Sleep and Stress Analysis

Summary

This project leverages a Factor Analysis of Mixed Data (FAMD) to dissect the interplay among several health-related variables. These variables include sleep duration, physical activity, heart rate, age, and gender, to identify factors that can contribute to lower stress levels and improved sleep quality. The analysis highlights that sleep hygiene and regular physical activity are pivotal in shaping overall well-being. These insights are valuable to organizations seeking to boost productivity, reduce healthcare costs, and foster a healthier, more engaged workforce and workplace environment.

Introduction

In today's competitive business landscape, employee wellness is more than a personal concern—it directly affects productivity, healthcare expenditures, and overall organizational performance. By integrating advanced analytical techniques like FAMD, this project provides a multidimensional view of health factors that influence stress and sleep quality.

Business Value

Enhanced Employee Well-being

By pinpointing critical health determinants, organizations can design targeted wellness programs. Improved sleep and reduced stress lead to better mental clarity, increased energy, and higher job satisfaction—all of which contribute to enhanced productivity.

Cost Reduction

Investing in preventive health measures reduces long-term healthcare costs. The analysis supports the strategic allocation of resources toward initiatives that not only improve employee health but also lower absenteeism and associated healthcare expenses.

Data-Driven Decision Making

The FAMD analysis provides a data-driven foundation for business decisions. Understanding the interactions between demographic factors and lifestyle behaviors empowers leaders to tailor interventions to diverse employee groups, maximizing the effectiveness of wellness programs.

Competitive Advantage

Companies that proactively promote health and wellness foster a positive corporate image and a strong employer brand. This can lead to better talent retention and attraction, further strengthening the business's competitive position in the market.

Variable Definitions:

Gender: Recorded as male or female (Binary)

Age: Measured in Years (Numeric)

Occupation: Profession of the individuals (Categorical)

Sleep duration: Number of hours the person sleeps per data on average (Numeric)

Quality of Sleep: on a 1 to 10 scale, a measure of the person's perceived sleep quality with 10 being excellent (Categorical)

Physical activity level: The number of minutes per day a person engages in physical activity such as exercise. (Numeric)

Stress Level: A subject rating of the person's stress on a scale of 1 to 10, with 10 being high. (Categorical)

BMI: Body mass Index classifies a person into 4 categories, underweight, normal, overweight, and obese. (Categorical)

High_Blood_Pressure: Initially the Blood Pressure variable with Systolic/Diastolic measurements per person. We converted it into a binary variable indicating whether a person has high blood pressure. (Binary)

Heart Rate (BPM): is the person's resting heart rate. (Numeric)

Daily steps: Number of steps per day (Numeric)

Sleep disorder: The presence or absence of a sleep disorder categorized as None, insomnia, or sleep apnea. (Categorical)

Link to dataset

Analysis Overview

The FAMD output reveals five principal dimensions that explain approximately 60.7% of the total variance in the data. Each dimension represents a cluster of interrelated variables:

- **Dimension 1 (18% Cumulative Variance):**
  Dominated by demographic and physiological measures, this dimension highlights Age, Sleep Duration, Heart Rate, and Gender. It sets a baseline profile for how intrinsic factors relate to overall health.

- **Dimension 2 (14.4% Cumulative Variance):**
  With significant contributions from Sleep Duration and Age (and moderate inputs from Gender and Heart Rate), this dimension underscores the lifestyle factors that affect both sleep quality and stress.

- **Dimension 3 (10.9% Cumulative Variance):**
  Focused on physical activity, this dimension is driven by Daily Steps and Physical Activity Level. It illustrates the strong relationship between regular exercise and improved health outcomes.

- **Dimension 4 (≈8.76% Cumulative Variance):**
  This dimension primarily reflects gender differences. Although its overall variance is lower, it suggests subtle but important distinctions in how health factors manifest across male and female populations.

- **Dimension 5 (8.37% Cumulative Variance):**
  Similar to Dimension 3, this axis further refines the insights around physical activity, indicating that nuances in exercise behaviors also play a role in stress reduction and sleep quality.

Main Findings

- **Sleep Duration is Critical:**
  Both Dimensions 1 and 2 underscore the importance of sleep duration in overall health. Adequate and consistent sleep is strongly associated with lower stress and better recovery, making it a primary focus for wellness initiatives.

- **Physical Activity Drives Health:**
  Dimensions 3 and 5 show that regular physical activity, measured via daily steps and activity levels, is a major contributor to improved health outcomes. This reinforces the need for programs that encourage exercise and movement throughout the day.

- **Cardiovascular Health as an Indicator:**
  The recurring role of Heart Rate across several dimensions suggests that cardiovascular metrics can serve as important indicators of overall health and stress levels. Monitoring and maintaining optimal heart health could have a positive impact on sleep and stress management.

- **Personalization Based on Demographics:**
  The influence of Age and Gender, particularly visible in Dimensions 1, 2, and 4, indicates that health interventions should be tailored. Customized approaches that consider demographic differences will likely yield better outcomes.

Recommendations

1. **Promote Sleep Hygiene:**
    - **Initiative:** Implement educational programs and interventions to improve sleep quality.
    - **Action:** Encourage regular sleep schedules, reduce exposure to screens before bedtime, and create relaxing work environments.
    - **Impact:** Better sleep leads to enhanced cognitive function and reduced stress.
2. **Encourage Regular Physical Activity:**
    - **Initiative:** Develop corporate wellness programs that incentivize physical activity.
    - **Action:** Introduce step challenges, subsidize gym memberships, and create opportunities for movement (e.g., standing desks, walking meetings).
    - **Impact:** Regular exercise not only improves cardiovascular health but also supports mental well-being and stress reduction.
3. **Integrate Health Monitoring Technologies:**
    - **Initiative:** Invest in wearable devices and health monitoring platforms.
    - **Action:** Use data analytics to track sleep, activity, and heart rate metrics, enabling personalized health interventions.
    - **Impact:** Continuous monitoring helps identify stressors early and tailors wellness programs to individual needs.
4. **Customize Wellness Programs:**
    - **Initiative:** Design health interventions that are sensitive to demographic differences.
    - **Action:** Offer targeted programs for different age groups and genders to address specific health challenges.
    - **Impact:** Personalized programs can lead to more effective stress management and improved overall health outcomes.