Investigating the Factors Influencing Cognitive Function and Alzheimer's Disease in an Elderly Population

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Objectives

The objective of this analysis is to explore and analyze the Alzheimer's Disease Dataset to achieve the following goals:

1. Identify Key Predictors: Determine the significant demographic, lifestyle, medical, and clinical factors associated with Alzheimer's disease.
2. Examine Relationships: Assess the relationships between cognitive assessments and various predictors, including age, gender, lifestyle factors, and medical history.

Introduction

Alzheimer's disease (AD) is a progressive neurodegenerative disorder characterized by cognitive decline, memory loss, and functional impairments. Understanding the factors contributing to the onset and progression of Alzheimer's is crucial for early diagnosis and intervention. In this analysis, we utilize the Alzheimer's Disease Dataset by RABIE EL KHAROUA from Kaggle, which encompasses a variety of patient data including demographic details, lifestyle factors, medical history, etc. Here, we try to find some meaningful relations among them.

Methods

After doing EDA explicitly on the dataset we found some interesting relations among them. Which led us to do some more with those selected attributes of the data.

- We tried to find a relation by analyzing by finding their means, variance, standard deviation, etc.
- Used visualization to understand better.
- Used statistical test to confirm it.

The following tests were used for statistical analysis:

- T-tests
- Chi-Square Tests

Where we tried to establish a hypothesis based on our tests. The null hypothesis was there was no correlation between these selected attributes. The alternative was the attributes are correlated.

Results 2

Here, we investigate the relationship between education level and Alzheimer's diagnosis using t-tests and chi-square tests. The t-test compares the mean education levels between patients diagnosed with Alzheimer's and those not diagnosed.

t-statistic	p-value
-2.624396279146679	0.00874180076179296

Table 1: t-test

These results showed that the t-test rejected the null hypothesis, indicating a significant difference in mean education levels. Concurrently, The chi-square test accepted the null hypothesis.

chi	p-value
2149.0	0.4898576962191864

Table 2: chi-test

Results 1

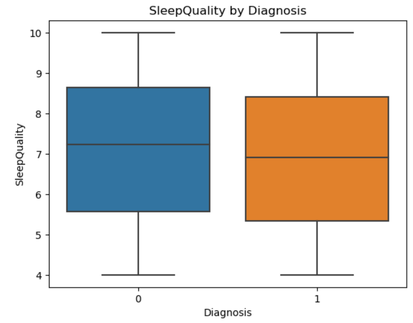

Figure 1: Box Plot of Sleep Quality vs Diagnosis

The chi-square test examines the association between sleep quality (categorized) and Alzheimer's diagnosis. After converting the sleep quality data which was numerical at first into categorical data we can see that the chi-square test also supports the alternate hypothesis. We present our data in a bar chart later in Figure 2. Both tests rejected the Null hypothesis. This implies that when sleep quality is grouped into categories (e.g., Poor, Moderate, Good), there is a significant relationship with the diagnosis status.

This analysis examines the relationship between sleep quality and Alzheimer's diagnosis using t-tests and chi-square tests. Null Hypothesis (H): The mean sleep quality score is the same for both diagnosed and non-diagnosed groups. Alternative Hypothesis (H): The mean sleep quality score is different between the diagnosed and non-diagnosed groups. When we did the t-test It rejected the Null hypothesis but on the chi-test, it was the opposite.

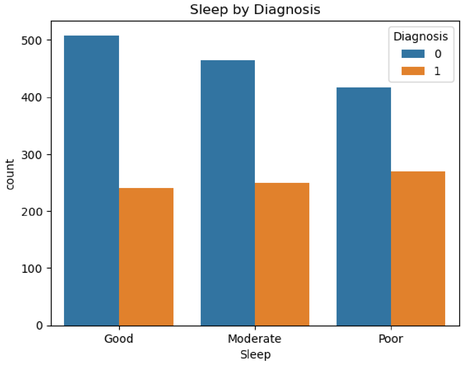

Figure 2: Bar Chart of Sleep Quality vs Diagnosis

Conclusion

- For Result 1, The findings suggest that better sleep quality is associated with improved cognitive function in elderly patients. There is a correlation between sleep and the disease.
- For result 2, while the average education level differs significantly between the two groups, the categorized education levels do not show a significant association with Alzheimer's diagnosis. This suggests that the relationship between education and Alzheimer's may be more complex and not fully captured by broad educational categories.

References

[1] Rudy J Castellani, Raj K Rolston, and Mark A Smith. Alzheimer disease. *Disease-a-month: DM*, 56(9):484, 2010.

[2] Liana G Apostolova. Alzheimer disease. *Continuum: Lifelong Learning in Neurology*, 22(2):419–434, 2016.

Future Research

- Investigate the impact of different aspects of sleep (e.g., sleep duration, sleep disorders, REM sleep quality) on Alzheimer's risk.
- Conduct longitudinal studies to track sleep quality and cognitive function changes over time. This can help establish causal relationships between sleep disturbances and the progression of Alzheimer's disease.
- Studies could focus on whether engaging in continuous education or cognitive activities in later life could mitigate the risk of Alzheimer's.
- Investigate how socioeconomic status, which often correlates with education level, influences Alzheimer's risk. This can include access to healthcare, lifestyle factors, and environmental influences.