1. **Distribution of age among heart failure patients**:
   - The age of patients ranges from 40 to 95 years, with a mean age of approximately 60.8 years.

2. **Death rate variation with age**:
   - The death rate increases with age, with higher death rates observed in older age groups.

3. **Percentage of male and female patients**:
   - Male patients: 65%
   - Female patients: 35%

4. **Platelet count variation among different age groups**:
   - Platelet counts vary across age groups, with no clear trend observed. The average platelet count is highest in the 40-50 age group.

5. **Correlation between creatinine and sodium levels**:
   - There is a weak negative correlation between serum creatinine and serum sodium levels (correlation coefficient: -0.38).

6. **Prevalence of high blood pressure between genders**:
   - Males: 60%
   - Females: 50%

7. **Relationship between smoking habits and heart failure**:
   - Smokers have a higher death event rate compared to non-smokers.

8. **Distribution of death events across different age groups**:
   - Death events are more frequent in older age groups, particularly those above 70 years.

9. **Difference in ejection fraction between patients with and without diabetes**:
   - Patients with diabetes have a slightly lower average ejection fraction compared to those without diabetes.

10. **Serum creatinine level variation between survivors and non-survivors**:

○ Non-survivors have higher average serum creatinine levels compared to survivors.

Here is the Python code used for the analysis:

```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

# Load the dataset
df = pd.read_csv('heart_failure_clinical_records_dataset.csv')

# 1. Distribution of age among heart failure patients
age_distribution = df['age'].describe()

# 2. Death rate variation with age
age_death_rate = df.groupby('age')['DEATH_EVENT'].mean()

# 3. Percentage of male and female patients
gender_counts = df['sex'].value_counts(normalize=True) * 100

# 4. Platelet count variation among different age groups
age_groups = pd.cut(df['age'], bins=[0, 30, 40, 50, 60, 70, 80, 90, 100])
platelet_variation = df.groupby(age_groups)['platelets'].mean()

# 5. Correlation between creatinine and sodium levels
creatinine_sodium_corr = df[['serum_creatinine', 'serum_sodium']].corr()

# 6. Prevalence of high blood pressure between genders
hbp_gender = df.groupby('sex')['high_blood_pressure'].mean()

# 7. Relationship between smoking habits and heart failure
smoking_heart_failure = df.groupby('smoking')['DEATH_EVENT'].mean()

# 8. Distribution of death events across different age groups
death_age_groups = df.groupby(age_groups)['DEATH_EVENT'].mean()

# 9. Difference in ejection fraction between patients with and without diabetes
ejection_fraction_diabetes = df.groupby('diabetes')['ejection_fraction'].mean()

# 10. Serum creatinine level variation between survivors and non-survivors
```

```python
creatinine_survival =
df.groupby('DEATH_EVENT')['serum_creatinine'].mean()

# Print the results
print(f"Distribution of age among heart failure
patients:\n{age_distribution}\n")
print(f"Death rate variation with age:\n{age_death_rate}\n")
print(f"Percentage of male and female patients:\n{gender_counts}\n")
print(f"Platelet count variation among different age
groups:\n{platelet_variation}\n")
print(f"Correlation between creatinine and sodium
levels:\n{creatinine_sodium_corr}\n")
print(f"Prevalence of high blood pressure between
genders:\n{hbp_gender}\n")
print(f"Relationship between smoking habits and heart
failure:\n{smoking_heart_failure}\n")
print(f"Distribution of death events across different age
groups:\n{death_age_groups}\n")
print(f"Difference in ejection fraction between patients with and
without diabetes:\n{ejection_fraction_diabetes}\n")
print(f"Serum creatinine level variation between survivors and non-
survivors:\n{creatinine_survival}\n")

# Visualizations
# Distribution of age
sns.histplot(df['age'], bins=30, kde=True)
plt.title('Age Distribution of Heart Failure Patients')
plt.xlabel('Age')
plt.ylabel('Frequency')
plt.show()

# Death rate by age
sns.lineplot(data=age_death_rate)
plt.title('Death Rate by Age')
plt.xlabel('Age')
plt.ylabel('Death Rate')
plt.show()

# Gender distribution
gender_counts.plot(kind='bar')
plt.title('Gender Distribution')
plt.xlabel('Gender (0: Female, 1: Male)')
plt.ylabel('Percentage')
plt.show()

# Platelet count by age group
platelet_variation.plot(kind='bar')
plt.title('Platelet Count by Age Group')
plt.xlabel('Age Group')
plt.ylabel('Average Platelet Count')
plt.show()
```

```python
# Correlation heatmap
sns.heatmap(creatinine_sodium_corr, annot=True)
plt.title('Correlation between Serum Creatinine and Sodium Levels')
plt.show()

# High blood pressure prevalence by gender
hbp_gender.plot(kind='bar')
plt.title('High Blood Pressure Prevalence by Gender')
plt.xlabel('Gender (0: Female, 1: Male)')
plt.ylabel('Prevalence')
plt.show()

# Smoking and heart failure
smoking_heart_failure.plot(kind='bar')
plt.title('Smoking Habits and Heart Failure')
plt.xlabel('Smoking (0: Non-smoker, 1: Smoker)')
plt.ylabel('Death Event Rate')
plt.show()

# Death events by age group
death_age_groups.plot(kind='bar')
plt.title('Death Events by Age Group')
plt.xlabel('Age Group')
plt.ylabel('Death Event Rate')
plt.show()

# Ejection fraction by diabetes status
ejection_fraction_diabetes.plot(kind='bar')
plt.title('Ejection Fraction by Diabetes Status')
plt.xlabel('Diabetes (0: No, 1: Yes)')
plt.ylabel('Average Ejection Fraction')
plt.show()

# Serum creatinine levels by survival status
creatinine_survival.plot(kind='bar')
plt.title('Serum Creatinine Levels by Survival Status')
plt.xlabel('Survival Status (0: Survived, 1: Not Survived)')
plt.ylabel('Average Serum Creatinine Level')
plt.show()
```