A Lifelong Asthma Case Study: Uncovering Triggers, Patterns, and Trends Through Data

Capstone Project by Abnerson Ocampo

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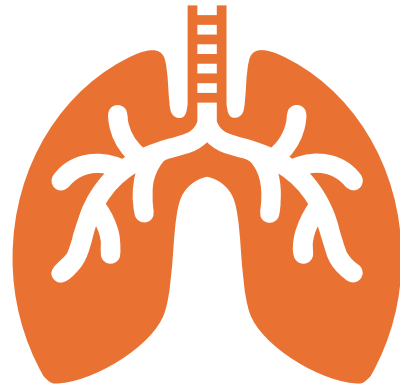**Upright** Education

Data Sponsor: Firsthand Asthma Case Study

Data: Personal Asthma Logs Dataset (Self-Collected, 2021-2024)

Description: This dataset consists of four years of manually recorded <u>severe asthma episodes</u>, including but not limited to:

- Symptoms
- Triggers
- Vital Signs
- Medications & Supplements
- Environmental Conditions

Introduction

What is Asthma?

Asthma is a **chronic respiratory condition** that causes inflammation and narrowing of the airways, making breathing difficult. It is characterized by **wheezing, shortness of breath, chest tightness, and coughing**.

I have lived with asthma **my entire life**, experiencing firsthand the unpredictability of severe episodes. One day, I decided it was time to take control—**to finally analyze this chronic illness once and for all** and put my knowledge to good use.

Why This Study Matters?

Asthma is not a one-size-fits-all condition. Triggers, severity, and patterns vary from person to person—what causes a severe attack in one individual may have no effect on another. This is why a **personalized, data-driven approach** is essential.

This project goes **beyond analysis**—it's a **personal journey** to uncover insights I've never explored before. From data collection to cleaning, exploration, and findings, this study transforms **asthma logs into actionable insights**. Not only does it enhance my asthma management, but it also shows how **data can empower individuals** to **take control of their health**.

Before diving into the data, I asked myself: What questions do I need to answer that will truly impact my life? Because as Data Analysts, our job isn't just to create fancy charts—it's to **uncover critical insights** that drive **real change** and **create impact**.

Key Questions We Aim to Answer:

1. How Long Do I Have Before My Breathing Becomes **Critical**?

2. What **Factors** Cause Faster Escalation to Severe Breathing Difficulty?

3. How Low Does My Oxygen Levels Drop **Before** Nebulization?

4. How **Effective** Is Nebulization in Recovering Oxygen Levels?

5. What Are My Major Key Asthma **Triggers**?

6. Is My Asthma **Seasonal**? Do Certain Months Have More Attacks?

7. When Do My Asthma Attacks Happen?
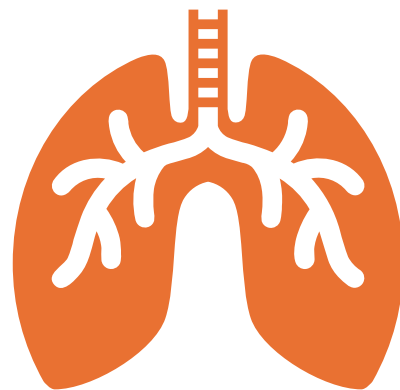
Exploratory Data Analysis

I will strive to provide actionable insights and impactful recommendations every step of the way, ensuring that the analysis helps shed light on practical steps for improving asthma care.

1. How Long Do I Have Before My Breathing Becomes **Critical**?

On average, there is a **15-min** delay between the first symptoms of severe asthma and the moment nebulization becomes necessary.

This metric, referred to as **Critical Response Window**, represents the delay before reaching a state where nebulization is essential to prevent escalation to emergency intervention.

Understanding this response window is **crucial**, as it allows me to recognize early warning signs and take preventive measures.

Key Question # 1 - Recommendations

- Be mindful of the average response window.

- Recognize early symptoms: pay attention to coughing, wheezing, or chest tightness as early warning signs.

- Keep medication readily available. Never ever forget your inhaler when going outside.

- Work with a Doctor or specialist to create an asthma care plan based on the 15-min average response window we discovered.

Temperature

*Higher Temperatures Correlate with Faster Escalation*
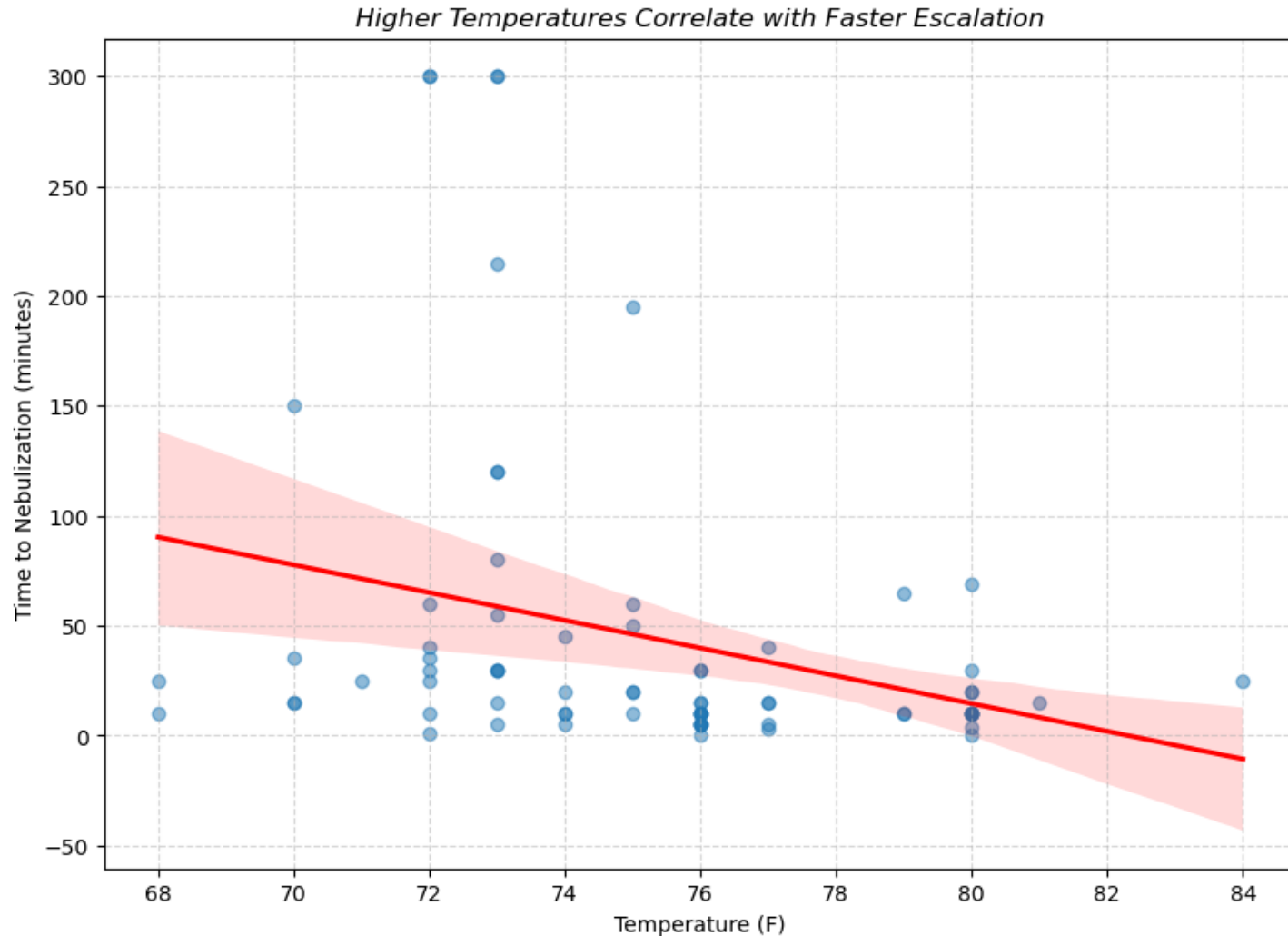
2. What **Factors** Cause Faster Escalation to Severe Breathing Difficulty?

