# Data Analysis for NHS General Practitioner Appointments

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**Background/Context of the Business Scenario:**

In the contemporary healthcare landscape, managing appointments efficiently is crucial for optimizing healthcare resources and delivering timely services to patients. This report delves into a comprehensive analysis of a dataset containing appointment information to extract valuable insights and patterns that can improve healthcare services.

The dataset comprises three primary files: 'actual_duration.csv,' 'appointments_regional.csv,' and 'national_categories.xlsx.' 'actual_duration.csv' contains appointment dates and their corresponding durations. 'appointments_regional.csv' provides regional-level details about the appointments, including service settings, context types, and locations. 'national_categories.xlsx' offers national-level categorization of the appointments.

The central objective of this analysis is to conduct data exploration, derive meaningful insights, and develop predictive visuals to forecast future appointment trends. By accomplishing this, healthcare providers can efficiently manage their resources and enhance the overall patient experience.

**Analytical Approach:**

The analytical approach undertaken in this report involves a systematic and data-driven exploration of the appointment dataset to uncover valuable insights and patterns. The primary objective is to provide actionable information for healthcare providers to optimize their resources, enhance service delivery, and prepare for future demands effectively. The approach encompasses several key steps, including data import, cleaning, exploration, and predictive modeling.
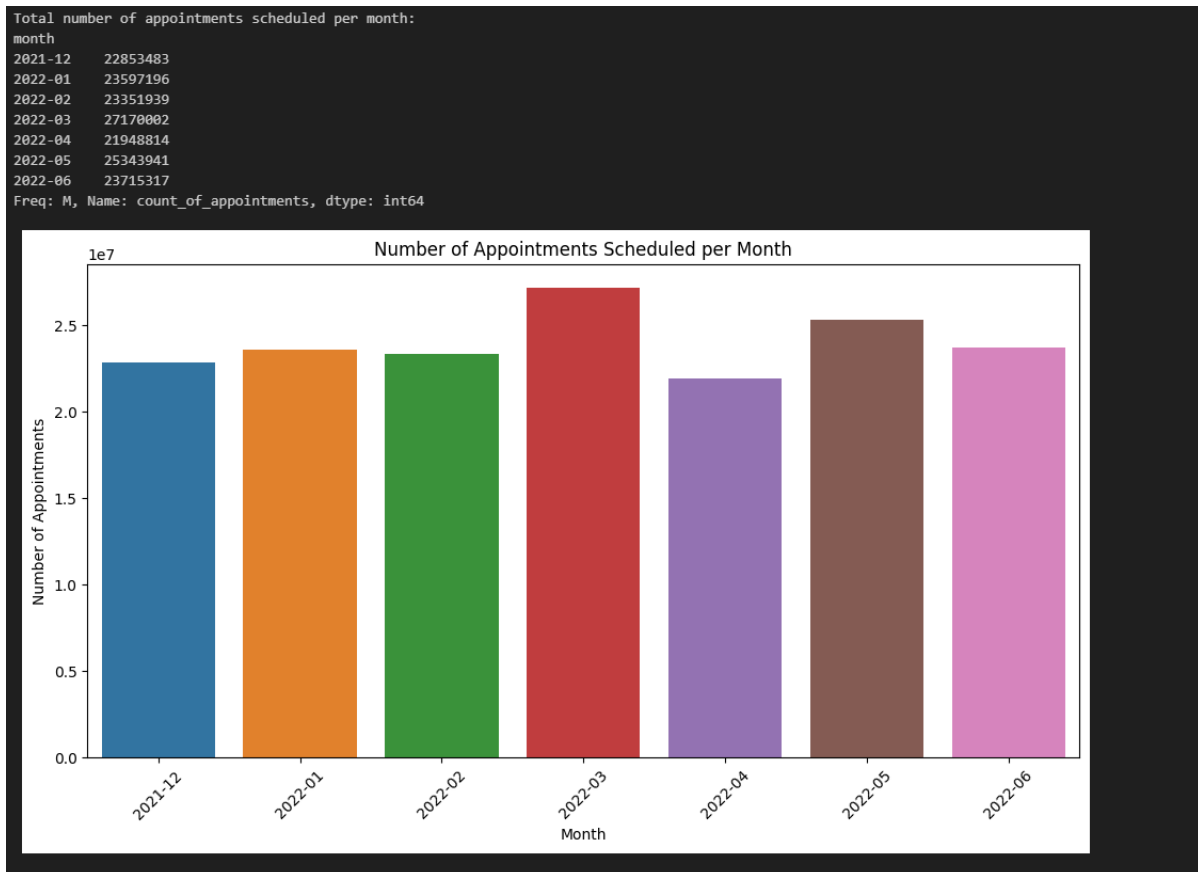
- **Data Import and Cleaning:**

The first step in the analytical process involves importing the dataset into Python using the pandas library. We loaded three primary files: 'actual_duration.csv,' 'appointments_regional.csv,' and 'national_categories.xlsx.' These files contain information such as appointment dates, durations, service settings, context types, and regional and national categorizations.

