Heart_Disease_Diagnostic

April 26, 2024

1 Heart disease diagnostic

[25]:
```
# Import library
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

[26]:
```
# Import Dataset
df = pd.read_csv('Heart Disease data.csv')
df.head(10)
```

[26]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target
0	52	1	0	125	212	0	1	168	0	1.0	2	2	3	0
1	53	1	0	140	203	1	0	155	1	3.1	0	0	3	0
2	70	1	0	145	174	0	1	125	1	2.6	0	0	3	0
3	61	1	0	148	203	0	1	161	0	0.0	2	1	3	0
4	62	0	0	138	294	1	1	106	0	1.9	1	3	2	0
5	58	0	0	100	248	0	0	122	0	1.0	1	0	2	1
6	58	1	0	114	318	0	2	140	0	4.4	0	3	1	0
7	55	1	0	160	289	0	0	145	1	0.8	1	1	3	0
8	46	1	0	120	249	0	0	144	0	0.8	2	0	3	0
9	54	1	0	122	286	0	0	116	1	3.2	1	2	2	0

[27]:
```
df.shape
```

[27]:
```
(1025, 14)
```

[28]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1025 entries, 0 to 1024
Data columns (total 14 columns):
 #   Column    Non-Null Count  Dtype  
---  ------    --------------  -----  
 0   age       1025 non-null   int64  
 1   sex       1025 non-null   int64  
 2   cp        1025 non-null   int64  
 3   trestbps  1025 non-null   int64  
 4   chol      1025 non-null   int64  
 5   fbs       1025 non-null   int64  
 6   restecg   1025 non-null   int64  
 7   thalach   1025 non-null   int64  
 8   exang     1025 non-null   int64  
 9   oldpeak   1025 non-null   float64
 10  slope     1025 non-null   int64  
 11  ca        1025 non-null   int64  
 12  thal      1025 non-null   int64  
 13  target    1025 non-null   int64  
dtypes: float64(1), int64(13)
memory usage: 112.2 KB
```

[29]:
```
df.describe()
```

[29]:

	age	sex	cp	trestbps	chol	\
count	1025.000000	1025.000000	1025.000000	1025.000000	1025.00000	
mean	54.434146	0.695610	0.942439	131.611707	246.00000	
std	9.072290	0.460373	1.029641	17.516718	51.59251	
min	29.000000	0.000000	0.000000	94.000000	126.00000	
25%	48.000000	0.000000	0.000000	120.000000	211.00000	
50%	56.000000	1.000000	1.000000	130.000000	240.00000	
75%	61.000000	1.000000	2.000000	140.000000	275.00000	
max	77.000000	1.000000	3.000000	200.000000	564.00000	

	fbs	restecg	thalach	exang	oldpeak	\
count	1025.000000	1025.000000	1025.000000	1025.000000	1025.000000	
mean	0.149268	0.529756	149.114146	0.336585	1.071512	
std	0.356527	0.527878	23.005724	0.472772	1.175053	
min	0.000000	0.000000	71.000000	0.000000	0.000000	
25%	0.000000	0.000000	132.000000	0.000000	0.000000	
50%	0.000000	1.000000	152.000000	0.000000	0.800000	

```
75%       0.000000     1.000000   166.000000     1.000000     1.800000
max       1.000000     2.000000   202.000000     1.000000     6.200000

              slope           ca         thal       target
count  1025.000000  1025.000000  1025.000000  1025.000000
mean      1.385366     0.754146     2.323902     0.513171
std       0.617755     1.030798     0.620660     0.500070
min       0.000000     0.000000     0.000000     0.000000
25%       1.000000     0.000000     2.000000     0.000000
50%       1.000000     0.000000     2.000000     1.000000
75%       2.000000     1.000000     3.000000     1.000000
max       2.000000     4.000000     3.000000     1.000000
```

[30]:
```
# lets find is there any missing values in this data
df.isnull().sum()
```

[30]:
```
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
```

[31]:
```
df = df.dropna(axis=0)
df.shape
```

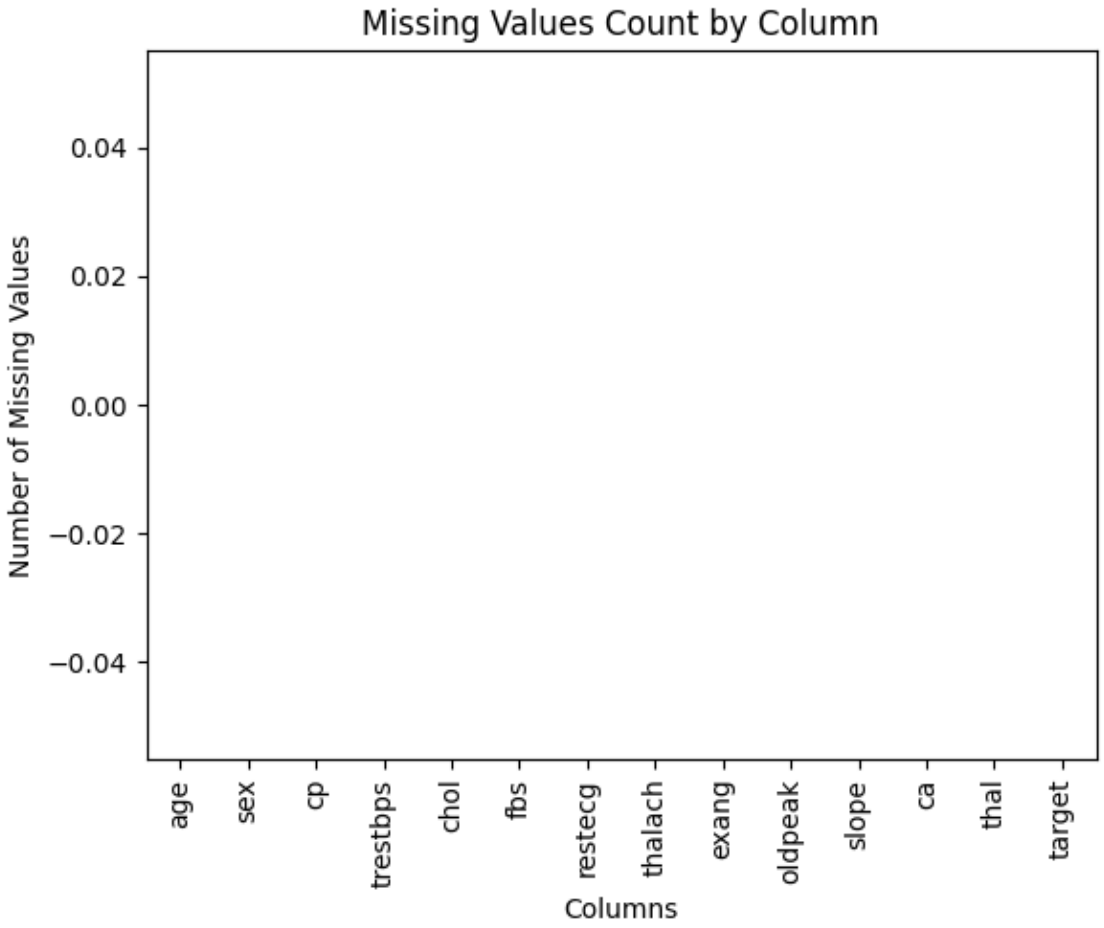
[31]:
```
(1025, 14)
```

[32]:
```
num_rows = len(df['target'])
print("Number of rows in the 'target' column:", num_rows)
```

```
Number of rows in the 'target' column: 1025
```

[33]:
```
missing_values_count = df.isnull().sum()
missing_values_count.plot(kind='bar')
plt.xlabel('Columns')
plt.ylabel('Number of Missing Values')
plt.title('Missing Values Count by Column')
```

```
plt.show()
```



[34]:
```
df.corr()
```

[34]:

	age	sex	cp	trestbps	chol	fbs	\
age	1.000000	-0.103240	-0.071966	0.271121	0.219823	0.121243	
sex	-0.103240	1.000000	-0.041119	-0.078974	-0.198258	0.027200	
cp	-0.071966	-0.041119	1.000000	0.038177	-0.081641	0.079294	
trestbps	0.271121	-0.078974	0.038177	1.000000	0.127977	0.181767	
chol	0.219823	-0.198258	-0.081641	0.127977	1.000000	0.026917	
fbs	0.121243	0.027200	0.079294	0.181767	0.026917	1.000000	
restecg	-0.132696	-0.055117	0.043581	-0.123794	-0.147410	-0.104051	
thalach	-0.390227	-0.049365	0.306839	-0.039264	-0.021772	-0.008866	
exang	0.088163	0.139157	-0.401513	0.061197	0.067382	0.049261	
oldpeak	0.208137	0.084687	-0.174733	0.187434	0.064880	0.010859	
slope	-0.169105	-0.026666	0.131633	-0.120445	-0.014248	-0.061902	
ca	0.271551	0.111729	-0.176206	0.104554	0.074259	0.137156	

```
thal      0.072297  0.198424 -0.163341  0.059276  0.100244 -0.042177
target   -0.229324 -0.279501  0.434854 -0.138772 -0.099966 -0.041164

            restecg   thalach     exang   oldpeak     slope        ca  \
age       -0.132696 -0.390227  0.088163  0.208137 -0.169105  0.271551
sex       -0.055117 -0.049365  0.139157  0.084687 -0.026666  0.111729
cp         0.043581  0.306839 -0.401513 -0.174733  0.131633 -0.176206
trestbps  -0.123794 -0.039264  0.061197  0.187434 -0.120445  0.104554
chol      -0.147410 -0.021772  0.067382  0.064880 -0.014248  0.074259
fbs       -0.104051 -0.008866  0.049261  0.010859 -0.061902  0.137156
restecg    1.000000  0.048411 -0.065606 -0.050114  0.086086 -0.078072
thalach    0.048411  1.000000 -0.380281 -0.349796  0.395308 -0.207888
exang     -0.065606 -0.380281  1.000000  0.310844 -0.267335  0.107849
oldpeak   -0.050114 -0.349796  0.310844  1.000000 -0.575189  0.221816
slope      0.086086  0.395308 -0.267335 -0.575189  1.000000 -0.073440
ca        -0.078072 -0.207888  0.107849  0.221816 -0.073440  1.000000
thal      -0.020504 -0.098068  0.197201  0.202672 -0.094090  0.149014
target     0.134468  0.422895 -0.438029 -0.438441  0.345512 -0.382085

              thal    target
age       0.072297 -0.229324
sex       0.198424 -0.279501
cp       -0.163341  0.434854
trestbps  0.059276 -0.138772
chol      0.100244 -0.099966
fbs      -0.042177 -0.041164
restecg  -0.020504  0.134468
thalach  -0.098068  0.422895
exang     0.197201 -0.438029
oldpeak   0.202672 -0.438441
slope    -0.094090  0.345512
ca        0.149014 -0.382085
thal      1.000000 -0.337838
target   -0.337838  1.000000
```

[35]:
```
# Remove duplicates in dataset
df = df.drop_duplicates()
```

[36]:
```
df.shape
```

[36]:
```
(302, 14)
```

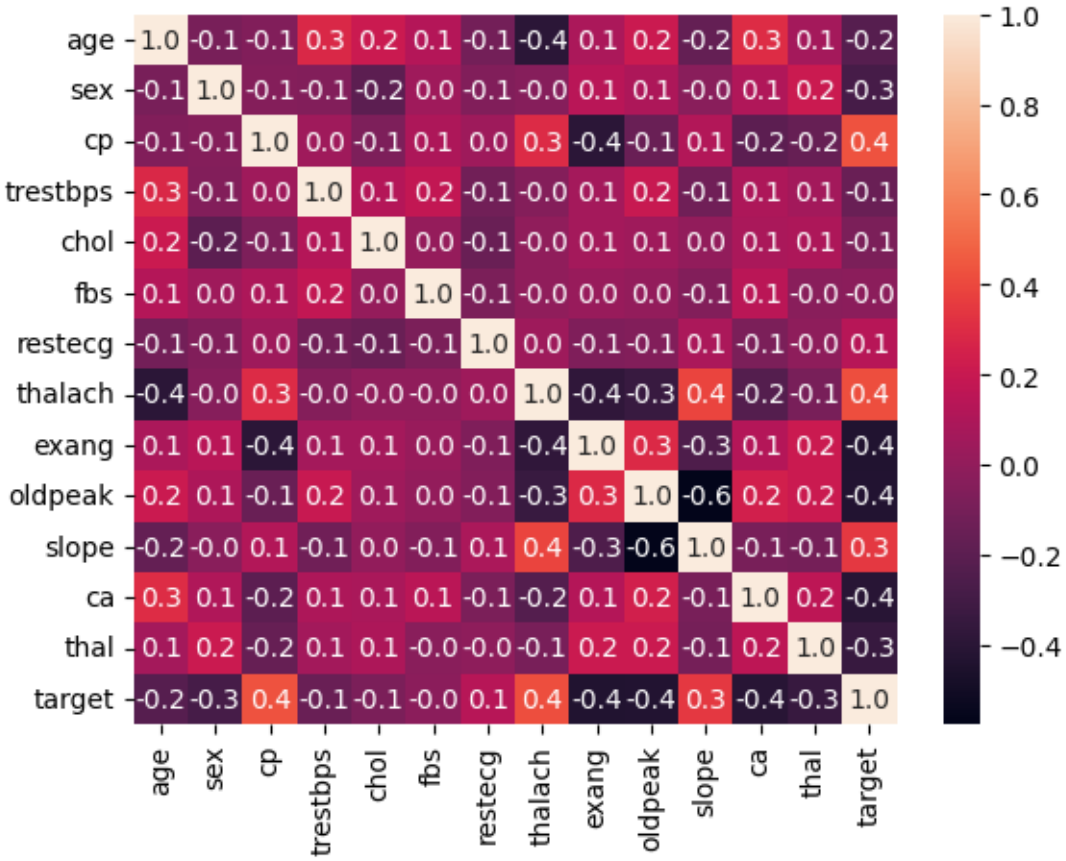
[37]:
```
num_rows = len(df['target'])
print("Number of rows in the 'target' column:", num_rows)
```

```
Number of rows in the 'target' column: 302
```

2 Explanatory Data Analysis

[38]:
```
#Visualizing the correlation
sns.heatmap(df.corr(), annot=True, fmt=".1f")
```

