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HEART ATTACK ANALYSIS

INTRODUCTION

A heart attack, medically referred to as a myocardial infarction, occurs when a portion of the heart muscle is deprived of adequate blood supply. This condition becomes increasingly severe as time elapses without medical intervention to reestablish blood flow, leading to more extensive damage to the heart tissue. The primary cause of heart attacks is coronary artery disease (CAD), a condition characterized by the narrowing or blockage of the coronary arteries that supply blood to the heart muscle.

DATASET CONTENTS

- **Age:** Age of the patient
- **Sex:** Sex of the patient
- **exang:** exercise induced angina (1 = yes; 0 = no)
- **ca:** number of major vessels (0-3)
- **cp:** Chest Pain type chest pain type
    - Value 1: typical angina
    - Value 2: atypical angina
    - Value 3: non-anginal pain
    - Value 4: asymptomatic
- **trtbps:** resting blood pressure (in mm Hg)
- **chol:** cholesterol in mg/dl fetched via BMI sensor
- **fbs:** (fasting blood sugar > 120 mg/dl) (1 = true; 0 = false)
- **rest_ecg:** resting electrocardiographic results
    - Value 0: normal
    - Value 1: having ST-T wave abnormality (T wave inversions and/or ST elevation or depression of > 0.05 mV)
    - Value 2: showing probable or definite left ventricular hypertrophy by Estes' criteria
- **thalach:** maximum heart rate achieved
- **target:** 0= less chance of heart attack 1= more chance of heart attack

AIM

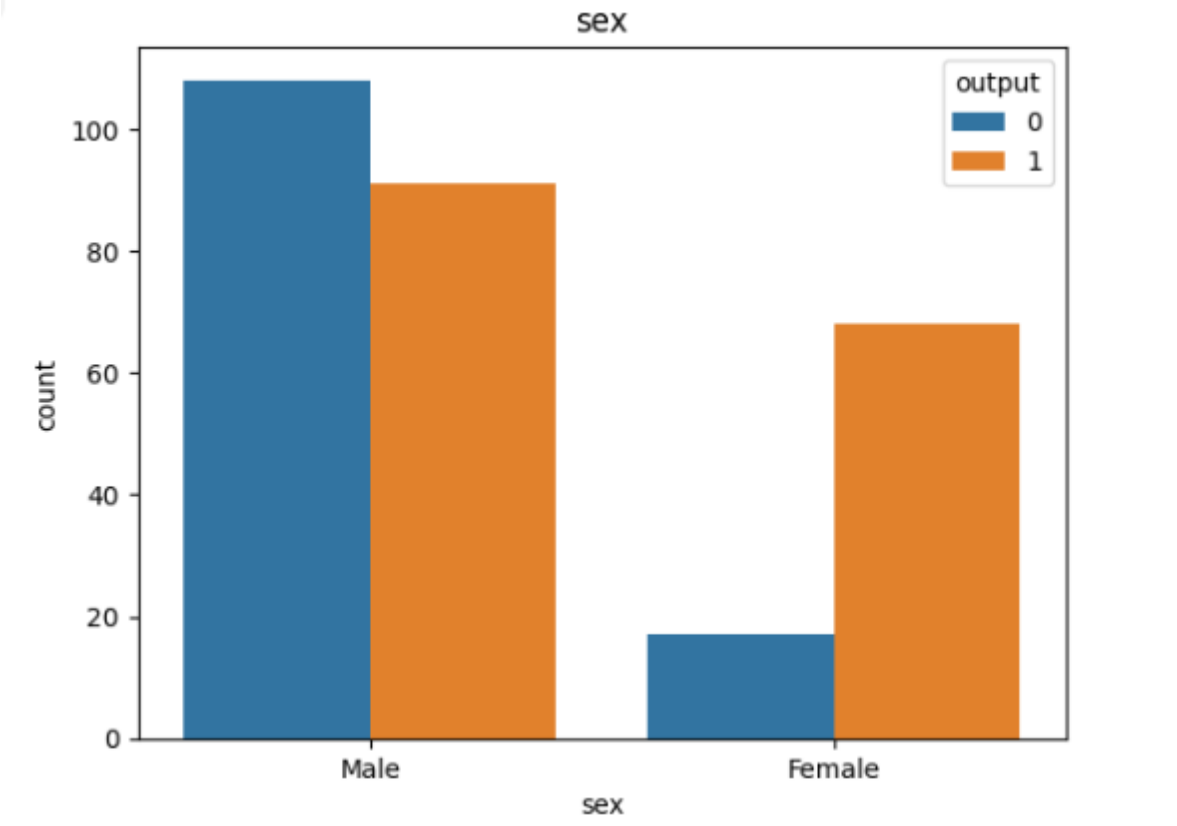
The aim of this analysis is to determine whether a person has a low or high chance of having a heart attack based on various characteristics of their body. These characteristics include age, sex, type of chest pain, resting blood pressure, cholesterol levels, fasting blood sugar,

resting electrocardiographic results, exercise-induced angina, number of major vessels, and maximum heart rate achieved.

