heart_disease

December 31, 2023

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

[ ]:
```
pd.set_option('display.max_column',None)
file_path = 'C:\Dataworks\Iungo solutions\heart_disease.csv'
df = pd.read_csv(file_path)
df.head(10)
```

[ ]:
```
   Gender  age      education  currentSmoker  cigsPerDay  BPMeds  \
0    Male   39   postgraduate              0         0.0     0.0
1  Female   46  primaryschool              0         0.0     0.0
2    Male   48     uneducated              1        20.0     0.0
3  Female   61       graduate              1        30.0     0.0
4  Female   46       graduate              1        23.0     0.0
5  Female   43  primaryschool              0         0.0     0.0
6  Female   63     uneducated              0         0.0     0.0
7  Female   45  primaryschool              1        20.0     0.0
8    Male   52     uneducated              0         0.0     0.0
9    Male   43     uneducated              1        30.0     0.0

  prevalentStroke  prevalentHyp  diabetes  totChol  sysBP  diaBP    BMI  \
0              no             0         0    195.0  106.0   70.0  26.97
1              no             0         0    250.0  121.0   81.0  28.73
2              no             0         0    245.0  127.5   80.0  25.34
3              no             1         0    225.0  150.0   95.0  28.58
4              no             0         0    285.0  130.0   84.0  23.10
5              no             1         0    228.0  180.0  110.0  30.30
6              no             0         0    205.0  138.0   71.0  33.11
7              no             0         0    313.0  100.0   71.0  21.68
8              no             1         0    260.0  141.5   89.0  26.36
9              no             1         0    225.0  162.0  107.0  23.61

   heartRate  glucose Heart_ stroke
0       80.0     77.0            No
1       95.0     76.0            No
2       75.0     70.0            No
```

```
3       65.0    103.0           yes
4       85.0     85.0            No
5       77.0     99.0            No
6       60.0     85.0           yes
7       79.0     78.0            No
8       76.0     79.0            No
9       93.0     88.0            No
```

[ ]:

```python
df['Heart_stroke'] = df['Heart_ stroke']
df.drop(columns=['Heart_ stroke'], inplace=True)
df
```

[ ]:

```
      Gender  age     education  currentSmoker  cigsPerDay  BPMeds  \
0       Male   39   postgraduate              0         0.0     0.0
1     Female   46  primaryschool              0         0.0     0.0
2       Male   48     uneducated              1        20.0     0.0
3     Female   61       graduate              1        30.0     0.0
4     Female   46       graduate              1        23.0     0.0
…      …  …            …            …         …     …
4233    Male   50     uneducated              1         1.0     0.0
4234    Male   51       graduate              1        43.0     0.0
4235  Female   48  primaryschool              1        20.0     NaN
4236  Female   44     uneducated              1        15.0     0.0
4237  Female   52  primaryschool              0         0.0     0.0

     prevalentStroke  prevalentHyp  diabetes  totChol  sysBP  diaBP    BMI  \
0                 no             0         0    195.0  106.0   70.0  26.97
1                 no             0         0    250.0  121.0   81.0  28.73
2                 no             0         0    245.0  127.5   80.0  25.34
3                 no             1         0    225.0  150.0   95.0  28.58
4                 no             0         0    285.0  130.0   84.0  23.10
…              …           …       …      …    …    …    …
4233              no             1         0    313.0  179.0   92.0  25.97
4234              no             0         0    207.0  126.5   80.0  19.71
4235              no             0         0    248.0  131.0   72.0  22.00
4236              no             0         0    210.0  126.5   87.0  19.16
4237              no             0         0    269.0  133.5   83.0  21.47

      heartRate  glucose Heart_stroke
0          80.0     77.0           No
1          95.0     76.0           No
2          75.0     70.0           No
3          65.0    103.0          yes
4          85.0     85.0           No
…         …      …          …
4233       66.0     86.0          yes
4234       65.0     68.0           No
```

```
4235      84.0   86.0         No
4236      86.0    NaN         No
4237      80.0  107.0         No

[4238 rows x 16 columns]
```

##Data wrangling for the heart disease dataset

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

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4238 entries, 0 to 4237
Data columns (total 16 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   Gender           4238 non-null   object
 1   age              4238 non-null   int64
 2   education        4133 non-null   object
 3   currentSmoker    4238 non-null   int64
 4   cigsPerDay       4209 non-null   float64
 5   BPMeds           4185 non-null   float64
 6   prevalentStroke  4238 non-null   object
 7   prevalentHyp     4238 non-null   int64
 8   diabetes         4238 non-null   int64
 9   totChol          4188 non-null   float64
 10  sysBP            4238 non-null   float64
 11  diaBP            4238 non-null   float64
 12  BMI              4219 non-null   float64
 13  heartRate        4237 non-null   float64
 14  glucose          3850 non-null   float64
 15  Heart_stroke     4238 non-null   object
dtypes: float64(8), int64(4), object(4)
memory usage: 529.9+ KB
```

```
[ ]: df.dtypes
```

```
[ ]: Gender              object
     age                  int64
     education           object
     currentSmoker        int64
     cigsPerDay         float64
     BPMeds             float64
     prevalentStroke     object
     prevalentHyp         int64
     diabetes             int64
     totChol            float64
     sysBP              float64
     diaBP              float64
```