- The **downward trend** suggests that, as temperature increases, the Critical Response Window tends to **shorten**, indicating that **higher temperatures** may contribute to faster asthma escalation.
- Studies suggest that warmer temperatures can worsen breathing due to **airway constriction**, **dehydration**, and increased **humidity**.

Sleep

The Impact of Sleep Deprivation on Asthma
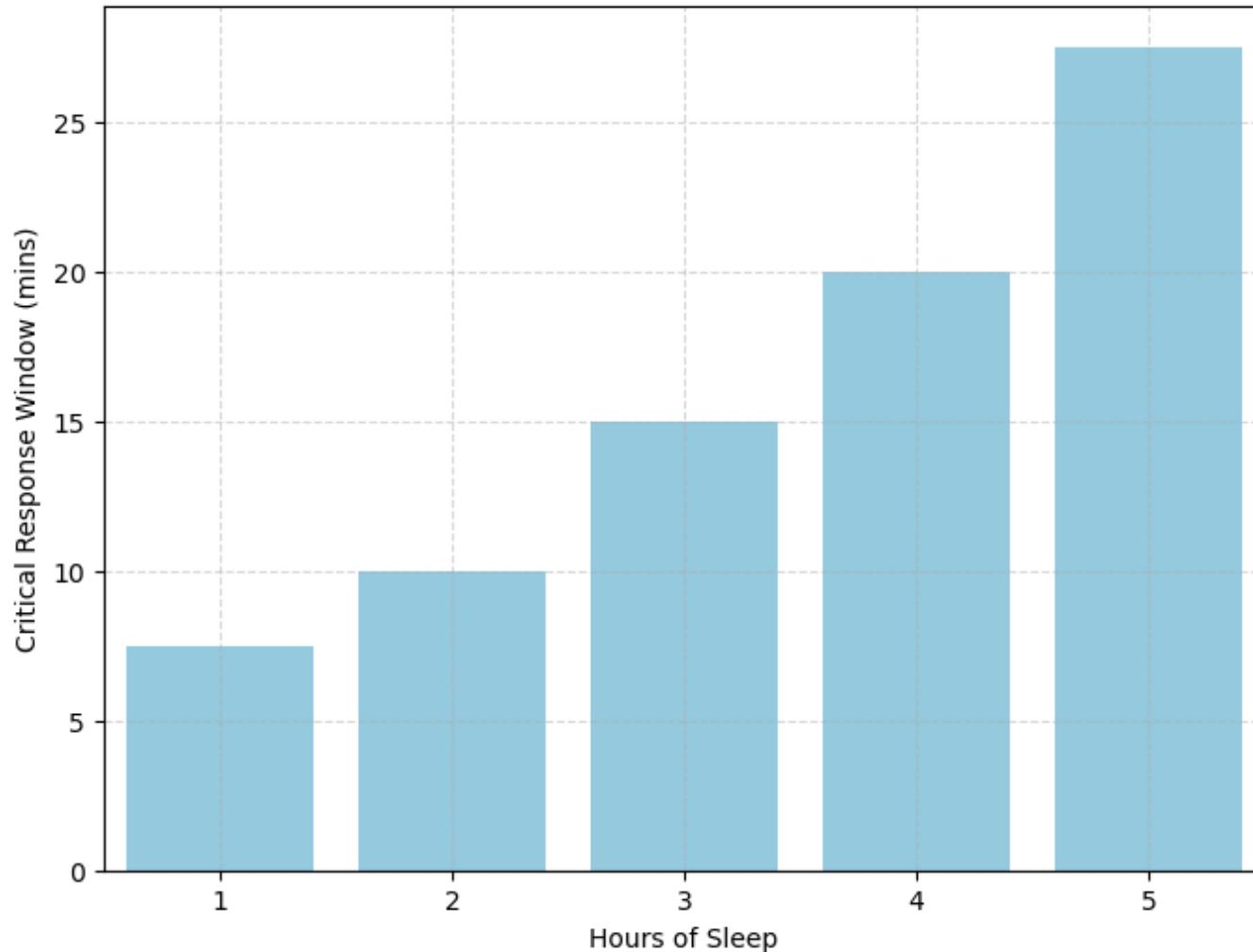
2. What **Factors** Cause Faster Escalation to Severe Breathing Difficulty?

