Week 2 – Data Cleaning, Preprocessing & Exploratory Data Analysis (EDA)

In this week, we prepare the dataset for modeling by performing cleaning, feature engineering, preprocessing, and deeper exploratory data analysis.

Student Information

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Objectives

By the end of this notebook, you will:

- Clean incorrect or unrealistic values
- Convert age from days → years
- Engineer new features (BMI)
- Scale numerical features
- Explore data relationships using visualizations
- Save cleaned dataset for Week 3 modeling

1. Import Libraries

In [2]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

sns.set(style="whitegrid")
```

2. Load Raw Dataset

In [3]:
```
df = pd.read_csv("../data/raw/cardio_train.csv", sep=';')
df.head()
```

Out[3]:

	id	age	gender	height	weight	ap_hi	ap_lo	cholesterol	gluc	smoke	alco	active
0	0	18393	2	168	62.0	110	80	1	1	0	0	1
1	1	20228	1	156	85.0	140	90	3	1	0	0	1
2	2	18857	1	165	64.0	130	70	3	1	0	0	0
3	3	17623	2	169	82.0	150	100	1	1	0	0	1
4	4	17474	1	156	56.0	100	60	1	1	0	0	0

3. Convert Age from Days to Years

Convert Age (days → years)

Age is stored in days; convert it into more understandable units.

In [5]:
```
# Never modify raw data directly. Always keep original columns intact.
df['age_years'] = (df['age'] / 365).astype(int)
df[['age', 'age_years']].head()
```

Out[5]:

	age	age_years
0	18393	50
1	20228	55
2	18857	51
3	17623	48
4	17474	47

4. Correct BP Values

Fix unrealistic blood pressure values

Some records in `ap_hi` (systolic BP) and `ap_lo` (diastolic BP) contain invalid or reversed values.

Rules:

- `ap_hi` ≥ `ap_lo`
- Remove extreme values

In [6]:
```
# Remove reversed BP values
df = df[df['ap_hi'] >= df['ap_lo']]
```

```
# Remove unrealistic BP values
df = df[(df['ap_hi'] > 50) & (df['ap_hi'] < 250)]
df = df[(df['ap_lo'] > 30) & (df['ap_lo'] < 200)]
```

5. Clean Height/Weight

In [7]:
```
df = df[(df['height'] > 120) & (df['height'] < 220)]
df = df[(df['weight'] > 30) & (df['weight'] < 200)]
```

6. Feature Engineering

Body Mass Index (BMI)

A useful indicator for heart disease.

In [8]:
```
df['bmi'] = df['weight'] / ((df['height'] / 100) ** 2)
df[['weight', 'height', 'bmi']].head()
```

Out[8]:

	weight	height	bmi
0	62.0	168	21.967120
1	85.0	156	34.927679
2	64.0	165	23.507805
3	82.0	169	28.710479
4	56.0	156	23.011177

7. Preprocessing (Scaling Numeric Values)

Machine learning models work better when numeric features are scaled.

We scale:

- age_years
- height
- weight
- ap_hi
- ap_lo
- bmi

In [18]:
```
from sklearn.preprocessing import StandardScaler

