NHS UK – Appointments Data Explanatory Data Analysis

Prepared and Presented by

Sujith Kumaar K C

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LSE THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

Objectives

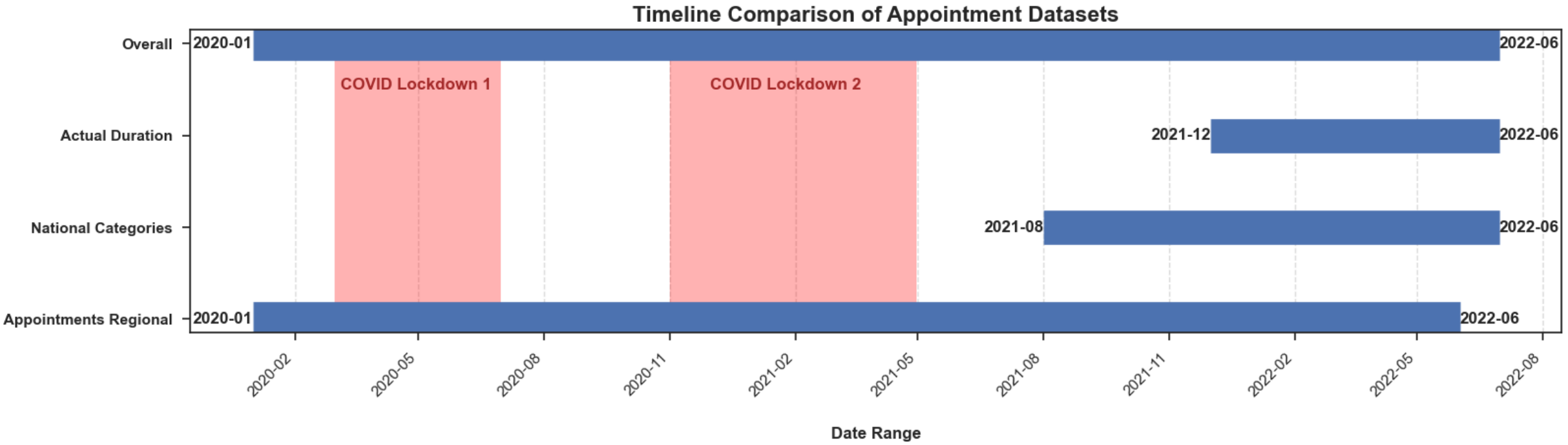
- **OBJECTIVE**
  - Gain insights into Service Utilisation patterns, Missed Appointments and explore possibilities for external data usage
- **GOALS**
  - Improve Utilization trends
  - Understand staff and capacity adequacy
  - Reduce Missed appointments

Data Overview

Dataset	Data Frequency	Start Date	End Date	Range
Appointments Regional	Monthly	2020-01-01	2022-06-01	30 months
National Categories	Daily	2021-08-01	2022-06-30	11 months
Actual Duration	Daily	2021-12-01	2022-06-30	7 months
Overall	-	2020-01-01	2022-06-30	30 months

The analysis has been performed with data provided in 3 datasets with different date ranges.

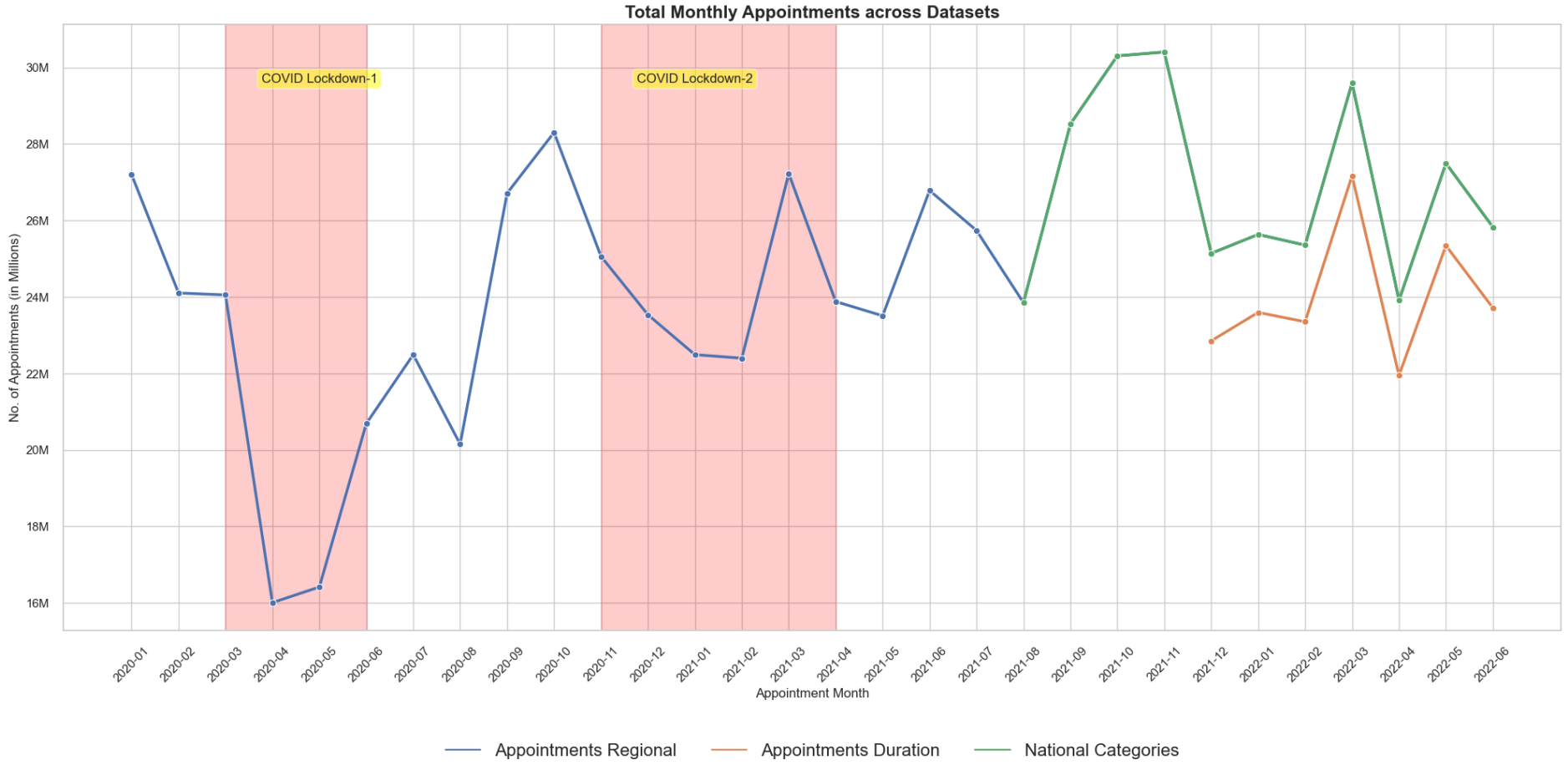
- **Appointments regional** – A monthly aggregated dataset with 30 months of data comprising details on Appointment Mode, HealthCare Professional Type and Time between Appointment and Booking and the no. of appointments served by these categories.
- **National Categories** – A daily dataset with 11 months data comprising details on Service Setting, National Categories and Context type.
- **Actual Duration** – A relatively new dataset with just the attended appointments for 7 months of daily data comprising details of the duration of appointments.
- All 3 Datasets have approximately even distribution of records across the months suggesting there is no skewness towards any particular time period.



Timeline and Monthly Appointments Overview

•**COVID-19 Impact:** The chart illustrates two lockdown periods (shaded red) that distinctly affected appointment volumes. A significant decline in appointments is observed during lockdown-1 (April-May 2020) and a more moderate decrease during lockdown-2 (November 2020 - February 2021).
• **Post-Lockdown Recovery:** Following each lockdown, appointment volumes exhibited a pronounced rebound, particularly after lockdown-1. This likely reflects the rescheduling of delayed or postponed appointments once restrictions were lifted.
• **Appointments Growth:** Post-lockdown, appointments exhibited considerable fluctuations, indicating shifting patient demands or adaptations in healthcare services in response to the pandemic.
• **Actual Duration:** The difference in appointments between National Categories and Actual Duration highlights the number of missed appointments within that month, which will be analysed in more detail subsequently.

Maximum Appointments	30,405,070
	Nov-2021 (4.1%)
Minimum Appointments	16,007,881
	Apr-2020 (2.2%)
Average Monthly Appointments	19,133,197
30 Month Total	742,804,525



NHS Appointment Distribution by Location: Aug 2021 - Jun 2022

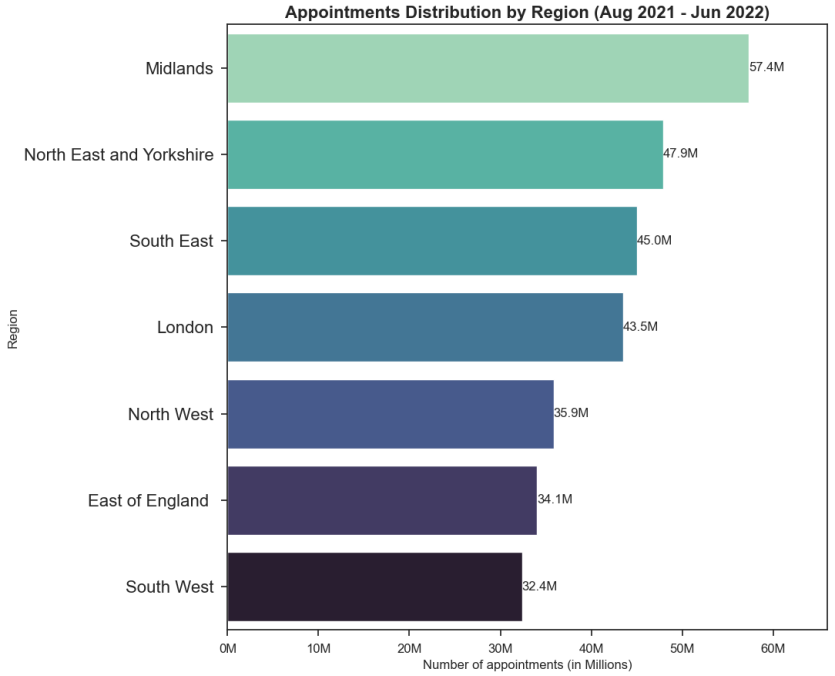
Total Appointments	Regions	ICB Locations	Sub-ICB Locations	Time Period
296,046,770	7	42	106	Aug 2021 – Jun 2022 (11 months)

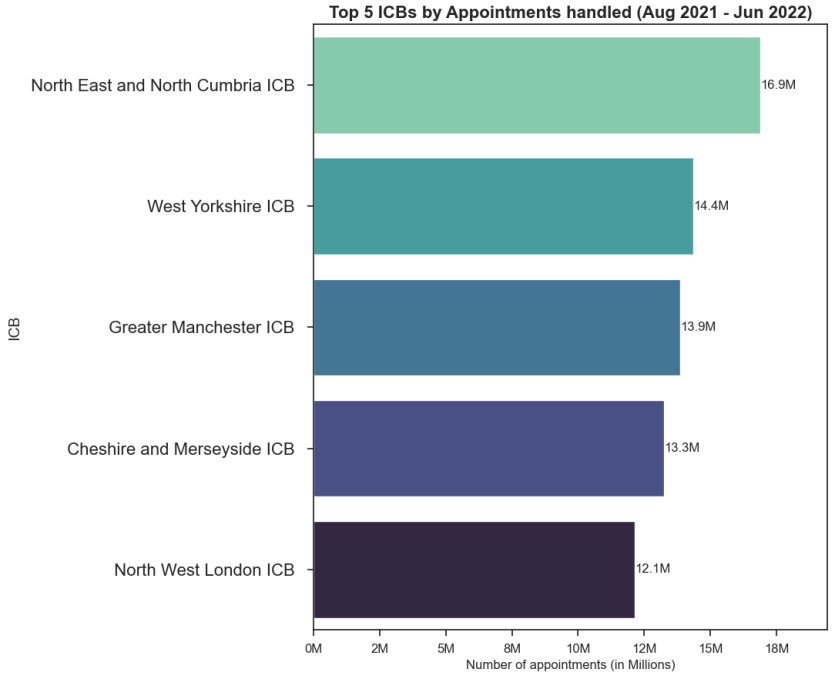
#	Region Name	ICBs	Sub-ICBs	Avg. Monthly Appts
1	Midlands	11	19	5.21 Million
2	North East & Yorkshire	4	23	4.35 Million
3	South East	6	11	4.09 Million
4	London	5	5	3.95 Million
5	North West	3	27	3.26 Million
6	East of England	6	14	3.09 Million
7	South West	7	7	2.94 Million