[38]: <Axes: >

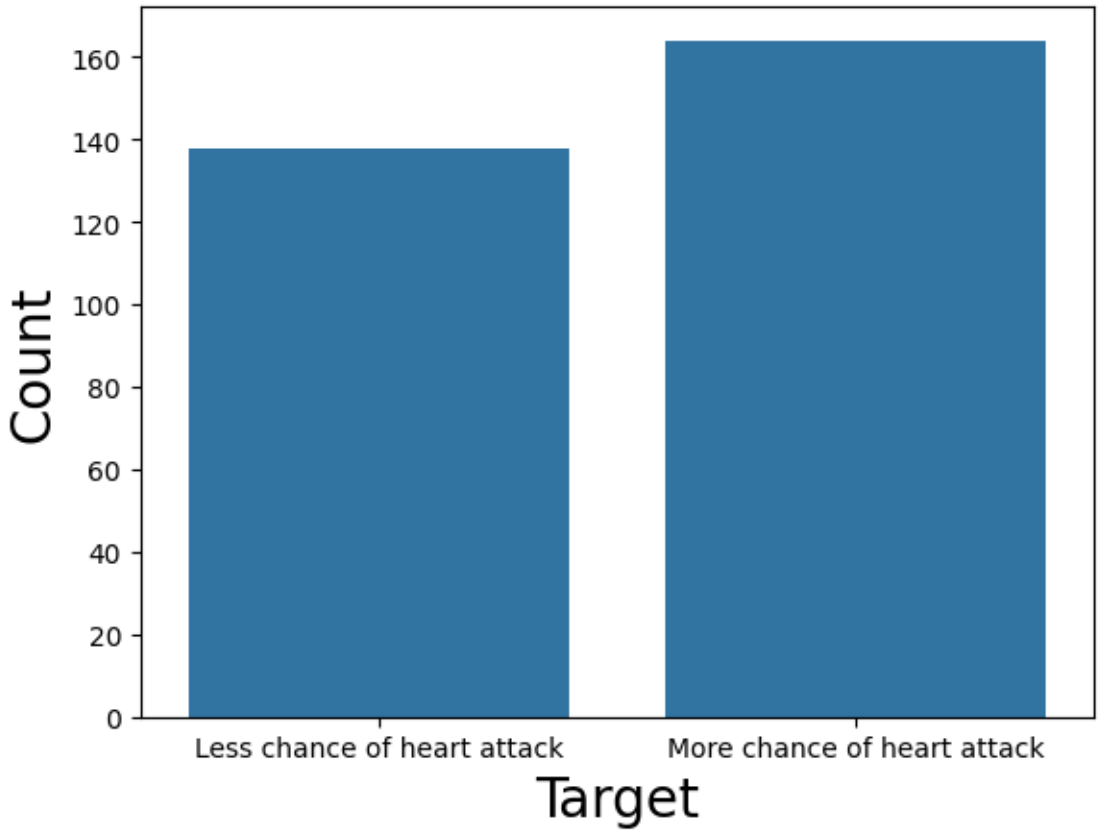


[39]:
```
target_counts = df['target'].value_counts()
print(target_counts)
```

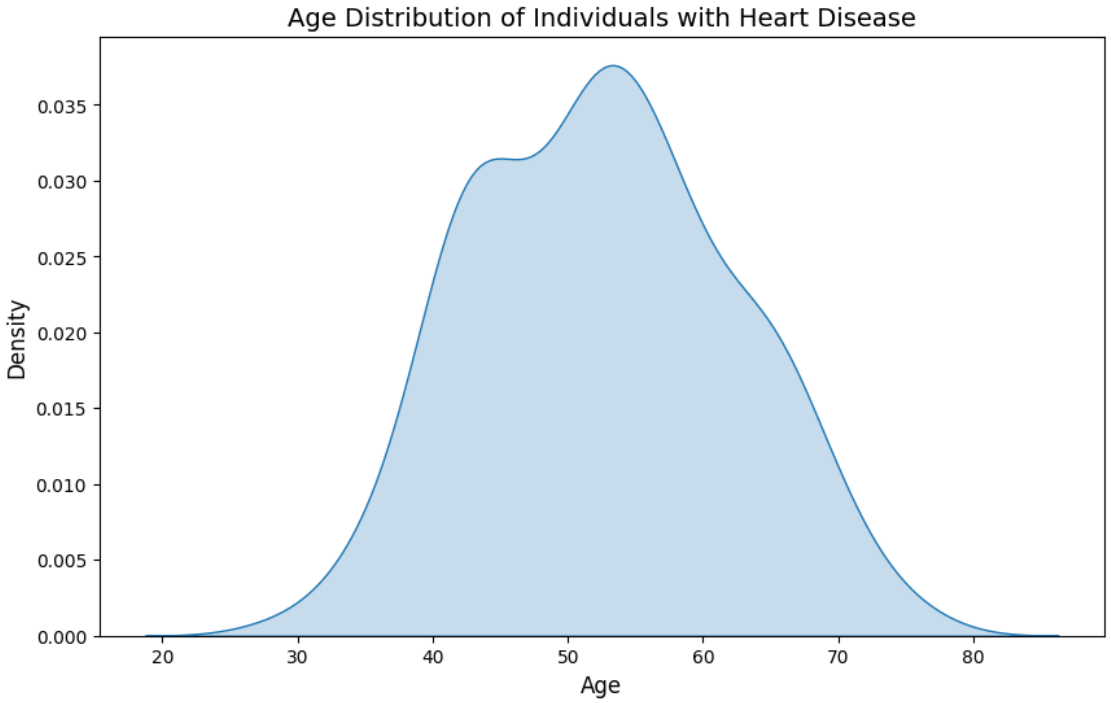
```
target
1    164
0    138
Name: count, dtype: int64
```

[40]:
```
#visualization of showing the count of individuals with less and more chance of␣
 ↪heart attack.
sns.countplot(x="target",data=df)
plt.xticks(([0,1]),['Less chance of heart attack', 'More chance of heart␣
 ↪attack'])
```

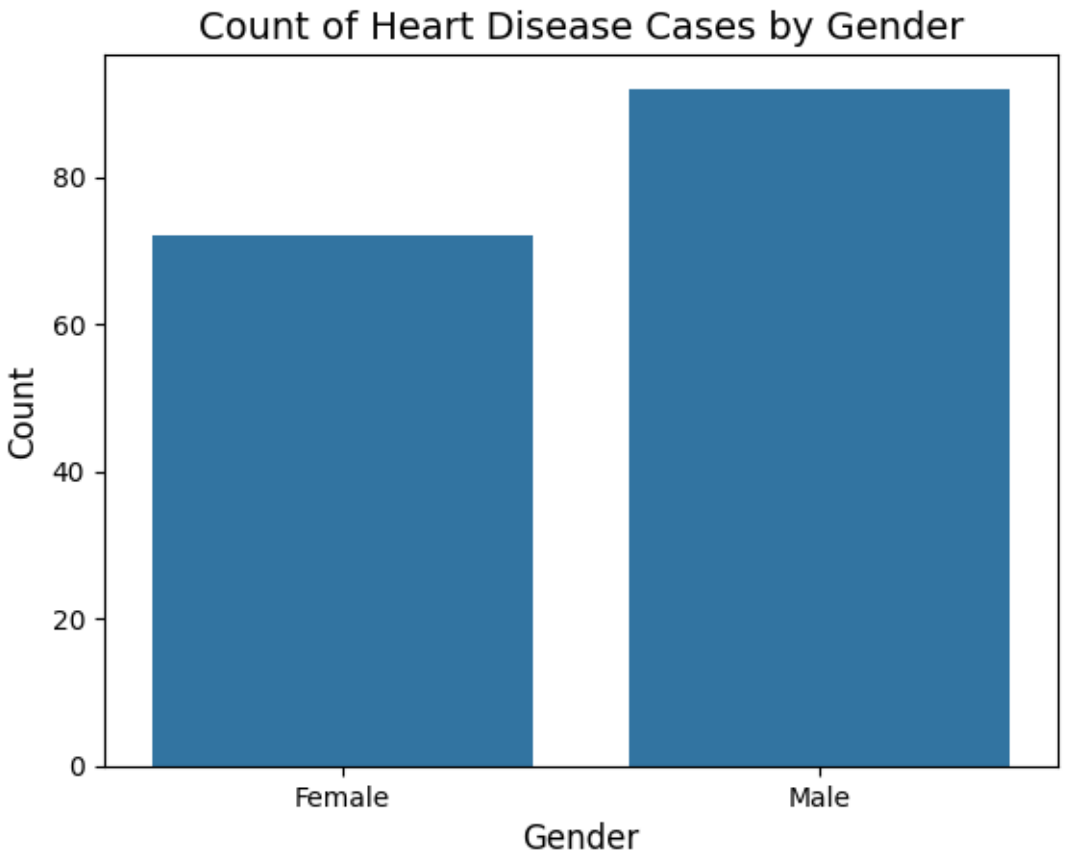
```
plt.xlabel('Target',fontsize=20)
plt.ylabel('Count',fontsize=20)
plt.show()
```



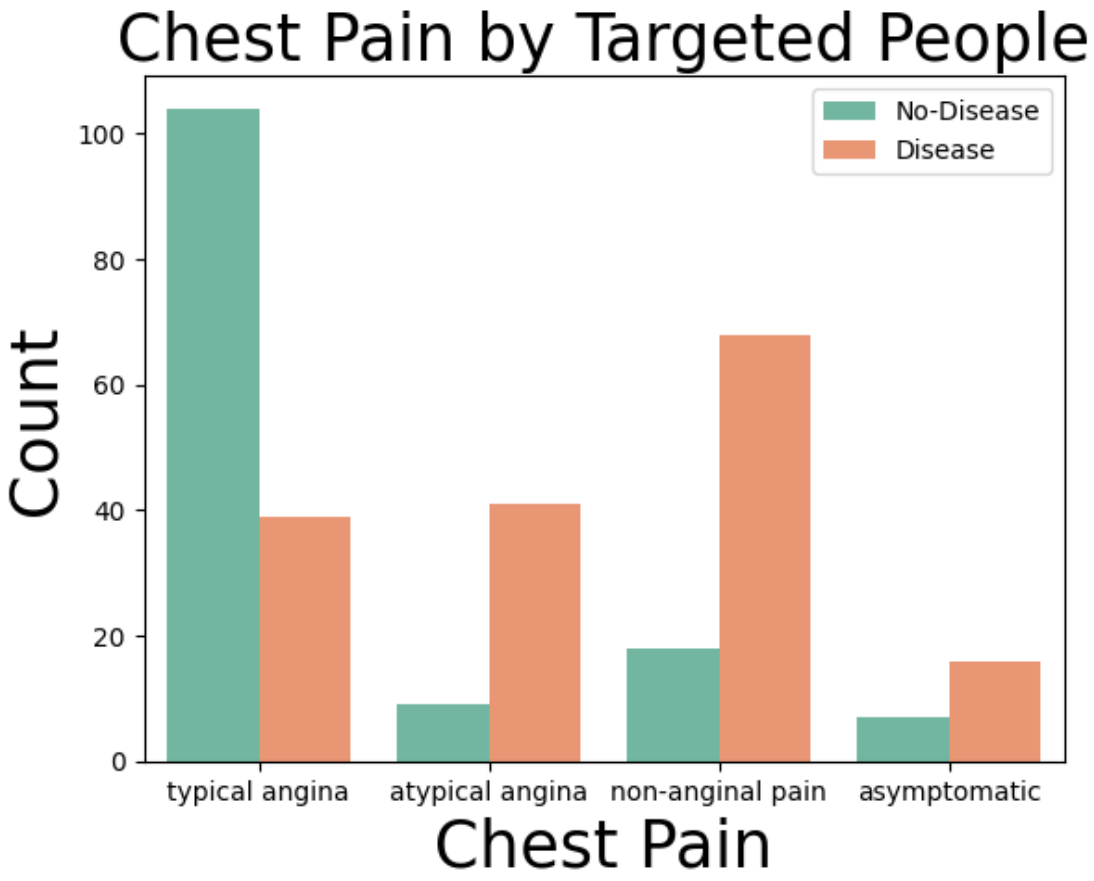
[41]:
```
heart_disease_df = df[df['target'] == 1]
plt.figure(figsize=(10, 6))
sns.kdeplot(data=heart_disease_df['age'], fill=True)
plt.xlabel('Age', fontsize=12)
plt.ylabel('Density', fontsize=12)
plt.title('Age Distribution of Individuals with Heart Disease', fontsize=14)
plt.show()

# Arround the age of 50 the density is high means that there are more people of␣
 ↪this age group which has heart-disease.
# this graph is kewed to the right means that there are more individuals with␣
 ↪heart disease in the older age groups compared to the younger age groups
```



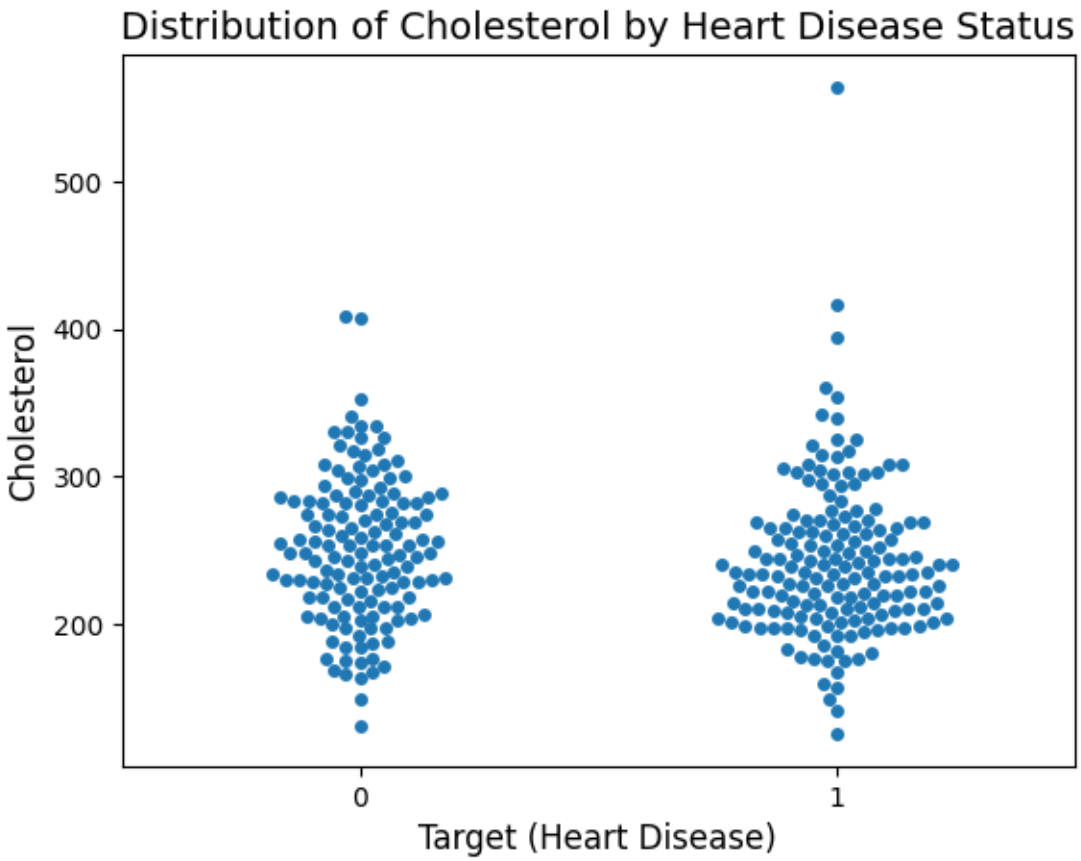
[42]:
```
#Now visualizing the count of heart disease cases by gender
heart_disease_df = df[df['target'] == 1]
sns.countplot(x='sex', data=heart_disease_df)
plt.xlabel('Gender', fontsize=12)
plt.ylabel('Count', fontsize=12)
plt.title('Count of Heart Disease Cases by Gender', fontsize=14)
plt.xticks(ticks=[0, 1], labels=['Female', 'Male'])
plt.show()
```



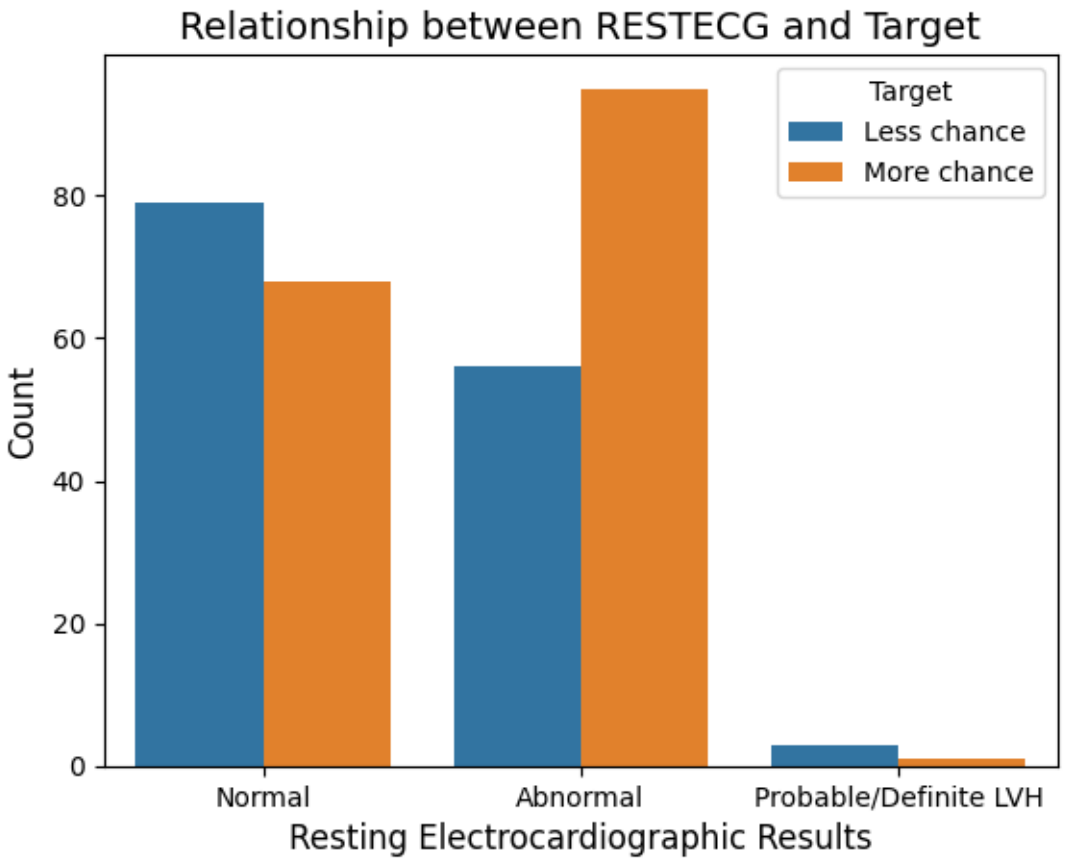
[43]:
```
sns.countplot(data=df,x='cp',hue='target',palette='Set2')
plt.legend(labels=['No-Disease', 'Disease'])
plt.xticks(([0,1,2,3]),['typical angina','atypical angina', 'non-anginal␣
 ↪pain','asymptomatic'])
plt.xlabel('Chest Pain',fontsize=25)
plt.ylabel('Count',fontsize=25)
plt.title('Chest Pain by Targeted People',fontsize=25)
plt.show()
```



[44]:
```
# cholestrol level for indivisuals with and without heart-disease
sns.swarmplot(x='target', y='chol', data=df)
plt.xlabel('Target (Heart Disease)', fontsize=12)
plt.ylabel('Cholesterol', fontsize=12)
plt.title('Distribution of Cholesterol by Heart Disease Status', fontsize=14)
plt.show()

# for indivisuals without heart disease, the cholesterol levels from a␣
 ↪distribution wiith a slightly lower central tendency
# for those who have heart disease the cholestrol level is high
```

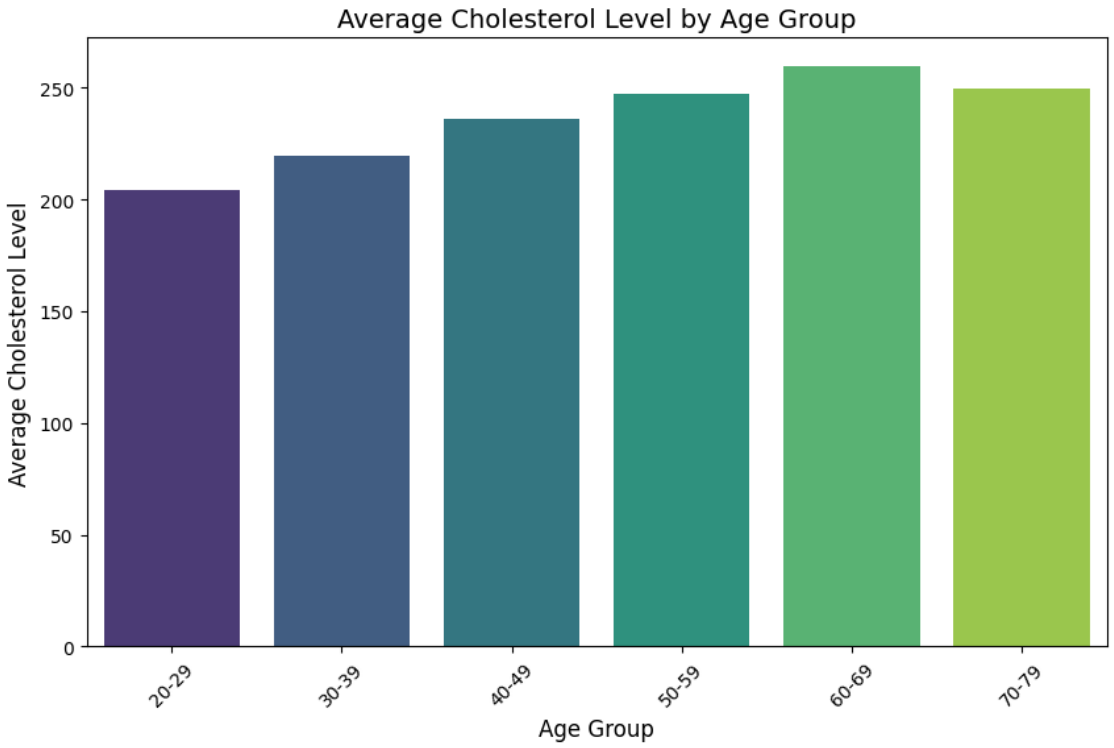


[45]:
```
sns.countplot(x='restecg', hue='target', data=df)
plt.xlabel('Resting Electrocardiographic Results', fontsize=12)
plt.ylabel('Count', fontsize=12)
plt.title('Relationship between RESTECG and Target', fontsize=14)
plt.legend(title='Target', labels=['Less chance', 'More chance'])
plt.xticks(ticks=[0, 1, 2], labels=['Normal', 'Abnormal', 'Probable/Definite␣
↪LVH'])
plt.show()
```



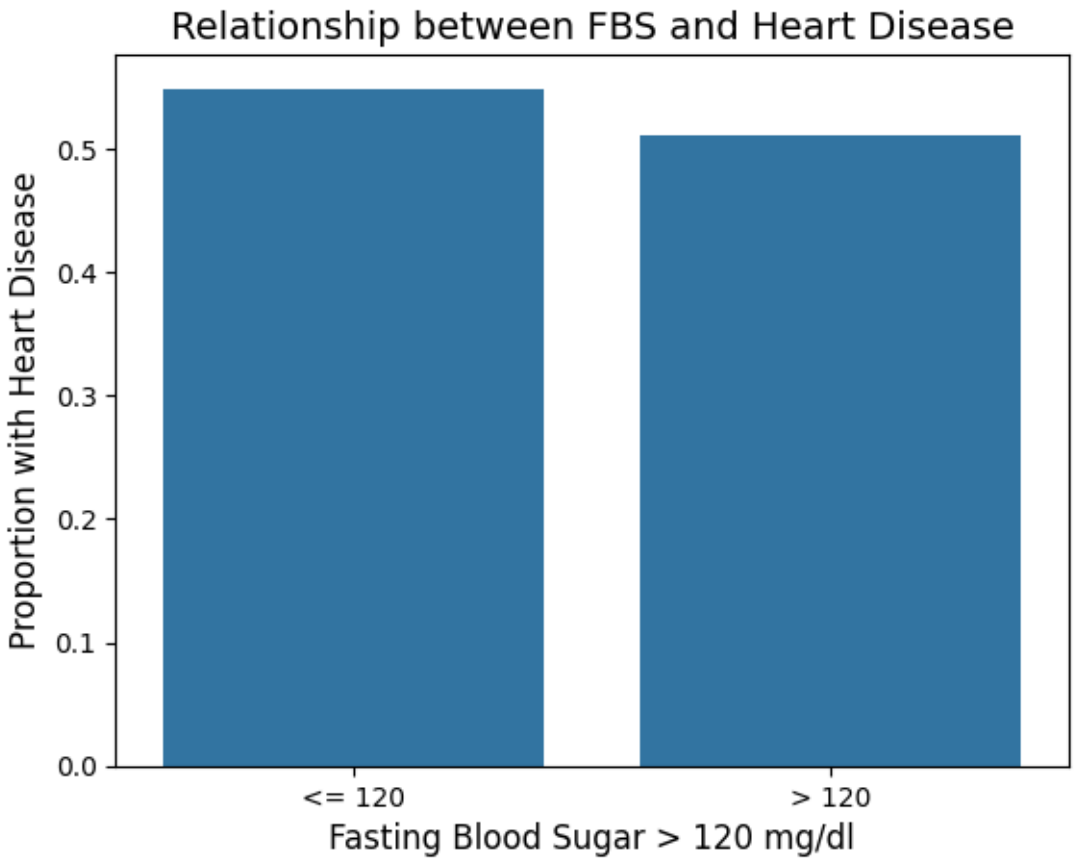
[46]:
```
age_bins = np.arange(20, 90, 10)
age_labels = [f'{i}-{i+9}' for i in range(20, 80, 10)]
df['age_group'] = pd.cut(df['age'], bins=age_bins, labels=age_labels,␣
 ↪right=False)
avg_chol_by_age = df.groupby('age_group')['chol'].mean().reset_index()
plt.figure(figsize=(10, 6))
sns.barplot(x='age_group', y='chol', data=avg_chol_by_age, palette='viridis')
plt.xlabel('Age Group', fontsize=12)
plt.ylabel('Average Cholesterol Level', fontsize=12)
plt.title('Average Cholesterol Level by Age Group', fontsize=14)
plt.xticks(rotation=45)
plt.show()
```

```
<ipython-input-46-ba5f8362b6ff>:6: FutureWarning:

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

  sns.barplot(x='age_group', y='chol', data=avg_chol_by_age, palette='viridis')
```

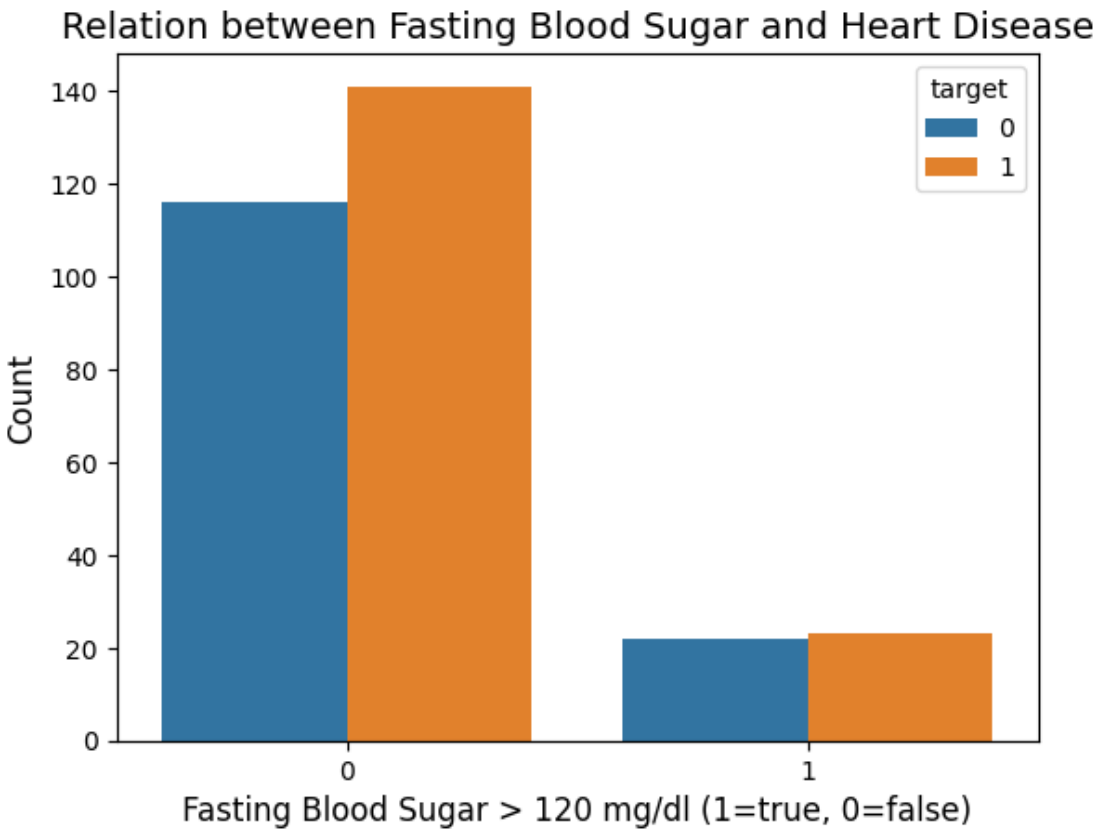


[47]:
```
sns.barplot(x='fbs', y='target', data=df, ci=None, estimator=lambda x: sum(x) /␣
↪len(x))
plt.xlabel('Fasting Blood Sugar > 120 mg/dl', fontsize=12)
plt.ylabel('Proportion with Heart Disease', fontsize=12)
plt.title('Relationship between FBS and Heart Disease', fontsize=14)
plt.xticks(ticks=[0, 1], labels=['<= 120', '> 120'])
plt.show()
```

```
<ipython-input-47-1e090fc21d01>:1: FutureWarning:

The `ci` parameter is deprecated. Use `errorbar=None` for the same effect.

  sns.barplot(x='fbs', y='target', data=df, ci=None, estimator=lambda x: sum(x)
/ len(x))
```



[48]:
```
sns.countplot(x='fbs', hue='target', data=df)
plt.xlabel('Fasting Blood Sugar > 120 mg/dl (1=true, 0=false)', fontsize=12)
plt.ylabel('Count', fontsize=12)
plt.title('Relation between Fasting Blood Sugar and Heart Disease', fontsize=14)
plt.show()
```


Relation between Fasting Blood Sugar and Heart Disease
target
0
1
Count
140
120
100
80
60
40
20
0
0
1
Fasting Blood Sugar > 120 mg/dl (1=true, 0=false)