NoShowAppointment

April 27, 2022

1 Project: Investigate a Dataset - NoShowAppointment

1.1 Table of Contents

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' tells us on what day the patient set up their appointment.

'Neighborhood' indicates the location of the hospital.

'Scholarship' indicates whether or not the patient is enrolled in Brasilian welfare program Bolsa Família.

Be careful about the encoding of the last column: it says 'No' if the patient showed up to their appointment, and 'Yes' if they did not show up.

1.1.2 Question(s) for Analysis

1. What factors are important for us to know in order to predict if a patient will show up for their scheduled appointment?
2. which age category is attending less? and what about at the most schedualed time?
3. Are females having more scholoarships than males in the dataset? and what about the attendence for boht of them if they have and have not the scholarship?

```
In [1]: import pandas as pd
        import numpy as np
        import matplotlib.pyplot as plt
        % matplotlib inline
```

Data Wrangling

1.1.3 General Properties

1.1.4 Gathering data step

```
In [2]: df= pd.read_csv('noshowappointments-kagglev2-may-2016.csv')
        df.head()
```

Out[2]:

	PatientId	AppointmentID	Gender	ScheduledDay	\
0	2.987250e+13	5642903	F	2016-04-29T18:38:08Z	
1	5.589978e+14	5642503	M	2016-04-29T16:08:27Z	
2	4.262962e+12	5642549	F	2016-04-29T16:19:04Z	
3	8.679512e+11	5642828	F	2016-04-29T17:29:31Z	
4	8.841186e+12	5642494	F	2016-04-29T16:07:23Z	

	AppointmentDay	Age	Neighbourhood	Scholarship	Hipertension	\
0	2016-04-29T00:00:00Z	62	JARDIM DA PENHA	0	1	
1	2016-04-29T00:00:00Z	56	JARDIM DA PENHA	0	0	
2	2016-04-29T00:00:00Z	62	MATA DA PRAIA	0	0	
3	2016-04-29T00:00:00Z	8	PONTAL DE CAMBURI	0	0	
4	2016-04-29T00:00:00Z	56	JARDIM DA PENHA	0	1	

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

1.1.5 Assessment step

-Number of both rows and columns of the data to have a good prespective and decide how to clean data wisly(e.g. if I can drop the missing values or replace them)

-Discovering types of data tells you if there is a wrong data type needs to be handled and if the type is 'object' discovering the first element of the column to know like the 'SchedualeddDay' column

-I have tried to discover whether there are missing or duplicated values also the data types and does it need cleaning ?

-Number of unique values to check if there is something needs to be handled (e.g. " f " and " F " in gender column if it exists)

```
In [3]: def Assessment(df):

            print('The data contains: {} columns and {} rows \n'.format(df.shape[1],df.shape[0]))
            print('Here are types of the data: \n {} \n '.format(df.dtypes))
            print('Exploaring more about the data types of some confusing columns')
            print('The data type of schedualed day is {} \n '.format(type(df['ScheduledDay'][0])))
            print('The data type of Appointment day is {} \n'.format(type(df['AppointmentDay'][0])))
            print('Number of Nan values in the columns: \n {} \n'.format(df.isnull().sum()))
            print('Number of duplicated row: \n {} \n'.format(df.duplicated().sum()))
```

```
            print('Check the unique values of the columns: \n {}'.format(df.nunique()))

        Assessment(df)
```

```
The data contains: 14 columns and 110527 rows

Here are types of the data:
 PatientId         float64
AppointmentID       int64
Gender             object
ScheduledDay       object
AppointmentDay     object
Age                 int64
Neighbourhood      object
Scholarship         int64
Hipertension        int64
Diabetes            int64
Alcoholism          int64
Handcap             int64
SMS_received        int64
No-show            object
dtype: object

Exploaring more about the data types of some confusing columns
The data type of schedualed day is <class 'str'>

The data type of Appointment day is <class 'str'>

Number of Nan values in the columns:
 PatientId         0
AppointmentID     0
Gender            0
ScheduledDay      0
AppointmentDay    0
Age               0
Neighbourhood     0
Scholarship       0
Hipertension      0
Diabetes          0
Alcoholism        0
Handcap           0
SMS_received      0
No-show           0
dtype: int64

Number of duplicated row:
 0
```

```
Check the unique values of the columns:
 PatientId          62299
AppointmentID     110527
Gender                 2
ScheduledDay      103549
AppointmentDay        27
Age                  104
Neighbourhood         81
Scholarship            2
Hipertension           2
Diabetes               2
Alcoholism             2
Handcap                5
SMS_received           2
No-show                2
dtype: int64
```

1.1.6 Data Cleaning

- Both missing and duplicated values are okay
- For data types of both SchedualDay and AppointmentDay need to be converted from string to datetime for more effective analysis
- There is no need to use some columns such as 'PatientId' and 'AppointmentID' where there is no varible inforamtion to be involved in the analysis
- Creating 'Age_categories' column to make the 'Age' column more accessible to analyze.

```
In [4]: def cleaning(df):

            df['ScheduledDay']=pd.to_datetime(df['ScheduledDay'])
            print('The new type of schedualed day is {}'.format(type(df['ScheduledDay'][0])))
            df['AppointmentDay']=pd.to_datetime(df['AppointmentDay'])
            print('The new type of appointment day is {}'.format(type(df['AppointmentDay'][0])))
            df.drop(columns=['PatientId','AppointmentID'], axis =1, inplace =True)
            bin_edges = [0,14,24,64,200]
            bin_names =['children','youth','adults','seniors']
            df['Age_categories'] =pd.cut(df['Age'],bin_edges,labels = bin_names)
            cleaned_df = df.head()
            return cleaned_df
        cleaning(df)
```

```
The new type of schedualed day is <class 'pandas._libs.tslibs.timestamps.Timestamp'>
The new type of appointment day is <class 'pandas._libs.tslibs.timestamps.Timestamp'>
```

```
Out[4]:   Gender        ScheduledDay AppointmentDay  Age      Neighbourhood  \
        0      F 2016-04-29 18:38:08     2016-04-29   62    JARDIM DA PENHA
        1      M 2016-04-29 16:08:27     2016-04-29   56    JARDIM DA PENHA
        2      F 2016-04-29 16:19:04     2016-04-29   62      MATA DA PRAIA
```

