جامعة مصر للمعلوماتية
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Egypt University of Informatics
Computer and Information Systems
Data Analysis Course

The Analysis of Different Health Factors Related to Heart Attack

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Introduction

This report investigates the dataset "Personal Key Indicators of Heart Disease" from 2022, aimed at understanding the factors influencing heart disease prevalence. The analysis includes data preprocessing, univariate analysis, and the application of machine learning techniques to predict heart disease.

Research Question

Is Heart Attack related to other health factors?

Hypothesis (all questions are included in the notebook as null hypothesis format)

1. Is there a significant difference in the mean BMI between individuals who have had a heart attack and those who haven't?
2. Is there a significant difference in the mean Physical Health Days between individuals who have had a heart attack and those who haven't?
3. Is there a significant difference in the mean of Sleeping Hours between individuals who have had a heart attack and those who haven't?
4. Is there a significant difference in the mean of Mental Health Days between individuals who have had a heart attack and those who haven't?

Population of Interest:

The population of interest includes individuals from the dataset who have been assessed for various health indicators and heart disease status in the USA.

Sampling Method:

The dataset includes a comprehensive collection of individuals without the explicit sampling methods mentioned.

Bias Identification:

Potential biases include:

- Self-reported health indicators may be inaccurate.
- Imbalance in the dataset where non-heart disease cases outnumber heart disease cases.

Dataset:

Number of samples used: 246000 (cleaned data)

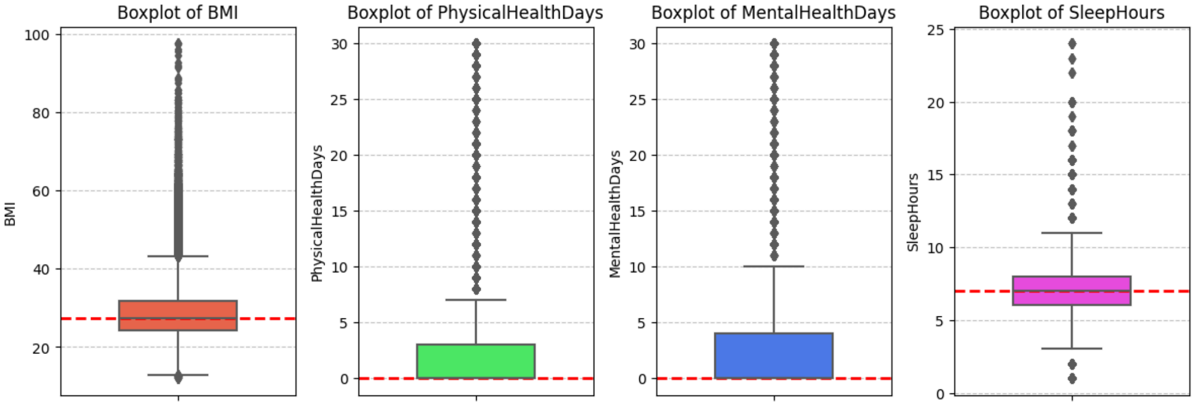
The dataset "heart_2022_no_nans.csv" includes multiple health-related features and the target variable indicating heart disease status.

The dataset includes information on individuals' state of residence, gender, general health status, physical and mental health days, healthcare utilization such as last checkup time, lifestyle factors like physical activity and sleep hours, as well as medical history including occurrences of heart attacks, strokes, asthma, skin cancer, COPD, depressive disorders, kidney disease, arthritis, and diabetes, among others. Additionally, the dataset contains data on sensory impairments, difficulties with daily activities, smoking and e-cigarette usage, chest scans, race/ethnicity, age, height, weight, BMI, alcohol consumption, HIV testing, flu vaccination, pneumococcal vaccination, tetanus vaccination, high-risk status, and COVID-19 positivity.

Analysis:

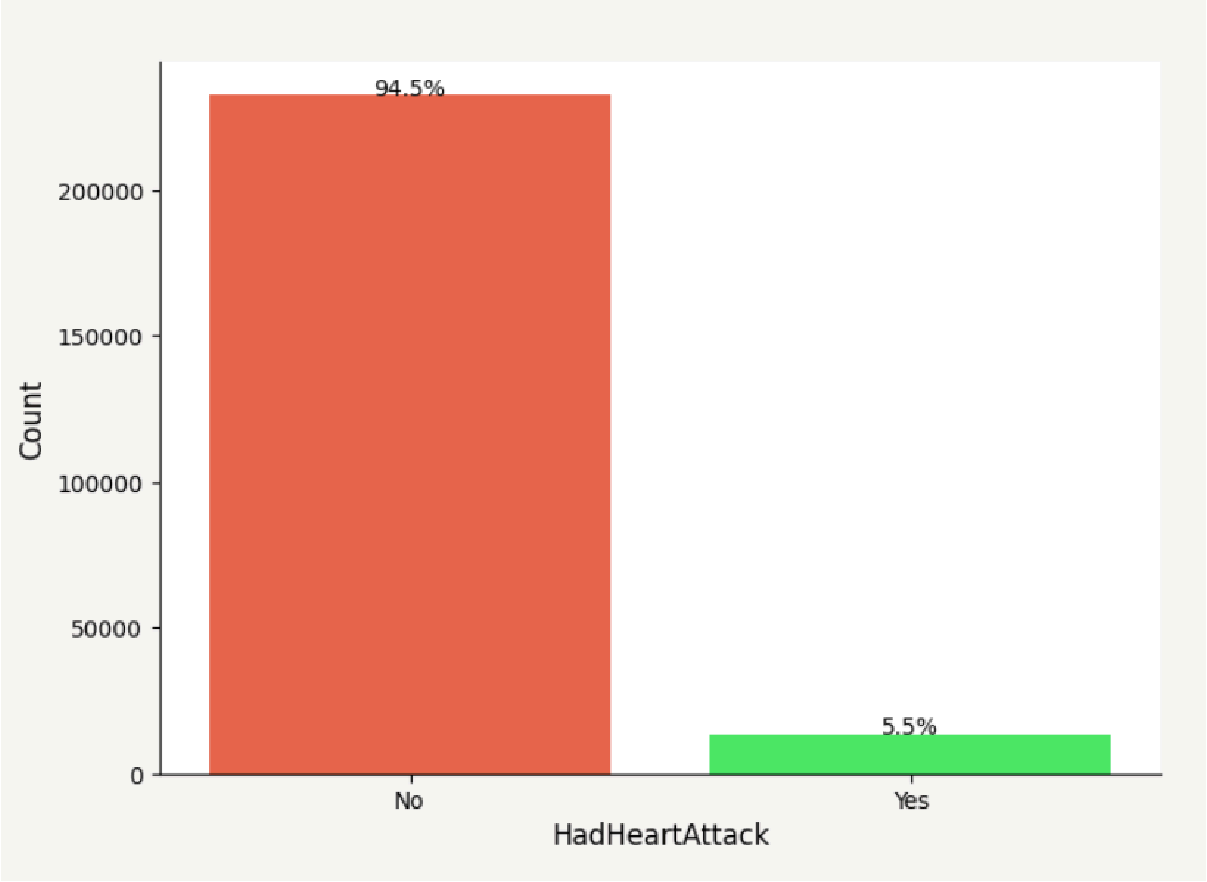
1. **Data Cleaning**: Removed duplicates.
2. **Data Summarization**:
    - Numerical summary statistics using **df.describe()**.
    - Count of distinct values in each column.
3. **Feature Identification**:
    - Numerical columns were identified for detailed analysis.
    - Categorical columns are listed for potential encoding.

4. **Univariate Analysis**:



Purpose: boxplots for each numerical feature to understand distributions and identify outliers.

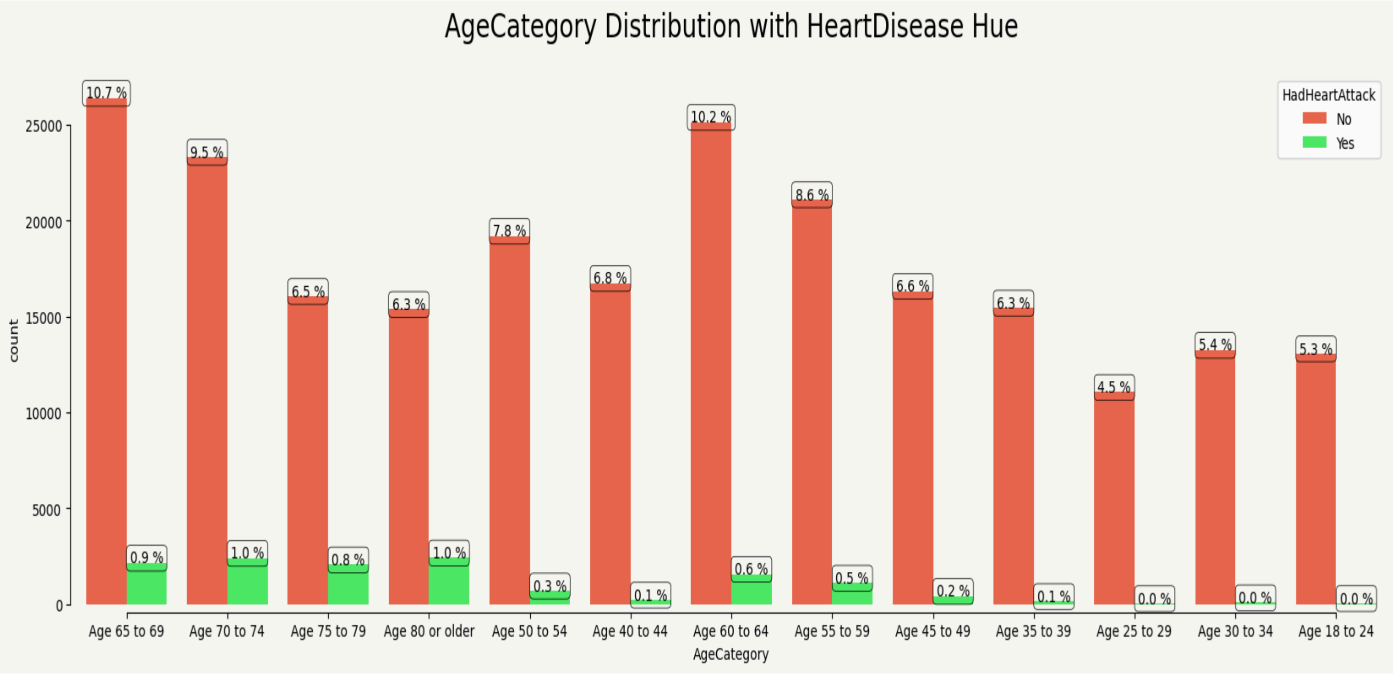
Bar charts for categorical features:



Insights: Only five percent of the American population has a heart attack.

5. **Bivariate Analysis:**

- Kernel Density Estimate plot for each numerical and categorical feature to understand distributions and identify outliers.



Insights: Older individuals are more expected to have heart Attack

Hypothesis Testing Steps

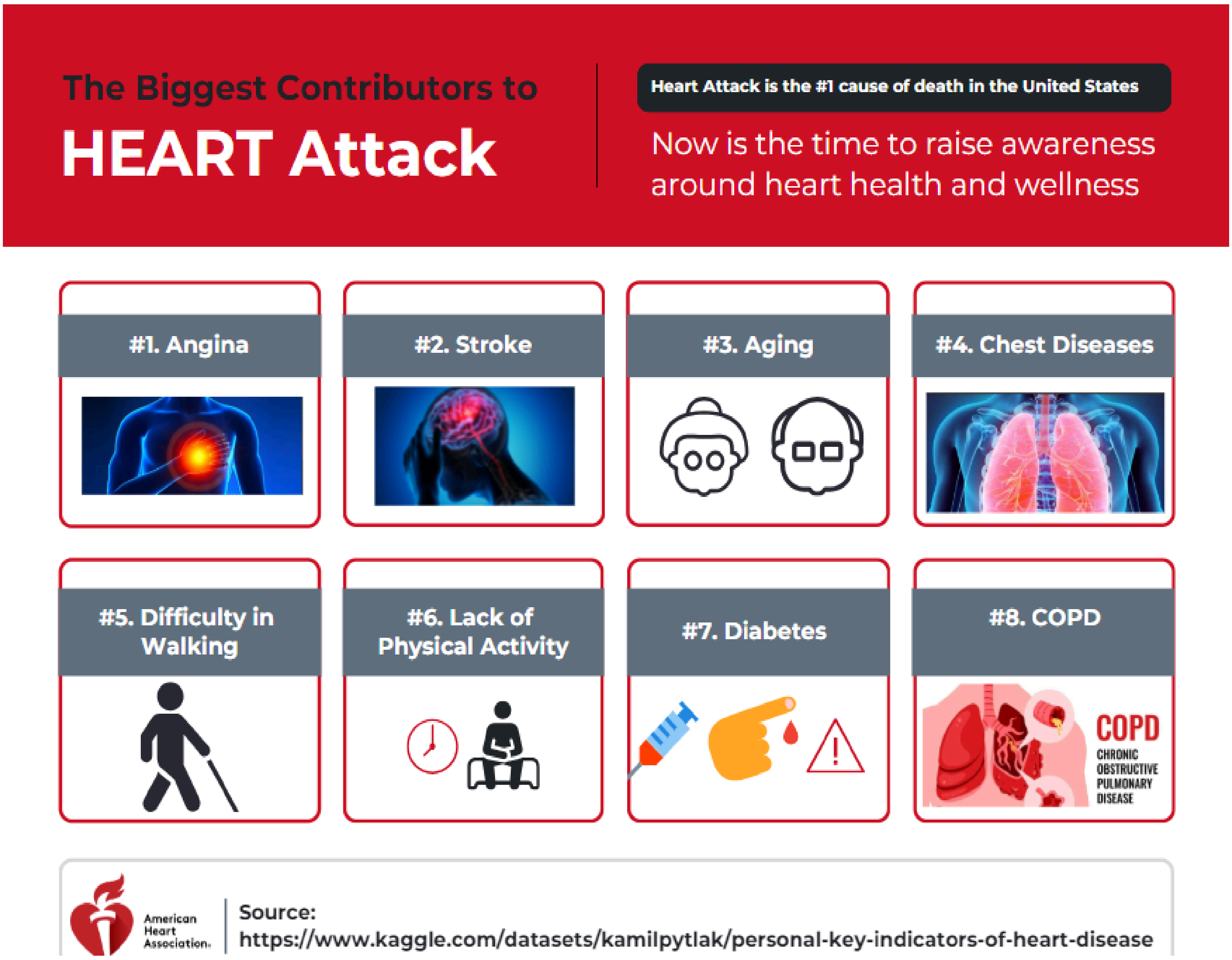
- Z-test is used to calculate the P-value for each hypothesis question provided above