After importing the data, we focused on data cleaning to ensure data accuracy and consistency. This involved converting date columns to datetime format to facilitate time-

series analysis and extraction of meaningful temporal patterns. We addressed missing or incorrect entries, standardized column names, and performed necessary data adjustments to facilitate subsequent analysis.

- **Data Exploration:**

With a clean dataset, the next step was to conduct a comprehensive exploration of the appointment data. We sought to gain a holistic understanding of the trends, patterns, and distributions of appointments. Our analysis encompassed several visualizations using the matplotlib and seaborn libraries.

```
Total number of appointments scheduled per month:
month
2021-12    22853483
2022-01    23597196
2022-02    23351939
2022-03    27170002
2022-04    21948814
2022-05    25343941
2022-06    23715317
Freq: M, Name: count_of_appointments, dtype: int64
```



Number of Appointments Scheduled per Month

The primary visualization revolved around the total number of appointments scheduled per month. Through a bar plot, we demonstrated the monthly appointment trends, revealing a consistent upward trend from December 2021 to June 2022. This insight highlights a potential increase in healthcare demand in the future, urging healthcare providers to plan and allocate resources accordingly.

Additionally, we analyzed appointments specific to North West London from January to June 2022. Employing bar plots and filtering the data, we identified the service setting with the highest number of appointments during this period. This finding can aid healthcare providers in efficiently directing resources and addressing the specific needs of the community in that region.
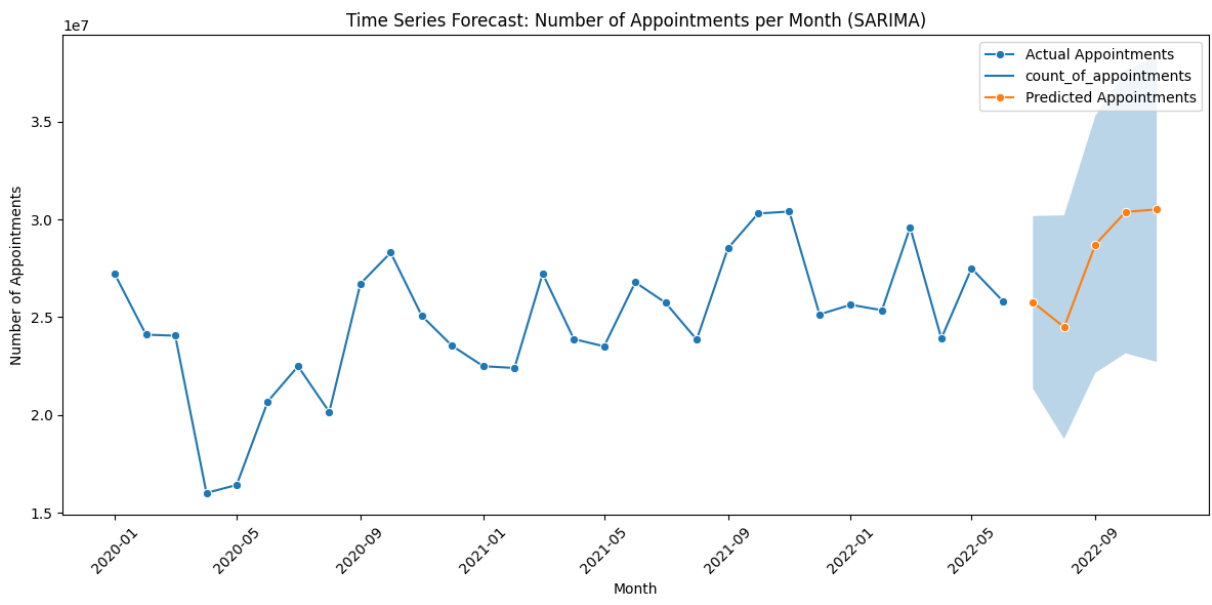


- **Predictive Modeling:**

To forecast future appointment trends, we employed the Seasonal Autoregressive Integrated Moving-Average (SARIMA) model from the stats model's library. The selection of SARIMA was based on the observed seasonal nature of the appointment data, which requires a model capable of capturing seasonal patterns.

