No-show appointments

September 5, 2021

1 Project: No-show appointments

1.1 Table of Contents

## 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' 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.
  - 'No-show' indicates No if shown and Yes if they didn't show up
  - 'Hipertension' indicates 0 for no and 1 for yes
  - 'Diabetes' indicates 0 for no diabetes and 1 if they have diabetes
  - 'Alcoholism' indicates 0 if they never take any alcohols and 1 if they have a history
  - 'Handicap' indicates 0 if they are not and 1 if they are handicaps
  - 'ScheduledDay' and 'AppointmentDay' related to the day of scheduling or appointment are they far from each other?

1.1.2 Question(s) for Analysis

- What is the proportion of people that didn't come?
- Is there a relation between not showing up and if they received SMS?
- Is there a relation between not showing up and if they were included in scholarship?
- Is there a relation between not showing up and if they were Handicapped?
- Is there a relation between not showing up and if they had an related history to alcohol?
- Is there a relation between not showing up and if they had a Diabetes?
- Is there a relation between not showing up and if they had a Hipertension?
- Which neighbourhood had received most people ?

- Is there a relation between not showing up and Age?

[1]:
```
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
import seaborn as sns

%matplotlib inline
```

[2]:
```
# Upgrade pandas
!pip install --upgrade pandas==1.3.2
```

```
Requirement already up-to-date: pandas==1.3.2 in
c:\users\peter\anaconda3\lib\site-packages (1.3.2)
Requirement already satisfied, skipping upgrade: numpy>=1.17.3 in
c:\users\peter\anaconda3\lib\site-packages (from pandas==1.3.2) (1.19.2)
Requirement already satisfied, skipping upgrade: pytz>=2017.3 in
c:\users\peter\anaconda3\lib\site-packages (from pandas==1.3.2) (2020.1)
Requirement already satisfied, skipping upgrade: python-dateutil>=2.7.3 in
c:\users\peter\anaconda3\lib\site-packages (from pandas==1.3.2) (2.8.1)
Requirement already satisfied, skipping upgrade: six>=1.5 in
c:\users\peter\anaconda3\lib\site-packages (from python-
dateutil>=2.7.3->pandas==1.3.2) (1.15.0)
```

## Data Wrangling

1.1.3 Gathering,Importing, Assessing and Cleaning Data Set

[3]:
```
df = pd.read_csv("noshowappointments-kagglev2-may-2016.csv")
df.head(3)
```

[3]:
```
      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

         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

   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
```

[4]:
```
df.tail(3)
```

```
[4]:            PatientId  AppointmentID Gender          ScheduledDay  \
     110524  1.557663e+13        5630692      F  2016-04-27T16:03:52Z
     110525  9.213493e+13        5630323      F  2016-04-27T15:09:23Z
     110526  3.775115e+14        5629448      F  2016-04-27T13:30:56Z

                   AppointmentDay  Age Neighbourhood  Scholarship  Hipertension  \
     110524  2016-06-07T00:00:00Z   21   MARIA ORTIZ            0             0
     110525  2016-06-07T00:00:00Z   38   MARIA ORTIZ            0             0
     110526  2016-06-07T00:00:00Z   54   MARIA ORTIZ            0             0

             Diabetes  Alcoholism  Handcap  SMS_received No-show
     110524         0           0        0             1      No
     110525         0           0        0             1      No
     110526         0           0        0             1      No
```

As we can see there's a columns we can drop like PatientId, AppointmentID. There's a cases we might not need to drop those columns. That's when we want to identify which Patient or which ID that hasn't shown "Maybe there's a death or something"

We will check unique values, null values, duplicated values first, datatypes, datashape and of course description

```
[5]: df.shape
```

```
[5]: (110527, 14)
```

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

```
[6]: 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
```

```
[7]: df.isnull().sum()
```

```
[7]: 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
```

[8]:
```
df.describe()
```

[8]:
```
          PatientId  AppointmentID            Age    Scholarship  \
count  1.105270e+05   1.105270e+05  110527.000000  110527.000000
mean   1.474963e+14   5.675305e+06      37.088874       0.098266
std    2.560949e+14   7.129575e+04      23.110205       0.297675
min    3.921784e+04   5.030230e+06      -1.000000       0.000000
25%    4.172614e+12   5.640286e+06      18.000000       0.000000
50%    3.173184e+13   5.680573e+06      37.000000       0.000000
75%    9.439172e+13   5.725524e+06      55.000000       0.000000
max    9.999816e+14   5.790484e+06     115.000000       1.000000

        Hipertension       Diabetes     Alcoholism        Handcap  \
count  110527.000000  110527.000000  110527.000000  110527.000000
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
```