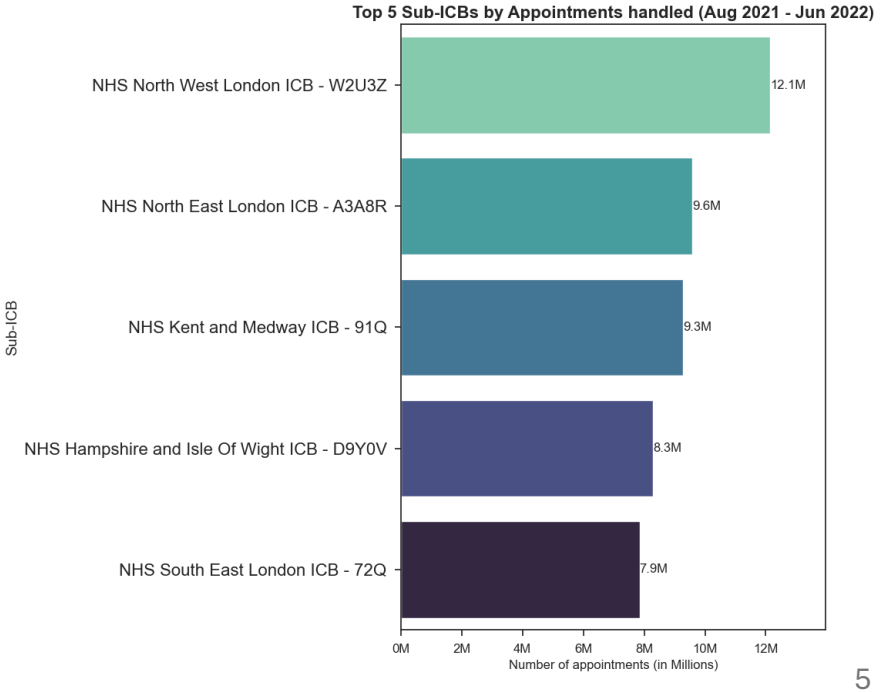
Insights:

- England has been divided by NHS into 7 regions and 42 ICB Locations as a restructuring effort from July 2022. These 42 ICBs comprise of 106 Sub-ICBs (previous administrative units called CCGs)*.
- The data analysis would be aggregating CCG / sub-ICB level data at a Region / ICB level.
- The 42 ICBs are split across 7 regions.
  - Midlands has the most ICBs (11), managing 57.4 Million appointments over 11 months (avg 5.21 Million monthly).
  - North West has the fewest ICBs (3), handling 35.9 Million appointments (3.26 avg monthly).
  - North East and North Cumbria ICB (Region: North East & Yorkshire) led ICB-level appointments at 16.9 Million.
  - North West London - W2U3Z Sub-ICB (Region: London) led Sub-ICB level appointments at 12.1 Million.

*Citation: NHS Confederation (2022), Integrated care systems (ICS): parliamentary briefing.

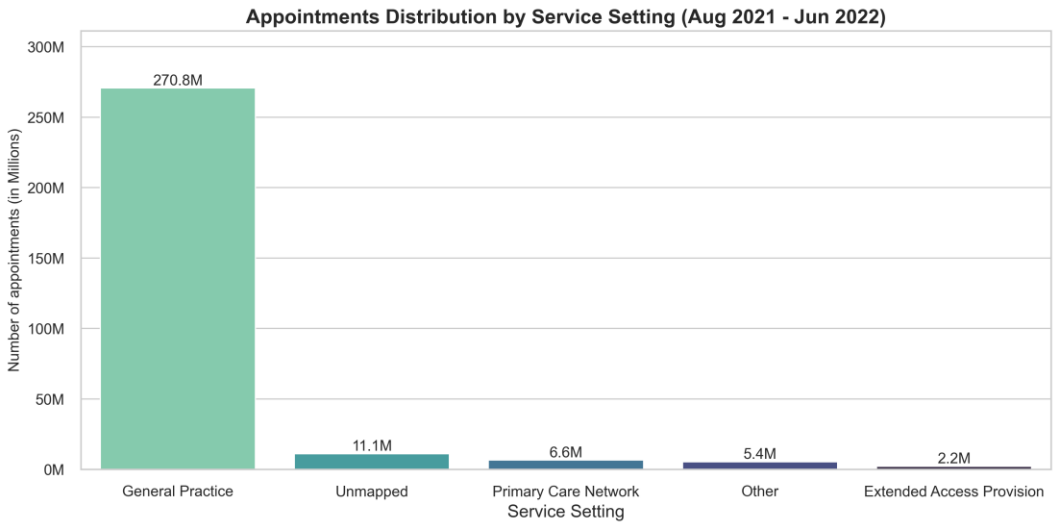






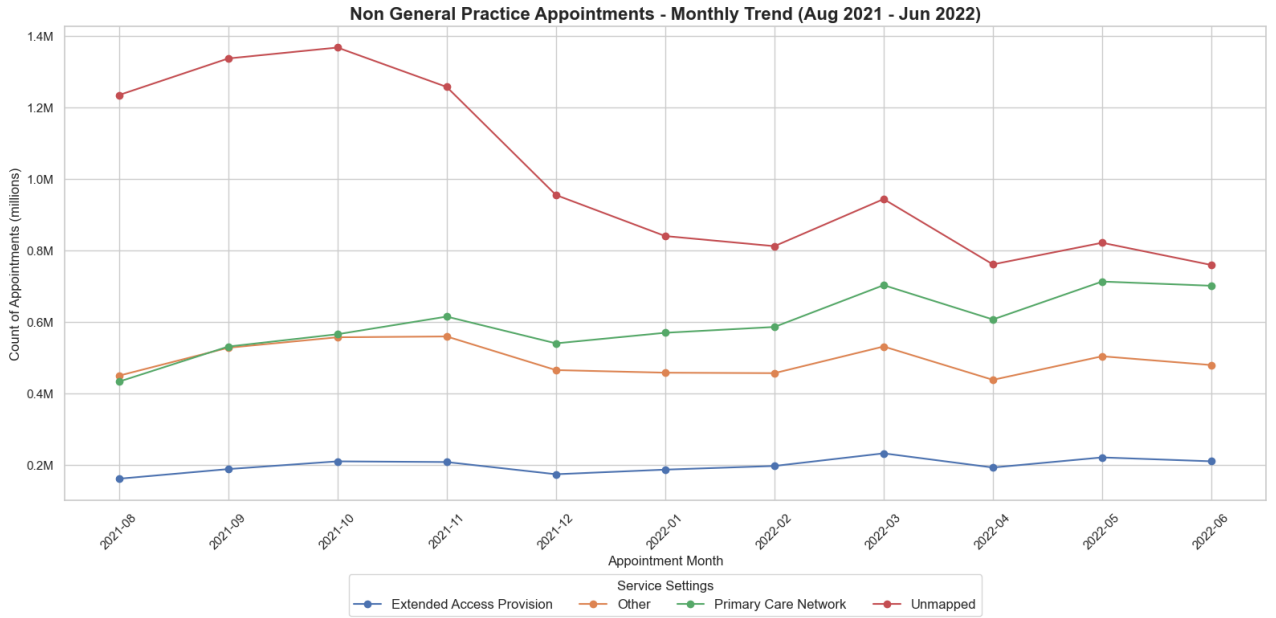
NHS Appointment Distribution by Service Setting: Aug 2021 - Jun 2022

Total Appointments	General Practice	Unmapped	Primary Care Network	Other	Extended Access Provision	Time Period
296,046,770	270,811,691 (91%)	11,080,810 (4%)	6,557,386 (2%)	5,420,076 (2%)	2,176,807 (1%)	Aug 2021 – Jun 2022 (11 months)



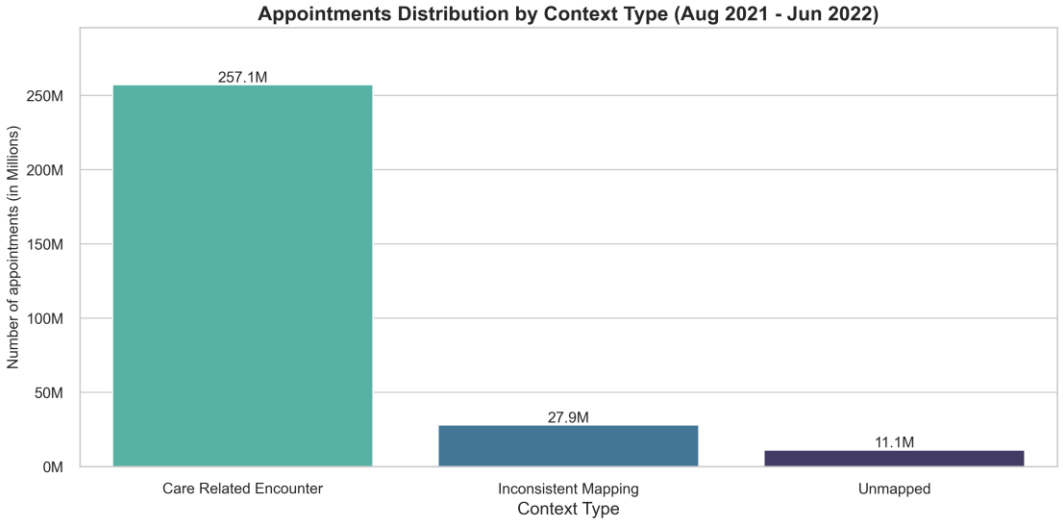
Insights:

- General Practice dominates NHS appointments, accounting for 91% of all appointments.
- There's significant variation in General Practice appointments over time, with peaks around October-November 2021 and March-April 2022.
- Unmapped appointments are the second largest category at 4% - Monthly trends show that this is being actively addressed and it has reduced significantly (1.2M in Aug 2021 to 0.7M in June 2022)
- Primary Care Network (PCN) and Extended Access Provision (EAP) appointments are relatively small portions of the total, at 2% and 1% respectively. PCN, has improved recently.
- All service settings except GP show more stable appointment numbers over time.
- There appears to be a seasonal pattern in General Practice appointments, with dips likely corresponding to holiday periods (December, August).



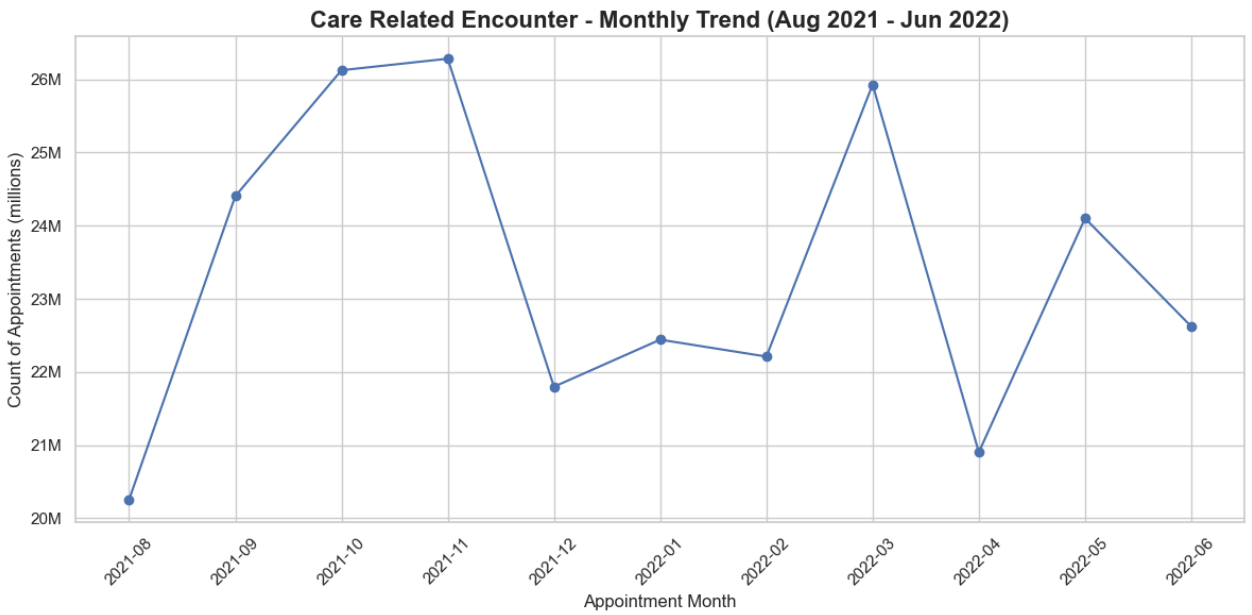
NHS Appointment Distribution by Context Type: Aug 2021 - Jun 2022