```
BMI                float64
heartRate          float64
glucose            float64
Heart_stroke        object
dtype: object
```

[ ]:

```
## Data Wrangling
# find the missing value
df.isnull().sum()
```

[ ]:

```
Gender               0
age                  0
education          105
currentSmoker        0
cigsPerDay          29
BPMeds              53
prevalentStroke      0
prevalentHyp         0
diabetes             0
totChol             50
sysBP                0
diaBP                0
BMI                 19
heartRate            1
glucose            388
Heart_stroke         0
dtype: int64
```

[ ]:

```
df['education'] = df['education'] .fillna(df['education'].mode().iloc[0])
df['cigsPerDay'] = df['cigsPerDay'].fillna(df['cigsPerDay'].median())
df['BPMeds'] = df['BPMeds'].fillna(df['BPMeds'].median())
df['totChol'] = df['totChol'].fillna(df['totChol'].median())
df['BMI'] = df['BMI'].fillna(df['BMI'].median())
df['heartRate'] = df['heartRate'].fillna(df['heartRate'].median())
df['glucose'] = df['glucose'].fillna(df['glucose'].median())

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

[ ]:

```
Gender             0
age                0
education          0
currentSmoker      0
cigsPerDay         0
BPMeds             0
prevalentStroke    0
prevalentHyp       0
diabetes           0
```

```
totChol            0
sysBP              0
diaBP              0
BMI                0
heartRate          0
glucose            0
Heart_stroke       0
dtype: int64
```

[ ]:
```
df.dtypes
```

[ ]:
```
Gender              object
age                  int64
education           object
currentSmoker        int64
cigsPerDay         float64
BPMeds             float64
prevalentStroke     object
prevalentHyp         int64
diabetes             int64
totChol            float64
sysBP              float64
diaBP              float64
BMI                float64
heartRate          float64
glucose            float64
Heart_stroke        object
dtype: object
```

Descriptive Statistics for the heart disease dataset

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

[ ]:
```
               age  currentSmoker   cigsPerDay       BPMeds  prevalentHyp  \
count  4238.000000    4238.000000  4238.000000  4238.000000   4238.000000
mean     49.584946       0.494101     8.941482     0.029259      0.310524
std       8.572160       0.500024    11.902399     0.168552      0.462763
min      32.000000       0.000000     0.000000     0.000000      0.000000
25%      42.000000       0.000000     0.000000     0.000000      0.000000
50%      49.000000       0.000000     0.000000     0.000000      0.000000
75%      56.000000       1.000000    20.000000     0.000000      1.000000
max      70.000000       1.000000    70.000000     1.000000      1.000000

          diabetes      totChol        sysBP        diaBP          BMI  \
count  4238.000000  4238.000000  4238.000000  4238.000000  4238.000000
mean      0.025720   236.689476   132.352407    82.893464    25.800205
std       0.158316    44.327427    22.038097    11.910850     4.071041
min       0.000000   107.000000    83.500000    48.000000    15.540000
```

```
25%        0.000000   206.000000   117.000000    75.000000    23.080000
50%        0.000000   234.000000   128.000000    82.000000    25.400000
75%        0.000000   262.000000   144.000000    89.875000    28.037500
max        1.000000   696.000000   295.000000   142.500000    56.800000

         heartRate      glucose
count  4238.000000  4238.000000
mean     75.878716    81.603587
std      12.025185    22.865246
min      44.000000    40.000000
25%      68.000000    72.000000
50%      75.000000    78.000000
75%      83.000000    85.000000
max     143.000000   394.000000
```

```
[ ]: df.rename(columns={'heart_ stroke': 'heart_stroke'}, inplace=True)
```

Frequency Analysis

```
[ ]: df['Gender'].value_counts()
```

```
[ ]: Gender
     Female    2419
     Male      1819
     Name: count, dtype: int64
```

```
[ ]: df['education'].value_counts()
```

```
[ ]: education
     uneducated       1825
     primaryschool    1253
     graduate          687
     postgraduate      473
     Name: count, dtype: int64
```

```
[ ]: df['prevalentStroke'].value_counts()
```

```
[ ]: prevalentStroke
     no     4213
     yes      25
     Name: count, dtype: int64
```

```
[ ]: df['Heart_stroke'].value_counts()
```

```
[ ]: Heart_stroke
     No     3594
     yes     644
     Name: count, dtype: int64
```

Correlation Analysis

```
[ ]: df.corr(numeric_only = True)
```

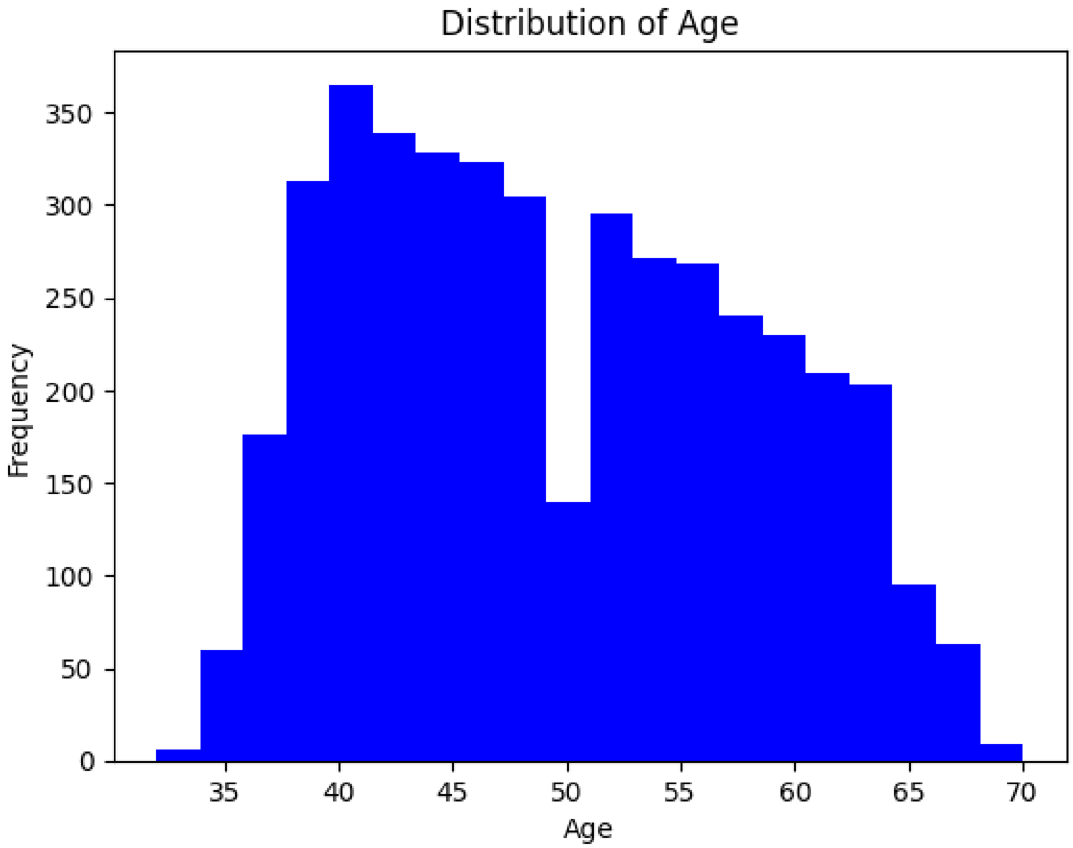
```
[ ]:                    age  currentSmoker  cigsPerDay    BPMeds  prevalentHyp  \
     age           1.000000      -0.213748   -0.191847  0.120955      0.307194
     currentSmoker -0.213748       1.000000    0.760239 -0.048358     -0.103260
     cigsPerDay    -0.191847       0.760239    1.000000 -0.044675     -0.065046
     BPMeds         0.120955      -0.048358   -0.044675  1.000000      0.258697
     prevalentHyp   0.307194      -0.103260   -0.065046  0.258697      1.000000
     diabetes       0.101258      -0.044295   -0.036150  0.051394      0.077808
     totChol        0.260105      -0.046466   -0.026976  0.078578      0.163054
     sysBP          0.394302      -0.130230   -0.088375  0.251503      0.696755
     diaBP          0.206104      -0.107746   -0.056687  0.192356      0.615751
     BMI            0.135174      -0.167161   -0.092211  0.099584      0.300510
     heartRate     -0.012848       0.062330    0.073853  0.015142      0.147196
     glucose        0.117788      -0.055177   -0.056863  0.049124      0.083571

                    diabetes   totChol     sysBP     diaBP       BMI  heartRate  \
     age            0.101258  0.260105  0.394302  0.206104  0.135174  -0.012848
     currentSmoker -0.044295 -0.046466 -0.130230 -0.107746 -0.167161   0.062330
     cigsPerDay    -0.036150 -0.026976 -0.088375 -0.056687 -0.092211   0.073853
     BPMeds         0.051394  0.078578  0.251503  0.192356  0.099584   0.015142
     prevalentHyp   0.077808  0.163054  0.696755  0.615751  0.300510   0.147196
     diabetes       1.000000  0.040117  0.111283  0.050329  0.086025   0.048996
     totChol        0.040117  1.000000  0.207522  0.163888  0.114811   0.090537
     sysBP          0.111283  0.207522  1.000000  0.784002  0.325161   0.182143
     diaBP          0.050329  0.163888  0.784002  1.000000  0.376623   0.181257
     BMI            0.086025  0.114811  0.325161  0.376623  1.000000   0.067520
     heartRate      0.048996  0.090537  0.182143  0.181257  0.067520   1.000000
     glucose        0.606493  0.045559  0.135136  0.059042  0.082219   0.087315

                     glucose
     age            0.117788
     currentSmoker -0.055177
     cigsPerDay    -0.056863
     BPMeds         0.049124
     prevalentHyp   0.083571
     diabetes       0.606493
     totChol        0.045559
     sysBP          0.135136
     diaBP          0.059042
     BMI            0.082219
     heartRate      0.087315
     glucose        1.000000
```

[ ]:

```
plt.hist(df['age'], bins=20, color='blue')
plt.title('Distribution of Age')
plt.xlabel('Age')
plt.ylabel('Frequency')
plt.show()
```

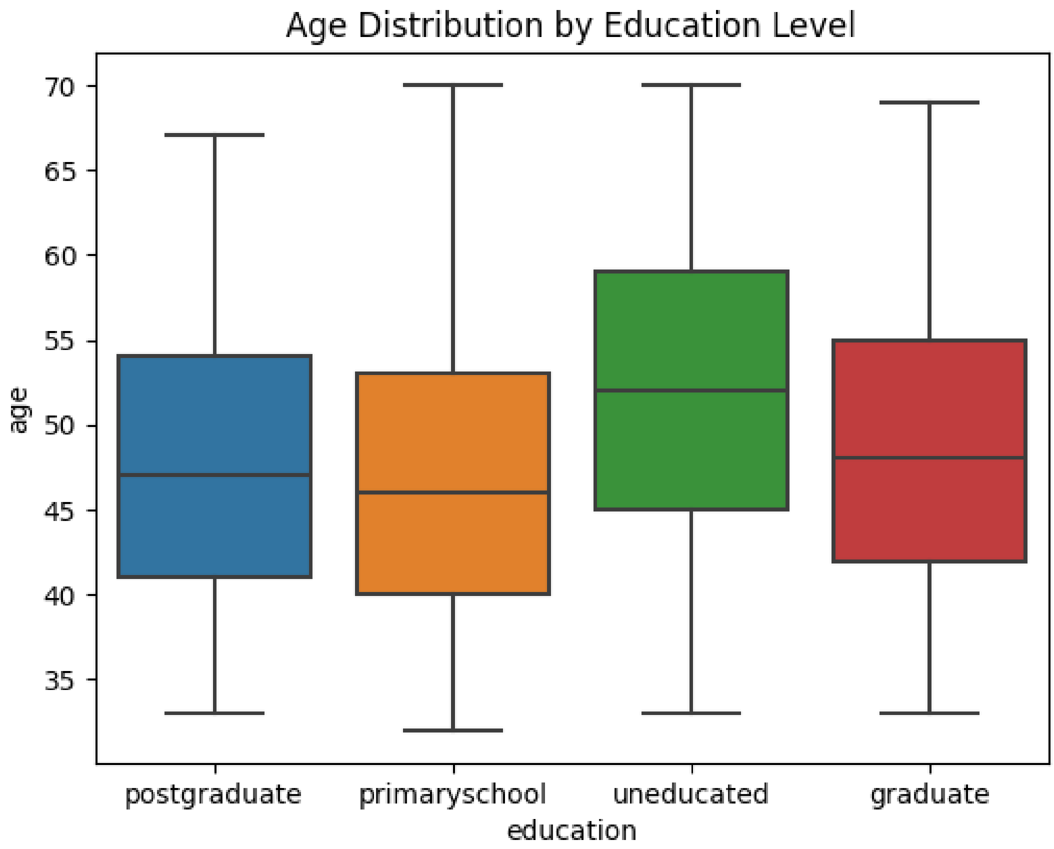


[ ]:

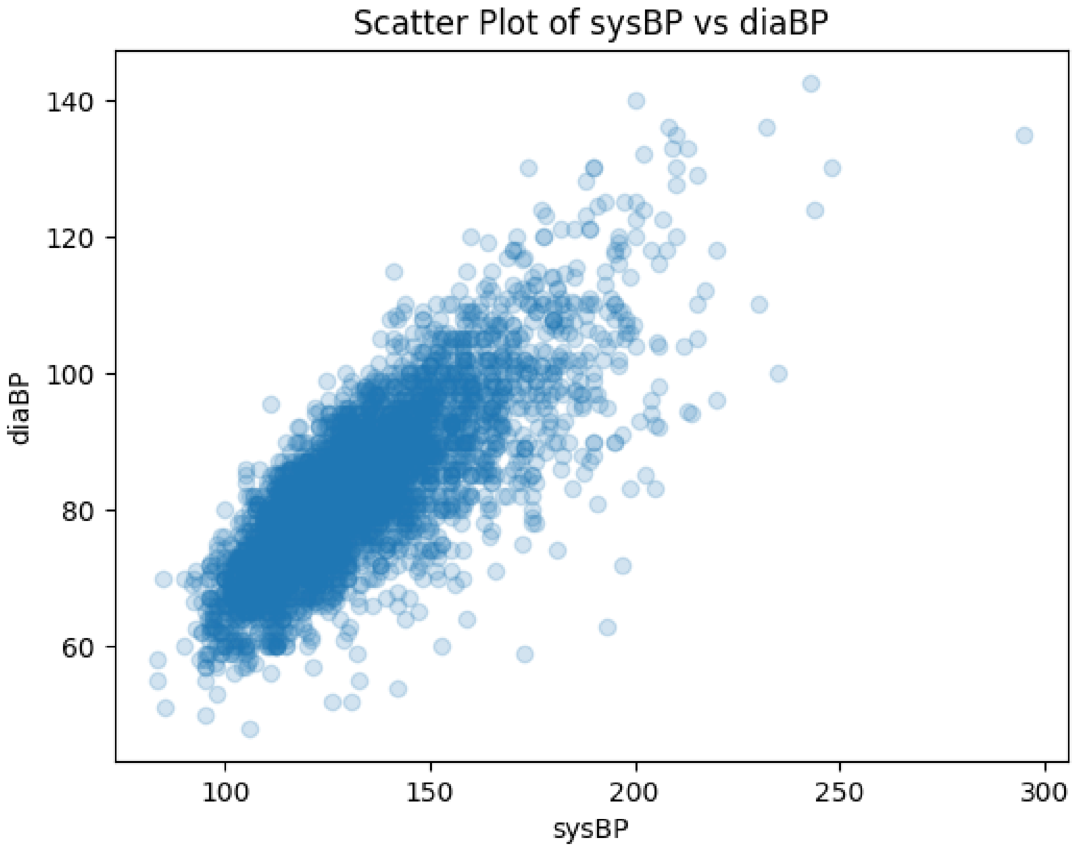
```
sns.boxplot(x='education', y='age', data= df)
plt.title('Age Distribution by Education Level')
plt.show()
```

```
c:\Users\marvellous\AppData\Local\Programs\Python\Python310\lib\site-
packages\seaborn\_oldcore.py:1498: FutureWarning: is_categorical_dtype is
deprecated and will be removed in a future version. Use isinstance(dtype,
CategoricalDtype) instead
  if pd.api.types.is_categorical_dtype(vector):
c:\Users\marvellous\AppData\Local\Programs\Python\Python310\lib\site-
packages\seaborn\_oldcore.py:1498: FutureWarning: is_categorical_dtype is
deprecated and will be removed in a future version. Use isinstance(dtype,
CategoricalDtype) instead
  if pd.api.types.is_categorical_dtype(vector):
```

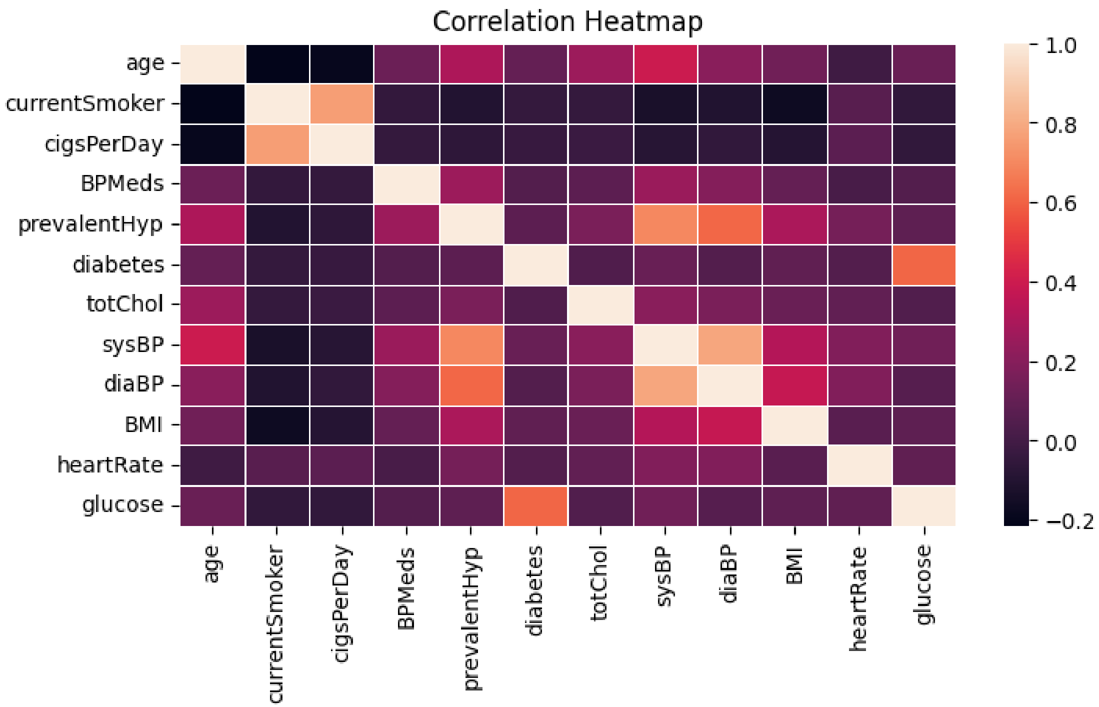
```
c:\Users\marvellous\AppData\Local\Programs\Python\Python310\lib\site-
packages\seaborn\_oldcore.py:1498: FutureWarning: is_categorical_dtype is
deprecated and will be removed in a future version. Use isinstance(dtype,
CategoricalDtype) instead
  if pd.api.types.is_categorical_dtype(vector):
```



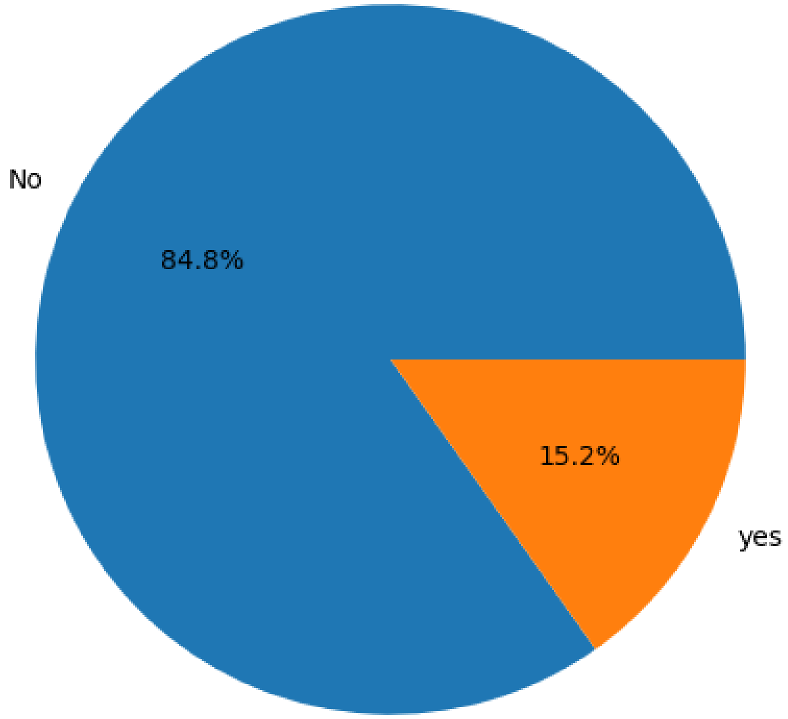
```
[ ]: plt.scatter(df['sysBP'], df['diaBP'], alpha = 0.2)
     plt.title('Scatter Plot of sysBP vs diaBP')
     plt.xlabel('sysBP')
     plt.ylabel('diaBP')
     plt.show()
```



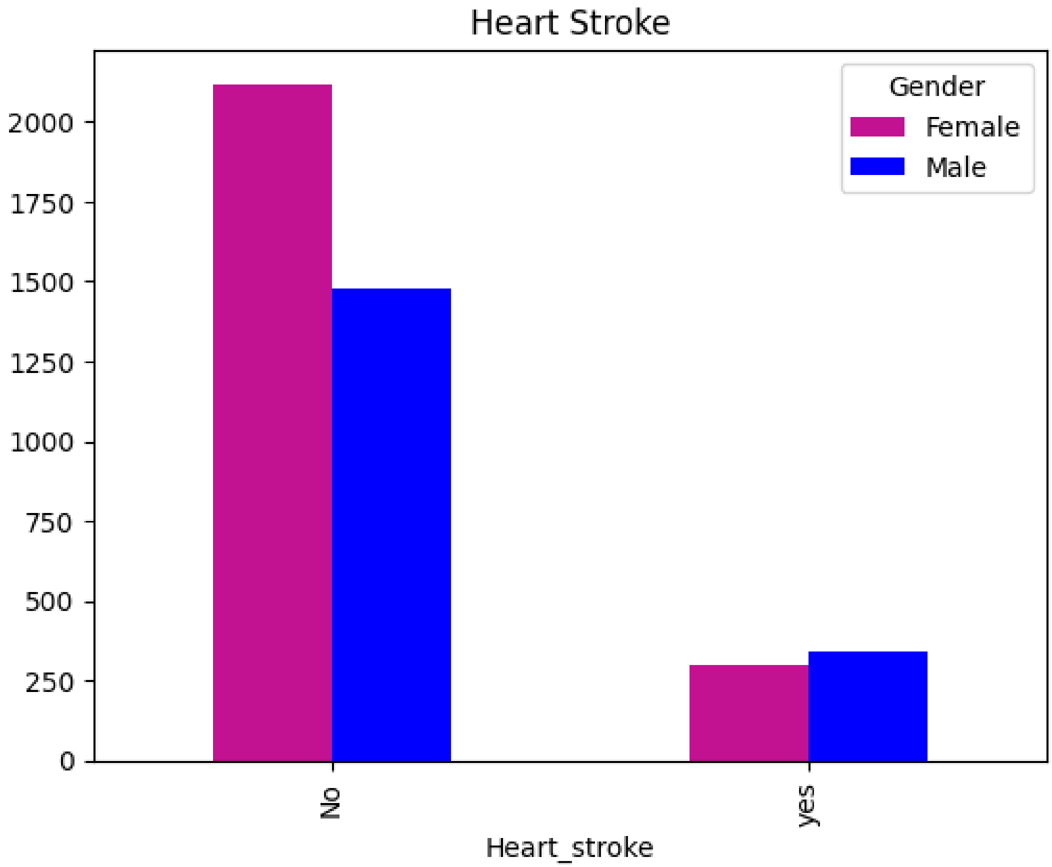
```
[ ]: correlation_matrix = df.corr(numeric_only = True)
     plt.figure(figsize=(8, 4))
     sns.heatmap(correlation_matrix, linewidths=0.7)
     plt.title('Correlation Heatmap')
     plt.show()
```



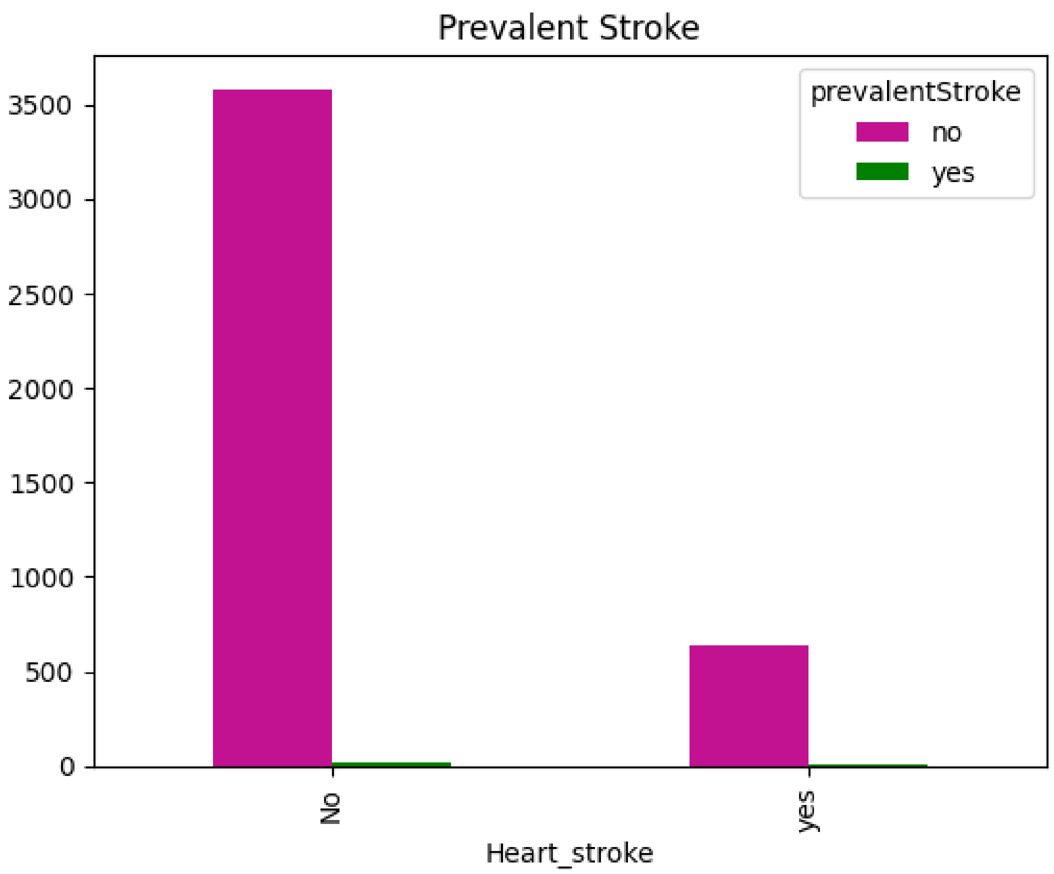
```
[ ]: plt.figure(figsize=(10, 6))
     plt.pie(df['Heart_stroke'].value_counts(),autopct='%1.
      ↪1f%%',labels=df['Heart_stroke'].value_counts().index,)
     plt.show()
```



```
[ ]: grouped_df = df.groupby(['Heart_stroke', 'Gender',]).size().
       ↪unstack(fill_value=0)
     grouped_df.plot(kind='bar', color=['#C21292', 'blue'] )
     plt.title('Heart Stroke')
     plt.show()
```



```
[ ]: groupeddf = df.groupby(['Heart_stroke', 'prevalentStroke',]).size().
       ↪unstack(fill_value=0)
     groupeddf.plot(kind='bar', color=['#C21292', 'Green'] )
     plt.title('Prevalent Stroke')
     plt.show()
```



[ ]:

```
plt.figure(figsize=(8, 4))
sns.countplot(x='education', data=df)
plt.title('Distribution of Education Levels')
plt.xlabel('Education Level')
plt.ylabel('Count')
plt.show()
```

```
c:\Users\marvellous\AppData\Local\Programs\Python\Python310\lib\site-
packages\seaborn\_oldcore.py:1498: FutureWarning: is_categorical_dtype is
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packages\seaborn\_oldcore.py:1498: FutureWarning: is_categorical_dtype is
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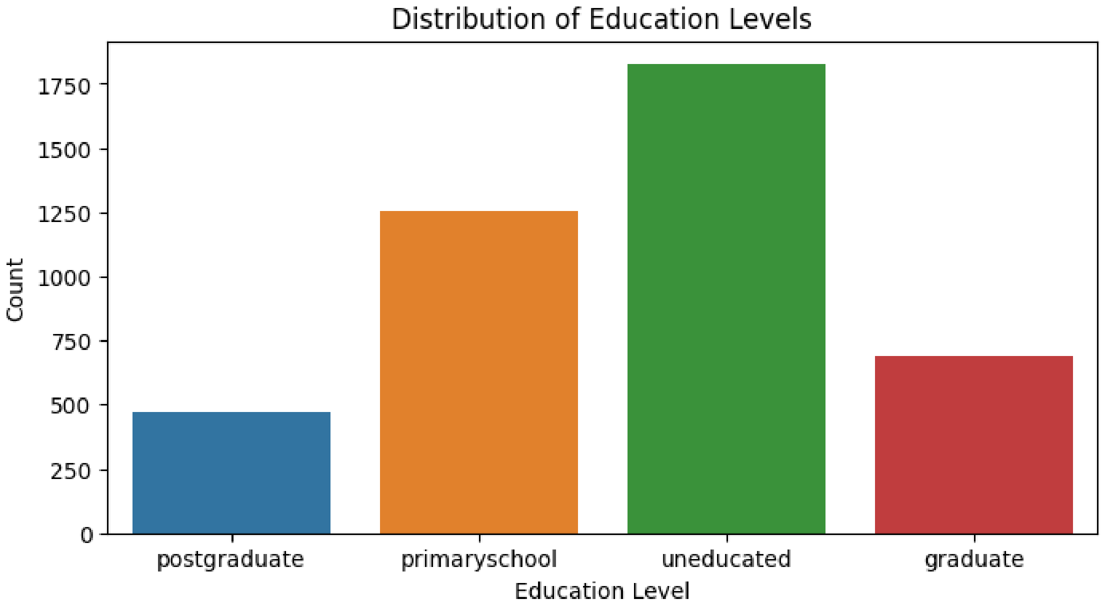
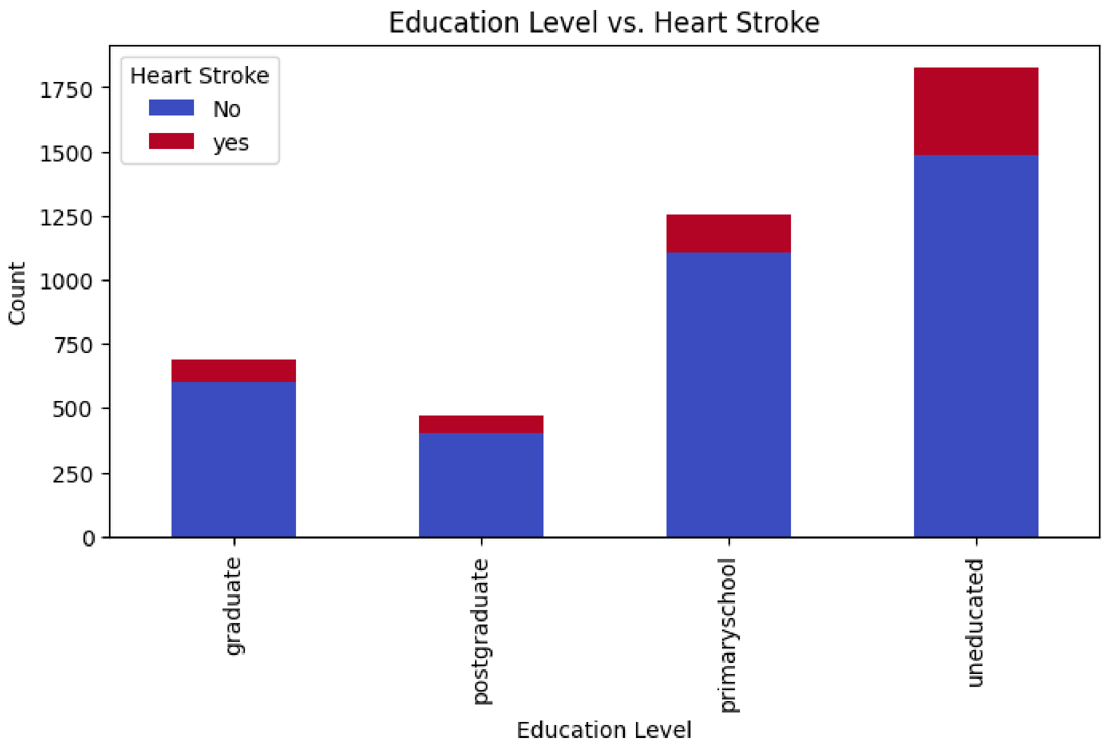
c:\Users\marvellous\AppData\Local\Programs\Python\Python310\lib\site-
packages\seaborn\_oldcore.py:1498: FutureWarning: is_categorical_dtype is
deprecated and will be removed in a future version. Use isinstance(dtype,
CategoricalDtype) instead
  if pd.api.types.is_categorical_dtype(vector):
```



[ ]:

```
education_counts = df.groupby(['education', 'Heart_stroke']).size().unstack()
education_counts.plot(kind='bar', stacked=True, figsize=(8, 4),␣
  ↪colormap='coolwarm')
plt.title('Education Level vs. Heart Stroke')
plt.xlabel('Education Level')
plt.ylabel('Count')
plt.legend(title='Heart Stroke')
plt.show()
```



Group by function

```
[ ]: education_counts = df.groupby(['education', 'Heart_stroke']).size().
      ↪unstack(fill_value = 0)

     print(education_counts)
```

```
Heart_stroke     No  yes
education
graduate        599   88
postgraduate    403   70
primaryschool  1106  147
uneducated     1486  339
```

```
[ ]:
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