- As **sleep decreased**, the Critical Response Window shrank **drastically**.
- Less than 6 hours of sleep? A **27-minute** window.
- Less than 2 hours? **7 minutes** left to act.
- **Sleep deprivation** directly reduces the time available for intervention during severe asthma attacks.
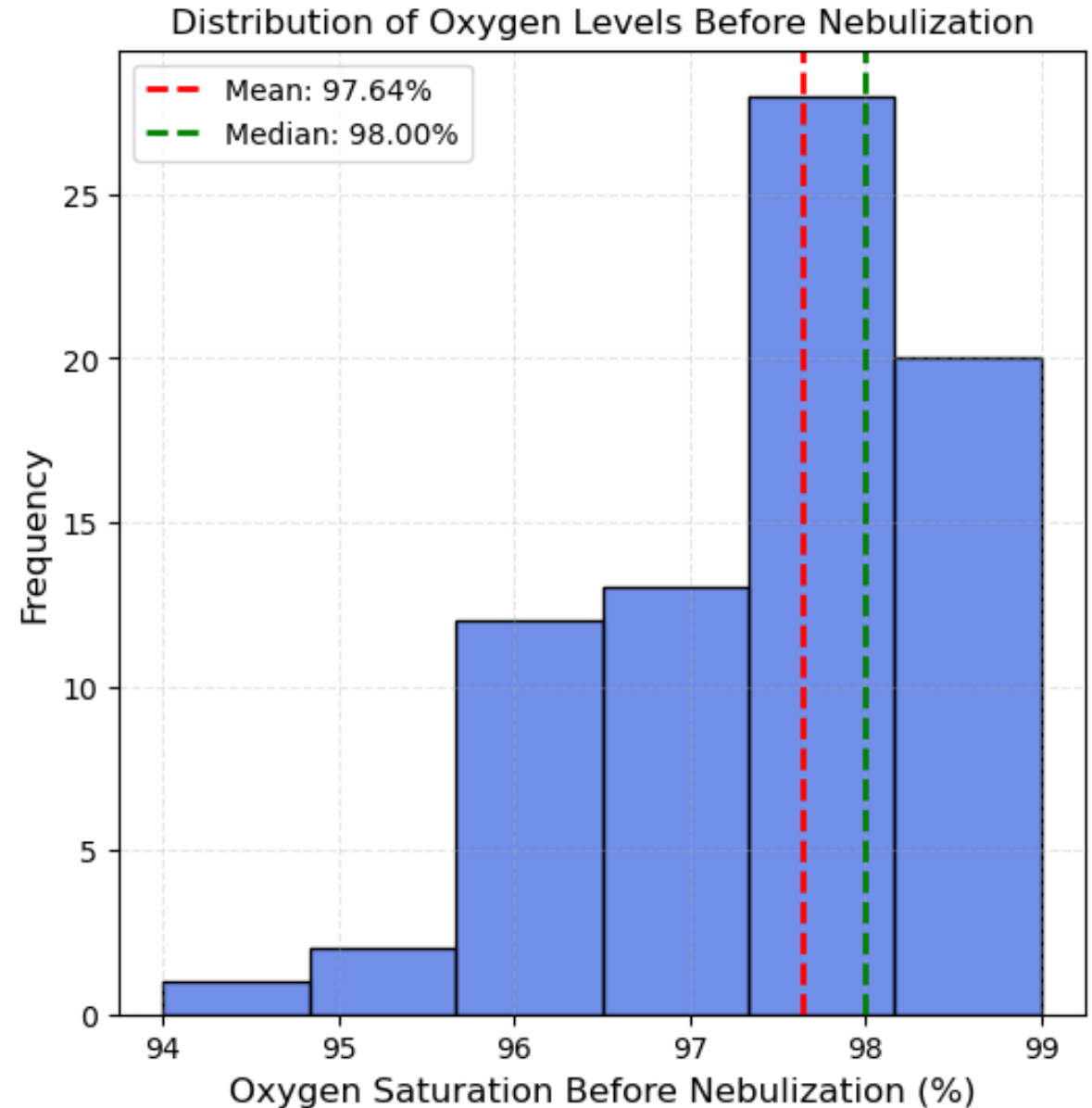
Key Question # 2 - Recommendations

- Regular **hydration**, combined with **breathing exercises**, can help reduce the burden on respiratory system during hot temperatures.

- **Avoid** outdoor exposure during the hottest parts of the day, and make sure asthma medications are easily **accessible**.

- Aim for at least **8 hours** of sleep per night. Research indicates that this amount of sleep is beneficial to overall health.

- **Address** sleep issues such as insomnia with a Doctor to improve sleep quality and asthma management.

3. How Low Does My Oxygen Level Drop **Before** Nebulization?

- Most episodes occurred within safe limits (**97-98%**), generally considered safe but enough to trigger severe breathing difficulty in my personal case.
- A few instances showed oxygen levels dropping below **96%** and as low as **94%**, indicating rare yet potentially unsafe oxygen levels.

Note: Although my oxygen levels generally remain in the safe zone, rare but critical drops highlight the need for constant monitoring before levels dip too low.

Distribution of Oxygen Levels Before Nebulization

- - Mean: 97.64%
- - Median: 98.00%

Frequency

Oxygen Saturation Before Nebulization (%)

Key Question # 3 - Recommendations

- **Monitor** oxygen levels closely. Using a **pulse oximeter** can help track trends and detect early warning signs.

- Stay **prepared** for rare drops in oxygen.

- **Consult** a Doctor if oxygen levels drop **frequently** below safe levels, discussing alternative medications or treatment adjustment

Oxygen Levels Before & After Nebulization

Source: asthma-logs-dataset-2021-2024
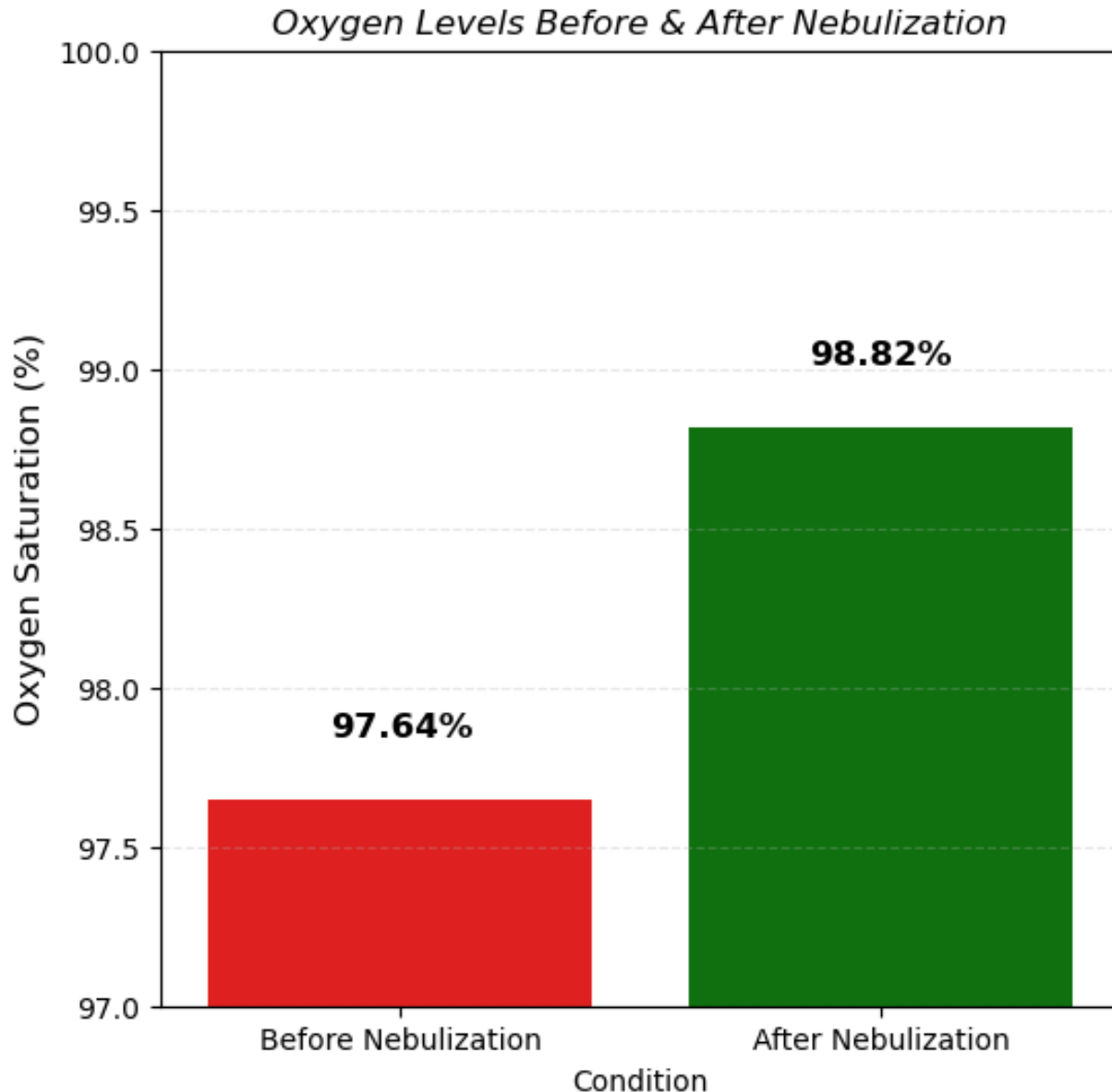
4. How **Effective** Is Nebulization in Recovering Oxygen Levels?

- On average, after nebulization, my oxygen rises to **98.32%**, meaning that treatment is reliably **effective** in restoring oxygen levels closer to normal.
- Since my oxygen levels generally remain high, this suggests that severe asthma attacks may **not always** be linked to **oxygen desaturation**, reinforcing the importance of monitoring symptoms **beyond** just oxygen readings.

Key Question # 4 - Recommendations

- Use oxygen as a **guide, not the sole indicator**. Since oxygen levels generally remain high, don't solely rely on pulse oximeters to assess asthma severity. **Monitor** other symptoms like wheezing, tightness of chest, and fatigue.

- Try to **relax** if oxygen levels are **stable** to control your breathing better, and to also lower heart rate. Don't panic.

- **Continue** nebulization for symptom relief. Nebulization still plays a critical role in improving airflow and easing breathing difficulties.

Stress
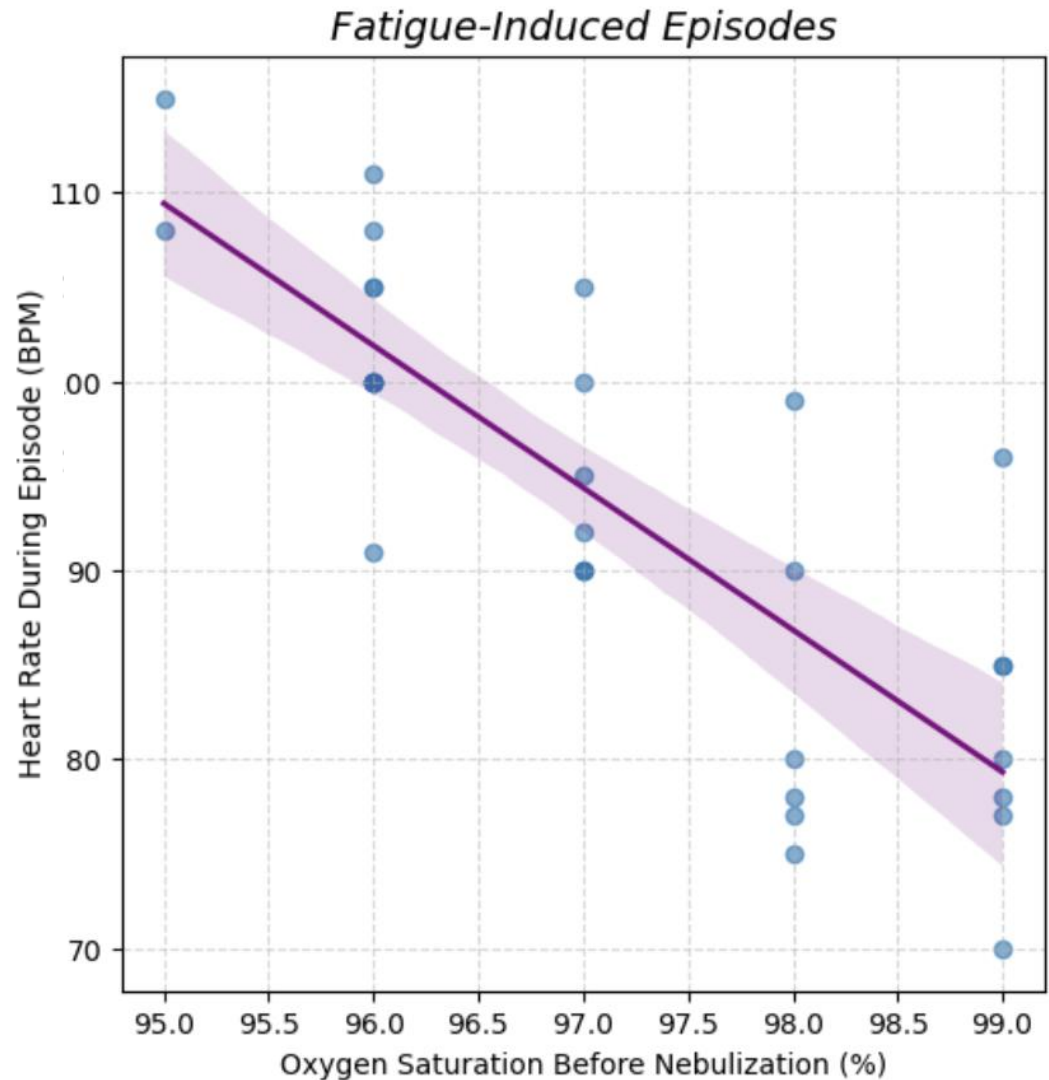
5. What Are My Major Key Asthma **Triggers**?

