Investigate_a_Dataset

December 19, 2022

1 Project: Investigate a Dataset - [Medical Appointment No Shows]

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Introduction

1.1.1 Dataset Description

This dataset collects information from 100k medical appointments in Brazil and is focused on the question of whether or not patients show up for their appointment. A number of characteristics about the patient are included in each row.

ScheduledDay : what day the patient set up their appointment.

Neighborhood : location of the hospital

Scholarship : whether or not the patient is enrolled in Brasilian welfare program

1.1.2 Question(s) for Analysis

What factors are important for us to know in order to predict if a patient will show up for their scheduled appointment?

```
In [1]: # Use this cell to set up import statements for all of the packages that you plan to use
        import numpy as np
        import pandas as pd
        import matplotlib.pyplot as plt
        import random
        import matplotlib.ticker as ticker
        import seaborn as sns

        # Remember to include a 'magic word' so that your visualizations are plotted
        #   inline with the notebook. See this page for more:
        #   http://ipython.readthedocs.io/en/stable/interactive/magics.html
        % matplotlib inline
```

Data Wrangling

1.1.3 General Properties

In [2]:
```
# Load the data
df = pd.read_csv('Database_No_show_appointments/noshowappointments-kagglev2-may-2016.csv
```

In [3]:
```
# Show few rows
df.head()
```

Out[3]:

	PatientId	AppointmentID	Gender	ScheduledDay	AppointmentDay	Age	Neighbourhood	Scholarship	Hipertension	Diabetes	Alcoholism	Handcap	SMS_received	No-show
0	2.987250e+13	5642903	F	2016-04-29T18:38:08Z	2016-04-29T00:00:00Z	62	JARDIM DA PENHA	0	1	0	0	0	0	No
1	5.589978e+14	5642503	M	2016-04-29T16:08:27Z	2016-04-29T00:00:00Z	56	JARDIM DA PENHA	0	0	0	0	0	0	No
2	4.262962e+12	5642549	F	2016-04-29T16:19:04Z	2016-04-29T00:00:00Z	62	MATA DA PRAIA	0	0	0	0	0	0	No
3	8.679512e+11	5642828	F	2016-04-29T17:29:31Z	2016-04-29T00:00:00Z	8	PONTAL DE CAMBURI	0	0	0	0	0	0	No
4	8.841186e+12	5642494	F	2016-04-29T16:07:23Z	2016-04-29T00:00:00Z	56	JARDIM DA PENHA	0	1	1	0	0	0	No

In [4]:
```
# Show the shape (rows,columns)
df.shape
```

Out[4]:
```
(110527, 14)
```

In [5]:
```
# Show some useful descriptive statistics about the data
df.describe()
```

Out[5]:

	PatientId	AppointmentID	Age	Scholarship	Hipertension	Diabetes	Alcoholism	Handcap	SMS_received
count	1.105270e+05	1.105270e+05	110527.000000	110527.000000	110527.000000	110527.000000	110527.000000	110527.000000	110527.000000
mean	1.474963e+14	5.675305e+06	37.088874	0.098266	0.197246	0.071865	0.030400	0.022248	0.321026
std	2.560949e+14	7.129575e+04	23.110205	0.297675	0.397921	0.258265	0.171686	0.161543	0.466873
min	3.921784e+04	5.030230e+06	-1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
25%	4.172614e+12	5.640286e+06	18.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
50%	3.173184e+13	5.680573e+06	37.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
75%	9.439172e+13	5.725524e+06	55.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000
max	9.999816e+14	5.790484e+06	115.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

```
mean        0.197246       0.071865       0.030400       0.022248
std         0.397921       0.258265       0.171686       0.161543
min         0.000000       0.000000       0.000000       0.000000
25%         0.000000       0.000000       0.000000       0.000000
50%         0.000000       0.000000       0.000000       0.000000
75%         0.000000       0.000000       0.000000       0.000000
max         1.000000       1.000000       1.000000       4.000000

        SMS_received
count  110527.000000
mean        0.321026
std         0.466873
min         0.000000
25%         0.000000
50%         0.000000
75%         1.000000
max         1.000000
```

 The majority of ages are between 18 to 55
 oops! there is a mistake in minimum age whish is -1
 The maximum age is 115 ! :) "to old"
 The average age is 37 years old
 75% of the patient receives SMS massege To confirm the appointment reservation

```
In [6]: # let's show the unique vlaues for each columns
        print('Age',sorted(df.Age.unique()))
        print('Scholarship',sorted(df.Scholarship.unique()))
        print('Hipertension',sorted(df.Hipertension.unique()))
        print('Diabetes',sorted(df.Diabetes.unique()))
        print('Alcoholism',sorted(df.Alcoholism.unique()))
        print('Handcap',sorted(df.Handcap.unique()))
        print('SMS_received',sorted(df.SMS_received.unique()))
```

```
Age [-1, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 2
Scholarship [0, 1]
Hipertension [0, 1]
Diabetes [0, 1]
Alcoholism [0, 1]
Handcap [0, 1, 2, 3, 4]
SMS_received [0, 1]
```

