London School of Economics
Data Analysis Career Accelerator
Diagnostic Analysis using Python

NHS Appointment Utilisation and Attendance Patterns: A Python Diagnostic Analysis

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Introduction

The NHS faces the challenge of balancing its resources with increasing demands. Key stakeholders debate whether to expand capacity or optimise existing resources. To inform this decision, the NHS is analysing missed appointments, a significant cost driver. By using Python to explore data and create visualisations, the goal is to understand the causes of missed appointments and develop strategies to reduce them, ultimately optimising resource allocation and improving efficiency.

Main Research Questions

Has there been adequate staff and capacity in the NHS networks?

A capacity utilisation analysis suggests that current resources may suffice with optimised management, though further investigation into specific staffing patterns is needed to confirm adequacy.

What was the actual utilisation of resources?

High utilisation rates across various appointment settings indicate potential areas for optimisation, especially in categories where data inconsistencies are present.

Analytical Approach

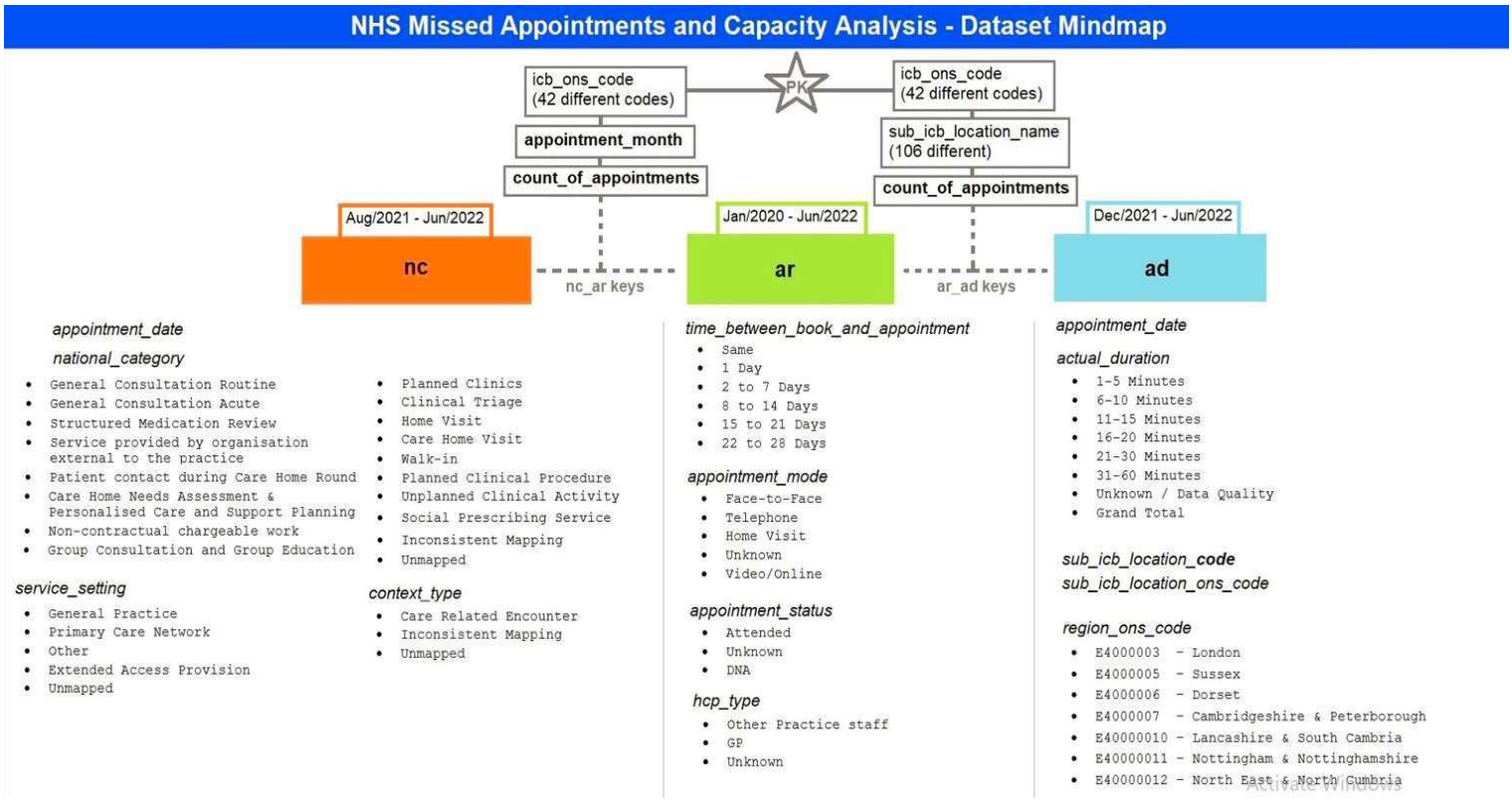
This analysis examines NHS staffing and resource capacity, exploring whether current resources can meet demand effectively or require optimisation. Capacity utilisation analysis suggests resources may be sufficient with improved management, though staffing patterns merit further investigation. High utilisation rates across appointment settings reveal opportunities for targeted optimisation, particularly in categories with data inconsistencies.

