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|  | | DSA-210 FINAL REPORT | | |  | |
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|  | | | BURAK BAHÇELİ |  | | |
|  | | | 32315 **THE IMPACT OF WEATHER AND AIR QUALITY ON SLEEP QUALITY**  **SUPERVISED BY**  **ÖZGÜR ASAR** |  | | |

**SABANCI UNIVERSITY**

**WHAT'S IN THIS REPORT?**

This report analyzes the effect of environmental variables on sleep quality. Over three months, data were collected regarding sleep patterns and environmental factors such as weather conditions and air quality. This study aimed to identify which external variables most significantly affect sleep duration, quality, and disturbances. Using data science tools such as regression analysis and data visualization, this work provides insight into sleep optimization under varying environmental conditions.

**Parameters in the Report:**

* **Date**: The date the data was recorded
* **Sleep Duration**: Total sleep time per night (in minutes)
* **Light/REM/Deep Sleep**: Stages of sleep tracked
* **Awake Time**: Time spent awake during the night
* **Temperature**: Daily average temperature (°C)
* **Humidity**: Daily average humidity (%)
* **Barometric Pressure**: Atmospheric pressure (hPa)
* **Precipitation**: Daily rain/snow levels (mm)
* **Air Quality Index (AQI)**: Pollution measurement
* **PM2.5 / PM10**: Concentration of fine particles (µg/m³)

These parameters allow a comprehensive understanding of how different environmental conditions may affect sleep.

**INTRODUCTION**

The purpose of this project is to explore how daily environmental conditions influence sleep patterns. By using a smartwatch to log sleep data and accessing weather and air quality data from Accuweather, this project integrates scientific methodology into a personal health context. It emphasizes how data-driven methods can lead to meaningful insights and actionable changes in lifestyle to improve well-being.

**WHAT DID I DO?**

Sleep and environmental data were collected daily across a three-month period. Each day’s record included sleep metrics (duration and stages) and weather-related variables (temperature, humidity, AQI, etc.).

Using Python libraries, I processed the data and created visualizations to observe relationships between sleep quality and environmental factors. Outliers (caused by travel, illness, or inconsistent sleep tracking) were flagged.

Once cleaned, the dataset was explored through scatter plots, heatmaps, and time series charts. The main analytical tool was regression analysis, used to identify which variables most significantly predicted sleep disturbances or improvements.

**GRAPHS AND CORRELATIONS**

**Key Observations:**

* **PM2.5 and REM Sleep (r = -0.58)**: High PM2.5 levels showed a negative correlation with REM sleep minutes.
* **Humidity and Sleep Disruptions (r = 0.41)**: Increased humidity was linked to more frequent waking and shorter deep sleep duration.
* **Temperature and Deep Sleep (r = 0.49)**: Moderate temperatures correlated positively with deep sleep time.
* **Precipitation and Sleep (no strong trend)**: Days with rain or snow showed no consistent impact on sleep.
* **AQI and Sleep Quality (r = -0.35)**: Poor air quality generally corresponded with less restful nights.

**General Insights:**

* Weather plays a measurable role in sleep quality, especially through temperature and humidity.
* Air pollution metrics (PM2.5, AQI) show an observable influence on REM and deep sleep stages.
* Trends fluctuate across weeks; consistent good sleep coincided with stable, clean air and cooler nights.

**EXAMPLE CHART ANALYSIS**

**1. Scatter Plot – REM Sleep vs. Temperature**:

* Shows a positive relationship around 12–14°C correlating with better REM sleep.

**2. Heatmap – Correlation Matrix of Variables**:

* Highlights strong and weak relationships among sleep, air quality, and weather variables.

**3. Line Plot – Deep Sleep Over Time**:

* Demonstrates how deep sleep fluctuated during environmental changes.

**4. Boxplot – Awake Time by Humidity Levels**:

* Awake time increases on higher humidity days.

**CAN IT BE BETTER?**

This project would benefit from more comprehensive sensors and longer data collection periods (across seasons). Variables such as noise levels, physical activity, and screen time could be included in future work. Additionally, using multiple participants would improve generalizability.

**FINAL WORDS**

**Main Takeaways:**

* **Temperature**, **PM2.5**, and **Humidity** are key influencers of sleep quality.
* Better air quality and moderate temperatures provide a foundation for restorative sleep.
* Applying data science tools to personal habits gives actionable insights and encourages healthier behaviors.

**Conclusion:**

The intersection of environmental science and personal health reveals that sleep is not just an internal biological process but one influenced by our surroundings. With the increasing accessibility of data, individuals can optimize their lifestyles in simple, science-backed ways. This project not only improved my sleep awareness but deepened my understanding of practical data science applications.