October 23, 2024

[5]:
```
import pandas as pd
```

[6]:
```
data = pd.read_csv('C:\\Users\\SRINIVASA SESHADRI␣
↪K\\OneDrive\\Documents\\MainFlow Services and Technologies Internship\\Task␣
↪6  Diabetes Analysis)\\diabetes_data.csv')
```

[7]:
```
type(data)
```

[7]:
```
pandas.core.frame.DataFrame
```

[8]:
```
data.shape
```

[8]:
```
(1879, 46)
```

[9]:
```
data.head(5)
```

[9]:

	PatientID	Age	Gender	Ethnicity	SocioeconomicStatus	EducationLevel	…
0	600044	0	1	2	1		
1	600151	1	0	1	2		
2	600289	1	0	1	3		
3	600321	1	1	1	2		
4	600427	1	0	1	3		

	BMI	Smoking	AlcoholConsumption	PhysicalActivity	…
0	32.985284	1	4.499365	2.443385	…
1	39.916764	0	1.578919	8.301264	…
2	19.782251	0	1.177301	6.103395	…
3	32.376881	1	1.714621	8.645465	…
4	16.808600	0	15.462549	4.629383	…

	TinglingHandsFeet	QualityOfLifeScore	HeavyMetalsExposure	OccupationalExposureChemicals	WaterQuality	MedicalCheckupsFrequency	…
0	1	73.765109	0	0	0	1.782724	
1	0	91.445753	0	1	0	3.381070	
2	0	54.485744	0	0	0	2.701019	
3	0	77.866758	0	1	0	1.409056	
4	0	37.731808	0	0	0	1.218452	

```
   MedicationAdherence HealthLiteracy Diagnosis DoctorInCharge
0           4.486980      7.211349         1   Confidential
1           5.961705      5.024612         1   Confidential
2           8.950821      7.034944         0   Confidential
3           3.124769      4.717774         0   Confidential
4           6.977741      7.887940         0   Confidential
[5 rows x 46 columns]
```

[10]:
```
data.tail(4)
```

[10]:
```
      PatientID Age Gender Ethnicity SocioeconomicStatus EducationLevel \
1875      7875   80      1         0                  2              2
1876      7876   38      1         0                  0              2
1877      7877   43      0         1                  2              0
1878      7878   85      1         0                  2              2

              BMI Smoking AlcoholConsumption PhysicalActivity … \
1875 27.694312   0     16.067905  7.107335 …
1876 35.640824   0     4.865124   9.881212 …
1877 32.423016   0     6.362936   4.750079 …
1878 33.145119   0     13.854861  5.434137 …

      TinglingHandsFeet QualityOfLifeScore HeavyMetalsExposure \
1875                  0  77.128599  0
1876                  0  13.148221  0
1877                  0  54.370980  0
1878                  1  43.720860  0

     OccupationalExposureChemicals WaterQuality MedicalCheckupsFrequency \
1875                             0            1                 0.424893
1876                             0            0                 0.553757
1877                             0            0                 1.132470
1878                             0            1                 3.070583
      MedicationAdherence HealthLiteracy Diagnosis DoctorInCharge
1875             5.217465      0.915878         1   Confidential
1876             3.377744      3.017481         1   Confidential
1877             0.009250      4.914556         1   Confidential
1878             8.483128      7.790921         1   Confidential
[4 rows x 46 columns]
```

[11]:
```
data.info()
```

```
<class
'pandas.core.frame.DataFrame'>
RangeIndex: 1879 entries, 0 to
1878 Data columns (total 46
columns):
```

```
#   Column                       Non-Null Count Dtype
--- ------                       -------------- -----
0   PatientID                    1879 non-nullint64
1    Age                         1879 non-nullint64
2   Gender                       1879 non-nullint64
3   Ethnicity                    1879 non-nullint64
4  SocioeconomicStatus           1879 non-nullint64
5  EducationLevel                1879 non-nullint64
6    BMI                         1879 non-nullfloat64
7   Smoking                      1879 non-nullint64
8  AlcoholConsumption            1879 non-nullfloat64
9  PhysicalActivity              1879 non-nullfloat64
 10 DietQuality                  1879 non-nullfloat64
 11 SleepQuality                 1879 non-nullfloat64
 12 FamilyHistoryDiabetes        1879 non-nullint64
 13 GestationalDiabetes          1879 non-nullint64
 14 PolycysticOvarySyndrome      1879 non-nullint64
 15 PreviousPreDiabetes          1879 non-nullint64
 16 Hypertension                 1879 non-nullint64
 17 SystolicBP                   1879 non-nullint64
 18 DiastolicBP                  1879 non-nullint64
 19 FastingBloodSugar            1879 non-nullfloat64
 20 HbA1c                        1879 non-nullfloat64
 21 SerumCreatinine              1879 non-nullfloat64
 22 BUNLevels                    1879 non-nullfloat64
 23 CholesterolTotal             1879 non-nullfloat64
 24 CholesterolLDL               1879 non-nullfloat64
 25 CholesterolHDL               1879 non-nullfloat64
 26 CholesterolTriglycerides     1879 non-nullfloat64
 27 AntihypertensiveMedications1879 non-nullint64
 28 Statins                      1879 non-nullint64
 29 AntidiabeticMedications      1879 non-nullint64
 30 FrequentUrination            1879 non-nullint64
 31 ExcessiveThirst              1879 non-nullint64
 32 UnexplainedWeightLoss        1879 non-nullint64
 33 FatigueLevels                1879 non-nullfloat64
 34 BlurredVision                1879 non-nullint64
 35 SlowHealingSores             1879 non-nullint64
 36 TinglingHandsFeet            1879 non-nullint64
37 QualityOfLifeScore           1879 non-null float64
38 HeavyMetalsExposure          1879 non-null int64
 39 OccupationalExposureChemicals 1879 non-  int64
 null
40 WaterQuality                 1879 non-null int64
41 MedicalCheckupsFrequency     1879 non-null float64
42 MedicationAdherence          1879 non-null float64
43 HealthLiteracy               1879 non-null float64
```

```
44 Diagnosis                    1879 non-null int64
45 DoctorInCharge               1879 non-null object
dtypes: float64(18), int64(27),
object(1) memory usage: 675.4+ KB
```

[12]:
```
data.describe()
```

[12]:
```
PatientID  Age   Gender     Ethnicity \ count
1879.000000 1879.000000 1879.000000 1879.000000
mean  6939.000000  55.043108   0.487493   0.755721
std   542.564896   20.515839   0.499977   1.047558
min   6000.000000  20.000000   0.000000   0.000000
25%   6469.500000  38.000000   0.000000   0.000000
50%   6939.000000  55.000000   0.000000   0.000000
75%   7408.500000  73.000000   1.000000   1.000000
max   7878.000000  90.000000   1.000000   3.000000

      SocioeconomicStatus EducationLevel     BMI     Smoking \
count       1879.000000  1879.000000 1879.000000 1879.000000
mean           0.992017     1.699308   27.687601   0.281533
std            0.764940     0.885665    7.190975   0.449866
min            0.000000     0.000000   15.025898   0.000000
25%            0.000000     1.000000   21.469981   0.000000
50%            1.000000     2.000000   27.722988   0.000000
75%            2.000000     2.000000   33.856460   1.000000
max            2.000000     3.000000   39.998811   1.000000

      AlcoholConsumption PhysicalActivity … SlowHealingSores
      \
count      1879.000000     1879.000000 …     1879.000000
mean         10.096587        5.200790 …        0.102714
std           5.914216        2.857012 …        0.303666
min           0.000928        0.004089 …        0.000000
25%           4.789725        2.751022 …        0.000000
50%          10.173865        5.249002 …        0.000000
75%          15.285359        7.671402 …        0.000000
max          19.996231        9.993893 …        1.000000

      TinglingHandsFeet QualityOfLifeScore
      HeavyMetalsExposure \
count     1879.000000       1879.000000       1879.000000
mean         0.111229         48.508643          0.052155
std          0.314500         28.758488          0.222400

min          0.000000          0.002390          0.000000

25%          0.000000         23.974098          0.000000

50%          0.000000         47.519693          0.000000
```

```
      75%           0.000000         72.883179          0.000000
      max           1.000000         99.788530          1.000000

OccupationalExposureChemicals WaterQuality MedicalCheckupsFrequency \
      count                 1879.000000 1879.000000           1879.000000
      mean                     0.103246    0.200639              1.997101
      std                      0.304361    0.400585              1.122632
      min                      0.000000    0.000000              0.004013
      25%                      0.000000    0.000000              1.057801
      50%                      0.000000    0.000000              1.987170
      75%                      0.000000    0.000000              2.946019
      max                      1.000000 1.000000                 3.999715

MedicationAdherence HealthLiteracy Diagnosis
      count        1879.000000   1879.000000 1879.000000
      mean            4.957539      5.011736    0.400213
      std             2.910934      2.920908    0.490072
      min             0.005384      0.000362    0.000000
      25%             2.420024      2.410113    0.000000
      50%             4.843886      5.035208    0.000000
      75%             7.513933      7.586865    1.000000
      max             9.997165      9.993029    1.000000

      [8 rows x 45 columns]
```