ANALYSIS OF THE DATASET

1. Finding whether the chances of heart attack is based on the sex of a patient.

Visualization

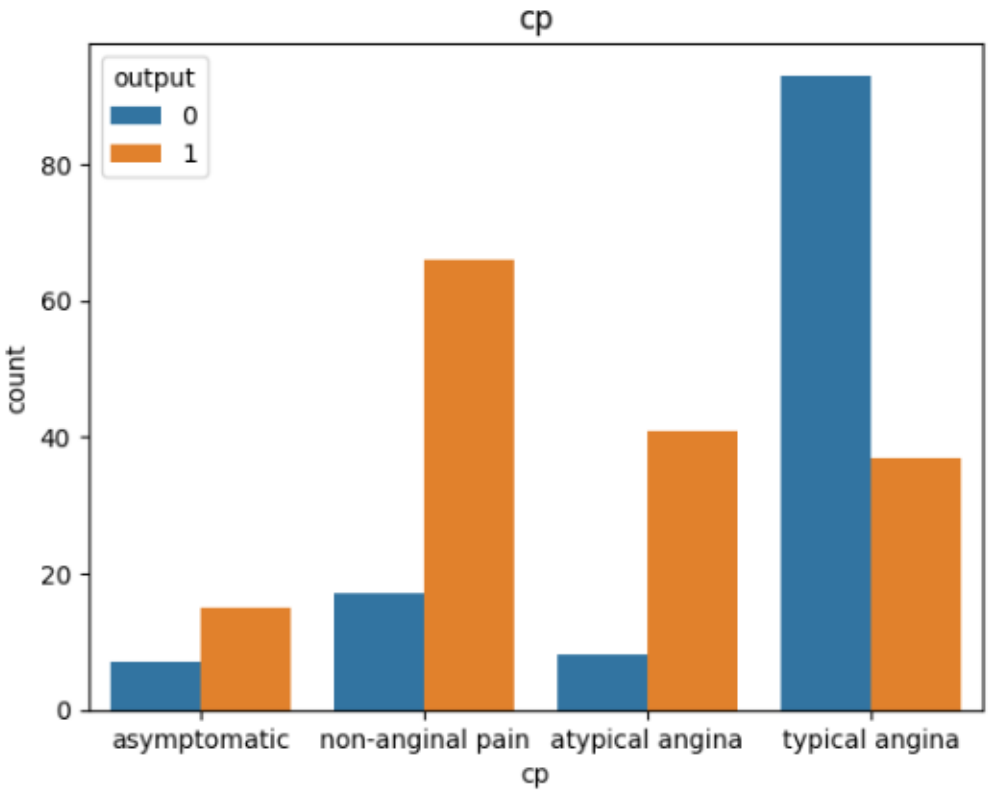


Inference:

- Female patients (represented by 0) show a higher prevalence of heart disease risk compared to male patients (represented by 1).
- Among females, a larger proportion exhibits a higher risk of heart attack, outnumbering those with a lower risk.
- Conversely, among males, the proportion of those with a higher risk of heart attack is lower compared to those with a lower risk.
- Despite there being more male patients in total, a higher proportion of female patients are at a greater risk of heart attack compared to male patients.

2. Finding which type of chest pain is causing a higher risk of heart attack.

Visualization

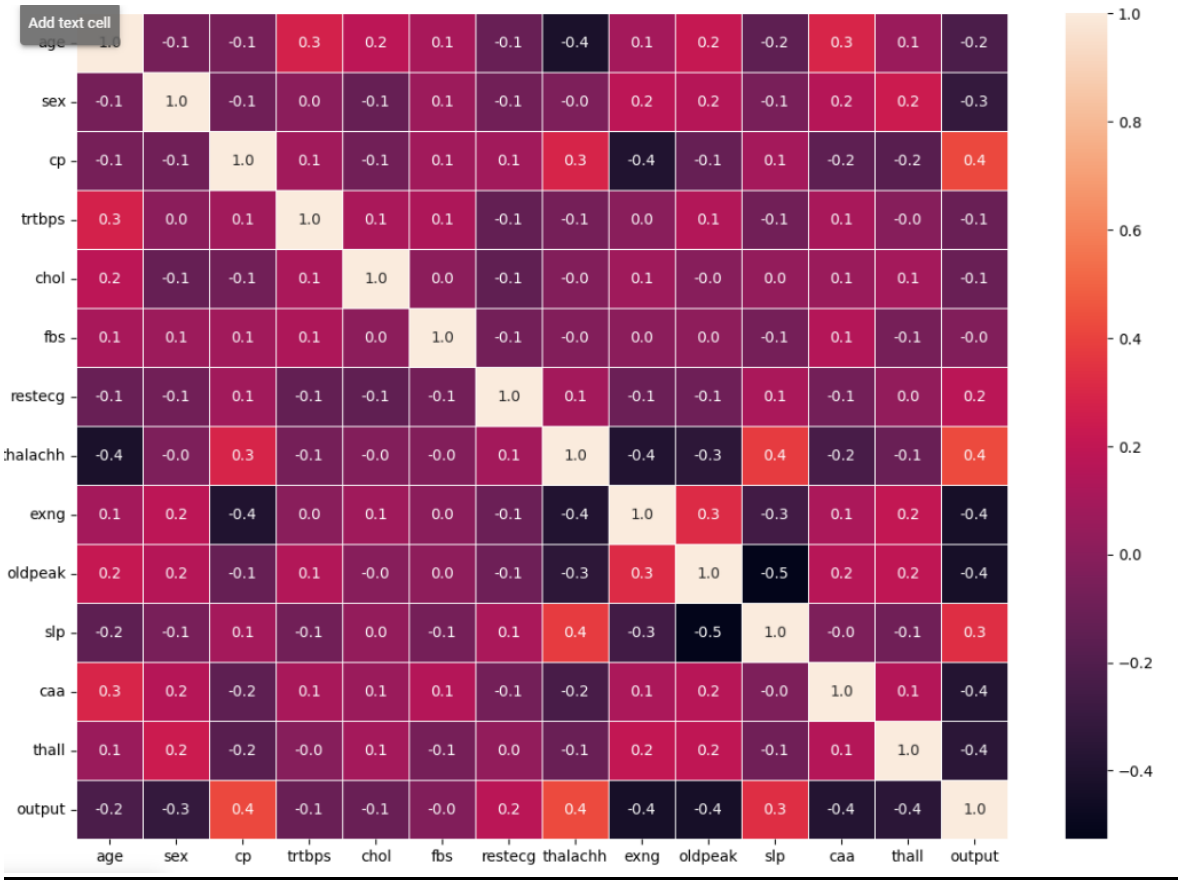


Inference:

- Type 2 chest pain (non-anginal pain) appears to be associated with a higher likelihood of heart attack risk among the four types observed.
- Patients experiencing type 2 chest pain (non-anginal pain) demonstrate a greater number with a higher risk of heart attack compared to other types.
- This inference suggests that individuals reporting type 2 chest pain may warrant closer attention or monitoring for heart disease risk factors.

3. Finding the characteristics that affect the output of the analysis the most.

Visualization

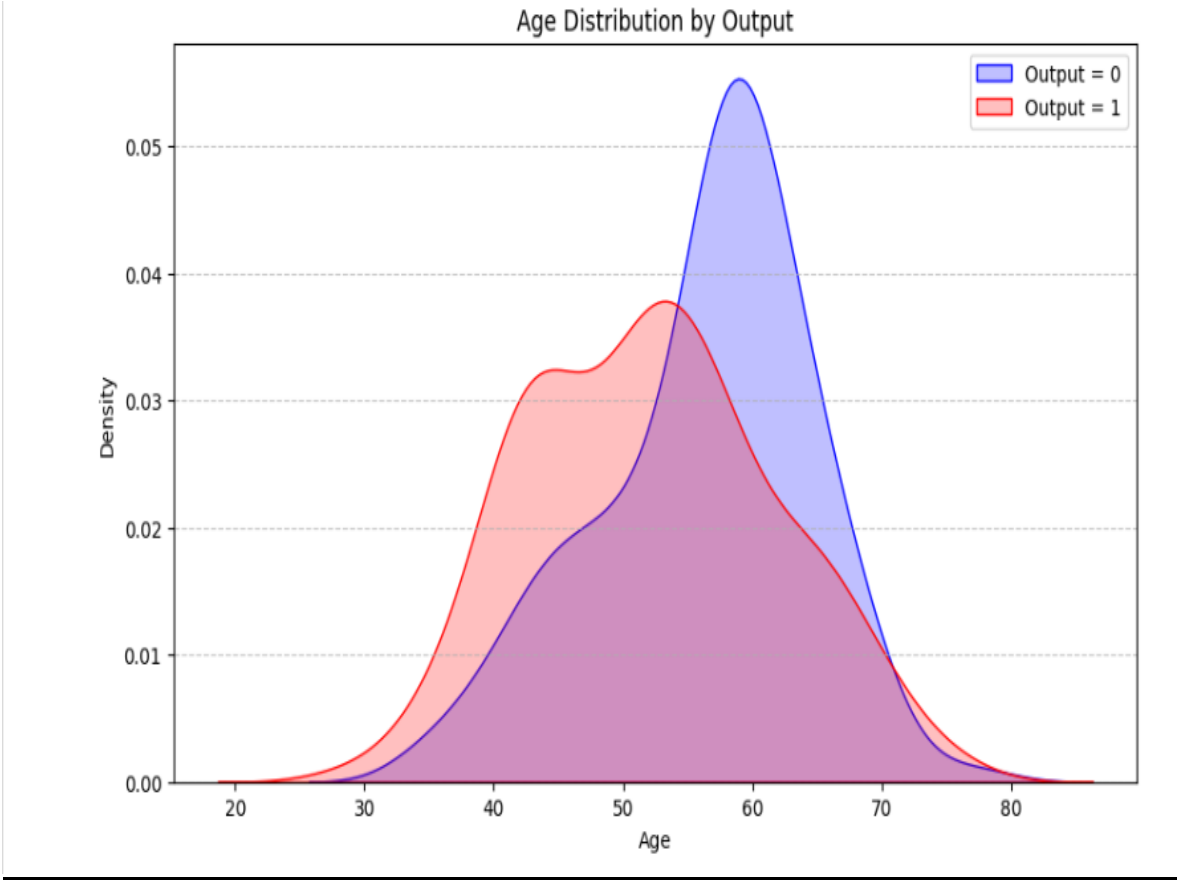


Inference:

- The visualization suggests that among all the characteristics in the dataset, "cp" (chest pain type), "thalachh" (maximum heart rate achieved), and "slp" (slope of the peak exercise ST segment) exhibit the most significant impact on the output.
- These characteristics demonstrate a high correlation with the output variable compared to other features in the dataset.
- Changes in "cp," "thalachh," and "slp" are likely to result in substantial alterations in the output for a patient.
- Consequently, monitoring and understanding variations in these three characteristics could be crucial for predicting and managing heart disease risk.

4. Analyzing the age distribution among individuals with a high likelihood of experiencing a heart attack.

Visualization

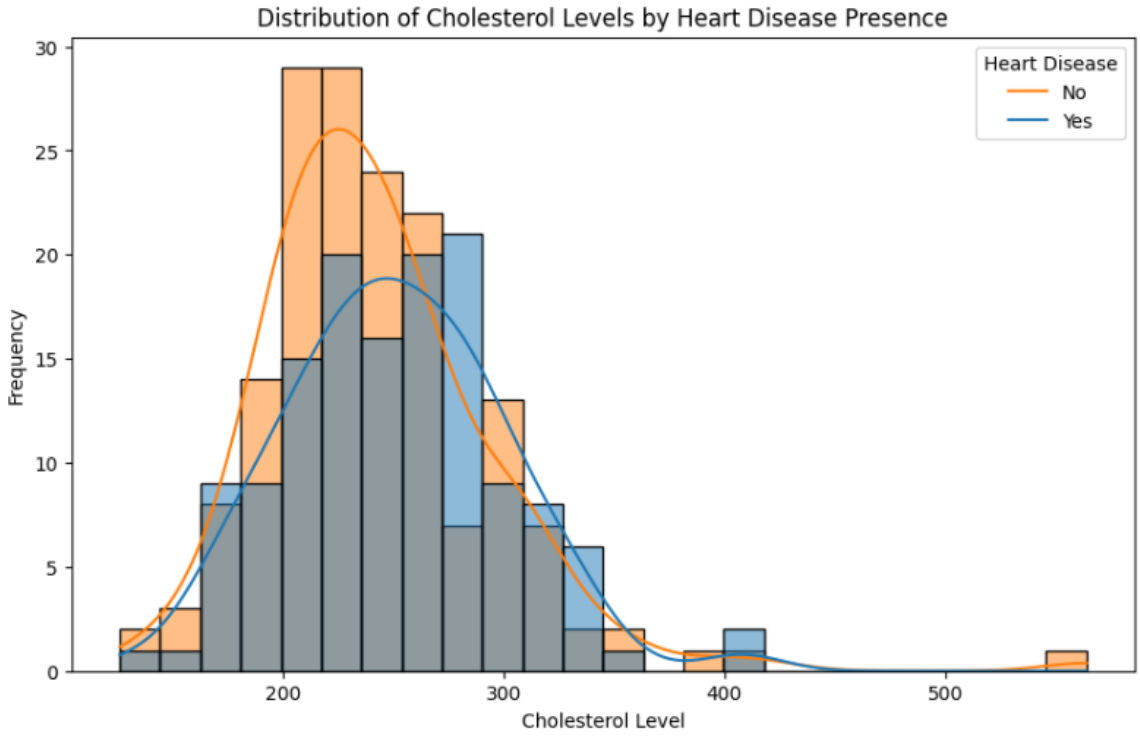


Inference:

- The density appears to be high between the age group of 50 to 60, indicating that there is a concentration of individuals with a higher risk of heart attack within this age range.
- Within the range of 40 to 60, there is a notable increase in the number of patients exhibiting a higher risk of heart attack, suggesting that this age bracket is particularly susceptible to heart-related issues.

5. Investigating the association between cholesterol levels and the probability of experiencing a high risk of heart attack.

Visualization



Inference

- The visualization indicates that there is a higher concentration of patients with a high risk of heart attack between the cholesterol levels of 200 to 300.
- Conversely, there appears to be a greater number of patients with lower chances of having a heart attack between the cholesterol levels of 200 to 225.
- Therefore, it can be inferred that individuals with cholesterol levels above 250 are more likely to have a higher risk of heart attack.

PREDICTION

The dataset includes a variety of patient attributes such as age, sex, type of chest pain, resting blood pressure, cholesterol levels, fasting blood sugar, resting electrocardiographic results, exercise-induced angina, number of major vessels, and maximum heart rate achieved. These attributes are used to predict the target variable, which indicates the likelihood of a heart attack (0 for less chance, 1 for more chance).

Age and Sex:

Both age and sex are important predictors of heart attack risk. Generally, older patients have a higher overall risk. While males typically have a higher risk of heart attack compared to females, the visualization suggests an interesting pattern: among female patients (represented by 0), those with a higher risk of heart attack outnumber those with a lower risk. Conversely, among male patients (represented by 1), those with a higher risk of heart attack are fewer compared to those with a lower risk. Despite the total number of male patients being greater than that of female patients, a higher proportion of female patients are at greater risk of heart attack compared to male patients in this specific dataset. These variables interact with other factors to influence the overall outcome.

Chest Pain Type (cp):

The type of chest pain is a significant predictor. From our observations, patients with type 2 chest pain (non-anginal pain) are more likely to have a higher risk of a heart attack compared to other types.

Resting Blood Pressure (trtbps) and Cholesterol (chol):

Higher levels of resting blood pressure and cholesterol are associated with an increased risk of heart attack. These factors indicate underlying cardiovascular stress and plaque buildup in arteries, respectively.

Fasting Blood Sugar (fbs):

A fasting blood sugar level greater than 120 mg/dl is an indicator of diabetes, which is a known risk factor for heart attacks.

Resting Electrocardiographic Results (rest_ecg):

Abnormalities in resting ECG results, such as ST-T wave abnormalities or left ventricular hypertrophy, are indicative of heart disease and elevate the risk of a heart attack.

Exercise-Induced Angina (exang):

Exercise-induced angina is a critical symptom. Patients who experience angina during physical exertion (exang = 1) have a higher risk of a heart attack.

Number of Major Vessels (ca):

The number of major vessels with significant narrowing (0-3) directly correlates with the severity of coronary artery disease, influencing heart attack risk.

Maximum Heart Rate Achieved (thalach):

The maximum heart rate achieved during exercise testing is a measure of cardiac fitness and stress tolerance. Lower maximum heart rates can indicate compromised heart function.

Logistic regression

Using logistic regression, we can effectively model the likelihood of a heart attack based on these predictors. The model highlights the complex interplay between various factors contributing to heart attack risk. Notably, patients with type 2 chest pain, high resting blood pressure, elevated cholesterol levels, abnormal ECG results, exercise-induced angina, and a higher number of affected major vessels are at a greater risk of experiencing a heart attack. By identifying these high-risk individuals, medical professionals can prioritize preventative measures and treatments to mitigate the risk and improve patient outcomes.

CONCLUSION

The predictive model for heart attack risk serves as a valuable tool for healthcare providers, enabling personalized care and early intervention. By applying this model, cardiologists and preventive medicine specialists can significantly enhance patient outcomes, optimize resource allocation, and contribute to the broader efforts in reducing the incidence and impact of heart disease. This analysis underscores the importance of leveraging data analytics in medical practice to improve patient care and public health.