**Key Patterns and Relationships in the Data**

**Exploratory Data Analysis (EDA) Insights**

**1. Age and Heart Disease Risk**

📌 **Pattern:**

* Heart disease prevalence **increases significantly after age 50**.
* Patients above **55 years old** show a **higher likelihood of heart disease**.

📊 **Insight:**

* Age is a key risk factor, aligning with clinical studies on cardiovascular health.

**2. Chest Pain Type and Heart Disease**

📌 **Pattern:**

* **Asymptomatic chest pain (cp = 3)** is the most common in patients **with** heart disease.
* **Typical and atypical angina (cp = 1, 2)** are more common in **healthy individuals**.

📊 **Insight:**

* Chest pain type is an important diagnostic indicator for risk assessment.

**3. Cholesterol & Blood Pressure**

📌 **Pattern:**

* **Cholesterol levels alone** do not strongly correlate with heart disease.
* Patients with **higher resting blood pressure (trestbps)** tend to have heart disease, but it’s not a sole predictor.

📊 **Insight:**

* Combining multiple features (cholesterol, blood pressure, and exercise stress) provides better risk assessment than any single metric.

**4. Exercise-Induced Angina (exang) and Heart Disease**

📌 **Pattern:**

* Patients who experience **angina during exercise** (exang = 1) are more likely to have heart disease.

📊 **Insight:**

* Exercise stress testing is an effective way to detect cardiovascular issues.

**5. Maximum Heart Rate (thalach) vs. Age**

📌 **Pattern:**

* **Younger patients** have a higher max heart rate.
* Patients with **thalach < 140 bpm** are at higher risk of heart disease.

📊 **Insight:**

* Max heart rate could be an important early warning sign when combined with other factors.

**6. ST Depression (oldpeak) and Heart Disease**

📌 **Pattern:**

* Patients with **oldpeak > 2.0** show **strong correlation** with heart disease.
* Indicates heart stress during exercise.

📊 **Insight:**

* Oldpeak is a strong predictor and should be monitored closely in stress tests.

**7. Feature Correlation Analysis**

📌 **Patterns:**

* **Positive correlation:** Age, oldpeak, and exang **increase** with heart disease risk.
* **Negative correlation:** Thalach (max heart rate) is **lower** in patients with heart disease.

📊 **Insight:**

* Using a combination of features enhances predictive accuracy