Exploring the Impact of Lifestyle Factors on the Development and Progression of Heart Disease

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Abstract

This project aims to study the impact of lifestyle factors, including smoking, physical activity, diet and alcohol drinking, on the onset and progression of heart disease. The study be based on the UCI Heart Disease Dataset, which contains comprehensive clinical and demographic information on patients with suspected heart disease. Data analysis and statistical methods will be used to explore the associations between lifestyle habits and heart disease outcomes in the parts of "Data" and " Methods and Data Analysis". The project seeks to provide valuable insights into how these daily factors that influence the risk and pathway of heart diseases. The findings will contribute to the existing body of knowledge on cardiovascular health and inform the development of targeted interventions . By better understanding the role of lifestyle factors in heart disease, this research aims to improve cardiovascular health outcomes and reduce the overall heart diseases at a population level.

1 Introduction

Heart disease remains a significant public health concern globally, accounting for a substantial burden of morbidity and mortality. Lifestyle factors, such as smoking, physical activity, diet, and alcohol consumption, have long been recognized as key modifiable risk factors that can significantly influence the development and progression of heart disease. Understanding the impact of these lifestyle factors on cardiovascular health is crucial for effective prevention and management strategies. The purpose of this project is to investigate the interplay between lifestyle factors and the presence or severity of heart diseases, using the Heart Disease Dataset from the UCI Machine Learning Repository which is a website that i found from my searchings about the most helpful dataset providers to find suitable datasets for researchs. After my investigations for finding a good dataset, I chose the Heart Disease Dataset that has 303 observations with a set of 14 clinical and demographic variables including categorical (sex, chest pain type (cp), fasting blood sugar > 120 mg/dl (fbs), resting electrocardiographic results (restecg), exercise induced angina (exang), slope of the peak exercise ST segment (slope), number of major vessels colored by fluoroscopy (ca), thalassemia

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(thal), target), discrete numeric (maximum heart rate achieved (thalach)) and continous numeric (age, resting blood pressure (trestbps, in mm Hg), serum cholesterol (chol, in mg/dl), ST depression induced by exercise relative to rest (oldpeak)) variables. After chosing the dataset, i pursued on looking for articles related to heart diseases and i saw that how specific lifestyle behaviours contribute to the risk and progression of cardiovascular heart problems. So at last, i designed my question as "What is the impact of lifestyle factors (such as smoking, physical activity, diet, and alcohol consumption) on the development and progression of heart disease?". Then, i just focused more specifically on the articles related to my research question for the project.

1.1 Literature Review

The impact of lifestyle choices on the development and progression of heart disease has been the subject of numerous researchs. This literature review focuses on examining the findings from selected studies on smoking, physical activity, diet and alcohol consumption in association with cardiovascular health outcomes. One of the studies focused on the impact of smoking and smoking cessation on cardiovascular events and mortality in older adults. The results showed a clear connection between smoking and increased cardiovascular risk, while smoking cessation was associated with a reduced risk of cardiovascular events and mortality (Mons et al., 2015). With regard to physical activity, Carnethon (2009) examined how much physical exercise is enough to benefit cardiovascular health. The evidence suggests that moderate-intensity aerobic activity of at least 150 minutes per week provides major cardiovascular benefits. The role of diet in the prevention of heart disease was undertaken by Bechthold et al. (2019) by the systematic research and dose-response meta-analysis that focused on food groups and their association with coronary heart disease, stroke and heart failure. They found that higher intakes of fruits, vegetables, whole grains, and nuts were associated with a lower risk of these cardiovascular consequences. In relation to alcohol consumption, Larsson et al. (2020) conducted a Mendelian randomisation study to investigate the link between alcohol consumption and cardiovascular disease. This report provides evidence of a causal relationship between higher alcohol consumption and increased risk of stroke and peripheral arterial disease. But the results also showed that genetically predicted alcohol consumption was not significantly associated with cardiovascular disease, suggesting that the associations observed in previous studies may be confounded by other factors. Overall, the results of these studies support the importance of a healthy lifestyle, including smoking cessation, regular physical activity, a balanced diet and moderate alcohol consumption, in the prevention and management of heart disease. Future research should continue to explore the long-term effects of lifestyle elements on heart disease, delve into the mechanisms underlying these relationships, and investigate strategies to promote behaviour change and maintain healthy lifestyle habits.

2 Data

In this section, discuss the source of the data set you use in your study, if you have done any operation on the raw data, these operations and the summary statistics about the data set. In this section, it is mandatory to have a table (Table 1) containing summary statistics (mean, standard deviation, minimum, maximum, etc. values) of all variables. Make the necessary references to your tables as shown in the previous sentence (**perkins:1991?**).

R codes for the analysis should start in this section. In this section, you should include the codes that imports the data set into R and the codes that generate summary statistics.

```
library(tidyverse)
library(here)
survey <- read_csv(here("data/heartdatas.csv"))
```

Note that code options are edited in some of the code chunks in the Rmd file.

With the `echo=FALSE` option, prevent the codes from appearing in the derived pdf file and report your results in tables.

Table 1: Summary Statistics

	Mean	Std.Dev	Min	Median	Max
age	54.54	9.05	29.00	56.00	77.00
ca	0.68	0.94	0.00	0.00	3.00
chol	247.35	52.00	126.00	243.00	564.00
cp	3.16	0.96	1.00	3.00	4.00
exang	0.33	0.47	0.00	0.00	1.00
fbs	0.14	0.35	0.00	0.00	1.00
oldpeak	8.80	11.07	0.00	4.00	62.00
restecg	1.00	0.99	0.00	1.00	2.00
sex	0.68	0.47	0.00	1.00	1.00
target	0.95	1.23	0.00	0.00	4.00
thal	4.73	1.94	3.00	3.00	7.00
thalach	149.60	22.94	71.00	153.00	202.00
trestbps	131.69	17.76	94.00	130.00	200.00

3 Methods and Data Analysis

In this section describe the methods that you use to achieve the purpose of the study. You should use the appropriate analysis methods (such as hypothesis tests and correlation analysis) that we covered in the class. If you want, you can also use other methods that we haven't covered. If you think some method is more suitable for the purpose of the analysis and

the data set, you can use that method (**newbold:2003?**; **verzani:2014?**; **wickham:2014?**; **wooldridge:2015a?**).

For example, if you are performing regression analysis, discuss your predicted equation in this section. Write your equations and mathematical expressions using $LaTeX$.

This section should also include different tables and plots. You can add histograms, scatter plots (such as Figure **??**), box plots, etc. Make the necessary references to your figures as shown in the previous sentence.

4 Conclusion

Summarize the results of your analysis in this section. Discuss to what extent your results responded to the research question you identified at the beginning and how this work could be improved in the future.

5 References

Bechthold, A., Boeing, H., Schwedhelm, C., Hoffmann, G., Knüppel, S., Iqbal, K., De Henauw, S., Michels, N., Devleesschauwer, B., Schlesinger, S., et al. (2019). Food groups and risk of coronary heart disease, stroke and heart failure: A systematic review and dose-response meta-analysis of prospective studies. *Critical Reviews in Food Science and Nutrition*, *59*(7), 1071–1090.

Carnethon, M. R. (2009). Physical activity and cardiovascular disease: How much is enough? *American Journal of Lifestyle Medicine*, *3*(1_suppl), 44S–49S.

Larsson, S. C., Burgess, S., Mason, A. M., & Michaëlsson, K. (2020). Alcohol consumption and cardiovascular disease: A mendelian randomization study. *Circulation: Genomic and Precision Medicine*, *13*(3), e002814.

Mons, U., Müezzinler, A., Gellert, C., Schöttker, B., Abnet, C. C., Bobak, M., Groot, L. de, Freedman, N. D., Jansen, E., Kee, F., et al. (2015). Impact of smoking and smoking cessation on cardiovascular events and mortality among older adults: Meta-analysis of individual participant data from prospective cohort studies of the CHANCES consortium. *Bmj*, *350*.