num_cols = ['age_years', 'height', 'weight', 'ap_hi', 'ap_lo', 'bmi']
```

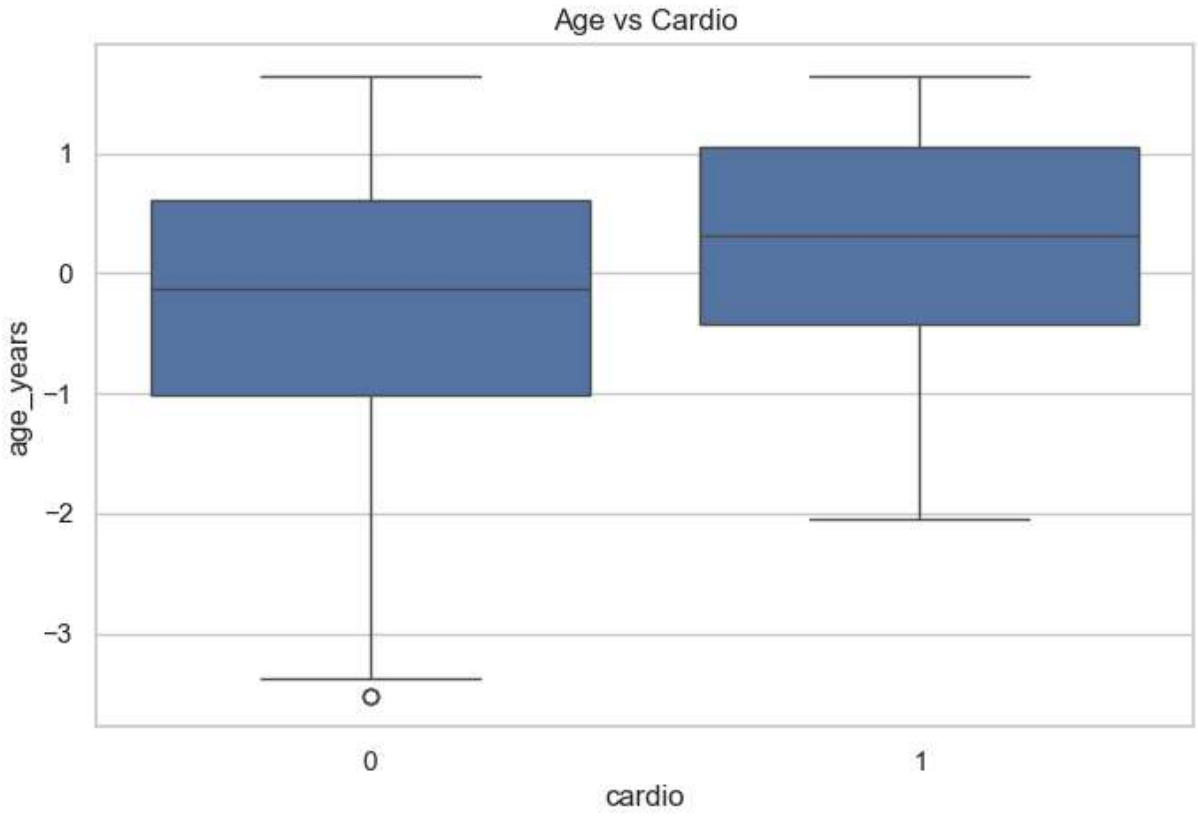
```
scaler = StandardScaler()
df[num_cols] = scaler.fit_transform(df[num_cols])
```

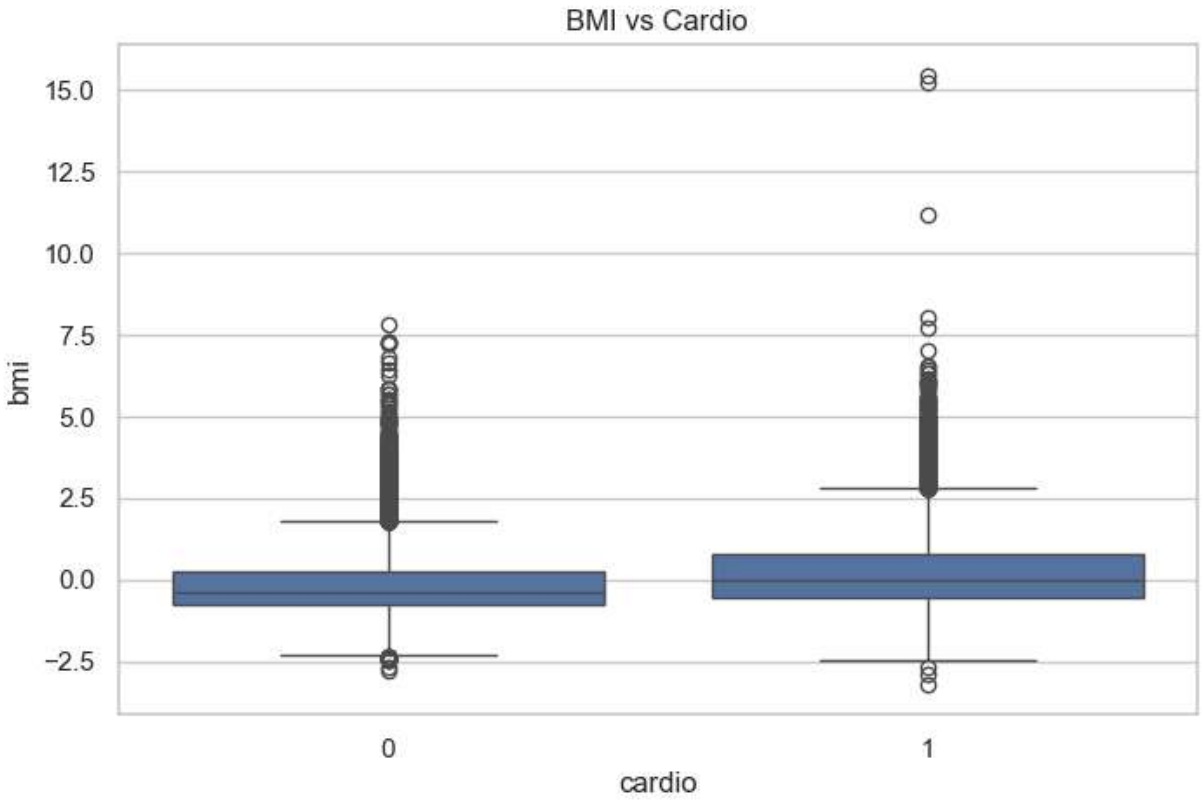
8. Exploratory Data Analysis (EDA)

