D206

August 19, 2021

[2]:
```
import pandas as pd
import seaborn as sns
import numpy as np
import matplotlib.pyplot as plt
from sklearn.decomposition import PCA
```

[3]:
```
pd.options.mode.chained_assignment = None  # default='warn' ---- ignores false␣
 ↪warning for database writing
```

[4]:
```
# write csv into datafile
df = pd.read_csv('medical_raw_data.csv')
print(df.head())
```

```
   Unnamed: 0  CaseOrder Customer_id                           Interaction  \
0           1          1     C412403  8cd49b13-f45a-4b47-a2bd-173ffa932c2f
1           2          2     Z919181  d2450b70-0337-4406-bdbb-bc1037f1734c
2           3          3     F995323  a2057123-abf5-4a2c-abad-8ffe33512562
3           4          4     A879973  1dec528d-eb34-4079-adce-0d7a40e82205
4           5          5     C544523  5885f56b-d6da-43a3-8760-83583af94266

                                UID          City State        County    Zip  \
0  3a83ddb66e2ae73798bdf1d705dc0932           Eva    AL        Morgan  35621
1  176354c5eef714957d486009feabf195      Marianna    FL       Jackson  32446
2  e19a0fa00aeda885b8a436757e889bc9   Sioux Falls    SD     Minnehaha  57110
3  cd17d7b6d152cb6f23957346d11c3f07  New Richland    MN        Waseca  56072
4  d2f0425877b10ed6bb381f3e2579424a    West Point    VA  King William  23181

        Lat  ...  TotalCharge  Additional_charges Item1 Item2 Item3  Item4  \
0  34.34960  ...  3191.048774        17939.403420     3     3     2      2
1  30.84513  ...  4214.905346        17612.998120     3     4     3      4
2  43.54321  ...  2177.586768        17505.192460     2     4     4      4
3  43.89744  ...  2465.118965        12993.437350     3     5     5      3
4  37.59894  ...  1885.655137         3716.525786     2     1     3      3

   Item5 Item6 Item7  Item8
0      4     3     3      4
1      4     4     3      3
2      3     4     3      3
```

```
3      4     5     5      5
4      5     3     4      3

[5 rows x 53 columns]
```

[5]:

```
# checks for duplicates
data = df.loc[df.duplicated()]
print(data)
```

```
Empty DataFrame
Columns: [Unnamed: 0, CaseOrder, Customer_id, Interaction, UID, City, State,
County, Zip, Lat, Lng, Population, Area, Timezone, Job, Children, Age,
Education, Employment, Income, Marital, Gender, ReAdmis, VitD_levels,
Doc_visits, Full_meals_eaten, VitD_supp, Soft_drink, Initial_admin, HighBlood,
Stroke, Complication_risk, Overweight, Arthritis, Diabetes, Hyperlipidemia,
BackPain, Anxiety, Allergic_rhinitis, Reflux_esophagitis, Asthma, Services,
Initial_days, TotalCharge, Additional_charges, Item1, Item2, Item3, Item4,
Item5, Item6, Item7, Item8]
Index: []

[0 rows x 53 columns]
```

[6]:

```
newdf = df[['ReAdmis', 'HighBlood', 'Stroke', 'Overweight', 'Arthritis',␣
 ↪'Diabetes', 'Hyperlipidemia', 'BackPain', 'Anxiety', 'Allergic_rhinitis',␣
 ↪'Reflux_esophagitis', 'Asthma'
]].copy()

print(newdf.head())
```

```
  ReAdmis HighBlood Stroke  Overweight Arthritis Diabetes Hyperlipidemia  \
0      No       Yes     No         0.0       Yes      Yes             No
1      No       Yes     No         1.0        No       No             No
2      No       Yes     No         1.0        No      Yes             No
3      No        No    Yes         0.0       Yes       No             No
4      No        No     No         0.0        No       No            Yes

  BackPain  Anxiety Allergic_rhinitis Reflux_esophagitis Asthma
0      Yes      1.0               Yes                 No    Yes
1       No      NaN                No                Yes     No
2       No      NaN                No                 No     No
3       No      NaN                No                Yes    Yes
4       No      0.0               Yes                 No     No
```

[7]:

```
# checks the number of null values.
print(newdf.isnull().sum())
```

```
ReAdmis                 0
HighBlood               0
```

```
Stroke                 0
Overweight           982
Arthritis              0
Diabetes               0
Hyperlipidemia         0
BackPain               0
Anxiety              984
Allergic_rhinitis      0
Reflux_esophagitis     0
Asthma                 0
dtype: int64
```

[8]:

```python
newdfNoNull = newdf.dropna() #create datafile with no null values
newdfNoNull.isnull().sum()
```

[8]:

```
ReAdmis               0
HighBlood             0
Stroke                0
Overweight            0
Arthritis             0
Diabetes              0
Hyperlipidemia        0
BackPain              0
Anxiety               0
Allergic_rhinitis     0
Reflux_esophagitis    0
Asthma                0
dtype: int64
```

[9]:

```python
newdfNoNull.shape
```

[9]:

```
(8126, 12)
```

[10]:

```python
# create a database with all values being 1 or 0 instead of Yes/No
di = {'Yes': 1, 'No': 0}
noNullwith1_0 = newdfNoNull.replace({'ReAdmis': di,'HighBlood': di,'Stroke':␣
 ↪di,'Overweight': di,'Arthritis': di,'Diabetes': di,'Hyperlipidemia':␣
 ↪di,'BackPain': di,'Anxiety': di,'Allergic_rhinitis': di,'Reflux_esophagitis':␣
 ↪di,'Asthma': di})
noNullwith1_0.head()
```

[10]:

```
   ReAdmis  HighBlood  Stroke  Overweight  Arthritis  Diabetes  \
0        0          1       0         0.0          1         1
4        0          0       0         0.0          0         0
5        0          0       0         1.0          1         1
6        0          1       0         1.0          1         1
7        0          0       0         1.0          0         0
```

```
   Hyperlipidemia  BackPain  Anxiety  Allergic_rhinitis  Reflux_esophagitis  \
0               0         1      1.0                  1                   0
4               1         0      0.0                  1                   0
5               0         1      0.0                  1                   0
6               1         1      1.0                  0                   1
7               0         0      0.0                  0                   0

   Asthma
0       1
4       0
5       0
6       0
7       0
```

```
[11]: noNullwith1_0.dtypes
```

```
[11]: ReAdmis                  int64
      HighBlood                int64
      Stroke                   int64
      Overweight             float64
      Arthritis                int64
      Diabetes                 int64
      Hyperlipidemia           int64
      BackPain                 int64
      Anxiety                float64
      Allergic_rhinitis        int64
      Reflux_esophagitis       int64
      Asthma                   int64
      dtype: object
```

```
[13]: # create 2 databases. 1 is patients that have been readmitted, 0 are first time␣
       ↪admitted patients
      readmissionDF_0 = noNullwith1_0.groupby(noNullwith1_0['ReAdmis']).get_group(0)
      readmissionDF_0.head()
```

```
[13]:    ReAdmis  HighBlood  Stroke  Overweight  Arthritis  Diabetes  \
      0        0          1       0         0.0          1         1
      4        0          0       0         0.0          0         0
      5        0          0       0         1.0          1         1
      6        0          1       0         1.0          1         1
      7        0          0       0         1.0          0         0

         Hyperlipidemia  BackPain  Anxiety  Allergic_rhinitis  Reflux_esophagitis  \
      0               0         1      1.0                  1                   0
      4               1         0      0.0                  1                   0
      5               0         1      0.0                  1                   0
```

```
6               1         1      1.0                  0                   1
7               0         0      0.0                  0                   0

   Asthma
0       1
4       0
5       0
6       0
7       0
```

[14]:

```
readmissionDF_1 = noNullwith1_0.groupby(noNullwith1_0['ReAdmis']).get_group(1)
readmissionDF_1.head()
```

[14]:

```
      ReAdmis  HighBlood  Stroke  Overweight  Arthritis  Diabetes  \
5000        1          1       0         0.0          0         0
5005        1          0       0         1.0          0         0
5008        1          1       0         0.0          1         0
5009        1          0       0         0.0          0         0
5010        1          0       0         1.0          1         0

      Hyperlipidemia  BackPain  Anxiety  Allergic_rhinitis  \
5000               1         0      0.0                  0
5005               1         0      0.0                  0
5008               0         0      0.0                  1
5009               0         0      1.0                  0
5010               0         0      1.0                  0

      Reflux_esophagitis  Asthma
5000                   0       0
5005                   1       0
5008                   1       0
5009                   0       0
5010                   0       0
```

[15]:

```
# readmissionDF_1 is database of patients readmitted
# readmissionDF_0 is database of patients for the first time
readmissionDF_0 = readmissionDF_0.drop(['ReAdmis'], axis=1)
readmissionDF_0['sum'] = readmissionDF_0.sum(axis=1)
readmissionDF_1 = readmissionDF_1.drop(['ReAdmis'], axis=1)
readmissionDF_1['sum'] = readmissionDF_1.sum(axis=1)

median0 = readmissionDF_0['sum'].median()
mean0 = readmissionDF_0['sum'].mean()
mode0 = readmissionDF_0['sum'].mode().iloc[0]

median1 = readmissionDF_1['sum'].median()
mean1 = readmissionDF_1['sum'].mean()
```

```
mode1 = readmissionDF_1['sum'].mode().iloc[0]
```

[16]:

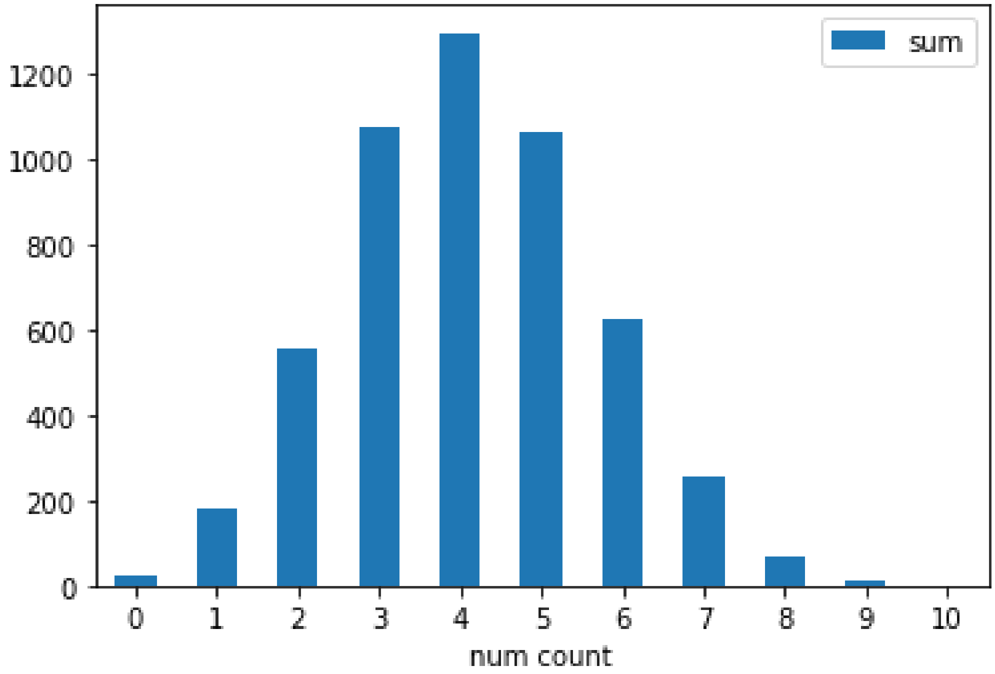
```
print(readmissionDF_0.head())
print('median0: ', median0)
print('mean0: ', mean0)
print('mode0: ', mode0)

print(readmissionDF_1.head())
print('median1: ', median1)
print('mean1: ', mean1)
print('mode1: ', mode1)
```

```
   HighBlood  Stroke  Overweight  Arthritis  Diabetes  Hyperlipidemia  \
0          1       0         0.0          1         1               0
4          0       0         0.0          0         0               1
5          0       0         1.0          1         1               0
6          1       0         1.0          1         1               1
7          0       0         1.0          0         0               0

   BackPain  Anxiety  Allergic_rhinitis  Reflux_esophagitis  Asthma  sum
0         1      1.0                  1                   0       1  7.0
4         0      0.0                  1                   0       0  2.0
5         1      0.0                  1                   0       0  5.0
6         1      1.0                  0                   1       0  8.0
7         0      0.0                  0                   0       0  1.0
median0:  4.0
mean0:  4.116048903551329
mode0:  4.0
      HighBlood  Stroke  Overweight  Arthritis  Diabetes  Hyperlipidemia  \
5000          1       0         0.0          0         0               1
5005          0       0         1.0          0         0               1
5008          1       0         0.0          1         0               0
5009          0       0         0.0          0         0               0
5010          0       0         1.0          1         0               0

      BackPain  Anxiety  Allergic_rhinitis  Reflux_esophagitis  Asthma  sum
5000         0      0.0                  0                   0       0  2.0
5005         0      0.0                  0                   1       0  3.0
5008         0      0.0                  1                   1       0  4.0
5009         0      1.0                  0                   0       0  1.0
5010         0      1.0                  0                   0       0  3.0
median1:  4.0
mean1:  4.13757147662294
mode1:  4.0
```

[17]:

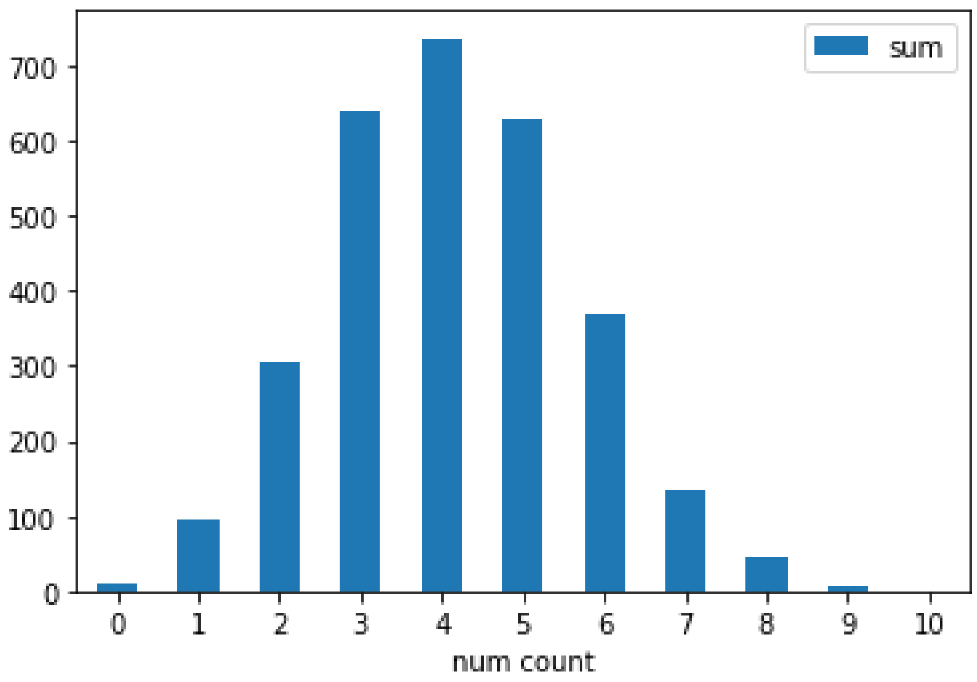
```
# creates bar chart of patients for FIRST TIME in hospital
```

```
counts0 = readmissionDF_0['sum'].value_counts() # gets counts of how many␣
 ↪patients have how many conditions
counts0 = pd.DataFrame(counts0) # converts data back into dataframe
counts0['num count'] = [4,3,5,6,2,7,1,8,0,9,10] #order for num. better to make␣
 ↪bell curve.
counts0 = counts0.sort_values(by=['num count']) # sort values by count to make␣
 ↪an easier to understand bar graph
ax = counts0.plot.bar(x='num count', y='sum', rot=0) # creates the bar chart
```



[18]:

```
# creates bar chart of patients for READMISSION in hospital
counts1 = readmissionDF_1['sum'].value_counts() # gets counts of how many␣
 ↪patients have how many conditions
counts1 = pd.DataFrame(counts1) # converts data back into dataframe
counts1['num count'] = [4,3,5,6,2,7,1,8,0,9,10] #order for num. better to make␣
 ↪bell curve.
counts1 = counts1.sort_values(by=['num count']) # sort values by count to make␣
 ↪an easier to understand bar graph
ax = counts1.plot.bar(x='num count', y='sum', rot=0) # creates the bar chart
```



[19]:

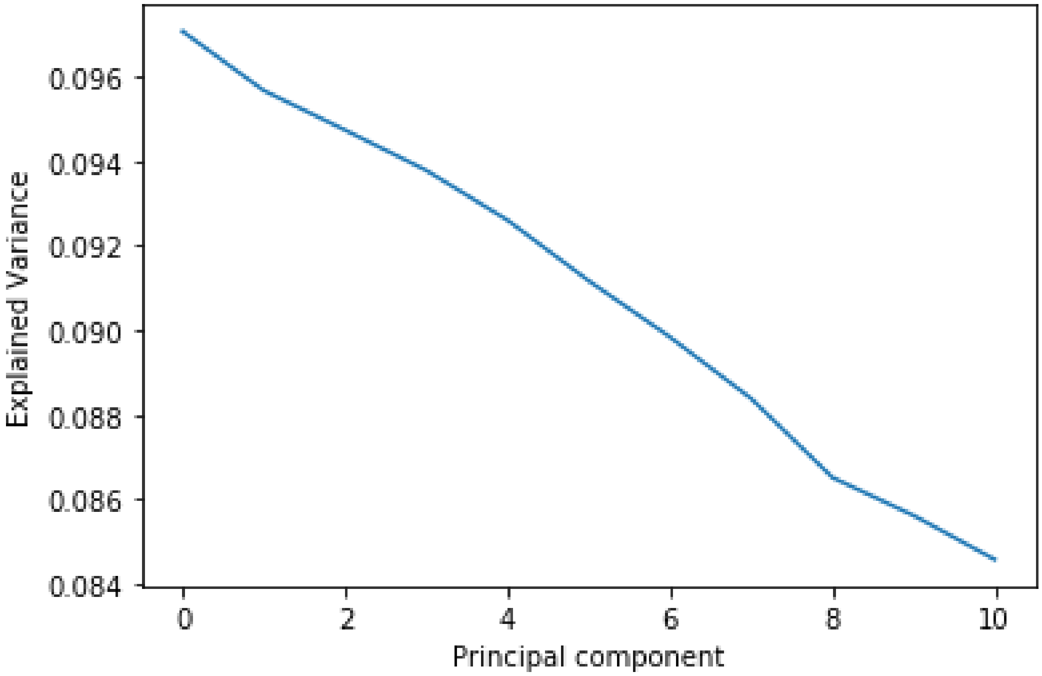
```
# PCA analysis start for patients on first visit
dataNumeric_0 = readmissionDF_0[['HighBlood', 'Stroke', 'Overweight',␣
 ↪'Arthritis', 'Diabetes', 'Hyperlipidemia', 'BackPain', 'Anxiety',␣
 ↪'Allergic_rhinitis', 'Reflux_esophagitis', 'Asthma']]
pcsNames_0 = []
for i, col in enumerate(dataNumeric_0.columns):
  pcsNames_0.append('PC'+str(i+1))
print(pcsNames_0)
normal0 = (dataNumeric_0 - dataNumeric_0.mean())/(dataNumeric_0.std())
print(normal0)
pca = PCA(n_components=normal0.shape[1])
pca.fit(normal0)
data_pca = pd.DataFrame(pca.transform(dataNumeric_0),columns = pcsNames_0)
print(data_pca)
```

```
['PC1', 'PC2', 'PC3', 'PC4', 'PC5', 'PC6', 'PC7', 'PC8', 'PC9', 'PC10', 'PC11']
      HighBlood    Stroke  Overweight  Arthritis  Diabetes  Hyperlipidemia  \
0      1.200791 -0.496432   -1.561873   1.347974  1.621223       -0.709612
4     -0.832622 -0.496432   -1.561873  -0.741710 -0.616699        1.408947
5     -0.832622 -0.496432    0.640133   1.347974  1.621223       -0.709612
6      1.200791 -0.496432    0.640133   1.347974  1.621223        1.408947
7     -0.832622 -0.496432    0.640133  -0.741710 -0.616699       -0.709612
...         ...       ...         ...        ...       ...             ...
9981  -0.832622  2.013984    0.640133  -0.741710 -0.616699        1.408947
9985  -0.832622  2.013984    0.640133  -0.741710 -0.616699        1.408947
```

```
9986   1.200791 -0.496432   -1.561873  -0.741710 -0.616699        1.408947
9993   1.200791 -0.496432    0.640133  -0.741710 -0.616699        1.408947
9994  -0.832622 -0.496432   -1.561873   1.347974 -0.616699       -0.709612

      BackPain   Anxiety  Allergic_rhinitis  Reflux_esophagitis    Asthma
0     1.211457  1.451096           1.227701           -0.844370  1.557474
4    -0.825292 -0.689001           1.227701           -0.844370 -0.641941
5     1.211457 -0.689001           1.227701           -0.844370 -0.641941
6     1.211457  1.451096          -0.814372            1.184086 -0.641941
7    -0.825292 -0.689001          -0.814372           -0.844370 -0.641941
...        ...       ...                ...                 ...       ...
9981  1.211457  1.451096           1.227701           -0.844370 -0.641941
9985 -0.825292 -0.689001          -0.814372           -0.844370 -0.641941
9986  1.211457 -0.689001          -0.814372           -0.844370  1.557474
9993 -0.825292 -0.689001          -0.814372           -0.844370 -0.641941
9994 -0.825292 -0.689001          -0.814372            1.184086  1.557474

[5153 rows x 11 columns]
           PC1       PC2       PC3       PC4       PC5       PC6       PC7  \
0     0.196327 -0.410238  1.383062 -1.166821  0.081773  1.399893  0.805733
1     0.885717  0.072989  0.302157  0.195194 -0.139855  0.665885 -0.424035
2     0.142324 -0.084869  0.967830 -0.652045  0.428960  1.157124 -0.335043
3    -0.250186 -0.040082  1.225882 -0.933982  0.031410  1.849890  0.696928
4    -0.134692  0.173090  0.433226 -0.315596  0.331322 -0.213724 -0.328156
...        ...       ...       ...       ...       ...       ...       ...
5148  0.647965  0.804272  1.287304 -0.047820 -0.227835  0.628963  0.439061
5149  0.151117  0.666257  0.377895  0.257562  0.642372  0.251795 -0.003250
5150  0.348480  0.936948  0.720583 -0.641555  0.011431  0.945741  0.269631
5151  0.289876  0.273262  0.977830 -0.152919  0.487021  0.402835 -0.234152
5152 -0.998474 -0.151875 -0.148067 -0.761090 -0.055331  0.897511 -0.196845

           PC8       PC9      PC10      PC11
0     0.723223 -0.076267  0.507427 -0.341883
1     0.116285 -0.071702  0.358126  0.539531
2    -0.162546 -1.108161  0.490695 -0.693010
3    -1.204631 -0.267982  0.118820  0.338873
4    -0.503723 -0.335406  0.111907  0.150721
...        ...       ...       ...       ...
5148 -0.466781 -0.833051  1.198036  0.535182
5149 -0.822471 -0.162355  0.842160  0.660316
5150  0.044584  1.033357  0.176231  0.041574
5151 -0.907958  0.517633 -0.005269  0.561348
5152  0.364037  0.192672  0.468315  0.377495

[5153 rows x 11 columns]
```

[20]:

```
sns.lineplot(y = pca.explained_variance_ratio_, x=range(0,11))
plt.ylabel('Explained Variance')
plt.xlabel('Principal component')
plt.show()
```



[22]:

```
for pc, var in zip(pcsNames_0, np.cumsum(pca.explained_variance_ratio_)):
    print(pc,var)
rotation_0 = pd.DataFrame(pca.components_.T, columns = pcsNames_0, index =␣
 ↪dataNumeric_0.columns)
print(rotation_0)
dataReduced_0 = data_pca.iloc[:,0:11]
print(dataReduced_0)
```

```
PC1 0.09706998511449275
PC2 0.19274243800950047
PC3 0.2874806766911285
PC4 0.38126295759967577
PC5 0.47387133432324124
PC6 0.5650443257884363
PC7 0.6548873137785118
PC8 0.743275560967274
PC9 0.8297980863917527
PC10 0.9154216572356548
PC11 0.9999999999999999
                         PC1       PC2       PC3       PC4       PC5  \
HighBlood          -0.099398 -0.106521  0.674979  0.112587  0.188947
Stroke             -0.238156  0.286473  0.075044  0.523068  0.344299
Overweight         -0.134692  0.173090  0.433226 -0.315596  0.331322
Arthritis          -0.331963 -0.527839  0.006855 -0.107834 -0.014810
Diabetes            0.227078 -0.173542 -0.144470 -0.217839  0.570582
Hyperlipidemia      0.523966  0.206694 -0.130374  0.050090 -0.033249
BackPain            0.020150  0.577127  0.239689 -0.155880 -0.351528
Anxiety             0.114947 -0.305407  0.237190 -0.294607 -0.412073
Allergic_rhinitis   0.361751 -0.133705  0.432531  0.145104 -0.106606
Reflux_esophagitis -0.570273  0.116316 -0.091211 -0.004903 -0.247782
Asthma             -0.096238  0.259648 -0.063710 -0.648352  0.207261

                         PC6       PC7       PC8       PC9      PC10      PC11
HighBlood           0.169390  0.169206  0.008102  0.551583 -0.335402  0.025932
Stroke              0.018350  0.400108  0.093589 -0.128405  0.512027  0.124900
Overweight         -0.213724 -0.328156 -0.503723 -0.335406  0.111907  0.150721
Arthritis           0.431857 -0.170463 -0.148489  0.100834  0.505685 -0.309516
Diabetes            0.406285  0.350731  0.010071 -0.369369 -0.289468 -0.126582
Hyperlipidemia      0.447169 -0.075202 -0.412337  0.301456  0.218226  0.384694
BackPain            0.313990  0.161678 -0.049029 -0.131063  0.022671 -0.562470
Anxiety            -0.155537  0.629466 -0.123904 -0.166476  0.193305  0.282499
Allergic_rhinitis   0.218716 -0.348833  0.528623 -0.373158  0.139900  0.154836
Reflux_esophagitis  0.450461 -0.040331  0.014678 -0.219542 -0.308105  0.493594
Asthma              0.015193  0.013949  0.497849  0.311380  0.270735  0.193418
           PC1       PC2       PC3       PC4       PC5       PC6       PC7  \
0     0.196327 -0.410238  1.383062 -1.166821  0.081773  1.399893  0.805733
1     0.885717  0.072989  0.302157  0.195194 -0.139855  0.665885 -0.424035
2     0.142324 -0.084869  0.967830 -0.652045  0.428960  1.157124 -0.335043
3    -0.250186 -0.040082  1.225882 -0.933982  0.031410  1.849890  0.696928
4    -0.134692  0.173090  0.433226 -0.315596  0.331322 -0.213724 -0.328156
...        ...       ...       ...       ...       ...       ...       ...
5148  0.647965  0.804272  1.287304 -0.047820 -0.227835  0.628963  0.439061
5149  0.151117  0.666257  0.377895  0.257562  0.642372  0.251795 -0.003250
5150  0.348480  0.936948  0.720583 -0.641555  0.011431  0.945741  0.269631
5151  0.289876  0.273262  0.977830 -0.152919  0.487021  0.402835 -0.234152
5152 -0.998474 -0.151875 -0.148067 -0.761090 -0.055331  0.897511 -0.196845

           PC8       PC9      PC10      PC11
0     0.723223 -0.076267  0.507427 -0.341883
1     0.116285 -0.071702  0.358126  0.539531
2    -0.162546 -1.108161  0.490695 -0.693010
3    -1.204631 -0.267982  0.118820  0.338873
4    -0.503723 -0.335406  0.111907  0.150721
...        ...       ...       ...       ...
5148 -0.466781 -0.833051  1.198036  0.535182
5149 -0.822471 -0.162355  0.842160  0.660316
5150  0.044584  1.033357  0.176231  0.041574
5151 -0.907958  0.517633 -0.005269  0.561348
```

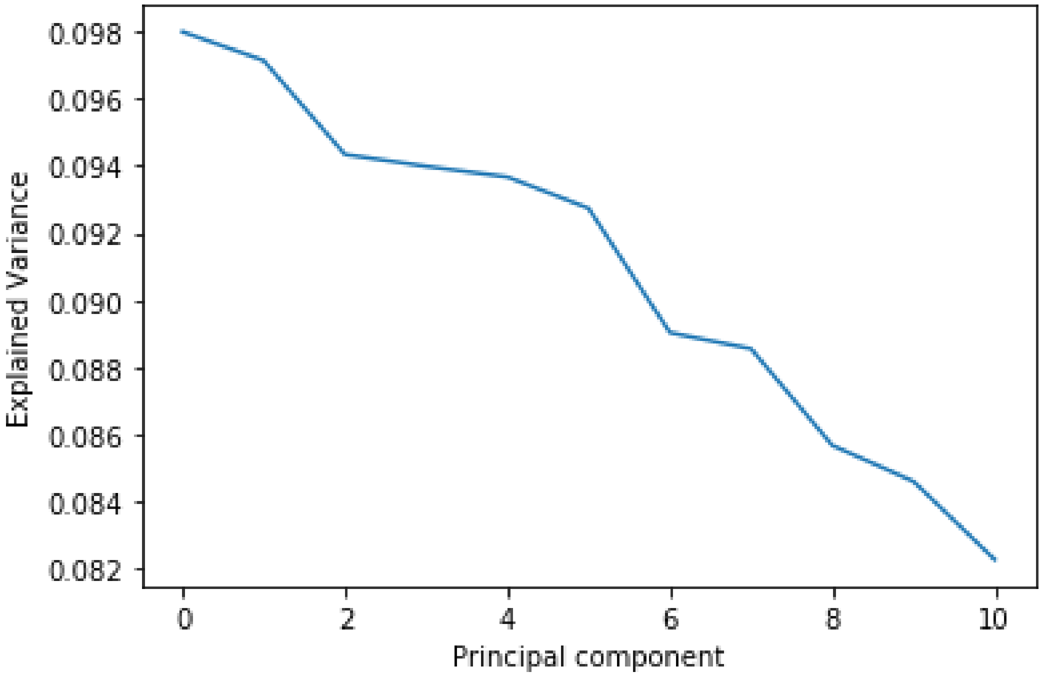
```
5152  0.364037  0.192672  0.468315  0.377495

[5153 rows x 11 columns]
```

[23]:
```
# PCA analysis start for patients readmission
dataNumeric_1 = readmissionDF_1[['HighBlood', 'Stroke', 'Overweight',␣
 ↪'Arthritis', 'Diabetes', 'Hyperlipidemia', 'BackPain', 'Anxiety',␣
 ↪'Allergic_rhinitis', 'Reflux_esophagitis', 'Asthma']]
pcsNames_1 = []
for i, col in enumerate(dataNumeric_1.columns):
  pcsNames_1.append('PC'+str(i+1))
print(pcsNames_1)
normal1 = (dataNumeric_1 - dataNumeric_1.mean())/(dataNumeric_1.std())
print(normal1)
pca = PCA(n_components=normal1.shape[1])
pca.fit(normal1)
data_pca = pd.DataFrame(pca.transform(dataNumeric_1),columns = pcsNames_1)
print(data_pca)
```

```
['PC1', 'PC2', 'PC3', 'PC4', 'PC5', 'PC6', 'PC7', 'PC8', 'PC9', 'PC10', 'PC11']
      HighBlood    Stroke  Overweight  Arthritis  Diabetes  Hyperlipidemia  \
5000   1.182812 -0.504326   -1.546942  -0.748626 -0.611326        1.388674
5005  -0.845158 -0.504326    0.646219  -0.748626 -0.611326        1.388674
5008   1.182812 -0.504326   -1.546942   1.335331 -0.611326       -0.719869
5009  -0.845158 -0.504326   -1.546942  -0.748626 -0.611326       -0.719869
5010  -0.845158 -0.504326    0.646219   1.335331 -0.611326       -0.719869
...         ...       ...         ...        ...       ...             ...
9992   1.182812 -0.504326   -1.546942   1.335331  1.635239        1.388674
9996   1.182812 -0.504326    0.646219   1.335331  1.635239       -0.719869
9997   1.182812 -0.504326    0.646219  -0.748626 -0.611326       -0.719869
9998  -0.845158 -0.504326    0.646219  -0.748626 -0.611326       -0.719869
9999  -0.845158 -0.504326    0.646219   1.335331 -0.611326        1.388674

      BackPain   Anxiety  Allergic_rhinitis  Reflux_esophagitis    Asthma
5000 -0.855139 -0.692057          -0.792988           -0.856318 -0.630042
5005 -0.855139 -0.692057          -0.792988            1.167397 -0.630042
5008 -0.855139 -0.692057           1.260629            1.167397 -0.630042
5009 -0.855139  1.444481          -0.792988           -0.856318 -0.630042
5010 -0.855139  1.444481          -0.792988           -0.856318 -0.630042
...        ...       ...                ...                 ...       ...
9992 -0.855139 -0.692057           1.260629            1.167397  1.586662
9996 -0.855139 -0.692057          -0.792988           -0.856318  1.586662
9997 -0.855139  1.444481           1.260629           -0.856318 -0.630042
9998  1.169007 -0.692057          -0.792988           -0.856318 -0.630042
9999 -0.855139 -0.692057           1.260629           -0.856318 -0.630042

[2973 rows x 11 columns]
           PC1        PC2        PC3        PC4        PC5        PC6        PC7  \
0    -0.057924 -0.536595 -0.160879 -0.192670 -0.311028  0.853253  0.026772
1     0.330288 -0.978442  0.151272  0.022804 -0.293706  0.237988 -0.141919
2    -0.309435 -1.064048 -0.240404  0.389100  0.870112  0.248398 -0.882834
3    -0.095368  0.465004 -0.382503 -0.310448  0.189645  0.185412 -0.424486
4    -0.434822 -0.224128 -0.174833 -1.086455  0.421219 -0.416535 -0.686364
...        ...       ...       ...       ...       ...       ...       ...
2968  0.008291 -1.462838  0.050304  0.002264  1.557662  1.137754  0.038704
2969 -0.864654 -1.065429  0.040172 -0.901392  1.205513  0.352058  0.263750
2970 -1.197910 -0.310507 -0.097749 -0.022320  0.375478  0.240810 -0.956485
2971 -0.525658 -0.313854 -0.287255 -0.000009 -0.093694 -0.738721  0.426110
2972 -0.200811 -1.120639  0.705484 -0.540291  0.280253 -0.294110 -0.309866

           PC8       PC9      PC10      PC11
0     0.397912  0.379004  0.537984  0.478336
1     0.760394  0.824330 -0.095291 -0.693047
2     0.070953  0.684389 -0.157267  0.683017
3     0.004348  0.300422  0.196920 -0.390397
4     0.334234  0.626948 -0.044357 -0.470085
...        ...       ...       ...       ...
2968  0.260376  0.959070  0.222987  0.312844
2969  0.805522 -0.043838 -0.069991  0.025584
2970  0.523069  0.557283  0.798303 -0.351077
2971  0.651737  0.458581  0.171004 -0.377235
2972  0.068328  1.157999  0.552872 -0.043188

[2973 rows x 11 columns]
```

[24]:

```
sns.lineplot(y = pca.explained_variance_ratio_, x=range(0,11))
plt.ylabel('Explained Variance')
plt.xlabel('Principal component')
plt.show()
```



```
[25]: for pc, var in zip(pcsNames_1, np.cumsum(pca.explained_variance_ratio_)):
        print(pc,var)

      rotation_1 = pd.DataFrame(pca.components_.T, columns = pcsNames_1, index =␣
       ↪dataNumeric_1.columns)
      print(rotation_1)
      dataReduced_1 = data_pca.iloc[:,0:11]
      print(dataReduced_1)
```

```
PC1 0.097998633008865
PC2 0.19514090128863842
PC3 0.28948311426047973
PC4 0.38347117397745756
PC5 0.4771416609844364
PC6 0.5698834012351238
PC7 0.6589150354964439
PC8 0.7474688772361852
PC9 0.8331380215196443
PC10 0.9177363790545597
PC11 1.0
                         PC1       PC2       PC3       PC4       PC5  \
HighBlood          -0.450425 -0.257051 -0.309543  0.034390 -0.012320
Stroke              0.044978  0.502939  0.438284  0.066247  0.137785
Overweight         -0.398258 -0.366498  0.245146 -0.209038 -0.149234
Arthritis           0.058804 -0.322634 -0.037476 -0.566969  0.380808
```

```
Diabetes            0.332395 -0.108234  0.008130 -0.071723  0.658177
Hyperlipidemia      0.392501 -0.279544  0.148663 -0.227060 -0.298709
BackPain           -0.127401  0.052644 -0.532401  0.209029  0.055540
Anxiety            -0.095368  0.465004 -0.382503 -0.310448  0.189645
Allergic_rhinitis  -0.253859 -0.151963  0.349151  0.462776  0.347387
Reflux_esophagitis  0.336045 -0.332400 -0.242537  0.458903  0.154236
Asthma             -0.407170 -0.011012  0.133915 -0.088053  0.328082

                         PC6       PC7       PC8       PC9      PC10      PC11
HighBlood           0.458951 -0.184569  0.342062 -0.133021  0.164508  0.476891
Stroke              0.011828 -0.013496  0.548261  0.291886 -0.183095  0.331556
Overweight         -0.317087 -0.088101  0.494066  0.070435  0.016202 -0.472626
Arthritis          -0.284859 -0.173777 -0.164180  0.256092 -0.257479  0.392937
Diabetes            0.042533  0.198934  0.321128 -0.378257  0.362865 -0.141899
Hyperlipidemia      0.394302  0.211341  0.055850  0.512025  0.373476  0.001445
BackPain           -0.421634  0.514211  0.157671  0.388147  0.154802  0.095391
Anxiety             0.185412 -0.424486  0.004348  0.300422  0.196920 -0.390397
Allergic_rhinitis  -0.086466 -0.259329 -0.317408  0.319448  0.420673  0.035055
Reflux_esophagitis  0.160773 -0.265160  0.210478  0.241871 -0.484969 -0.221866
Asthma              0.452521  0.511263 -0.187554  0.140914 -0.356087 -0.229718
           PC1       PC2       PC3       PC4       PC5       PC6       PC7  \
0    -0.057924 -0.536595 -0.160879 -0.192670 -0.311028  0.853253  0.026772
1     0.330288 -0.978442  0.151272  0.022804 -0.293706  0.237988 -0.141919
2    -0.309435 -1.064048 -0.240404  0.389100  0.870112  0.248398 -0.882834
3    -0.095368  0.465004 -0.382503 -0.310448  0.189645  0.185412 -0.424486
4    -0.434822 -0.224128 -0.174833 -1.086455  0.421219 -0.416535 -0.686364
...        ...       ...       ...       ...       ...       ...       ...
2968  0.008291 -1.462838  0.050304  0.002264  1.557662  1.137754  0.038704
2969 -0.864654 -1.065429  0.040172 -0.901392  1.205513  0.352058  0.263750
2970 -1.197910 -0.310507 -0.097749 -0.022320  0.375478  0.240810 -0.956485
2971 -0.525658 -0.313854 -0.287255 -0.000009 -0.093694 -0.738721  0.426110
2972 -0.200811 -1.120639  0.705484 -0.540291  0.280253 -0.294110 -0.309866

           PC8       PC9      PC10      PC11
0     0.397912  0.379004  0.537984  0.478336
1     0.760394  0.824330 -0.095291 -0.693047
2     0.070953  0.684389 -0.157267  0.683017
3     0.004348  0.300422  0.196920 -0.390397
4     0.334234  0.626948 -0.044357 -0.470085
...        ...       ...       ...       ...
2968  0.260376  0.959070  0.222987  0.312844
2969  0.805522 -0.043838 -0.069991  0.025584
2970  0.523069  0.557283  0.798303 -0.351077
2971  0.651737  0.458581  0.171004 -0.377235
2972  0.068328  1.157999  0.552872 -0.043188

[2973 rows x 11 columns]
```

```
[26]: readmissionDF_0.to_csv('readmissionDF_0_clean.csv') # clean dataset for first␣
       ↪time admittence
      readmissionDF_1.to_csv('readmissionDF_1_clean.csv') # clena dataset for␣
       ↪readmittence
```

```
[ ]:
```