We have some imposible ages -1 we will drop it .

```
In [7]: # Show each column type
        df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 110527 entries, 0 to 110526
```

```
Data columns (total 14 columns):
PatientId         110527 non-null float64
AppointmentID     110527 non-null int64
Gender            110527 non-null object
ScheduledDay      110527 non-null object
AppointmentDay    110527 non-null object
Age               110527 non-null int64
Neighbourhood     110527 non-null object
Scholarship       110527 non-null int64
Hipertension      110527 non-null int64
Diabetes          110527 non-null int64
Alcoholism        110527 non-null int64
Handcap           110527 non-null int64
SMS_received      110527 non-null int64
No-show           110527 non-null object
dtypes: float64(1), int64(8), object(5)
memory usage: 11.8+ MB
```

1.1.4 Data Cleaning

```
In [8]: df.query('Age==-1')
```

Out[8]:

	PatientId	AppointmentID	Gender	ScheduledDay	AppointmentDay	Age	Neighbourhood	Scholarship	Hipertension	Diabetes	Alcoholism	Handcap	SMS_received	No-show
99832	4.659432e+14	5775010	F	2016-06-06T08:58:13Z	2016-06-06T00:00:00Z	-1	ROMÃO	0	0	0	0	0	0	No

```
In [9]: # removing impossible age
        df.drop(index=99832,inplace=True)

In [10]: # Show the number of duplicated row if there are
         df.duplicated().sum()
```

Out[10]: 0

```
In [11]: # Drop unnecessary columns (those are specific to the patient)
         unnecessary = ['PatientId','AppointmentID','ScheduledDay','AppointmentDay']
         df.drop(unnecessary, axis=1, inplace=True)

In [12]: # Check drop cell
         df.head()
```

Out[12]:

	Gender	Age	Neighbourhood	Scholarship	Hipertension	Diabetes
0	F	62	JARDIM DA PENHA	0	1	0

```
1      M   56    JARDIM DA PENHA            0             0         0
2      F   62      MATA DA PRAIA            0             0         0
3      F    8  PONTAL DE CAMBURI            0             0         0
4      F   56    JARDIM DA PENHA            0             1         1

   Alcoholism  Handcap  SMS_received No-show
0           0        0             0      No
1           0        0             0      No
2           0        0             0      No
3           0        0             0      No
4           0        0             0      No
```

```
In [13]: # Checking for Nan values
         df.isnull().any()
```

```
Out[13]: Gender          False
         Age             False
         Neighbourhood   False
         Scholarship     False
         Hipertension    False
         Diabetes        False
         Alcoholism      False
         Handcap         False
         SMS_received    False
         No-show         False
         dtype: bool
```

No missing vlaues :)

```
In [14]: # Rename column using "_"instead of "-" good practice :)
         df.rename(columns={'No-show':'No_show'},inplace=True)
```

```
In [15]: df.head()
```

```
Out[15]:   Gender  Age      Neighbourhood  Scholarship  Hipertension  Diabetes  \
         0      F   62    JARDIM DA PENHA            0             1         0
         1      M   56    JARDIM DA PENHA            0             0         0
         2      F   62      MATA DA PRAIA            0             0         0
         3      F    8  PONTAL DE CAMBURI            0             0         0
         4      F   56    JARDIM DA PENHA            0             1         1

            Alcoholism  Handcap  SMS_received No_show
         0           0        0             0      No
         1           0        0             0      No
         2           0        0             0      No
         3           0        0             0      No
         4           0        0             0      No
```

Exploratory Data Analysis

1.1.5 Research Question (Is There a Correlation Between The Number Of Patient Who Showed and Each of Gender, Age, Neighbourhood, Scholarship, Hipertension, Diabetes, Alcoholism, Handcap, SMS_received)

```
In [16]: # First Assigning new names :
         show =  df.No_show == 'No'
         no_show = df.No_show == 'Yes'
```

```
In [17]: # show the number of patient who showed
         df[show].count()
```

```
Out[17]: Gender          88207
         Age             88207
         Neighbourhood   88207
         Scholarship     88207
         Hipertension    88207
         Diabetes        88207
         Alcoholism      88207
         Handcap         88207
         SMS_received    88207
         No_show         88207
         dtype: int64
```

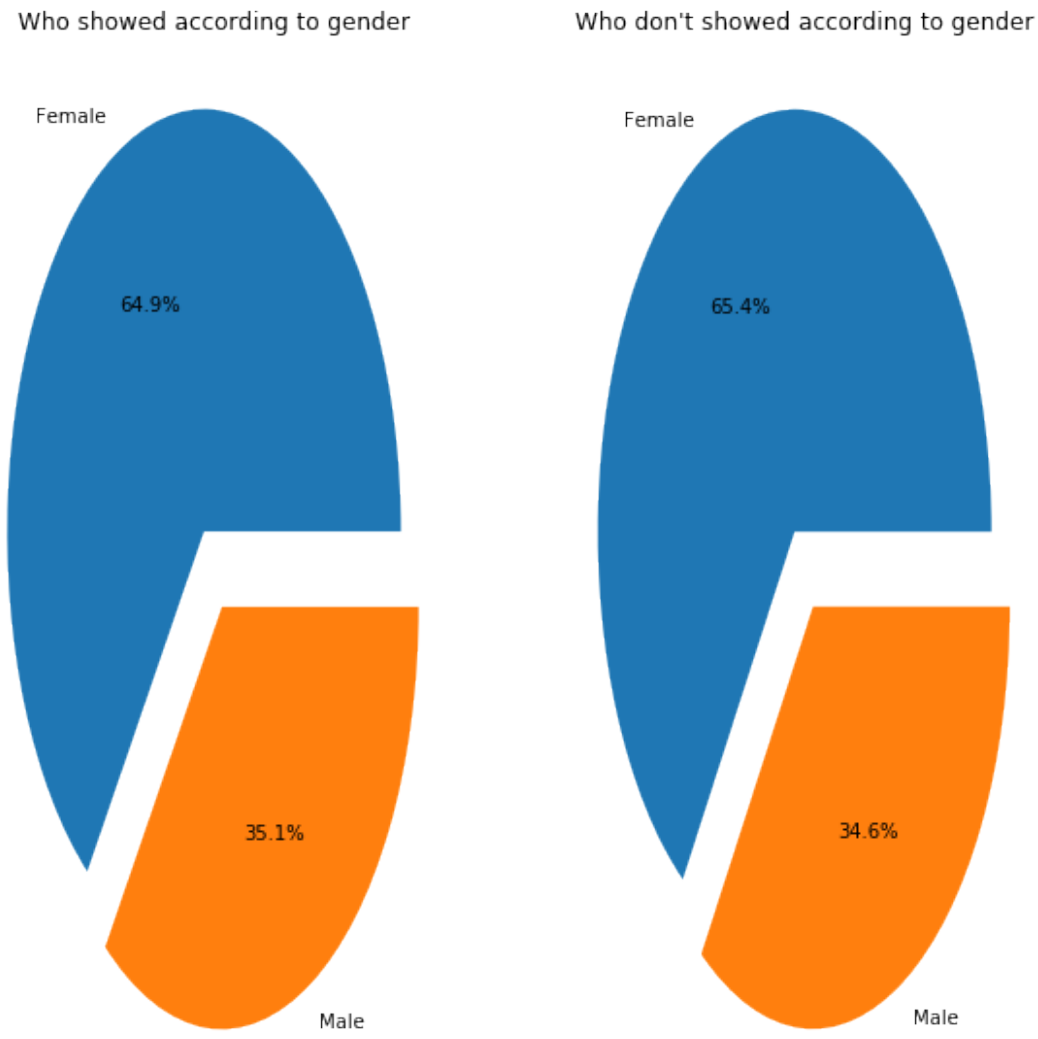
```
In [18]: # Show the number of patient who did not show
         df[no_show].count()
```

```
Out[18]: Gender          22319
         Age             22319
         Neighbourhood   22319
         Scholarship     22319
         Hipertension    22319
         Diabetes        22319
         Alcoholism      22319
         Handcap         22319
         SMS_received    22319
         No_show         22319
         dtype: int64
```

From the previous: The number of patient who showed is about 4 times those who did not show.

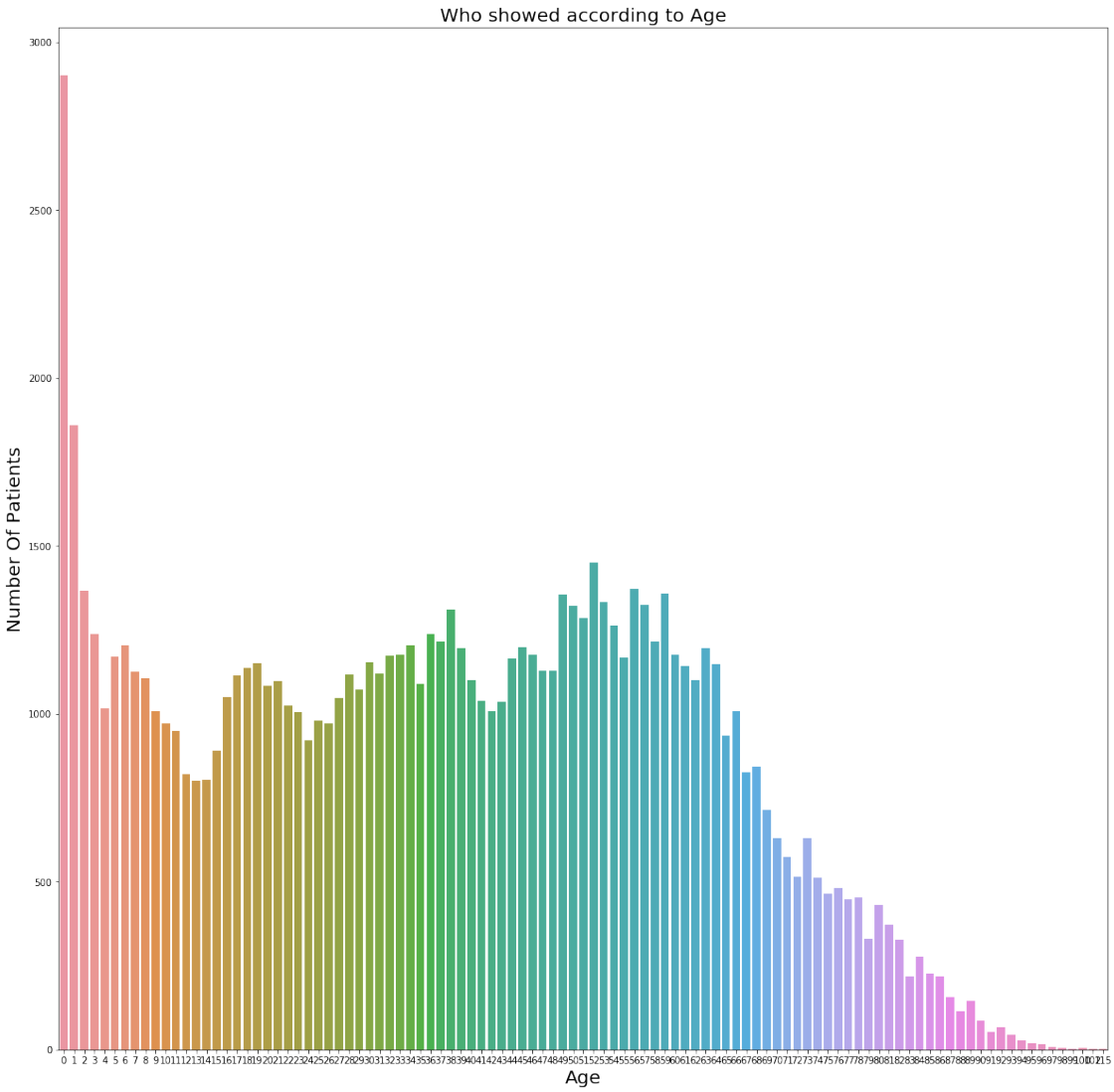
$\frac{88208}{22319}$=4

```
In [19]: # plot between the number of patient who showed or not according to Gender
         figure, axes=plt.subplots(1,2,figsize=(10,10))
         labels=['Female','Male']
         explode=(0.1,0.1)
         axes[0].pie(df.Gender[show].value_counts(),labels=labels,explode=explode,autopct='%1.1f
         axes[0].set_title("Who showed according to gender")
         axes[1].pie(df.Gender[no_show].value_counts(),labels=labels,explode=explode,autopct='%1
         axes[1].set_title("Who don\'t showed according to gender");
```



Gender is insignificant

```
In [20]: # plot between the number of patient who showed and the Age
         plt.figure(figsize=[20,20])
         sns.countplot(x=df.Age[show],data=df)
         plt.xlabel('Age', fontsize=20)
         plt.ylabel('Number Of Patients', fontsize=20);
         plt.title('Who showed according to Age', fontsize=20);
```




```
In [21]: df.Age[show].value_counts()
```

```
Out[21]: 0      2900
         1      1858
         52     1449
         56     1372
         2      1366
         59     1357
         49     1354
         53     1332
         57     1325
         50     1322
         38     1309
         51     1284
```

54	1262
3	1236
36	1236
58	1216
37	1216
6	1205
34	1204
45	1198
39	1196
63	1195
46	1177
33	1176
60	1175
32	1174
5	1169
55	1168
44	1164
30	1152
	...
72	514
74	513
76	480
75	463
78	452
77	448
80	430
81	371
79	329
82	326
84	276
85	226
83	219
86	218
87	157
89	144
88	114
90	86
92	66
91	53
93	43
94	27
95	18
96	16
97	9
98	5
100	4
102	2
115	2

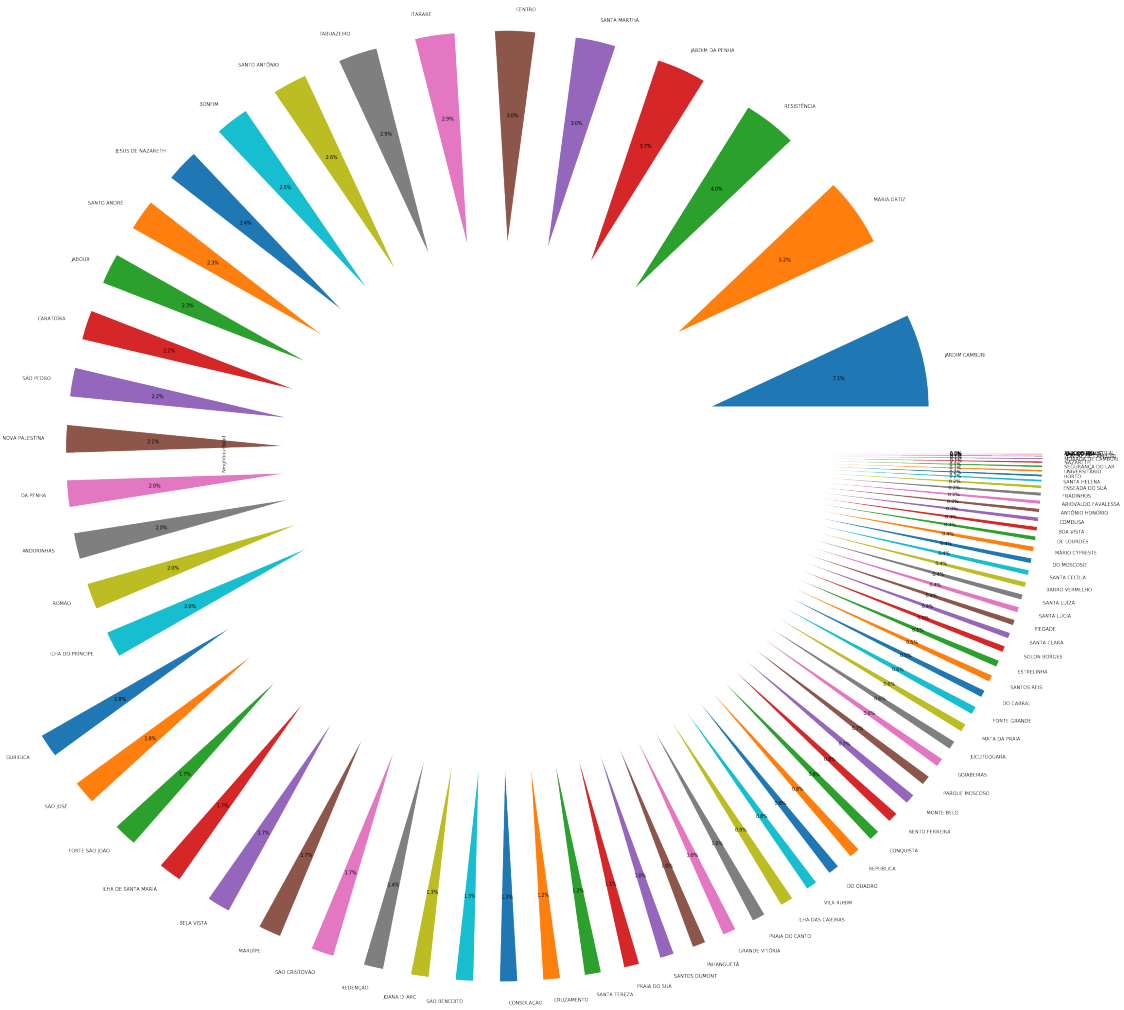
```
99         1
Name: Age, Length: 103, dtype: int64
```

It is clear that the number of younger patient who showed is larger than the older

```
In [22]: #show the number of unique neighbourhood that the patient showed from (for explode used
         len(df.Neighbourhood[show].unique())
```

```
Out[22]: 80
```

```
In [23]: # show the number of patient who showded according to the lacation of the hospital
         plt.figure(figsize=[20,20])
         explode=tuple([1]*20)+tuple([1.5]*60)
         df.Neighbourhood[show].value_counts().plot(kind='pie',explode=explode,autopct='%1.1f%%'
```



```
In [24]: df.Neighbourhood[show].value_counts()
```

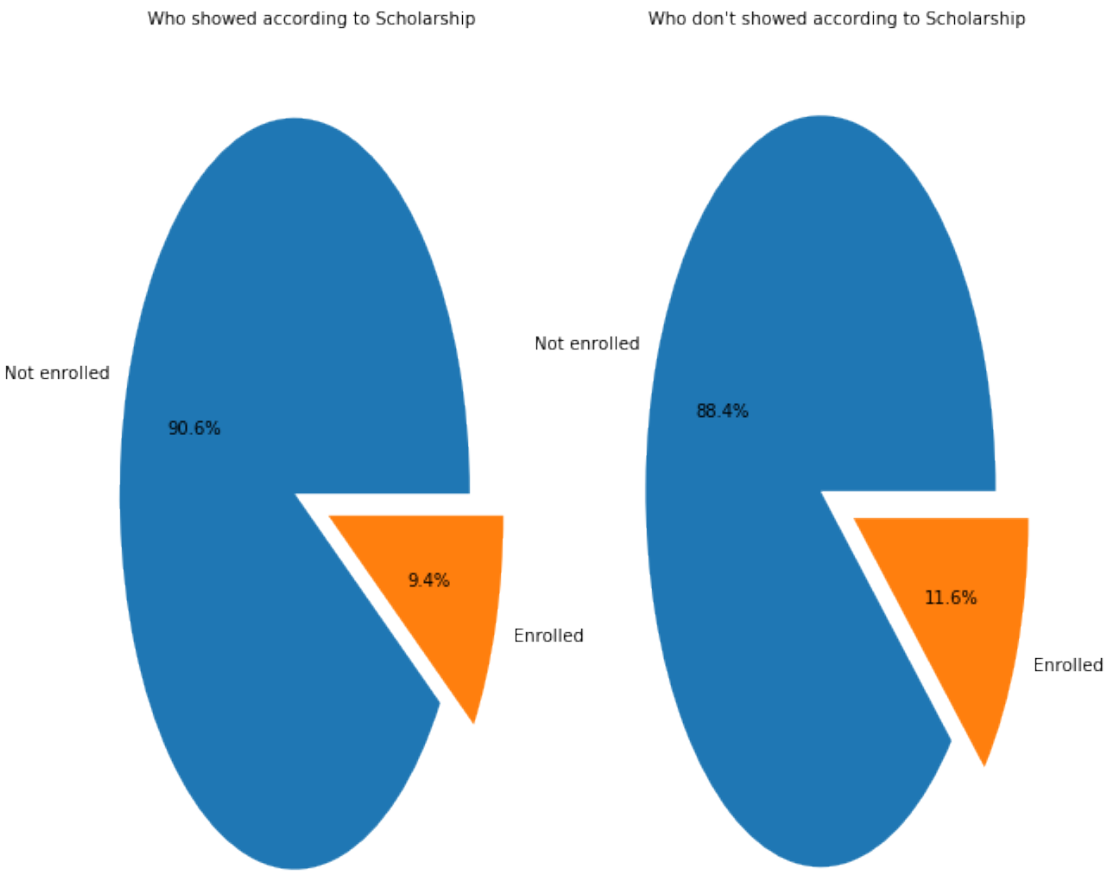
Out[24]:

JARDIM CAMBURI	6252
MARIA ORTIZ	4586
RESISTÊNCIA	3525
JARDIM DA PENHA	3246
SANTA MARTHA	2635
CENTRO	2631
ITARARÉ	2591
TABUAZEIRO	2559
SANTO ANTÔNIO	2262
BONFIM	2223
JESUS DE NAZARETH	2157
SANTO ANDRÉ	2063
JABOUR	2058
CARATOÍRA	1974
SÃO PEDRO	1933
NOVA PALESTINA	1862
DA PENHA	1788
ANDORINHAS	1741
ROMÃO	1740
ILHA DO PRÍNCIPE	1734
GURIGICA	1562
SÃO JOSÉ	1549
FORTE SÃO JOÃO	1543
ILHA DE SANTA MARIA	1524
BELA VISTA	1523
MARUÍPE	1478
SÃO CRISTÓVÃO	1473
REDENÇÃO	1278
JOANA D'ARC	1169
SÃO BENEDITO	1152
	...
DO CABRAL	472
SANTOS REIS	435
ESTRELINHA	432
SOLON BORGES	400
SANTA CLARA	372
PIEDADE	364
SANTA LÚCIA	352
SANTA LUÍZA	351
BARRO VERMELHO	332
SANTA CECÍLIA	325
DO MOSCOSO	321
MÁRIO CYPRESTE	317
DE LOURDES	258
BOA VISTA	254
COMDUSA	254
ANTÔNIO HONÓRIO	221
ARIOVALDO FAVALESSA	220

```
FRADINHOS               210
ENSEADA DO SUÁ          183
SANTA HELENA            141
HORTO                   133
UNIVERSITÁRIO           120
SEGURANÇA DO LAR        117
NAZARETH                106
MORADA DE CAMBURI        80
PONTAL DE CAMBURI        57
ILHA DO BOI              32
ILHA DO FRADE             8
AEROPORTO                 7
PARQUE INDUSTRIAL         1
Name: Neighbourhood, Length: 80, dtype: int64
```

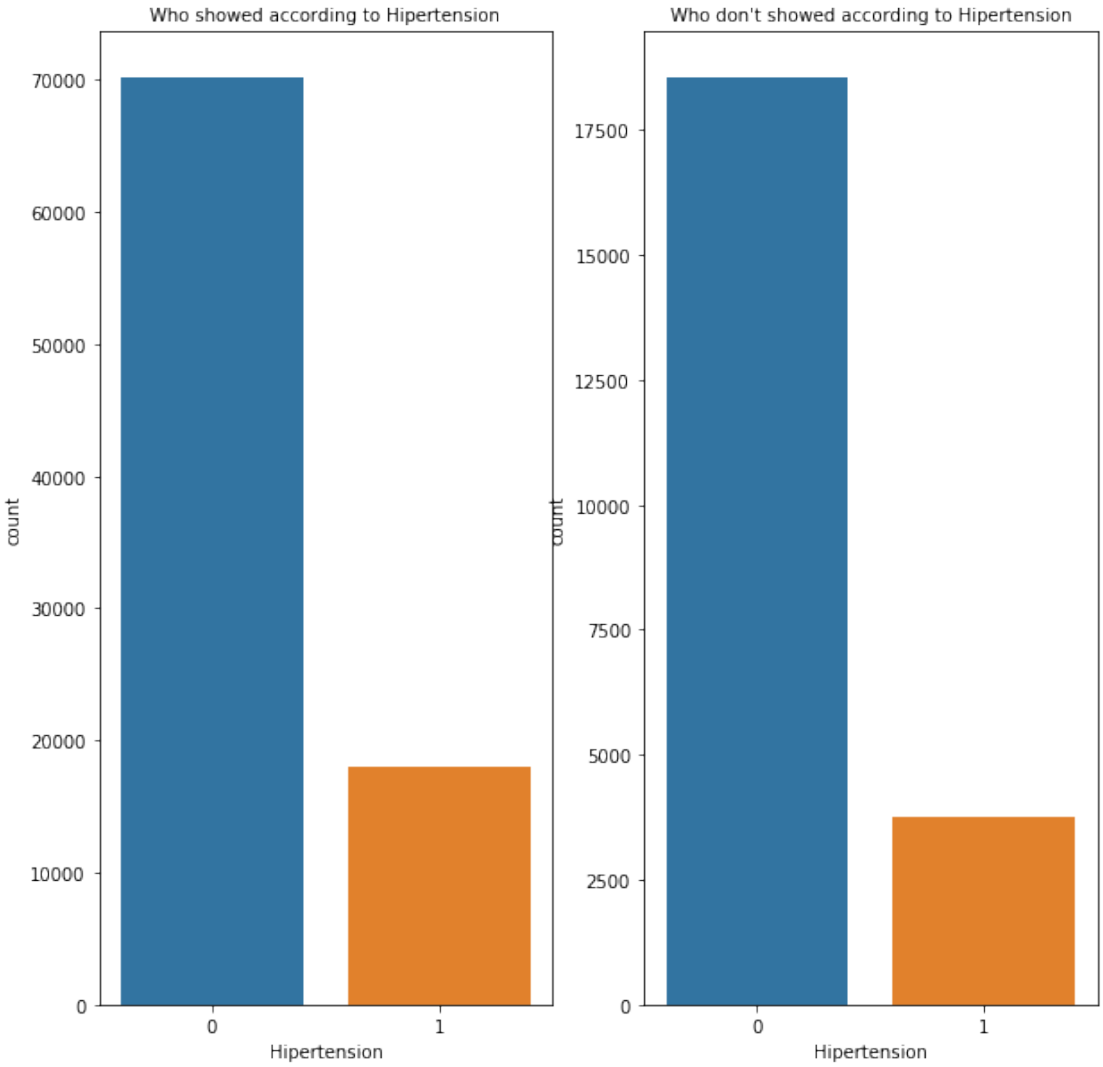
It is clear that the location of the hospital affects the number of showed patient

```
In [25]: # plot between the number of patient who showed or not and Scholarship
         figure, axes=plt.subplots(1,2,figsize=(10,10))
         labels=['Not enrolled','Enrolled']
         explode=(0.1,0.1)
         axes[0].pie(df.Scholarship[show].value_counts(),labels=labels,explode=explode,autopct='
         axes[0].set_title("Who showed according to Scholarship",fontsize=10)
         axes[1].pie(df.Scholarship[no_show].value_counts(),labels=labels,explode=explode,autopc
         axes[1].set_title("Who don\'t showed according to Scholarship",fontsize=10);
```



Most patient are not enrolled in Brasilian welfare program (Bolsa Família)
scholarship is insignificant

```
In [26]: # plot between the number of patient who showed or not and Hipertension
         figure, axes=plt.subplots(1,2,figsize=(10,10))
         sns.countplot(df.Hipertension[show], ax=axes[0])
         axes[0].set_title("Who showed according to Hipertension",fontsize=10)
         sns.countplot(df.Hipertension[no_show], ax=axes[1])
         axes[1].set_title("Who don\'t showed according to Hipertension",fontsize=10);
```

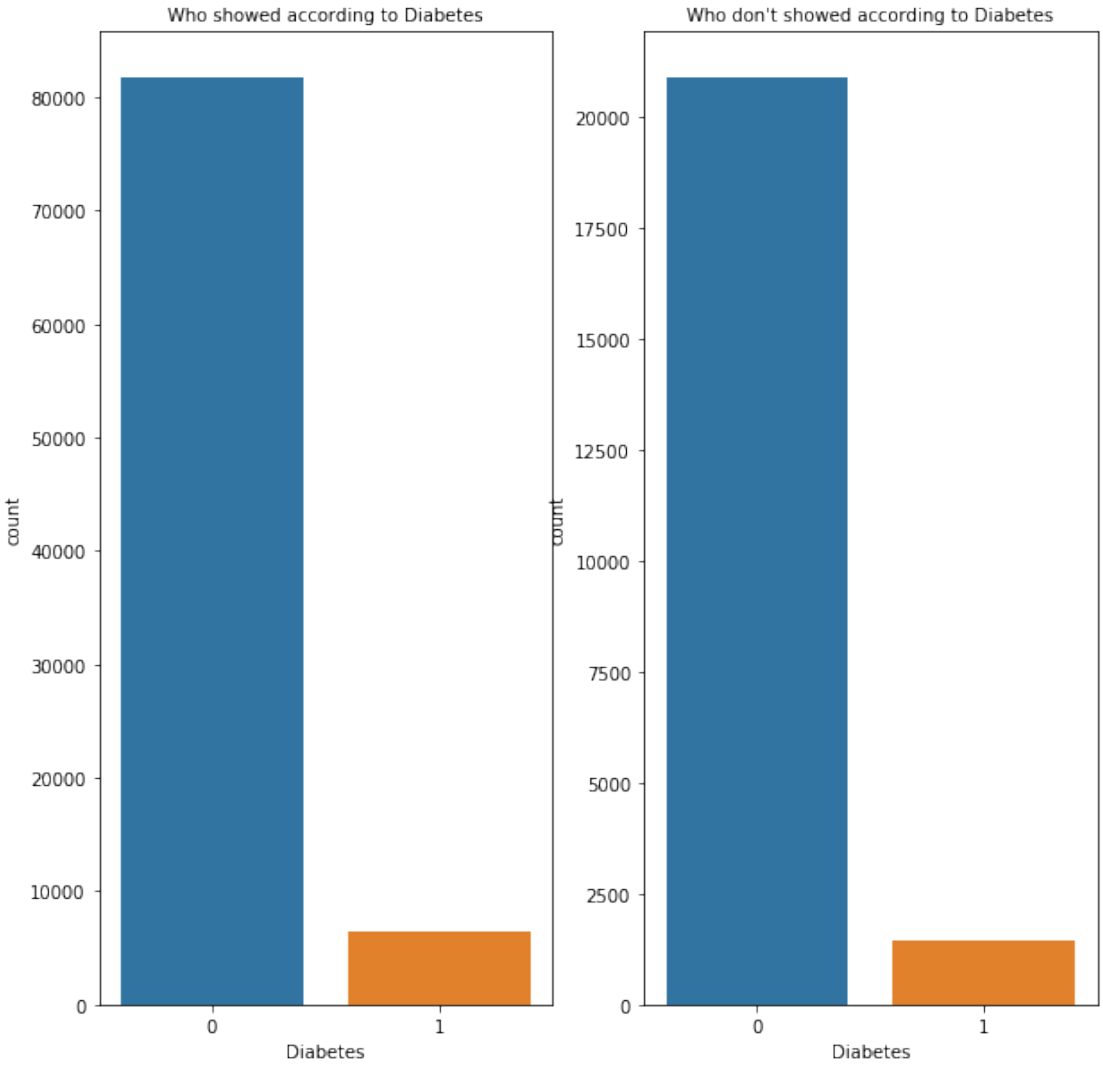



```
In [27]: df['Hipertension'].value_counts()
```

```
Out[27]: 0    88725
         1    21801
         Name: Hipertension, dtype: int64
```

who suffers from hipertension=$\frac{21801}{110527}$x100=19.7%
Hipertension is insignificant

```
In [28]: # plot between the number of patient who showed or not and Diabetes
         figure, axes=plt.subplots(1,2,figsize=(10,10))
         sns.countplot(df.Diabetes[show], ax=axes[0])
         axes[0].set_title("Who showed according to Diabetes",fontsize=10)
         sns.countplot(df.Diabetes[no_show], ax=axes[1])
         axes[1].set_title("Who don\'t showed according to Diabetes",fontsize=10);
```



diabetes is insignificant

```
In [ ]: # plot between the number of patient who showed or not and Alcoholism
        figure, axes=plt.subplots(1,2,figsize=(10,10))
        sns.countplot(df.Alcoholism[show], ax=axes[0])
        axes[0].set_title("Who showed according to Alcoholism",fontsize=10)
        sns.countplot(df.Alcoholism[no_show], ax=axes[1])
        axes[1].set_title("Who don\'t showed according to Alcoholism",fontsize=10);
```

Alcoholism is insignificant

```
In [ ]: # plot between the number of patient who showed or not and Handcap
        figure, axes=plt.subplots(1,2,figsize=(10,10))
        sns.countplot(df.Handcap[show], ax=axes[0])
        axes[0].set_title("Who showed according to Handcap",fontsize=10)
```

```
        sns.countplot(df.Handcap[no_show], ax=axes[1])
        axes[1].set_title("Who don\'t showed according to Handcap",fontsize=10);
```

Handcap is insignificant

```
In [ ]: # plot between the number of patient who showed or not and SMS_received
        figure, axes=plt.subplots(1,2,figsize=(10,10))
        sns.countplot(df.SMS_received[show], ax=axes[0])
        axes[0].set_title("Who showed according to SMS_received",fontsize=10)
        sns.countplot(df.SMS_received[no_show], ax=axes[1])
        axes[1].set_title("Who don\'t showed according to SMS_received",fontsize=10);
```

```
<li>The number of patient who recieved the SMS massenge is half the number of those who did not<
<li>SMS_received is insignificant</li>
```

Conclusions

```
<li>It is clear that the location of the hospital affects the number of showed patient</li>
<li>younger patient showed more than the older</li>
```

limitation : There is no direct correlation between the number of showed patient and hipertension, diabetes, alcoholism, Scholarship, handcap

1.2 Submitting your Project

```
In [ ]: from subprocess import call
        call(['python', '-m', 'nbconvert', 'Investigate_a_Dataset.ipynb'])
```