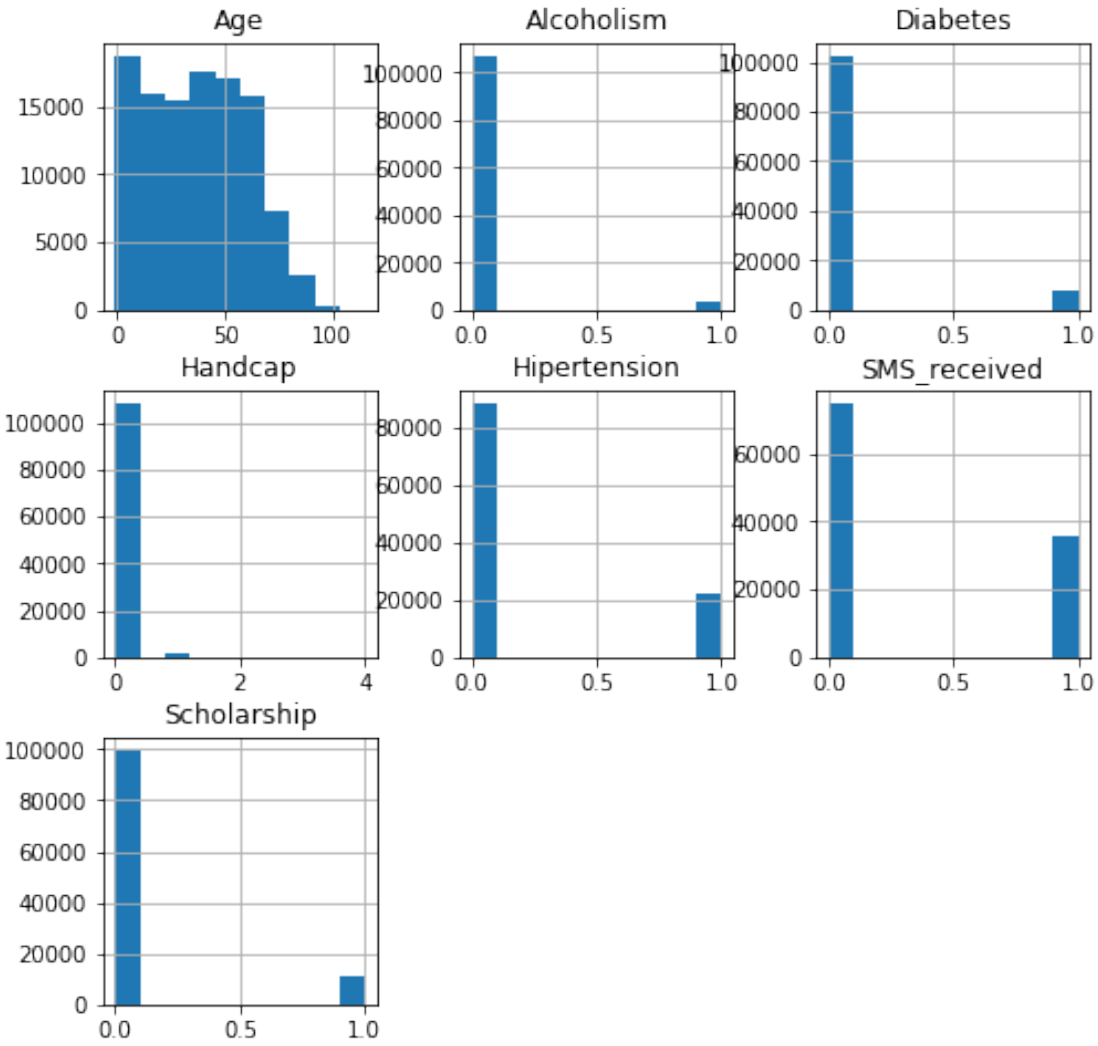
```
3      F 2016-04-29 17:29:31     2016-04-29    8  PONTAL DE CAMBURI
4      F 2016-04-29 16:07:23     2016-04-29   56    JARDIM DA PENHA

   Scholarship  Hipertension  Diabetes  Alcoholism  Handcap  SMS_received  \
0            0             1         0           0        0             0
1            0             0         0           0        0             0
2            0             0         0           0        0             0
3            0             0         0           0        0             0
4            0             1         1           0        0             0

  No-show Age_categories
0      No         adults
1      No         adults
2      No         adults
3      No       children
4      No         adults
```

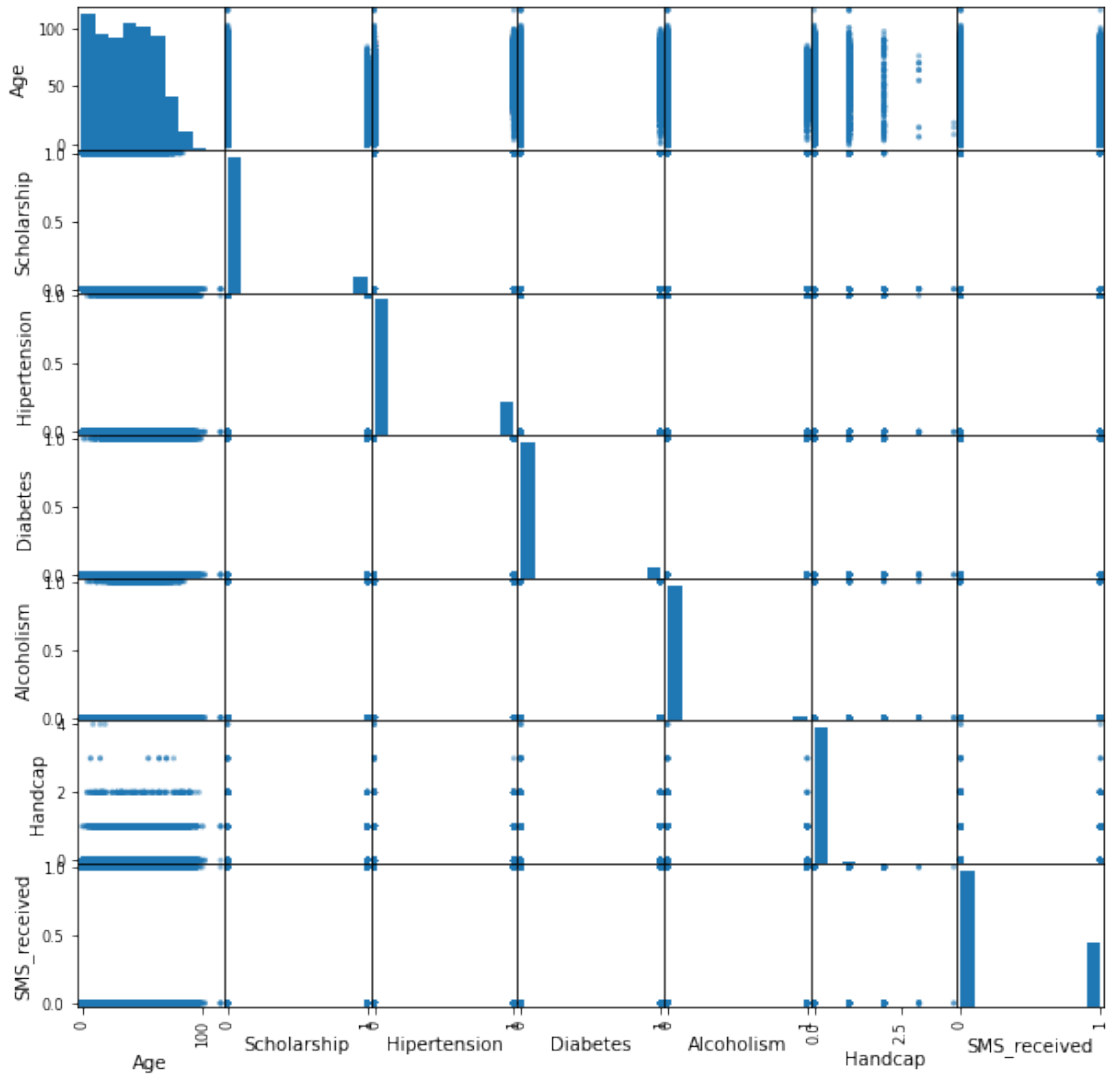
Exploratory Data Analysis

1.1.7 Research Question 1 (What factors are important for us to know in order to predict if a patient will show up for their scheduled appointment?)

```
In [6]: def General_exploration(df):
            print('The city that contains the largest number of people having the appointment is
            print('The city that contains the smallest number of people having the appointment i


            df.hist(figsize=(8,8));
            pd.plotting.scatter_matrix(df,figsize=(10,10));
        General_exploration(df)
```

```
The city that contains the largest number of people having the appointment is ANDORINHAS
The city that contains the smallest number of people having the appointment is JARDIM DA PENHA
```