Explore relationships between features and the target (`cardio`).

Distribution of Age and BMI by Target

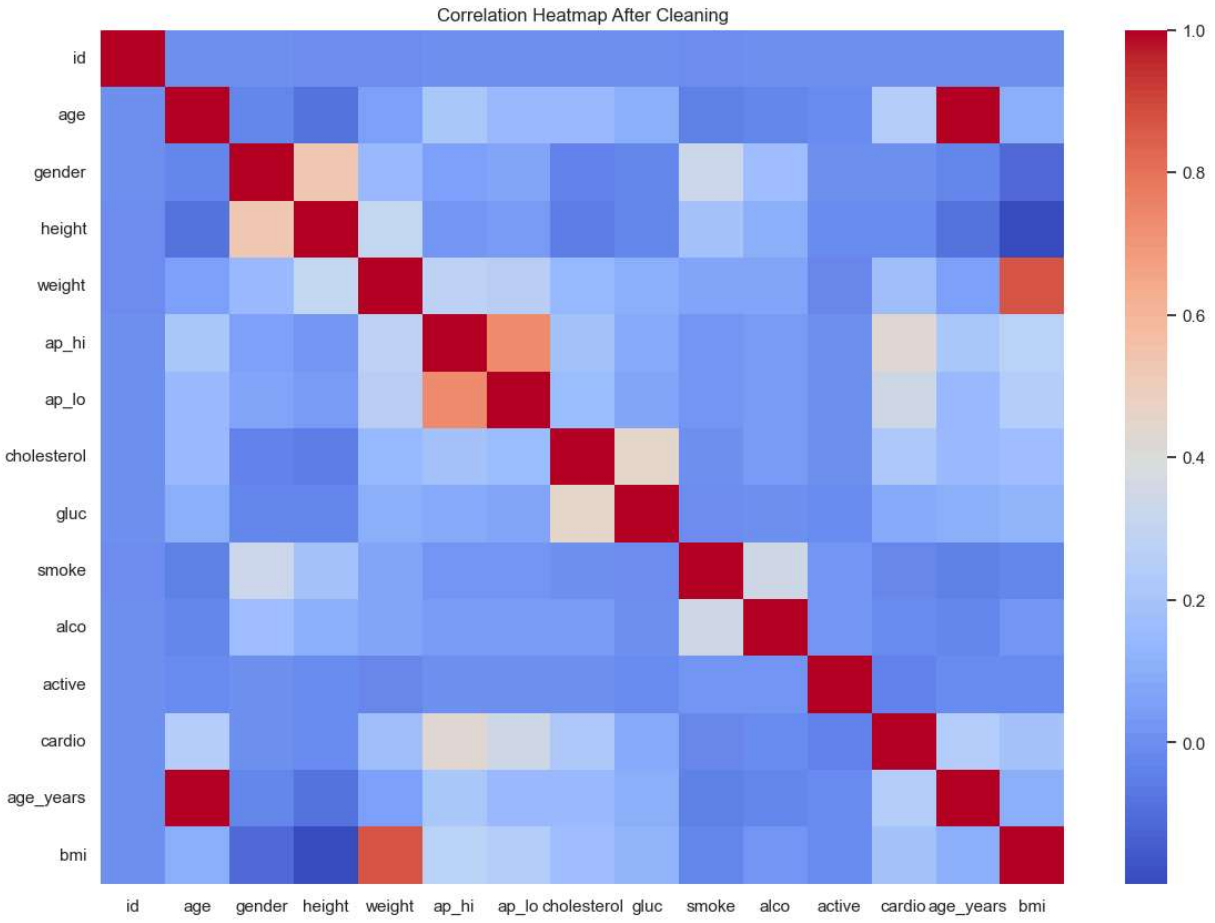
In [10]:
```
plt.figure(figsize=(8,5))
sns.boxplot(x='cardio', y='age_years', data=df)
plt.title("Age vs Cardio")
plt.show()