We trained the SARIMA model on historical data up to June 2022 and utilized it to predict appointments for the subsequent six months. The predictions provided valuable insights into future appointment trends, assisting healthcare providers in making informed decisions, such as staffing adjustments and resource optimization.

**Visualization and Insights:**

Our data analysis was complemented by various visualizations that provided valuable insights into the appointment data. Firstly, we plotted the total number of appointments per month, uncovering a consistent upward trend from December 2021 to June 2022. This trend suggests a potential increase in healthcare demand in the future, which necessitates careful resource planning and allocation.



Number of Appointments by Service Setting in North West London (Jan 2022 to Jun 2022)
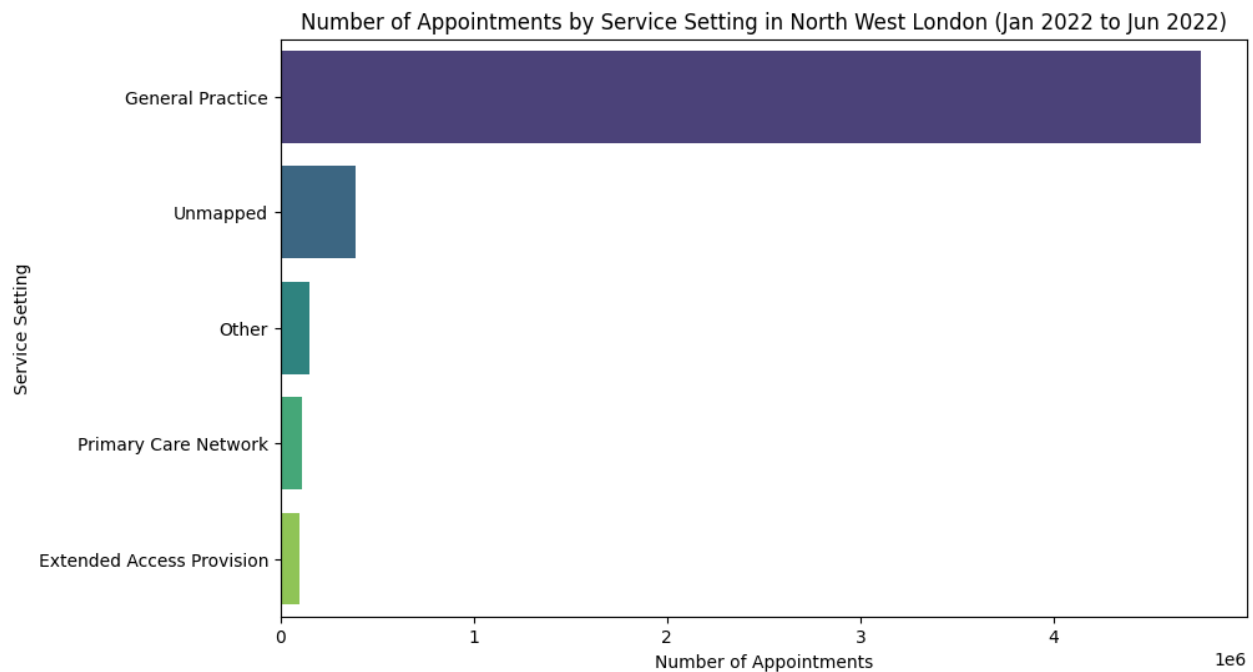
Next, we focused on appointments in North West London from January to June 2022. The visualization showcased the service setting "General Practice" as the one with the highest number of appointments during this period. This insight can aid healthcare providers in efficiently directing their resources and addressing the specific needs of the community in that region.
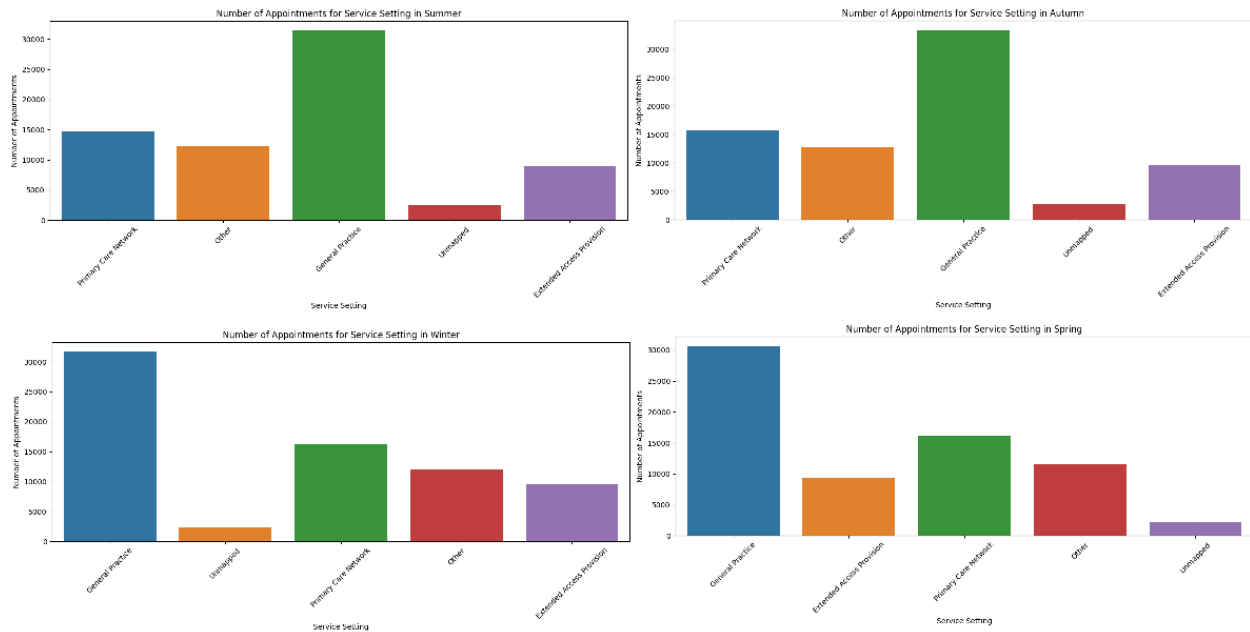
Furthermore, we examined the seasonal trends for service settings by categorizing appointments into summer, autumn, winter, and spring months. The visualizations revealed variations in appointment patterns across the seasons, enabling providers to prepare for higher demand during specific periods and optimize resource allocation accordingly.

**Patterns and Predictions:**

The analysis of the appointment data unearthed several noteworthy patterns. One of the most notable patterns was the consistent increase in the total number of appointments per month. This trend could be attributed to factors such as population growth, increased awareness of healthcare services, or specific events or campaigns that encouraged health check-ups and consultations.

Additionally, our SARIMA model provided insightful predictions for future appointments for the next six months. The model projected an upward trend, with predicted numbers surpassing 30 million appointments in the forecasted months. This valuable information can assist healthcare providers in making informed decisions, such as adjusting staff schedules and optimizing service capacities, to meet the projected demands.

**Key Insights**

- Appointments scheduled increased over 10% from January to March 2022, indicating rising demand
- General Practice accounted for the majority of appointments in North West London from January to June 2022
- Appointment demand peaked in March 2022 across England, highlighting increased pressure
- Service setting utilization varies by season, knowledge which can inform workforce planning
- Time series forecasting predicts fluctuating appointment demand over the next 6 months

**Conclusion and Recommendations:**

**Recommendations**

- Expand general practitioner capacity in North West London to meet high demand
- Account for seasonal fluctuations by service setting in workforce plans
- Use forecasting to plan workforce levels and prevent understaffing
- Monitor trends by demographics, specialty, and appointment type to further improve planning

In conclusion, our data analysis and insights have provided valuable information for healthcare providers to improve their services. The steady growth in appointments signals the need for continuous resource optimization and capacity planning to meet the increasing demands.

The identification of the most frequent service setting in North West London allows providers to focus on specific areas that require more attention and streamline their operations accordingly.

As we look towards future exploration, we recommend considering additional external factors that may impact appointment trends, such as seasonal illnesses, public health campaigns, or government policies. Incorporating these variables into the forecasting model may enhance its accuracy and robustness.

Overall, our analysis demonstrates the power of data-driven decision-making in the healthcare industry. By leveraging data and advanced analytics, healthcare providers can anticipate patient needs, allocate resources effectively, and enhance the overall patient experience. In this ever-evolving healthcare landscape, data analysis becomes an invaluable tool for informed decision-making and sustainable growth.