Factors Affecting Sleep Efficiency

Group No.7

Question 1: Name of all group members.

1. Ali Afkhami (30271805)
2. Daniela Mañozca Cruz (30262558)
3. Evan Losier (30022571)
4. Luisa Alejandra Sierra Guerra (30261956)
5. Ruby Nouri Kermani (30261323)

Question 2 (Introduction): If you have research topics in mind for this project, please briefly describe the topics and any background info I may need to understand the topic. What problems are you going to address? Why are these topics important to you? What are your goals? [2 pts]

Sleep is a fundamental biological need for humans, as highlighted in Maslow's hierarchy of needs. However, sleep alone is not sufficient; it must be efficient. Sleep efficiency refers to the proportion of time spent actually sleeping while in bed. Understanding sleep efficiency is critical because poor sleep quality can negatively impact individuals across multiple dimensions, including cognitive, emotional, and physical health. For example:

- Cognitive decline: Poor sleep efficiency has been linked to neuronal cell loss and impaired brain health (Wang & Aton, 2022).
- Mental health: Inefficient sleep is associated with symptoms of depression (Pan et al., 2022).
- Brain health: Short sleep duration increases the risk of reduced cognitive function and brain health (Fjell et al., 2023).
- Gut health: Sleep quality also affects the gut microbiota, which plays a role in overall health (Deng et al., 2024).

These issues not only affect an individual's body, but also their social and professional lives. Therefore, understanding the factors that influence sleep efficiency is essential for improving overall well-being.

The primary problem this project aims to address is identifying the key factors that influence sleep efficiency and understanding how these factors interact to affect sleep quality. Specifically, we will investigate:

- Bedtime: The time at which a person goes to bed can influence sleep efficiency because it affects the alignment with the body's natural circadian rhythm.
- Wake-up time: The time a person wakes up can disrupt sleep cycles if it is inconsistent or too early.
- Sleep duration: Both insufficient and excessive sleep can harm sleep quality. Oversleeping can lead to fatigue rather than restfulness.
- REM sleep: This stage is crucial for cognitive restoration and emotional regulation.
- Deep sleep: This phase is essential for physical recovery and immune function.
- Light sleep: While less restorative, light sleep still plays a role in transitioning between sleep stages.
- Awakenings: Frequent awakenings during the night can fragment sleep and reduce efficiency.
- Caffeine and alcohol consumption: These substances can disrupt sleep patterns and reduce sleep quality.

- Smoking status: Nicotine is a stimulant that can interfere with falling asleep and staying asleep.
- Exercise frequency: Regular physical activity has been shown to reduce stress and improve sleep quality.

By identifying the factors that influence sleep efficiency, we can provide evidence-based recommendations to help individuals improve their sleep quality and, consequently, their overall quality of life.

The goals of this project are:

1. To analyze how specific factors (e.g., bedtime, wake-up time, sleep duration, REM sleep, deep sleep, light sleep, awakenings, caffeine/alcohol consumption, smoking status, and exercise frequency) influence sleep efficiency.
2. To provide actionable recommendations for improving sleep quality based on the findings.

Question 3 (Methodology): Please briefly describe the data you have (or plan to acquire) to help answer the research topics above. Include: what type of variable or variables are included (quantitative, qualitative, etc.), how the variable or variables are measured (the measurement scale), and any other general info you may have on the variable(s) [2 pts]

The dataset is available on Kaggle under the title "A Study of Sleep Efficiency and Sleep Patterns." It contains the following information:

Variable	Type	Measurement Scale	Description
Subject ID	N/A	N/A	Unique identifier for each test subject.
Age	Quantitative	Integer (Years)	Age of the subject in years.
Gender	Qualitative	Boolean (Male/Female)	Gender of the subject.
Bedtime	Quantitative	Time of Day (rounded to the nearest half hour)	Time the subject goes to bed.
Wakeup time	Quantitative	Time of Day (rounded to the nearest half hour)	Time the subject wakes up.
Sleep duration	Quantitative	Number of hours (rounded to the nearest half hour)	Total time slept in hours.
Sleep efficiency	Quantitative	Percentage	Proportion of time spent asleep while in bed.

REM sleep percentage	Quantitative	Percentage	Percentage of time spent in REM sleep.
Deep sleep percentage	Quantitative	Percentage	Percentage of time spent in deep sleep.
Light sleep percentage	Quantitative	Percentage	Percentage of time spent in light sleep.
Awakenings	Quantitative	Integer (number of awakenings per night)	Number of times the subject wakes up during the night.
Caffeine consumption	Quantitative	Milligrams	Amount of caffeine consumed in the 24 hours prior to bedtime.
Alcohol consumption	Quantitative	Ounces	Amount of alcohol consumed in the 24 hours prior to bedtime.
Smoking status	Qualitative	Boolean (Yes/No)	Whether the subject is a smoker or non-smoker.
Exercise frequency	Quantitative	Integer (number of exercise sessions per week)	Number of times the subject exercises per week.

Question 4 (Methodology cont.): Is this your own data set (or the data of someone in the group) or is it "open" or "shared" data? [2 pts]

The dataset is shared data titled "Sleep Efficiency Dataset", available on Kaggle. It doesn't have a specific license, but it is available for download and does not indicate that it is not available for use. We acknowledge that the data belongs to the original authors and we are using it for the purpose of this project only.

Question 5 (Methodology cont.): Have you distributed the workload among your teammates? If yes, please describe the group members' workload distribution and responsibilities. [2 pts]

We are still discussing the workload among our teammates. However, we are providing a proposed distribution based on our background and preferences. This general distribution aims to guarantee a fair and balanced distribution of responsibilities, as well as the accomplishment of our project objects. The table is a guideline for work distribution, but our goal is to have all team members assist with every aspect of the project where possible.

Task	Lead Member
Data Wrangling	Ali Afkhami
Data Consolidation for Analysis	Ruby Nouri Kermani
Statistical Test and Models	Daniela Manozca & Evan Losier
Final Graphs	Luisa Alejandra Sierra
Results and Conclusions	Whole team
Presentation Slides	Luisa Alejandra Sierra

End of Project Checkpoint

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