Sleep Health and Lifestyle Dataset

統計應用方法實作計畫報告

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We have total 6 problems in this study

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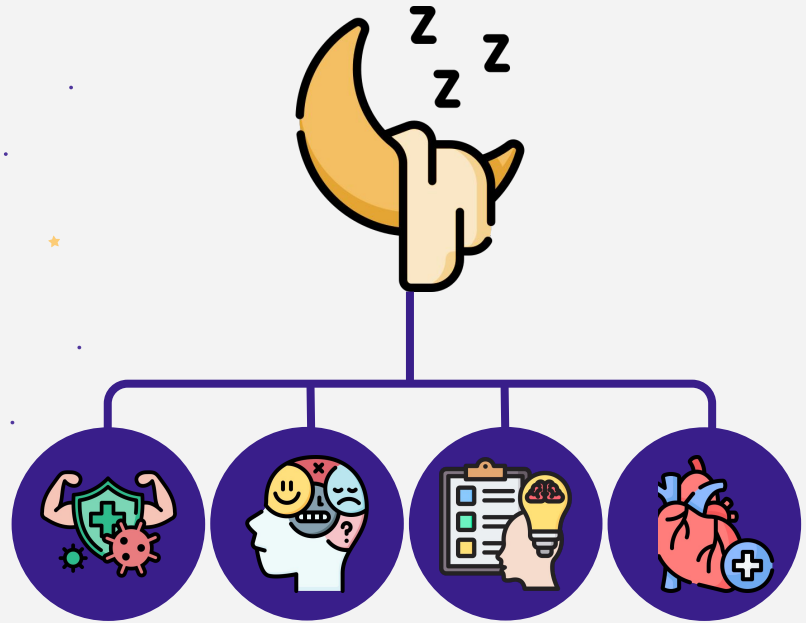
01

Introduction

Background
Motivation & Challenge
Study Aims

Background



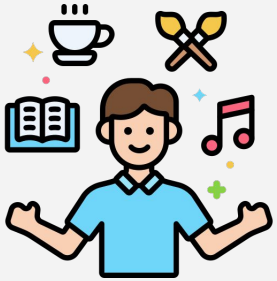
Sleep is a key factor in maintaining both physical and mental health in humans.

7~9 hours

Insomnia and sleep disorders are becoming increasingly common among people in modern society.

Affecting their overall health and quality of life.

Background



lifestyle habits

Previous studies have shown that many **lifestyle habits** can negatively affect sleep.

Individual characteristics

Individual characteristics have also been found to be potentially associated with sleep duration and quality.

However, there is still a **lack** of comprehensive analyses that integrate **multiple variables** to thoroughly investigate the lifestyle factors affecting sleep.

Motivation & Challenge

01 | Which factors have the greatest impact?

02 | Are there any interactions between them?

03 | Can these factors be used to predict the risk of sleep disorders?

Study Objective

01 | Whether personal characteristics significantly affect sleep quality and sleep duration.

02 | Whether exercise habits and stress levels are positively or negatively associated with sleep quality.

03 | Evaluate whether a simple predictive model can be established to identify individuals at risk of developing sleep disorders.

02

Dataset

Kaggle Dataset: Sleep Health and Lifestyle

Kaggle Dataset: Sleep Health and Lifestyle

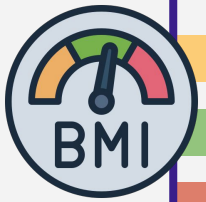
- Sample size: 374 participants.
- Features of data:

Personal characteristics	Lifestyle behaviors	Sleep indicators
Age	Daily steps	Sleep duration
Gender	Physical activity level	Quality of sleep
BMI	Stress level	Sleep disorder