plt.figure(figsize=(8,5))
sns.boxplot(x='cardio', y='bmi', data=df)
plt.title("BMI vs Cardio")
plt.show()
```





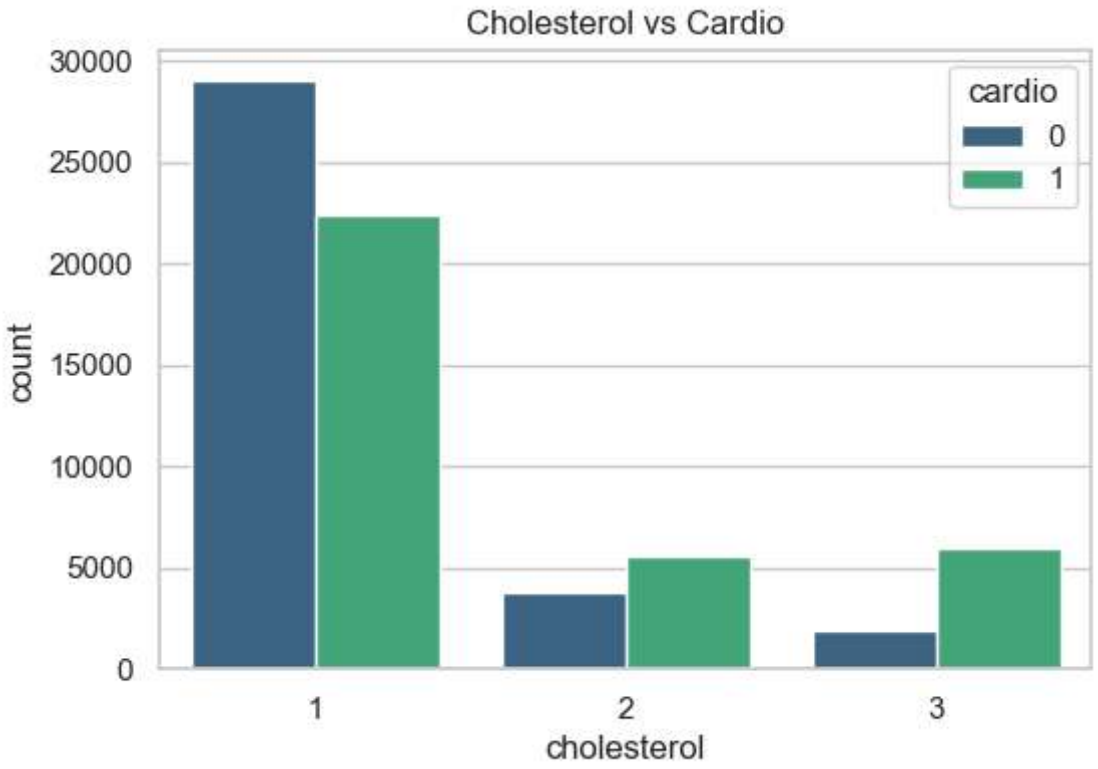
9. Correlation Heatmap

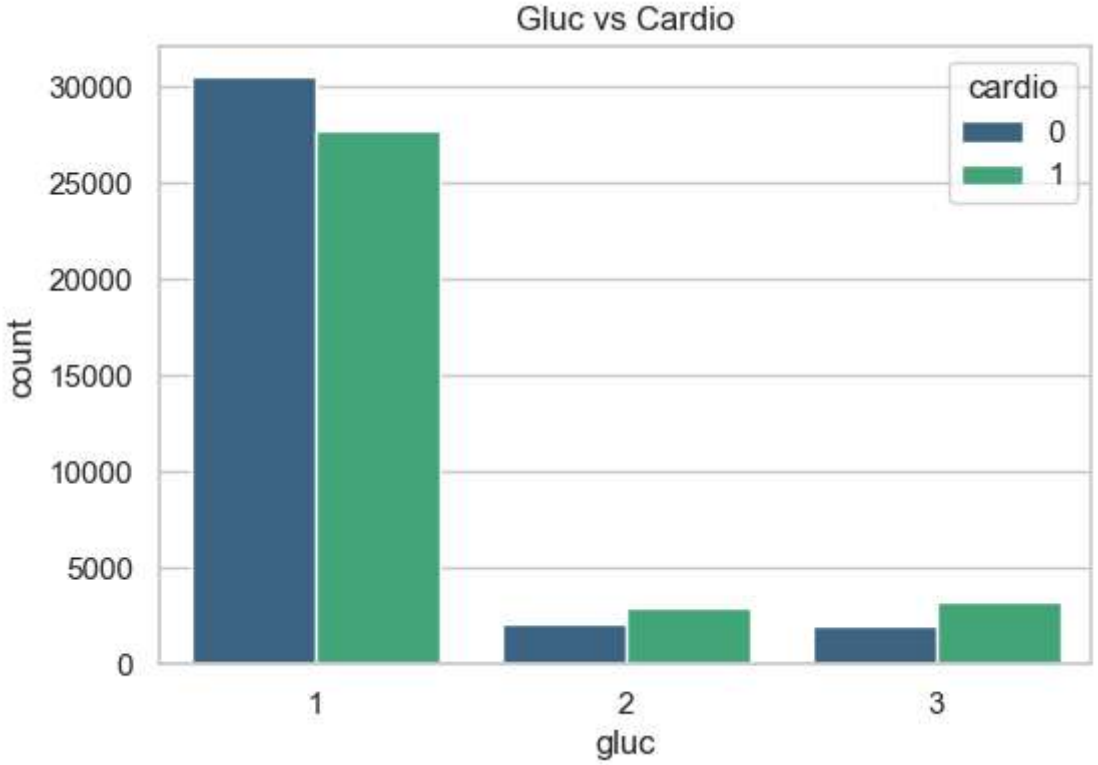
In [11]:
```
plt.figure(figsize=(14,10))
sns.heatmap(df.corr(), cmap='coolwarm', annot=False)
plt.title("Correlation Heatmap After Cleaning")
plt.show()
```

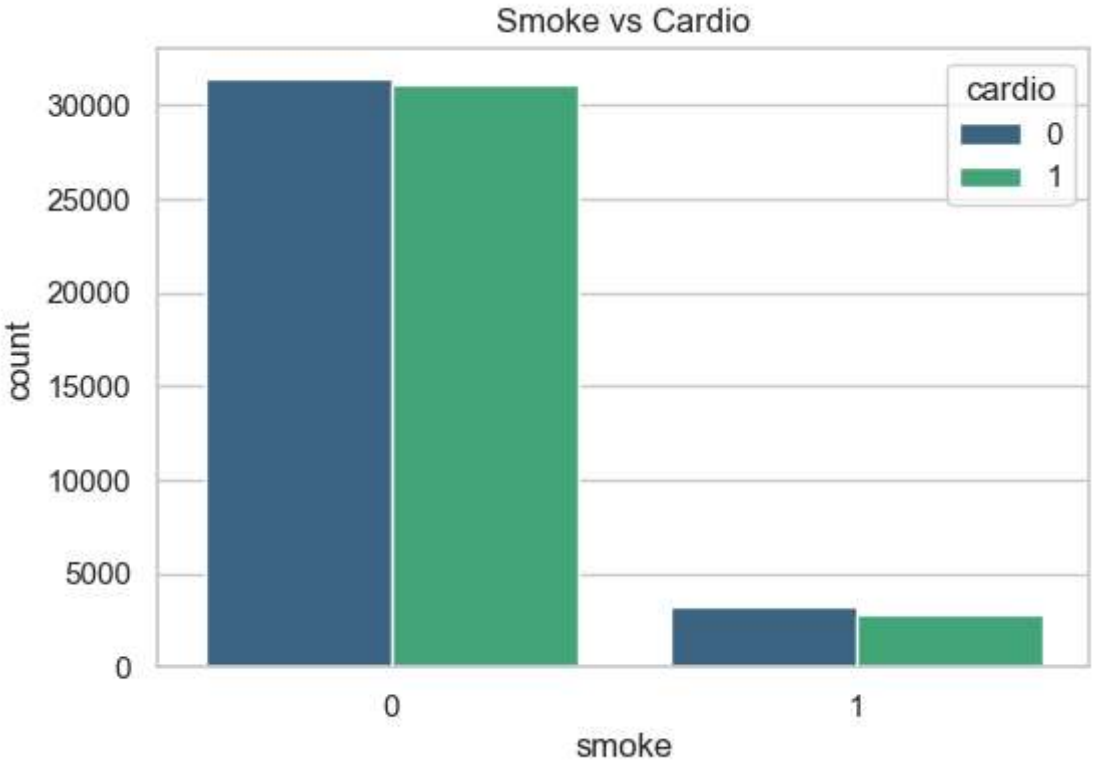


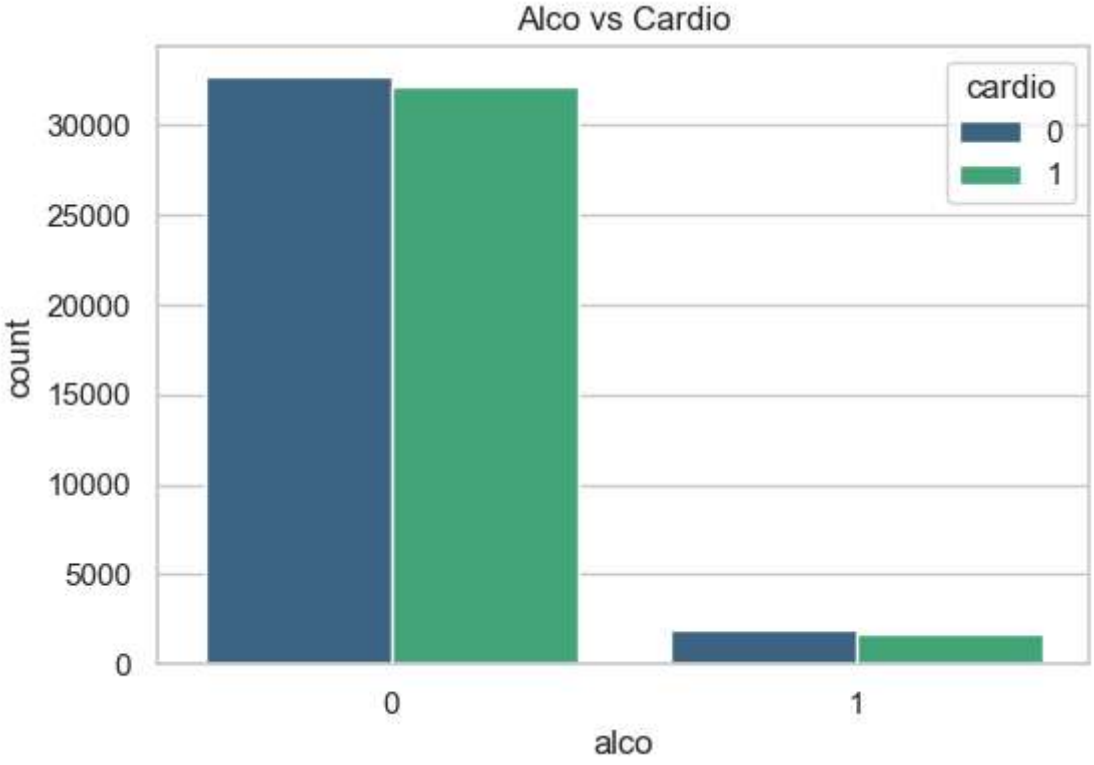
10. Countplots for Categorical Variables

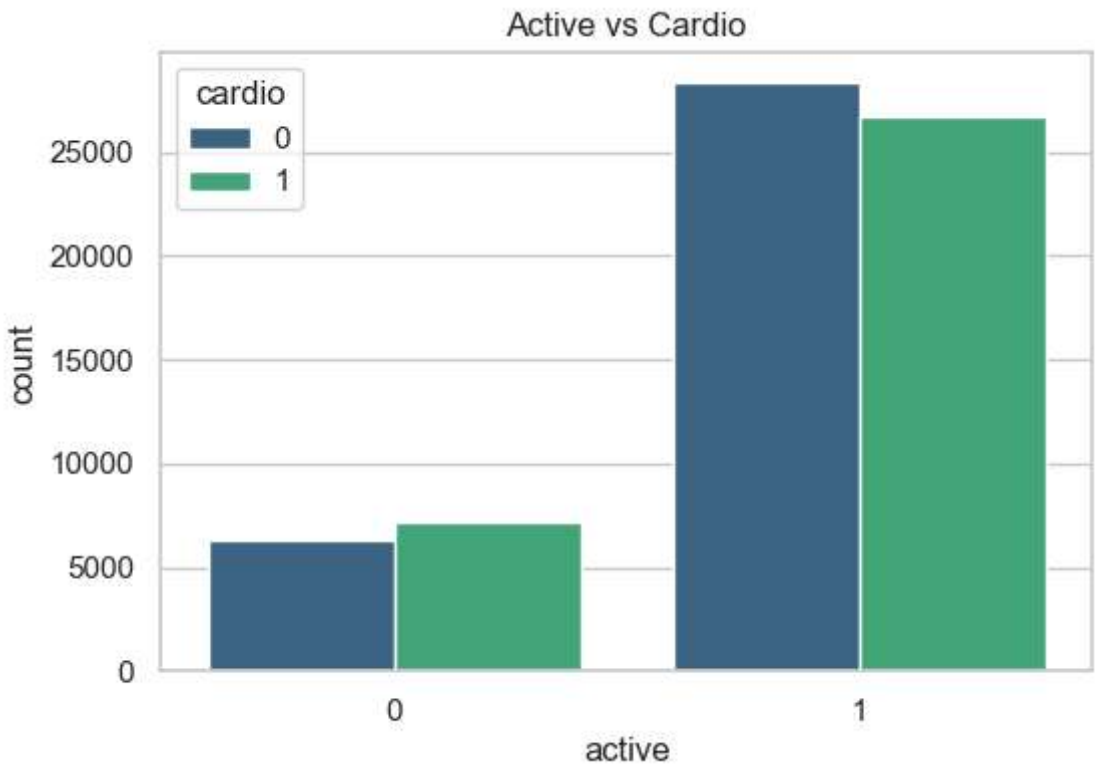
In [19]:
```
cat_cols = ['cholesterol', 'gluc', 'smoke', 'alco', 'active']