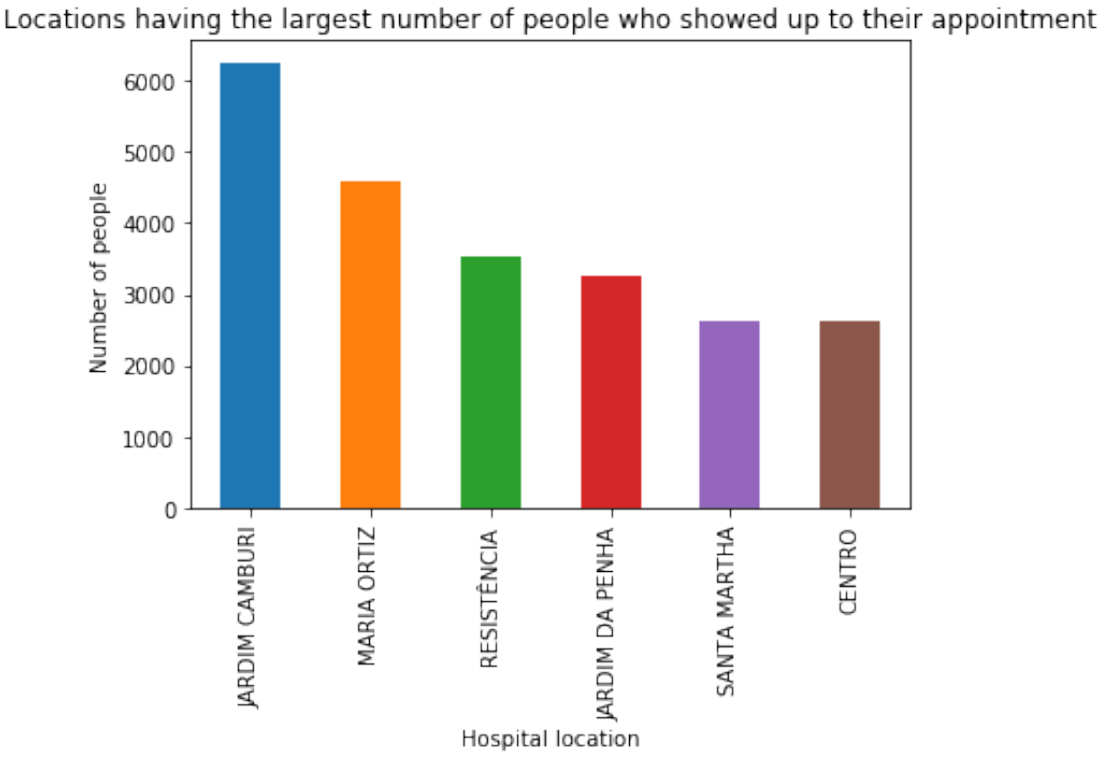

Age
Alcoholism
Diabetes
Handcap
Hipertension
SMS_received
Scholarship

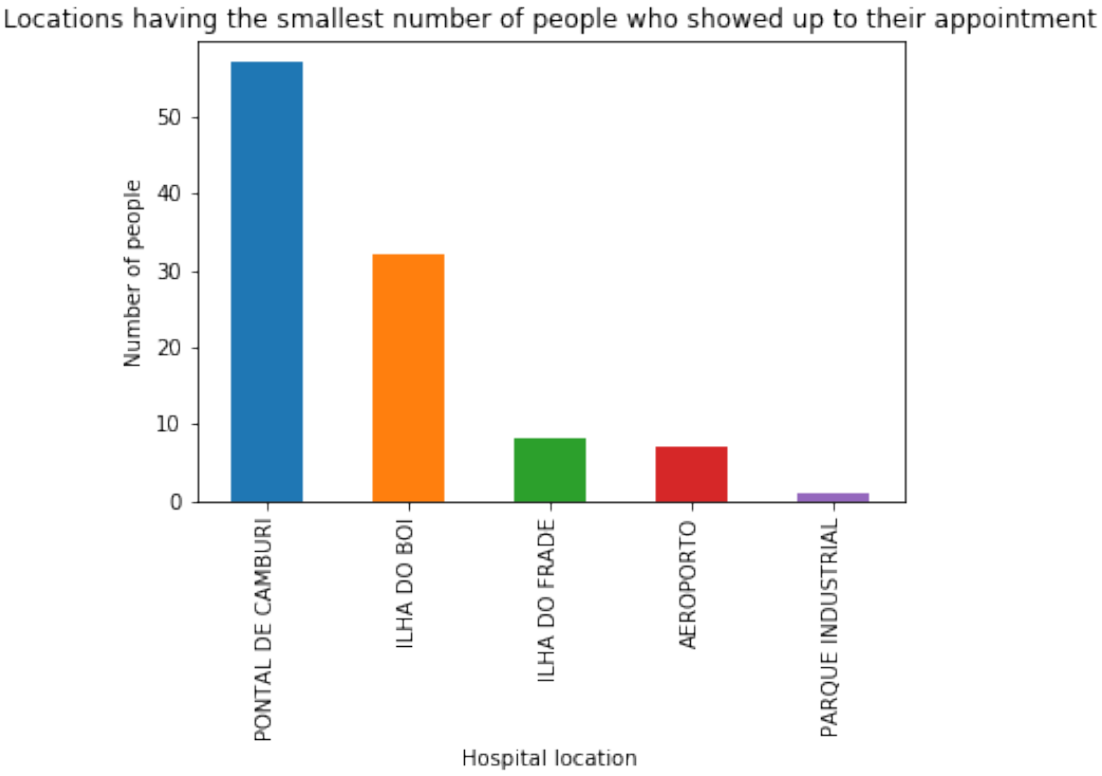


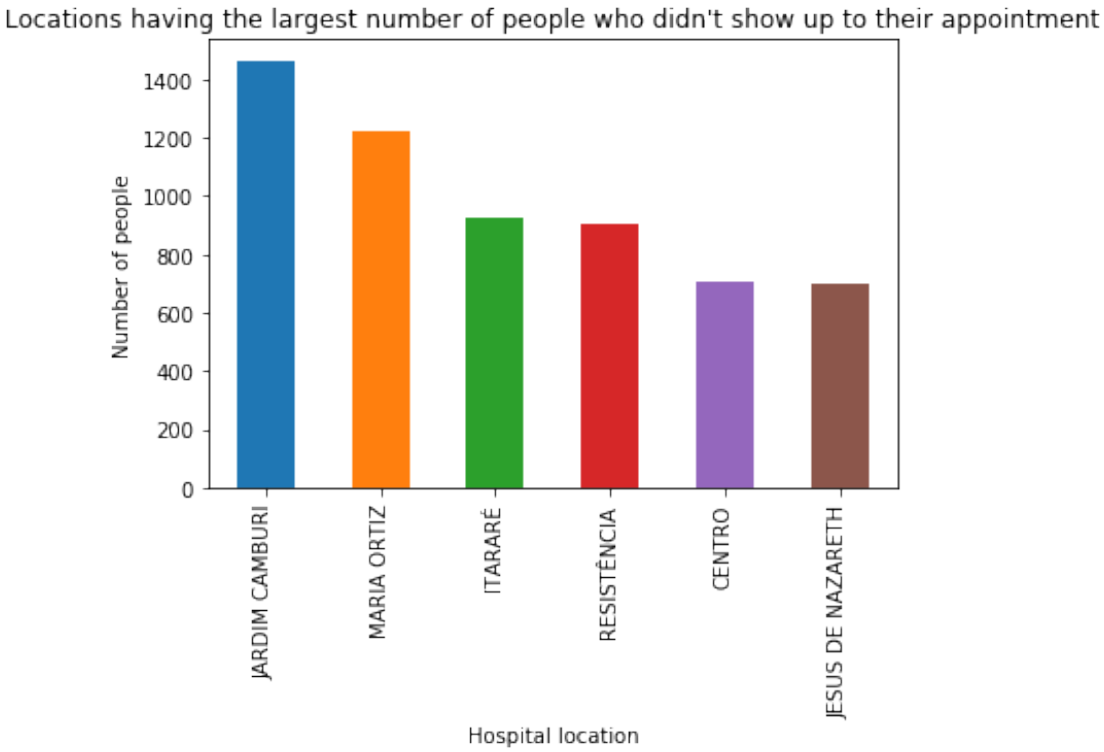

```
In [7]: def Answer_1Q(df):
            no =df['Neighbourhood'][df['No-show'] == "No"].value_counts()
            yes =df['Neighbourhood'][df['No-show'] == "Yes"].value_counts()
            no[:6].plot(kind='bar')
            plt.title('Locations having the largest number of people who showed up to their appo
            plt.ylabel('Number of people')
            plt.xlabel('Hospital location')
            plt.figure('1')
            no[75:].plot(kind = 'bar')
            plt.title('Locations having the smallest number of people who showed up to their app
            plt.ylabel('Number of people')
            plt.xlabel('Hospital location')
            plt.figure('2')
            yes[:6].plot(kind='bar')
```

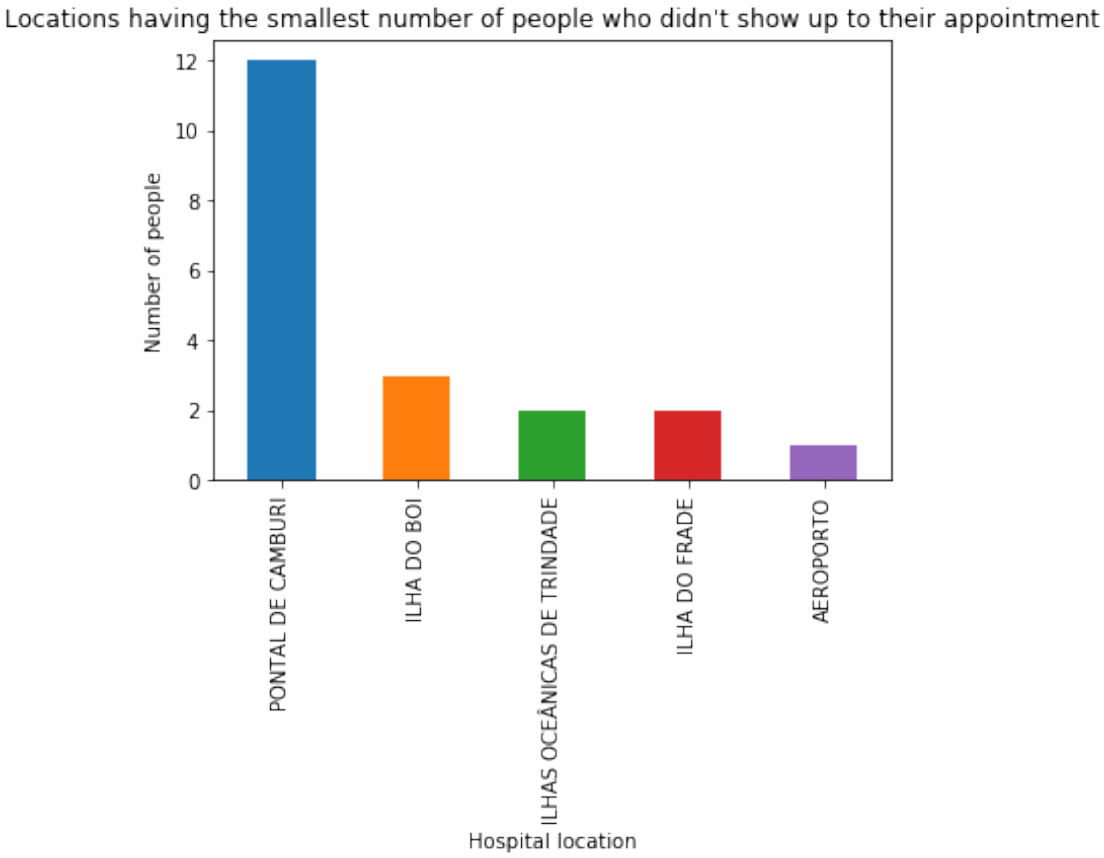
```
plt.title('Locations having the largest number of people who didn\'t show up to thei
plt.ylabel('Number of people')
plt.xlabel('Hospital location')
plt.figure('3')
yes[75:].plot(kind='bar')
plt.title('Locations having the smallest number of people who didn\'t show up to the
plt.ylabel('Number of people')
plt.xlabel('Hospital location')
plt.figure('4')
#print('The city that having largest number of people who showed up to their appoint
#print('The city that having smallest number of people who showed up to their appoin
#print('The city that having largest number of people who didn\'t show up to their a
#print('The city that having smallest number of people who didn\'t show up to their

list_of_vars= list(df.columns)
unwanted =['No-show', 'ScheduledDay','AppointmentDay', 'Neighbourhood','Age']
cols =list(set(list_of_vars) - set(unwanted))
for i in range(len(cols)):
    plt.subplots()
    df.groupby('No-show')['{}'.format(cols[i])].value_counts().plot(kind='barh');
    plt.xlabel('How many people?')
    plt.title('Corelation between {} and appointment absence'.format(cols[i]))
```

```
Answer_1Q(df)
```

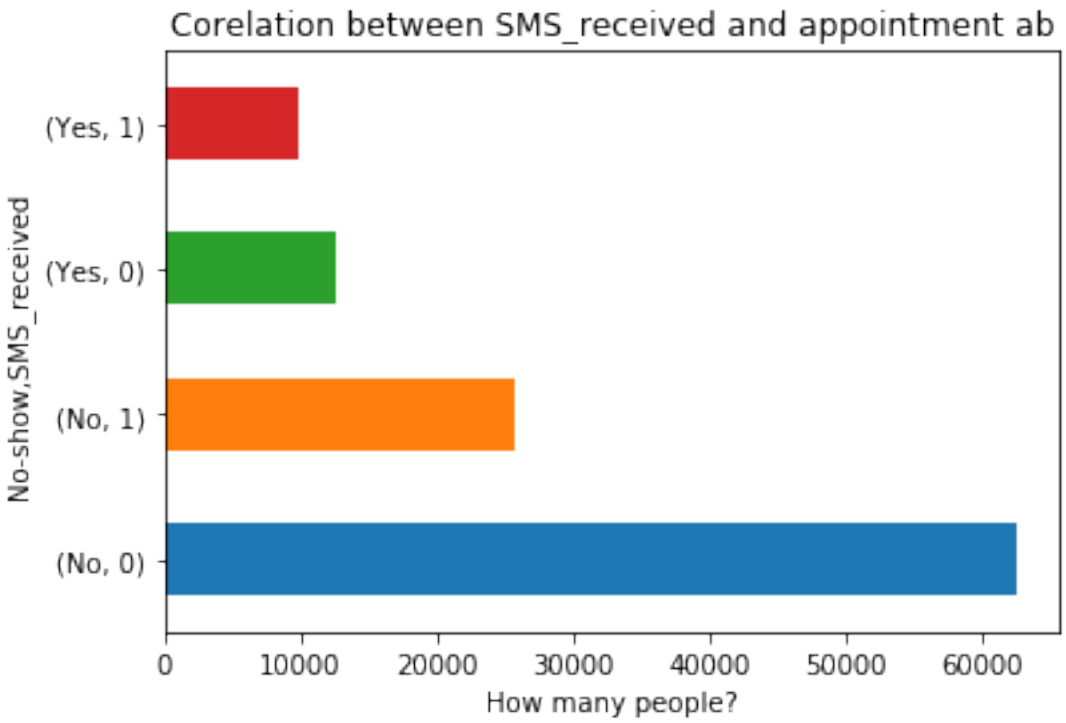


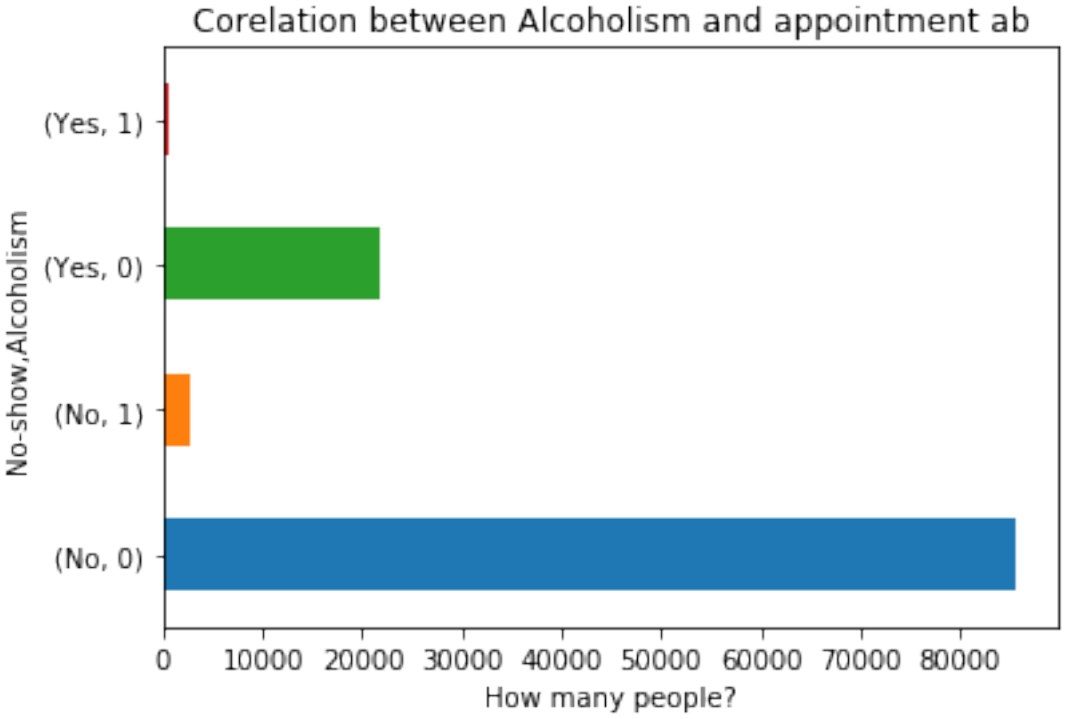

Locations having the smallest number of people who showed up to their appointment
Number of people
0
10
20
30
40
50
PONTAL DE CAMBURI
ILHA DO BOI
ILHA DO FRADE
AEROPORTO
PARQUE INDUSTRIAL
Hospital location

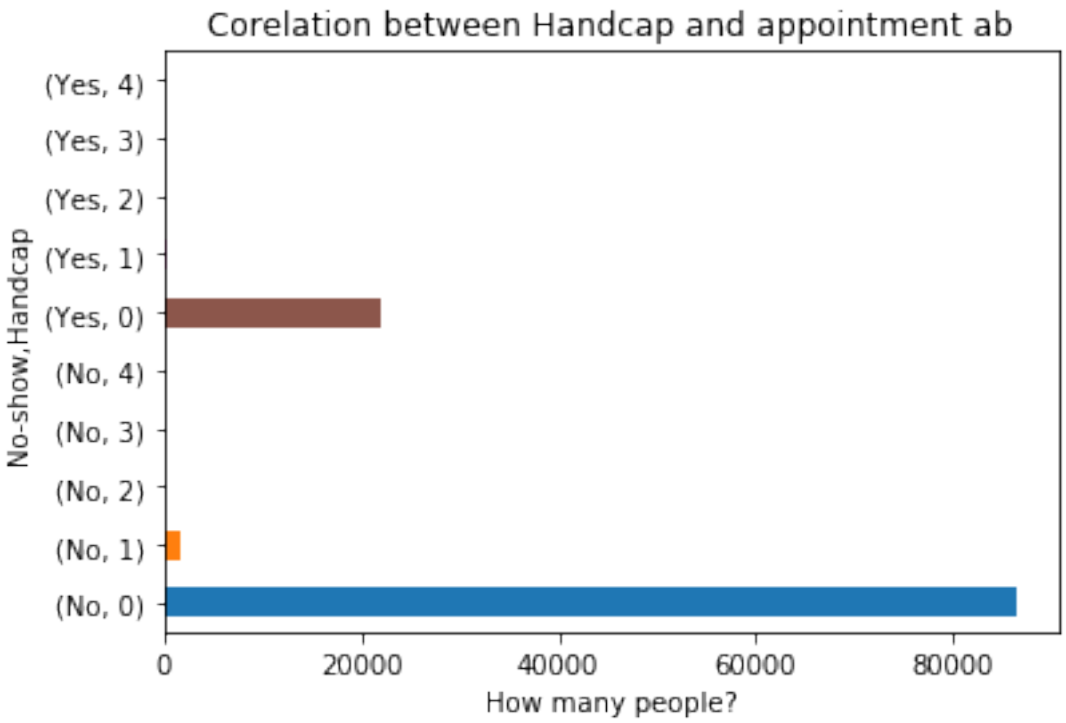

Locations having the largest number of people who didn't show up to their appointment
Number of people
0
200
400
600
800
1000
1200
1400
JARDIM CAMBURI
MARIA ORTIZ
ITARARÉ
RESISTÊNCIA
CENTRO
JESUS DE NAZARETH
Hospital location

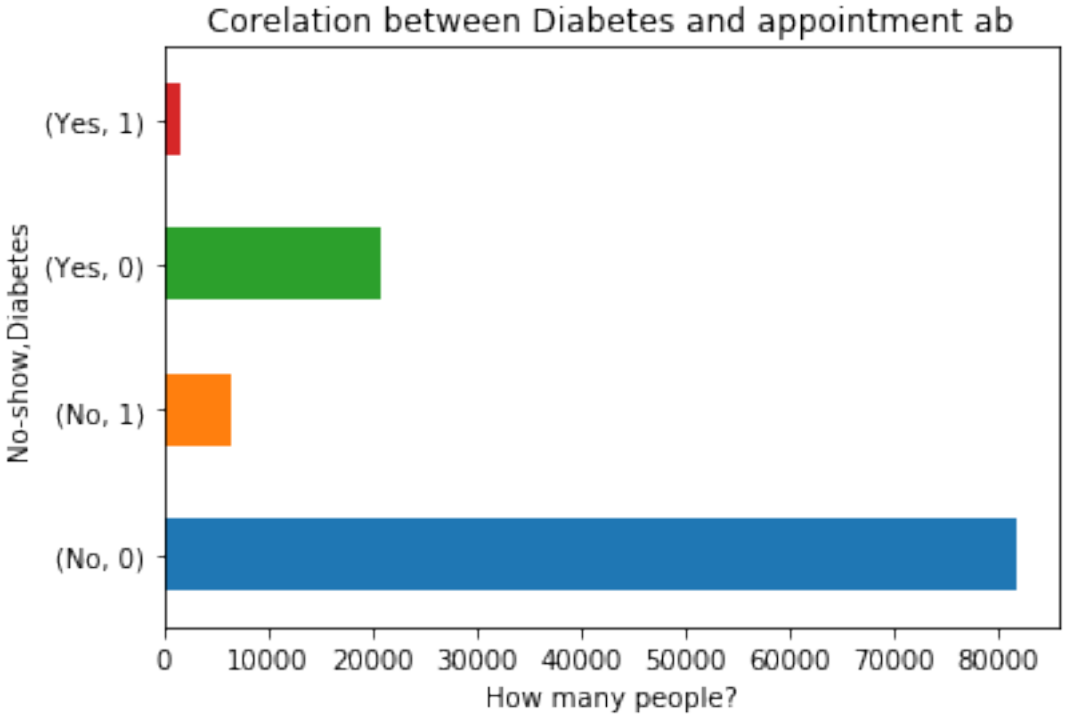


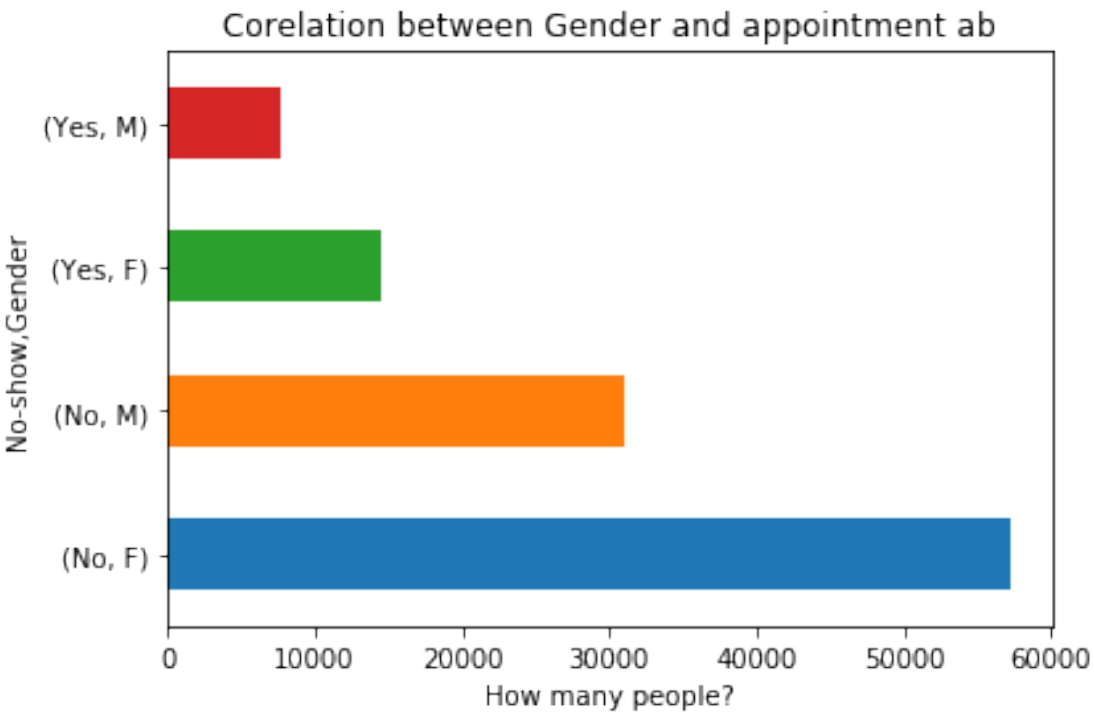

```
<matplotlib.figure.Figure at 0x7f03b13f17b8>
```

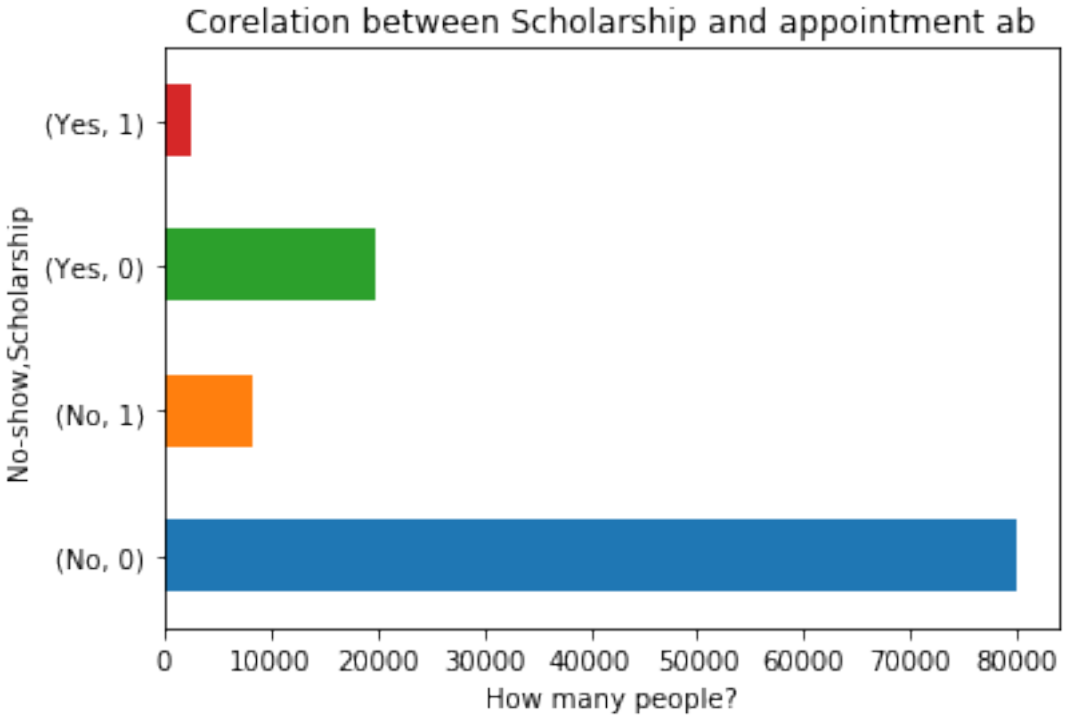

Corelation between SMS_received and appointment ab
No-show,SMS_received
(Yes, 1)
(Yes, 0)
(No, 1)
(No, 0)
0
10000
20000
30000
40000
50000
60000
How many people?

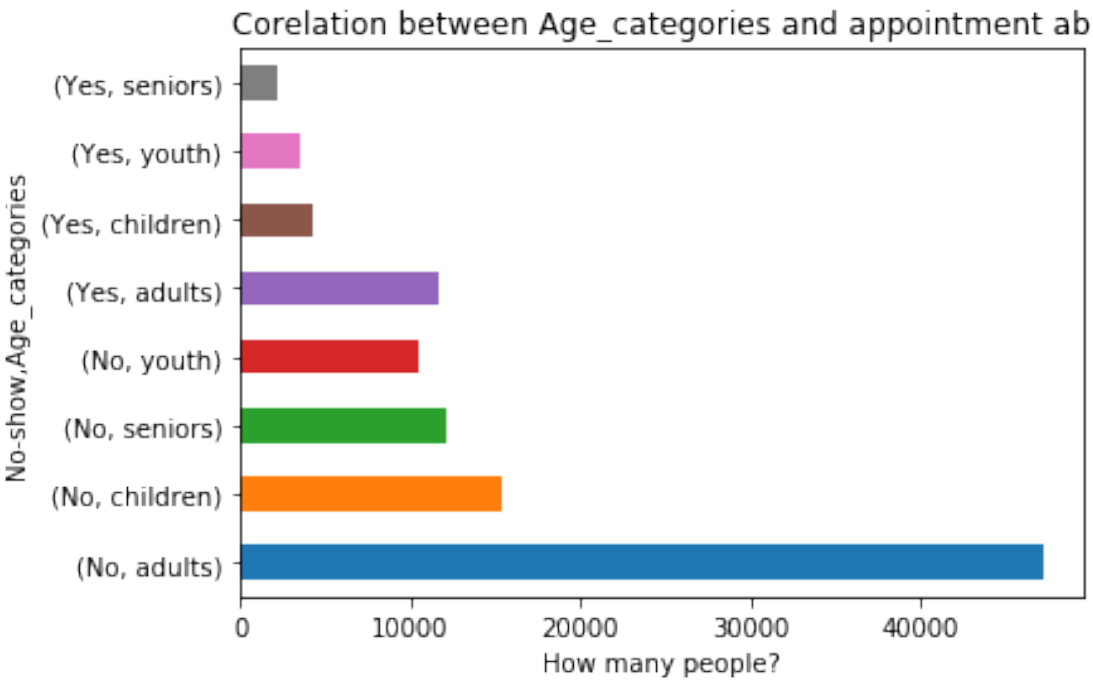

Corelation between Alcoholism and appointment ab
No-show,Alcoholism
(Yes, 1)
(Yes, 0)
(No, 1)
(No, 0)
0
10000
20000
30000
40000
50000
60000
70000
80000
How many people?

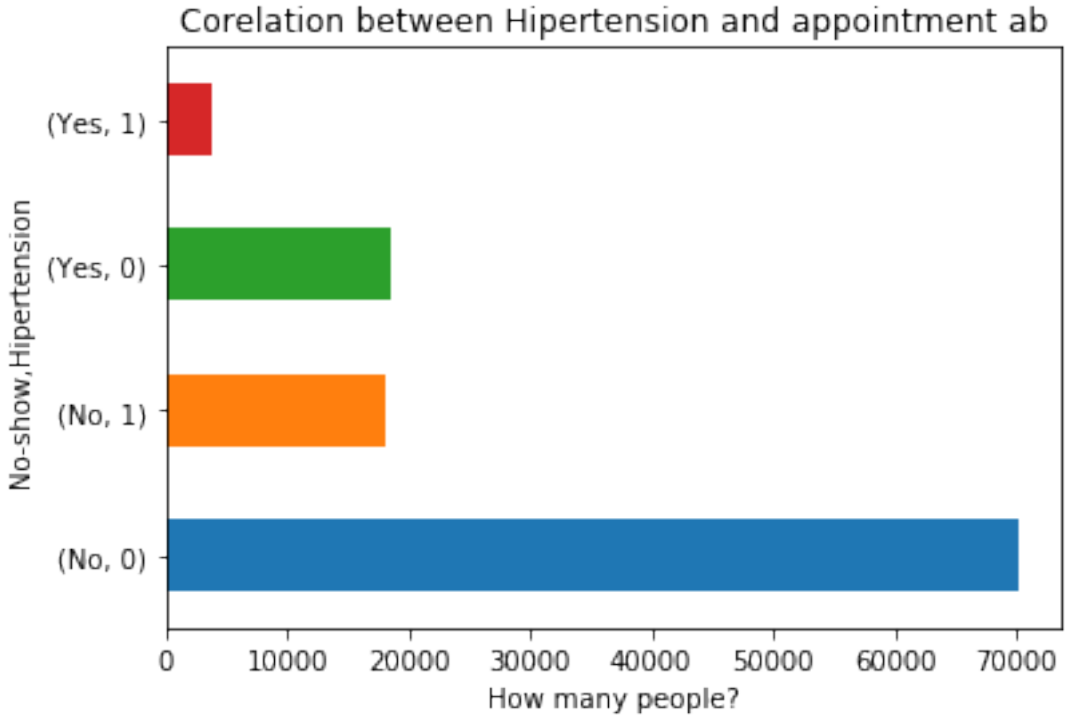

Corelation between Handcap and appointment ab
(Yes, 4)
(Yes, 3)
(Yes, 2)
(Yes, 1)
(Yes, 0)
(No, 4)
(No, 3)
(No, 2)
(No, 1)
(No, 0)
No-show,Handcap
0
20000
40000
60000
80000
How many people?


Corelation between Diabetes and appointment ab
(Yes, 1)
(Yes, 0)
(No, 1)
(No, 0)
No-show,Diabetes
0
10000
20000
30000
40000
50000
60000
70000
80000
How many people?


Corelation between Gender and appointment ab
(Yes, M)
(Yes, F)
(No, M)
(No, F)
No-show,Gender
0
10000
20000
30000
40000
50000
60000
How many people?

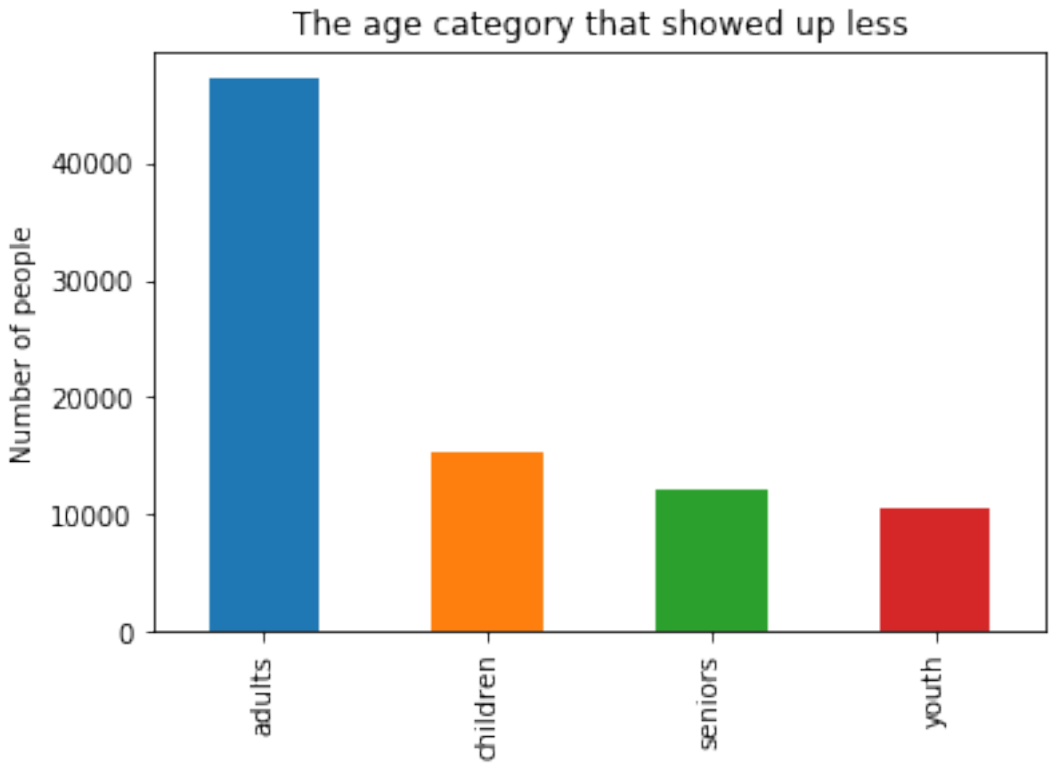

Corelation between Scholarship and appointment ab
(Yes, 1)
(Yes, 0)
(No, 1)
(No, 0)
No-show,Scholarship
0
10000
20000
30000
40000
50000
60000
70000
80000
How many people?

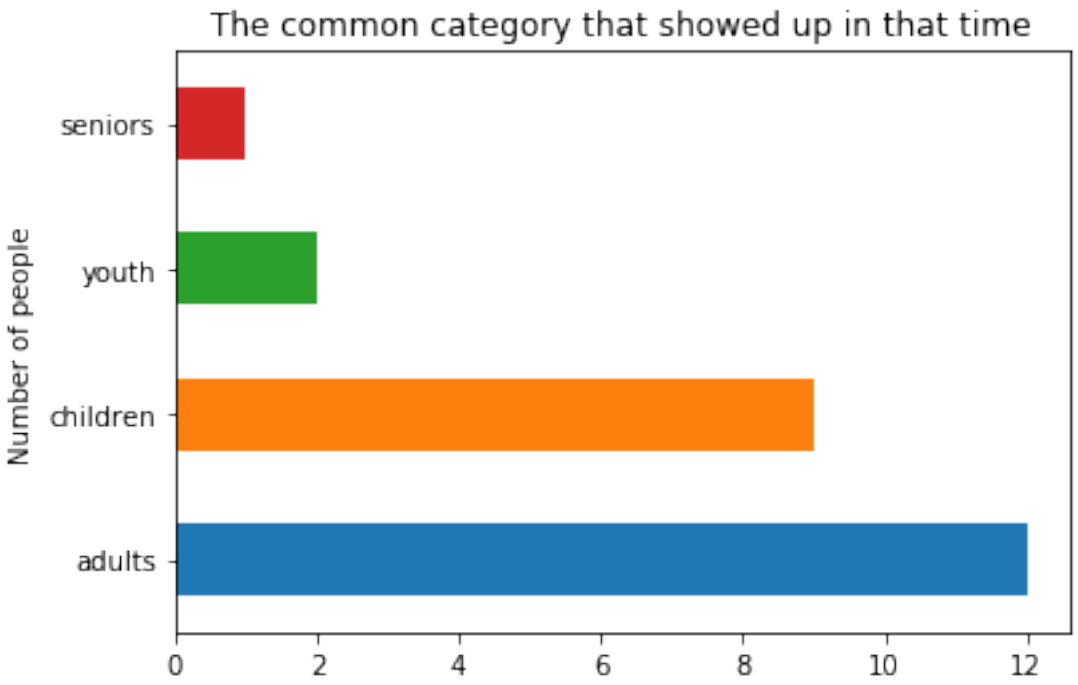

Corelation between Age_categories and appointment ab
(Yes, seniors)
(Yes, youth)
(Yes, children)
(Yes, adults)
(No, youth)
(No, seniors)
(No, children)
(No, adults)
No-show,Age_categories
0
10000
20000
30000
40000
How many people?


Corelation between Hipertension and appointment ab
(Yes, 1)
(Yes, 0)
(No, 1)
(No, 0)
No-show,Hipertension
0
10000
20000
30000
40000
50000
60000
70000
How many people?

1.1.8 Research Question 2 (which age category is attending less? and what about at the most schedualed time?)

```
In [13]: def Answer_2Q(df):
             plt.title('The age category that showed up less')
             df['Age_categories'][df['No-show']=="No"].value_counts().plot(kind='bar');
             plt.ylabel('Number of people')
             plt.figure('part_1')

             common_day =df['ScheduledDay'].mode()[0]
             df['Age_categories'][df['ScheduledDay'] == "2016-05-06 07:09:54"].value_counts().pl
             plt.title('The common category that showed up in that time')
             plt.ylabel('Number of people')

             plt.figure('part_2')

         Answer_2Q(df)
```



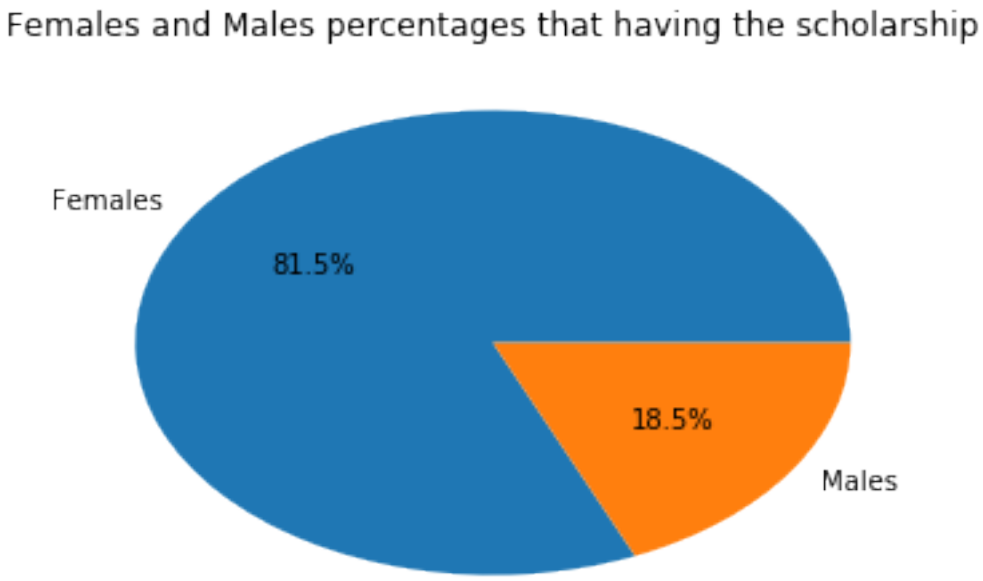


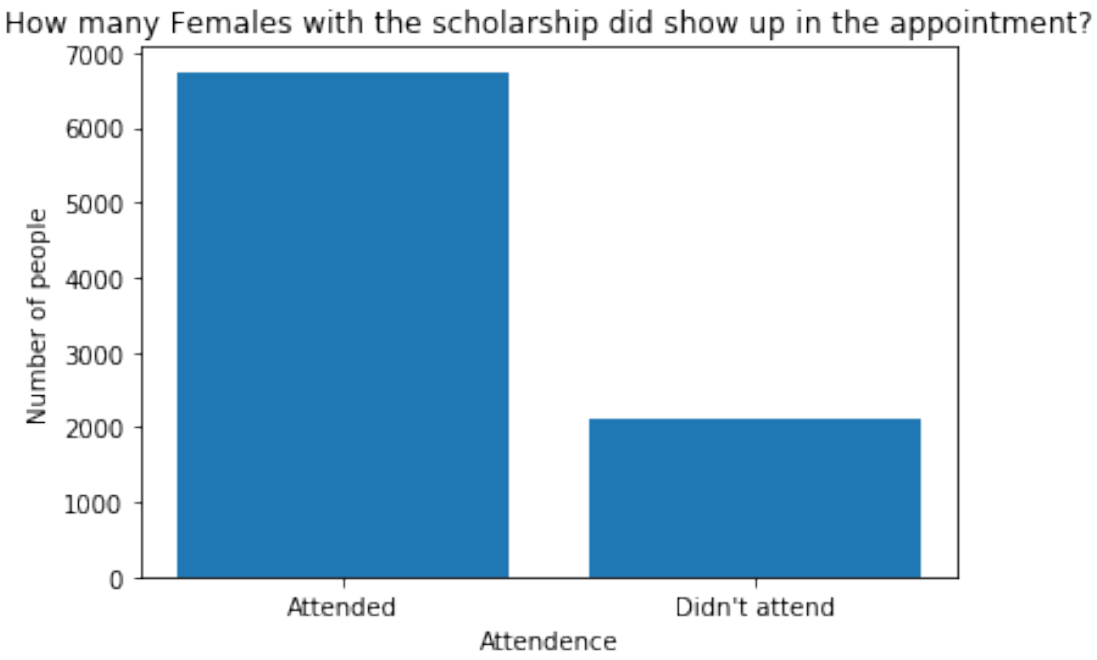

```
<matplotlib.figure.Figure at 0x7f3507f974e0>
```

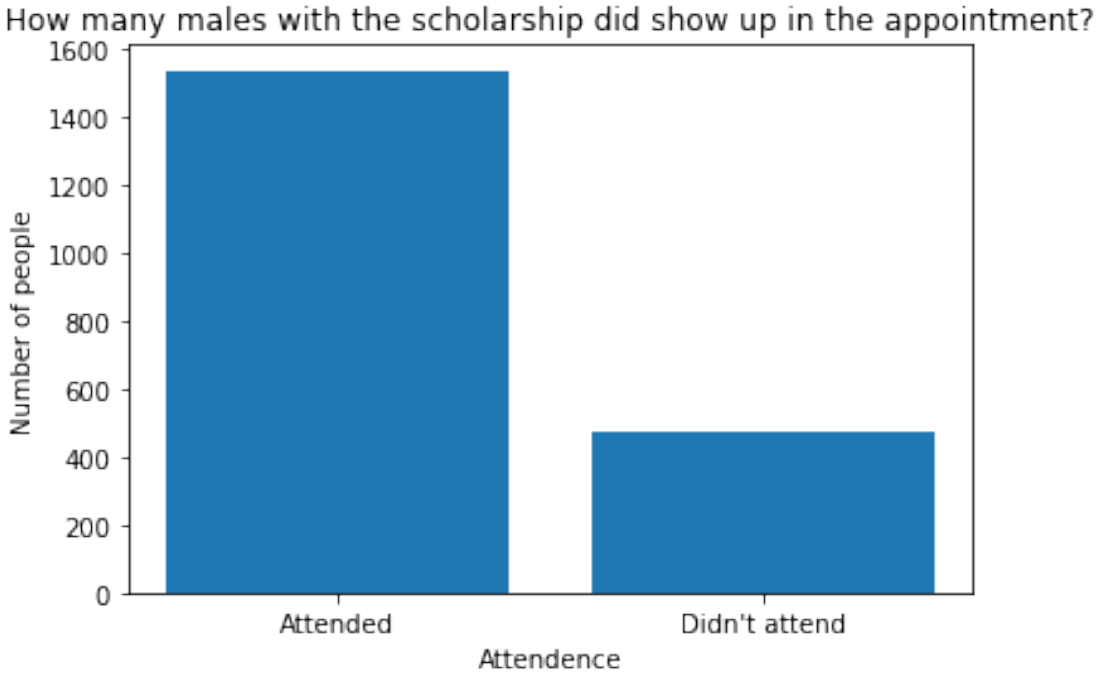
1.1.9 Research Question 3 (Are females having more scholoarships than males in the dataset? and what about the attendence for boht of them if they have and have not the scholarship?)

```
In [29]: def Answer_3Q(df):
             plt.title('Females and Males percentages that having the scholarship')
             third1 =df.query('Scholarship == 1')['Gender'].value_counts()
             plt.pie(third1,autopct='%1.1f%%',labels=['Females','Males']);
             plt.figure('1')

             third2_f =df.query('Scholarship == 1')[['Gender','No-show']]
             f =third2_f.query('Gender == "F"')['No-show'].value_counts()
             attendence = ['Attended', 'Didn\'t attend']
             plt.bar(attendence,f);
             plt.title('How many Females with the scholarship did show up in the appointment?')
             plt.xlabel('Attendence')
             plt.ylabel('Number of people')
             plt.figure('2')

             third2 =df.query('Scholarship == 1')[['Gender','No-show']]
             m =third2.query('Gender == "M"')['No-show'].value_counts()
             plt.bar(attendence,m);
```

```
    plt.title('How many males with the scholarship did show up in the appointment?')
    plt.xlabel('Attendence')
    plt.ylabel('Number of people')
    plt.figure('3')

Answer_3Q(df)
```








```
<matplotlib.figure.Figure at 0x7f2adc0b1940>
```

Conclusions

1.1.10 Results:

The data suggests that:

- Although the location has the maxmum number of people having the appointment is **ANDORINHAS**, but **JARDIM CAMBURI** is the one which has the largest number of people attending the appointment and and although **JARDIM DA PENHA** location has the minmum number of people having the appointment, but **AEROPORTO** seems to have the smallest number of people who isn't attending.
- There are high number of adults in the dataset and they are also the most appearing and not appearing group while the youth was the less appearing and the seinors less to not appear.
- Handicap patients specially are more likely to show up.
- In same way of SMS and scholarship factors which have some effect on attendence where they more people having them tend to show up in the appointment, people with disease(e.g.hypertention and diabetes) attend more compared to people who don't have any of the four.
- As the graph shows the Gender factor has an effect on the attendence due to the large number of females having the appointment.
- Most of alcohol adictors have more tendency to attend showing strong correlation.
- The age category that less showed up is Youth category.
- Adults category the most common group that schedualed in the most common schedualed day.
- Females enroll in the Bolisa Familia porgram more than Males.
- Most of them both attend while they have scholarship.

1.1.11 Limitations:

- Number of unique hospitals' locations in the data are 80 and not categorized to largre areas to lower their count for better analysis.
- Since most of the data varibles are categorical, a high level of statistical analysis is not allowed.