Features of dataset

Gender

189 185



216 Normal

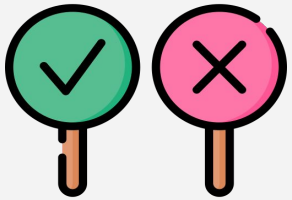
148 Overweight

10 Obeses

BMI

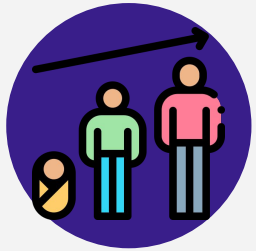
Sleep Disorder

41%



59%

Features of dataset



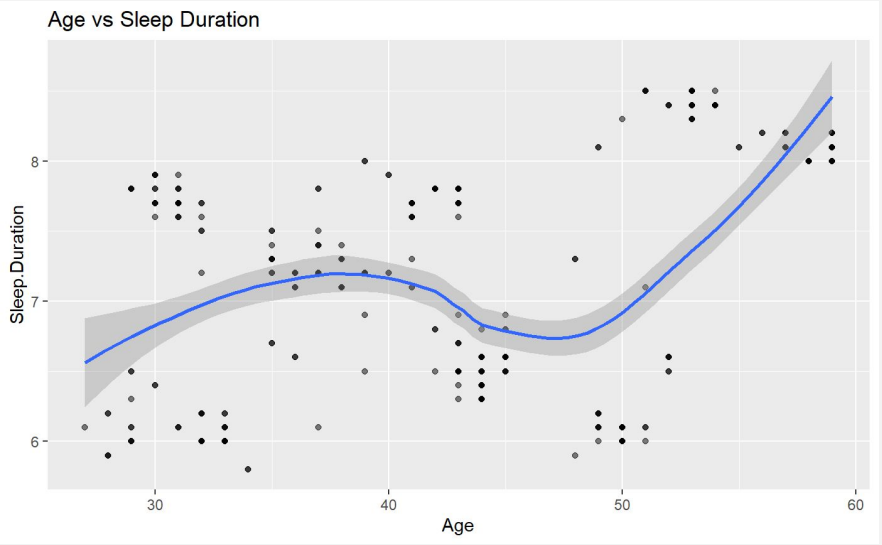
Age

30↓
Young Adults

31~45
Early Middle-aged Adults

46~60
Late Middle-aged Adults

Min = 27, Max = 60
Average = 39.3



▲ Age vs Sleep Duration by Scatter plot

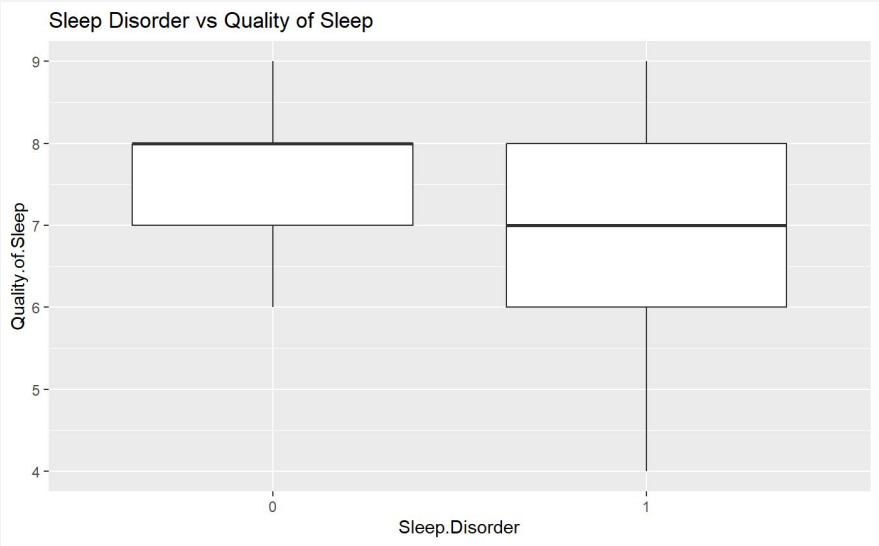
This may reflect changes in routines or lifestyle adjustments due to aging or retirement.

Features of dataset

Sleep quality

Score: 1 ~ 10

It was assessed by a self-reported questionnaire, where participants rated their overall sleep quality.