for col in cat_cols:
    plt.figure(figsize=(6,4))
    sns.countplot(data=df, x=col, hue='cardio', palette='viridis')
    plt.title(f"{col.capitalize()} vs Cardio")
    plt.show()
```


Cholesterol vs Cardio
cardio
0
1
count
30000
25000
20000
15000
10000
5000
0
1
2
3
cholesterol


Gluc vs Cardio
cardio
0
1
count
30000
25000
20000
15000
10000
5000
0
1
2
3
gluc


Smoke vs Cardio
cardio
0
1
30000
25000
20000
15000
10000
5000
0
count
0
1
smoke


Alco vs Cardio
cardio
0
1
30000
25000
20000
15000
10000
5000
0
count
0
1
alco



11. Dataset Shape After Cleaning

In [15]:
```
df.shape
```

Out[15]: (68581, 15)

12. Save Cleaned Dataset

In [16]:
```
import os

os.makedirs("../data/processed", exist_ok=True)
df.to_csv("../data/processed/clean_cardio.csv", index=False)

print("Cleaned dataset saved successfully!")
```

```
Cleaned dataset saved successfully!
```

Week 2 Completed Successfully

- ✔ Cleaned incorrect and unrealistic values
- ✔ Converted age → years
- ✔ Created BMI feature

- ✔ Scaled numerical columns
- ✔ Explored data using EDA plots
- ✔ Saved cleaned dataset for Week 3

In [ ]: