
ALLIANCE
UNIVERSITY

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**Project Report**

**Statistics for Data Science**

**Semester – 2**

# "Youth Smoking And Drugs"

**By**

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## Project Overview

In this project, we looked into the serious issue of youth smoking and drug use. We used a dataset from SAMHSA (the Substance Abuse and Mental Health Services Administration), which gave us information about teenagers—things like their age, gender, and whether they used substances like cigarettes, alcohol, or drugs. The goal was to dig into this data to find patterns and better understand what might influence young people to start using these substances.

## Challenges

Working with real-world data always brings some hurdles. First, we had to clean up the dataset—some parts were missing, and others needed to be reformatted. We also noticed that some types of drug use were much less common in the dataset, which made it harder to build accurate models. On top of that, figuring out which features were actually meaningful and translating technical findings into real-world insights wasn't always easy.

## Introduction

Teen substance use is something that affects not just individuals, but families, schools, and communities. It's often linked with long-term health problems, both mental and physical. That's why understanding the "why" behind these behaviors is so important. By using data and some basic machine learning tools, this project set out to uncover the key factors behind youth smoking and drug use.

## Project Goals

We set out to do a few key things with this project:

- Clean up and organize the data so we could actually work with it.
- Use charts and graphs to spot trends—like whether substance use increases with age, or differs by gender.
- Try out some predictive models to see what factors might help us tell if someone is likely to use drugs or smoke.
- And most importantly, pull out insights that could help inform school programs, awareness campaigns, or health policies aimed at prevention

## Conclusion

In the end, we learned a lot. Age, peer pressure, and gender all seemed to play a role in whether someone might start using substances. The models we used, like logistic regression and decision trees, helped highlight these patterns. Overall, this project showed how data can shine a light on social issues and hopefully be used to build smarter, more effective ways to protect young people from the dangers of drug and tobacco use.

```python
#data set of youth smoking and drug
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
df=pd.read_csv(r"C:\Users\abung\Downloads\Youth smoking SDS.csv")
df
```

```
      Year Age_Group  Gender  Smoking_Prevalence  Drug_Experimentation  \
0     2024     15-19    Both               18.85                 32.40
1     2024    Oct-14  Female               34.88                 41.57
2     2023    Oct-14    Both               42.00                 56.80
3     2024     40-49    Both               33.75                 42.90
4     2023     15-19    Male               47.90                 39.62
...    ...       ...     ...                 ...                   ...
9995  2023     15-19    Male               49.17                 10.21
9996  2020       80+  Female               48.00                 30.85
9997  2021     25-29    Both               47.62                 39.54
9998  2022     40-49    Male                9.37                 11.64
9999  2023    Oct-14    Male               43.77                 21.95

     Socioeconomic_Status  Peer_Influence School_Programs  Family_Background
\
0                    High               5             Yes                  1
1                    High               6             Yes                 10
2                    High               6             Yes                  2
3                  Middle              10              No                  9
4                    High               1              No                  2
...                   ...             ...             ...                ...
9995                  Low               7             Yes                  4
9996               Middle               8             Yes                  8
9997                 High               1              No                  7
9998                  Low               7              No                 10
9999                 High               4             Yes                  3

      Mental_Health Access_to_Counseling  Parental_Supervision  \
0                 5                   No                     4
1                 5                   No                     9
2                 7                  Yes                     2
3                 7                  Yes                     2
4                 4                  Yes                     4
...             ...                  ...                   ...
9995              5                   No                     7
9996              8                   No                     4
9997              2                  Yes                     1
9998              1                   No                     2
9999              4                  Yes                     1

     Substance_Education  Community_Support  Media_Influence
0                     No                  3                1
1                    Yes                  9                3
```

```
2                    No                  5                1
3                    No                 10                9
4                    No                 10                3
...                 ...                ...              ...
9995                Yes                  2                9
9996                Yes                  8                9
9997                 No                  5               10
9998                Yes                 10                4
9999                 No                  6                3

[10000 rows x 15 columns]
```

```
df.tail()
```

```
      Year Age_Group  Gender  Smoking_Prevalence  Drug_Experimentation  \
9995  2023     15-19    Male               49.17                 10.21
9996  2020       80+  Female               48.00                 30.85
9997  2021     25-29    Both               47.62                 39.54
9998  2022     40-49    Male                9.37                 11.64
9999  2023    Oct-14    Male               43.77                 21.95

     Socioeconomic_Status  Peer_Influence School_Programs  Family_Background
\
9995                  Low               7             Yes                  4
9996               Middle               8             Yes                  8
9997                 High               1              No                  7
9998                  Low               7              No                 10
9999                 High               4             Yes                  3

      Mental_Health Access_to_Counseling  Parental_Supervision  \
9995              5                   No                     7
9996              8                   No                     4
9997              2                  Yes                     1
9998              1                   No                     2
9999              4                  Yes                     1

     Substance_Education  Community_Support  Media_Influence
9995                 Yes                  2                9
9996                 Yes                  8                9
9997                  No                  5               10
9998                 Yes                 10                4
9999                  No                  6                3
```

```
df.head()
```

```
   Year Age_Group  Gender  Smoking_Prevalence  Drug_Experimentation  \
0  2024     15-19    Both               18.85                 32.40
1  2024    Oct-14  Female               34.88                 41.57
2  2023    Oct-14    Both               42.00                 56.80
3  2024     40-49    Both               33.75                 42.90
```

```
4  2023     15-19    Male               47.90                 39.62

  Socioeconomic_Status  Peer_Influence School_Programs  Family_Background  \
0                 High               5             Yes                  1
1                 High               6             Yes                 10
2                 High               6             Yes                  2
3               Middle              10              No                  9
4                 High               1              No                  2

   Mental_Health Access_to_Counseling  Parental_Supervision  \
0              5                   No                     4
1              5                   No                     9
2              7                  Yes                     2
3              7                  Yes                     2
4              4                  Yes                     4

  Substance_Education  Community_Support  Media_Influence
0                  No                  3                1
1                 Yes                  9                3
2                  No                  5                1
3                  No                 10                9
4                  No                 10                3
```

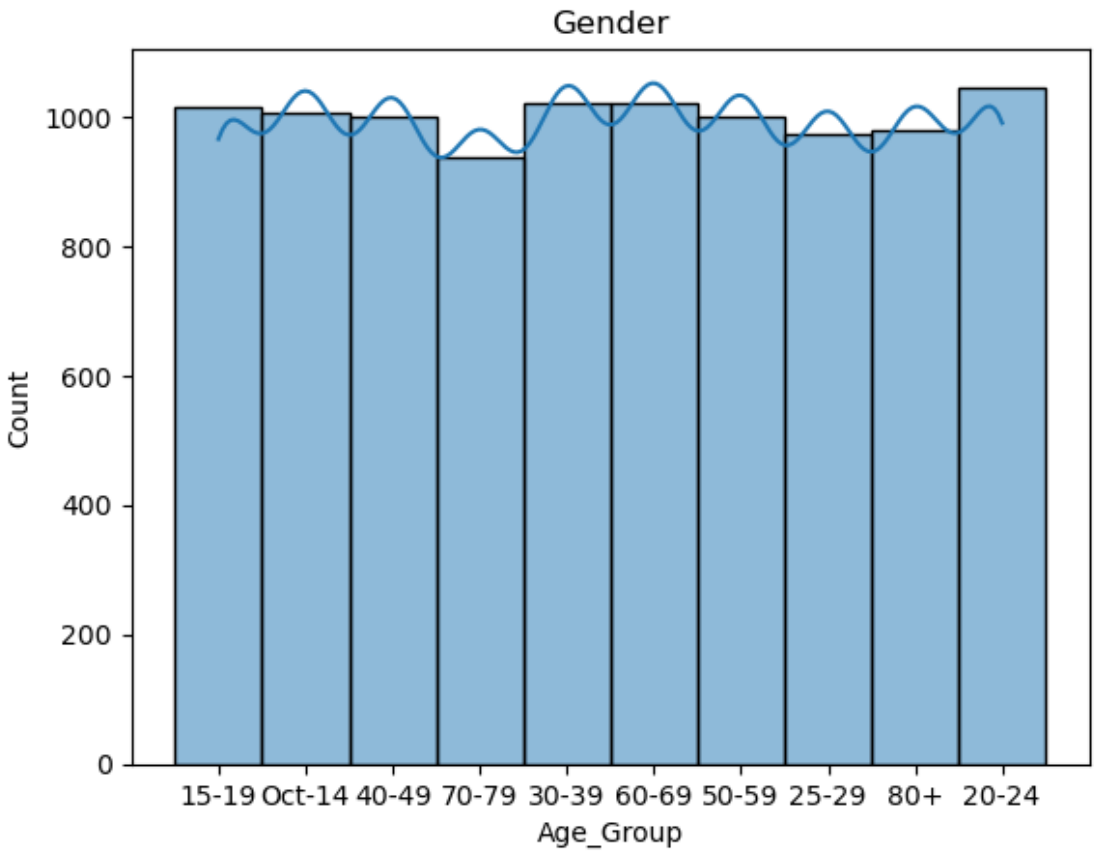
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 15 columns):
 #   Column                Non-Null Count  Dtype
---  ------                --------------  -----
 0   Year                  10000 non-null  int64
 1   Age_Group             10000 non-null  object
 2   Gender                10000 non-null  object
 3   Smoking_Prevalence    10000 non-null  float64
 4   Drug_Experimentation  10000 non-null  float64
 5   Socioeconomic_Status  10000 non-null  object
 6   Peer_Influence        10000 non-null  int64
 7   School_Programs       10000 non-null  object
 8   Family_Background     10000 non-null  int64
 9   Mental_Health         10000 non-null  int64
 10  Access_to_Counseling  10000 non-null  object
 11  Parental_Supervision  10000 non-null  int64
 12  Substance_Education   10000 non-null  object
 13  Community_Support     10000 non-null  int64
 14  Media_Influence       10000 non-null  int64
dtypes: float64(2), int64(7), object(6)
memory usage: 1.1+ MB
```

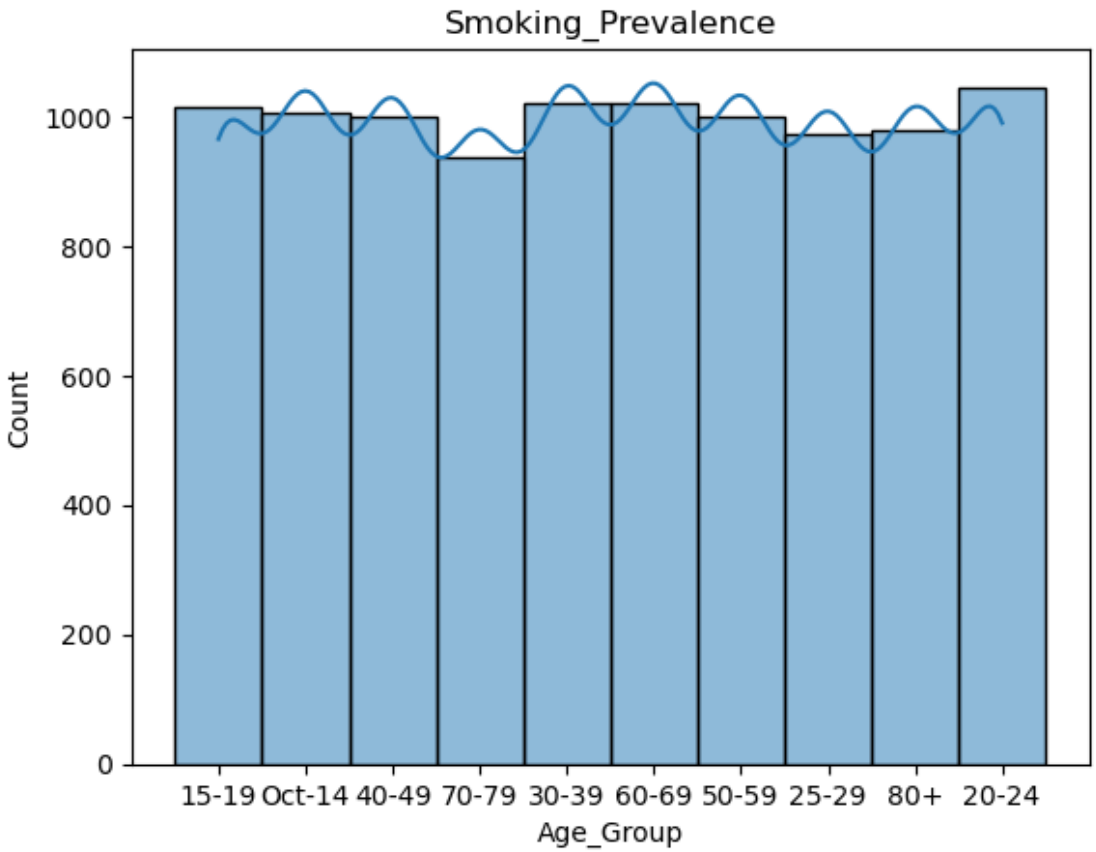
```
df.describe()
```

```
              Year  Smoking_Prevalence  Drug_Experimentation  Peer_Influence
\
count  10000.000000        10000.000000          10000.000000    10000.000000
mean    2022.000500           27.439257             40.150182        5.440100
std        1.425027           12.975528             17.515917        2.863151
min     2020.000000            5.000000             10.000000        1.000000
25%     2021.000000           16.160000             24.920000        3.000000
50%     2022.000000           27.355000             40.100000        5.000000
75%     2023.000000           38.672500             55.462500        8.000000
max     2024.000000           50.000000             69.990000       10.000000

       Family_Background  Mental_Health  Parental_Supervision  \
count       10000.000000   10000.000000          10000.000000
mean            5.513300       5.469800              5.528000
std             2.865038       2.879326              2.891514
min             1.000000       1.000000              1.000000
25%             3.000000       3.000000              3.000000
50%             6.000000       5.000000              6.000000
75%             8.000000       8.000000              8.000000
max            10.000000      10.000000             10.000000

       Community_Support  Media_Influence
count       10000.000000     10000.000000
mean            5.544600         5.506200
std             2.870302         2.872836
min             1.000000         1.000000
25%             3.000000         3.000000
50%             6.000000         6.000000
75%             8.000000         8.000000
max            10.000000        10.000000
```

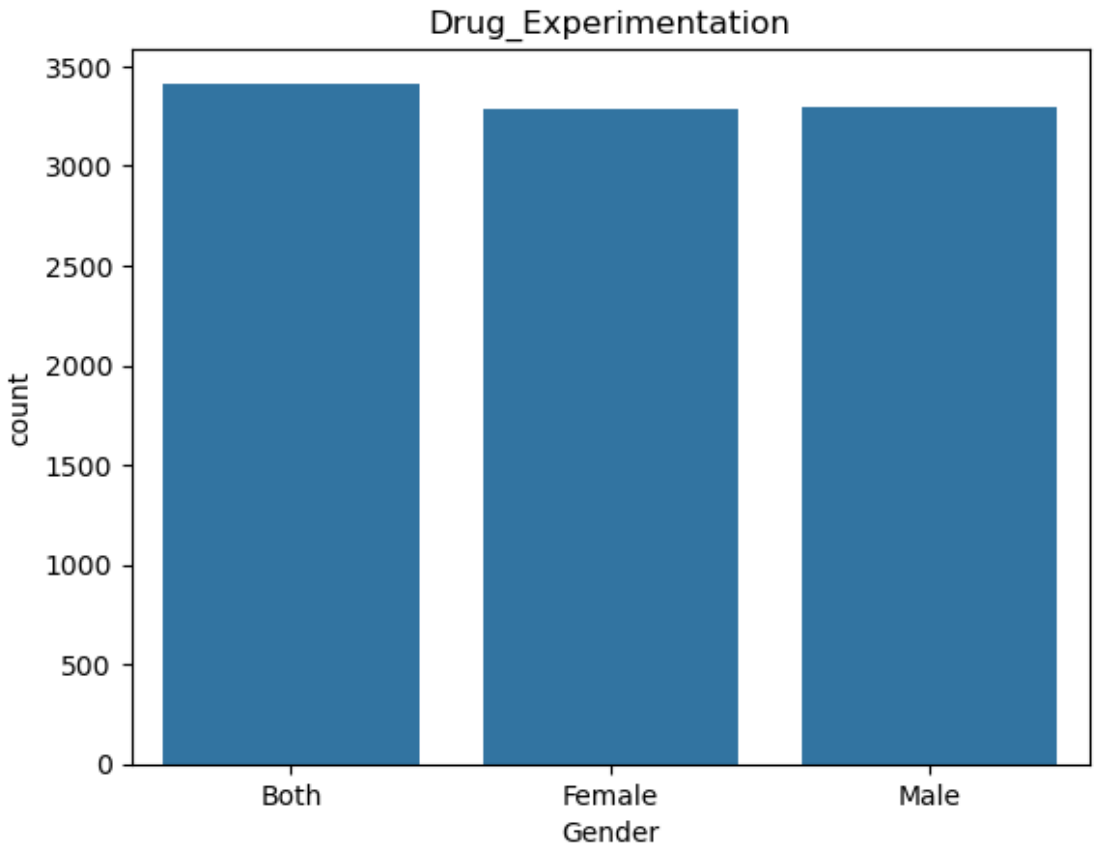
```
# Univariate Analysis: Numerical
sns.histplot(df['Age_Group'], kde=True).set_title('Gender')
plt.show()
```



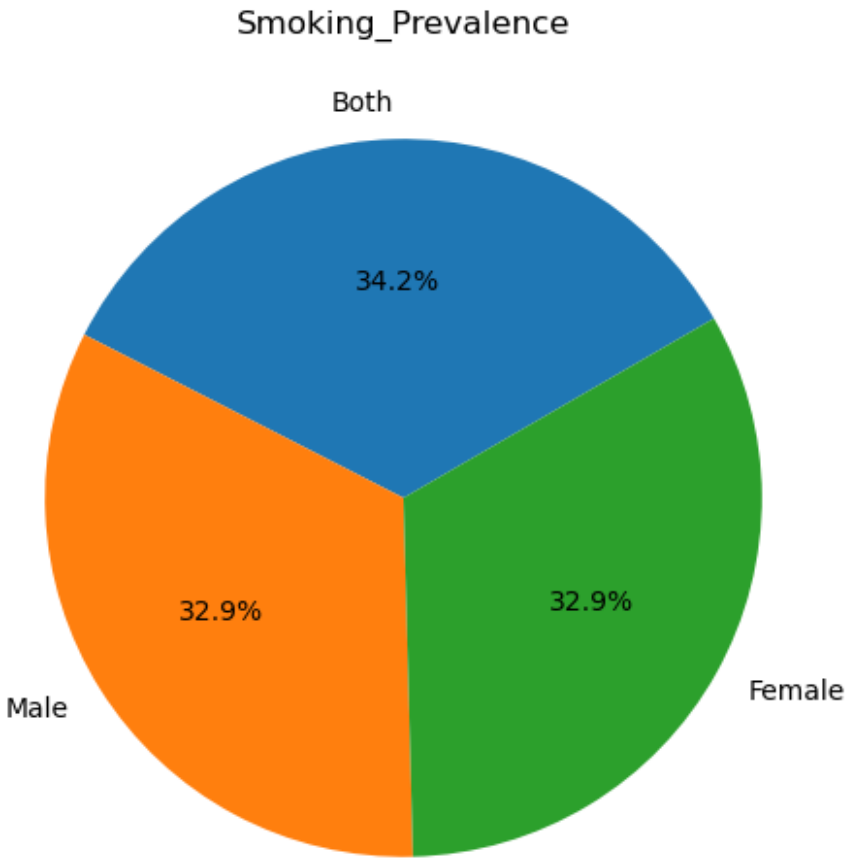

```
# Univariate Analysis: Numerical
sns.histplot(df['Age_Group'], kde=True).set_title('Smoking_Prevalence')
plt.show()
```



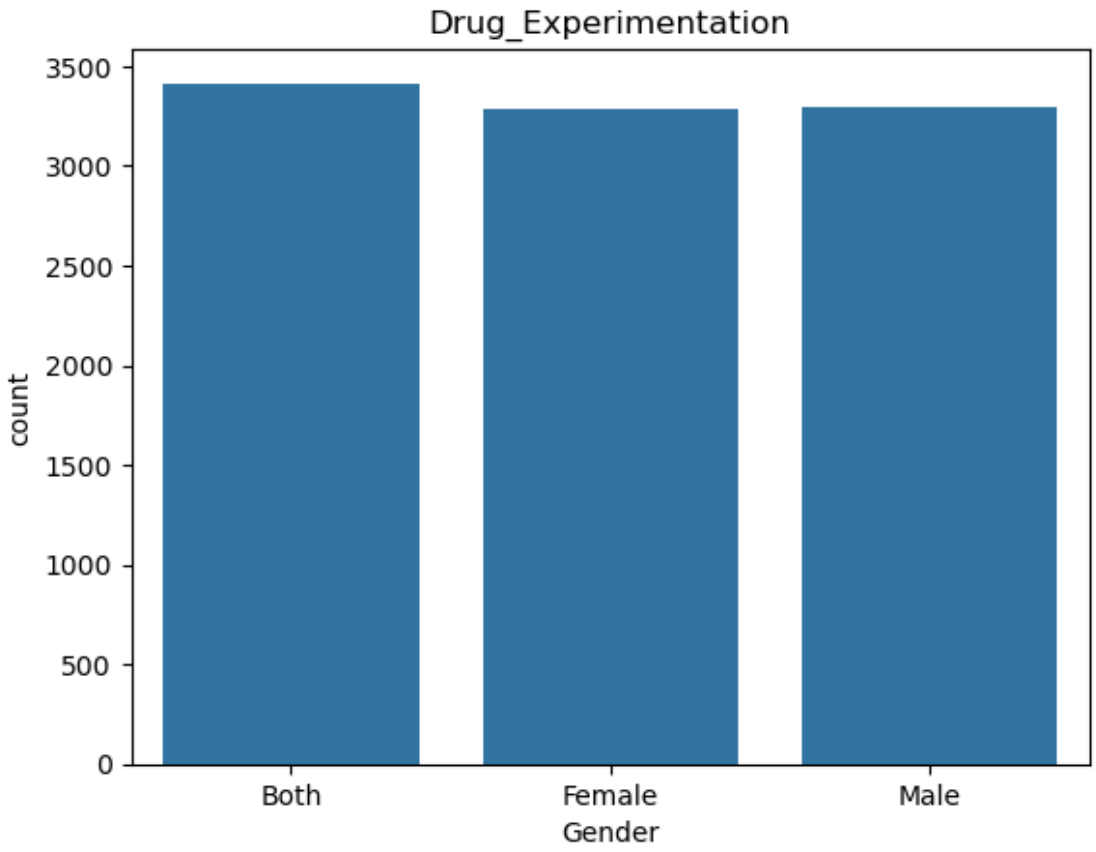

```
# Univariate Analysis: Categorical
sns.countplot(x='Gender', data=df).set_title('Drug_Experimentation')
plt.show()
```



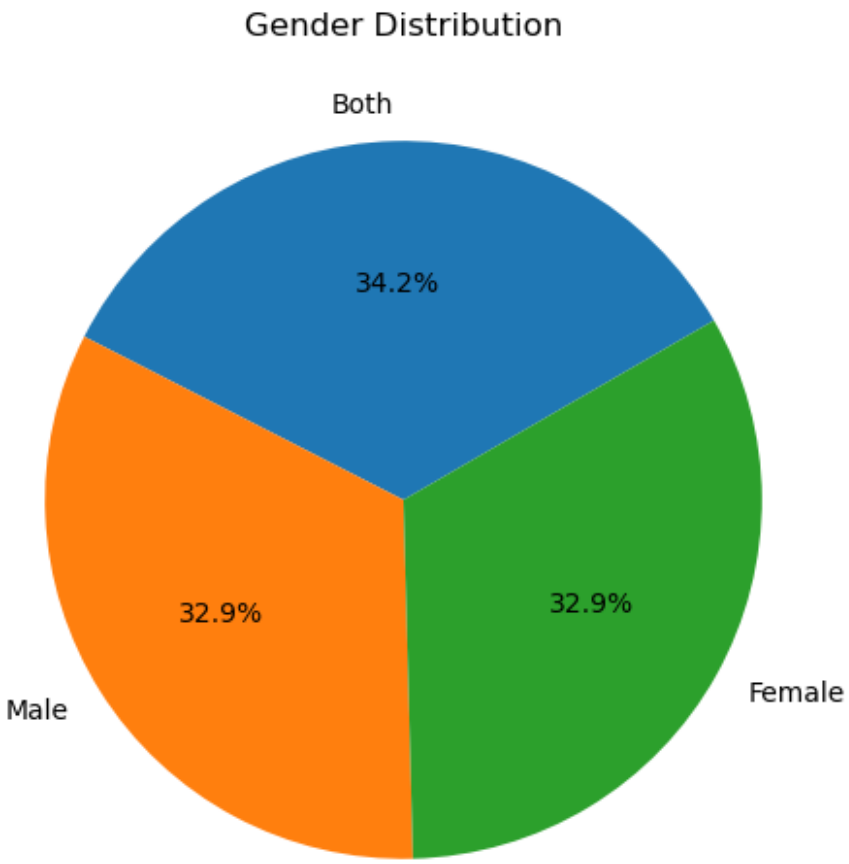

```
# Univariate Pie Chart: Gender distribution
Smoking_Prevalence= df['Gender'].value_counts()
plt.figure(figsize=(6, 6))
plt.pie(Smoking_Prevalence, labels=Smoking_Prevalence.index,
autopct='%1.1f%%', startangle=30)
plt.title('Smoking_Prevalence')
plt.show()
```



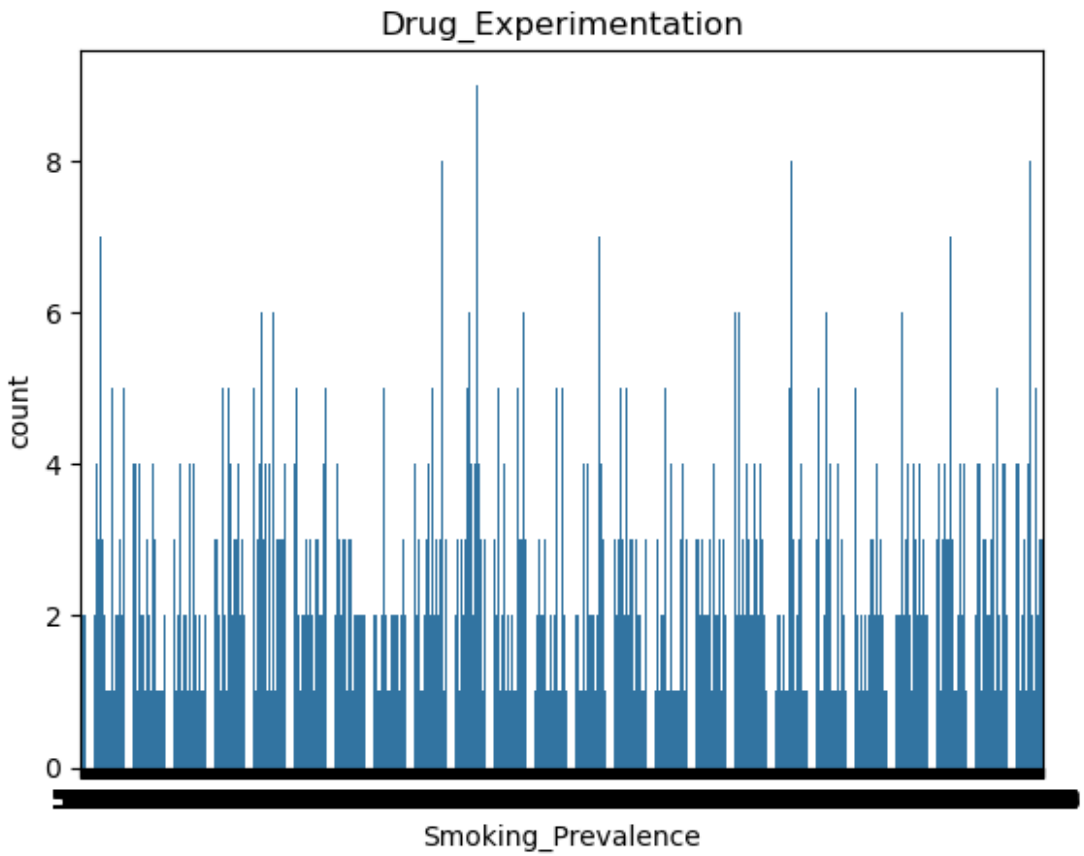

```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
df=pd.read_csv(r"C:\Users\abung\Downloads\Youth smoking SDS.csv")
sns.countplot(x='Gender', data=df).set_title('Drug_Experimentation')
plt.show()
```



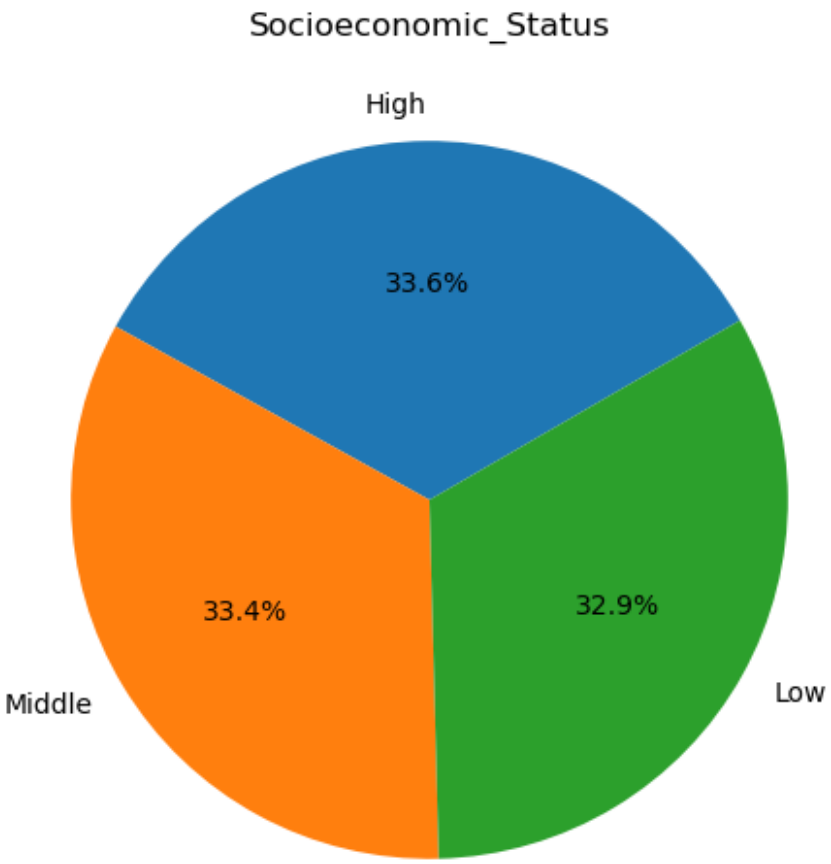

```
gender_counts = df['Gender'].value_counts()
plt.figure(figsize=(6, 6))
plt.pie(gender_counts, labels=gender_counts.index, autopct='%1.1f%%',
startangle=30)
plt.title('Gender Distribution')
plt.show()
```



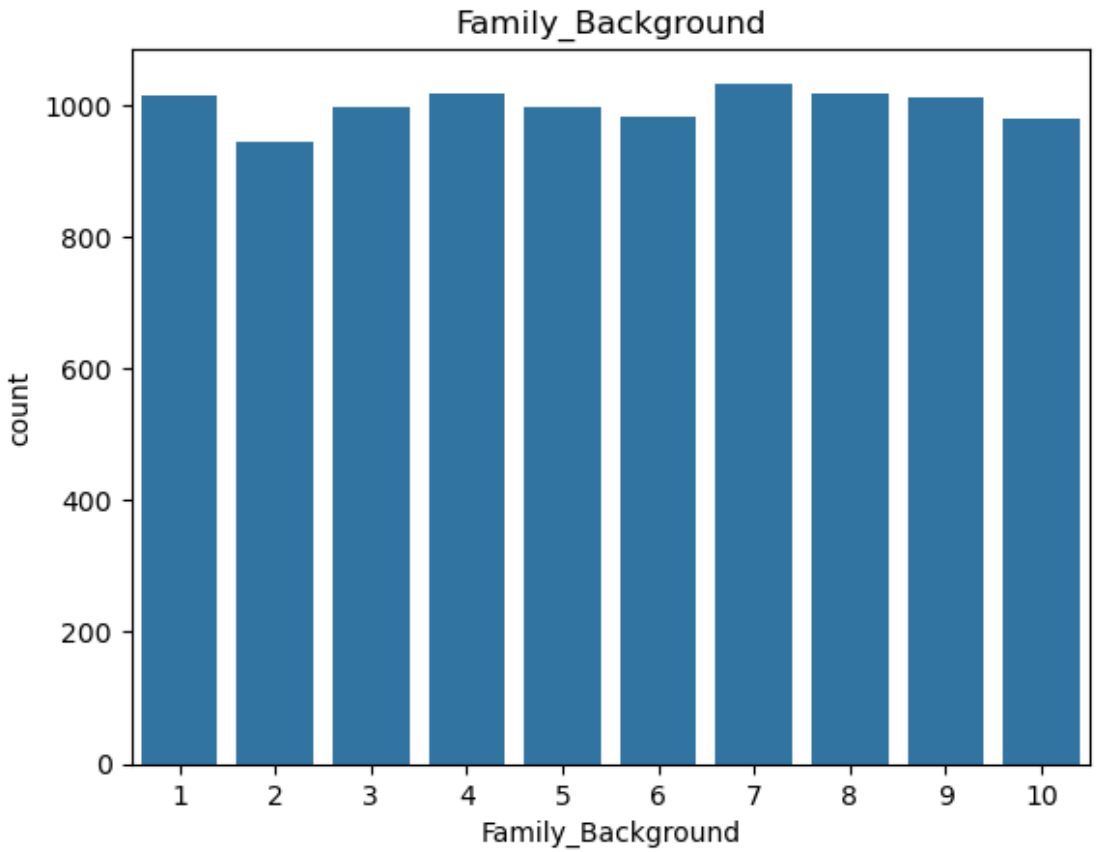

```
sns.countplot(x='Smoking_Prevalence',data=df).set_title('Drug_Experimentation
')
plt.show()
```



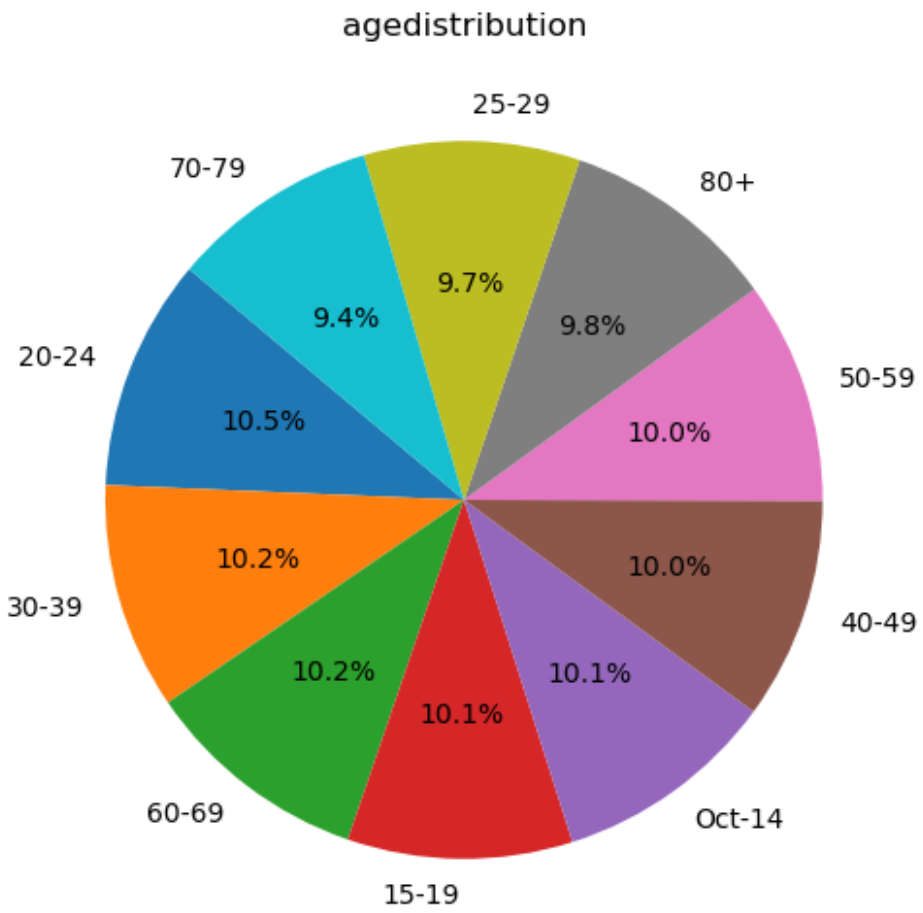

```
import matplotlib.pyplot as plt  # Add this if not already done
Smoking_Prevalence_counts =df['Socioeconomic_Status'].value_counts()
plt.figure(figsize=(6, 6))
plt.pie(Smoking_Prevalence_counts,labels=Smoking_Prevalence_counts.index,auto
pct='%1.1f%%',startangle=30)
plt.title('Socioeconomic_Status')
plt.show()
```



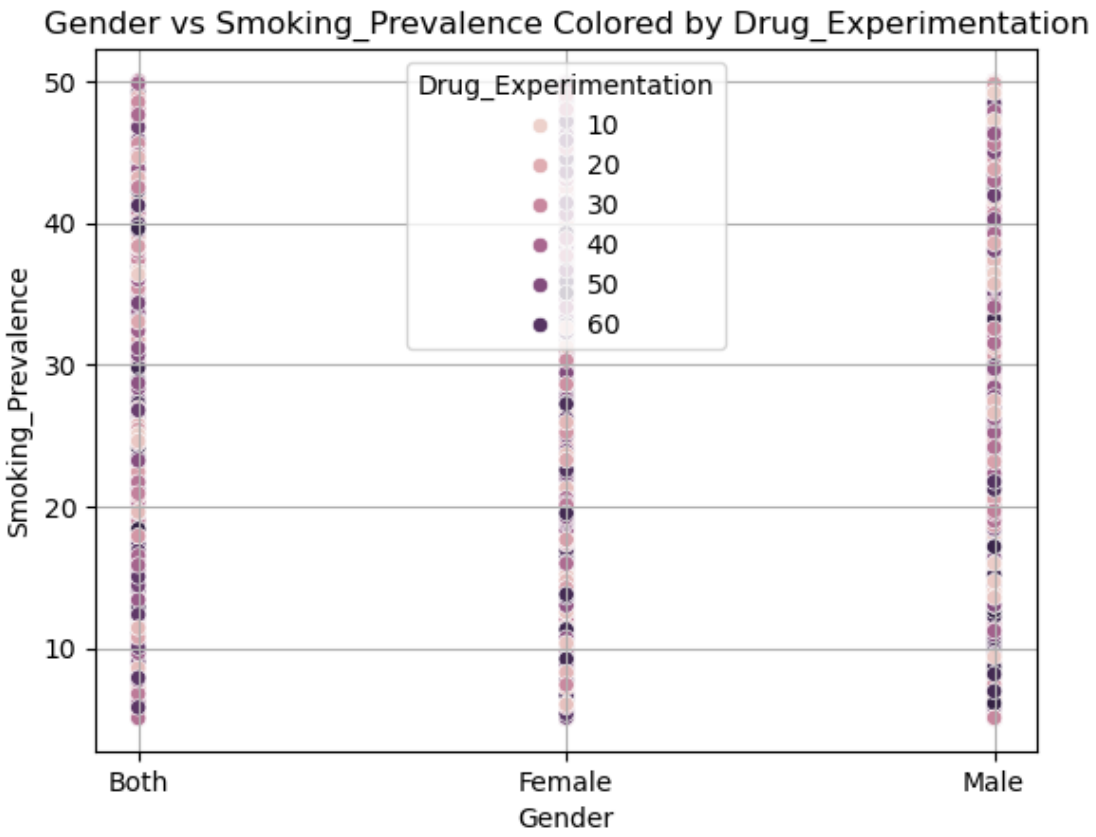

```
# Univariate Analysis: Categorical
sns.countplot(x='Family_Background', data=df).set_title('Family_Background')
plt.show()
```




```
# Univariate Pie Chart: Dietary Habits
age_count = df['Age_Group'].value_counts()
plt.figure(figsize=(6, 6))
plt.pie(age_count, labels=age_count.index, autopct='%1.1f%%', startangle=140)
plt.title('agedistribution')
plt.show()
```

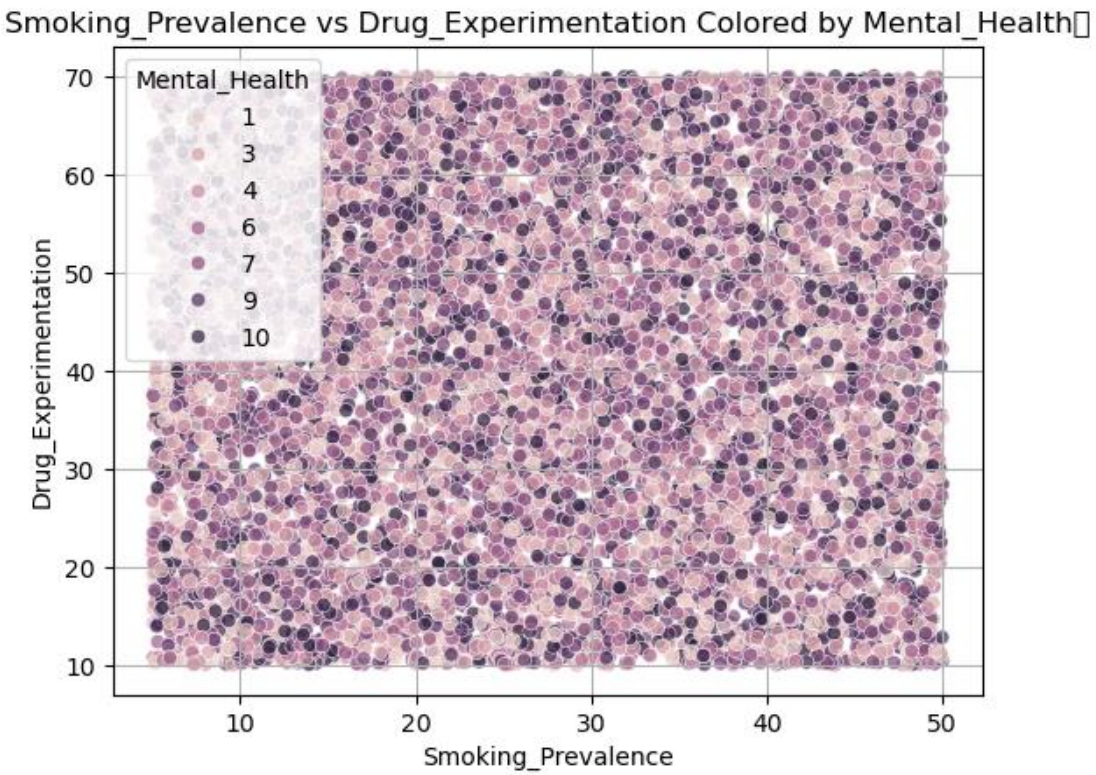



