HU	3889
3	16C	E38000247	TS18 2AW	18742
4	16C	E38000247	TS5 8SB	11327
5	16C	E38000247	TS14 7DJ	7726
6	16C	E38000247	TS18 2AT	14738
7	16C	E38000247	TS24 7PW	10566
8	16C	E38000247	TS5 6HF	8201
9	16C	E38000247	TS24 7PW	11815
10	16C	E38000247	TS3 6AL	5573
11	16C	E38000247	TS12 2FF	7581
12	16C	E38000247	TS23 2LA	4149
13	16C	E38000247	TS1 3QY	12303
14	16C	E38000247	TS17 0EE	18393
15	16C	E38000247	TS10 4NW	10177
16	16C	E38000247	TS3 7RL	8946
17	16C	E38000247	TS4 3BU	7910
18	16C	E38000247	TS6 6TD	22902
19	16C	E38000247	TS12 2TG	9395
20	16C	E38000247	TS1 2NX	8929
21	16C	E38000247	TS18 1HU	4143
22	16C	E38000247	TS5 6HA	20921
23	16C	E38000247	TS15 9DD	14776
24	16C	E38000247	TS1 2NX	7293
25	16C	E38000247	TS1 3RY	16499
26	16C	E38000247	TS24 7PW	13702
27	16C	E38000247	TS14 7DJ	11519
28	16C	E38000247	TS17 0EE	20960
29	16C	E38000247	TS1 3RX	9827

Appendix 6: Removing duplicates in appointments_regional (ar) dataset

I removed 21,604 duplicate records from the appointments_regional (ar) dataset to ensure the accuracy of all subsequent analysis. Since the dataset contains aggregated appointment counts, any duplicate rows would artificially inflate total values, distort averages, and compromise calculations such as proportions and trends over time. This was particularly important for analyses involving comparisons across regions or months, and for any normalisation based on population size or record count. Removing duplicates helped preserve the integrity of grouping operations and visualisations.

```
# Check for duplicates
# There are 21,604 duplicate records in appointments_regional.
print("Number of duplicate records in ar:",ar_original.duplicated().sum())
```

```
Number of duplicate records in ar: 21604
```

Appendix 7: Procedure for sense checking data

The steps for preparing the workstation are outlined in the body of the report.

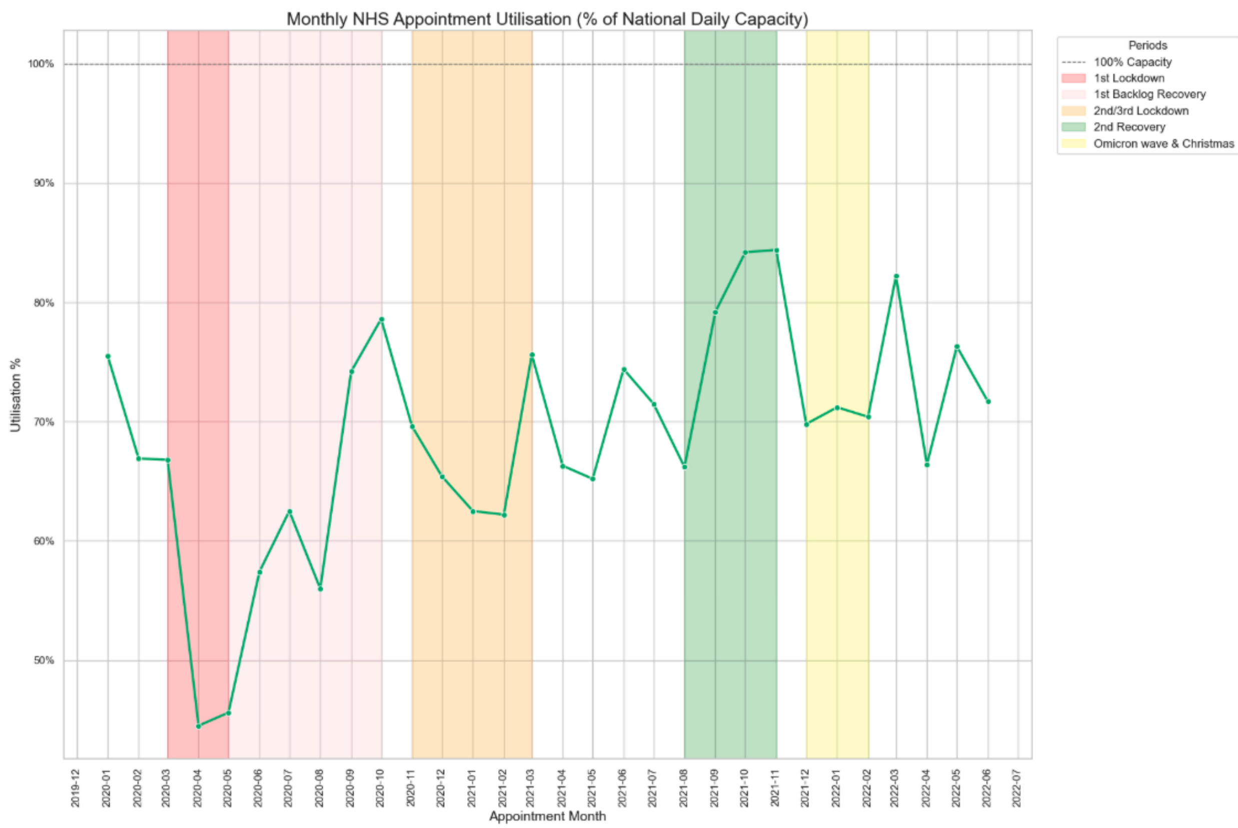
Using nc dataframe as an example: steps are the same for ar and ad

```
# Import the data
nc_original = pd.read_excel('national_categories.xlsx')

# View the top five rows of the DataFrame.
nc_original.head()

# The tail() function displays the bottom five rows and confirms there is no metadata
stored as a footer.
nc_original.tail()

# The info() function displays metadata for actual_duration.
# This confirms the data types for each column, the shape of the DataFrame and confirms there
are no null values.
nc_original.info()

# Check for missing values.
print("\nMissing values per column:\n", nc_original.isnull().sum())

# Review metadata and descriptive statistics.
# The describe() function gives summary statistics for any numerical columns.
# The only numerical column is 'count_of_appointments'.
# The round() function is used to limit the decimal places displayed to two.
nc_original.describe().round(2)

# Check for duplicates
print("Number of duplicate records in nc:",nc_original.duplicated().sum())

# Merge nc_original with icb_region_names to add columns for icb_name and
region_name
# Merged dataset will be named nc
nc = pd.merge(nc_original,
        icb_region_names[['icb_ons_code', 'icb_name', 'region_name']],
        how='left', on='icb_ons_code')

# View the dataset to check the new columns are added
nc.head()
```

Appendix 8: Detailed interpretations of the visualisation outputs

Ordered from 8A to 8M.

8A) Capacity



While the average monthly utilisation of NHS appointment capacity appears to sit comfortably at 65%, this figure risks oversimplifying system performance. As noted by NHS England (2017), "utilisation is a measure of how much capacity is used" but aiming for consistently high utilisation can lead to overpressure, reduced staff morale, and adverse operational behaviours.

The 65% figure was calculated by averaging monthly utilisation percentages across the 30-month period. However, this method does not account for monthly variability, local surges, or structural constraints - such as staffing shortages or system shocks like the COVID-19 pandemic. Services require headroom and contingency to operate safely and responsively.

To better understand and manage capacity in the future, a national benchmark alone is insufficient. Instead, the NHS would benefit from:

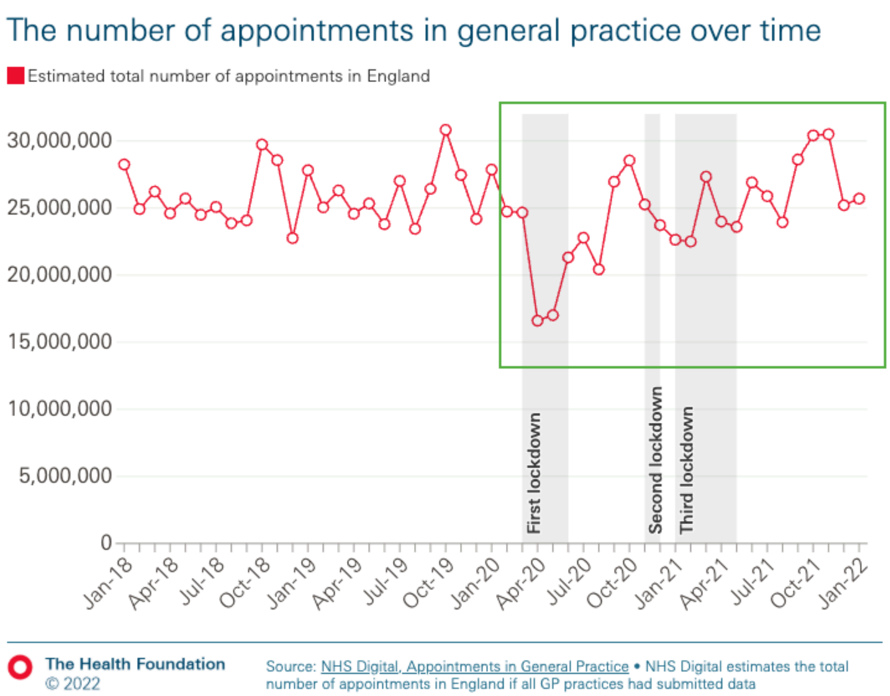
- Defined maximum capacity limits across granular levels (practice, ICB, and region), and by appointment category
- A broader data range and improved consistency in data quality and completeness

- Recognition that apparent underutilisation may reflect resilience and flexibility, not inefficiency

This analysis reinforces that a single average percentage cannot capture the nuance or strain within local systems. Granular planning and smarter resource allocation will be vital as the NHS seeks to build resilience and meet rising demand.

To assess appointment utilisation over time, I selected the ar DataFrame (appointments_regional.csv) as the primary dataset. This dataset was the most appropriate for time-series analysis, as it spans a 30-month period from January 2020 to June 2022, capturing the onset of the COVID-19 pandemic, subsequent lockdowns, backlog recovery periods, and seasonal pressures such as winter and the December holiday season. Other datasets in the project covered shorter timeframes and were less suitable.

It is evident from the line graph that there are distinct peaks and troughs in utilisation over time. Based on personal experience and the timeframe covered by the data, these fluctuations appeared likely to align with key phases of the COVID-19 pandemic. To validate this assumption, further research was conducted to accurately map these periods, with findings detailed in Appendix 9. The pattern observed in our charts closely mirrors that published by The Health Foundation (2022a). Notably, the green-shaded area shows a similar trajectory in highlighting consistency across data sources. As noted, declines in appointments in general practice during the COVID-19 pandemic mostly occurred around the time of lockdown restrictions and high infection rates (The Health Foundation, 2022a). This supports the interpretation of dips in our data as being closely aligned with pandemic-related pressures.



Methodology

- Monthly Aggregation
  The data was grouped by appointment_month to calculate the total number of appointments per month across all Integrated Care Boards (ICBs).
- National Capacity Benchmark
  NHS daily capacity benchmark metric of 1.2 million appointments per day (Fourthrev, 2025)
- Utilisation Metric Calculation
  Monthly utilisation was calculated as:

  Utilisation (%) = (Monthly Appointments ÷ *(30 × 1.2 million)*) × 100

This represents the percentage of the expected national appointment capacity that was utilised each month. The result was rounded to one decimal place for clarity.

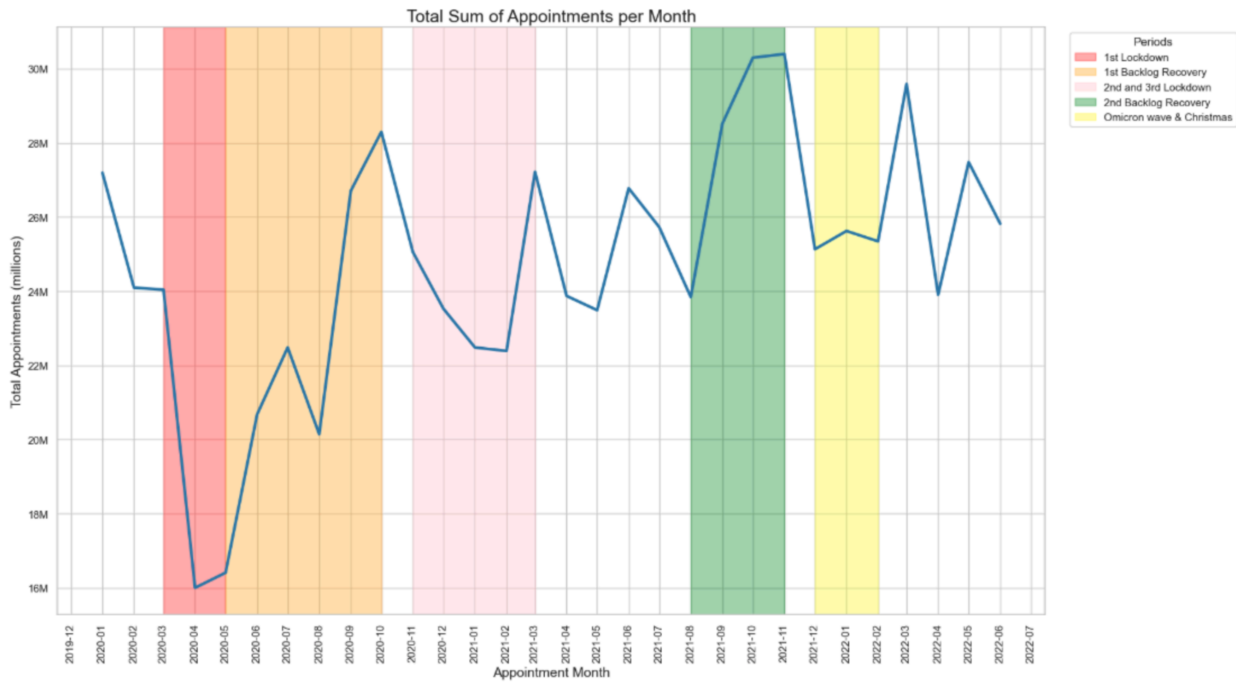
Visualisation
A line graph was created to visualise monthly utilisation. The following enhancements were applied:

- A horizontal reference line at 100% to represent full capacity.
- Shaded bands to highlight key time periods (Appendix 9), including:
  - 1st Lockdown (Mar–May 2020)
  - 1st Backlog Recovery (May–Oct 2020)
  - 2nd/3rd Lockdown (Nov 2020–Mar 2021)
  - 2nd Recovery (Aug–Nov 2021)
  - Omicron wave & Christmas (Dec 2021–Feb 2022)
- X-axis formatting to show each month (rotated for readability).

