Heart Attack Prediction - Data Cleaning & EDA

1. Imports and Setup

In [7]:

```python
# Imports

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

# Setup

os.makedirs('../data/processed', exist_ok=True)
os.makedirs('../reports/figures', exist_ok=True)
sns.set_style("whitegrid")
```

2. Load and Inspect Data

In [4]:

```python
df = pd.read_excel('../data/raw/data.xlsx', engine='openpyxl')

print("--- Data Info ---")
df.info()

print("\n--- Missing Values ---")
print(df.isnull().sum())

print(f"\n--- Number of Duplicate Rows ---")
print(df.duplicated().sum())
```

```
--- Data Info ---
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 303 entries, 0 to 302
Data columns (total 14 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   age       303 non-null    int64
 1   sex       303 non-null    int64
 2   cp        303 non-null    int64
 3   trestbps  303 non-null    int64
 4   chol      303 non-null    int64
 5   fbs       303 non-null    int64
 6   restecg   303 non-null    int64
 7   thalach   303 non-null    int64
 8   exang     303 non-null    int64
 9   oldpeak   303 non-null    float64
 10  slope     303 non-null    int64
 11  ca        303 non-null    int64
 12  thal      303 non-null    int64
 13  target    303 non-null    int64
dtypes: float64(1), int64(13)
memory usage: 33.3 KB

--- Missing Values ---
age         0
sex         0
cp          0
trestbps    0
chol        0
fbs         0
restecg     0
thalach     0
exang       0
oldpeak     0
slope       0
ca          0
thal        0
target      0
dtype: int64
```

```
--- Number of Duplicate Rows ---
1
```

3. Clean Data

In [5]:

```
# --- Clean Data ---
# Remove the 1 duplicate row found during inspection
if df.duplicated().sum() > 0:
    df.drop_duplicates(inplace=True)
    print(f"Dropped {df.duplicated().sum() + 1} duplicate row. New shape: {df.shape}")
else:
    print("No duplicate rows found.")

# Save the cleaned data for future use and for Tableau
df.to_csv('../data/processed/cleaned_heart_data.csv', index=False)
print("Cleaned data saved to 'data/processed/cleaned_heart_data.csv'")
```

```
Dropped 1 duplicate row. New shape: (302, 14)
Cleaned data saved to 'data/processed/cleaned_heart_data.csv'
```

4: Statistical Summary

In [8]:

```
# --- Statistical Summary ---
print("--- Statistical Summary of the Data ---")
df.describe().T
```

```
--- Statistical Summary of the Data ---
```

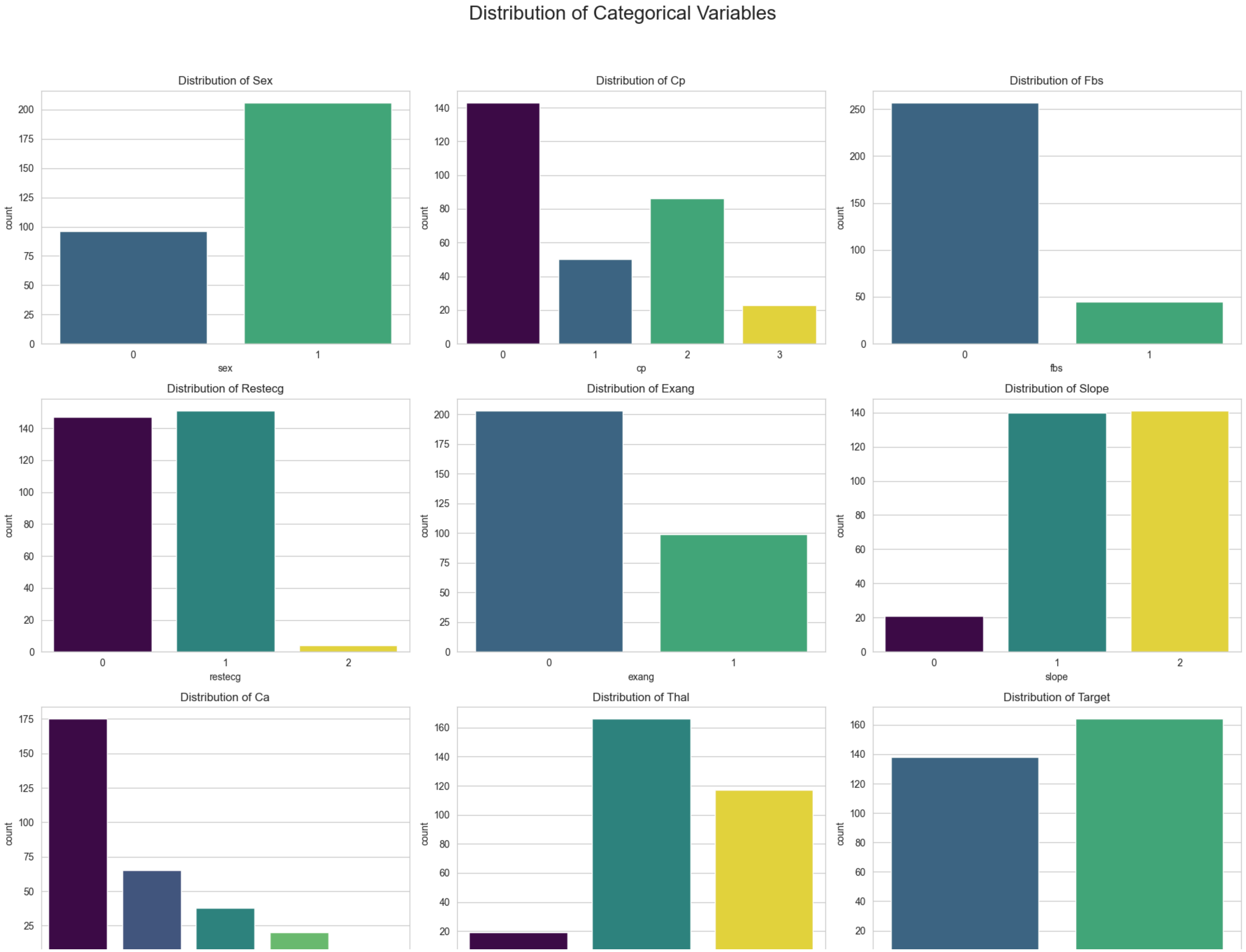
Out[8]:

	count	mean	std	min	25%	50%	75%	max
age	302.0	54.420530	9.047970	29.0	48.00	55.5	61.00	77.0
sex	302.0	0.682119	0.466426	0.0	0.00	1.0	1.00	1.0
cp	302.0	0.963576	1.032044	0.0	0.00	1.0	2.00	3.0
trestbps	302.0	131.602649	17.563394	94.0	120.00	130.0	140.00	200.0
chol	302.0	246.500000	51.753489	126.0	211.00	240.5	274.75	564.0
fbs	302.0	0.149007	0.356686	0.0	0.00	0.0	0.00	1.0
restecg	302.0	0.526490	0.526027	0.0	0.00	1.0	1.00	2.0
thalach	302.0	149.569536	22.903527	71.0	133.25	152.5	166.00	202.0
exang	302.0	0.327815	0.470196	0.0	0.00	0.0	1.00	1.0
oldpeak	302.0	1.043046	1.161452	0.0	0.00	0.8	1.60	6.2
slope	302.0	1.397351	0.616274	0.0	1.00	1.0	2.00	2.0
ca	302.0	0.718543	1.006748	0.0	0.00	0.0	1.00	4.0
thal	302.0	2.324503	0.588366	1.0	2.00	2.0	3.00	3.0
target	302.0	0.543046	0.498970	0.0	0.00	1.0	1.00	1.0

5: Explore Categorical Variables

In [9]:

```
# --- Explore Categorical Variables ---
# CORRECTED the variable names to match the actual columns in your data
categorical_vars = ['sex', 'cp', 'fbs', 'restecg', 'exang', 'slope', 'ca', 'thal', 'target']
fig, axes = plt.subplots(3, 3, figsize=(18, 15))
fig.suptitle('Distribution of Categorical Variables', fontsize=20)

# Loop through the variables and create a count plot for each
for i, var in enumerate(categorical_vars):
    row, col = i // 3, i % 3
    # FIX for FutureWarning: Assign the variable to 'hue' to use a palette and disable the legend
    sns.countplot(x=var, data=df, ax=axes[row, col], hue=var, palette='viridis', legend=False)
    axes[row, col].set_title(f'Distribution of {var.title()}')

plt.tight_layout(rect=[0, 0.03, 1, 0.95])
plt.savefig('../reports/figures/categorical_distributions.png', bbox_inches='tight')
plt.show()
```