```
# Age vs Academic Pressure Colored by Dietary Habits scaatter plot
sns.scatterplot(x='Gender',
y='Smoking_Prevalence',hue='Drug_Experimentation',data=df)
plt.title('Gender vs Smoking_Prevalence Colored by Drug_Experimentation')
plt.xlabel('Gender')
plt.ylabel('Smoking_Prevalence')
plt.grid(True)
plt.show()
```

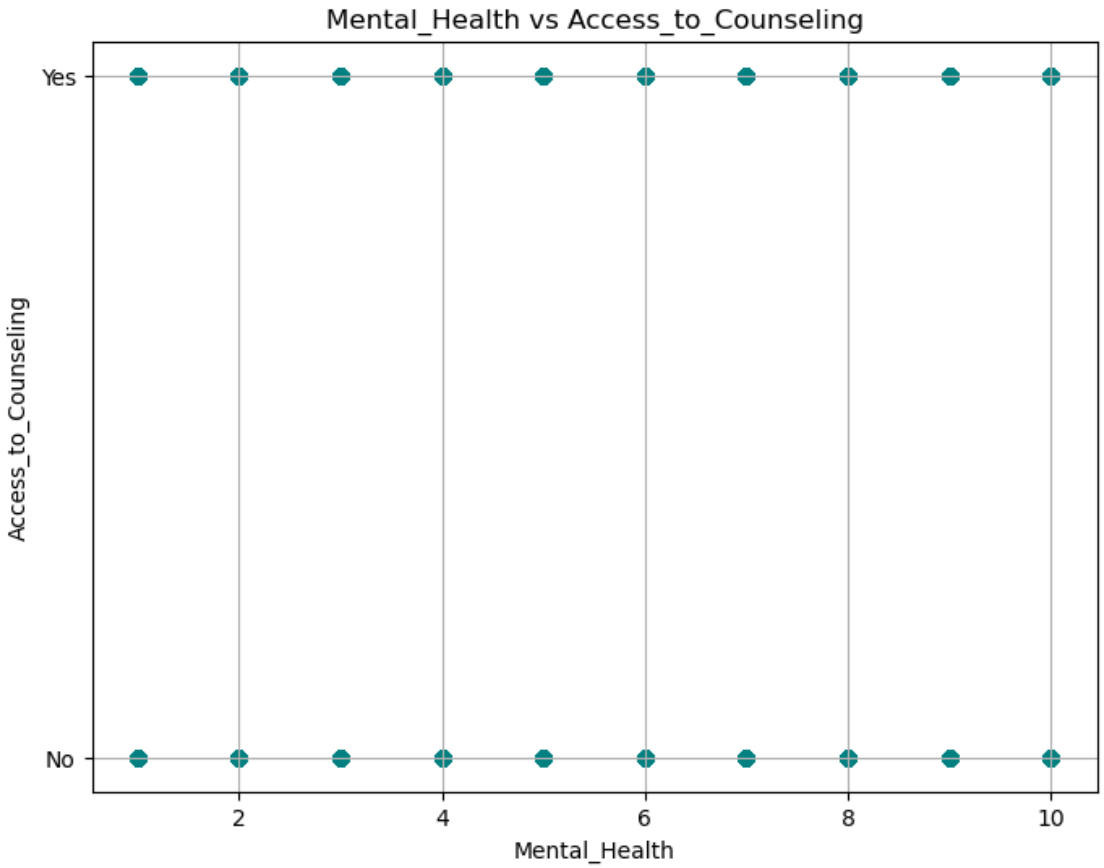



```
# Scatter plot colored by Mental_Health
sns.scatterplot(x='Smoking_Prevalence', y='Drug_Experimentation',
hue='Mental_Health',data=df, alpha=0.7)
plt.title('Smoking_Prevalence vs Drug_Experimentation Colored by
Mental_Health     ')
plt.xlabel('Smoking_Prevalence')
plt.ylabel('Drug_Experimentation')
plt.grid(True)
plt.show()
```

```
C:\Users\abung\AppData\Roaming\Python\Python312\site-
packages\IPython\core\pylabtools.py:170: UserWarning: Glyph 9 (   ) missing
from current font.
  fig.canvas.print_figure(bytes_io, **kw)
```

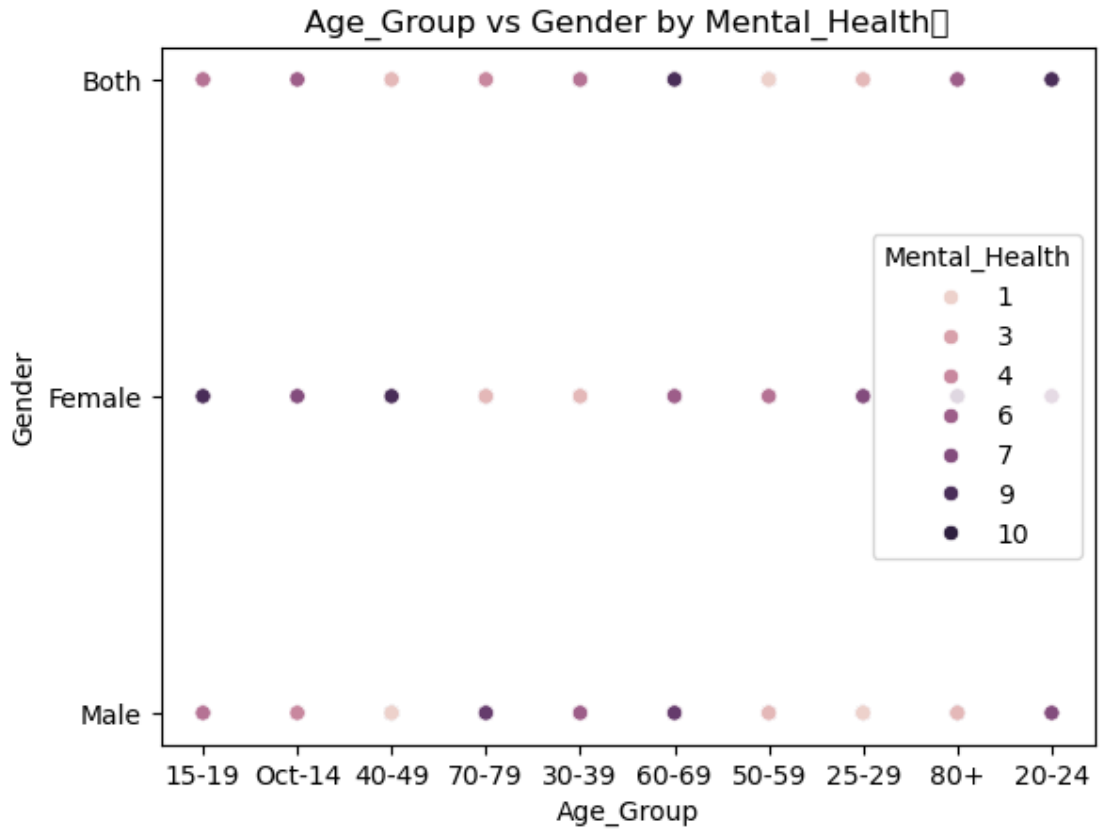



```
# Mental_Health vs Access_to_Counseling scatter plot
plt.figure(figsize=(8, 6))
plt.scatter(df['Mental_Health'], df['Access_to_Counseling'], color='teal',
alpha=0.5)
plt.title('Mental_Health vs Access_to_Counseling')
plt.xlabel('Mental_Health')
plt.ylabel('Access_to_Counseling')
plt.grid(True)
plt.show()
```

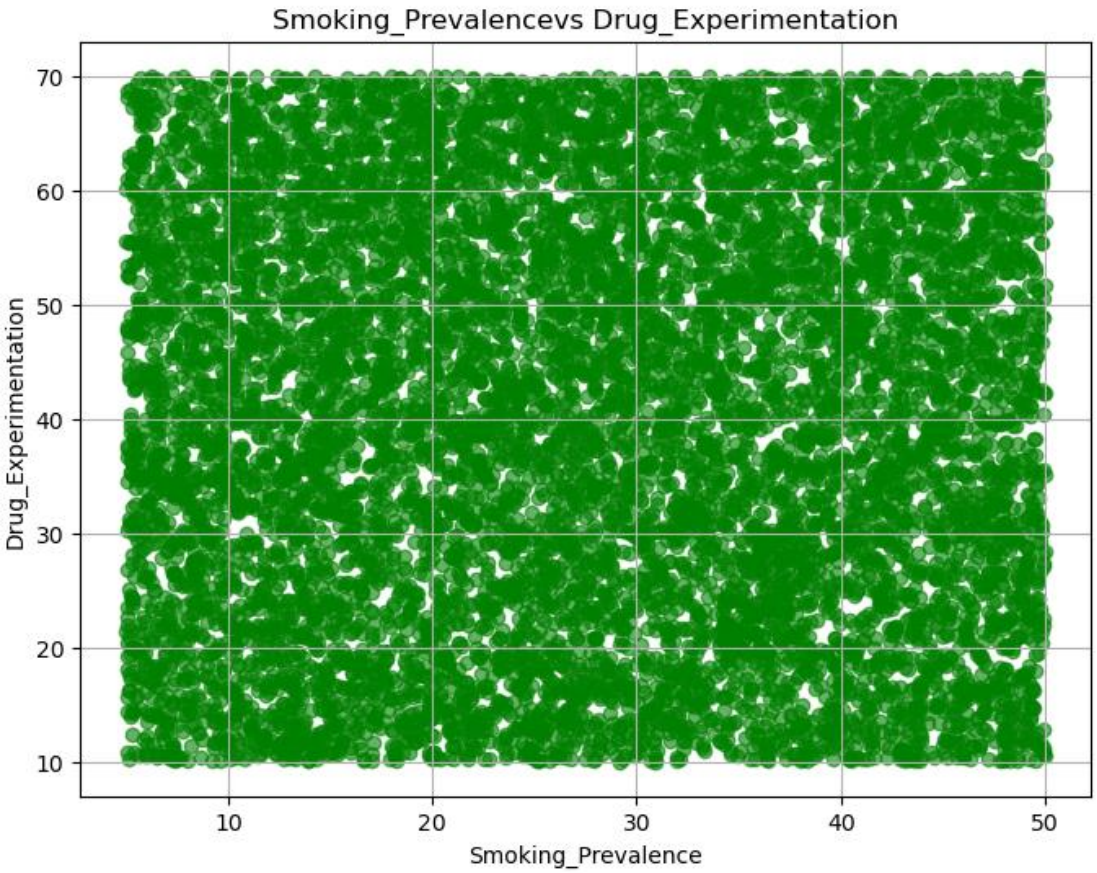



```
 # Scatter plot with hue based on Mental_Health
sns.scatterplot(x='Age_Group', y='Gender', hue='Mental_Health',data=df)
plt.title('Age_Group vs Gender by Mental_Health ')
plt.xlabel('Age_Group')
plt.ylabel('Gender')
plt.show()
```

```
C:\Users\abung\AppData\Roaming\Python\Python312\site-
packages\IPython\core\pylabtools.py:170: UserWarning: Glyph 9 (   ) missing
from current font.
  fig.canvas.print_figure(bytes_io, **kw)
```

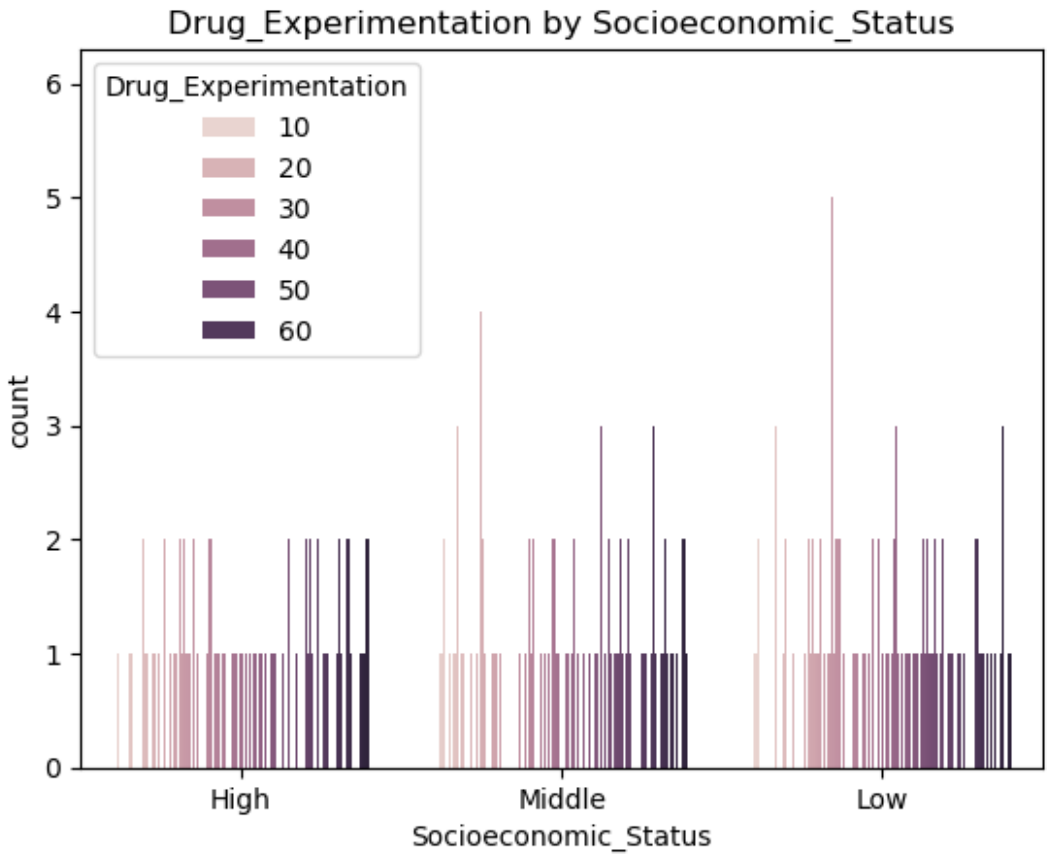



```
# Scatter plot(Smoking_Prevalence vs Drug_Experimentation)
plt.figure(figsize=(8, 6))
plt.scatter(df['Smoking_Prevalence'],df['Drug_Experimentation'], alpha=0.6,
c='green')
plt.title('Smoking_Prevalencevs Drug_Experimentation')
plt.xlabel('Smoking_Prevalence')
plt.ylabel('Drug_Experimentation')
plt.grid(True)
plt.show()
```

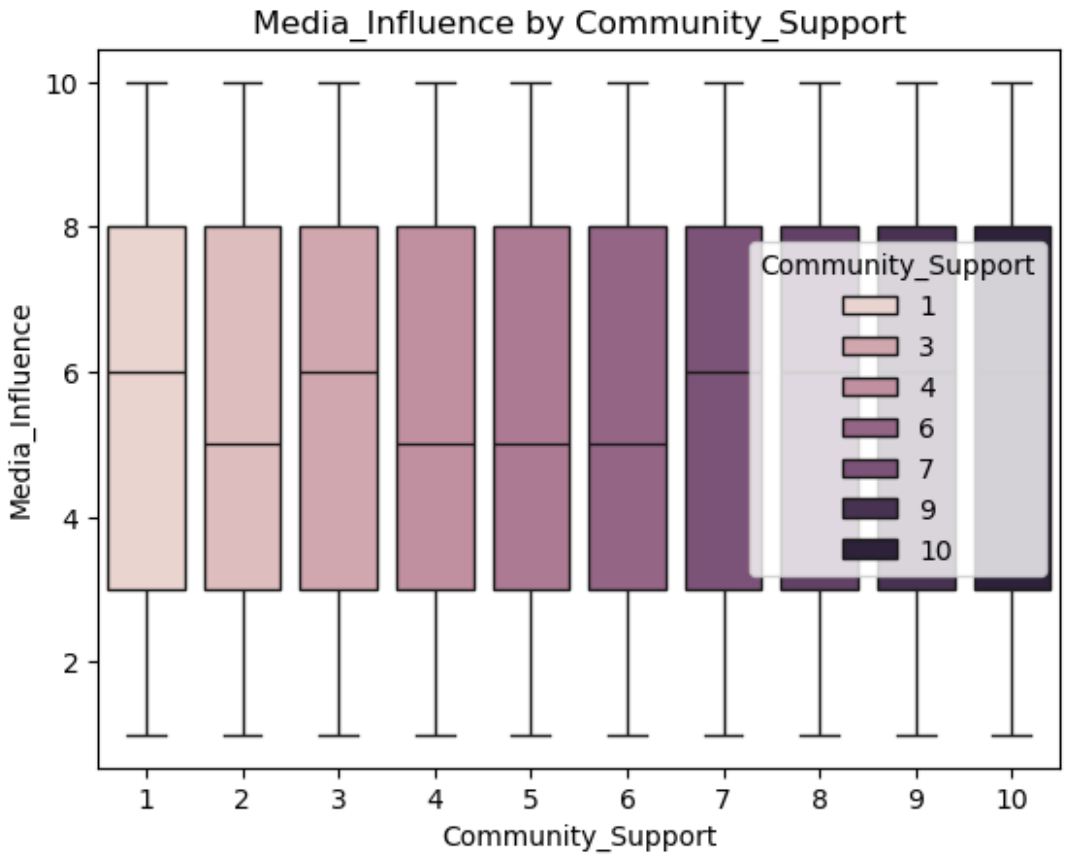



```
# Bivariate Socioeconomic_Status vs Socioeconomic_Status
sns.countplot(x='Socioeconomic_Status', hue='Drug_Experimentation',data=df)
plt.title('Drug_Experimentation by Socioeconomic_Status')
plt.show()
```

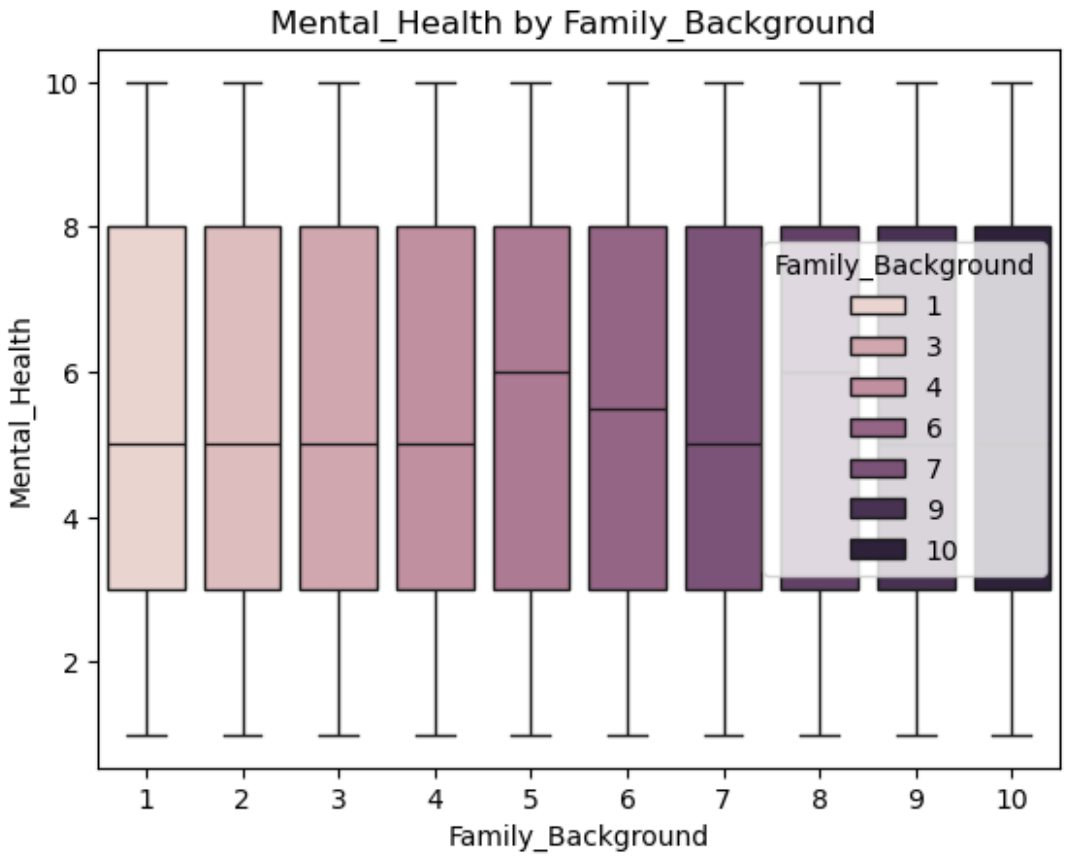
```
C:\Users\abung\AppData\Roaming\Python\Python312\site-
packages\IPython\core\pylabtools.py:170: UserWarning: Creating legend with
loc="best" can be slow with large amounts of data.
  fig.canvas.print_figure(bytes_io, **kw)
```



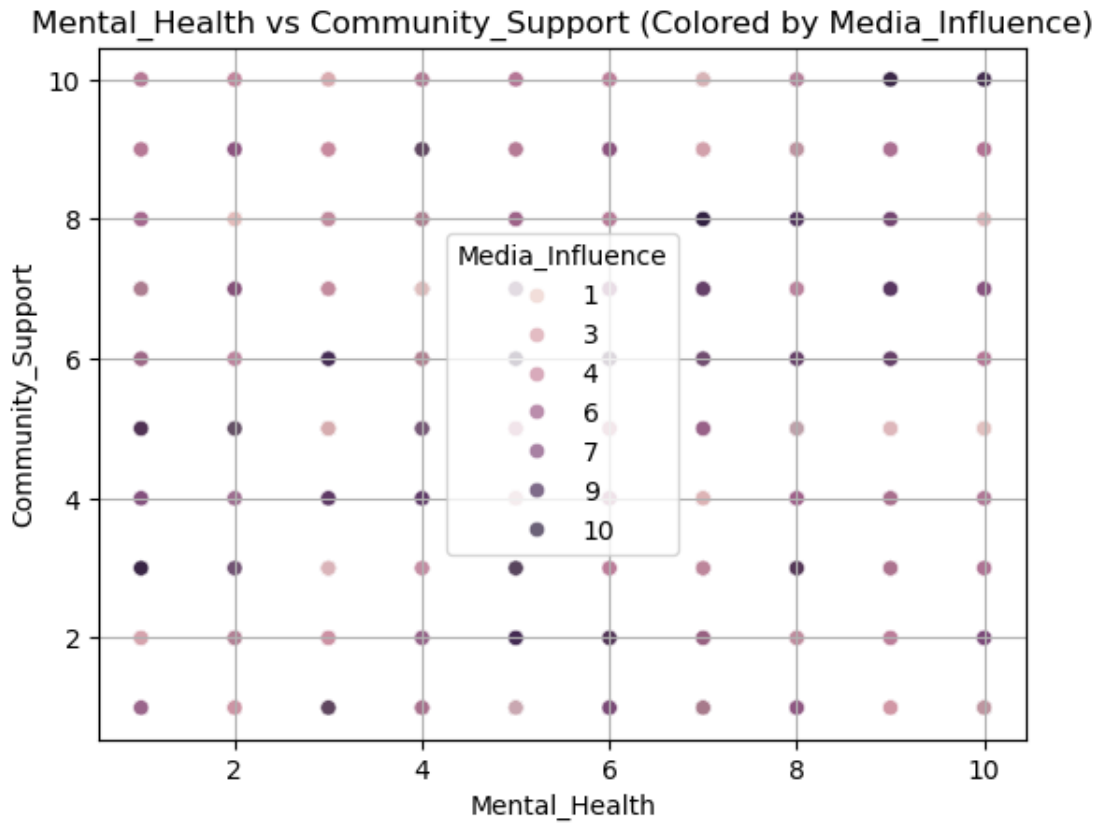

```
# Bivariate Analysis Community_Support vs Media_Influence
sns.boxplot(x='Community_Support',
y='Media_Influence',hue='Community_Support', data=df)
plt.title('Media_Influence by Community_Support')
plt.show()
```



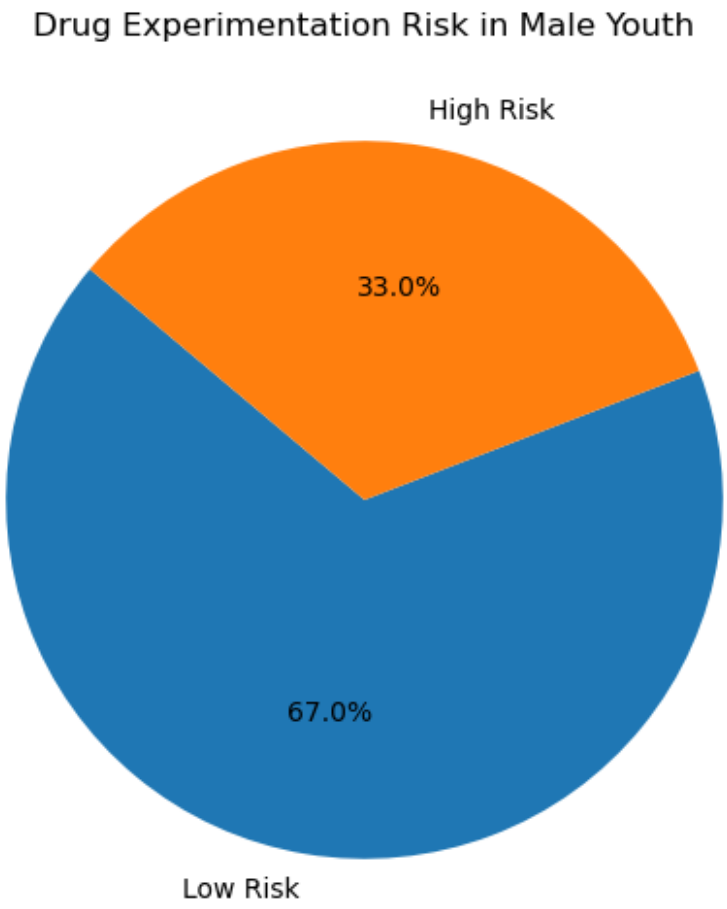

```
# Bivariate Analysis Family_Background vs Mental_Health
sns.boxplot(x='Family_Background',
y='Mental_Health',hue='Family_Background',data=df)
plt.title('Mental_Health by Family_Background ')
plt.show()
```

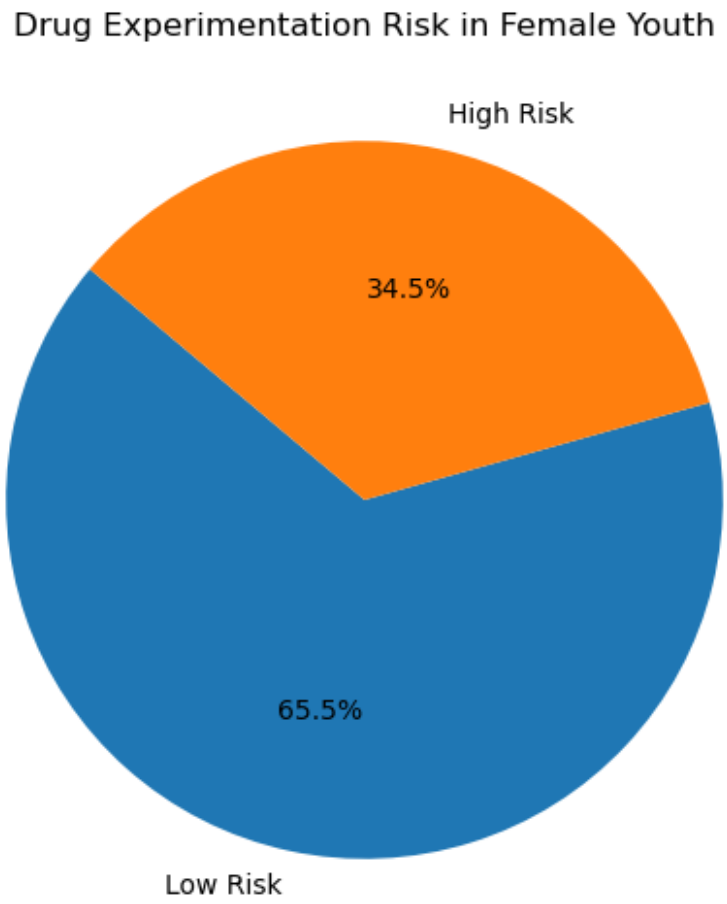



```
# Scatter Plot (Bivariate): Mental_Health vs Community_Support, colored by
Media_Influence
sns.scatterplot(x='Mental_Health',y='Community_Support',hue='Media_Influence'
,data=df,alpha=0.7)
plt.title('Mental_Health vs Community_Support (Colored by Media_Influence)')
plt.xlabel('Mental_Health')
plt.ylabel('Community_Support')
plt.grid(True)
plt.show()
```



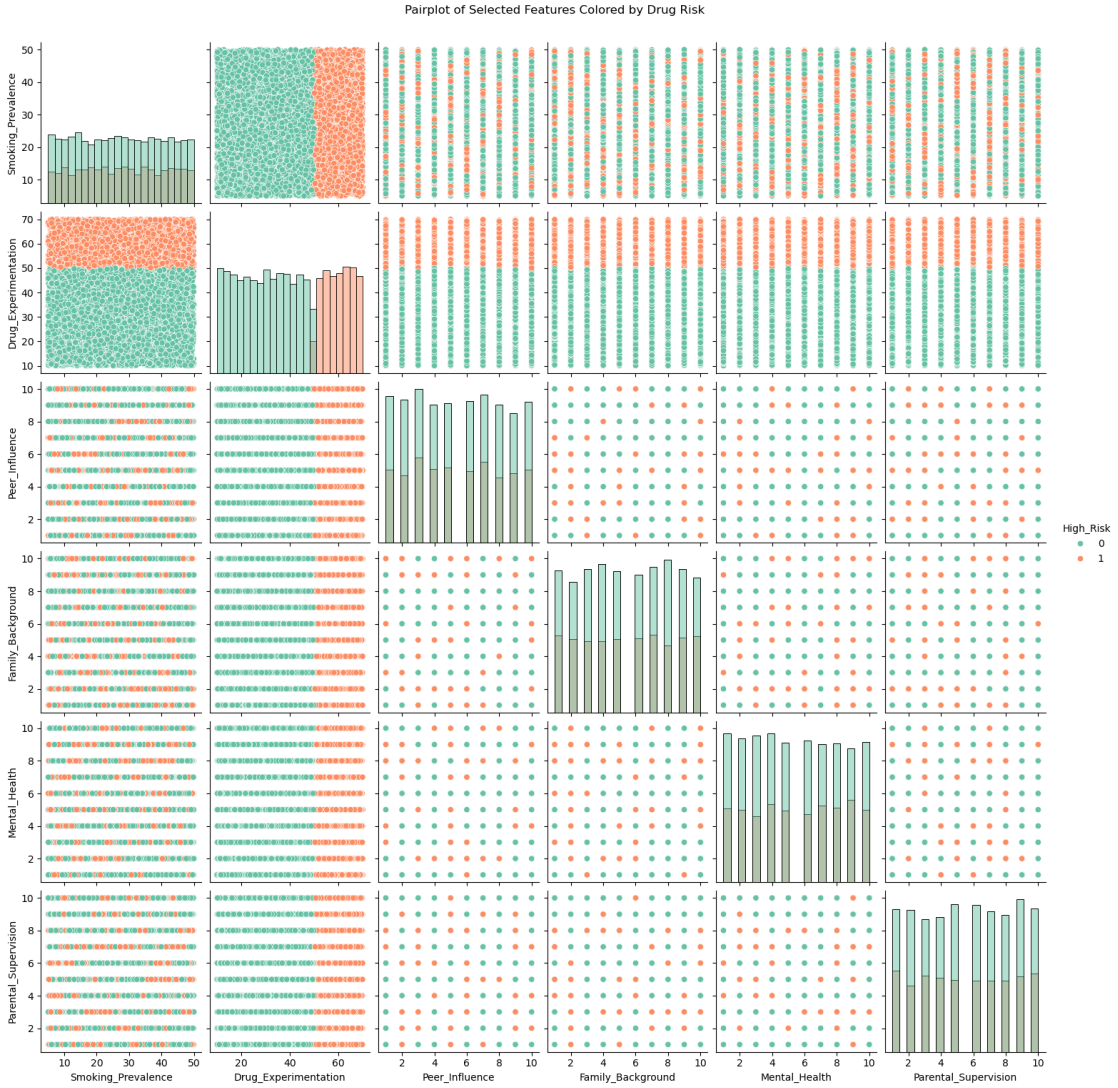

```
male_df = df[df['Gender'] == 'Male']
female_df = df[df['Gender'] == 'Female']

# Use 'Drug_Experimentation' as a risk indicator
# Define: >= 50 as High Risk (1), < 50 as Low Risk (0)
male_risk = (male_df['Drug_Experimentation'] >=
50).astype(int).value_counts()
female_risk = (female_df['Drug_Experimentation'] >=
50).astype(int).value_counts()

# Plot Male Risk Pie Chart
plt.figure(figsize=(6, 6))
plt.pie(male_risk, labels=['Low Risk', 'High Risk'], autopct='%1.1f%%',
startangle=140)
plt.title('Drug Experimentation Risk in Male Youth')
plt.show()

# Plot Female Risk Pie Chart
plt.figure(figsize=(6, 6))
plt.pie(female_risk, labels=['Low Risk', 'High Risk'], autopct='%1.1f%%',
startangle=140)
plt.title('Drug Experimentation Risk in Female Youth')
plt.show()
```


Drug Experimentation Risk in Male Youth
High Risk
33.0%
67.0%
Low Risk

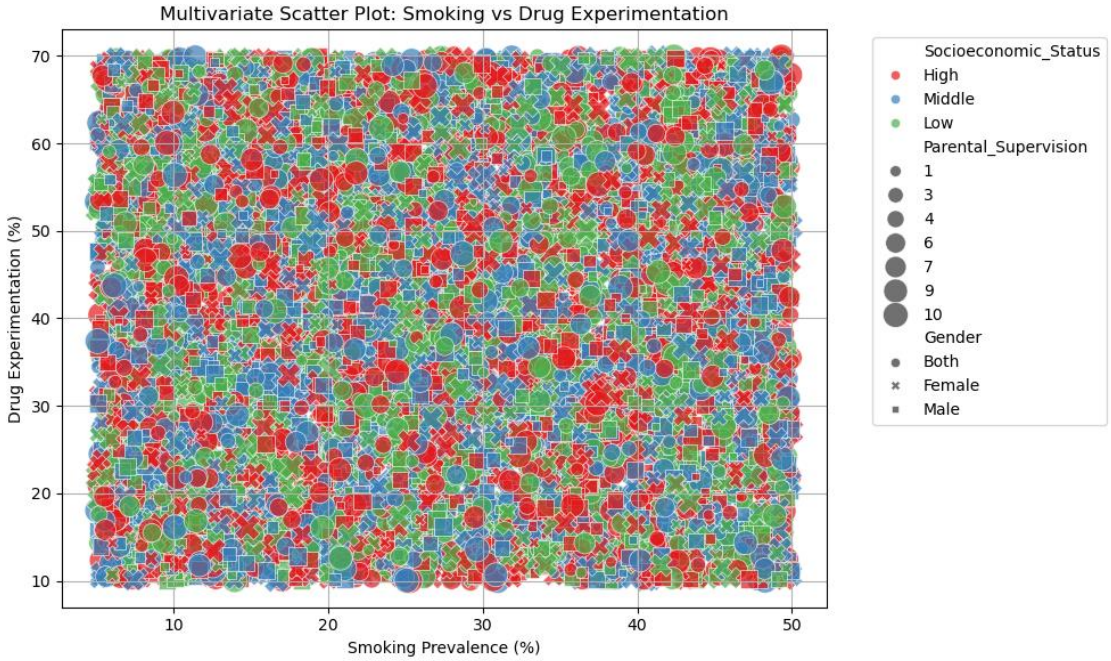



```
# Define selected numeric columns for multivariate analysis
selected_columns = [
    'Smoking_Prevalence',
    'Drug_Experimentation',
    'Peer_Influence',
    'Family_Background',
    'Mental_Health',
    'Parental_Supervision'
]

# Rename the dataset variable
df = df.rename(columns=str.strip)  # Optional cleanup, if needed

# Create a proxy binary label for Drug Risk
df['High_Risk'] = (df['Drug_Experimentation'] >= 50).astype(int)

# Drop missing values from selected columns and 'High_Risk'
plot_data = df[selected_columns + ['High_Risk']].dropna()

# Pairplot with hue based on drug risk
```

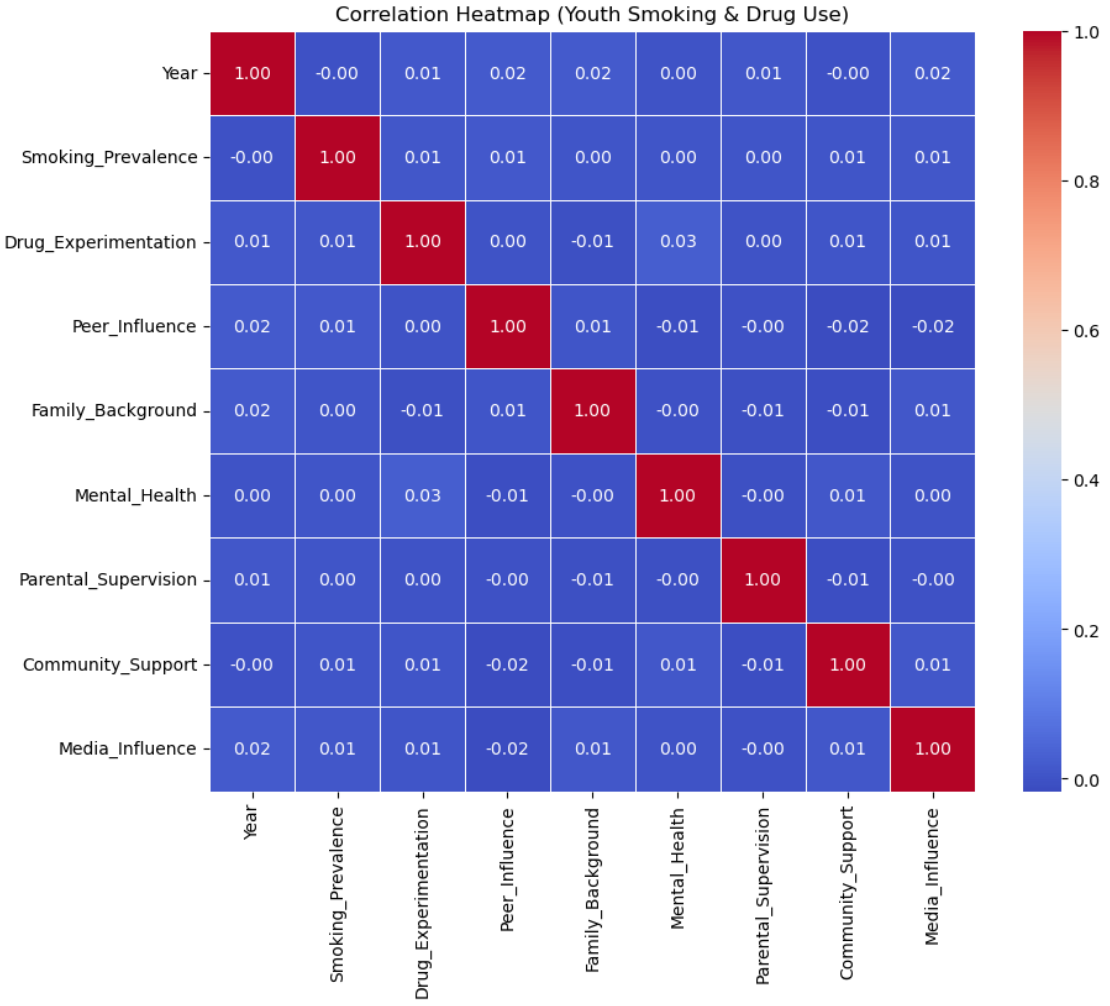
```
sns.pairplot(plot_data, hue='High_Risk', diag_kind='hist', palette='Set2')
plt.suptitle("Pairplot of Selected Features Colored by Drug Risk", y=1.02)
plt.show()
```




```
plt.figure(figsize=(10, 6))
sns.scatterplot( x='Smoking_Prevalence',y='Drug_Experimentation',
hue='Socioeconomic_Status', size='Parental_Supervision', style='Gender',
data=df, palette='Set1', sizes=(50, 250),alpha=0.7)
plt.title('Multivariate Scatter Plot: Smoking vs Drug Experimentation')
plt.xlabel('Smoking Prevalence (%)')
plt.ylabel('Drug Experimentation (%)')
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left')
plt.grid(True)
plt.tight_layout()
plt.show()
```




```
corr_matrix = df.corr(numeric_only=True)

# Plot heatmap
plt.figure(figsize=(10, 8))
sns.heatmap(corr_matrix, annot=True, cmap='coolwarm', fmt=".2f",
linewidths=0.5)
plt.title('Correlation Heatmap (Youth Smoking & Drug Use)')
plt.show()
```


Correlation Heatmap (Youth Smoking & Drug Use)
Year
Smoking_Prevalence
Drug_Experimentation
Peer_Influence
Family_Background
Mental_Health
Parental_Supervision
Community_Support
Media_Influence
1.00 -0.00 0.01 0.02 0.02 0.00 0.01 -0.00 0.02
-0.00 1.00 0.01 0.01 0.00 0.00 0.00 0.01 0.01
0.01 0.01 1.00 0.00 -0.01 0.03 0.00 0.01 0.01
0.02 0.01 0.00 1.00 0.01 -0.01 -0.00 -0.02 -0.02
0.02 0.00 -0.01 0.01 1.00 -0.00 -0.01 -0.01 0.01
0.00 0.00 0.03 -0.01 -0.00 1.00 -0.00 0.01 0.00
0.01 0.00 0.00 -0.00 -0.01 -0.00 1.00 -0.01 -0.00
-0.00 0.01 0.01 -0.02 -0.01 0.01 -0.01 1.00 0.01
0.02 0.01 0.01 -0.02 0.01 0.00 -0.00 0.01 1.00
1.0
0.8
0.6
0.4
0.2
0.0