# Effect of Sleep Deprivation on Driving Ability

February 19, 2025

## 1 Introduction

Sleep deprivation is known to impair cognitive and motor functions. This study investigates the effect of different levels of sleep deprivation on driving ability using statistical hypothesis testing.

## 2 Methodology

A dataset was analyzed containing driving ability scores for two groups:

- 1 night of sleep deprivation
- 2 nights of sleep deprivation

A normality check using the Shapiro-Wilk test confirmed that the data follows a normal distribution (W-values: 0.9619 and 0.9609 respectively, p-values: 0.583 and 0.563, respectively). Since the data was normally distributed, a paired t-test was conducted to compare the two groups.

The following Python code was used for analysis:

```
import pandas as pd
import scipy.stats as stats

# Load the dataset
df = pd.read_excel("Hypothesis_testing_homework_data.xlsx")

# Select relevant columns
df = df.iloc[:, :2]
df.columns = ["1_night", "2_nights"]

df = df.apply(pd.to_numeric, errors='coerce')
df = df.dropna()

# Extract groups
group1 = df["1_night"]
group2 = df["2_nights"]
```

```
# Normality check
shapiro_1 = stats.shapiro(group1)
shapiro_2 = stats.shapiro(group2)

print(f"Shapiro-Wilk test for 1 night: W={shapiro_1.statistic:.4f}, p={shapiro_1
print(f"Shapiro-Wilk test for 2 nights: W={shapiro_2.statistic:.4f}, p={shapiro_

# Conduct paired t-test
test_result = stats.ttest_rel(group1, group2)
print(f"Paired t-test: Statistic={test_result.statistic:.4f}, p-value={test_resu

def interpret_result(p_value, alpha=0.05):
    return "Significant difference between groups (reject H0)" if p_value < alph

print("Result:", interpret_result(test_result.pvalue))
```

## 3 Results

The paired t-test results are as follows:

- T-statistic: 6.9339
- p-value: $7.45 \times 10^{-7}$

Since the p-value is significantly lower than 0.05, we reject the null hypothesis and conclude that sleep deprivation significantly affects driving ability.

## 4 Conclusion

The statistical analysis provides strong evidence that increased sleep deprivation leads to a significant decline in driving ability. The findings confirm that after two nights of sleep deprivation, driving ability scores decline significantly compared to one night. This highlights the importance of adequate sleep for safe driving.