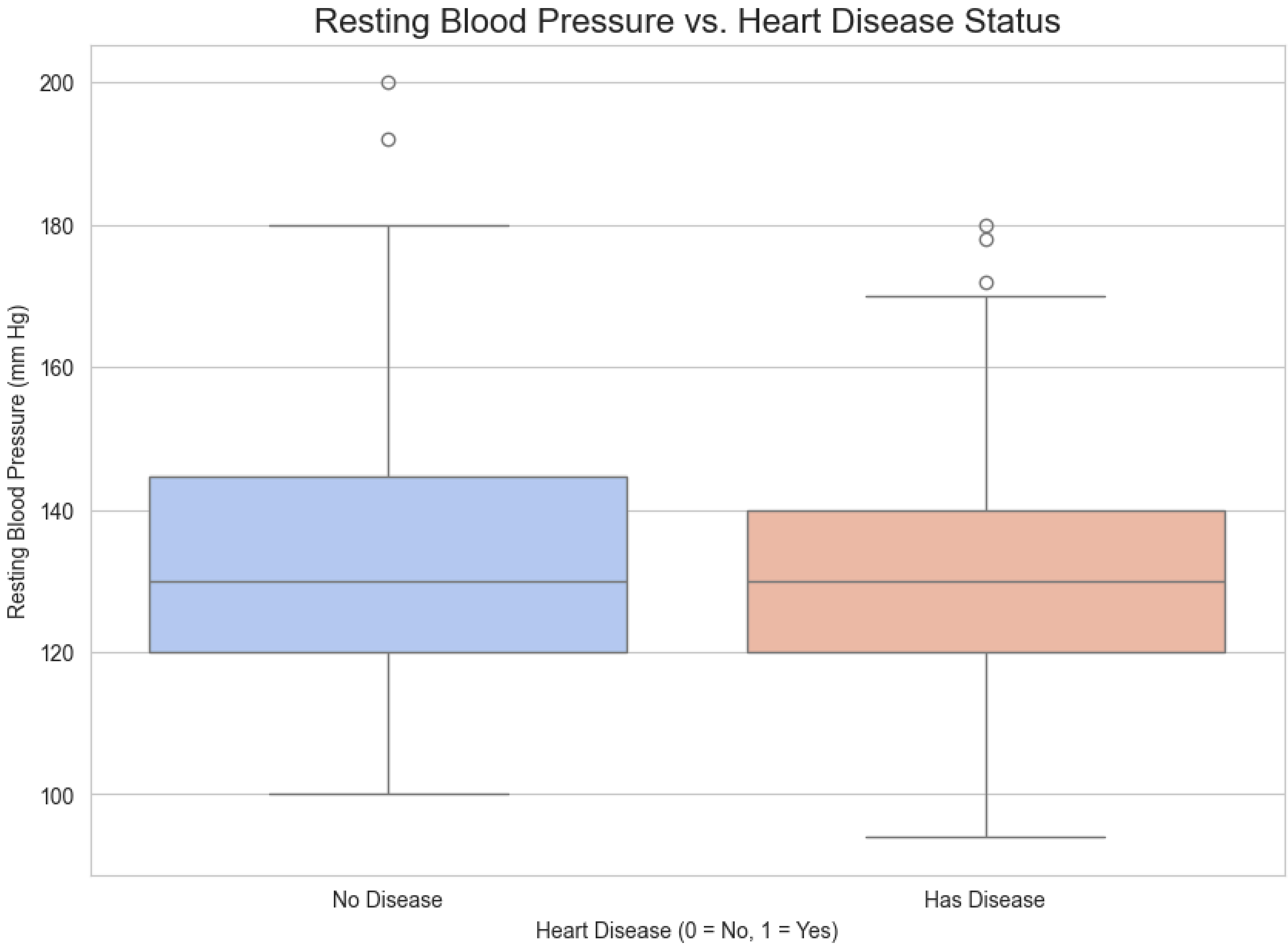

Distribution of Categorical Variables
Distribution of Sex
Distribution of Cp
Distribution of Fbs
Distribution of Restecg
Distribution of Exang
Distribution of Slope
Distribution of Ca
Distribution of Thal
Distribution of Target
count
sex
cp
fbs
restecg
exang
slope
0
1
2
3
0
25
50
75
100
125
150
175
200
250
20
40
60
80
120
140
160

6: Occurrence of Heart Disease across Age

In [10]:

```
# --- Resting Blood Pressure vs. Heart Disease ---
plt.figure(figsize=(10, 7))
# CORRECTED 'output' to 'target' and 'trtbps' to 'trestbps'
sns.boxplot(x='target', y='trestbps', data=df, palette='coolwarm')
plt.title('Resting Blood Pressure vs. Heart Disease Status', fontsize=16)
plt.xlabel('Heart Disease (0 = No, 1 = Yes)')
plt.ylabel('Resting Blood Pressure (mm Hg)')
plt.xticks([0, 1], ['No Disease', 'Has Disease']) # More descriptive labels
plt.savefig('../reports/figures/bp_vs_heart_disease.png', bbox_inches='tight')
plt.show()
```

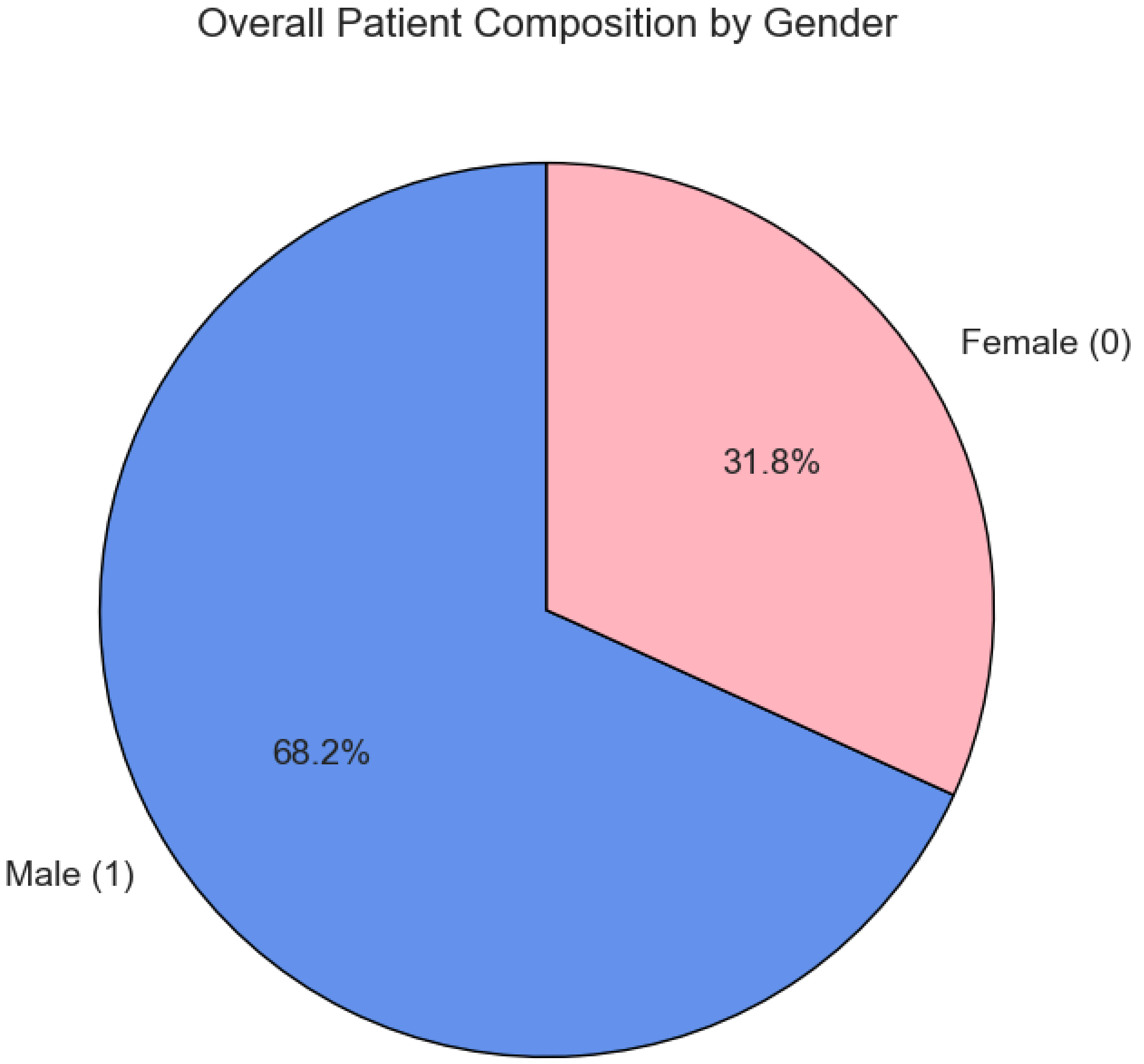
```
C:\Users\ThapeloMasebe\AppData\Local\Temp\ipykernel_52240\2457019085.py:4: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and se
t `legend=False` for the same effect.

  sns.boxplot(x='target', y='trestbps', data=df, palette='coolwarm')
```



8: Patient Composition by Gender

In [11]:

```
# --- Patient Composition by Gender ---
plt.figure(figsize=(8, 8))
df['sex'].value_counts().plot.pie(
autopct='%1.1f%%', startangle=90, colors=['#6495ED', '#FFB6C1'],
labels=['Male (1)', 'Female (0)'], textprops={'fontsize': 14},
wedgeprops={'edgecolor': 'black', 'linewidth': 1}
)
plt.title('Overall Patient Composition by Gender', fontsize=16)
plt.ylabel('') # Hide the 'sex' label on the y-axis
plt.savefig('../reports/figures/gender_composition.png', bbox_inches='tight')
plt.show()
```


Overall Patient Composition by Gender
Female (0)
31.8%
68.2%
Male (1)