This approach allowed for a clear and contextualised view of how the NHS managed appointment capacity across a volatile period, revealing changes in utilisation in response to system pressures.

8B) Activity

NHS England (2017) defines capacity as “all we can do” and activity as “what we actually did”. The following graph outlines the sum of appointments across the 30 month time frame.



To visualise overall NHS appointment volume trends, I used the ar DataFrame to calculate the total number of appointments per month. The data was grouped by appointment_month, and a line graph was created to illustrate changes over the 30-month period from January 2020 to June 2022.

Formatting techniques were applied to improve readability:

- The y-axis was formatted to display total appointment counts in whole millions (e.g. 16M, 18M) using a custom tick formatter. This improves readability by avoiding scientific notation and making large numbers easier to interpret for a general audience.
- The x-axis was formatted to display each month clearly, with rotated labels for legibility.
- Shaded bands were added to highlight key periods.

The trend line in this chart mirrors the pattern observed of the utilisation percentage graph discussed above. This is expected, as utilisation is directly calculated from total appointment volume using a fixed national capacity benchmark. As such, both graphs reflect the same underlying fluctuations in service activity over time. As a result, this graph was excluded from the business presentation.

8C) ICB-Level Activity and Capacity Pressure Analysis

Part 1: Appointments per 1,000 Registered Patients (at ICB level)

To enable fair comparisons of service activity across different areas, I calculated the number of appointments delivered per 1,000 registered patients at the Integrated Care Board (ICB) level.

The reg_patients dataset was used to determine the number of registered patients at the Sub-ICB level. Sub-ICB codes were then matched to their parent ICB using a lookup derived from the nc dataset (national_categories.xlsx). Patient counts were aggregated to the ICB level, providing total registered population figures per ICB.

For appointment activity, I used the ar dataset (appointments_regional.csv), which spans January 2020 to June 2022 - the longest available period across datasets. This dataset includes 742.8 million appointments, making it the most comprehensive source of appointment volume available.

Each ICB's total appointment count was then divided by its registered population, and the result was scaled to produce a rate per 1,000 patients:

$$\text{Appointments per 1000} = (\text{Total Appointments} \div \text{Registered Patients}) \times 1000$$

This allows for standardised comparison across ICBs of varying population sizes, offering insights into relative service activity and demand.

The resulting table included all 42 ICBs, with their associated region, name, total registered patients, appointment volumes, and calculated appointments per 1,000 population.

Part 2: ICB-Level Capacity Pressure - Actual vs Expected Appointment Volumes

To understand how consistently NHS appointment delivery exceeded estimated system capacity, I analysed appointment activity at the ICB level.

First, I used the ar dataset to calculate the total number of appointments delivered each month for each ICB. I then estimated each ICB's expected monthly capacity based on its share of the national registered patient population, assuming a national benchmark of 1.2 million appointments per day across 21 working days per month (i.e. 25.2 million monthly appointments nationally). This assumes that ICB-level capacity should be proportionally distributed by population size.

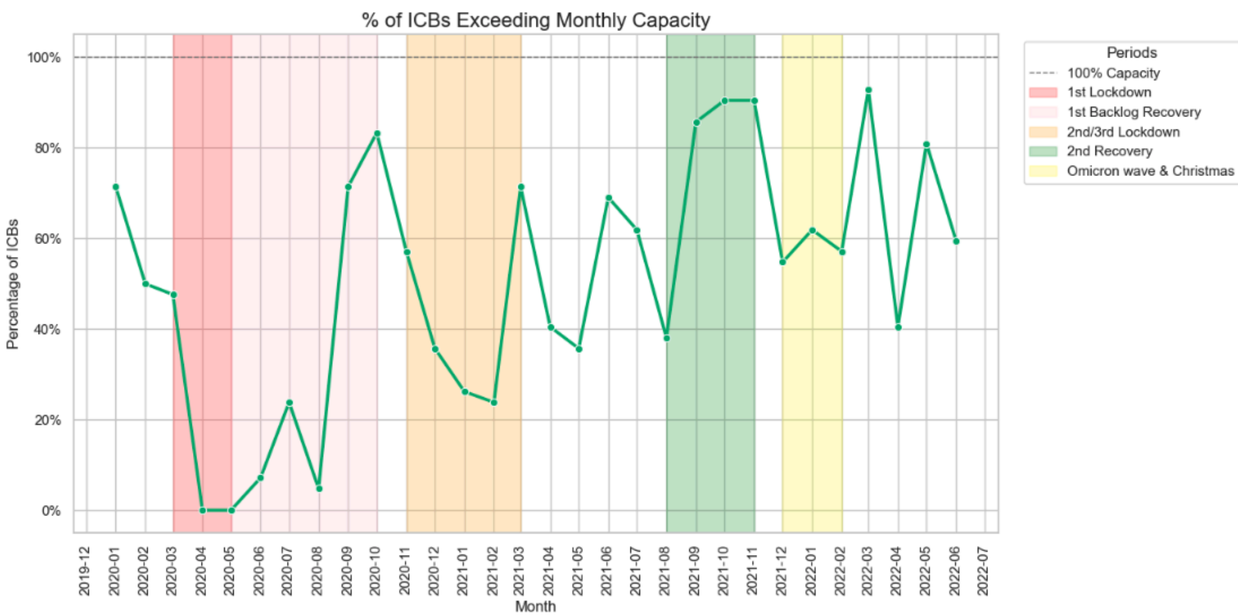
Each ICB's actual appointment volume was then compared to its expected capacity. From this, I calculated:

- Whether the ICB exceeded its estimated capacity

● By how much (in absolute numbers)

These results were summarised by month to identify what proportion of ICBs exceeded their capacity in any given month.

The resulting line chart provides a clear picture of how stretched the system was across the country, month by month. This analysis highlights regional variation in strain, showing that even when the system appears to stay within capacity on average, a significant number of local areas may be overburdened.

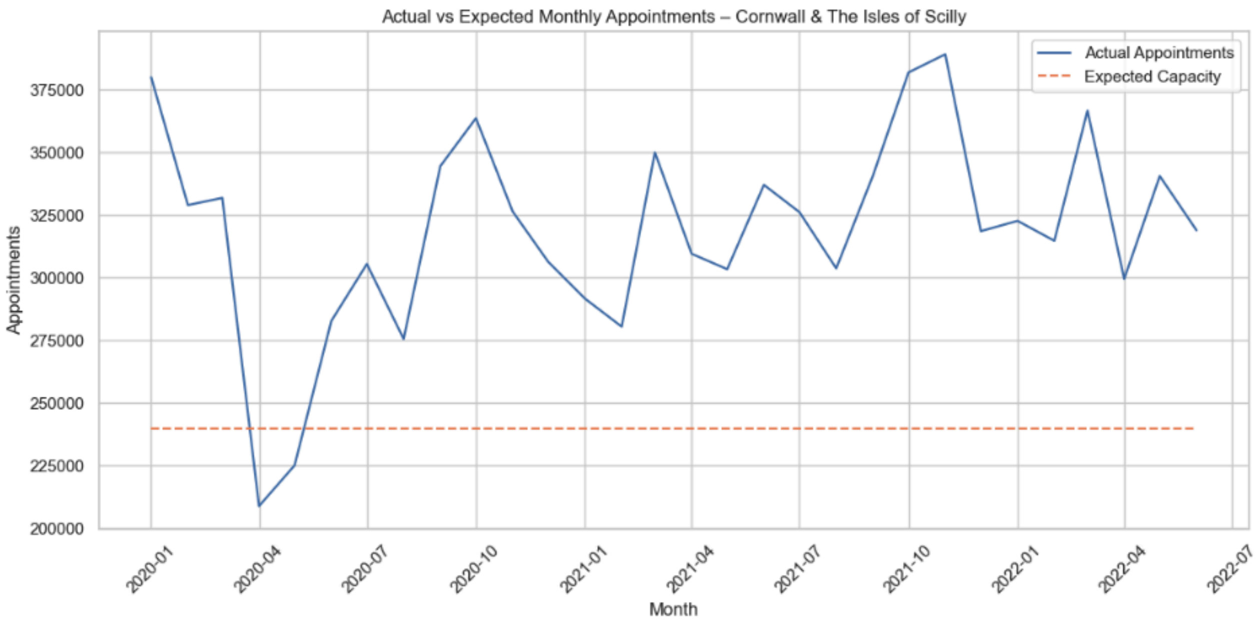


<u>Opportunities for further analysis:</u>

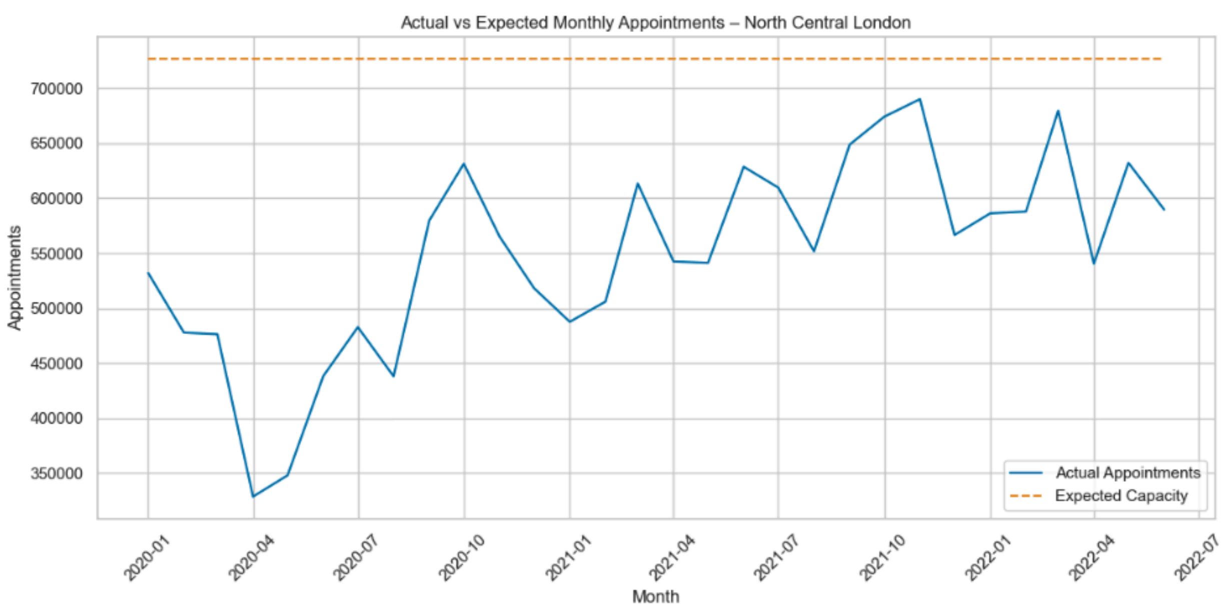
A number of charts were produced to visualise appointment activity at the ICB level (see Notebook). These were not included in the main analysis, as they were not considered central to answering the core business questions. However, with additional time and resources, there is clear value in further exploring ICB-level data in more detail. For instance, future work could include generating charts comparing actual vs. expected appointment rates per ICB, or identifying outliers in service provision. These early visualisations represent only the tip of the iceberg and highlight the potential for deeper analysis to support localised decision-making.

An example of such a chart is shown below:

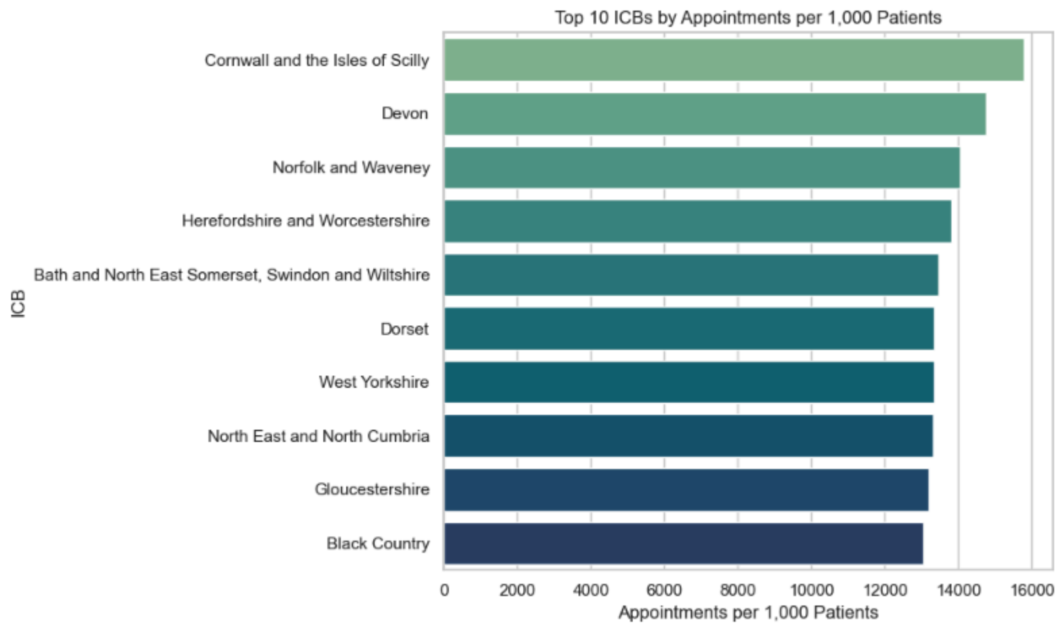
Top Performing ICB - Cornwall & The Isles of Scilly



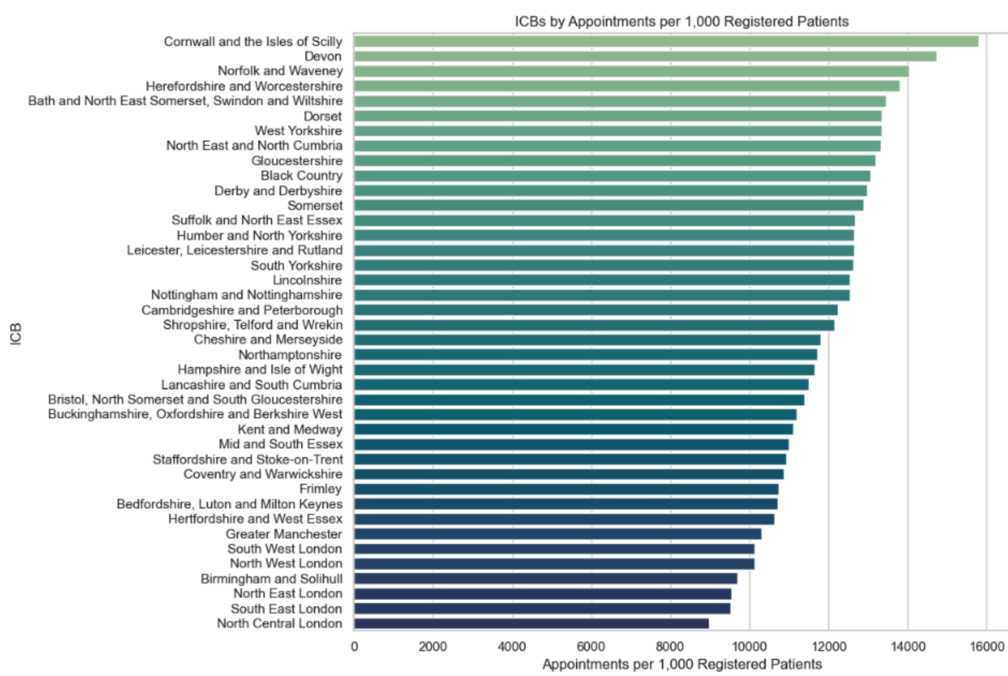
Bottom Performing ICB - North Central London



Further visualisations in the notebook explore the spread for the top 10 and bottom 10 ICBs. The graph shows relatively similar counts within the top 10.



This visualisation provides a quick overview of all ICBs performance.

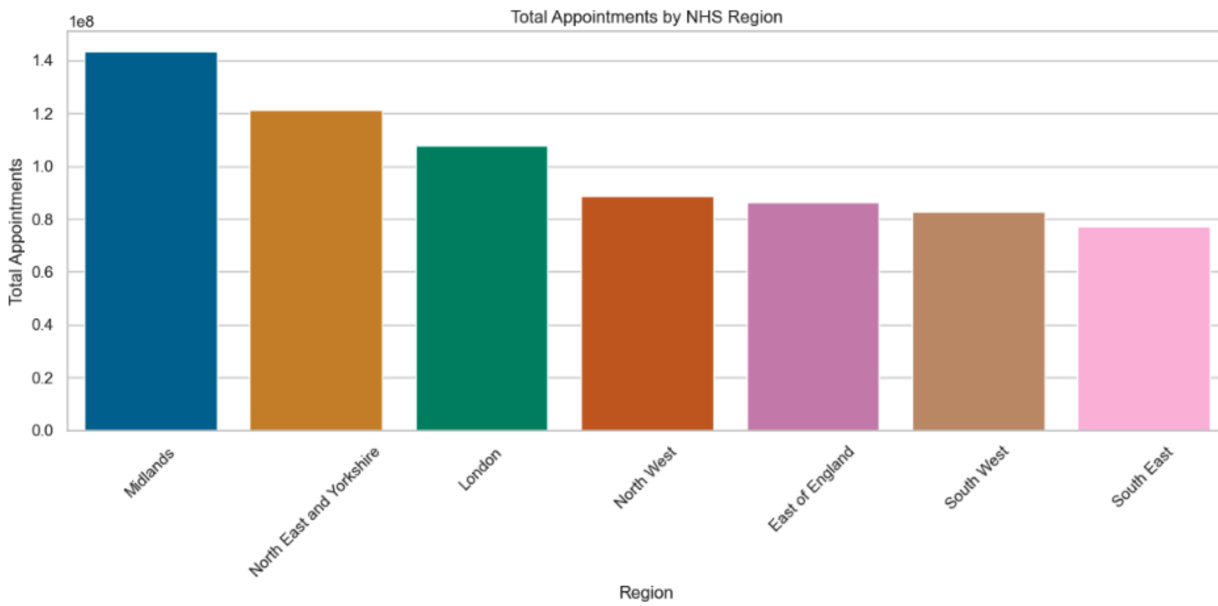


Eloise Farmer

8D) Region Level Analysis

The following charts provide a regional breakdown of appointment activity across NHS England. These visualisations were not included in the main body of analysis but offer useful context on variation between regions.

This chart displays *total appointment volumes by region* without adjusting for population. While the Midlands delivered the highest number of appointments overall, this must be interpreted alongside population size and per capita metrics. This further highlights the need for relative capacity assessment and more granular analysis.



By comparing appointment volumes to population size across NHS regions, the overall distribution appears broadly aligned, though some regions deliver more or less than their population share.

Highest number of appointments was The Midlands, accounting for 20% of all recorded appointments. The Midlands (comprising the East Midlands and West Midlands) has a combined population representing 16% of the UK population (ONS, 2021).

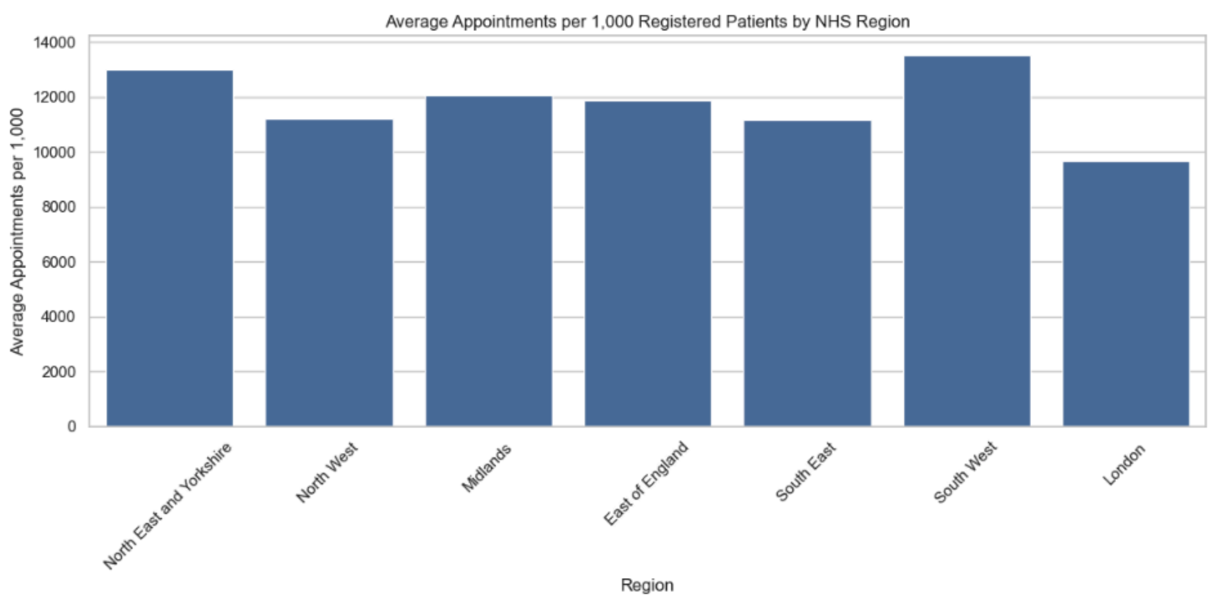
In contrast, the region with the lowest share of appointments was the South East, delivering 10.9% of total appointments. The South West has a population of approximately 5.7 million, which is 14% of the UK population (ONS, 2021).

<u>Values Used from ONS (2021)</u>
East Midlands: 4,880,800
West Midlands: 5,950,900
Combined Midlands: 10,831,700
South East: 9,311,600
UK total: 67,026,300

It is important to highlight the issue of data quality and completeness. The Midlands may benefit from more consistent reporting standards, which could partly explain its higher share of recorded appointments relative to population size.

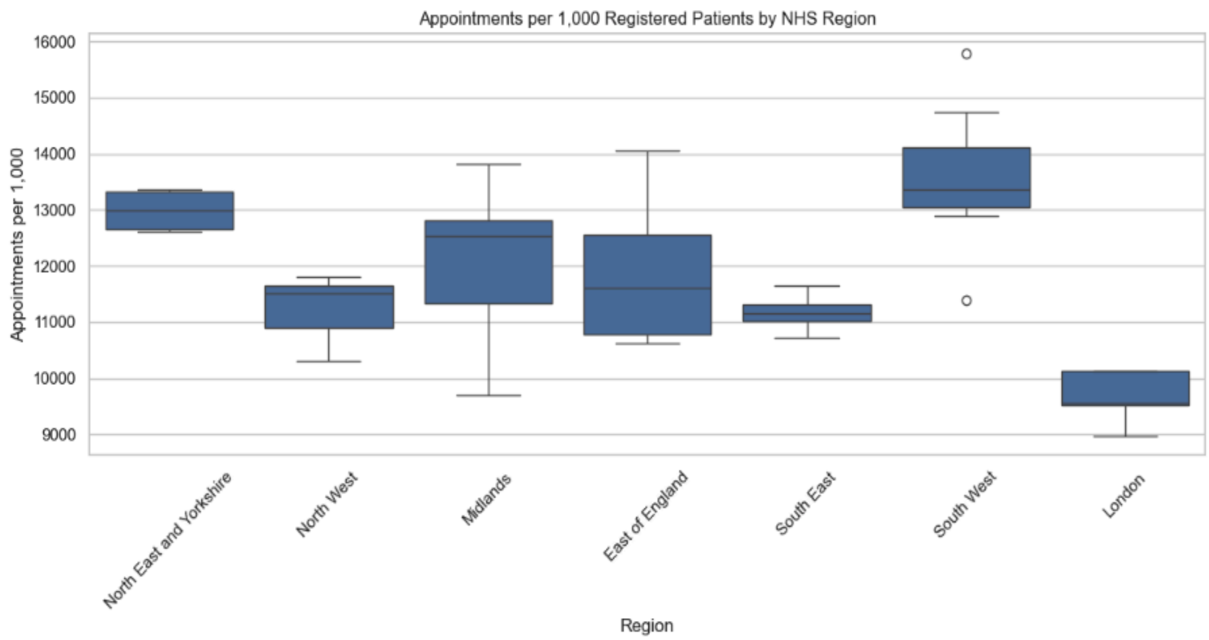
To enable meaningful comparison across regions of different sizes, this chart presents the average number of appointments delivered per 1,000 registered patients. These values were aggregated from the calculations described in Appendix 7C. While the Midlands and North East & Yorkshire delivered the highest number of total appointments, this reflects both high population and high service volume. However, when adjusted for population size, the South West, despite ranking lower in total appointments, emerges as the highest performer per capita, delivering the most appointments per 1,000 registered patients.

While averages provide helpful regional comparisons, they can mask substantial internal variation.

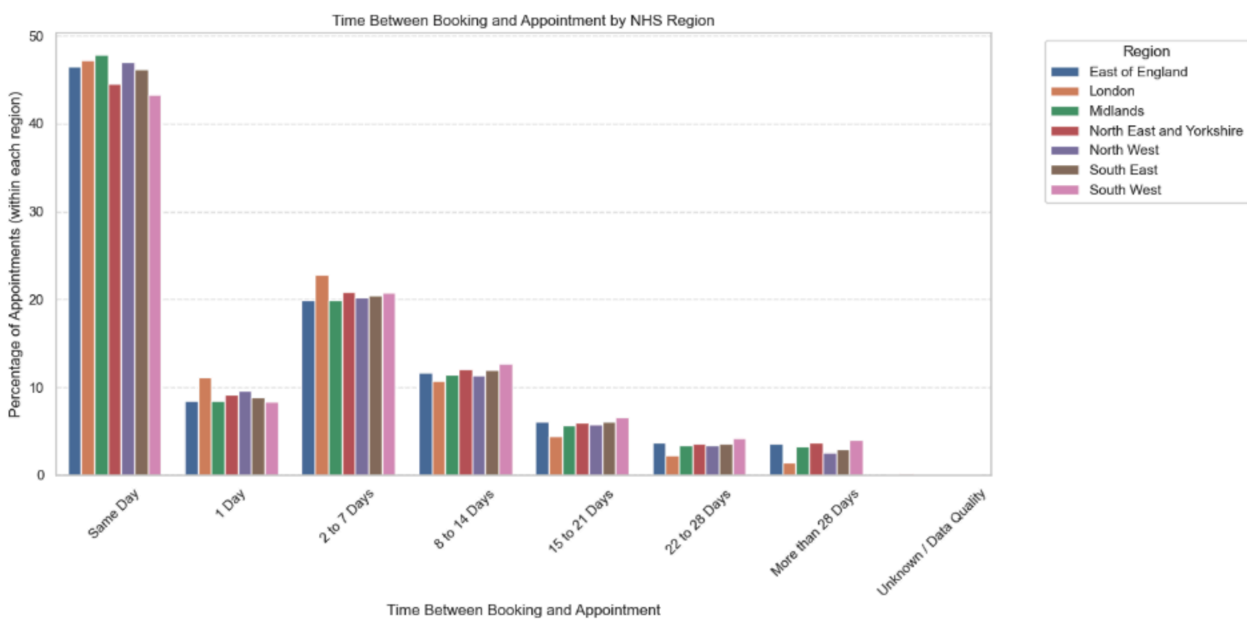


The boxplot reveals variation in appointment rates per 1,000 registered patients across ICBs within each NHS region. Regions such as the Midlands, East of England, and South West exhibit wider interquartile ranges (IQRs) and greater overall spread, indicating considerable variation in service delivery across ICBs. This suggests that while some ICBs in these regions may be delivering significantly above average, others are delivering less - potentially due to differences in capacity, reporting, or demand.

In contrast, North East & Yorkshire displays a narrow IQR and short whiskers, suggesting a high level of consistency in appointment delivery across its ICBs. London also shows a narrow IQR but consistently lower appointment rates, with little upward variation. These differences highlight the importance of evaluating region-level performance alongside ICB variation, particularly when making decisions about resource allocation or interpreting headline totals.



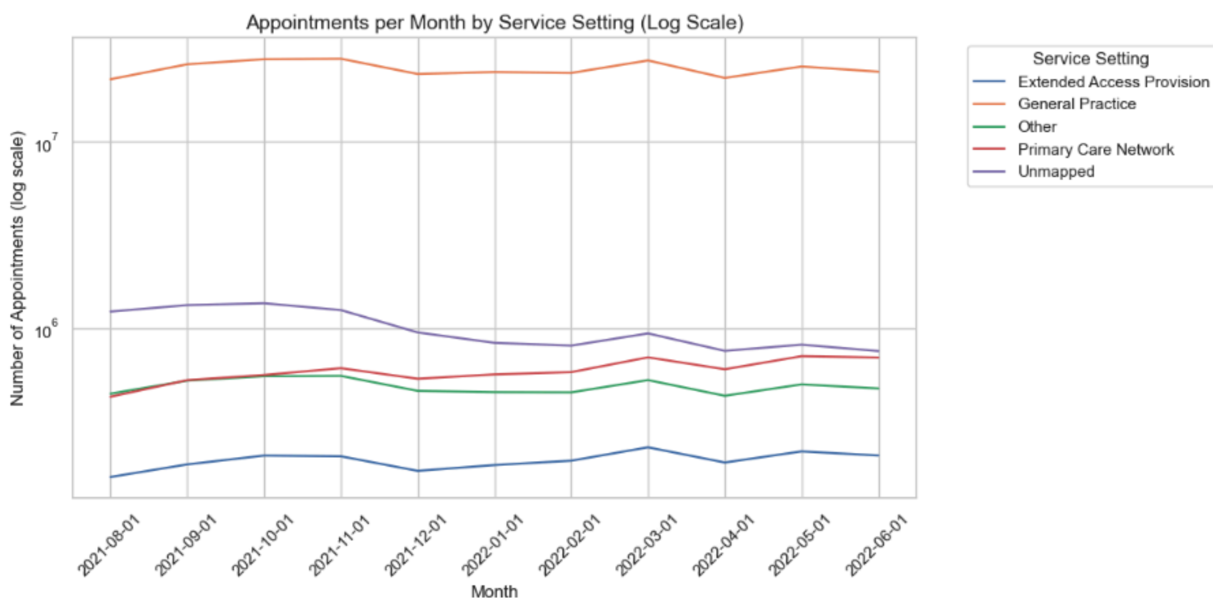
Time between booking and appointment is relatively consistent across regions.



Throughout this analysis, it was considered to plot at a sub_icb level but given there are 106 it was deemed impractical for the scope of this particular project.

8E) Service Setting

The following graph shows the monthly total of appointments by service setting across an 11-month period using the nc dataset. Due to the large difference in scale between General Practice and other service settings, direct comparison on a standard axis obscures the variation among smaller categories. To address this, a logarithmic scale was applied to the y-axis, allowing for easier interpretation.



- General Practice consistently dominates in appointment volume throughout the period, reflecting its central role in primary care delivery (91.5% of appointments)
- Unmapped appointments show a steady decline, suggesting improvements in service classification or data recording practices over time.
- Other service settings (e.g. Extended Access Provision and 'Other') remain relatively stable.
- Primary Care Network appointments increase gradually.

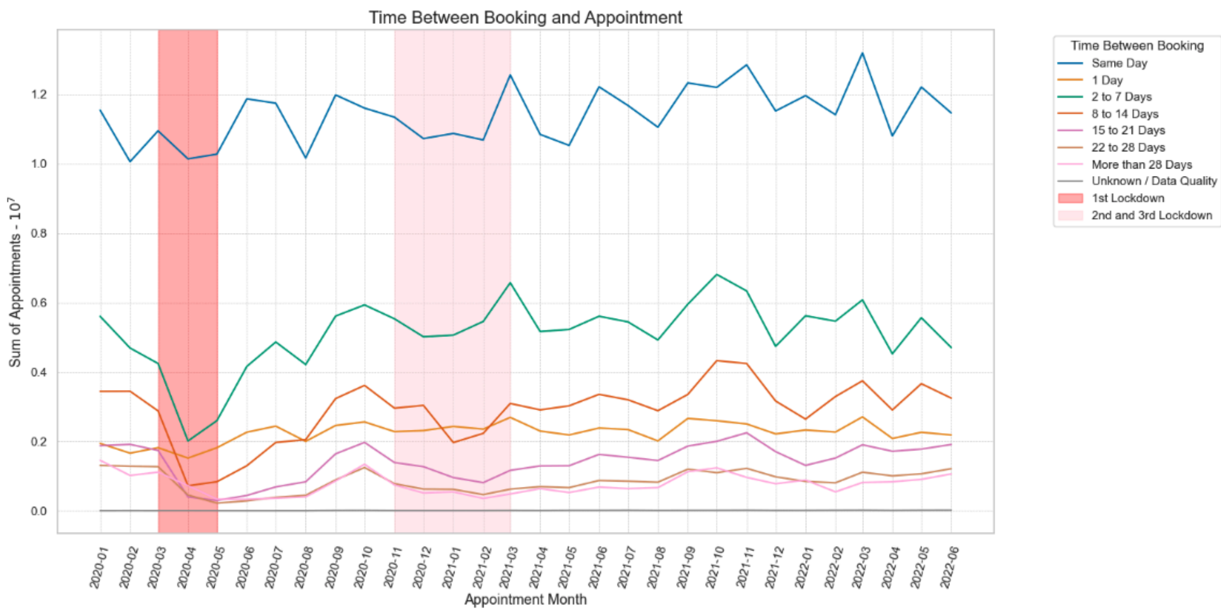
The rise in PCN appointments could be attributed to NHS England's Primary Care Networks (PCNs) initiative, established under the GP Contract Five-Year Framework (2019–2024). This policy was designed to improve access to care, expand the multidisciplinary workforce, and support proactive, population-based health management (NHS England, 2019a). The framework also introduced new funding streams and service specifications for PCNs, further incentivising their integration into routine appointment delivery.

Although an interesting graph, it was excluded from the business presentation as we already know that general practice dominates and is the focal point of the business questions.

8F) Time Between Booking and Appointment

The graph shows that the majority of appointments over time were delivered on the same day, followed by those booked 2–7 days and 8–14 days in advance. This pattern suggests that patients were generally able to access care within the recommended two-week target.

However, the graph also highlights distinct drops in total appointment volumes during the first and second/third national lockdowns, most notably in same-day and short-wait appointments. These dips reflect the immediate impact of the COVID-19 pandemic on routine primary care delivery.

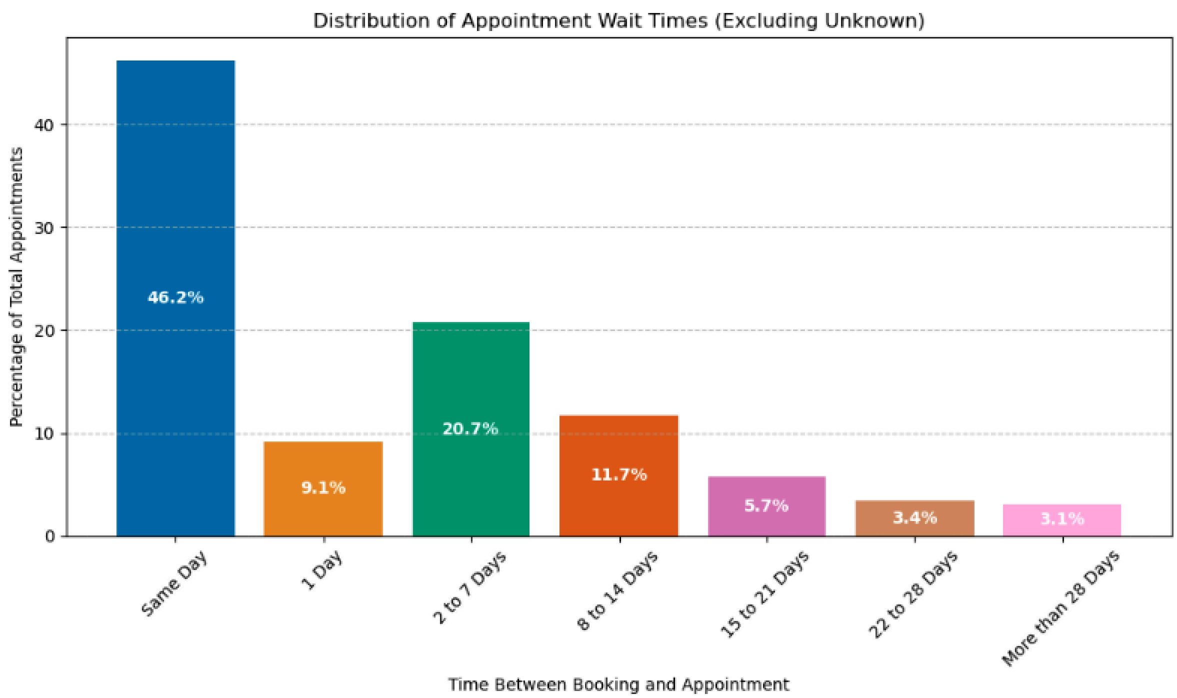


This analysis has utilised the less than 14 days ‘target’ for time between booking and appointment. That is, the NHS expects patients to be offered a routine GP appointment within 14 days of request. This is supported by incentive structures (QOF/IIF), practice-level triage policies, and government guidance stating that non-urgent appointments should be offered within two weeks.

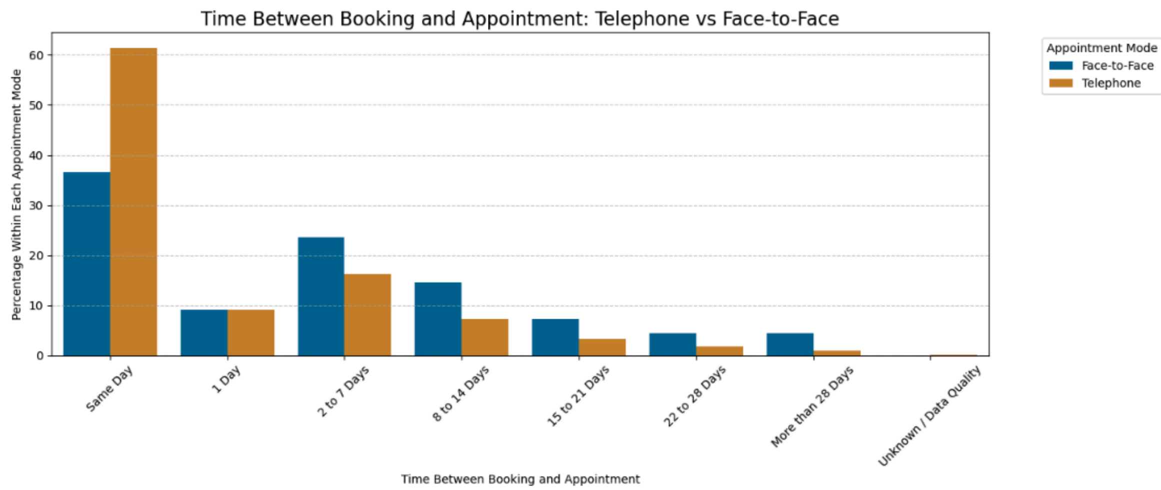
- UK Government Policy Announcement: Patients will be able to see their GP within two weeks - or sooner if clinically urgent (Department of Health and Social Care, 2022).
- NHS England (2023d) - Investment and Impact Fund (IIF) Indicators 2023/24: This document includes access-related indicators incentivising timely routine appointments, often referring to two-week access goals.
- NHS England (2023b) - Primary Care Access Recovery Plan: “We are clear that no patient should wait longer than two weeks for a routine appointment.”

- British Medical Association (n.d.) - GP Access Guidance: The BMA summarises NHS England expectations and confirms the goal of offering patients routine appointments within 14 days.

The graph below shows that 88% of appointments were delivered within the 14-day target. While this appears positive at first glance, the remaining 12% represents approximately 91 million appointments - a substantial volume. This highlights that even a relatively small percentage can equate to significant service demand and potential delays at scale.



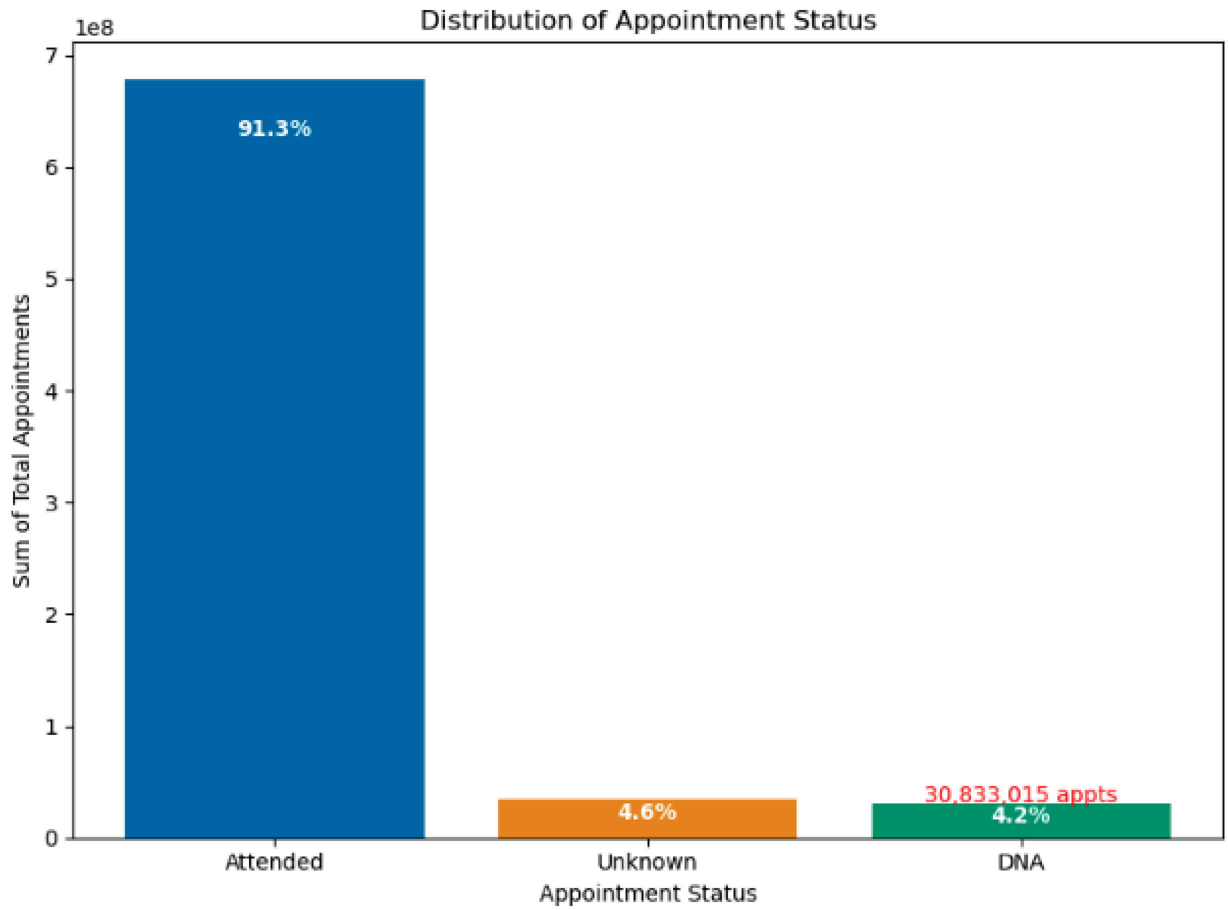
What else impacts time between? One clear factor is appointment mode. The graph below compares telephone and face-to-face appointments, revealing that telephone appointments are far more likely to be delivered on the same day. In fact, over 60% of telephone appointments are same-day, compared to around 35% for face-to-face. This reflects the greater flexibility and lower operational burden of telephone consultations.



8G) Appointment Attendance

At first glance, the data appears positive, with 91% of GP appointments marked as attended. However, a deeper look reveals that the 4% of appointments missed without notice (commonly referred to as “Did Not Attend” or DNAs) translate to over 30 million missed appointments. That's across the dataset date range of 30 months.

According to NHS England, each missed GP appointment costs the NHS an average of £30 (NHS, 2019b). When we apply an estimated cost of £30 per missed appointment, this equates to a staggering £924 million in lost value to the NHS. What appears to be a small percentage is actually a major drain on healthcare resources and system efficiency.



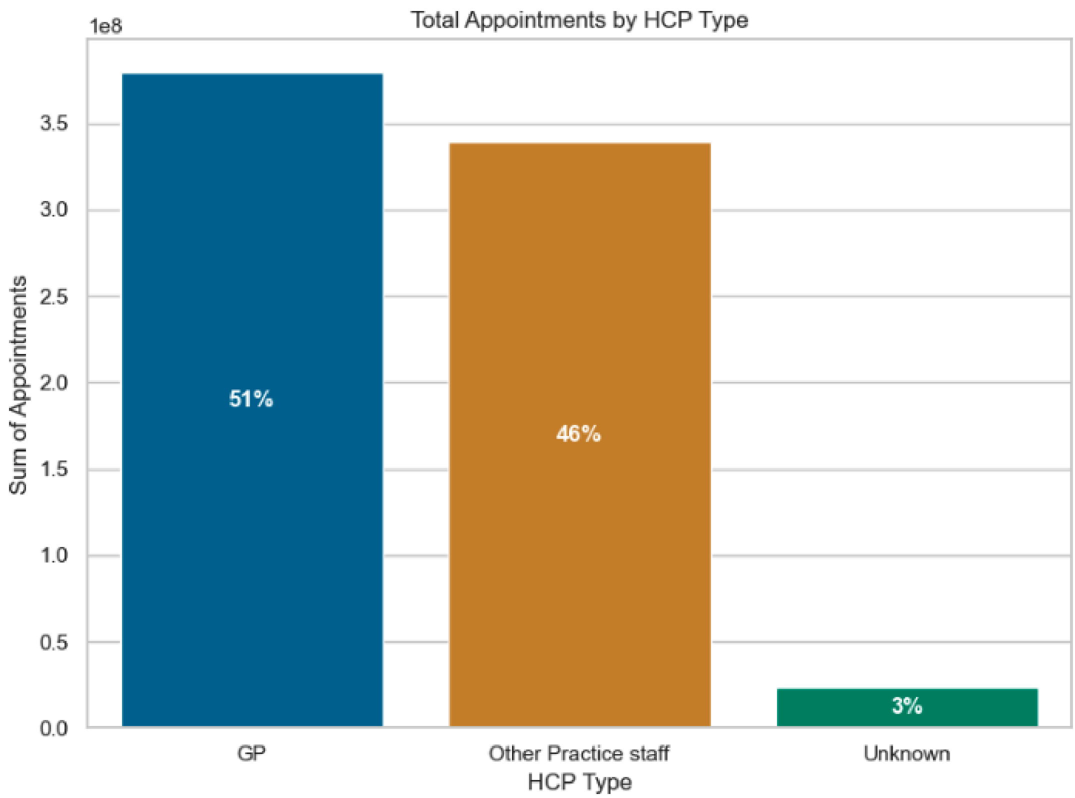
4% of appointments account for 30,833,015 appointments (30 x 30,833,015 = £924,990,450)

8H) HCP Usage

GPs were responsible for 51% of total appointments, while Other Practice Staff accounted for 46% - a surprisingly small gap that highlights how significantly non-GP clinicians contribute to care delivery. This suggests the NHS is already making considerable use of other healthcare professionals to manage demand and improve efficiency. The "Other Practice Staff" category includes a wide range of occupations, indicating that a substantial portion of routine and ongoing care is being delivered by non-GP staff.

While this grouping limits visibility into specific staff roles, the trend suggests a shift toward a more diversified primary care workforce. It also raises important questions about how these roles are deployed - for example, whether non-GP clinicians are disproportionately delivering telephone appointments, while GPs handle a greater share of face-to-face consultations. Further breakdown by staff type and appointment mode would provide valuable insight into current workforce utilisation patterns and future planning opportunities.

Note on data quality: According to the metadata, there are known issues with the accurate classification of healthcare professional types. Specifically, *"Healthcare professional type (HCP type) was incorrectly extracted for some practices from October 2017 onwards. This has led to potential incorrect reporting of some HCP Types, including nurses. The only HCP type currently collected with high enough consistency for publication is GP."*

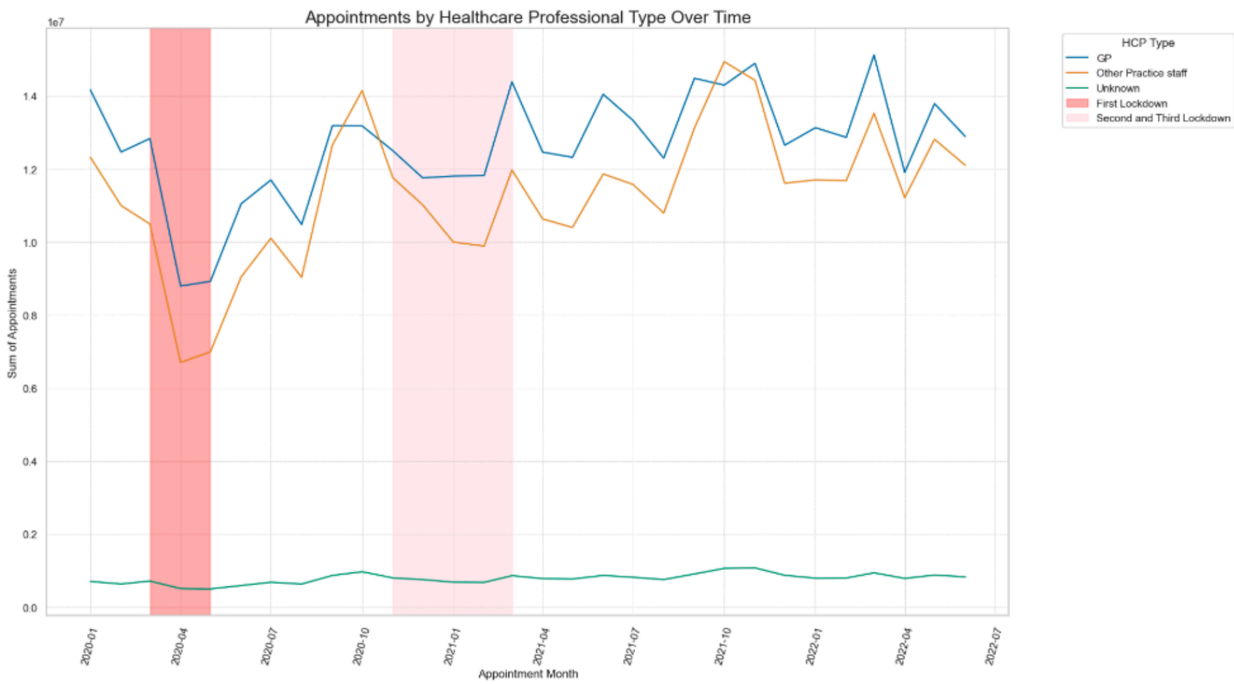


The occupations grouped as HCP type 'GP' are: GP registrar, Locum GP, Principal GP
The occupations grouped as HCP type 'Other Practice Staff' are:

- Acupuncturist
- Chiropodist
- Community Psychiatric Nurse
- Counsellor
- Dispenser
- District Nurse
- Health Visitor
- Interpreter/Link Worker
- Osteopath
- Other Practice Staff
- Physiotherapist
- Practice Nurse

It is clear that more granular categorisation is needed to accurately assess workforce distribution and resource utilisation, particularly as the NHS increasingly relies on a multidisciplinary team to deliver care at scale.

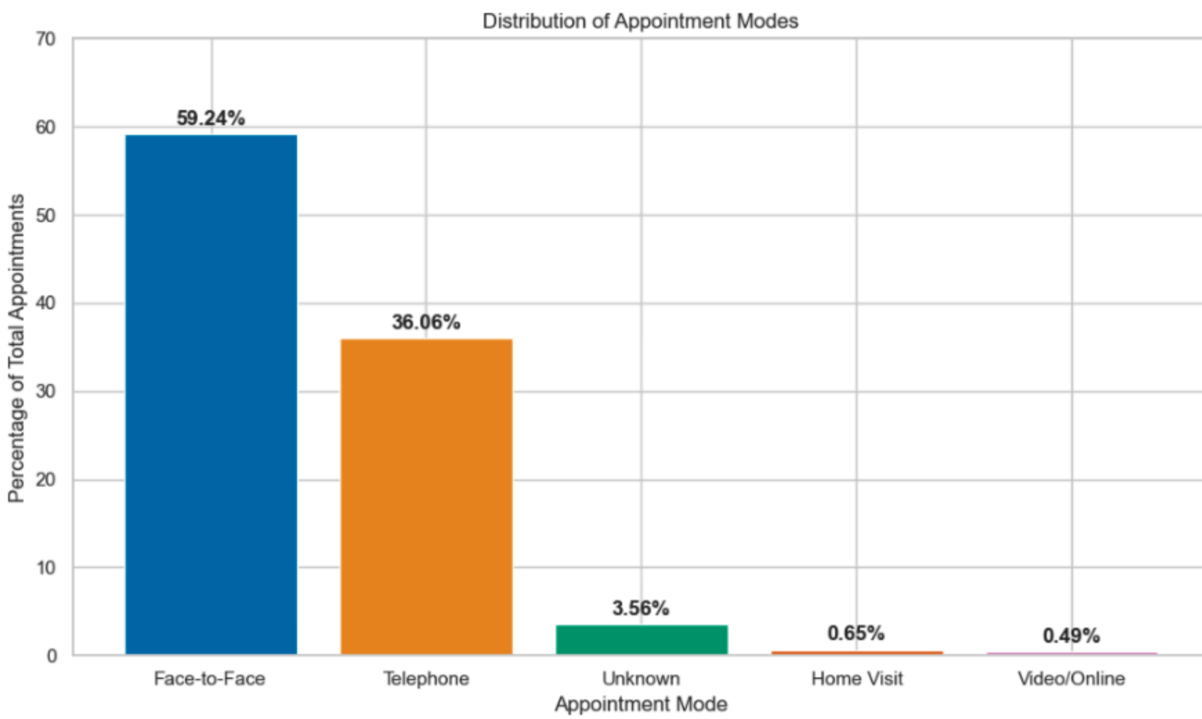
This graph shows that appointment trends for GPs and Other Practice Staff follow closely aligned patterns, with peaks and troughs occurring at similar points across the timeline. This likely attributes to a system-wide response, rather than isolated behaviour by certain regions. Interestingly, there are two distinct periods where Other Practice Staff briefly overtake GPs in appointment volume.



Expanding the use of Other Practice Staff - such as pharmacists, physiotherapists, and physician associates - plays an important role in tackling NHS workforce pressures and keeping up with rising demand. These roles help practices see more patients, take pressure off GPs by handling routine or lower-complexity tasks, and support more team-based, multidisciplinary care (NHS Confederation, 2023). While bringing in additional staff hasn't always reduced GP workload directly, early evidence shows they can improve prescribing quality, support safer medicine use, and boost patient satisfaction (NIHR, 2023a; NIHR, 2023b). Many patients also report positive experiences with these staff, especially valuing the longer appointment times and feeling listened to (NIHR, 2023b). As general practice continues to evolve, having a broader mix of professionals will be key to keeping services accessible, protecting GP time, and improving overall quality of care (NHS Confederation, 2023; Boseley, 2016).

8I) Appointment Delivery

- Appointments by mode show that the majority are delivered face to face (59%), followed by 36% via telephone.
- It is also important to note that 3.56% of appointments are categorised as 'Unknown', which amounts to more than 26.4 million records. This again represents a significant data quality issue.
- While video or online consultations represent only a small percentage, they still account for over 3.6 million appointments



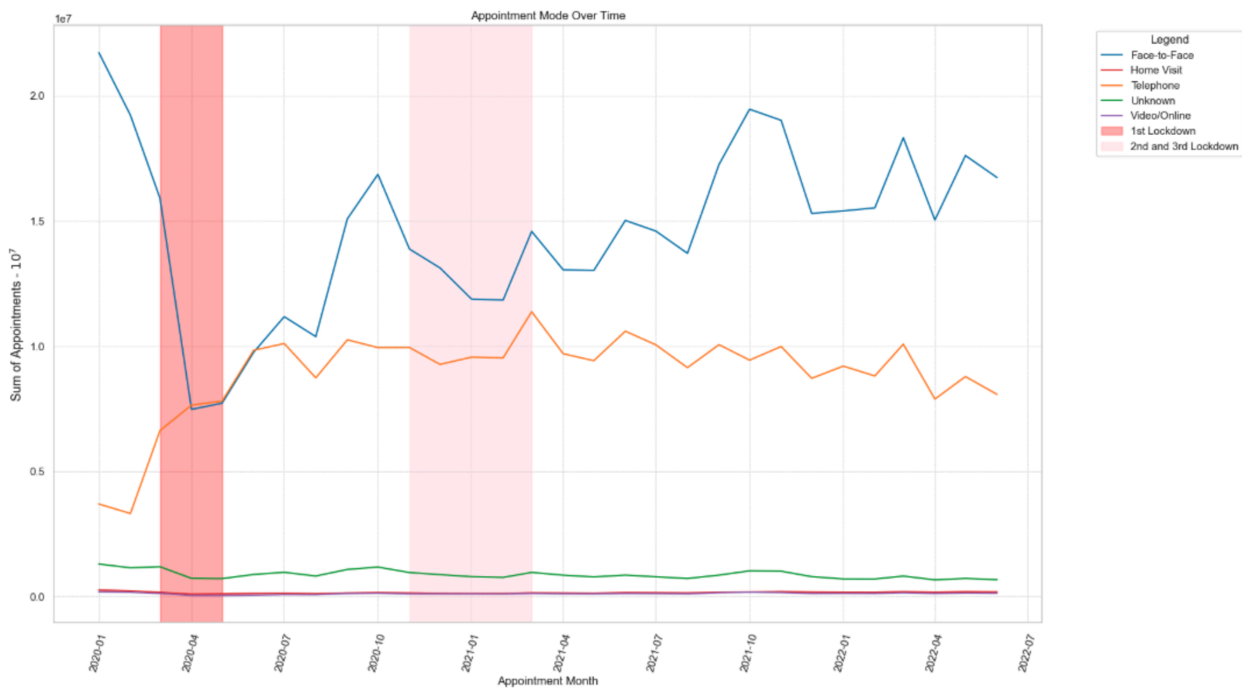
The monthly trend in appointment mode reveals several fluctuations, though face-to-face appointments consistently remain the most common. During the first lockdown, there is a noticeable drop in face-to-face appointments, likely driven by public health restrictions - while telephone appointments rose sharply in response.

Toward the later months of the dataset, telephone appointments gradually decline, while face-to-face delivery increases steadily, possibly reflecting patient or provider preference for in-person care. However, as highlighted in the report's recommendations, this shift should be explored further to determine the reason behind it.

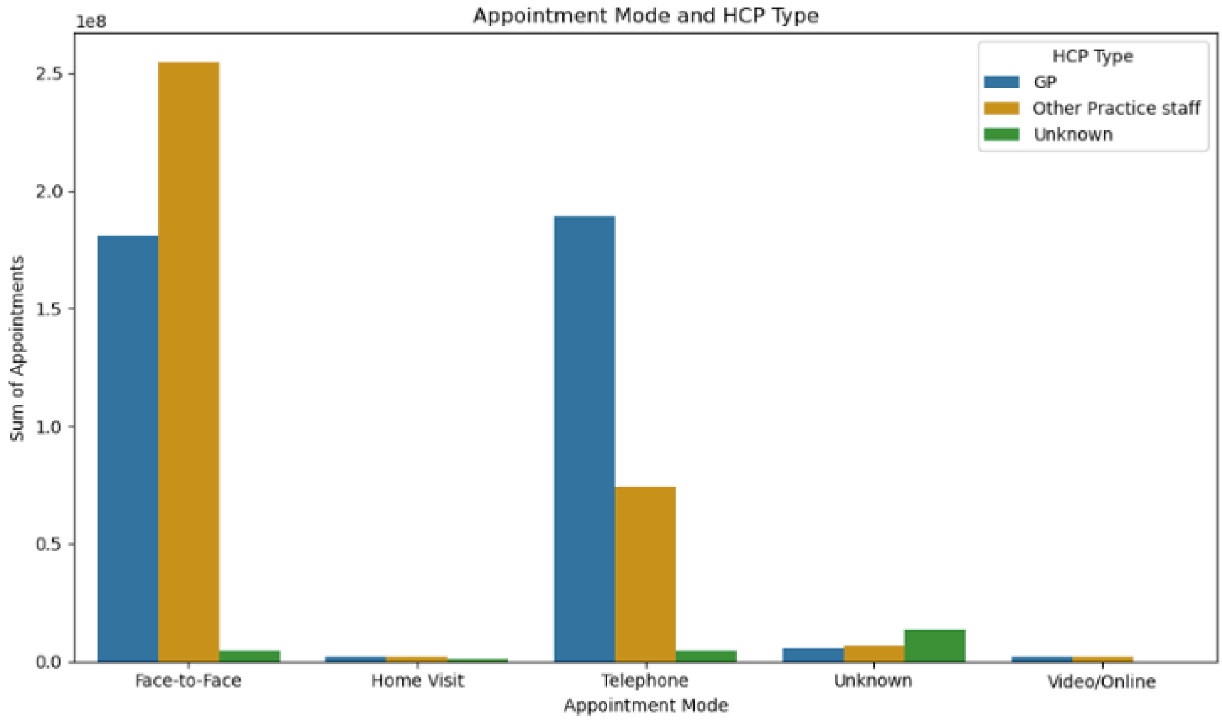
An analysis published in the *British Journal of General Practice*, based on data from 12,000 users of an online consultation system, found that telephone appointments were the most popular option. Patients reported that online and telephone modes saved time, reduced the need for unnecessary travel, helped avoid long appointment waits, and were preferred for discussing sensitive topics (University of Manchester, 2023).

Supporting this, another analysis of over 10 million patient-initiated contact requests across English GP practices (2019–2022) found that only a minority of patients explicitly requested face-to-face consultations, suggesting that remote access options are increasingly accepted and often preferred (The Health Foundation, 2023).

The NHS is already working towards increasing phone consultations (as explored in Appendix 10). It is vital that they continue to prioritise this.



The graph below demonstrates that Other Practice Staff deliver the majority of face-to-face appointments, while GPs complete the highest number of telephone consultations. This pattern suggests that Other Practice Staff play a key role in supporting the delivery of in-person care, thereby enabling GPs to focus on telephone consultations.

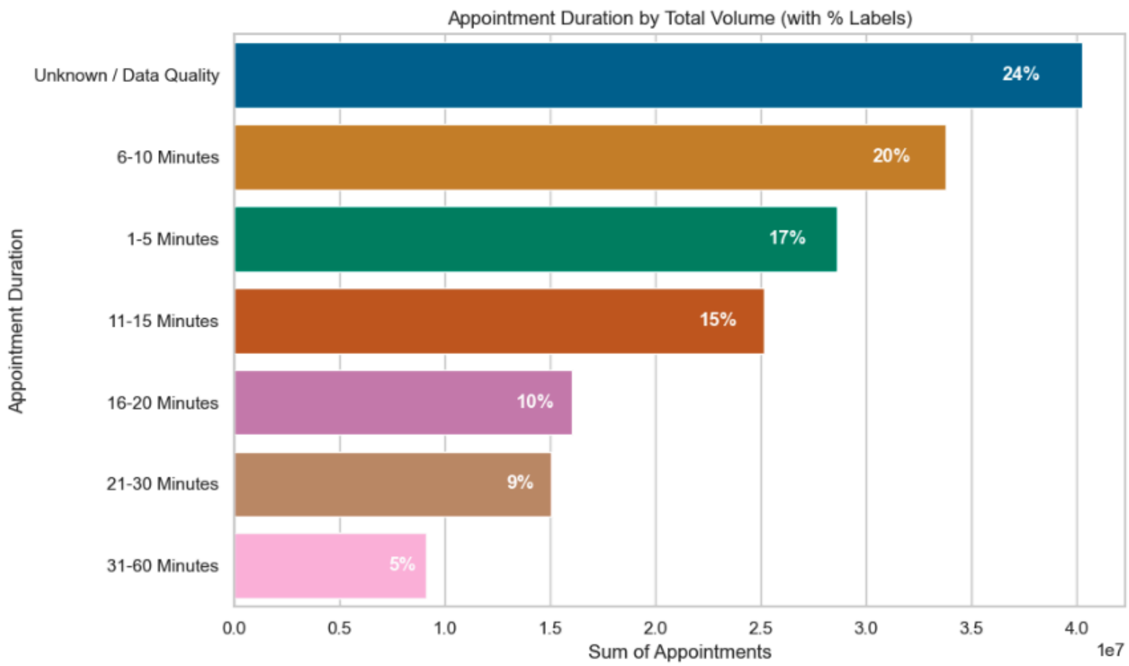


Telephone consultations are generally more time-efficient than face-to-face appointments, with multiple studies showing they require less clinical time - on average, around 1.5 minutes shorter per consultation (Downes et al, 2017; Bunn et al, 2005). This can translate into substantial time savings at scale, allowing GPs to manage more patients and triage care more quickly. Additionally, telephone consultations reduce the need for room allocation, patient waiting times, and administrative overhead. However, the efficiency benefits are not absolute - some studies report that increased volume and complexity of calls may offset time savings, and that telephone consultations can sometimes lead to follow-up in-person visits. Therefore, while telephone appointments can enhance operational efficiency, especially for routine or low-complexity issues, they should be used strategically alongside face-to-face care to maximise both clinical and resource effectiveness.

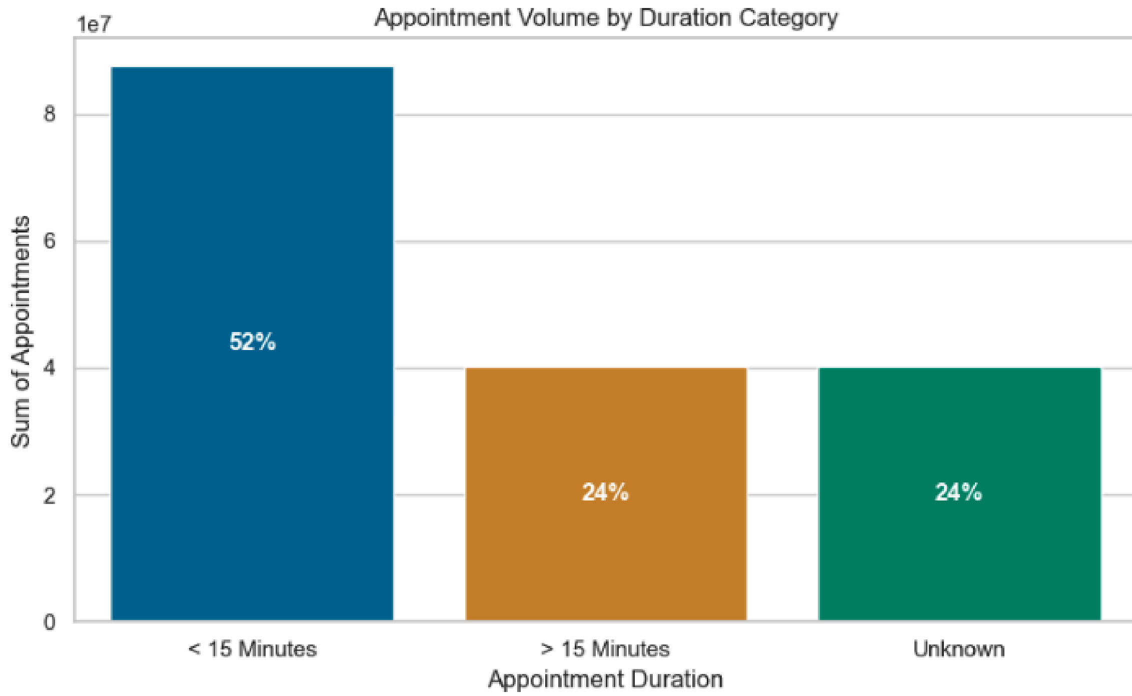
8J) Appointment Length

This data highlights significant inconsistencies in how appointment duration is recorded. A key limitation is that appointment length is not collected uniformly - it may reflect the scheduled duration, the actual start time, or the recorded end time, depending on how each practice uses the system. Notably, 24% of appointments are categorised as unknown or affected by data quality issues, representing over 40 million appointments.

While the NHS does not mandate a standard appointment length, both the British Medical Association (BMA) and the Royal College of General Practitioners (RCGP) (Boseley, 2016; RCGP, 2022) recommend a 15-minute duration for routine GP consultations. This benchmark provides a useful reference point for interpreting the data and identifying where improvements in scheduling and resource use may be required.



By grouping the data into three categories - appointments under 15 minutes, over 15 minutes, and unknown - we can assess how current appointment patterns align with this recommended benchmark.



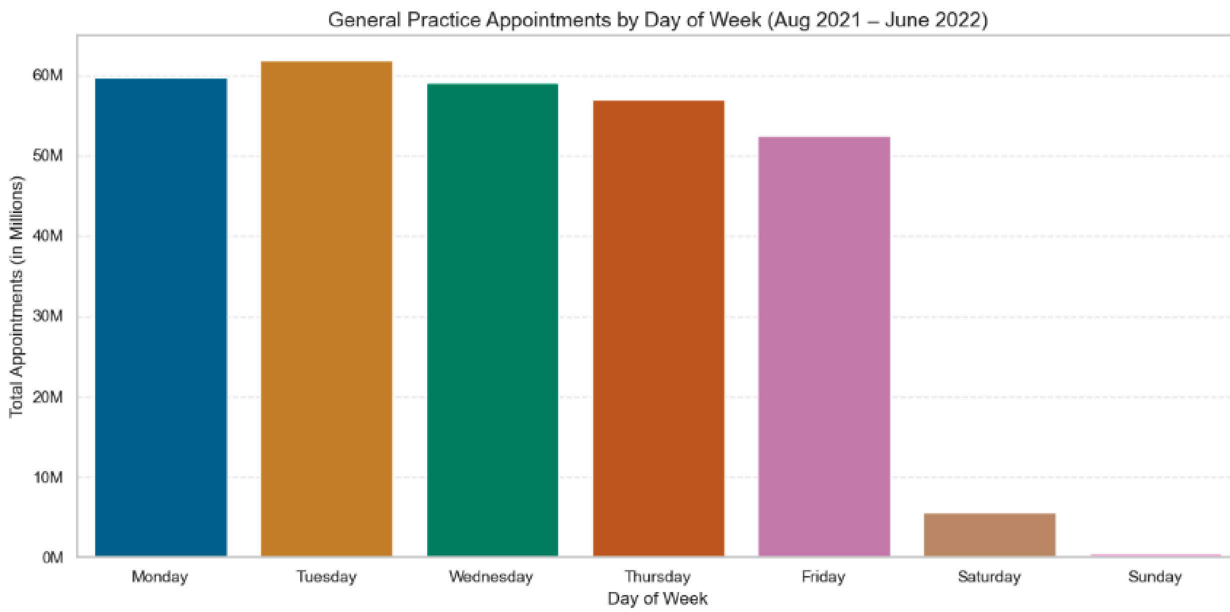
The data shows that 52% of appointments are within the recommended 15-minute window, while 25% exceed it. If GPs are consistently spending more than 15 minutes per appointment, this may contribute to inefficiencies across the staffing network, especially given rising demand.

As highlighted in earlier sections on Healthcare Professional (HCP) types, there are opportunities to optimise appointment length and distribution by ensuring GPs are not tied up with cases that could be effectively managed by other practice staff. This is particularly relevant for Face-to-Face appointments, which may take longer and could be reallocated to other team members where clinically appropriate.

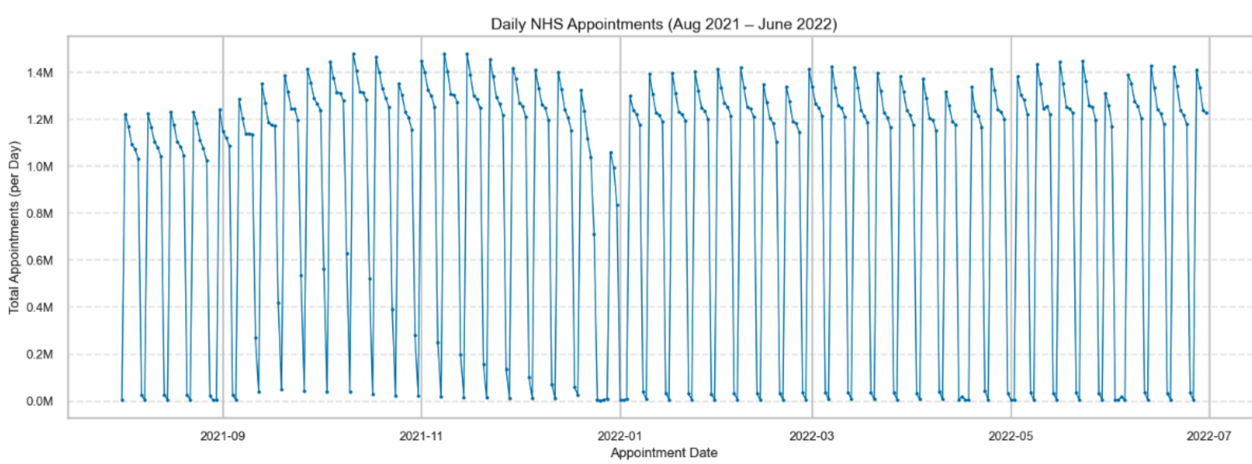
8K) Daily Trends

The graph shows that appointments are most concentrated at the start of the week, with Tuesday having the highest volume, followed closely by Monday. The slightly lower Monday figures are likely influenced by Bank Holidays, which typically fall on Mondays and reduce available appointment slots.

This chart uses the nc DataFrame, which provides 11 months of data (August 2021 to June 2022) and includes appointment dates. While the ad dataset also contains appointment date information, it spans only 8 months, making nc the preferred dataset for analysing weekly appointment trends.

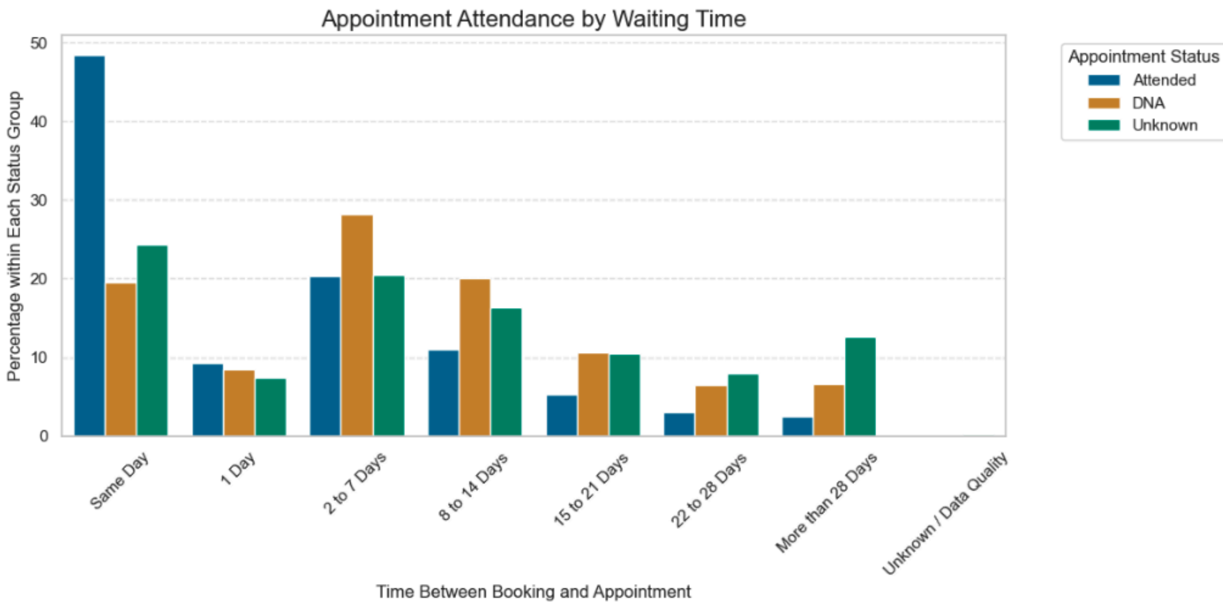


The next graph provides an alternative perspective by displaying appointment volume over time, with individual dots representing daily totals. A recurring weekly pattern is evident, where appointment volumes decline progressively from Monday through to Friday, followed by sharp drops on weekends. These weekend troughs are expected, reflecting limited service provision during Saturdays and Sundays.



8L) Additional Attendance Factors:

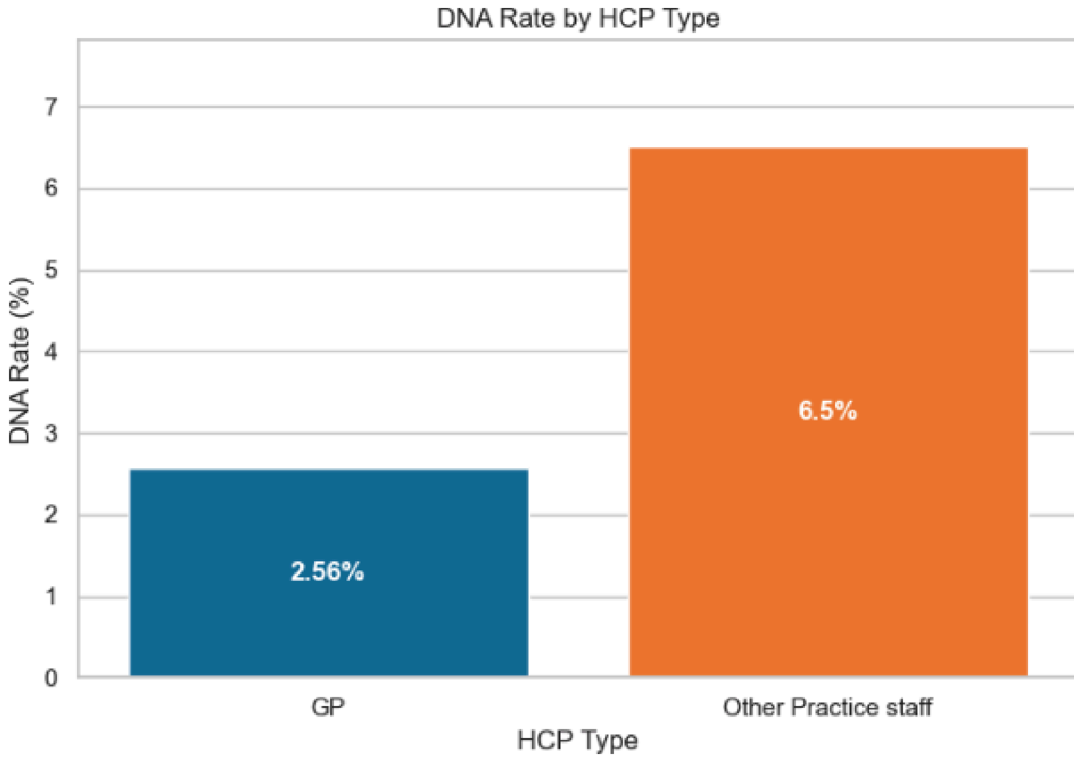
Booking-to-appointment time and Attendance
The chart below illustrates that attendance rates increase as the time between booking and appointment decreases. Same-day show the highest attendance, while longer waiting times are associated with a gradual decline in appointment adherence. This trend reinforces the importance of timely access in improving appointment outcomes and reducing non-attendance.



Attendance and Mode

A simple comparison shows that telephone appointments have a 95% attendance rate, while face-to-face appointments have an 89% attendance rate. This suggests that remote consultations may support greater appointment adherence, likely due to their convenience and flexibility for patients.

Attendance and HCP Type
The chart below shows there is a clear difference in Did Not Attend (DNA) rates between healthcare professional types. Appointments with Other Practice Staff (OPS) have a DNA rate of 6.5%, more than double that of GPs, which sits at 2.56%. This suggests that patients may engage differently depending on who the appointment is with. It would be valuable to explore patient perceptions and expectations around HCP types, as these attitudes could be influencing attendance behaviour and may present an opportunity to improve utilisation through better communication or targeted education.

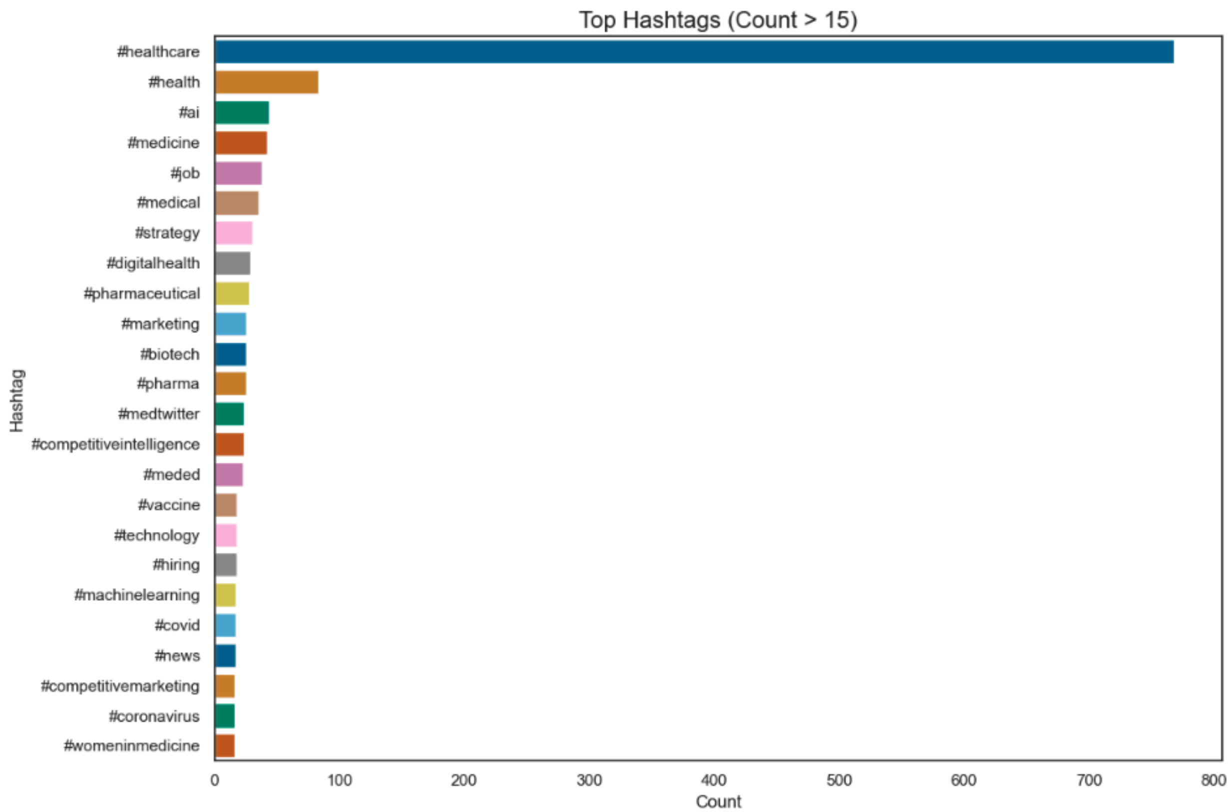


8M) Twitter Data

This section presents a social media analytics approach, using sentiment analysis and topic extraction to explore public conversation about the NHS on Twitter. The goal is to identify prevailing themes and emotional tone, offering additional insight into patient concerns and service perceptions outside of formal feedback channels.

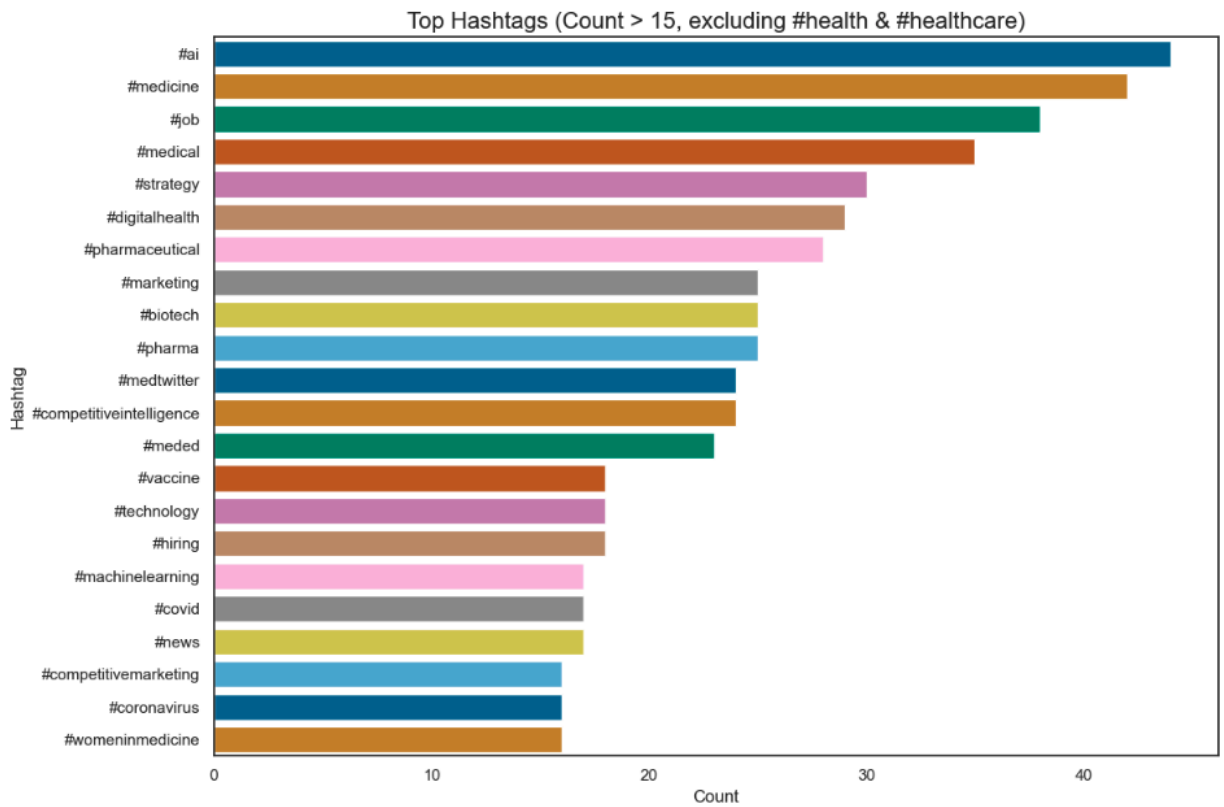
The most effective method using the data provided was to analyse hashtags. These were scraped and filtered by count. The graph below shows hashtags with a count greater than 15 - originally, all hashtags were displayed, but the graph became too cluttered (the full version can be viewed in the notebook).

Even so, this graph isn't especially insightful but does show the clear dominance of #healthcare in the dataset.



To better understand the data outside of #healthcare, it was removed in the following graph, as well as #health. Key themes can be extracted:

- Focus on technology: #AI, #digitalhealth, #technology, #biotech, #machinelearning
- Focus on job market: #job, #marketing, #competitive marketing, #hiring, #womeninmedicine
- #covid, #coronavirus and #vaccine sit below technology themes
- Additional healthcare hashtags remain: #medicine, #medical, #pharma, #pharmaceutical



The top favourited tweets were filtered to assess relevance to the NHS:

Tweet	**Hashtags**	**Insight**	**Favourite Count**
Lipid-Lowering Drugs #TipsForNewDocs #MedEd #MedTwitter #medicine #medical #medicare #health #healthcare #FOAMed #ClinicalPearl #clinicaltips #MedStudents #medstudenttwitter #lipid Credit: @medics_AbuSaif https://t.co/biwq6A1yVD	#TipsForNewDocs #MedEd #MedTwitter #medicine #medical #medicare #health #healthcare #FOAMed #ClinicalPearl #clinicaltips #MedStudents #medstudenttwitter #lipid	The link is an image about lipid lowering drugs and discussing statins, nicotinic acid etc.	42
You ready for JCO @_JennyCo ❤️\n\n#Healthcare data	#Healthcare	Difficult to depict but JennyCo is a cryptocurrency coin.	28

powered by @Conste11ationDAG 🔥			
How health insurance works 😂 \n\n#comedy #adulting #healthcare https://t.co/ciksdeoAkb	#comedy, #adulting, #healthcare	A 1 minute video about health insurance in America (comedy).	20

Is the data useful? Limitations and Future Potential of Twitter Data in NHS Analysis

The Twitter dataset provided in this project lacks the level of detail and contextual relevance required to draw robust conclusions about NHS service utilisation or missed GP appointments. Much of the content is either general or unrelated to primary care, with no ability to reliably filter tweets by healthcare setting, geography, or user type (e.g patients vs. professionals). Without metadata such as geolocation, timestamp precision, or user demographics, the dataset cannot be meaningfully linked to NHS performance indicators or appointment data.

However, existing research demonstrates that Twitter can be a valuable tool in healthcare analysis when applied in a targeted and methodologically sound way. For example, Greaves et al. (2014) showed that sentiment analysis of online text could successfully predict patient experience ratings in hospital settings, suggesting that social media posts can reflect real-world service perceptions. Similarly, Clyne et al. (2018) conducted a structured Twitter campaign (#ShowsWorkplaceCompassion) to collect qualitative data from NHS staff, illustrating how hashtags and prompt-based collection can generate insight into professional experiences and system pressures. Studies like these highlight Twitter's potential to surface public sentiment, access barriers, and behavioural drivers behind missed appointments - areas that are difficult to capture through administrative data alone.

Nonetheless, using Twitter data for healthcare analytics raises important considerations and risks, particularly around data privacy, representativeness, and ethical use. Because Twitter posts are public, they fall outside traditional consent models used in health research. While aggregation and anonymisation reduce some risk, analysts must be cautious about drawing conclusions that could affect specific communities without verifying broader representativeness.

To improve the utility of Twitter data for NHS-related insights in future projects, more refined data scraping approaches are required. These would include:

- Keyword and Hashtag Filtering
  - Search tweets using relevant health-related terms (e.g. "GP appointment," "NHS access," "#gpbooking," etc.) from the tweet_text_only column.
- Impersonal Metadata Collection - Collect only non-personal metadata such as:
  - Timestamp (to track trends over time)
  - Location information (if available) to allow mapping to regions or ICBs. This ensures the approach aligns with data privacy and ethical standards.

- Text Preprocessing
    - Clean and prepare tweet text by removing noise such as URLs, emojis, stop words, and duplicates.
- Natural Language Processing (NLP) Techniques - Apply NLP methods to extract insights:
    - Sentiment analysis to detect public mood (positive/negative/neutral) toward GP services or appointment systems.
    - Topic modelling to uncover recurring themes (e.g. difficulty booking, frustration with phone lines, digital access issues).

Incorporating these techniques would allow social media data to be used as a complementary layer to internal NHS analytics - providing richer, more real-time insight into why services may be underutilised, where public frustration is emerging, or how patients perceive appointment systems. With proper safeguards in place, Twitter data could support more patient-informed, data-driven service design across NHS primary care.

However, changes to Twitter's data access model have introduced significant barriers to large-scale social media analysis. With the discontinuation of free academic API access in 2023, collection of NHS-related tweets now requires a paid subscription, making such analyses less accessible to researchers. As a result, careful consideration is required before pursuing Twitter-based analytics, particularly in terms of feasibility, budget, and data availability.

Appendix 9: Understanding the lockdown and recovery periods & the impact of COVID on Primary Care

Period:	**Primary Care / GP Services Impact**	**Wider NHS System Context (Elective Care)**	**Key Sources**
First Lockdown (Mar 1 – May 1, 2020)	Face-to-face appointments dropped by up to 70%. Remote triage systems implemented rapidly. Routine care paused.	Elective surgeries suspended mid-March to create COVID surge capacity.	BMA (2022); Health Foundation (2022b); NHS England (2020)
First Backlog Recovery (May 1 – Oct 1, 2020)	GP services gradually restored; some in-person care returned under new safety measures.	Hospitals began phased elective recovery, though backlog was substantial.	NHS England (2020); BMA (2022)

Second/Third Lockdown (Nov 1, 2020 – Mar 1, 2021)	Remote GP consultations remained dominant. GPs began COVID vaccination rollout in Dec 2020. Staff diverted from routine care.	Elective care reduced again due to winter wave pressures.	BMA (2022); NHS England (2021); Nuffield Trust (2022)
Second Recovery (Aug 1 – Nov 1, 2021)	NHS pushed for increased face-to-face access in general practice. Pressure and demand remained high.	Hospitals increased elective work with recovery funding but faced constraints.	NHS England (2021); House of Commons Library (2021)
Omicron Wave / Christmas (Dec 1, 2021 – Feb 1, 2022)	Omicron wave led to widespread staff absence and booster campaign prioritisation. Routine appointments disrupted again.	Over 100,000 elective procedures cancelled; NHS under winter strain.	Nuffield Trust (2022); BMA (2022)

Appendix 10: NHS Initiatives Summary since 2022

The table below summarises key NHS initiatives introduced since 2022 that aim to improve general practice delivery. This research was used to improve understanding and provide context to the analysis team.

Year	Initiative	Key Focus	Reference
2022	Plan for Patients (DHSC)	GP appointments within 2 weeks; investment in phone systems, pharmacy access, and workforce support.	DHSC, 2022
2023	Primary Care Access Recovery Plan (NHS England)	Improved telephone access, triage, same-day care, and real-time appointment data visibility.	NHS England, 2023
2023	Investment and Impact Fund (IIF) 2023/24	Incentivising access, timeliness, and appointment volumes via Primary Care Networks (PCNs).	NHS England, 2023d
2023	Additional Roles Reimbursement Scheme (ARRS) – Expanded	Funded expansion of non-GP roles (e.g., pharmacists, paramedics, PAs) to increase appointment capacity.	NHS England, 2023a

2023–25	Federated Data Platform (FDP) (NHS England)	Secure, integrated data platform for capacity planning, elective recovery, and population health.	NHS England, 2023c
2024	NHS Long Term Workforce Plan	Scaling medical training, supporting flexible work, improving retention, and reducing workforce gaps.	NHS England, 2024a
2024	Primary Care Data Dashboard Updates (NHS Digital)	More granular public tracking of appointment mode, volume, and access trends across regions.	NHS Digital, 2024a
2024	NHS App Integration Expansion	Integration of appointment booking and patient-reported experience data into national systems.	NHS England, 2024b
2025	GP Workforce Updates (NHS Digital)	GP headcount rose by 3.2%, while FTE growth lagged at 1.8% – highlighting part-time working trends.	NHS Digital, 2025a

Appendix 11: Staffing Patterns

It is difficult to analyse utilisation of resources without wanting to explore the trends of staff within the NHS.

NHS staffing pressures follow a predictable seasonal pattern, with peak shortages in winter due to a combination of increased sickness, annual leave, and heightened service demand. Summer also experiences reduced capacity from staff holidays and transitional disruption during the August junior doctor rotation (Palmer, 2022; NHS England, 2022; NHS Digital 2024a; BMA, 2023). These cyclical patterns underscore the importance of proactive workforce planning to maintain appointment availability and service resilience throughout the year.

> NHS workforce data reveals an annual increase of 33,347 professionally qualified clinical staff since April 2024 - a 4.2% rise - indicating sustained investment in clinical capacity across the system (NHS, 2025b).
>
> From 2023 to 2024, there was a 3.7% increase in the number of General Practitioners, with headcount rising to 47,181 (NHS Digital, 2024c). However the number of full-time equivalent (FTE) GPs increased by just 2.6%.
>
> From 2024 to 2025, the GP headcount rose by a further 3.2%, while the number of full-time equivalent (FTE) GPs increased by just 1.8% (NHS Digital, 2025a). This highlights the continued prevalence of part-time and flexible working arrangements in general practice.

Continued investment in increasing NHS staffing is essential to meet ongoing service demand and reduce delays. Staffing pressures follow a predictable seasonal pattern.

NHS Digital data consistently shows headcount increases outpacing FTE increases - meaning more people are entering the workforce, but not in full-time roles. The NHS should move away from traditional, full-time GP models and continue to capitalise on this recruitment trend by designing services that better accommodate and support a flexible, non-FTE workforce.

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