```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from scipy.stats import chi2_contingency, ttest_ind
```

LOADING DATA

```
df = pd.read_csv("synthetic_asthma_dataset.csv")
```

```
print(df.shape)
print(df.columns)
print(df.info())
print(df.describe(include='all'))
```

```
(10000, 17)
Index(['Patient_ID', 'Age', 'Gender', 'BMI', 'Smoking_Status',
       'Family_History', 'Allergies', 'Air_Pollution_Level',
       'Physical_Activity_Level', 'Occupation_Type', 'Comorbidities',
       'Medication_Adherence', 'Number_of_ER_Visits', 'Peak_Expiratory_Flow',
       'FeNO_Level', 'Has_Asthma', 'Asthma_Control_Level'],
      dtype='object')
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 17 columns):
 #   Column                   Non-Null Count  Dtype
---  ------                   --------------  -----
 0   Patient_ID               10000 non-null  object
 1   Age                      10000 non-null  int64
 2   Gender                   10000 non-null  object
 3   BMI                      10000 non-null  float64
 4   Smoking_Status           10000 non-null  object
 5   Family_History           10000 non-null  int64
 6   Allergies                7064 non-null   object
 7   Air_Pollution_Level      10000 non-null  object
 8   Physical_Activity_Level  10000 non-null  object
 9   Occupation_Type          10000 non-null  object
 10  Comorbidities            5033 non-null   object
 11  Medication_Adherence     10000 non-null  float64
 12  Number_of_ER_Visits      10000 non-null  int64
 13  Peak_Expiratory_Flow     10000 non-null  float64
 14  FeNO_Level               10000 non-null  float64
 15  Has_Asthma               10000 non-null  int64
 16  Asthma_Control_Level     2433 non-null   object
dtypes: float64(4), int64(4), object(9)
memory usage: 1.3+ MB
None
        Patient_ID           Age  Gender           BMI Smoking_Status  \
count        10000  10000.000000   10000  10000.000000          10000
unique       10000           NaN       3           NaN              3
top     ASTH109983           NaN  Female           NaN          Never
freq             1           NaN    4814           NaN           6070
mean           NaN     44.930700     NaN     25.053320            NaN
std            NaN     25.653559     NaN      4.874466            NaN
min            NaN      1.000000     NaN     15.000000            NaN
25%            NaN     23.000000     NaN     21.600000            NaN
50%            NaN     45.000000     NaN     25.000000            NaN
75%            NaN     67.000000     NaN     28.400000            NaN
max            NaN     89.000000     NaN     45.000000            NaN

        Family_History Allergies Air_Pollution_Level Physical_Activity_Level  \
count     10000.000000      7064               10000                    10000
unique             NaN         4                   3                        3
top                NaN      Dust            Moderate               Sedentary
freq               NaN      2479                4915                     4062
mean          0.303400       NaN                 NaN                      NaN
std           0.459749       NaN                 NaN                      NaN
min           0.000000       NaN                 NaN                      NaN
25%           0.000000       NaN                 NaN                      NaN
50%           0.000000       NaN                 NaN                      NaN
75%           1.000000       NaN                 NaN                      NaN
max           1.000000       NaN                 NaN                      NaN
```

```
df.head()
```

oking_Status	Family_History	Allergies	Air_Pollution_Level	Physical_Activity_Level	Occupatio
Former	1	NaN	Moderate	Sedentary	(
Former	0	Dust	Low	Moderate	
Never	0	Dust	Moderate	Moderate	
Never	0	Multiple	High	Sedentary	(
Never	0	Multiple	Moderate	Active	

Next steps: Generate code with df | View recommended plots | New interactive sheet

** DATA CLEANING**

```
print(df.isnull().sum())
```

```
Patient_ID                   0
Age                          0
Gender                       0
BMI                          0
Smoking_Status               0
Family_History               0
Allergies                 2936
Air_Pollution_Level          0
Physical_Activity_Level      0
Occupation_Type              0
Comorbidities             4967
Medication_Adherence         0
Number_of_ER_Visits          0
Peak_Expiratory_Flow         0
FeNO_Level                   0
Has_Asthma                   0
Asthma_Control_Level      7567
dtype: int64
```

```
df.fillna(method='ffill', inplace=True)
```

```
/tmp/ipython-input-3970806690.py:1: FutureWarning: DataFrame.fillna with 'method' is deprecated and will raise in a future version.
  df.fillna(method='ffill', inplace=True)
```

```
df.drop_duplicates(inplace=True)
```

```
df.head()
```

oking_Status	Family_History	Allergies	Air_Pollution_Level	Physical_Activity_Level	Occupatio
Former	1	NaN	Moderate	Sedentary	(
Former	0	Dust	Low	Moderate	
Never	0	Dust	Moderate	Moderate	
Never	0	Multiple	High	Sedentary	(
Never	0	Multiple	Moderate	Active	

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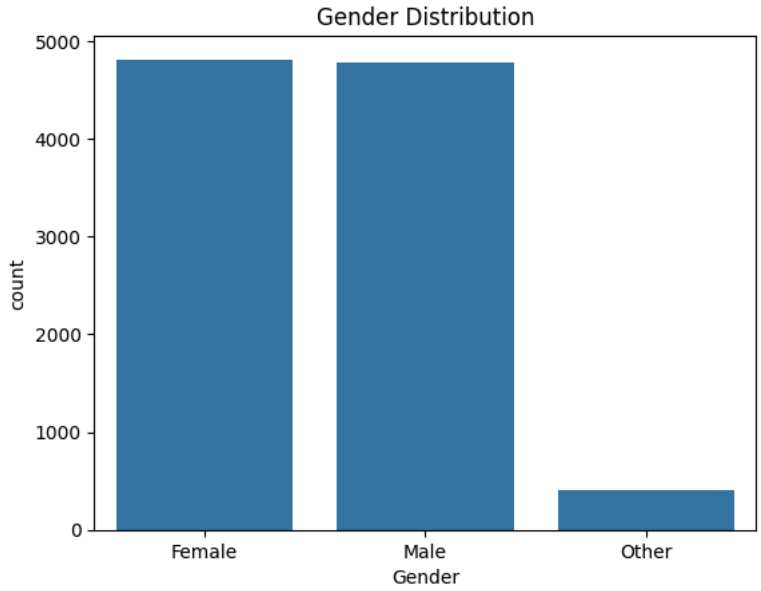
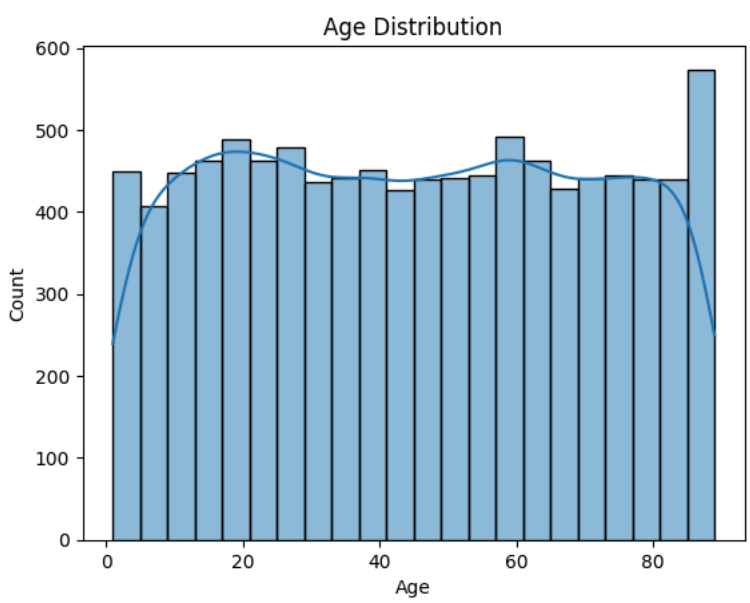
EXPLORATORY DATA ANALYSIS (EDA)

** UNIVARIATE ANALYSIS**

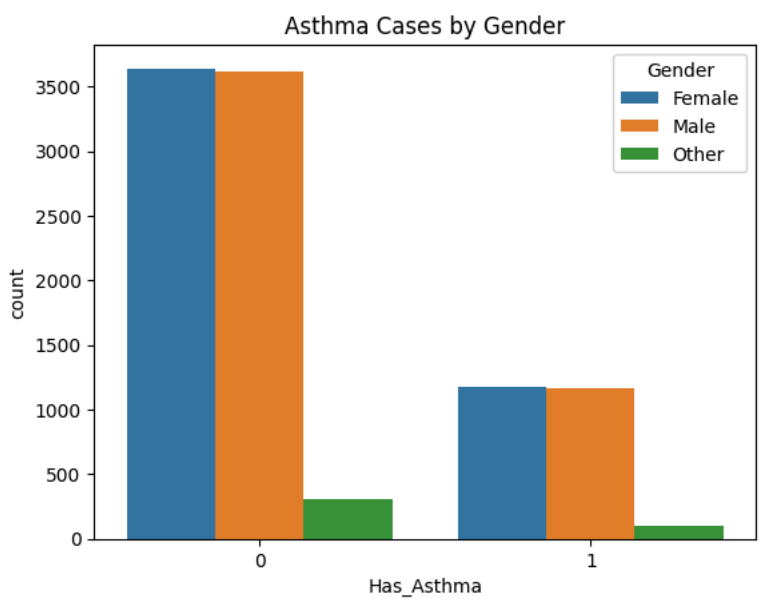
```
# 1. Distribution of gender
sns.countplot(data=df, x='Gender')
plt.title("Gender Distribution")
plt.show()
```



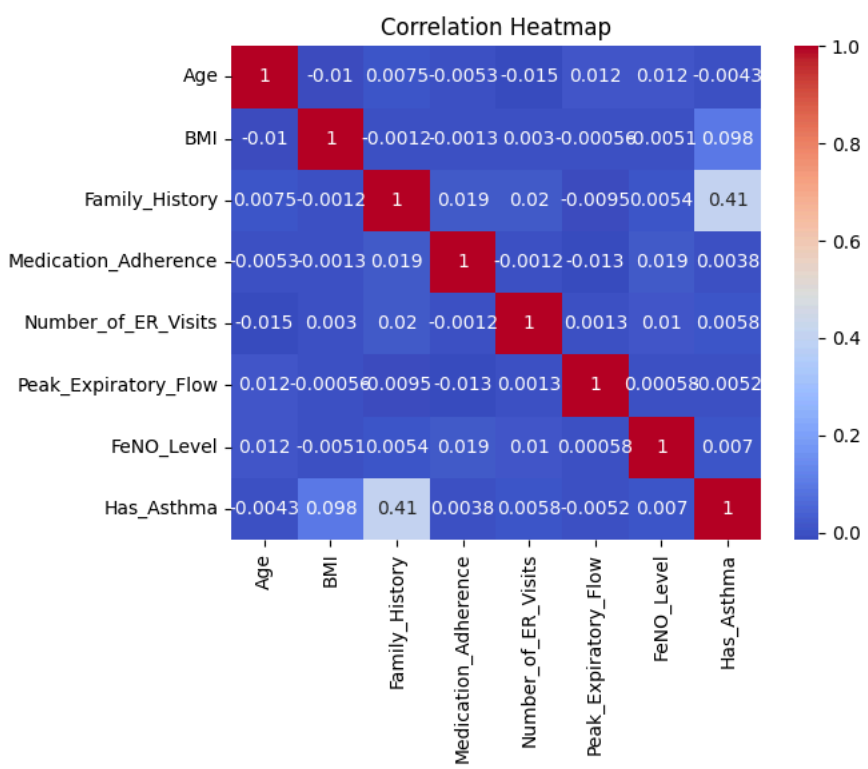

```
# Age distribution
sns.histplot(data=df, x='Age', kde=True)
plt.title("Age Distribution")
plt.show()
```



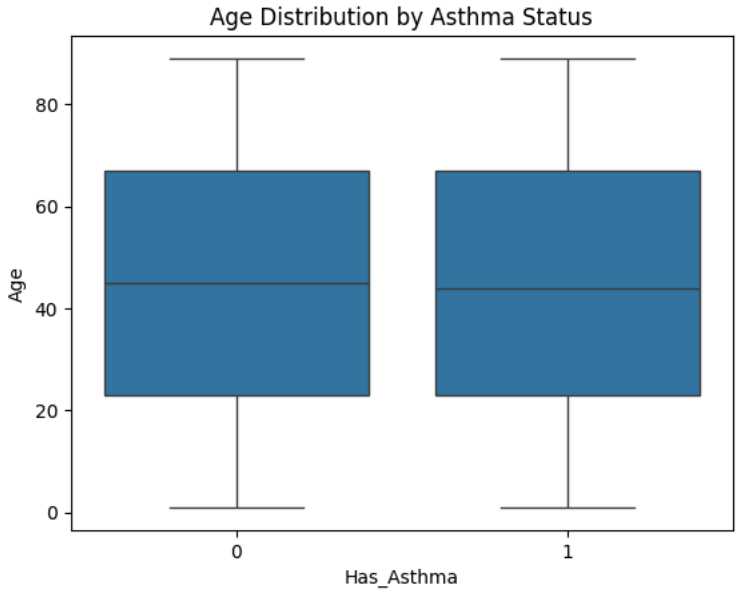

```
#Asthma prevalence by gender
sns.countplot(data=df, x='Has_Asthma', hue='Gender')
plt.title("Asthma Cases by Gender")
plt.show()
```



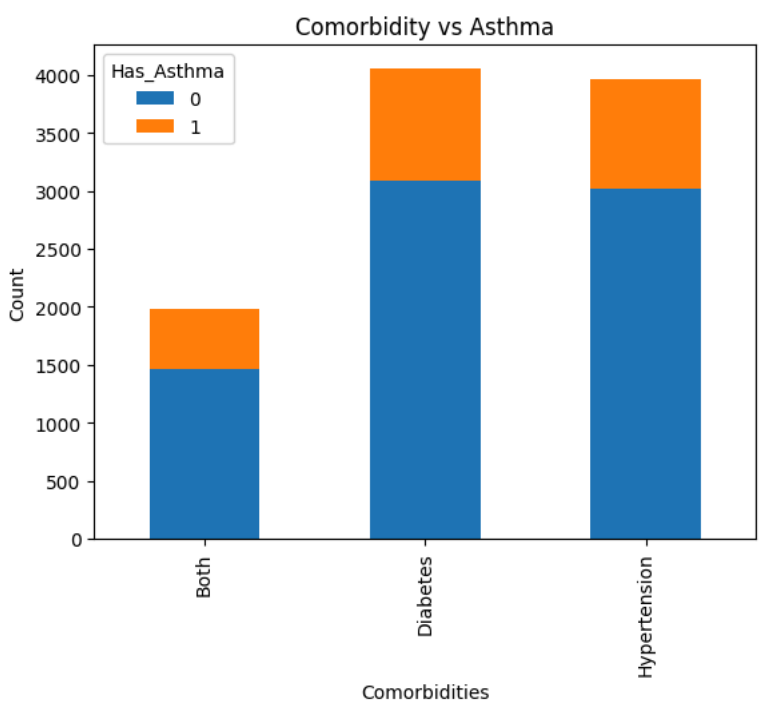

```
#Correlation matrix (for numeric variables)
sns.heatmap(df.corr(numeric_only=True), annot=True, cmap='coolwarm')
plt.title("Correlation Heatmap")
plt.show()
```




```
#Age vs Has Asthma
sns.boxplot(x='Has_Asthma', y='Age', data=df)
plt.title("Age Distribution by Asthma Status")
plt.show()
```




```
#Comorbidity vs Has Asthma
pd.crosstab(df['Comorbidities'], df['Has_Asthma']).plot(kind='bar', stacked=True)
plt.title("Comorbidity vs Asthma")
plt.ylabel("Count")
plt.show()
```



STATISTICAL TESTING

Chi-square test: Gender vs Asthma

```
from scipy.stats import chi2_contingency

contingency = pd.crosstab(df['Gender'], df['Has_Asthma'])
chi2, p, dof, expected = chi2_contingency(contingency)

print("Chi-square Test")
print("Chi2 Stat:", chi2)
print("p-value:", p)
if p < 0.05:
    print("Reject H0: Gender and asthma are associated.")
else:
    print("Fail to reject H0: No significant association.")
```

```
Chi-square Test
Chi2 Stat: 0.15592975133514347
```

```
p-value: 0.9249969158721212
Fail to reject H0: No significant association.
```

T-test: Age of asthma vs non-asthma Hypothesis:

```
asthma_age = df[df['Has_Asthma'] == 1]['Age']
non_asthma_age = df[df['Has_Asthma'] == 0]['Age']

t_stat, p_val = ttest_ind(asthma_age, non_asthma_age, equal_var=False)

print("T-test for Age")
print("T-statistic:", t_stat)
print("p-value:", p_val)
if p_val < 0.05:
    print("Reject H0: Age differs between asthma and non-asthma patients.")
else:
    print("Fail to reject H0: No age difference.")
```

```
T-test for Age
T-statistic: -0.43514227581166276
p-value: 0.6634819556405647
Fail to reject H0: No age difference.
```

Start coding or generate with AI.

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