[13]:
```
data = data.drop_duplicates()
data
```

[13]:
```
   PatientID Age Gender Ethnicity SocioeconomicStatus EducationLevel \
0       6000   44      0         1                  2              1
1       6001   51      1         0                  1              2
2       6002   89      1         0                  1              3
3       6003   21      1         1                  1              2
4       6004   27      1         0                  1              3
…        … …     …       …                  …              …
1874    7874   37      0         0                  2              2
1875    7875   80      1         0                  2              2
1876    7876   38      1         0                  0              2
```

```
      1877      7877   43    0     1     2     0
      1878      7878   85    1     0     2     2

                BMI Smoking AlcoholConsumption PhysicalActivity … \
0     32.985284   1     4.499365   2.443385 …
1     39.916764   0     1.578919   8.301264 …
2     19.782251   0     1.177301   6.103395 …
3     32.376881   1     1.714621   8.645465 …
4     16.808600   0     15.462549  4.629383 …
      …         …     …                …              … …
1874  20.811137   0     10.946207  3.217636 …
1875  27.694312   0     16.067905  7.107335 …
1876  35.640824   0     4.865124   9.881212 …
1877  32.423016   0     6.362936   4.750079 …
1878  33.145119   0     13.854861  5.434137 …

           TinglingHandsFeet QualityOfLifeScore HeavyMetalsExposure \
      0                    1         73.765109                   0
      1                    0         91.445753                   0
      2                    0         54.485744                   0
      3                    0         77.866758                   0
      4                    0         37.731808                   0
      …                  …             …                     …
      1874                 1         88.122729                   0
      1875                 0         77.128599                   0
      1876                 0         13.148221                   0
      1877                 0         54.370980                   0
      1878                 1         43.720860                   0

     OccupationalExposureChemicals WaterQuality MedicalCheckupsFrequency \
      0                            0           0                1.782724
      1                            0           1                3.381070
      2                            0           0                2.701019
      3                            0           1                1.409056
```

```
4                              0           0                1.218452
…                            …           …                      …
1874                           0           1                3.154225
1875                           0           1                0.424893
1876                           0           0                0.553757
1877                           0           0                1.132470
1878                           0           1                3.070583

      MedicationAdherence HealthLiteracy Diagnosis DoctorInCharge
0                4.486980      7.211349         1   Confidential
1                5.961705      5.024612         1   Confidential
2                8.950821      7.034944         0   Confidential
3                3.124769      4.717774         0   Confidential
4                6.977741      7.887940         0   Confidential
…                     …             …       …              …
1874             3.849584      8.805087         0   Confidential
1875             5.217465      0.915878         1   Confidential
1876             3.377744      3.017481         1   Confidential
1877             0.009250      4.914556         1  Confidential
1878             8.483128      7.790921         1  Confidential
[1879 rows x 46 columns]
```

[14]:
```
data.isnull()
```

[14]:
```
      PatientID  Age Gender Ethnicity SocioeconomicStatus \
0         False False  False     False              False
1         False False  False     False              False
2         False False  False     False              False
3         False False  False     False              False
4         False False  False     False              False
…         …     …      …         …                  …
1874      False False  False     False              False
1875      False False  False     False              False
1876      False False  False     False              False
```

```
1877     False False  False     False             False
1878     False False  False     False             False

                    BMI         Smoking         AlcoholConsumption
     EducationLevel  PhysicalActivity \
0             False False   False            False          False
1             False False   False            False          False
2             False False   False            False          False
3             False False   False            False          False
4             False False   False            False          False
…             …    …     …                …              …
1874          False False   False            False          False
1875          False False   False            False          False
1876          False False   False            False          False
1877          False False   False            False          False
1878          False False   False            False          False

      … TinglingHandsFeet QualityOfLifeScore HeavyMetalsExposure \
0     …             False            False             False
1     …             False            False             False
2     …             False            False             False
3     …             False            False             False
4     …             False            False             False
… …                 …                …                 …
1874  …             False            False             False
1875  …             False            False             False
1876  …             False            False             False
1877  …             False            False             False
1878  …             False            False             False

OccupationalExposureChemicals WaterQuality MedicalCheckupsFrequency \
 0                          False       False                  False
 1                          False       False                  False
 2                          False       False                  False
```

```
3                         False       False                 False
4                         False       False                 False
…                         …           …                     …
1874                      False       False                 False
1875                      False       False                 False
1876                      False       False                 False
1877                      False       False                 False
1878                      False       False                 False

      MedicationAdherence  HealthLiteracy  Diagnosis  DoctorInCharge
0                   False           False      False           False
1                   False           False      False           False
2                   False           False      False           False
3                   False           False      False           False
4                   False           False      False           False
…                   …               …          …               …
1874                False           False      False           False
1875                False           False      False           False
1876                False           False      False           False
1877                False           False      False           False
1878                False           False      False           False

[1879 rows x 46 columns]
```

[15]:
```
data.isnull().sum()
```

[15]:
```
PatientID                0
Age                      0
Gender                   0
Ethnicity                0
SocioeconomicStatus      0
EducationLevel           0
BMI                      0
Smoking                  0
AlcoholConsumption       0
PhysicalActivity         0
DietQuality              0
SleepQuality             0
```

```
FamilyHistoryDiabetes          0
GestationalDiabetes            0
PolycysticOvarySyndrome        0
PreviousPreDiabetes            0
Hypertension                   0
SystolicBP                     0
DiastolicBP                    0
FastingBloodSugar              0
HbA1c                          0
SerumCreatinine                0
BUNLevels                      0
CholesterolTotal               0
CholesterolLDL                 0
CholesterolHDL                 0
CholesterolTriglycerides       0
AntihypertensiveMedications    0
Statins                        0
AntidiabeticMedications        0
FrequentUrination              0
ExcessiveThirst                0
UnexplainedWeightLoss          0
FatigueLevels                  0
BlurredVision                  0
SlowHealingSores               0
TinglingHandsFeet              0
QualityOfLifeScore             0
HeavyMetalsExposure            0
OccupationalExposureChemicals  0
WaterQuality                   0
MedicalCheckupsFrequency       0
MedicationAdherence            0
HealthLiteracy                 0
Diagnosis                      0
DoctorInCharge                 0
dtype: int64
```

[16]:
```
data.isnull().sum().sum()
```

[16]: 0

[17]:
```
import numpy as np
from scipy import stats
```

[18]:
```
data.columns
```

[18]: Index(['PatientID', 'Age', 'Gender', 'Ethnicity',
'SocioeconomicStatus',

```
        'EducationLevel', 'BMI', 'Smoking', 'AlcoholConsumption',
        'PhysicalActivity', 'DietQuality', 'SleepQuality',
        'FamilyHistoryDiabetes', 'GestationalDiabetes',
        'PolycysticOvarySyndrome', 'PreviousPreDiabetes',
        'Hypertension',
        'SystolicBP', 'DiastolicBP', 'FastingBloodSugar', 'HbA1c',
        'SerumCreatinine', 'BUNLevels', 'CholesterolTotal',
        'CholesterolLDL',
        'CholesterolHDL', 'CholesterolTriglycerides',
        'AntihypertensiveMedications', 'Statins',
        'AntidiabeticMedications',
        'FrequentUrination', 'ExcessiveThirst',
        'UnexplainedWeightLoss',
        'FatigueLevels', 'BlurredVision', 'SlowHealingSores',
        'TinglingHandsFeet', 'QualityOfLifeScore',
        'HeavyMetalsExposure',
        'OccupationalExposureChemicals', 'WaterQuality',
        'MedicalCheckupsFrequency', 'MedicationAdherence',
        'HealthLiteracy',
        'Diagnosis', 'DoctorInCharge'],
       dtype='object')
```

[19]:
```
data.drop(['PatientID', 'Gender', 'Ethnicity',
'SocioeconomicStatus',
           'EducationLevel', 'Smoking', 'AlcoholConsumption',
           'FamilyHistoryDiabetes', 'GestationalDiabetes',
           'PolycysticOvarySyndrome', 'PreviousPreDiabetes',
           'Hypertension', 'AntihypertensiveMedications',
           'Statins', 'AntidiabeticMedications', 'FrequentUrination',
           'ExcessiveThirst', 'UnexplainedWeightLoss',
           'BlurredVision', 'SlowHealingSores', 'TinglingHandsFeet',
           'HeavyMetalsExposure', 'OccupationalExposureChemicals',
           'WaterQuality', 'Diagnosis',
          'DoctorInCharge'], axis=1, inplace=True)
print(data.head())
```

```
   Age     BMI PhysicalActivity DietQuality SleepQuality SystolicBP \
0   44 32.985284        2.443385   4.898831     4.049885         93
1   51 39.916764        8.301264   8.941093     7.508150        165
2   89 19.782251        6.103395   7.722543     7.708387        119
3   21 32.376881        8.645465   4.804044     6.286548        169
4   27 16.808600        4.629383   2.532756     9.771125        165

                                  HbA1c SerumCreatinine BUNLevels
   DiastolicBP FastingBloodSugar \
0           73     163.687162 9.283631      2.665607 28.190147
```

```
1          99     188.347070 7.326870   4.172177 32.149491
2          91     127.703653 4.083426   1.973168 10.018375
3          87     82.688415 6.516645    3.057797 44.123281
4          69     90.743395 5.607222    4.150353   7.757117

 CholesterolTotal CholesterolLDL CholesterolHDL CholesterolTriglycerides \
0      254.270670     86.993627     70.801469            190.335834
1      155.358831    110.056105     39.900112             81.172469
2      231.608922     62.035793     62.480666            279.809069
3      176.592374     68.238410     46.977819            112.751396
4      157.344121     66.476215     40.059755            381.528785
   FatigueLevels QualityOfLifeScore MedicalCheckupsFrequency \
0      9.534169         73.765109              1.782724
1      0.123214         91.445753              3.381070
2      9.643320         54.485744              2.701019
3      3.403557         77.866758              1.409056
4      2.924687         37.731808              1.218452

   MedicationAdherence HealthLiteracy
0     4.486980   7.211349 1
      5.961705   5.024612 2
      8.950821   7.034944
3           3.124769      4.717774
4            6.977741       7.887940
```

[20]:
```
Q1=data.quantile(0.25)
Q3=data.quantile(0.75)
IQR=Q3-Q1
print(IQR)
```

```
Age                         35.000000
BMI                         12.386479
PhysicalActivity             4.920380
DietQuality                  4.879256
SleepQuality                 3.042025
SystolicBP                  44.000000
DiastolicBP                 30.000000
FastingBloodSugar           65.020892
HbA1c                        2.979356
SerumCreatinine              2.243660
BUNLevels                   21.334289
CholesterolTotal            76.596373
CholesterolLDL              73.813498
CholesterolHDL              40.047150
CholesterolTriglycerides172.535014
FatigueLevels                5.152024
```

```
QualityOfLifeScore        48.909081
MedicalCheckupsFrequency   1.888217
MedicationAdherence        5.093910
HealthLiteracy             5.176752
dtype: float64
```

[21]:
```
data[~((data< (Q1-1.5*IQR) ) | (data>(Q3+1.5*IQR)) ) .any(axis=1)]
data
```

[21]:

	Age	BMI	PhysicalActivity	DietQuality	SleepQuality	SystolicBP	DiastolicBP	FastingBloodSugar	HbA1c	SerumCreatinine	BUNLevels
0	44	32.985284	2.443385	4.898831	4.049885	93	73	163.687162	9.283631	2.665607	28.190147
1	51	39.916764	8.301264	8.941093	7.508150	165	99	188.347070	7.326870	4.172177	32.149491
2	89	19.782251	6.103395	7.722543	7.708387	119	91	127.703653	4.083426	1.973168	10.018375
3	21	32.376881	8.645465	4.804044	6.286548	169	87	82.688415	6.516645	3.057797	44.123281
4	27	16.808600	4.629383	2.532756	9.771125	165	69	90.743395	5.607222	4.150353	7.757117
…	…	…	…	…	…	…	…	…	…	…	…
1874	37	20.811137	3.217636	8.338196	8.703430	104	74	109.832032	5.920723	3.984707	21.645433
1875	80	27.694312	7.107335	3.034771	4.472689	166	115	90.729361	7.332397	2.132178	7.433835
1876	38	35.640824	9.881212	2.657002	4.812610	128	70	149.366801	4.907208	2.195365	26.225481
1877	43	32.423016	4.750079	8.736024	7.017390	124	91	162.027044	8.820613	0.893745	41.555665
1878	85	33.145119	5.434137	5.127496	4.924963	134	86	175.011749	7.814477	4.607711	28.471762

```
     CholesterolTotal CholesterolLDL CholesterolHDL \
0          254.270670     86.993627     70.801469
1          155.358831    110.056105     39.900112
2          231.608922     62.035793     62.480666
3          176.592374     68.238410     46.977819
4          157.344121     66.476215     40.059755
…                …            …             …
1874       260.342336     99.720234     40.296248
1875       273.728852    179.858432     48.873298
1876       293.513379    113.915759     62.217083
1877       178.559550    141.601955     74.116118
1878       268.635952     57.431715     73.728242
     CholesterolTriglycerides FatigueLevels QualityOfLifeScore \
0                  190.335834     9.534169         73.765109
1                   81.172469     0.123214         91.445753
2                  279.809069     9.643320         54.485744
3                  112.751396     3.403557         77.866758
4                  381.528785     2.924687         37.731808
…                         …            …                …
1874               198.613903     3.693506         88.122729
1875               271.239061     4.225031         77.128599
1876               374.429055     1.174257         13.148221
1877               171.298228     9.732583         54.370980
1878               174.869266     4.360088         43.720860
     MedicalCheckupsFrequency MedicationAdherence HealthLiteracy
0                    1.782724           4.486980       7.211349
1                    3.381070           5.961705       5.024612
2                    2.701019           8.950821       7.034944
3                    1.409056           3.124769       4.717774
4                    1.218452           6.977741       7.887940
…                         …                  …              …
1874                 3.154225           3.849584       8.805087
1875                 0.424893           5.217465       0.915878
1876                 0.553757           3.377744       3.017481
1877                 1.132470           0.009250       4.914556
1878                 3.070583           8.483128       7.790921
[1879 rows x 20 columns]
```