- **Critical Response Window**: 20 mins
- **Average Heart Rate**: 88.4 BPM
- **Average Oxygen Saturation**: 97.55%
- **r** = -0.7514, **p** = 0.0001

Stress-Induced Episodes
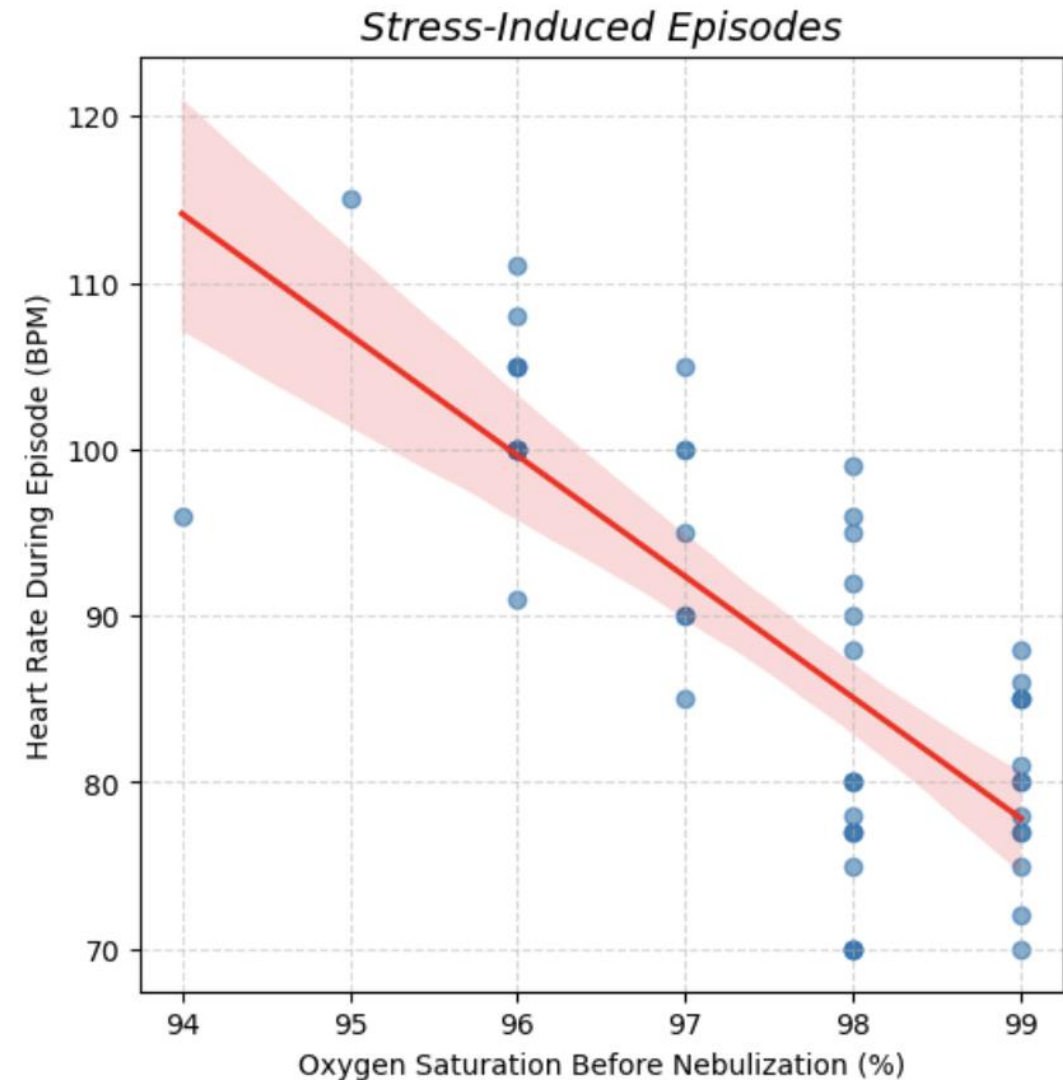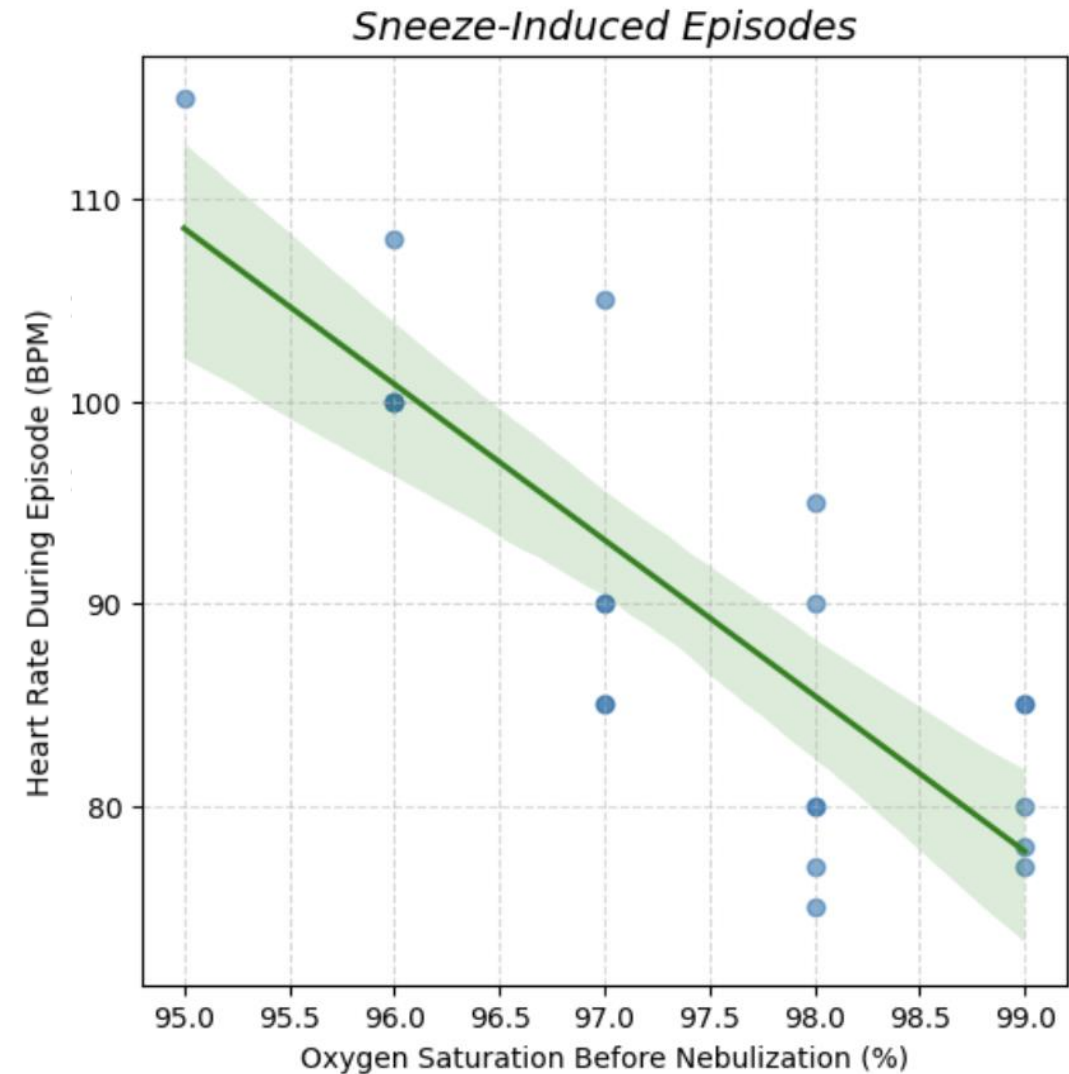
5. What Are My Major Key Asthma **Triggers**?

- **Critical Response Window**: 27.5 mins
- **Average Heart Rate**: 93 BPM
- **Average Oxygen Saturation**: 97.19%
- **r** = -0.8133, **p** = 0.0001

Fatigue-Induced Episodes

5. What Are My Major Key Asthma **Triggers**?

- **Critical Response Window**: 35 mins
- **Average Heart Rate**: 90 BPM
- **Average Oxygen Saturation**: 97.41%
- **r** = -0.8279, **p** = 0.0001

Sneeze

Sneeze-Induced Episodes

Heart Rate During Episode (BPM) vs Oxygen Saturation Before Nebulization (%)

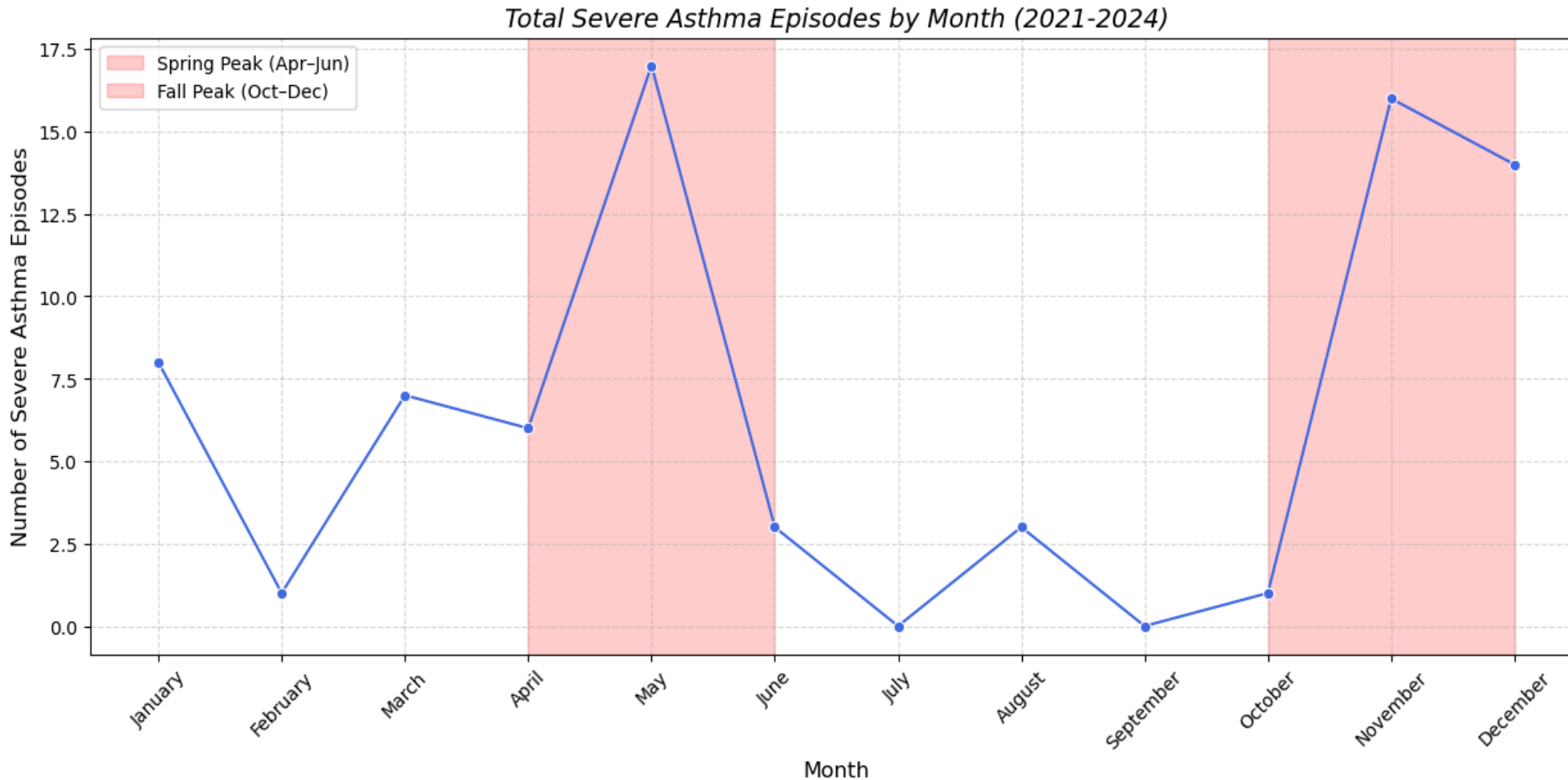# **Key Question # 5** - Recommendations

- Do **stress-relieving activities** like mindfulness and meditation, avoiding stress triggers etc.

- Monitor **energy levels** and rest adequately to avoid fatigue-induced attacks. Optimize **sleep** quality.

- Watch out and **avoid** known allergies.

- Any **combinations** of these different triggers may potentially be **threatening**.

- Always be ready to intervene **earlier** instead of waiting for symptoms to worsen.

6. Is My Asthma **Seasonal**? Do Certain Months Have More Attacks?

Total Severe Asthma Episodes by Month (2021-2024)

Seasonal peaks in Spring (*April-Jun*) and Fall (*Oct-Dec*)

Possible Reasons:

- **High pollen** levels can trigger **allergic** asthma.
- Changes in **temperature**.
- **Seasonal illness** (cold & flu) could worsen asthma symptoms.
- Cooler, drier air may **irritate airways**, making asthma attacks more frequent.
- Past logs indicate these seasonal patterns are consistent across **multiple years**.

Key Question # 6 - Recommendations

- Use **air purifiers** or masks to reduce exposure to **allergens** and **pollutants** that may trigger asthma.

- **Track** seasonal trends to prepare in **advance** for high-risk months.

- Maintain **hydration** & **humidity control** indoors to prevent airway irritation from dry or cold air.

- **Limit** outdoor exposure during peak **pollen seasons**.

7. When Do My Attacks Happen?

- There are noticeable peaks in severe asthma attacks around **3-4AM and 4-5PM**.
- The early morning attacks may be linked to **circadian rhythms**, and **nighttime airway constriction**, which can worsen asthma symptoms.
- It could also be influenced by **disruptions** in my sleep schedule or an **irregular body clock**.

Asthma Episodes by Time of Day
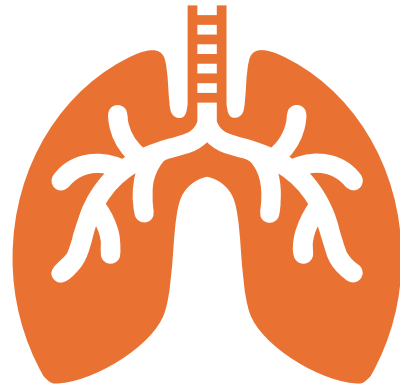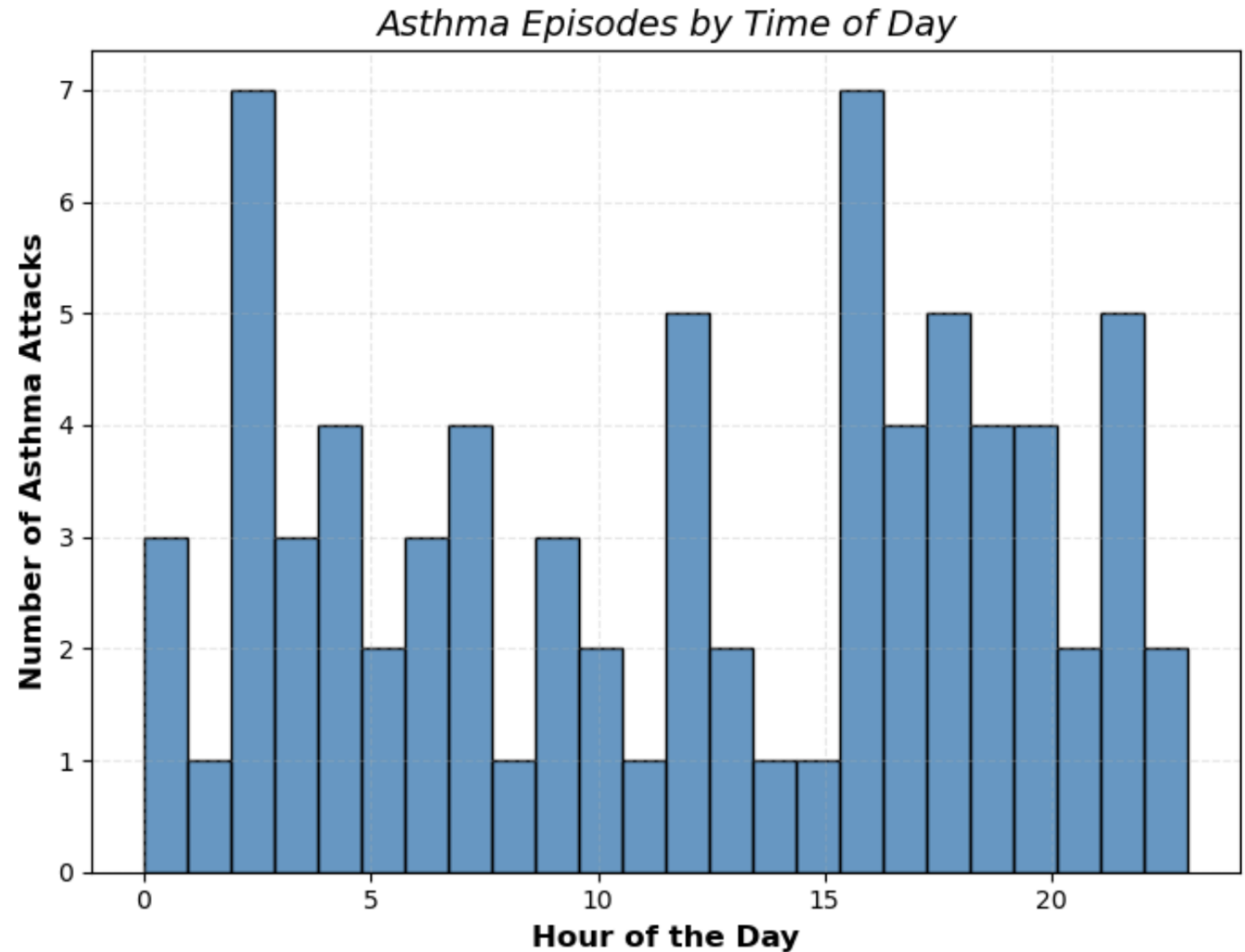
7. When Do My Attacks Happen?

- The highest number of severe asthma attacks occur on **Mondays** and **Sundays**.
- Monday spikes could be linked to work or school **stress**, and Monday blues.
- Sunday spikes may be influenced by **weekend activities**, or **disrupted sleep schedules** before the start of a new week.
- **Wednesday** and midweek days show lower attack rates, possibly due to more consistent routines, and less stress.

Asthma Attacks by Day of the Week
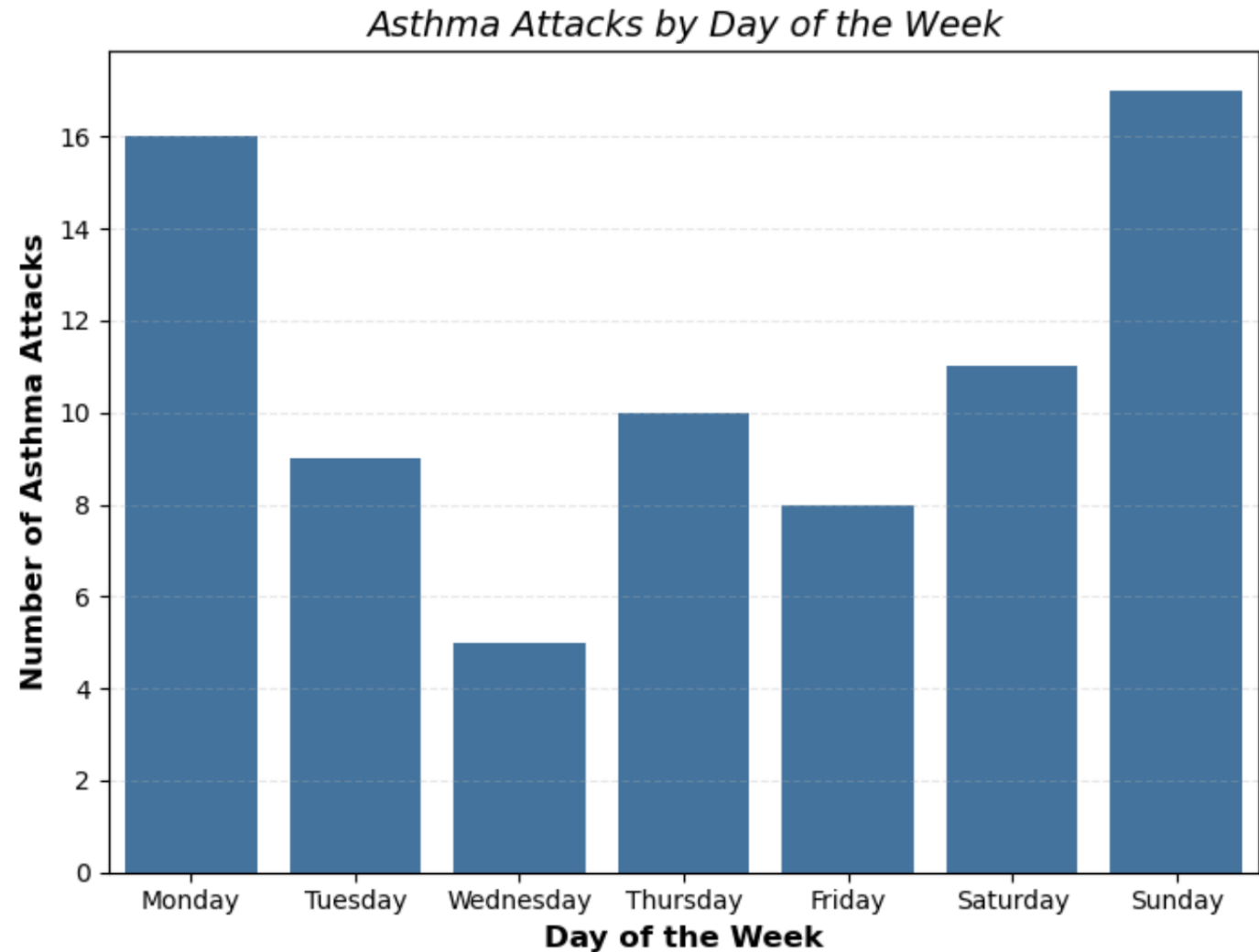
Key Question # 7 - Recommendations

- Prioritize **sufficient rest**. Disrupted sleep can contribute to asthma exacerbations.

- Aim for consistent bedtime and at least **7-9 hours** of sleep per night to support better lung function and reduce nighttime attacks.

- Maintain a consistent weekend routine – **avoid** drastic shifts in sleep, diet, or physical activity that could contribute to Sunday night disruptions.

- If certain days have consistently higher attacks, **consult with a Doctor** about optimizing medication timing or preventive strategies.
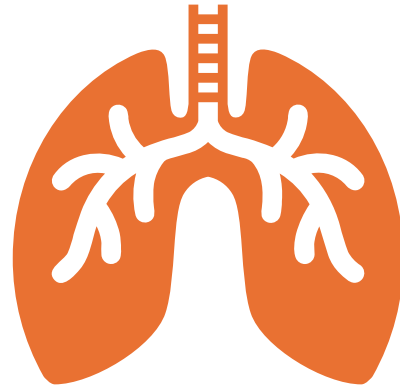
Conclusion

As Data Analysts, our job isn't just to create fancy charts—it's to uncover critical insights that drive **real change** and **create impact**. This project is a reflection of that purpose, showing how **data can empower** individuals to **take control of their health**. With that said, though data can guide us, always consult a medical professional.

Thank You

I appreciate your time and attention throughout this presentation.

For the full analysis, visualizations, and code check the link here:
https://abnersonocampo.github.io/comprehensive-asthma-analysis/

Email: abnersonocampo@gmail.com | LinkedIn: https://linkedin.com/in/abnerson-ocampo/