- General Steps for Each Test:
  1. Stating the null and alternative hypotheses.
  2. Collecting the data for individuals who had a heart attack and those who did not have.
  3. Conducting a two-sample z-test using the **z-test** function to compare the means of the two groups.
  4. Obtaining the z-statistic and p-value from the z-test.
  5. Set the significance level (alpha: α) at 0.05
  6. Compare the p-value to the alpha:
     - ➢ If the p-value is less than 0.05, the null hypothesis is rejected
     - ➢ If the p-value is greater than 0.05, the null hypothesis is not rejected (fail to reject it)

Conclusion

The Biggest Contributors to Heart Attack according to Pearson correlation:

1. **Angina**
2. **Stroke**
3. **Aging**
4. **Chest Diseases**
5. **Difficulty in Walking**
6. **Lack of Physical Activity**
7. **Diabetes**
8. **COPD (Chronic Obstructive Pulmonary Disease)**



The Biggest Contributors to

HEART Attack

Heart Attack is the #1 cause of death in the United States

Now is the time to raise awareness around heart health and wellness

#1. Angina

#2. Stroke

#3. Aging

#4. Chest Diseases

#5. Difficulty in Walking

#6. Lack of Physical Activity

#7. Diabetes

#8. COPD

COPD
CHRONIC OBSTRUCTIVE PULMONARY DISEASE
American Heart Association.

Source: https://www.kaggle.com/datasets/kamilpytlak/personal-key-indicators-of-heart-disease

Z Test for Independence Results:

1. There is a significant difference in the mean BMI between individuals who have had a heart attack and those who haven't.
2. There is a significant difference in the mean of Physical health days between individuals who have had a heart attack and those who haven't.
3. There is a significant difference in the mean of Mental Health Days between individuals who have had a heart attack and those who haven't
4. There is no significant difference in the mean of Sleep Hours between individuals who have had a heart attack and those who haven't.

Any potential issues

1. **Imbalanced Groups:**

   If the number of individuals who have had a heart attack is much smaller or larger than those who haven't, it can affect the reliability of the statistical tests.

2. **Confounding Variables:**

   There may be other variables not accounted for in the analysis that could influence both the likelihood of having a heart attack and the variables being tested (e.g., Lifestyle Factors, Gender, Depressive Disorder, Socioeconomic Status, Chronic Conditions, Medication Usage).

3. **Lack of Control for Multiple Comparisons:**

   Conducting multiple tests increases the chance of Type I errors (false positives).

Workload Distribution:

Mohamed Ibrahim: Jupyter Notebook Code

Mohamed Mostafa: Report

Mohamed Karim: Poster

Abdullah Mousa: **Nothing**

Seif El Islam: **Nothing**