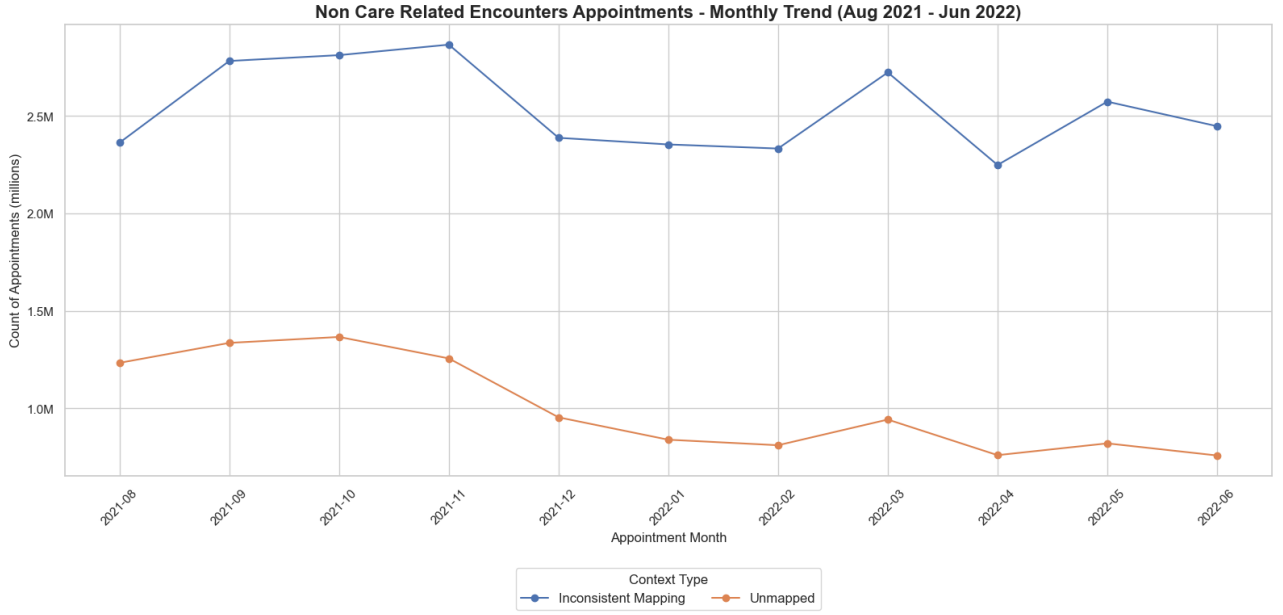
Total Appointments	Care Related Encounter	Inconsistent Mapping	Unmapped	Time Period
296,046,770	257,075,158 (87%)	27,890,802 (9%)	11,080,810 (4%)	Aug 2021 – Jun 2022 (11 months)



Insights:

- Care Related Encounter dominates NHS appointments, accounting for 87% of all appointments.
- There's significant variation in Care Related Encounters appointments over time, with peaks around October-November 2021 and March-April 2022.
- Unmapped appointments are at 4% - Monthly trends show that this is being actively addressed and it has reduced significantly (1.2M in Aug 2021 to 0.7M in June 2022)
- Inconsistent Mapping could be the bigger data quality issue compared to Unmapped – is retaining approximately 2.3M appointments per month





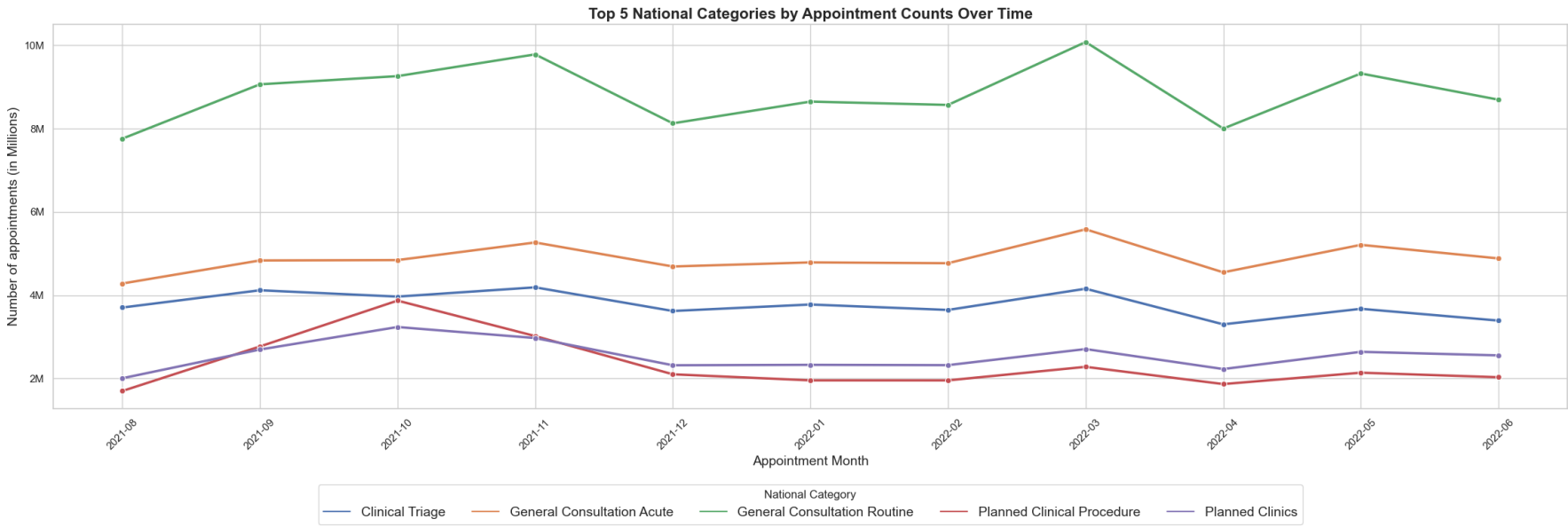
NHS Appointment Distribution by National Categories: Aug 2021 - Jun 2022

Total Appointments	General Consultation – Routine	General Consultation – Acute	Clinical Triage	Planned Clinics	Planned Clinical Procedure	Time Period
296,046,770	97,271,522 (33%)	53,691,150 (18%)	41,546,964 (14%)	28,019,748 (9%)	25,702,694 (9%)	Aug 2021 – Jun 2022 (11 mos)

National Category	Appointments	% of Total
General Consultation Routine	97,271,522	32.86
General Consultation Acute	53,691,150	18.14
Clinical Triage	41,546,964	14.03
Planned Clinics	28,019,748	9.46
Planned Clinical Procedure	25,702,694	8.68
Unplanned Clinical Activity	3,055,794	1.03
Home Visit	2,144,452	0.72
Structured Medication Review	1,858,379	0.63
Service provided by organisation external to the practice	852,133	0.29
Patient contact during Care Home Round	810,330	0.27
Care Home Visit	628,279	0.21
Social Prescribing Service	475,828	0.16
Walk-in	412,438	0.14
Care Home Needs Assessment & Personalised Care and Support Planning	405,904	0.14
Non-contractual chargeable work	138,911	0.05
Group Consultation and Group Education	60,632	0.02
Inconsistent Mapping	*27,890,802*	*9.42*
Unmapped	*11,080,810*	*3.74*

Insights:

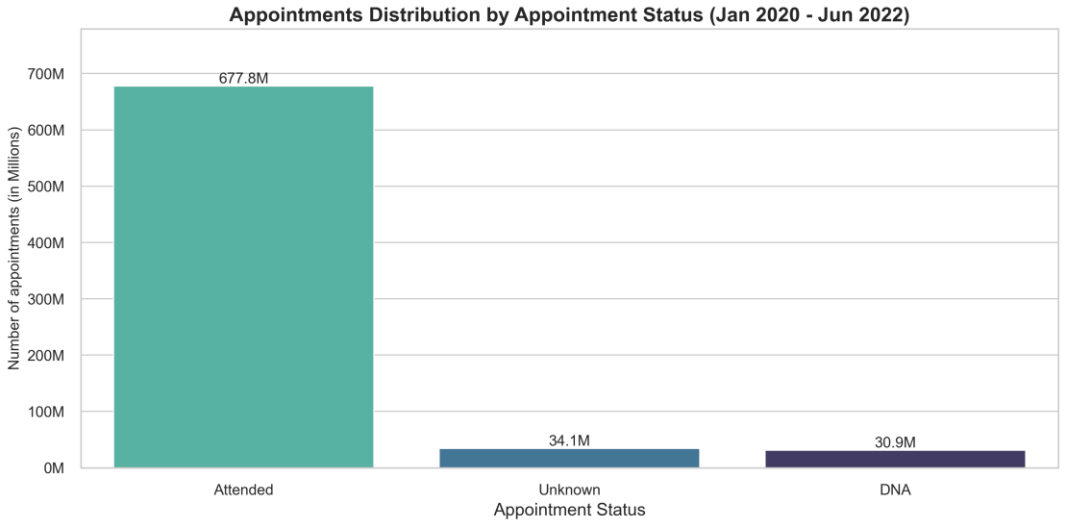
- There are 16 distinct national categories under which all care related appointments are categorized.
- General Consultations (Acute and Routine) account for 51% of all appointments.
- 12% of all appointments have data quality issues related to Inconsistent mapping of national categories and unmapped appointments.
- Planned clinics, Planned Clinical procedures peaking at 2021-10 at 3.2 Million and relatively lower peak of 2.8 Million appointments show the difference in COVID related demand has started coming down in 2022.



Missed Appointments - Analysis

NHS Appointment Distribution by Appointment Status: Jan 2020 - Jun 2022

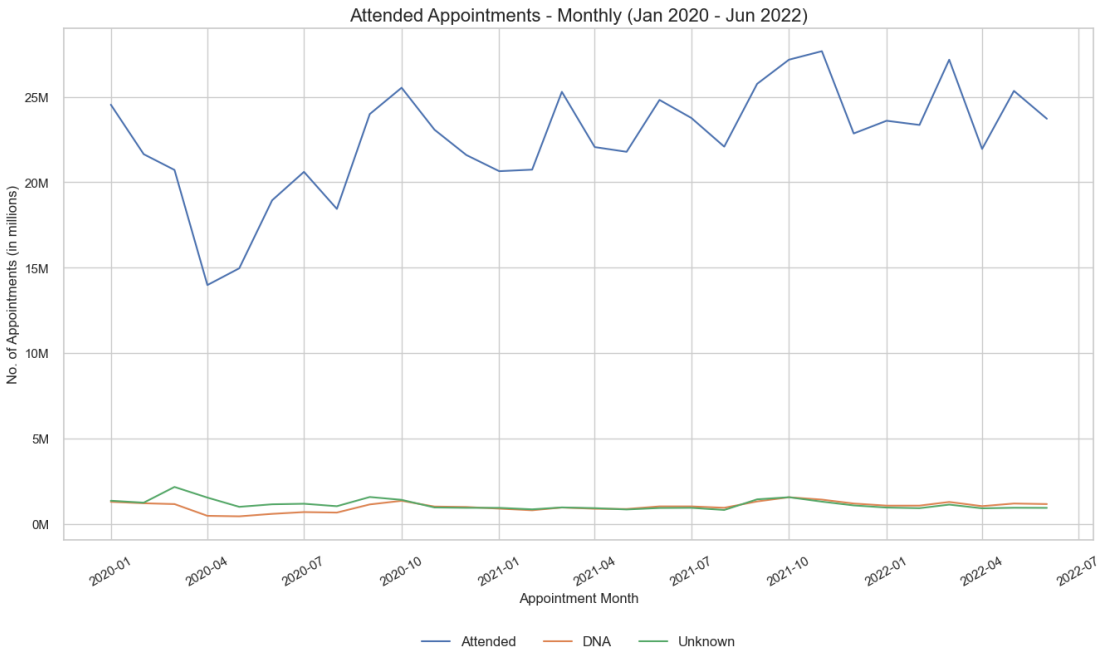
Total Appointments	Attended	Did Not Attend (DNA)	Unknown	Time Period
742,804,525	**677,755,876** (91%)	**30,911,233** (4.16%)	**34,137,416** (4.6%)	**Jan 2020 – Jun 2022** (30 months)

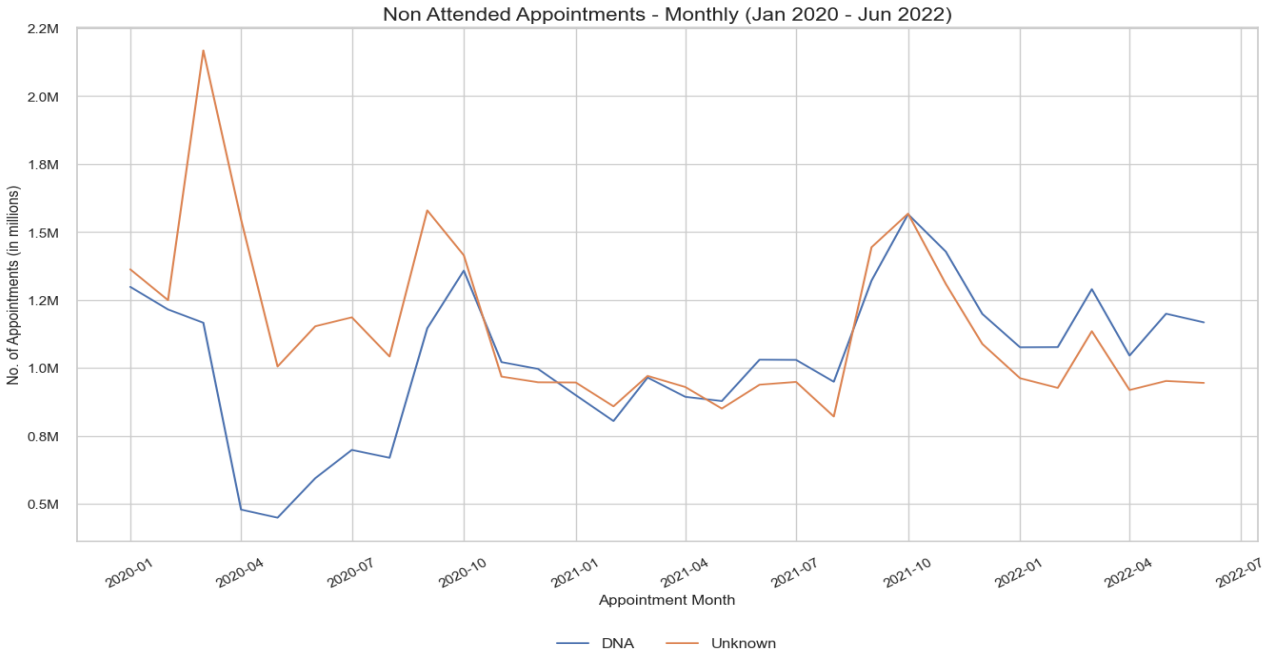


Insights:

- 91% of appointments were attended.
- 4.16% were Did-Not-Attend.
- The monthly overview of attended and Did-Not-Attend appointments aligns with total trends.
- Unknown appointments peaked in February-March 2020; thereafter, they mirrored overall appointments. This suggests a significant number of Unknowns during this peak, warranting deeper investigation into data quality.

Note: Missed appointments will be detailed in upcoming slides.

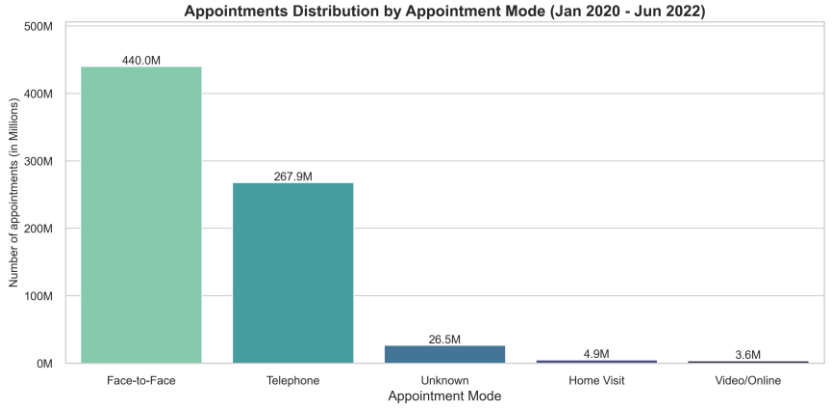


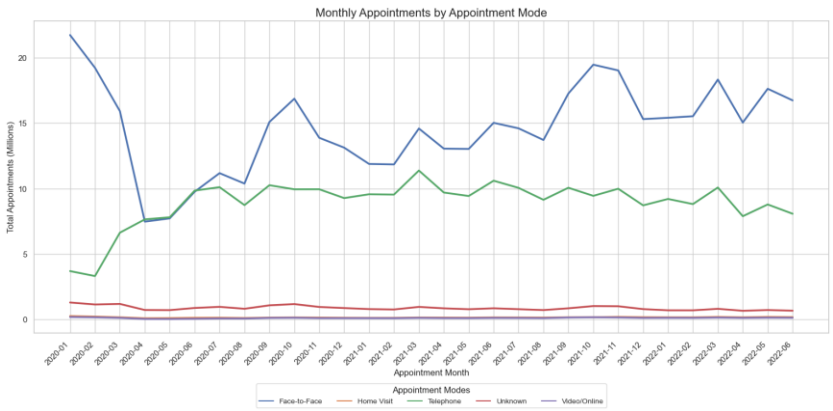


NHS Appointment Distribution by Categories: Jan 2020 - Jun 2022

Total Appointments	Appointment Mode	HealthCare Professional Type	Time between booking & appointment	Time Period
742,804,525	5 Modes	3 Types	8 groups	**Jan 2020 – Jun 2022** (30 months)

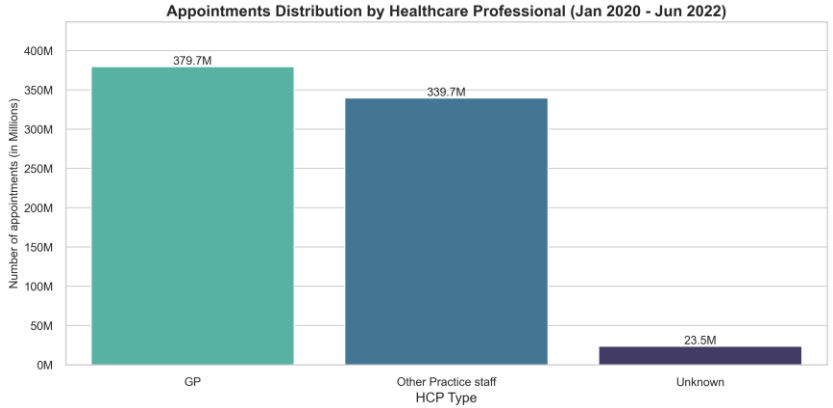
Appointment Mode

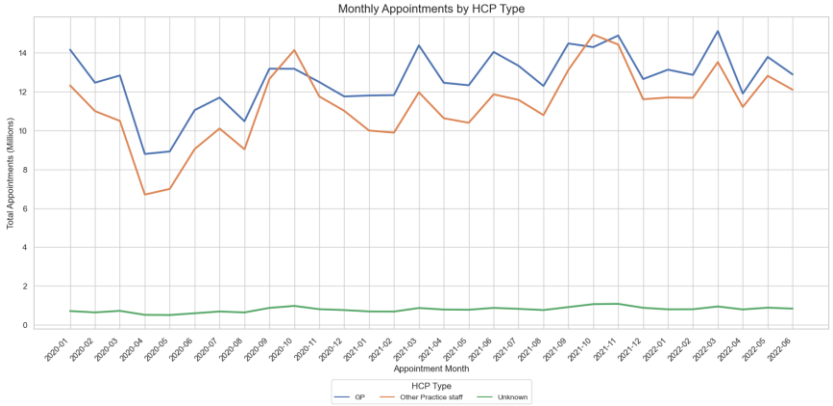




- Of the 5 Appointment modes, Face to Face has the most appointments, followed by Telephone.
- Face to Face has reduced significantly since pre-COVID days, Telephone has doubled. Online and Home visits form a small and stable subset of appointments
- Seasonal spikes are visible in both Face to Face and Telephone appointments.

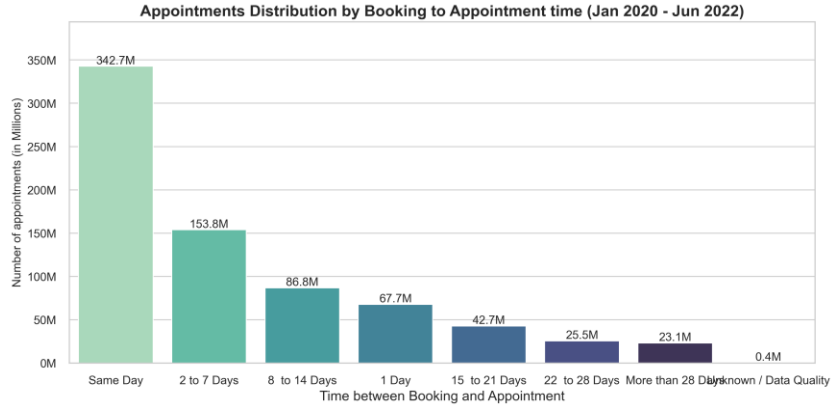
HealthCare Professional Type

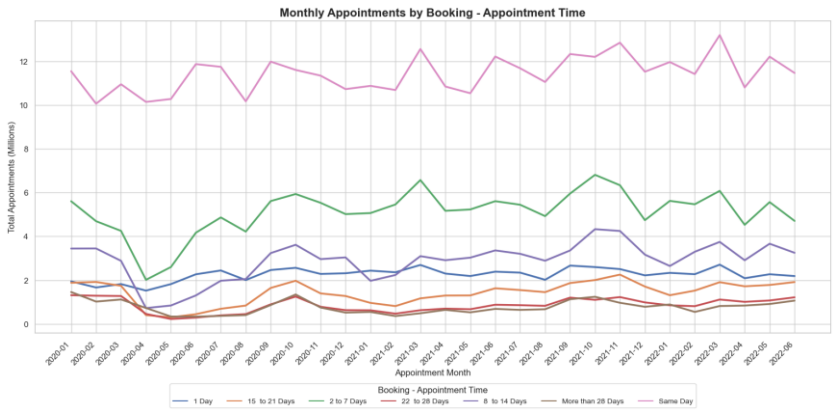




- General Practice is handling the most appointments, closely followed by Other Practice staff.
- Other Practice staff comprise of 16 practioner types within showcasing how GP is the biggest HCP type individually.
- Other Practice staff appointments go higher than GP in the Autumnal peaks alone suggesting an annual pattern.

Time between booking & appointment





- Same day appointments are handling the most appointments, followed by 2-7 Days.
- COVID wave troughs are not seen in same-day appointments, but spikes are suggesting same day appointments are being over utilized.
- Seasonal spikes in each booking time follow the same pattern as overall trend.

Missed Appointments - Overview

Total Appointments

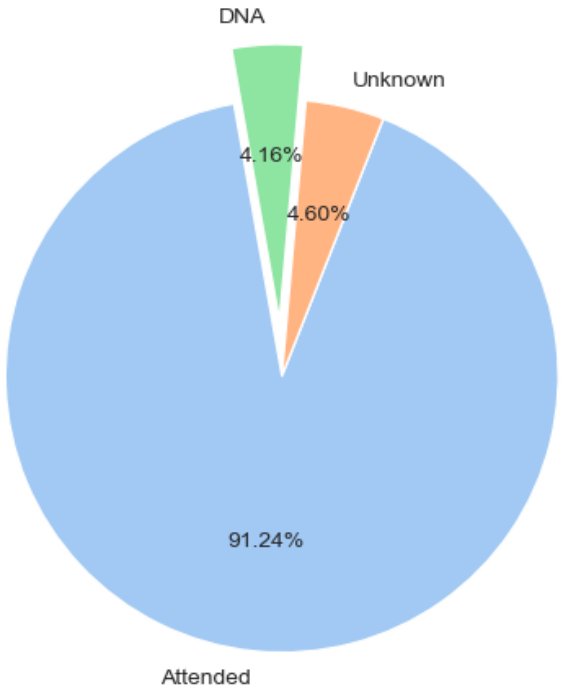
742,804,525

Missed Appointments

30,911,233 (4.16% of All Appointments)

Time Period

Jan 2020 – Jun 2022 (30 months)



Business Impact*: **£ 1.29 Billions** over 30 months (**~ £ 43.28 M** per month)

Goal of Analysis:

1. Identify major factors causing Missed appointments
2. Reduce Missed appointments through targeted approach

Factors considered for Missed (Did Not Attend) Appointments Analysis:

- Appointment Mode
- Time between booking and appointment
- Region
- HealthCare Profession

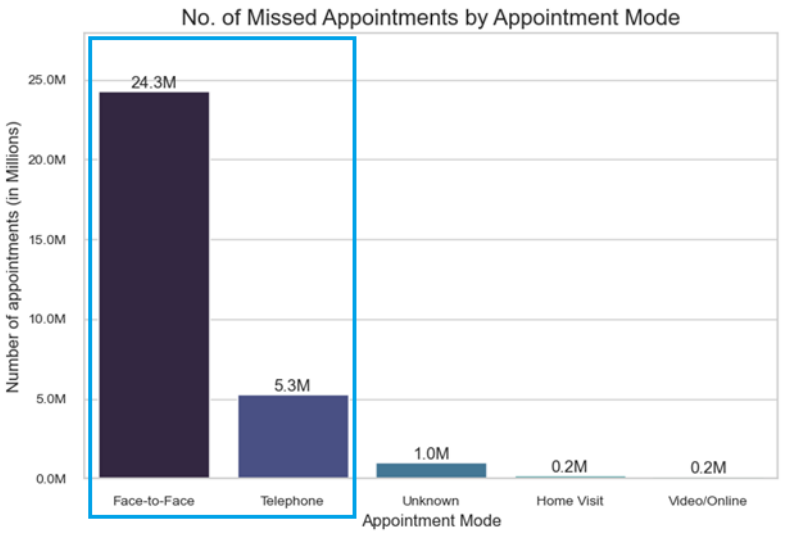
Note : The time period under consideration includes the COVID outbreak window. Since the outbreak had multiple waves and knock-on effects, the entire time-period has been considered without outliers.

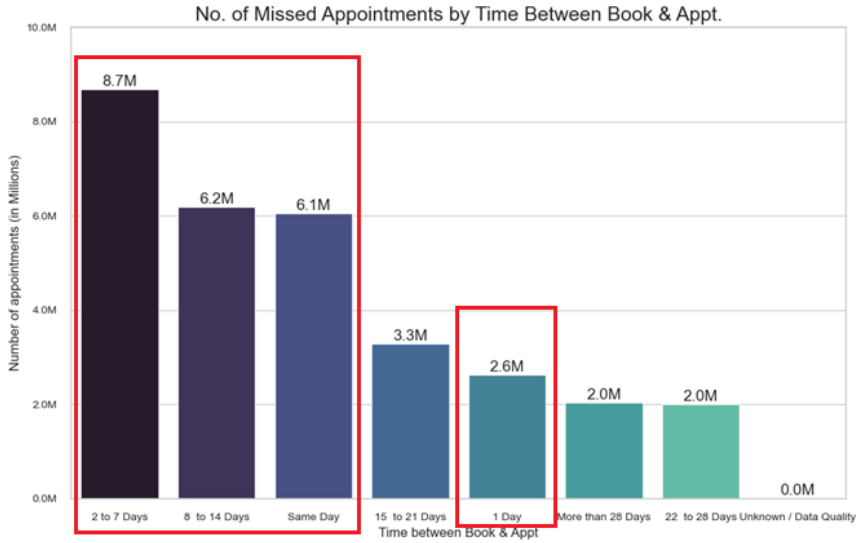
NHS England — Average spend per appointment in 2023: £42

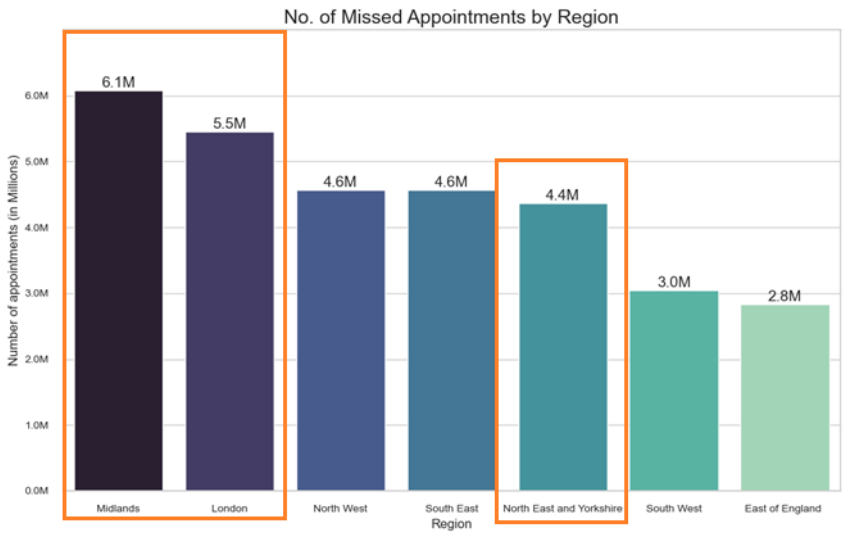
Missed Appointments – Factor wise Distribution

Time Period

Jan 2020 – Jun 2022 (30 months)







Key Findings:

Appointment Mode:

- 95.3% of all appointments are Face-to-Face or Telephone
- 95.5% of missed appointments are Face-to-Face or Telephone

Time between Booking and Appointment:

- 87.7% of all appointments have a booking time of 0-14 days
- 76.3% of missed appointments occur within this 0-14 day booking window [Same Day, 1 Day, 2-7 Days, 8-14 Days]

Region:

- Midlands, London, North East and Yorkshire account for 50% of all appointments and 51% of missed appointments.

72.5% of all Missed appointments are Face-to-Face or Telephone appointments with a booking window between 0-14 Days

Data quality is affected by inconsistencies in the dataset. The time between bookings and appointments varies due to multiple factors. Non-GP healthcare professional types are grouped broadly. Appointment modes may not accurately reflect the true setting, especially with unknown values from certain GP systems. These factors should be considered when interpreting the data.

Attended Appointments by Month & Mode

Time Period

Jan 2020 – Jun 2022 (30 months)

Appointment Trends

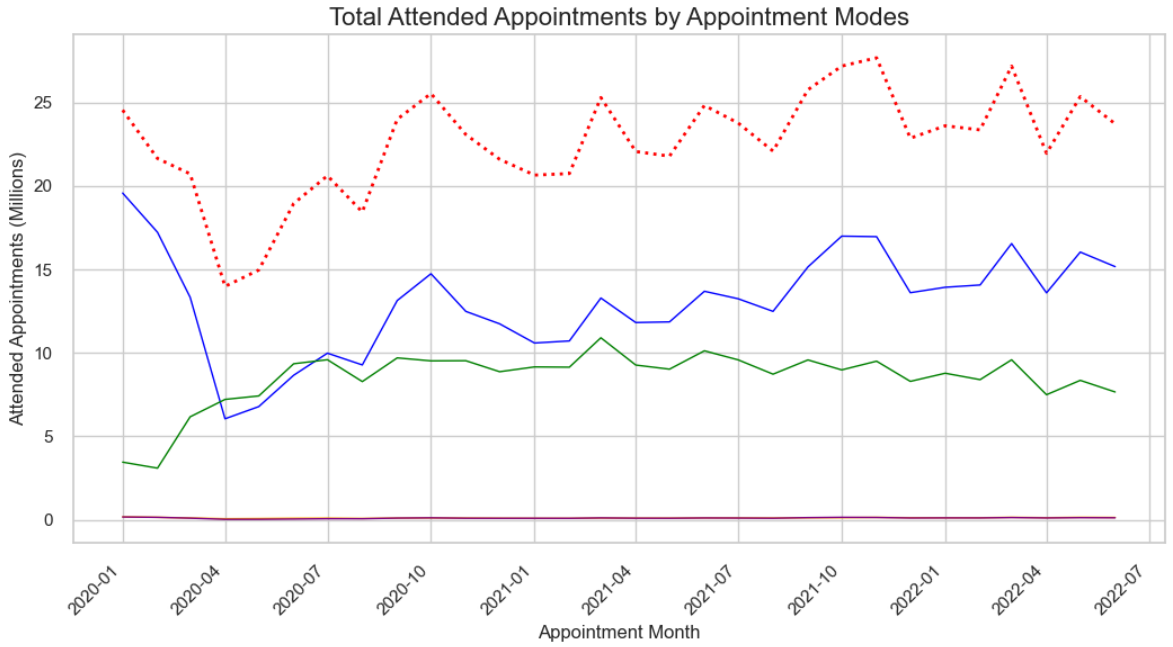
- Total appointments have fluctuated but overall increased.
- Shift from face-to-face to a mixed model since COVID.
- Telephone appointments now exceed Face-to-Face and have doubled since pre-COVID (from ~4.8M to ~9.5M per month).

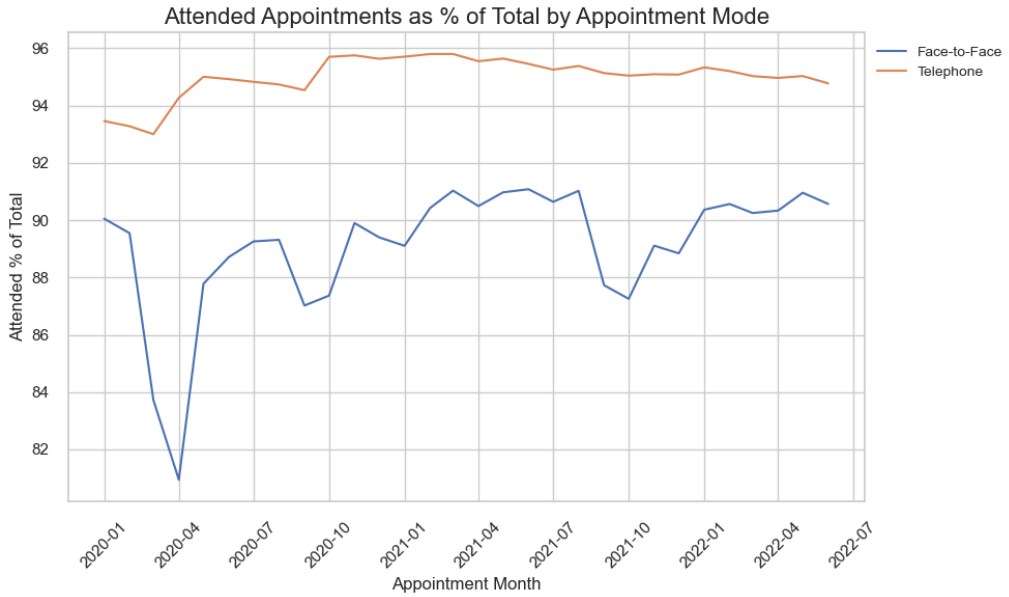
Attended Appointment Rates

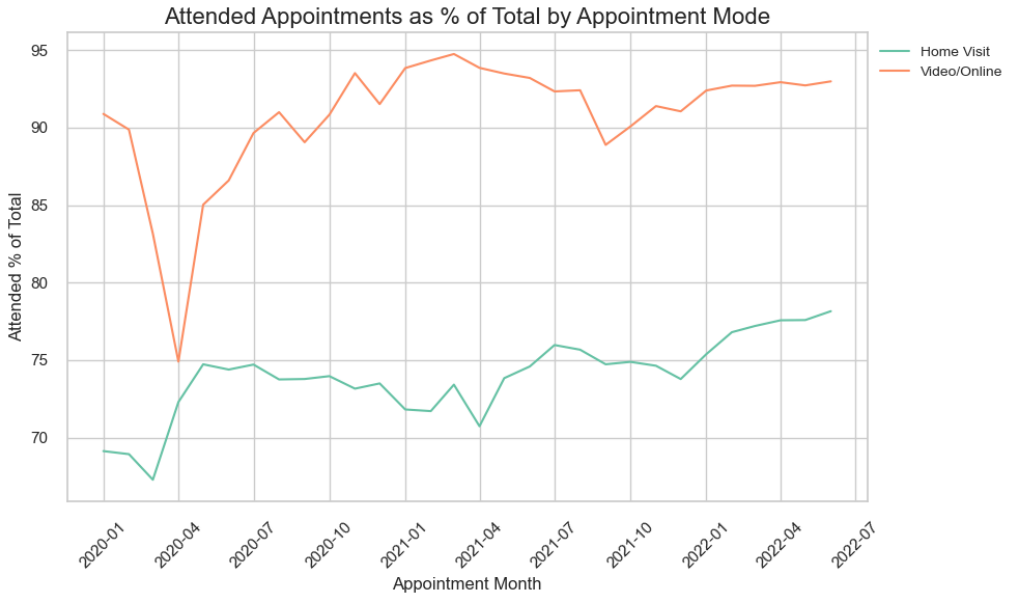
- Face-to-face and Online/Video follow the same trend.
- Telephone attendance rates have stayed high at 93-95%.
- Home visits have improved from 68% to 77% since pre-COVID.

Key Takeaways

- Telephone Dominance: Notable growth in telephone appointments shows adaptation.
- Face-to-Face Recovery: Slow recovery indicates need for targeted efforts for in-person attendance.
- Digital Transformation: Increase in telephone and video appointments signals a shift to remote healthcare options.







Missed Appointments by Month & Appointment Mode

Time Period

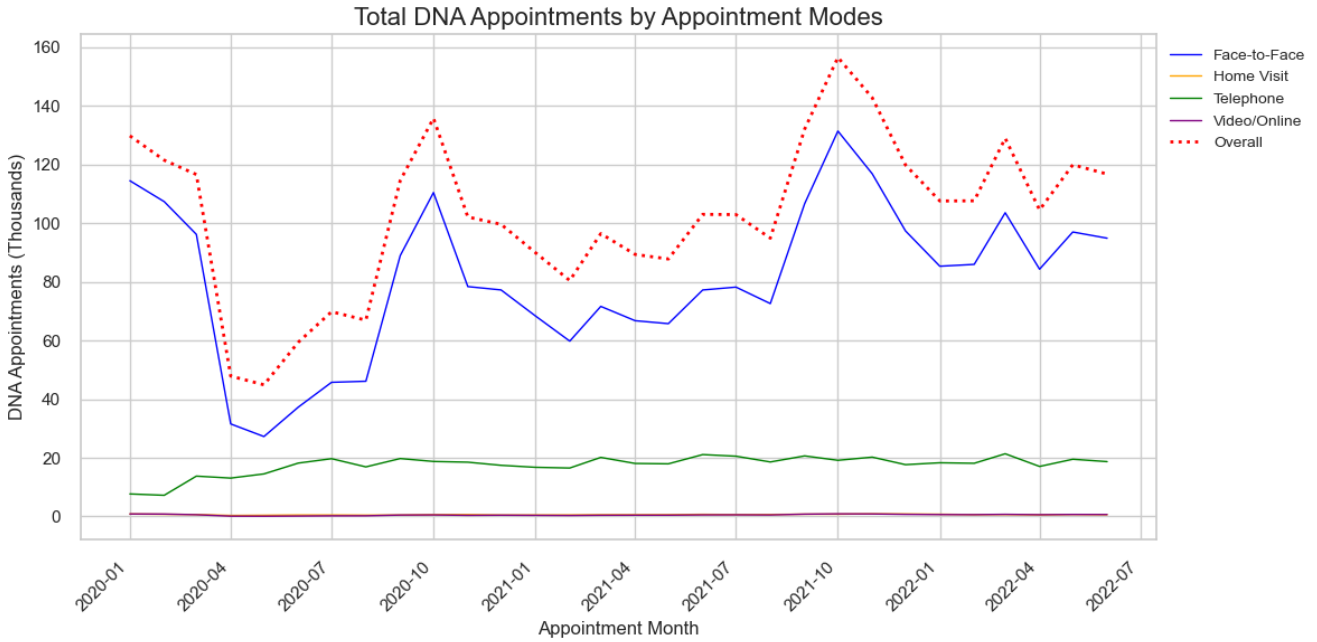
Jan 2020 – Jun 2022 (30 months)

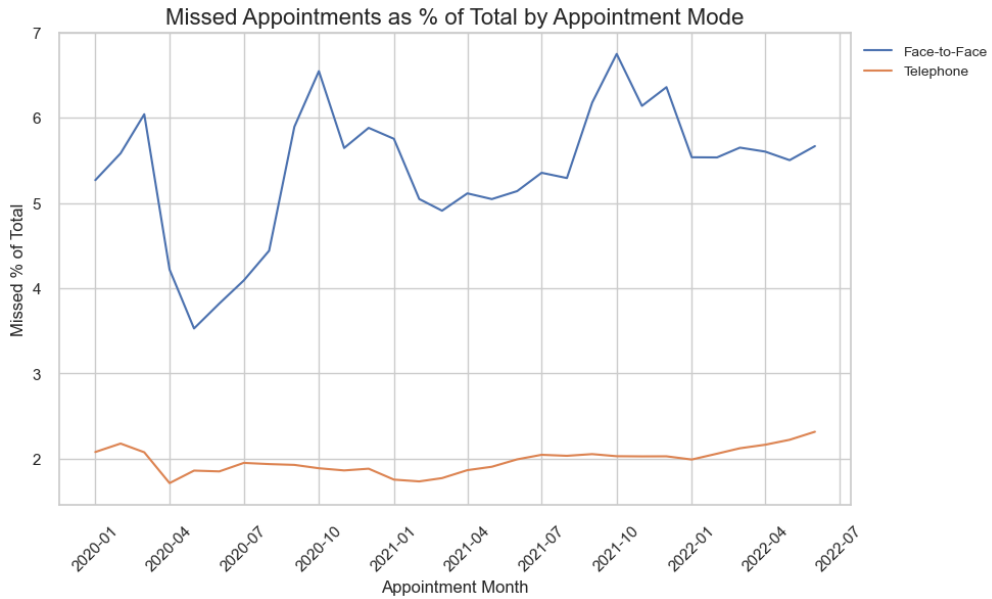
Appointment Trends
- Face-to-face dominates, followed by telephone appointments.
- Drop in face-to-face appointments in early 2020 (COVID-19) with gradual recovery.

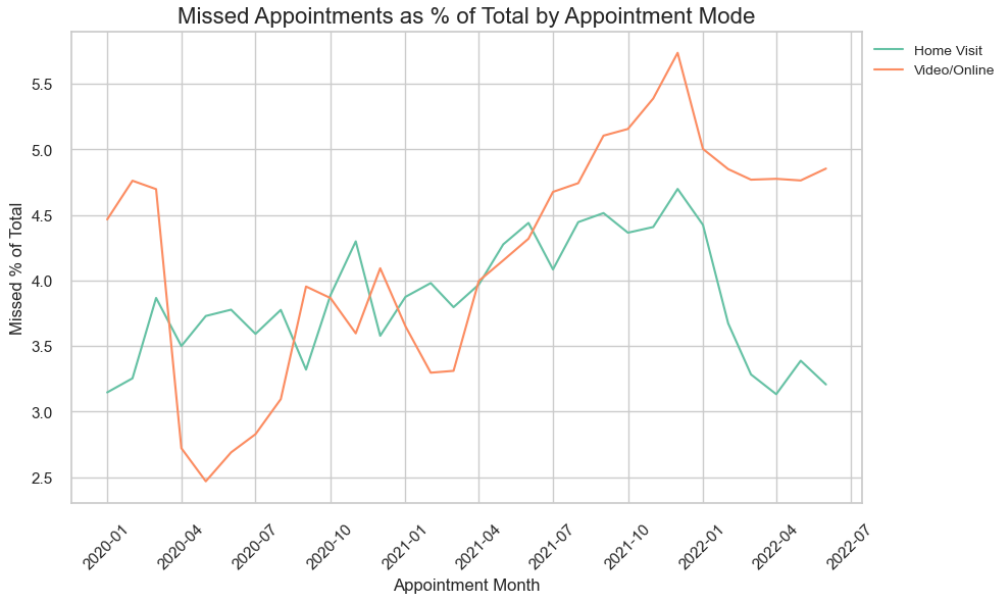
Missed Appointment Rates
- Face-to-face: Highest (4-7%)
- Telephone: Lower (1.5-2.5%)
- Home visits/video: Variable (3-6%), but low volume.

Key Takeaways
- Face-to-face: Highest volume & missed rate, best improvement potential.
- Telephone: Low missed rate, limited improvement.
- Home visits/video: Too low volume to affect missed rates significantly.

Reducing missed face-to-face appointments may significantly improve overall attendance and resource use.







Missed Appointments – by Appointment Mode & Time between Booking and Appointment

Time Period

Jan 2020 – Jun 2022 (30 months)

Overall Missed Appointment Rate:
Average missed appointments across modalities: 4.16%.

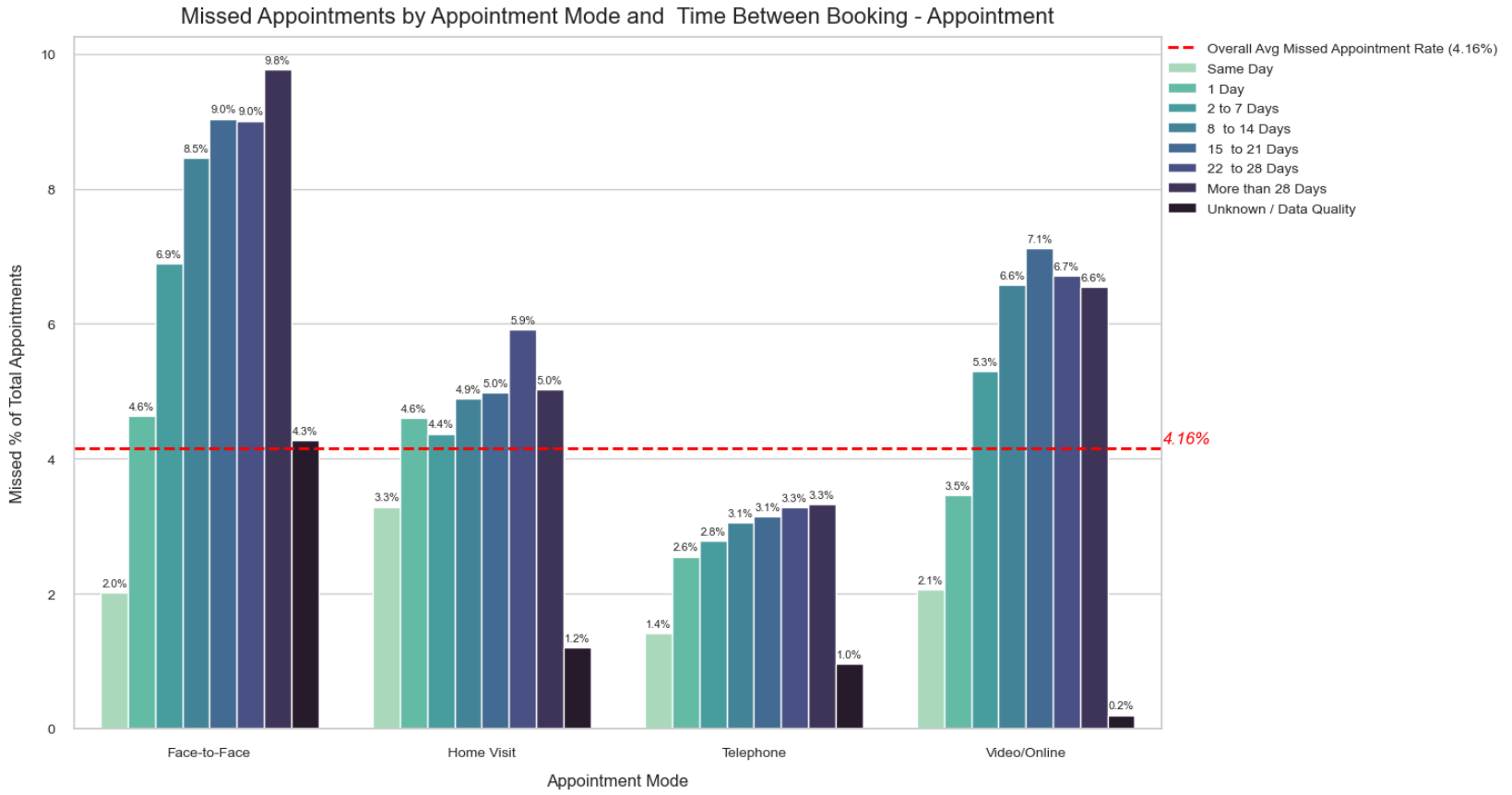
Face-to-Face:
- Has the Highest missed rates
- Highest: 9.8% for More than 28 days appointments
- Lowest: 2.0% for same-day appointments.

Home Visits:
- Highest missed rate: 5.9% for 22-28 days in advance.
- Lowest: 3.3% for same-day appointments.

Telephone Appointments:
- Has the Lowest missed rates.
- Variation across booking timeframes is minor.
- Highest missed rate: 3.3% for 22-28 days and over 28 days.
- Lowest: 1.4% for same-day appointments – Lowest across all

Video/Online Appointments:
- Trend similar to Face-to-Face Missed appointments.
- Highest missed rate: 7.1% for 15-21 days in advance.
- Lowest: 2.1% for same-day appointments.

Comparative Analysis:
- Face-to-face and video/online appointments show high variation.
- Telephone appointments are consistent and have the lowest missed rates.



Longer intervals correlate with higher missed rates for all modalities. Same-day and next-day show consistently lower rates. Reducing booking intervals may significantly lower missed rates across the board.

Face to Face appointments:
- For <8 days appointments: Increasing the capacity of 1 day appointments (currently at : ~1.33M appointments/month vs ~5.36M Same day appointments/month), could potentially improve missed rates and reduce over-utilisation, with the appropriate distribution of resources.
- For >= 8 days appointments: Reminders and Appointment confirmations calls can help reduce the Missed rates for appointments above 1 week.

Region-wise Outliers

Time Period

Jan 2020 – Jun 2022 (30 months)

Midlands – [11 ICBs / 19 Sub ICBs] :

- Higher missed appointment rates for home visits

London – [5 ICBs / 5 Sub ICBs]:

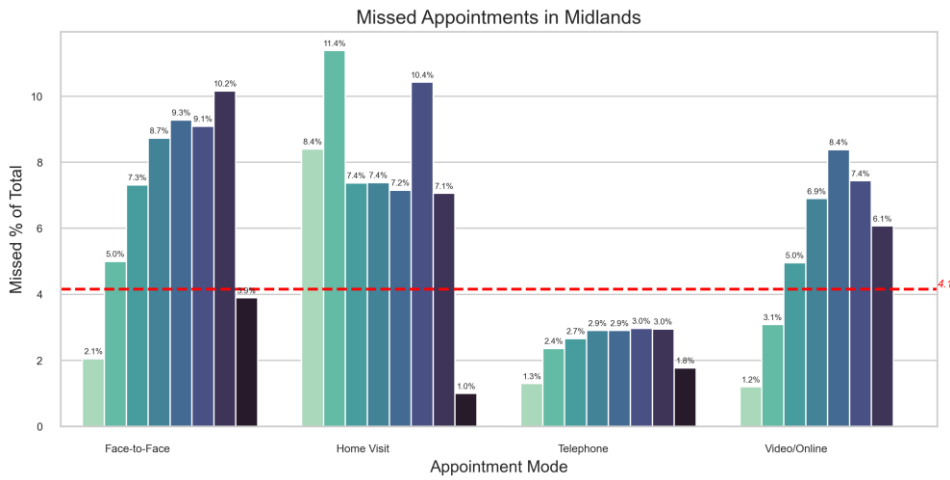
- Highest rates for face-to-face missed appointments, with several categories exceeding 11%.
- Better performing in Home visits and Telephone

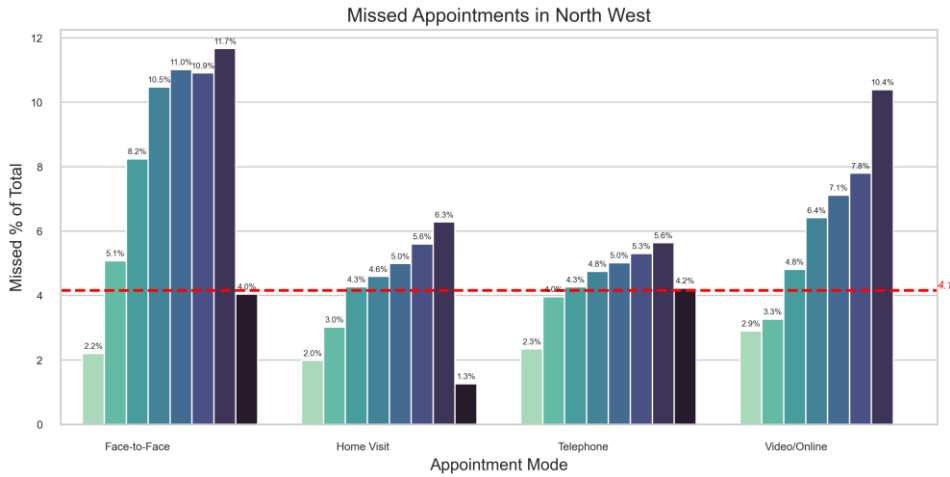
North West – [3 ICBs / 27 Sub ICBs]:

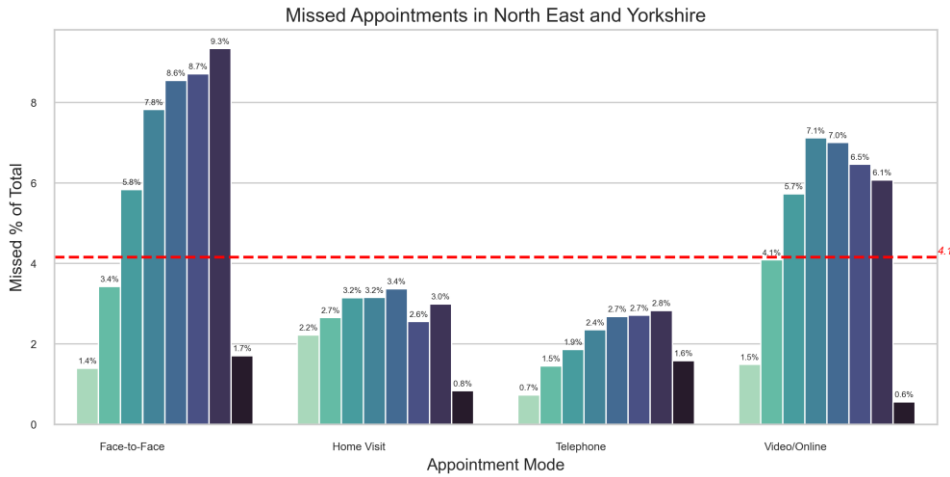
- Telephone missed rates are higher, all modes are following the same pattern.
- Has the highest Video/Online missed rate across these regions.

NE & Yorkshire – [4 ICBs / 23 Sub ICBs]:

- Home visits and Telephone missed rates and significantly lower.
- Has the lowest rate across regions / modes in Telephone at 0.7% for Same-day.







Overall Missed Appointment Rate (4.16%)
Same Day
1 Day
2 to 7 Days
8 to 14 Days
15 to 21 Days
22 to 28 Days
More than 28 Days
Unknown / Data Quality

Missed Appointments - Insights and Recommendations

Insights:

- Face to Face appointments account for 78% of all missed appointments, Telephone follows at 17% of all missed appointments.
- Monthly Face to Face appointments have reduced in numbers compared to pre-COVID numbers, but the rate of missed appointments have not improved significantly.
- Monthly Telephone appointments have doubled since pre-COVID, but the missed appointment rates are still lowest among modes.
- Most appointments are booked within 0-14 days, also where most missed appointments occur.
- Midlands, London, North-West and North East & Yorkshire contribute to 62% of all missed appointments.
- Longer intervals correlate with higher missed rates for all modalities. Same-day and next-day show consistently lower rates.

Recommendations:

Booking Intervals:

- Reduce booking intervals can significantly lower missed rates across all appointment modes.

Face to Face appointments:

- For <8 days appointments: Increasing the capacity for handling 1 day appointments (currently at : ~1.33M appointments/month vs ~5.36M Same day appointments/month), could potentially improve missed rates and reduce over-utilisation, with the appropriate distribution of resources.

- For >= 8 days appointments: Reminders and Appointment confirmations calls can help reduce the Missed rates for appointments above 1 week.

Region-wise:

- Different missed rate patterns across regions indicate unique issues. A granular analysis can better identify and resolve these issues.
- Analysis of the administrative structure (Medical professionals to Patients demography to Area covered to no. of ICBs / Sub ICBs handling them in a ratio) can help identify ideal settings of the administrative structure to get better results with existing resources.
- Studying and adopting best practices can lead to improving rates further in each region – London's Home visit practices can be adopted by the other 3 regions to see if it improves their missed rates.

Digital shift:

- Telephone's shift in handling more appointments and better attendance rates suggests a shift to remote healthcare options. Early adoption of best practices from Telephone to Video/Online early on can mitigate future and long-term issues on Missed appointments.

Need for better Data:

- Enhancing data collection methods – better segregation of HCP types, daily instead of monthly data, and geography-specific data points will enable thorough analysis.

Capacity and Utilisation – Trends and Patterns

Daily Capacity - Utilisation Trends

Time Period

Aug 2021 – Jun 2022 (11 months)

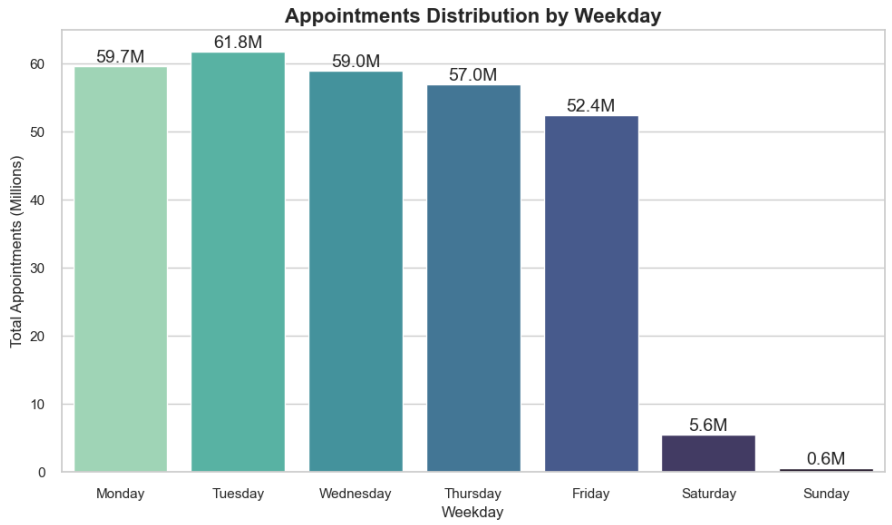
The average maximum daily capacity provided by NHS is 1.2 million appointments.

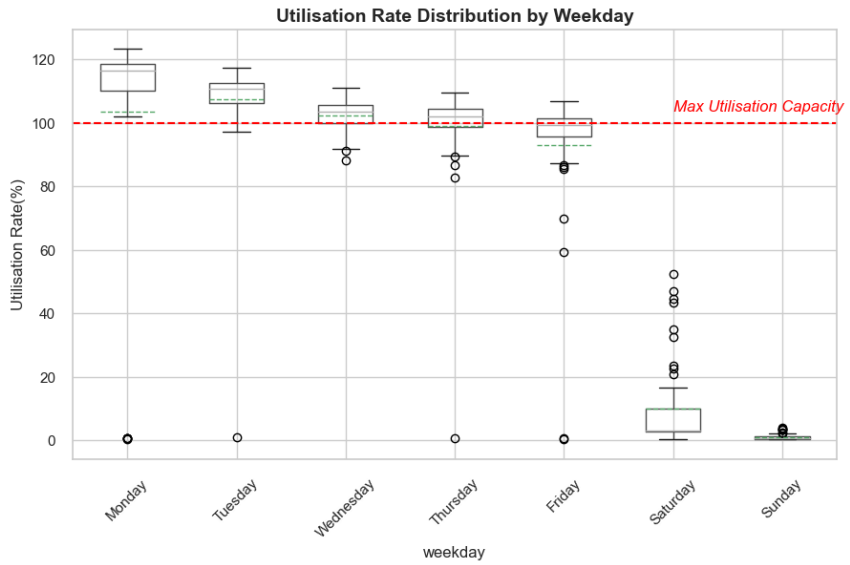
Weekdays:

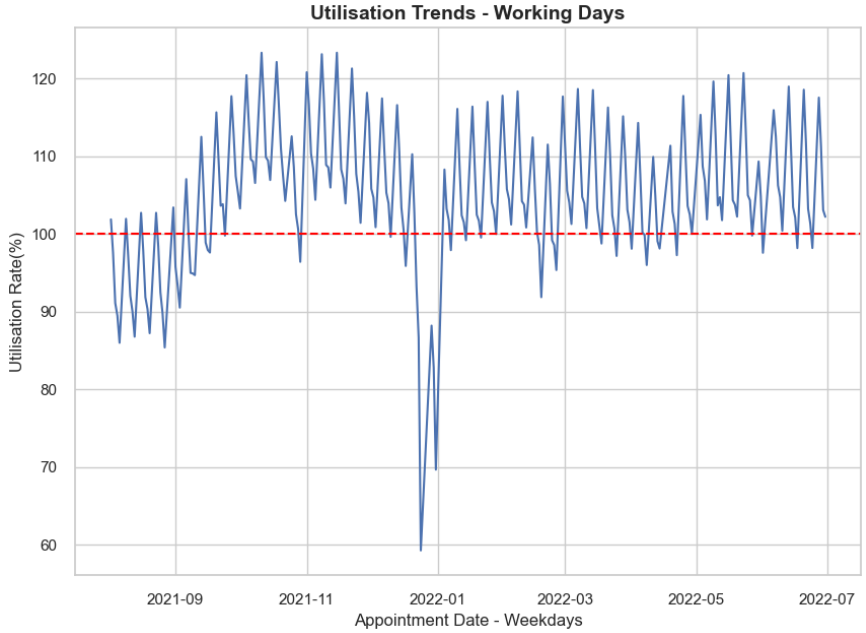
- 98% of these appointments occur on weekdays (Monday to Friday), while only 2% take place on weekends.
- Daily utilisation rates typically exceed capacity on weekdays, with Tuesdays and Mondays being the busiest, followed by Wednesdays.
- 73% of the Weekdays (175 of 239 days – including bank holidays) were over-utilised.
- Mondays show the highest average utilisation despite 2nd in terms of numbers, due to many bank holidays falling on this day.
- The only time Weekday average utilisation goes below 80% are on Christmas Eve (24-12-2021 – 59%) and New Year's Eve (31-12-2021 – 69%).
- Since the end of COVID Phase 2, weekday utilisation remains consistently high, reaching 125% in Nov-Dec 2021.

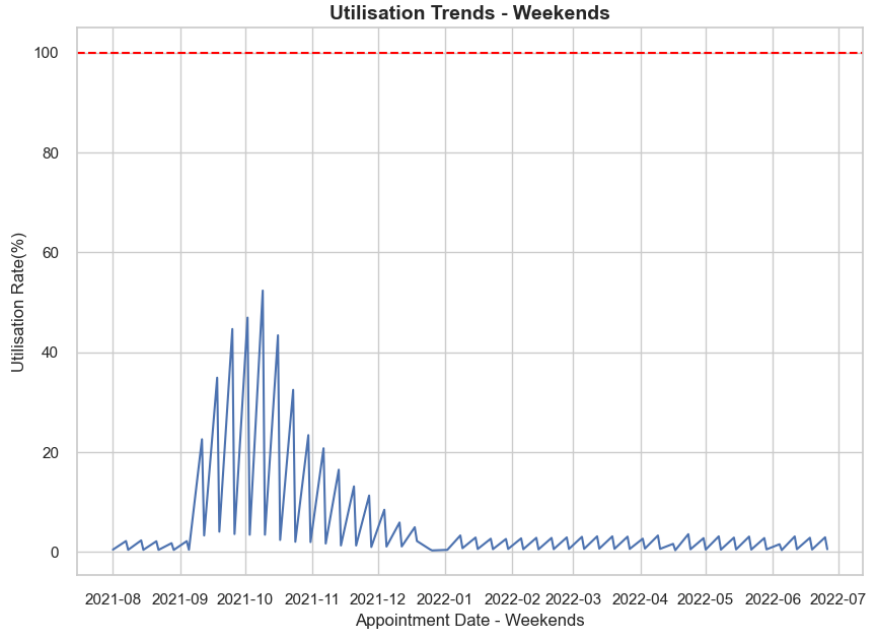
Weekends:

- In contrast, weekends experience the lowest rates; Saturdays higher compared to Sundays.
- However, from Sept-Dec 2021, Saturdays showed 50% utilisation as NHS staff provided additional support.









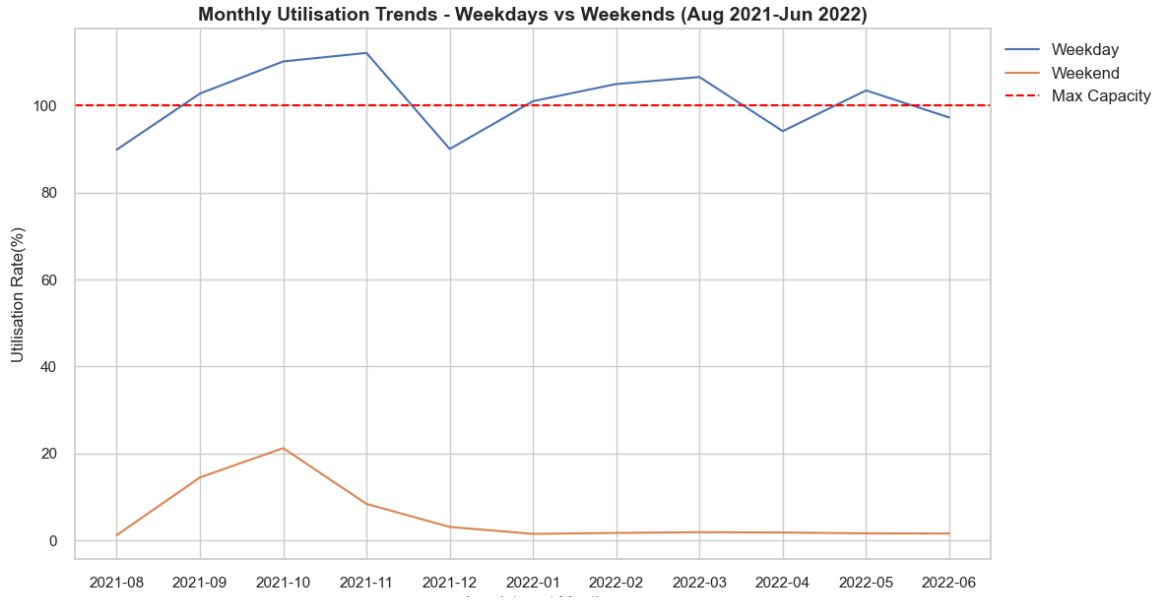
Monthly Capacity - Utilisation Trends

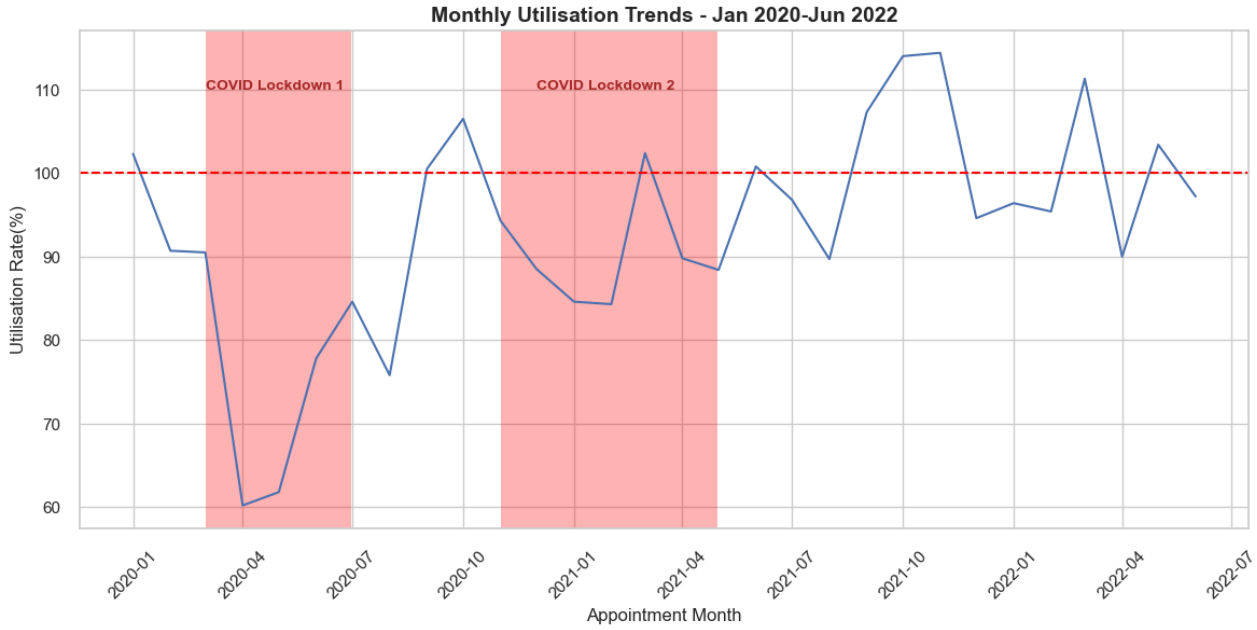
The average maximum daily capacity provided by NHS is 1.2 million appointments or an extrapolated monthly capacity of 26.58 million appointments per month*

Monthly Trends:

- Weekdays are consistently over-utilized while weekends are mostly flat. The peak 20% utilization seen in weekend during Oct-2021 shows that the Post COVID phase-2, the NHS resources were highly over-utilized during this time-frame.
- The cyclical pattern of hitting the peak every 4 months in the weekday trend suggests a possible seasonal trend. However, when checked against the 30-month chart below, **both peaks are occurring after the end of COVID lockdowns.**
- We would require extended data to correctly analyse the presence of any ***seasonal patterns*** with respect to appointment bookings / utilisation of resources.
- Utilization peaks post-lockdowns suggest a backlog of appointments and increased demand

*(22.15 Days in a month – 22 weekdays and .15 for weekends)





- COVID related backlogs has come down as indicated in the smaller peak in 2022-03, however a constant >100% utilisation could lead to burnout and long-term issues.
- Improving staff and resource availability during the weekends in a rotational-shift basis can bring down the utilisation rates over the weekdays.
- This would have to be piloted and marketed to ensure patients are made aware that more NHS appointments are available over the weekend.
- We would have to monitor the trends to confirm the current status and predict potential future states without a COVID bias.

Capacity and Utilisation - Insights and Recommendations

Insights:

- 98% of these appointments occur on weekdays (Monday to Friday), while only 2% take place on weekends.
- 73% of the Weekdays (175 of 239 days – including bank holidays) were over-utilised.
- In contrast, weekends experience the lowest rates; Saturdays higher compared to Sundays

Covid Impact:

- Utilization peaks post-lockdowns suggest a backlog of appointments and increased demand
- Since the end of COVID Phase 2, weekday utilisation remains consistently high, reaching 125% in Nov-Dec 2021. Weekend utilisation also reached 50% in the weekends during Nov-Dec 2021 to overcome the backlog of appointments.
- We would have to monitor the trends to confirm the current status and predict potential future states without a COVID bias.

Recommendations:

- **Weekend Utilization:** As weekends are significantly underutilized, there is a strong case for expanding weekend appointments. This could alleviate weekday overutilization, particularly in regions like Midlands and London.
- **Pilot Expanded Weekend Access:** Trial weekend appointments in regions with higher missed weekday appointments and overutilization rates. Promote these to patients to ensure uptake and monitor performance over time.
- **Staffing Adjustments:** Redistribute staff resources to balance weekend and weekday availability. This would help in managing overutilization during the week and make better use of underutilized weekends. Need for hiring more staff in the long term cannot be determined as the window we are analysing is still dealing with the after-effects of COVID and the demand has been high, but short term hiring is recommended.

Key Insights and Recommendations

1. Adjust Capacity Based on Appointment Patterns:
- Focus on Face-to-Face appointments: Since Face to Face appointments have the highest missed rates, reallocating resources to shorter booking intervals could reduce both missed appointments and improve overall capacity utilisation.
- **Recommendation:** Reduce long-term Face-to-Face bookings (28+ days) and increase same-day and next-day availability, where missed rates are lower.

2. Shift to Reliable Appointment Modes:
- **Telephone appointments** have consistently lower missed rates and have seen a significant increase in usage since COVID-19.
- **Recommendation:** Telephone appointments have lower missed rates and increased usage since COVID-19. Encourage telephone or video consultations for follow-ups or non-urgent cases to optimize resource use, especially on weekdays.

3. Improve Weekend Slot Utilization:
- Weekend slots are often underutilized
- **Recommendation:** Increase same-day and next-day booking for weekends to manage demand spillover from weekdays. This would allow patients more flexibility and improve attendance rates and would also spread out utilization.

4. Implement Appointment Reminders:
- Appointments with more than 14 days booking to appointment window is missed across all modalities
- **Recommendation:** Targeted reminders can reduce missed appointments in the 8-21 day window. Automate reminders for Face-to-Face and Telephone appointments a few days prior to ensure better attendance.

5. Adjust Resources for High-Demand Days:
- Tuesdays and Wednesdays see high utilization and missed appointments.
- **Recommendation:** Balance staffing and availability to ensure balanced resource distribution throughout the week. For instance, redistributing some appointments from high-demand days to underutilized days like Fridays or weekends.

6. Region-Specific Strategies:
- As certain regions (e.g., Midlands, London, North East & Yorkshire) account for more missed appointments and higher weekday over-utilization, region-specific strategies are essential.
- **Recommendation:** Use localized data to adjust capacity per region. For example, in London, focus on reducing missed Face-to-Face appointments by increasing availability of telephone consultations and promoting weekend slots, where underutilization is common.

7. Dynamic Staff Allocation:
- Considering the variability in demand for different appointment modes (e.g., Home Visits and Face-to-Face), a flexible staffing model could improve capacity utilization.
- **Recommendation**: Implement a dynamic staffing model that reallocates healthcare professionals based on real-time demand.