Through a multidimensional approach—including exploratory data analysis (EDA) of NHS ICB datasets and trend analysis of healthcare-related Twitter data—this study uncovers appointment scheduling trends, service utilisation patterns, data quality issues, and popular healthcare topics, capturing both operational insights and public sentiment.

Descriptive statistics, trend analysis, and correlation studies inform strategic decisions on resource allocation, service improvement, and communication within the NHS. By integrating these findings, the analysis provides actionable insights to enhance operational efficiency, data quality, and public engagement.

Data Analysis Overview

This analysis examines NHS data across three primary datasets:



Basic Exploration and Descriptive Statistics

The datasets were explored for descriptive insights:

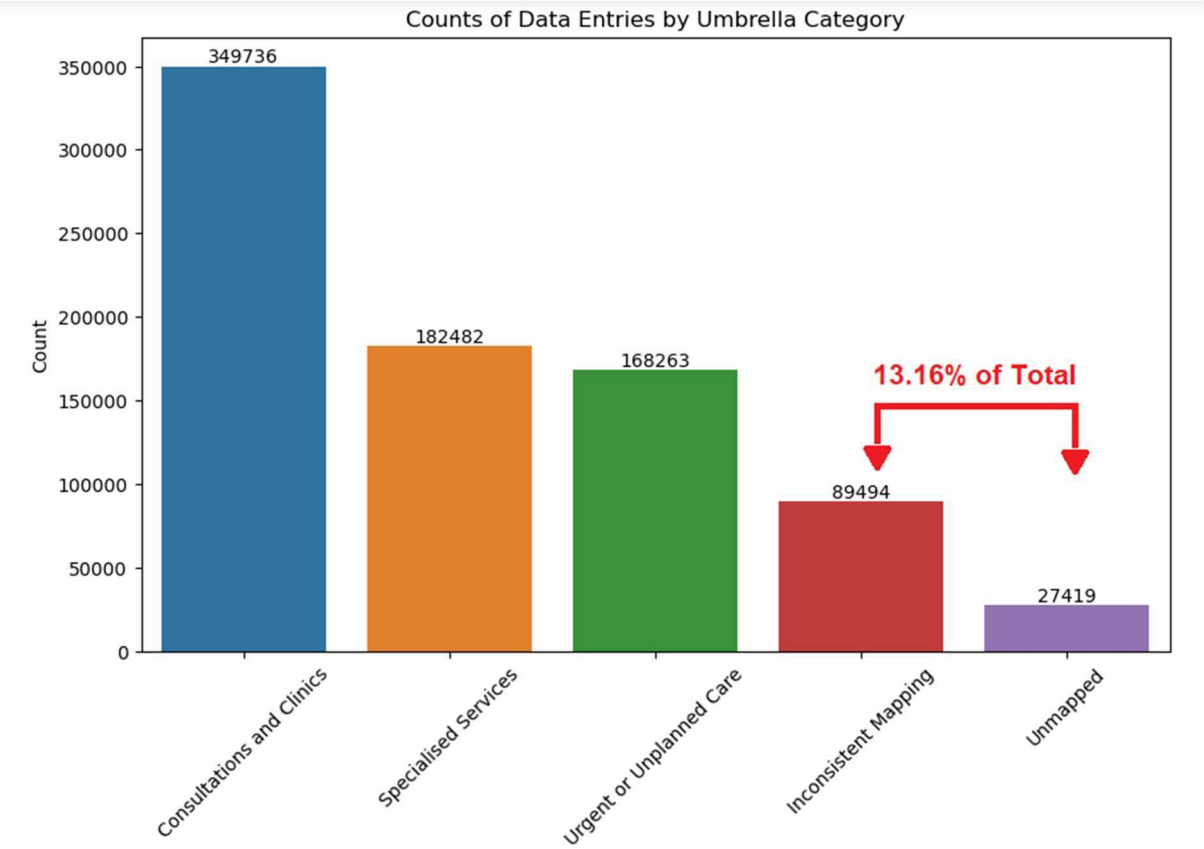
Actual Duration (ad): A mean appointment count of 1219.08 with notable high variance suggests diverse appointment types and durations. Approximately 14.63% of the data contains ‘Unknown/Data Quality’, highlighting data collection issues.

Appointments Regional (ar): Monthly appointment counts range widely, with ‘Face-to-Face‘ as the dominant mode, though remote options like ‘Telephone‘ surged during the pandemic.

National Categories (nc): High variability in counts, with approximately 13.16% of data inconsistencies, particularly in ‘Unmapped‘ categories, suggesting further data refinement is necessary.

Quality and Opportunities in the Data

Data Gaps: Missing values in ‘Unknown/Data Quality‘ fields limit data accuracy and analysis reliability.



Data Inconsistencies: The high percentage of ‘Inconsistent Mapping’ and ‘Unmapped’ data—13.16% of total entries—highlights a pressing need for standardisation to enable accurate reporting on appointment utilisation and attendance patterns. This inconsistency impacts the ability to make precise recommendations, as it introduces uncertainty in identifying trends across service types.

Lack of standardised categorisation also complicates merging datasets based on identifiers like `icb_ons_code`, which would allow for more granular analysis across datasets. Without reliable categorisation, drawing insights from the data becomes challenging, limiting the NHS's ability to make informed decisions about resource allocation and service optimisation.

Exploratory Data Analysis (EDA) Findings

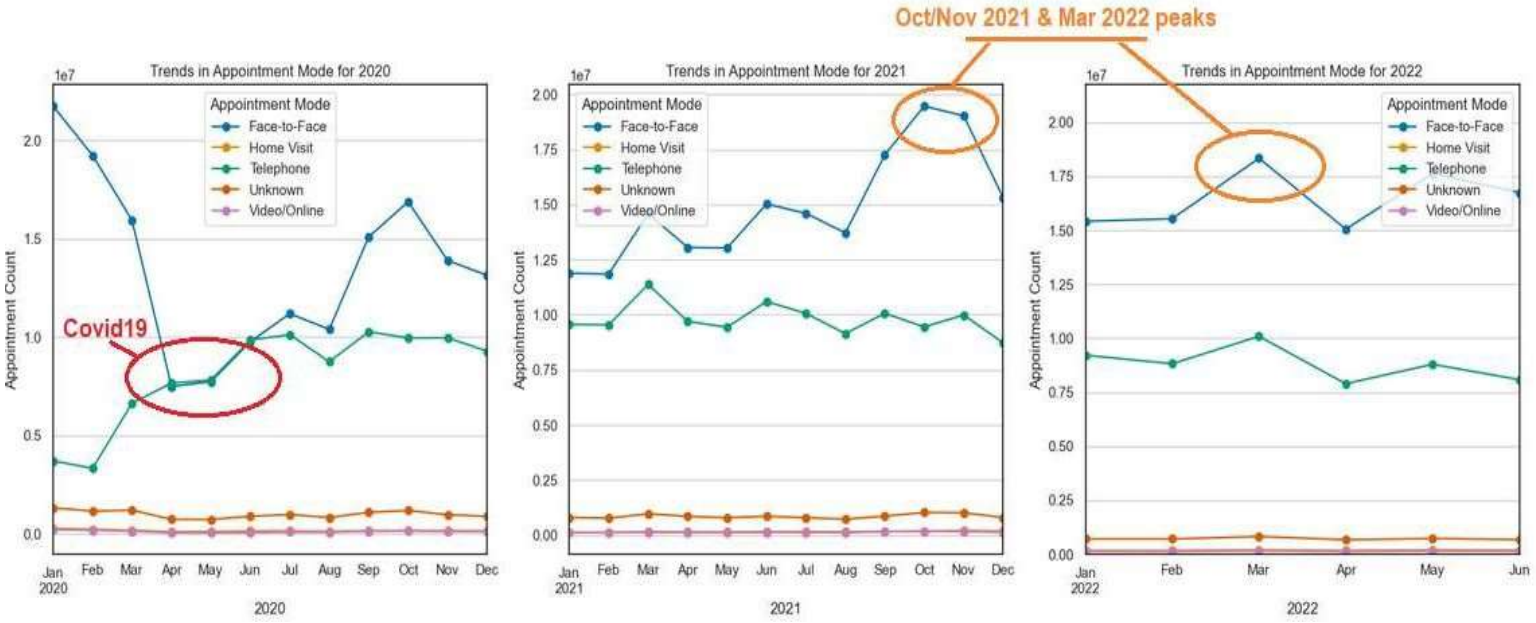
Busiest Days: Analysis of weekday patterns faced memory limitations, yet initial findings suggest peaks on certain days, warranting further statistical analysis.

Seasonal Trends: Appointment volumes fluctuate, peaking in November 2021, with indications that public health initiatives and seasonal illnesses may influence trends.

Segmentation Analysis: To understand patterns across patient demographics and appointment types, data was segmented by critical variables such as region, `appointment_mode`, and `service_setting`. This segmentation provides insights into demand patterns, helping identify high-demand regions and appointment types.

Appointment Trends

Mode of Appointment: The visualisation shows shifts in NHS appointment modes from 2020 to 2022, highlighting the impact of COVID-19 on Face-to-Face appointments, a rise in Telephone consultations, and seasonal peaks in demand.



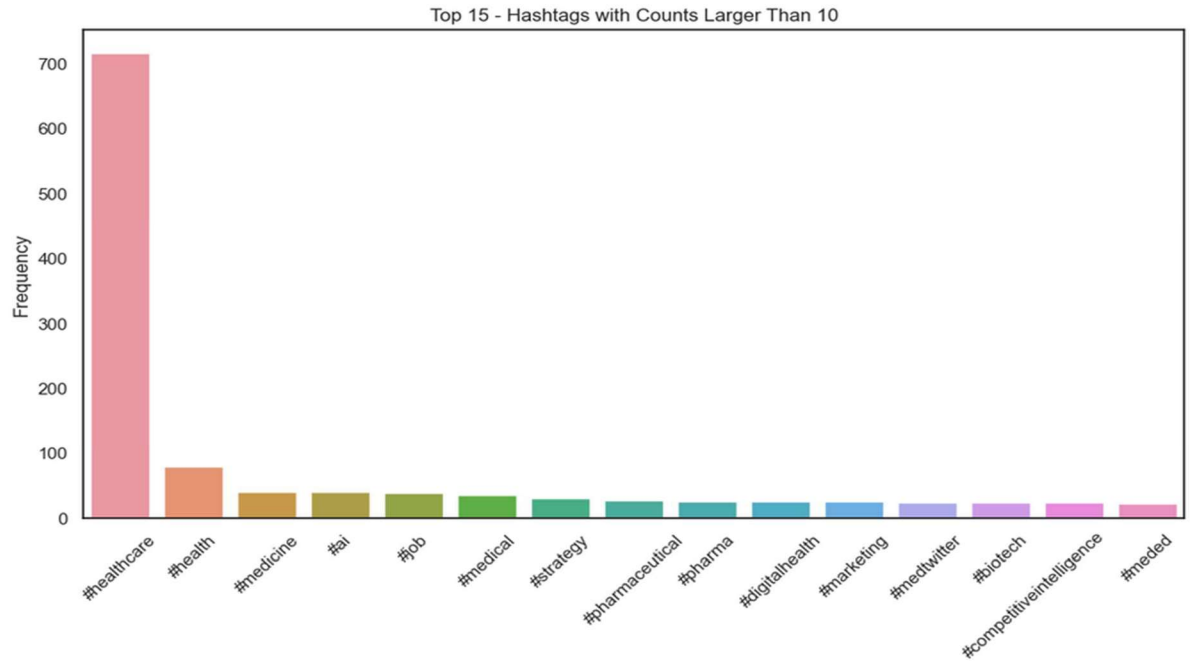
The data was aggregated monthly by appointment mode and plotted using line graphs with annotated key events (such as COVID-19) and custom aesthetics to highlight trends, peaks, and seasonal fluctuations, ensuring clear, context-rich visualisation for analysing appointment patterns over time.

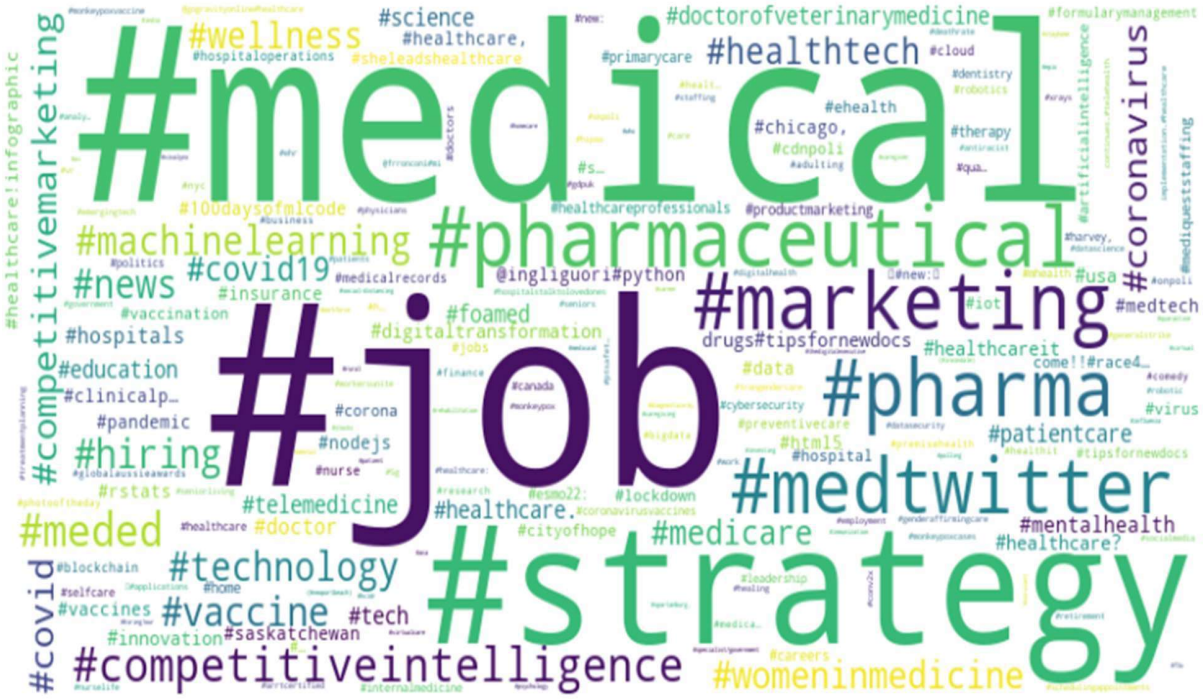
NLP and Word Cloud Analysis

Social Media Hashtag Analysis: NLP techniques were applied to extract and analyse frequently used healthcare-related hashtags, revealing key topics such as `#medical`, `#job`, and `#strategy` that reflect public interest in healthcare careers, industry strategy, and pharmaceuticals.

The data was processed to remove noise, and a word cloud was generated to visualise popular terms, with larger text size indicating higher frequency. A word cloud visualisation highlighted these terms by frequency, suggesting areas for NHS to enhance engagement through targeted social media outreach and communication strategies.

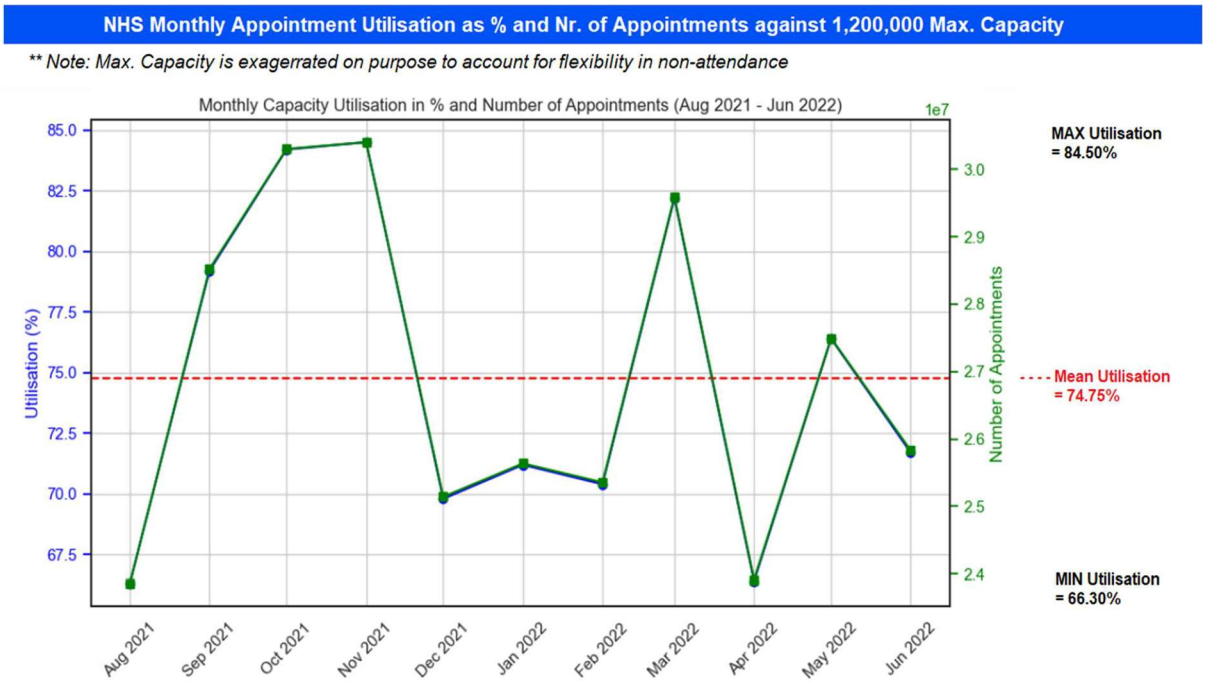
Notably, NHS-specific hashtags were absent, indicating an opportunity to develop a more cohesive NHS presence on social media. This absence suggests that the NHS could enhance its social media strategy by promoting NHS-specific hashtags to drive engagement and increase visibility in healthcare discussions.





Capacity Utilisation

Attendance Trends: ‘Face-to-Face’ appointments showed steady attendance rates, while ‘Home Visits’ unsurprisingly had minimal non-attendance due to the nature of the setting, highlighting how appointment modes influence overall attendance patterns and provide insights into patient accessibility and resource allocation.



Peak Months: October and November 2021 recorded the highest utilisation, with an overall rate of 84.5%, which already reflects efficient use of resources within the system's operational constraints and provides little room for increasing capacity without risking overburdening the system.

Recommendations

1. **Data Quality Enhancement:** Implement standardised data entry protocols and regular audits to reduce 'Unknown/Data Quality' entries, enabling more reliable analyses.

2. **Incorporate Timestamps:** Using precise timestamps for appointment booking and completion could improve scheduling efficiency and enable time-based trend analysis for better resource management.

3. **Social Media Engagement Strategy:** Encourage consistent use of NHS-specific hashtags for increased visibility and engagement on social media. Consider strategies to track hashtag engagement and inform public health messaging.

4. **Optimise Appointment Modes**: Based on DNA trends, assess the effectiveness of remote appointment modes. Encouraging suitable appointment modes during peak periods could enhance attendance rates and optimise patient flow.

5. **Targeted Resource Allocation:** During high-demand months, deploy additional resources to address surges in appointment bookings. This could include flexible staffing arrangements to accommodate peak periods.

6. **Advanced Modelling**: Consider developing models for predicting no-show likelihood, aiding in pre-emptive resource planning.

Conclusion

This report provides actionable insights into NHS appointment patterns and highlights areas for improvement in data quality, patient engagement, and resource utilisation. By implementing targeted strategies for optimising appointment modes, enhancing social media outreach, and refining data collection protocols, the NHS can better meet patient needs while maximising operational efficiency to support the NHS's goals of efficient, data-driven resource management.

Next Steps

- Address data quality and inconsistency issues through standardised entry protocols and data audits.
- Implement patient engagement strategies leveraging insights from social media to reach a broader audience effectively.
- Monitor intervention outcomes to assess the impact on attendance rates, capacity, and utilisation.