▲ Sleep disorder vs Quality of sleep by Box plot

03

Study problems

We have total 7 problems in this study

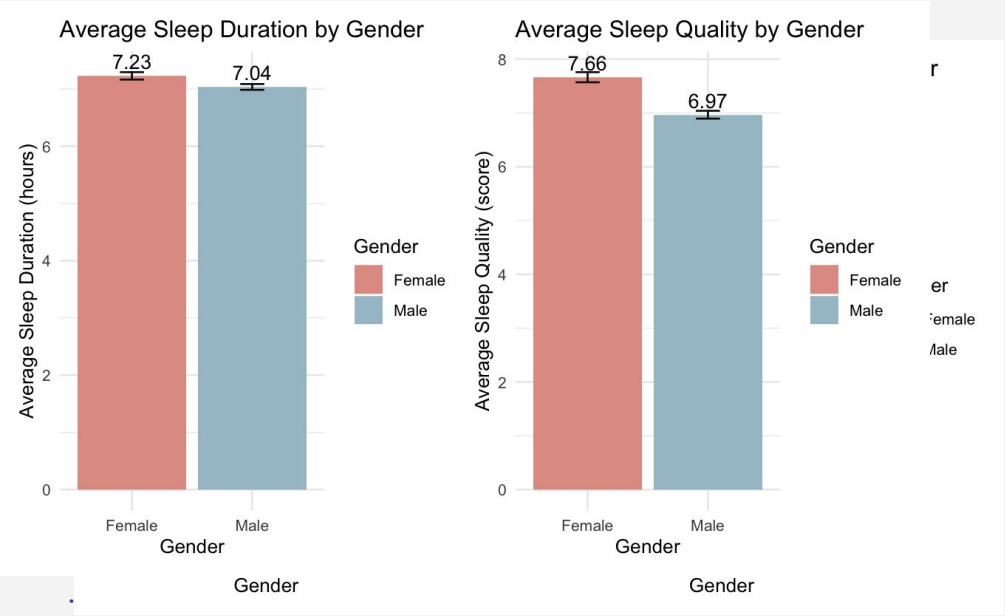
Study Problems

- ✓ Does gender affect sleep?
- ✓ Does age affect sleep?
- ✓ Does BMI affect sleep duration?
- ✓ What is the relationship between physical activity and sleep quality?
- ✓ Do different factors affect sleep duration or sleep quality?
- ✓ Which factors significantly influence the likelihood of having a sleep disorder?

04

Results & conclusion

The differences in sleep duration and sleep quality between males and females



- Average Sleep duration and Quality of sleep by Bar plot

Sleep Duration

Two-Sample t-Test result: $t = 2.36$, $df \approx 349$, $p = 0.019$

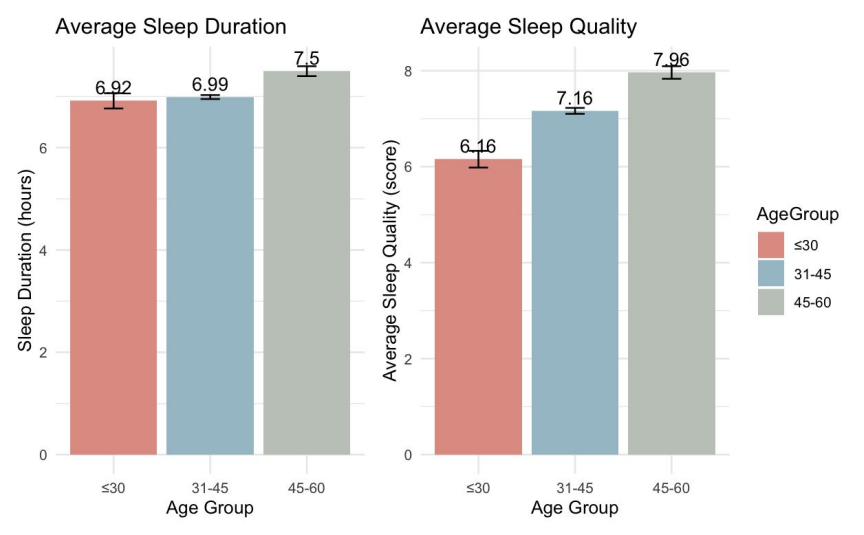
Average sleep duration: females > males difference of approximately 0.19 hours.