[22]:
```
data.describe()
```

[22]:
```
              Age       BMI PhysicalActivity DietQuality SleepQuality \
count 1879.000000 1879.000000   1879.000000 1879.0000001879.000000
mean    55.043108   27.687601      5.200790   4.895801    7.021328
std     20.515839    7.190975      2.857012   2.867144    1.729469
min     20.000000   15.025898      0.004089   0.000885    4.004336
25%     38.000000   21.469981      2.751022   2.476802    5.481789
50%     55.000000   27.722988      5.249002   4.888566    7.094692
```

```
75%    73.000000   33.856460        7.671402   7.356058    8.523814
max    90.000000   39.998811        9.993893   9.998677    9.989372
```

```
       SystolicBP DiastolicBP
       FastingBloodSugar                          HbA1c \
count 1879.000000 1879.000000    1879.000000 1879.000000
mean  134.050559   89.863757      135.204490   6.976133
std   25.613830    17.328086       37.515750   1.739365
min   90.000000    60.000000       70.074649   4.003089
25%   112.000000   75.000000      102.341470   5.443856
50%   134.000000   90.000000      137.398241   7.095732
75%   156.000000  105.000000      167.362362   8.423211
max   179.000000  119.000000      199.935506   9.991193
```

```
      SerumCreatinine              BUNLevels CholesterolTotal
      CholesterolLDL \
count   1879.000000 1879.000000    1879.000000   1879.000000
mean       2.784590  27.798153     225.006464    124.656831
std        1.308023  12.800797      43.367170     42.911145
min        0.500565   5.010401     150.056094     50.058252
25%        1.654472  17.172009     186.933051     87.810946
50%        2.855105  28.190147     225.120112    124.918023
75%        3.898133  38.506299     263.529424    161.624444
max        4.993974  49.975728     299.998480    199.898732
```

```
      CholesterolHDL CholesterolTriglycerides FatigueLevels \
count   1879.000000            1879.000000  1879.000000
mean      60.060944             227.386167     4.949003
std       23.316682             101.071578     2.884483
min       20.014494              50.154649     0.004977
25%       40.011963             140.873930     2.417748
50%       60.456988             228.417429     4.851914
75%       80.059112             313.408944     7.569772
max       99.958394             399.885928     9.999979
```

```
      QualityOfLifeScore               MedicalCheckupsFrequency
      MedicationAdherence \
count       1879.000000           1879.000000       1879.000000
mean          48.508643              1.997101          4.957539
std           28.758488              1.122632          2.910934
min            0.002390              0.004013          0.005384
25%           23.974098              1.057801          2.420024
50%           47.519693              1.987170          4.843886
75%           72.883179              2.946019          7.513933
max           99.788530              3.999715          9.997165
```

```
      HealthLiteracy
```

```
count    1879.000000
mean        5.011736
std         2.920908
min         0.000362
25%         2.410113
50%         5.035208
75%         7.586865
max         9.993029
```

[23]:
```
print(data.columns)
```

```
Index(['Age', 'BMI', 'PhysicalActivity', 'DietQuality',
'SleepQuality',
  'SystolicBP', 'DiastolicBP', 'FastingBloodSugar', 'HbA1c',
      'SerumCreatinine', 'BUNLevels', 'CholesterolTotal',
      'CholesterolLDL',
      'CholesterolHDL', 'CholesterolTriglycerides', 'FatigueLevels',
 'QualityOfLifeScore', 'MedicalCheckupsFrequency', 'MedicationAdherence',
      'HealthLiteracy'],
     dtype='object')
```

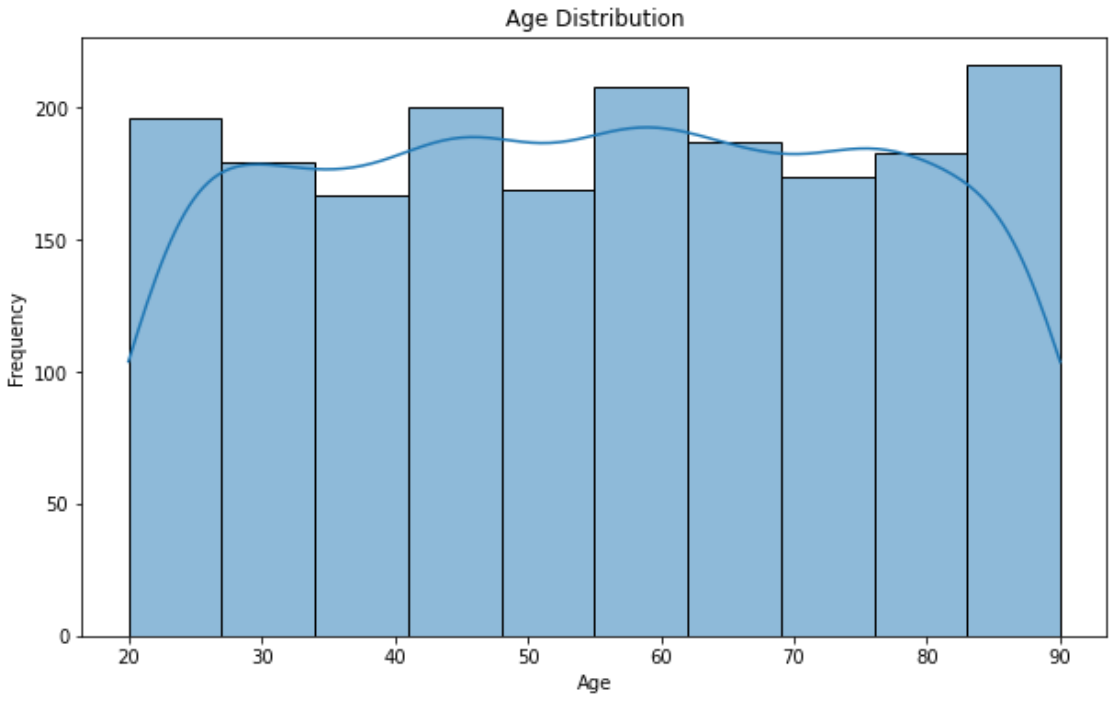
[67]:
```
'''
Questions
1. What is the overall distribution of ages in the dataset?
2. What is the distribution of BMI values among the participants?
3. How does physical activity level correlate with BMI?
4. Are there trends in physical activity levels across different age
   groups?
5. What are the average systolic and diastolic blood pressure
   readings across␣ ↪different age groups?
6. Are there patterns in fasting blood sugar levels based on BMI and
   age?
7. How do total cholesterol, LDL, HDL, and triglycerides compare among ␣
 ↪different age groups?
'''
```

[67]:
```
'\nQuestions \n1. What is the overall distribution of ages in the
dataset?\n2. What is the distribution of BMI values among the
participants?\n3. How does physical activity level correlate with
BMI?\n4. Are there trends in physical activity levels across
different age groups?\n5. What are the average systolic and diastolic
blood pressure readings across different age groups?\n6. Are there
```

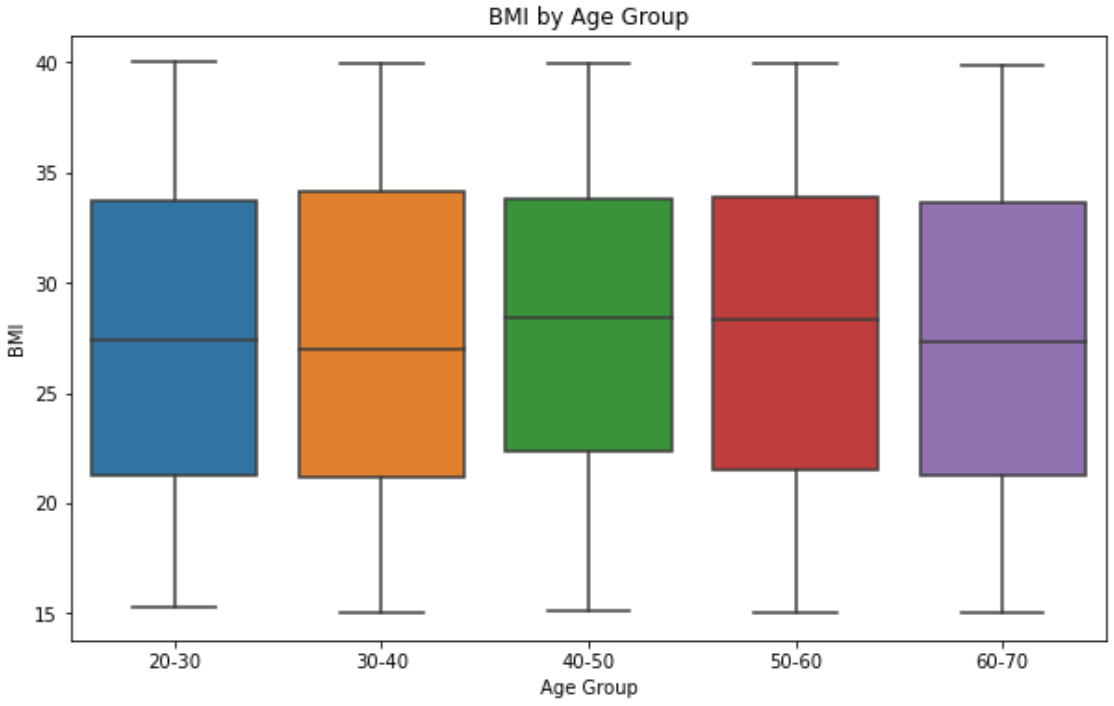
```
patterns in fasting blood sugar levels based on BMI and age?\n7. How
do total cholesterol, LDL, HDL, and triglycerides compare among
different age groups?\n'
```

[25]:
```
import seaborn as sns
import matplotlib.pyplot as plt
```

[41]:
```
# What is the overall distribution of ages in the dataset?
plt.figure(figsize=(10, 6))
sns.histplot(data['Age'], bins=10, kde=True)
plt.title('Age Distribution')
plt.xlabel('Age')
plt.ylabel('Frequency')
plt.show()
```



[27]:
```
#  What is the distribution of BMI values among the participants?
data['AgeGroup'] = pd.cut(data['Age'], bins=[20, 30, 40, 50, 60, 70],␣
 ↪labels=['20-30', '30-40', '40-50', '50-60', '60-70'])
plt.figure(figsize=(10, 6))
sns.boxplot(data=data, x='AgeGroup',  ='BMI')
plt.title('BMI by Age Group ')
plt.xlabel('Age Group')
plt.ylabel('BMI')
plt.show()
```

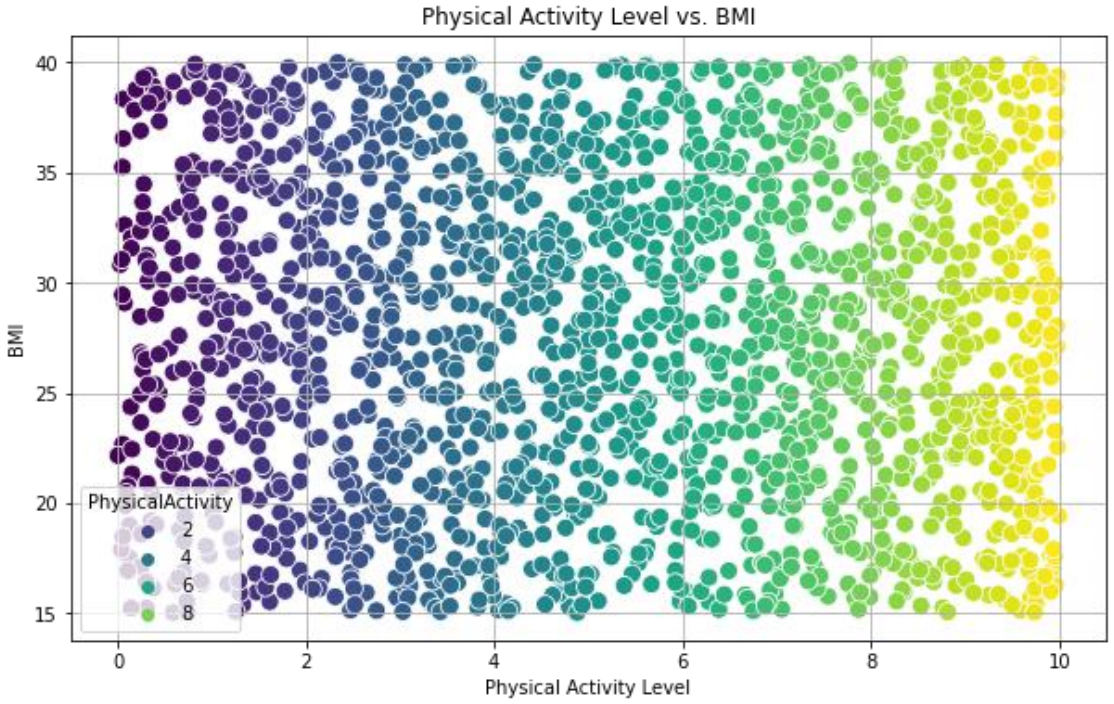


[28]:
```
print(data[['PhysicalActivity', 'BMI', 'SystolicBP',
'DiastolicBP']].describe()) print(data[['PhysicalActivity', 'BMI',
'SystolicBP', 'DiastolicBP']].nunique())
```

```
       PhysicalActivity         BMI   SystolicBP
                                     DiastolicBP
count     1879.000000 1879.000000 1879.000000 1879.000000
mean         5.200790   27.687601  134.050559   89.863757
std          2.857012    7.190975   25.613830   17.328086
min          0.004089   15.025898   90.000000   60.000000
25%          2.751022   21.469981  112.000000   75.000000
50%          5.249002   27.722988  134.000000   90.000000
75%          7.671402   33.856460  156.000000  105.000000
```

```
max           9.993893   39.998811  179.000000  119.000000
PhysicalActivity  1879
BMI               1879
SystolicBP          90
DiastolicBP         60
dtype: int64
```

[35]:
```
# How does physical activity level correlate with BMI or health metrics like␣
↪blood pressure?
# Scatter Plot for Physical Activity vs. BMI
plt.figure(figsize=(10, 6))
sns.scatterplot(data=data, x='PhysicalActivity',  ='BMI',␣
↪hue='PhysicalActivity', palette='viridis',  =100)
plt.title('Physical Activity Level vs. BMI ')
plt.xlabel('Physical Activity Level')
plt.ylabel('BMI')
plt.grid()
plt.show()
```



[30]:
```
# How does physical activity level correlate with BMI or health
metrics like␣ ↪blood pressure?
# Calculating and printing correlation coefficient for Physical
Activity and BMI correlation_bmi =
```

```
data['PhysicalActivity'].corr(data['BMI']) print(f'Correlation
between Physical Activity and BMI: {correlation_bmi:.2f}')
```

```
Correlation between Physical Activity and BMI: -0.00
```

[43]:
```
pd.crosstab(data.PhysicalActivity, data.AgeGroup)
```

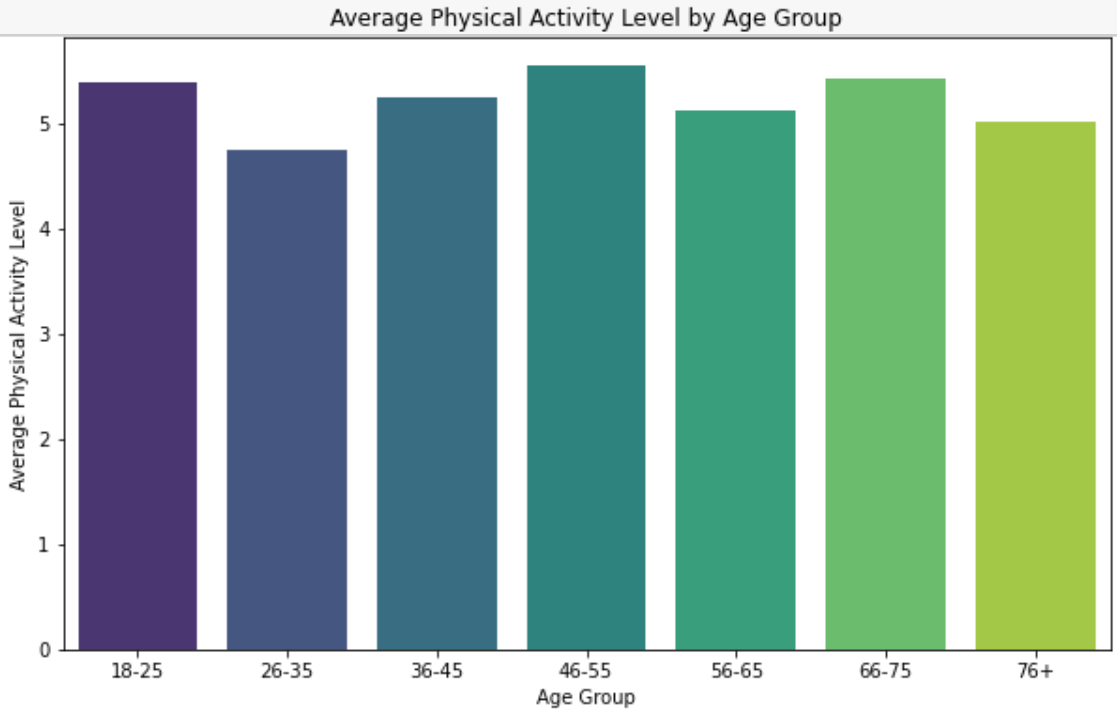
[43]:

AgeGroup	18-25	26-35	36-45	46-55	56-65	66-75	76+
PhysicalActivity							
0.004089	0	0	0	0	1	0	0
0.038327	0	0	1	0	0	0	0
0.045043	0	1	0	0	0	0	0
0.050365	0	1	0	0	0	0	0
0.051823	0	0	0	0	0	1	0
…	…	…	…	…	…	…	…
9.969412	0	0	0	0	1	0	0
9.969572	0	1	0	0	0	0	0
9.974534	0	1	0	0	0	0	0
9.980205	0	0	0	1	0	0	0
9.980646	0	0	0	1	0	0	0

[1714 rows x 7 columns]

[40]:
```
#Are there trends in physical activity levels across different age
groups?
    # Creating age groups
    bins = [18, 25, 35, 45, 55, 65, 75, 85]
    labels = ['18-25', '26-35', '36-45', '46-55', '56-65', '66-75',
    '76+'] data['AgeGroup'] = pd.cut(data['Age'], bins=bins,
    labels=labels, right=False)

    # Calculating average physical activity level by age group
    avg_activity_by_age =
    data.groupby('AgeGroup')['PhysicalActivity'].mean().
    ↪reset_index()

    # Bar Plot for Average Physical Activity by Age Group
    plt.figure(figsize=(10, 6))
    sns.barplot(data=avg_activity_by_age, x='AgeGroup',
    y='PhysicalActivity',␣
```

```
 ↪palette='viridis') plt.title('Average Physical
Activity Level by Age Group') plt.xlabel('Age
Group') plt.ylabel('Average Physical Activity
Level') plt.show()
```



[73]:
```
pd.crosstab(data.AgeGroup, data.SystolicBP)
```

[73]:

SystolicBP	90	91	92	93	94	95	96	97	98	99	…	170	171
AgeGroup											…		
18-25	0	2	1	1	1	3	2	5	0	2	…	2	1
26-35	6	4	2	3	8	1	1	2	3	6	…	7	3
36-45	1	2	0	4	1	4	3	4	2	1	…	2	2
46-55	3	1	1	5	5	5	4	1	2	2	…	5	3
56-65	2	3	1	3	1	1	5	0	2	2	…	7	3
66-75	2	1	0	5	3	3	5	4	3	2	…	1	1
76+	1	4	4	3	5	6	4	3	4	6	…	6	2

SystolicBP	172	173	174	175	176	177	178	179
AgeGroup								

```
18-25        2    1    1    0    0    0    1    4
26-35        2    2    2    1    2    2    5    4
36-45        3    3    3    0    2    1    2    2
46-55        3    6    4    3    1    0    2    4
56-65        5    5    5    2    3    1    7    3
66-75        2    1    1    1    3    5    4    1
76+          2    4    4    4    1    2    5    2

[7 rows x 90 columns]
```

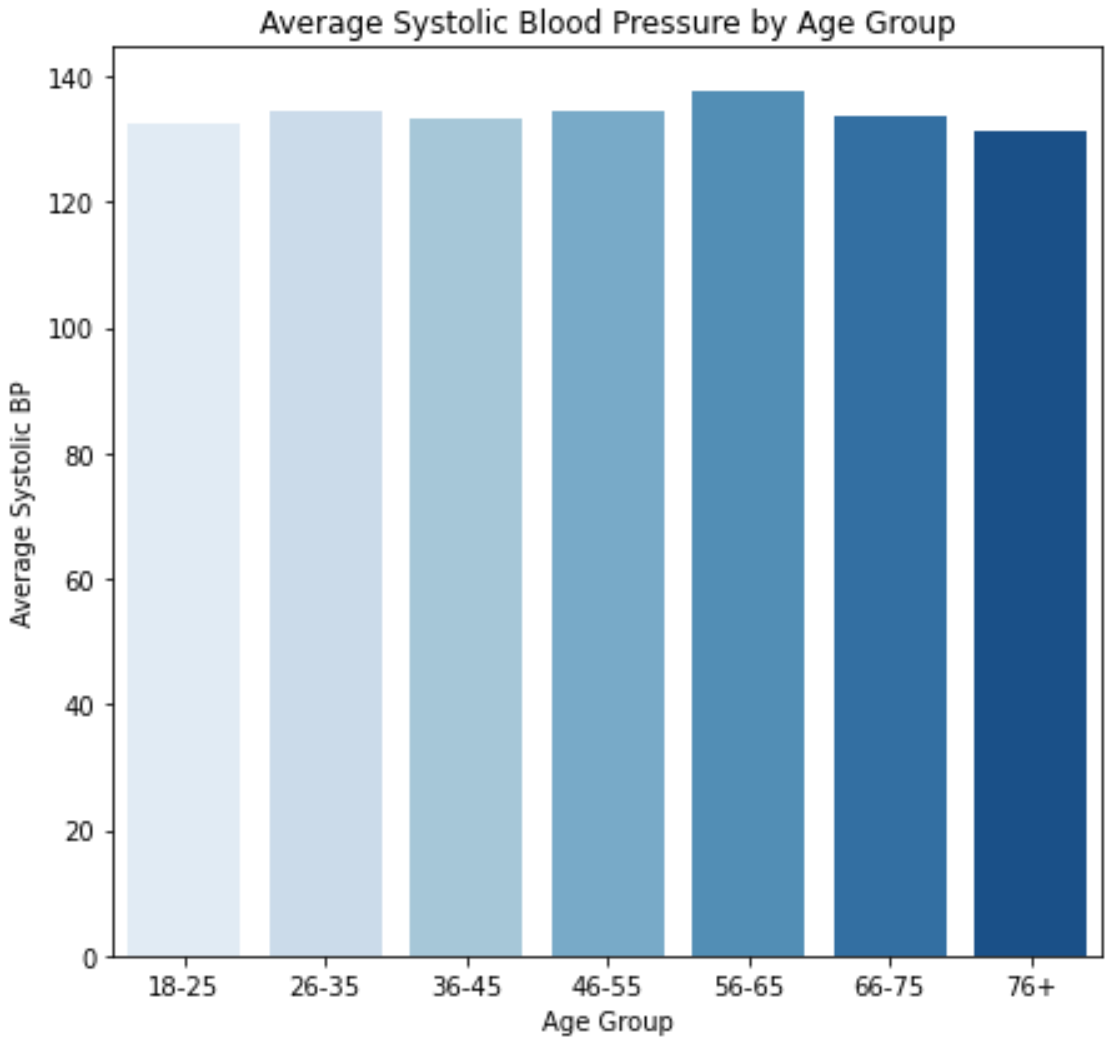
[70]:
```
pd.crosstab(data.AgeGroup, data.DiastolicBP)
```

[70]:
```
DiastolicBP 60 61   62   63   64   65   66   67   68   69   … 110 111 \
AgeGroup                                                     …
18-25        1    2    2    1    4    6    3    5    1    2 …    1    2
26-35        5    4    8    2    3    2    2    1    5    4 …    6    3
36-45        4    5    2    1    8    4    4    3    6    4 …    5    4
46-55        4    2    1    4    9    6    5    4    9    3 …    1    2
56-65        6    3    8    4    6    1    3    5    8    5 …    7    9
66-75        3    4    4   11    3    4    5    4    2    4 …    4    9
76+          2    2    1    4    7    7    1    2    3    6 …    5    4

DiastolicBP 112 113 114 115 116 117 118 119
AgeGroup
18-25        2    1    4    3    0    2    2    4
26-35        4    5    5    7    5    1    4   10
36-45        3    9    7    3    5    3    5    5
46-55        4    4    2    4    4    1    6    4
56-65        6    5    4    5    2    7    4    3
66-75       11    1    5    5    3    5    4    5
76+          3    3    4    2    5    5    9    5

[7 rows x 60 columns]
```

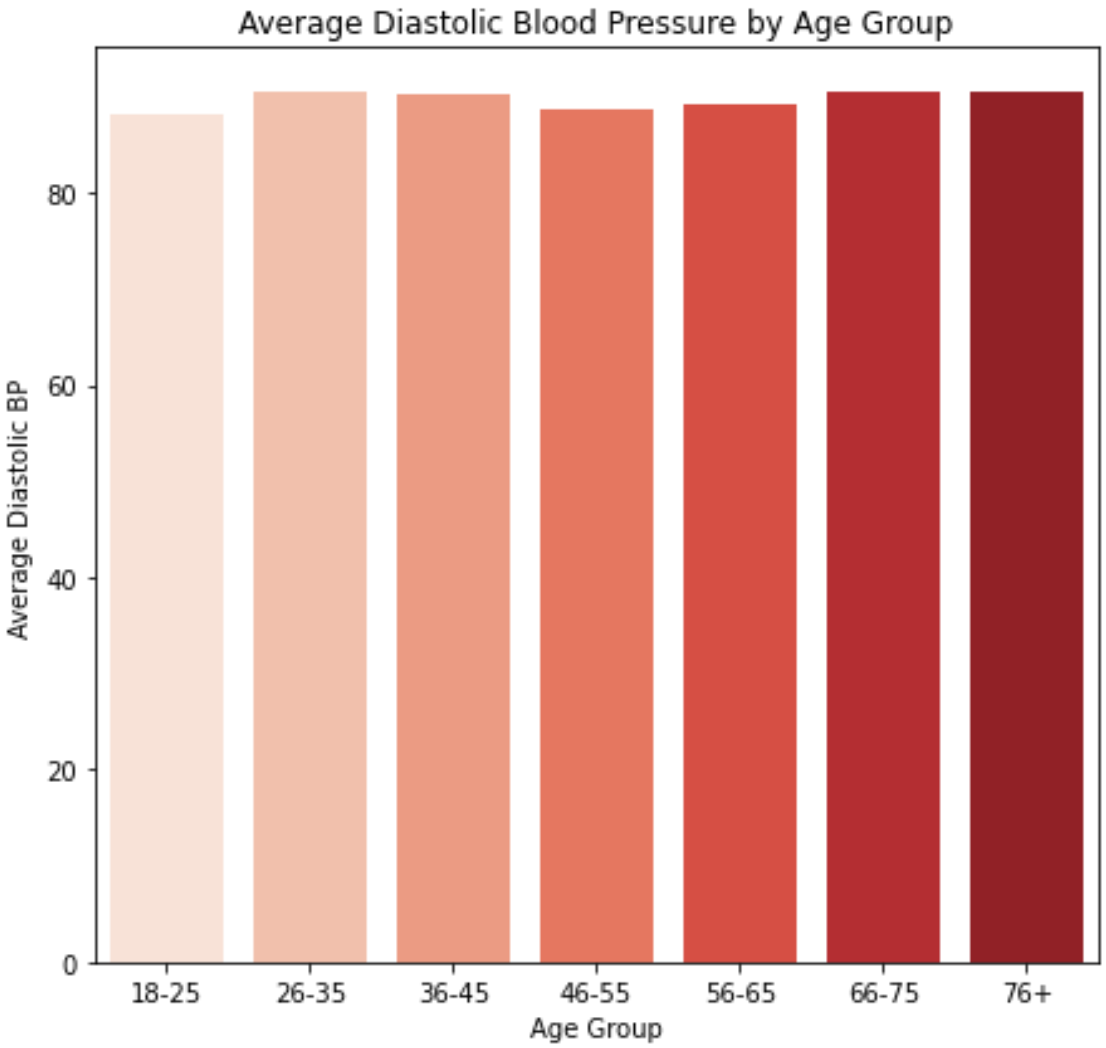
[45]:
```
# What are the average systolic and diastolic blood pressure
readings across␣ ↪different age groups? # Creating age groups
```

```
bins = [18, 25, 35, 45, 55, 65, 75, 85]
labels = ['18-25', '26-35', '36-45', '46-55', '56-65', '66-75',
'76+'] data['AgeGroup'] = pd.cut(data['Age'], bins=bins,
labels=labels, right=False)

# Calculating average systolic and diastolic blood pressure by age
group avg_bp_by_age = data.groupby('AgeGroup')[['SystolicBP',
'DiastolicBP']].mean(). ↪reset_index()
```

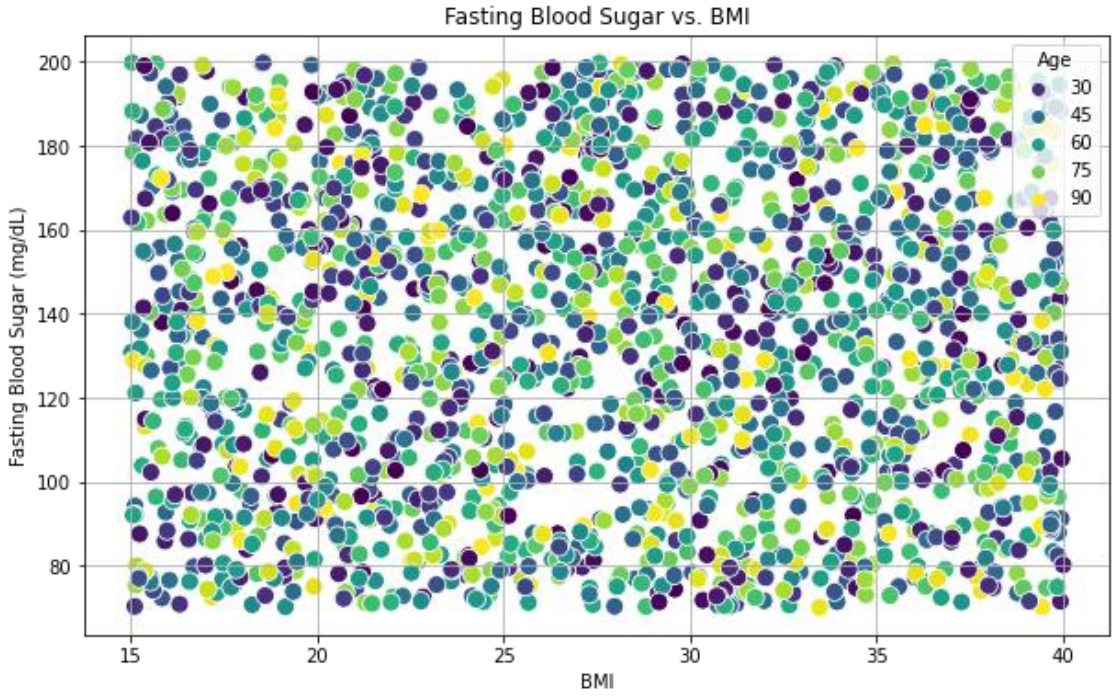
[50]:
```
# Bar Plot for Average Systolic Blood Pressure
plt.figure(figsize=(12, 6)) plt.subplot(1, 2, 1)
sns.barplot(data=avg_bp_by_age, x='AgeGroup', y='SystolicBP',
palette='Blues')
plt.title('Average Systolic Blood Pressure by Age
Group') plt.xlabel('Age Group')
plt.ylabel('Average Systolic BP')
plt.tight_layout()
plt.show()
```



