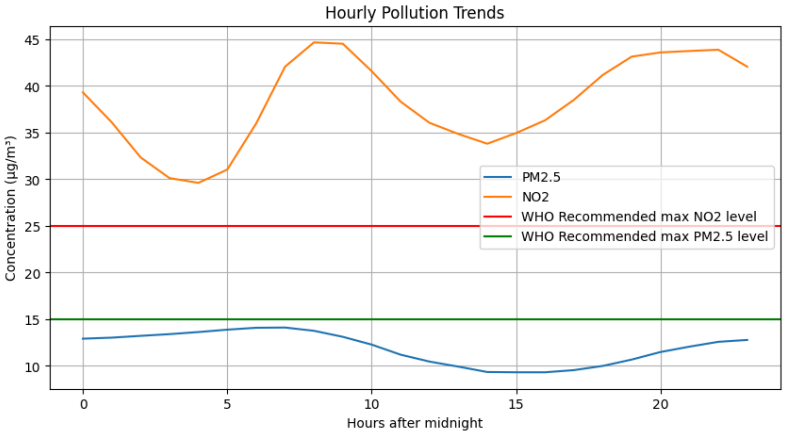
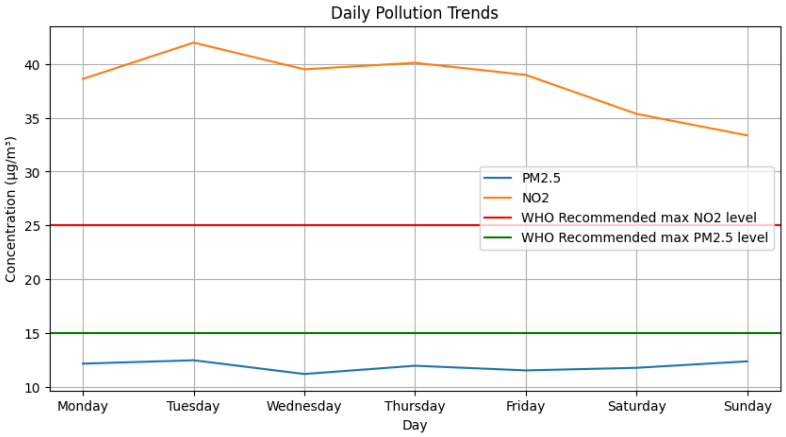
1. Approach and methods:

To create a realistic yet hypothetical dataset, I began by researching existing air pollution data. After analyzing multiple datasets, I selected the **Breathe London AQ mesh pods dataset** as the foundation for NO_2 and $PM_{2.5}$ measurements. I refined the dataset by keeping only relevant columns and handled missing values by dropping rows with null measurements, aligning with the goal of an imperfect dataset. To introduce hypothetical variability, I added random noise to the pollutant measurements. Finally, based on research-backed causal relationships, I simulated heart rate, respiratory rate, and running pace values influenced by NO_2 levels.





2. Summary of Findings

The average NO_2 and $PM_{2.5}$ levels across London were **11.93 µg/m³** and **38.25 µg/m³**, respectively, allowing us to identify locations with more favorable air quality.

We also analyzed **hourly pollutant trends** (see figure) to determine optimal and poor air quality periods. **Seasonal patterns**, though not included in a figure, showed better air quality in spring and summer compared to autumn and winter. Additionally, weekend pollutant levels were lower, likely due to reduced traffic and industrial activity.

An **interactive heat map** was generated to visualize pollutant concentrations across London, with a screenshot included below. Using **K-means clustering**, we classified locations into **low, medium, and high** pollution zones and plotted latitude/longitude data. However, computational constraints prevented us from integrating this into a more realistic map like the heat map.

Our analysis indicated a link between higher NO_2 levels and adverse health effects, but these findings were based on simulated health data rather than real-world measurements. With more time, we would refine the simulation using actual physiological data for improved accuracy.

3. Conclusions and Recomendations

To reduce exposure, individuals should avoid peak pollution hours, choose cleaner routes, and use air quality apps. Policymakers can expand low-emission zones, regulate industrial pollution, and promote green urban planning. Increased air quality monitoring and public awareness will further support informed decision-making.