Quality of Sleep

Two-Sample t-Test result: $t = 5.86$, $df \approx 348$, $p < 0.001$

Average sleep quality: females(7.66) > males(6.97) difference of about 0.7 points.

The differences in sleep duration and sleep quality among different age.



▲ Average Sleep duration and Quality of sleep by Bar plot

Sleep Duration

One-Way ANOVA: $F(2, 371) = 17.85$, $p < 0.001$

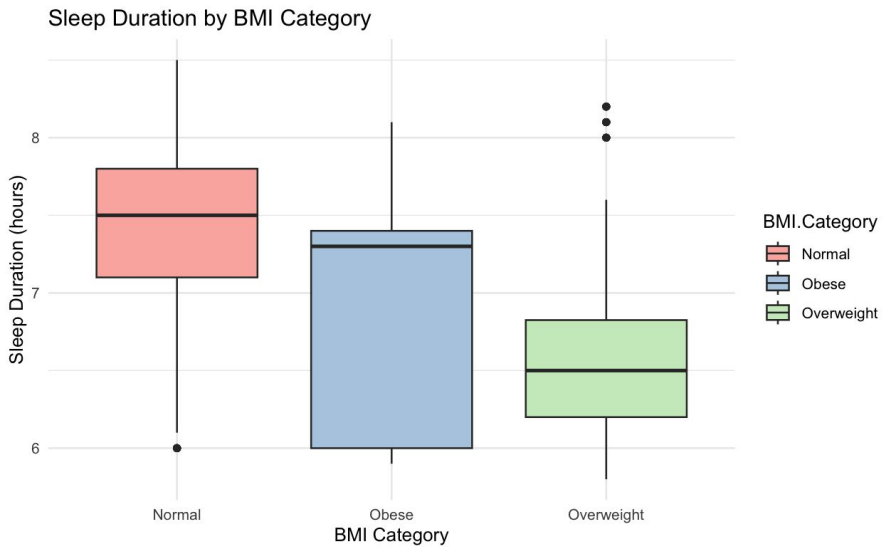
This suggests that age is an important factor in explaining the variation in sleep duration.

Quality of Sleep

Tukey Posteriori comparison

- The early middle-aged group was 1 point higher than young adult group ($p < 0.001$).
- The late middle-aged group had higher sleep quality than the other two groups.

The differences in sleep duration among different BMI.



▲ BMI Category and Sleep Duration by Box plot

Sleep Duration

One-Way ANOVA: $F(2, 371) = 31.00$, $p < 0.001$

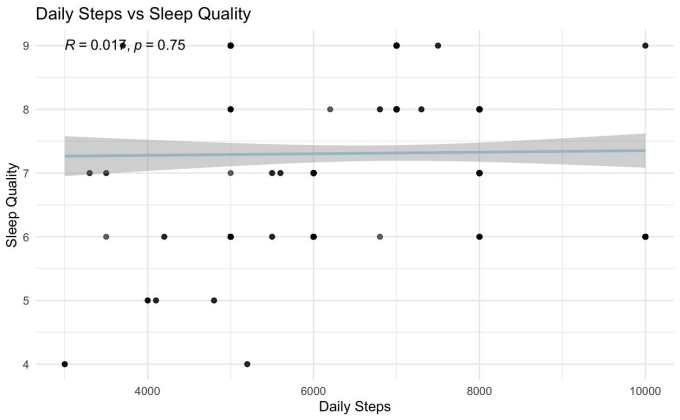
Tukey Posteriori comparison

✓ Overweight group was significantly lower than normal weight

✓ Obese group: The difference between any other group was not significant.

Association between daily step count & daily physical activity duration and sleep quality?

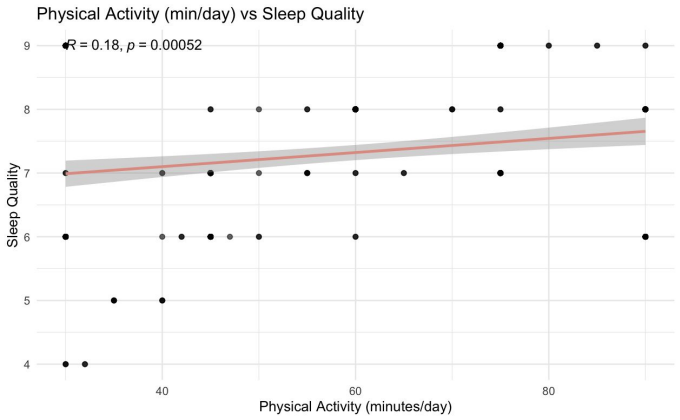
Daily steps



Pearson correlation analysis: r = 0.017, p = 0.746

There is virtually no linear association between daily step count and sleep quality .

Physical activity



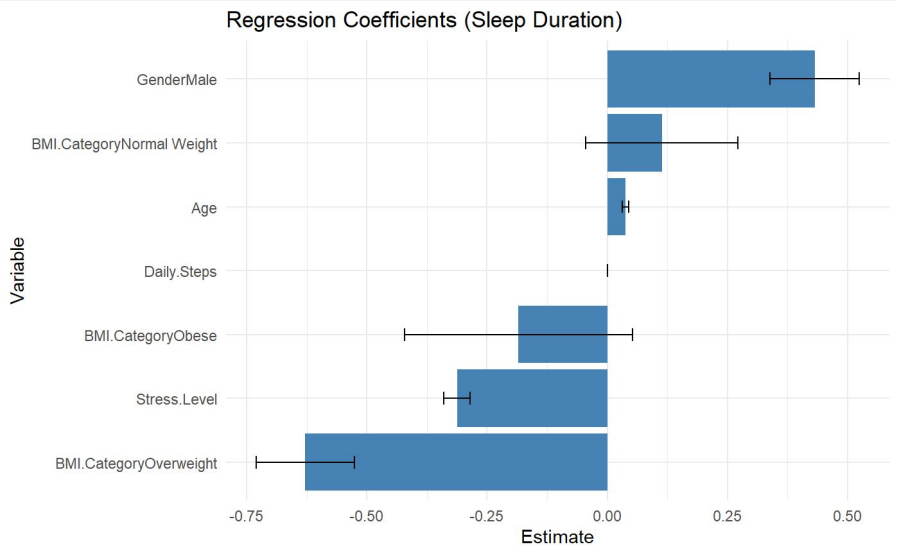
Spearman rank correlation analysis: rho = 0.179, p = 0.0005

Individuals with higher levels of physical activity tend to have better sleep quality.

Do different factors affect sleep duration or sleep quality?

Multiple linear regression model

$$sleep\ duration = \beta_0 + \beta_1 \cdot Age + \beta_2 \cdot Gender + \beta_3 \cdot BMI\ Category + \beta_4 \cdot Daily\ Steps + \beta_5 \cdot Stress\ Level + \varepsilon$$



01 Older age → Slightly longer sleep duration (0.038 hours)

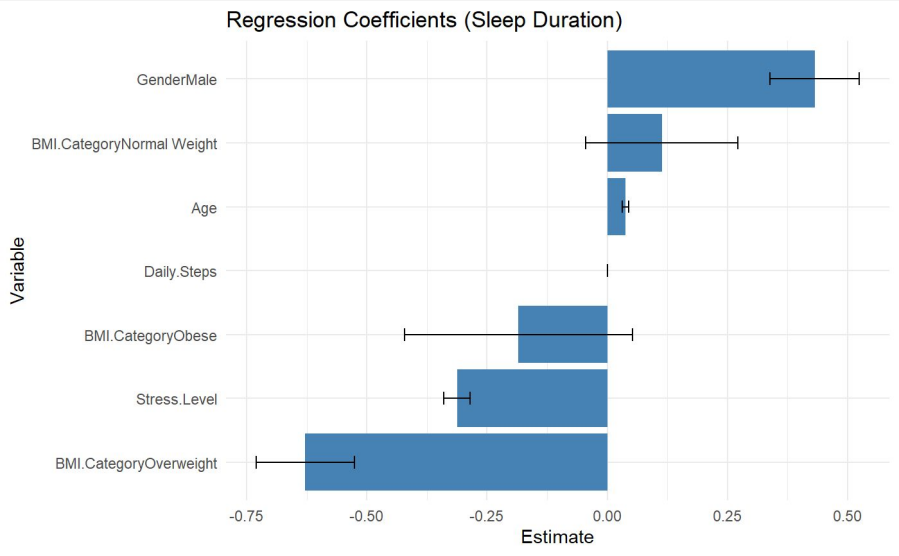
02 Males sleep about 0.43 hours more than females

03 Overweight individuals sleep significantly less (0.63 hours less)

04 Higher stress levels are significantly associated with shorter sleep (1 stress / 0.31 hours)

Do different factors affect sleep duration or sleep quality?

Multiple linear regression model



05 More daily steps → Slightly more sleep (small effect)

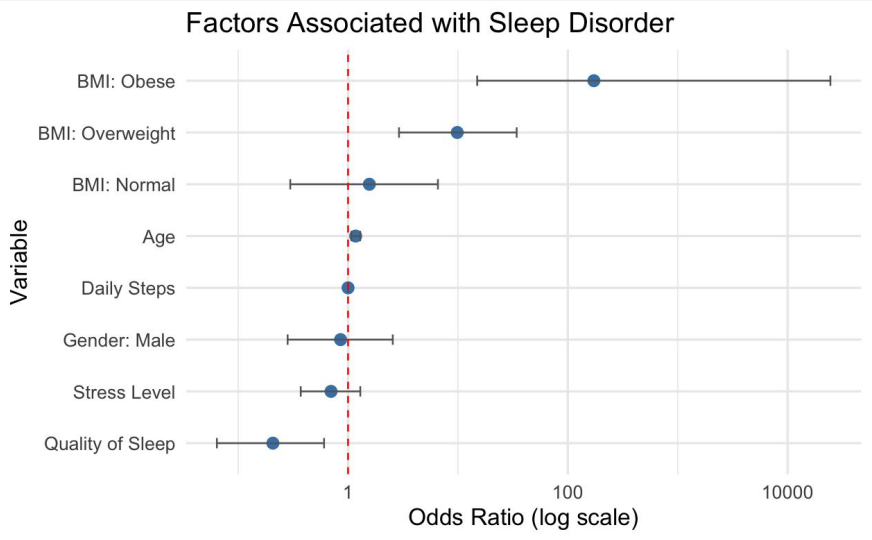
06 The coefficient for Male and Age is positive → males and older individuals tend to sleep more.

07 The coefficients for Stress and Overweight are negative → higher stress levels and those who are overweight tend to sleep less.

08 The horizontal line for Normal Weight crosses 0 → variable is not statistically significant.

Which factors significantly affect the likelihood of having a sleep disorder?

Firth Logistic Regression model



- ✓ Age was identified as a significant positive risk factor for sleep disorders (OR = 1.17, $p < 0.001$)
- ✓ Participants were overweight (OR = 9.86) or obese (OR = 172.6) had a substantially higher risk of sleep disorders
- ✓ Sleep quality served as a protective factor, 1-point increase, sleep disorder decreased by 79%

BMI and subjective sleep quality are the most critical factors influencing sleep disorders.

Conclusion

The primary associated factor

- ✓ Age
- ✓ Overweight
- ✓ Quality of sleep

Affect sleep duration and sleep disorder

Daily steps

Quality of sleep

Significantly poorer sleep quality and shorter sleep duration.

- ✓ Obese
- ✓ Overweight

Healthy weight management

The impact of stress on sleep duration is clear.

Using stress intervention as one of the health promotion strategies.

Thanks