[52]:
```
# Bar Plot for Average Diastolic Blood Pressure
plt.figure(figsize=(12, 6)) plt.subplot(1, 2, 2)
sns.barplot(data=avg_bp_by_age, x='AgeGroup', y='DiastolicBP',
palette='Reds')
plt.title('Average Diastolic Blood Pressure by Age
Group') plt.xlabel('Age Group')
plt.ylabel('Average Diastolic BP')
plt.tight_layout()
plt.show()
```



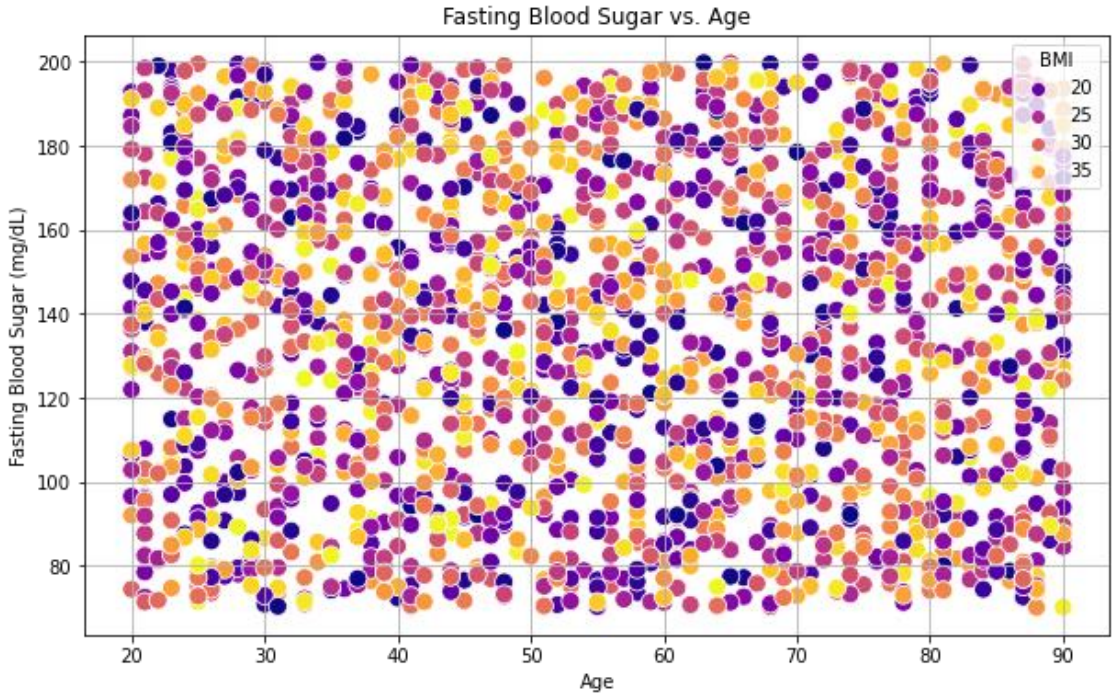
[53]:
```
#Are there patterns in fasting blood sugar levels based on BMI and age?

# Scatter Plot for Fasting Blood Sugar vs. BMI
plt.figure(figsize=(10, 6)) sns.scatterplot(data=data,
x='BMI', y='FastingBloodSugar', hue='Age',␣
 ↪palette='viridis', s=100)
plt.title('Fasting Blood Sugar vs.
BMI') plt.xlabel('BMI')
plt.ylabel('Fasting Blood Sugar
(mg/dL)')
plt.grid()
plt.show()
```



[54]:
```
correlation_bmi = data['FastingBloodSugar'].corr(data['BMI'])
print(f'Correlation between Fasting Blood Sugar and BMI:
{correlation_bmi:.2f}')
```

```
Correlation between Fasting Blood Sugar and BMI: -0.01
```

[56]:
```
#Are there patterns in fasting blood sugar levels based on BMI and
age?

# Scatter Plot for Fasting Blood Sugar vs. Age
plt.figure(figsize=(10, 6)) sns.scatterplot(data=data,
x='Age', y='FastingBloodSugar', hue='BMI',␣
 ↪palette='plasma', s=100)
plt.title('Fasting Blood Sugar vs.
Age') plt.xlabel('Age')
plt.ylabel('Fasting Blood Sugar
(mg/dL)') plt.grid() plt.show()
```



[57]:
```
correlation_age = data['FastingBloodSugar'].corr(data['Age'])
print(f'Correlation between Fasting Blood Sugar and Age:
{correlation_age:.2f}')
```

```
Correlation between Fasting Blood Sugar and Age: -0.02
```

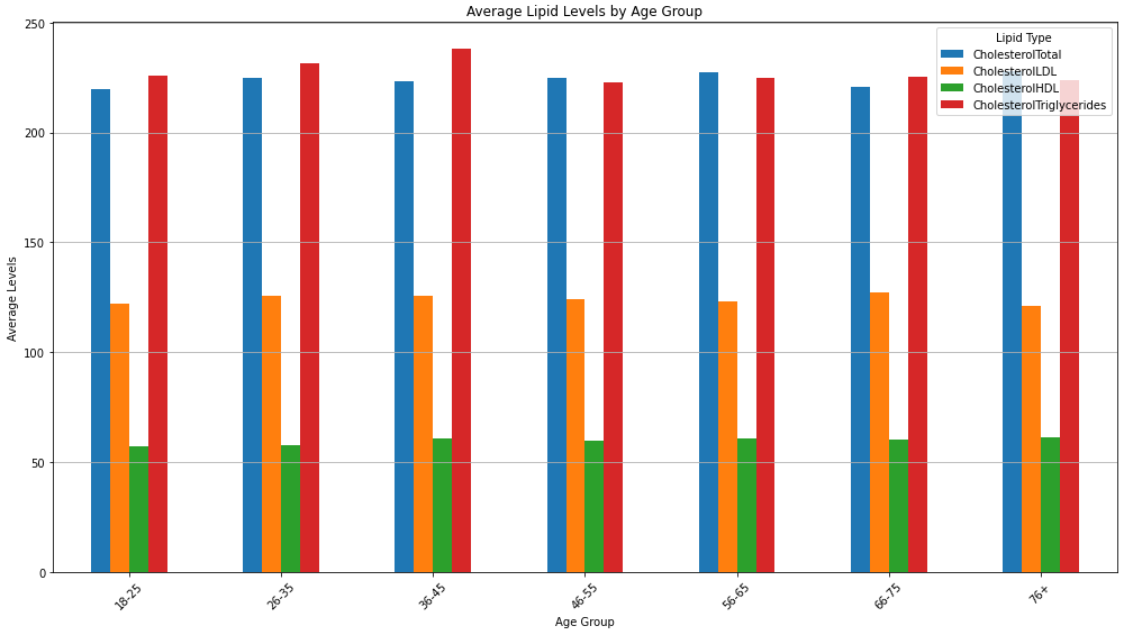
[58]:
```
# How do total cholesterol, LDL, HDL, and triglycerides compare
 among different␣ ↪age groups?
# Creating age groups
bins = [18, 25, 35, 45, 55, 65, 75, 85]
labels = ['18-25', '26-35', '36-45', '46-55', '56-65', '66-75',
'76+'] data['AgeGroup'] = pd.cut(data['Age'], bins=bins,
labels=labels, right=False)
```

[64]:
```
# Calculating average lipid levels by age group
avg_lipidlevels =
data.groupby('AgeGroup')[['CholesterolTotal',␣
 ↪'CholesterolLDL', 'CholesterolHDL',
 'CholesterolTriglycerides']].mean(). ↪reset_index()
```

[65]:
```
#How do total cholesterol, LDL, HDL, and triglycerides compare among
 different␣ ↪age groups?
```

```
# Bar Plot for Average Lipid Levels plt.figure(figsize=(14, 8))
avg_lipidlevels.plot(x='AgeGroup', kind='bar', figsize=(14, 8),
legend=True) plt.title('Average Lipid Levels by Age Group')
plt.xlabel('Age Group')
plt.ylabel('Average Levels')
plt.xticks(rotation=45)
plt.grid(axis='y')
plt.legend(title='Lipid Type')
plt.tight_layout()
plt.show()
```

```
<Figure size 1008x576 with 0 Axes >
```



[ ]: