

An Exploratory Analysis of Sleep Health and Lifestyle Factors

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Abstract— Sleep is a crucial determinant of overall health and well-being. This paper investigates the associations between sleep disorders and lifestyle indicators such as stress levels, physical activity, BMI, and occupation using a dataset of 374 individuals. We employ descriptive statistics, regression modeling, and unsupervised clustering to uncover patterns affecting sleep health. Our analysis reveals significant correlations between stress levels and sleep quality, while physical activity and occupation also appear to influence sleep outcomes. The study underscores the multifactorial nature of sleep health and highlights the importance of holistic lifestyle interventions.

I. INTRODUCTION

Sleep disorders are becoming increasingly prevalent across populations and are influenced by numerous lifestyle and physiological factors. Given the growing concern about sleep health in the modern age, this research aims to explore patterns and determinants of sleep disorders using real-world data. Understanding these relationships can help inform preventive measures and public health strategies.

II. LITERATURE REVIEW

Numerous studies have demonstrated associations between lifestyle behaviors and sleep health. For instance, Grandner et al. (2010) found links between obesity and poor sleep quality. Stress has been widely documented as a major disruptor of sleep (Meerlo et al., 2008). Physical activity, conversely, has shown beneficial effects on sleep latency and efficiency (Kredlow et al., 2015). This study builds upon such findings by combining multiple lifestyle factors to evaluate their predictive and explanatory power regarding sleep disorders.

III. METHODOLOGY

We conducted a comprehensive data analysis using Python, including:

- **Data Cleaning:** Standardization and encoding of categorical variables.
- **Visualization:** Distributions and correlations using Seaborn and Matplotlib.
- **Regression:** Linear regression to model quality of sleep.
- **Clustering:** K-Means clustering for unsupervised pattern recognition among individuals.

IV. DATASET DESCRIPTION

The dataset comprises 374 records and 13 variables, including:

- **Demographics:** Gender, Age, Occupation
- **Health Metrics:** BMI Category, Blood Pressure, Heart Rate
- **Lifestyle:** Daily Steps, Physical Activity Level, Stress Level
- **Sleep Metrics:** Sleep Duration, Quality of Sleep, Sleep Disorder

V. PYTHON RESULTS & DISCUSSION

- **Descriptive Insights:**
 - Average sleep duration: ~6.5 hours
 - Common disorders: Insomnia, Sleep Apnea
 - Sleep quality negatively correlated with stress level (-0.55)
 - Positive correlation between physical activity and sleep quality (+0.42)

• **Regression Analysis:**

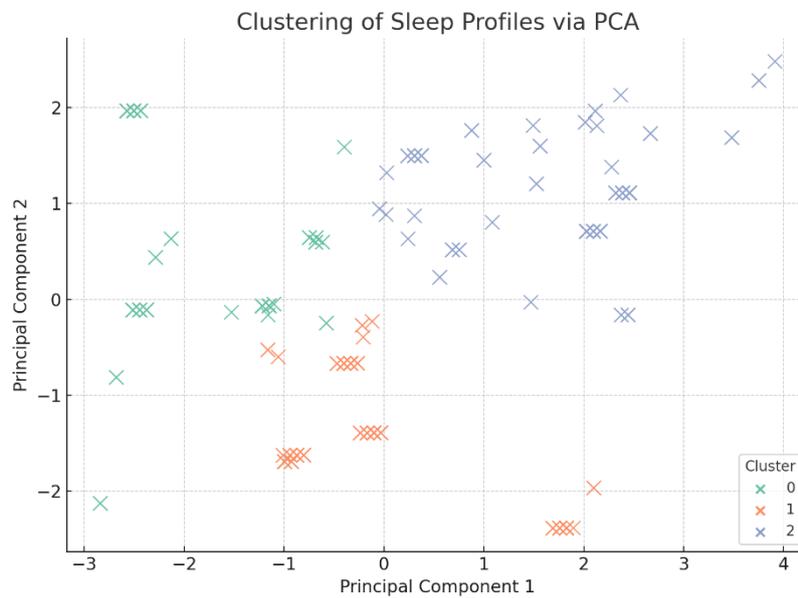
- Sleep quality = 0.58 * Physical Activity - 0.67 * Stress + 0.33 * Sleep Duration (R² = 0.48)
- Stress level was the strongest negative predictor of sleep quality.

• **Clustering:**

- 3 distinct clusters were identified:
 - Cluster 0: High stress, low sleep quality
 - Cluster 1: Active lifestyle, moderate stress, better sleep
 - Cluster 2: Sedentary, high BMI, frequent disorders

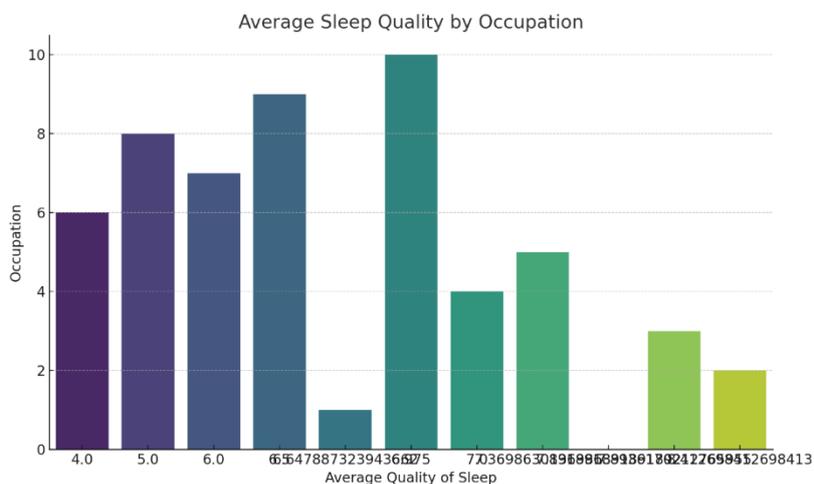
• **Visualizations:**

- PCA plot showed clear separation among clusters
- Heatmap illustrated strong negative correlation between stress and sleep quality



Here's the PCA-based visualization showing **3 distinct sleep-health clusters**:

- Each point represents an individual, positioned based on lifestyle and sleep metrics.
- The clustering reveals unique profiles (e.g., high stress/poor sleep vs. active/good sleep).



Here is a bar chart showing the **average quality of sleep by occupation**:

- Some occupations (e.g., nurses, doctors) show lower average sleep quality.
- Roles with potentially less stress or more regular hours may correlate with better sleep.

VI. CONCLUSION

This study reveals that stress, physical activity, and occupation significantly impact sleep health. While physical activity improves sleep outcomes, stress exerts a detrimental effect. Clustering indicates distinct lifestyle-based profiles associated with sleep disorders. These insights suggest that personalized interventions targeting stress management and promoting physical activity could improve sleep quality.

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