[9]:
```
df.duplicated().sum()
```

[9]:
```
0
```

[10]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 110527 entries, 0 to 110526
Data columns (total 14 columns):
 #   Column          Non-Null Count   Dtype
---  ------          --------------   -----
 0   PatientId       110527 non-null  float64
 1   AppointmentID   110527 non-null  int64
 2   Gender          110527 non-null  object
 3   ScheduledDay    110527 non-null  object
 4   AppointmentDay  110527 non-null  object
 5   Age             110527 non-null  int64
 6   Neighbourhood   110527 non-null  object
 7   Scholarship     110527 non-null  int64
 8   Hipertension    110527 non-null  int64
 9   Diabetes        110527 non-null  int64
 10  Alcoholism      110527 non-null  int64
 11  Handcap         110527 non-null  int64
 12  SMS_received    110527 non-null  int64
 13  No-show         110527 non-null  object
dtypes: float64(1), int64(8), object(5)
memory usage: 11.8+ MB
```

[11]:
```
# by repeating this code we get the following
type(df['No-show'][0])
```

[11]:
```
str
```

The dtypes we get

- 2 Gender 110527 non-null object (String)
- 3 ScheduledDay 110527 non-null object (String)
- 4 AppointmentDay 110527 non-null object (String)
- 6 Neighbourhood 110527 non-null object (String)
- 13 No-show 110527 non-null object (String)

1.1.4 Data Cleaning

1.2 Copy Dataframe

[12]:
```
# Before droping let's make a copy of our dataframe that's a safest option
df_1 = df.copy()
```

1.3 Drop ID columns

[13]:
```python
df_1.drop(['PatientId','AppointmentID'], axis = 1, inplace = True)
df_1.head()
```

[13]:
```
  Gender          ScheduledDay        AppointmentDay  Age      Neighbourhood  \
0      F  2016-04-29T18:38:08Z  2016-04-29T00:00:00Z   62    JARDIM DA PENHA
1      M  2016-04-29T16:08:27Z  2016-04-29T00:00:00Z   56    JARDIM DA PENHA
2      F  2016-04-29T16:19:04Z  2016-04-29T00:00:00Z   62      MATA DA PRAIA
3      F  2016-04-29T17:29:31Z  2016-04-29T00:00:00Z    8  PONTAL DE CAMBURI
4      F  2016-04-29T16:07:23Z  2016-04-29T00:00:00Z   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
0      No
1      No
2      No
3      No
4      No
```

[14]:
```python
df_1.tail()
```

[14]:
```
       Gender          ScheduledDay        AppointmentDay  Age Neighbourhood  \
110522      F  2016-05-03T09:15:35Z  2016-06-07T00:00:00Z   56   MARIA ORTIZ
110523      F  2016-05-03T07:27:33Z  2016-06-07T00:00:00Z   51   MARIA ORTIZ
110524      F  2016-04-27T16:03:52Z  2016-06-07T00:00:00Z   21   MARIA ORTIZ
110525      F  2016-04-27T15:09:23Z  2016-06-07T00:00:00Z   38   MARIA ORTIZ
110526      F  2016-04-27T13:30:56Z  2016-06-07T00:00:00Z   54   MARIA ORTIZ

        Scholarship  Hipertension  Diabetes  Alcoholism  Handcap  \
110522            0             0         0           0        0
110523            0             0         0           0        0
110524            0             0         0           0        0
110525            0             0         0           0        0
110526            0             0         0           0        0

        SMS_received No-show
110522             1      No
110523             1      No
110524             1      No
110525             1      No
110526             1      No
```

1.4 Checking Value Counts for each Column

[15]:
```
df_1['Gender'].value_counts()
```

[15]:
```
F    71840
M    38687
Name: Gender, dtype: int64
```

[16]:
```
df_1['Age'].value_counts()
```

[16]:
```
 0      3539
 1      2273
 52     1746
 49     1652
 53     1651
        …
 115       5
 100       4
 102       2
 99        1
-1         1
Name: Age, Length: 104, dtype: int64
```

1.5 Outlier Detection

Whoaaa!! outliers detected

We will drop the value of Age = -1 and we will count the ages that greater Than 102 and drop this value

0 and 1 are for children that are newly born so we will keep both

[17]:
```
filt_1 = df_1.query('Age >= 102')
filt_2 = df_1.query('Age < 0')
```

[18]:
```
filt_1
```

[18]:
```
      Gender          ScheduledDay         AppointmentDay  Age Neighbourhood  \
58014      F  2016-05-03T09:14:53Z  2016-05-03T00:00:00Z  102     CONQUISTA
63912      F  2016-05-16T09:17:44Z  2016-05-19T00:00:00Z  115    ANDORINHAS
63915      F  2016-05-16T09:17:44Z  2016-05-19T00:00:00Z  115    ANDORINHAS
68127      F  2016-04-08T14:29:17Z  2016-05-16T00:00:00Z  115    ANDORINHAS
76284      F  2016-05-30T09:44:51Z  2016-05-30T00:00:00Z  115    ANDORINHAS
90372      F  2016-05-31T10:19:49Z  2016-06-02T00:00:00Z  102  MARIA ORTIZ
97666      F  2016-05-19T07:57:56Z  2016-06-03T00:00:00Z  115      SÃO JOSÉ

       Scholarship  Hipertension  Diabetes  Alcoholism  Handcap  SMS_received  \
58014            0             0         0           0        0             0
63912            0             0         0           0        1             0
```

```
63915            0             0         0           0        1             0
68127            0             0         0           0        1             0
76284            0             0         0           0        1             0
90372            0             0         0           0        0             0
97666            0             1         0           0        0             1

      No-show
58014      No
63912     Yes
63915     Yes
68127     Yes
76284      No
90372      No
97666      No
```

[19]:

```
filt_2
```

[19]:

```
      Gender          ScheduledDay        AppointmentDay  Age Neighbourhood  \
99832      F  2016-06-06T08:58:13Z  2016-06-06T00:00:00Z   -1         ROMÃO

       Scholarship  Hipertension  Diabetes  Alcoholism  Handcap  SMS_received  \
99832            0             0         0           0        0             0

      No-show
99832      No
```

1.5.1 Drop Ages that are greater than or equal 102 and less than 0

[20]:

```
df_1.drop(df_1[df_1['Age'] >= 102].index, inplace = True)
```

[21]:

```
df_1.drop(df_1[df_1['Age'] < 0].index, inplace = True)
```

[22]:

```
df_1[df_1['Age'] < 0]
```

[22]:

```
Empty DataFrame
Columns: [Gender, ScheduledDay, AppointmentDay, Age, Neighbourhood, Scholarship,
Hipertension, Diabetes, Alcoholism, Handcap, SMS_received, No-show]
Index: []
```

[23]:

```
df_1[df_1['Age'] >= 102]
```

[23]:

```
Empty DataFrame
Columns: [Gender, ScheduledDay, AppointmentDay, Age, Neighbourhood, Scholarship,
Hipertension, Diabetes, Alcoholism, Handcap, SMS_received, No-show]
Index: []
```

[24]:

```
df_1.describe()
```

[24]:

```
                 Age    Scholarship   Hipertension       Diabetes  \
count  110519.000000  110519.000000  110519.000000  110519.000000
mean       37.084519       0.098273       0.197251       0.071870
std        23.103165       0.297684       0.397925       0.258274
min         0.000000       0.000000       0.000000       0.000000
25%        18.000000       0.000000       0.000000       0.000000
50%        37.000000       0.000000       0.000000       0.000000
75%        55.000000       0.000000       0.000000       0.000000
max       100.000000       1.000000       1.000000       1.000000

          Alcoholism        Handcap   SMS_received
count  110519.000000  110519.000000  110519.000000
mean        0.030402       0.022213       0.321040
std         0.171692       0.161441       0.466878
min         0.000000       0.000000       0.000000
25%         0.000000       0.000000       0.000000
50%         0.000000       0.000000       0.000000
75%         0.000000       0.000000       1.000000
max         1.000000       4.000000       1.000000
```

[25]:

```python
df_1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 110519 entries, 0 to 110526
Data columns (total 12 columns):
 #   Column          Non-Null Count   Dtype
---  ------          --------------   -----
 0   Gender          110519 non-null  object
 1   ScheduledDay    110519 non-null  object
 2   AppointmentDay  110519 non-null  object
 3   Age             110519 non-null  int64
 4   Neighbourhood   110519 non-null  object
 5   Scholarship     110519 non-null  int64
 6   Hipertension    110519 non-null  int64
 7   Diabetes        110519 non-null  int64
 8   Alcoholism      110519 non-null  int64
 9   Handcap         110519 non-null  int64
 10  SMS_received    110519 non-null  int64
 11  No-show         110519 non-null  object
dtypes: int64(7), object(5)
memory usage: 11.0+ MB
```

[26]:

```python
df_1['Neighbourhood'].value_counts()
```

[26]:

```
JARDIM CAMBURI                 7717
MARIA ORTIZ                    5804
RESISTÊNCIA                    4431
JARDIM DA PENHA                3877
```

```
ITARARÉ                        3514
                               …
ILHA DO BOI                      35
ILHA DO FRADE                    10
AEROPORTO                         8
ILHAS OCEÂNICAS DE TRINDADE       2
PARQUE INDUSTRIAL                 1
Name: Neighbourhood, Length: 81, dtype: int64
```

[27]:
```
df_1['No-show'].value_counts()
```

[27]:
```
No     88203
Yes    22316
Name: No-show, dtype: int64
```

1.6 Q0: What is the proportion of people that didn't come?

[28]:
```
## getting the yes values
df_y = df_1[df_1['No-show'] == 'Yes']
df_y
```

[28]:
```
       Gender          ScheduledDay        AppointmentDay  Age  \
6           F  2016-04-27T15:05:12Z  2016-04-29T00:00:00Z   23
7           F  2016-04-27T15:39:58Z  2016-04-29T00:00:00Z   39
11          M  2016-04-26T08:44:12Z  2016-04-29T00:00:00Z   29
17          F  2016-04-28T09:28:57Z  2016-04-29T00:00:00Z   40
20          F  2016-04-27T07:51:14Z  2016-04-29T00:00:00Z   30
…       …                   …                   …  …
110484      F  2016-06-03T14:43:56Z  2016-06-07T00:00:00Z   45
110492      M  2016-06-08T08:50:19Z  2016-06-08T00:00:00Z   33
110496      F  2016-06-06T17:35:38Z  2016-06-08T00:00:00Z   37
110515      M  2016-06-06T15:58:05Z  2016-06-08T00:00:00Z   33
110516      F  2016-06-07T07:45:16Z  2016-06-08T00:00:00Z   37

         Neighbourhood  Scholarship  Hipertension  Diabetes  Alcoholism  \
6           GOIABEIRAS            0             0         0           0
7           GOIABEIRAS            0             0         0           0
11      NOVA PALESTINA            0             0         0           0
17           CONQUISTA            1             0         0           0
20      NOVA PALESTINA            0             0         0           0
…                …          …           …       …         …
110484  BARRO VERMELHO            0             0         0           0
110492     MARIA ORTIZ            0             1         0           0
110496     MARIA ORTIZ            0             1         0           0
110515     MARIA ORTIZ            0             1         0           0
110516     MARIA ORTIZ            0             0         0           0
```

```
        Handcap  SMS_received No-show
6             0             0     Yes
7             0             0     Yes
11            0             1     Yes
17            0             0     Yes
20            0             0     Yes
…         …           …     …
110484        0             0     Yes
110492        0             0     Yes
110496        0             0     Yes
110515        0             0     Yes
110516        0             0     Yes

[22316 rows x 12 columns]
```

proportion of the people that not shown is equal **Yes** [22316 rows]/ **all** [110519 all dataframe]

```
[29]: proportion = 22316 / 110519
      proportion
```

```
[29]: 0.2019200318497272
```

There's 20,2% of people not shown. That means from 100 people there's a posibility that 20 people won't come

```
[30]: df_1['Scholarship'].value_counts()
```

```
[30]: 0    99658
      1    10861
      Name: Scholarship, dtype: int64
```

```
[31]: df_1['Hipertension'].value_counts()
```

```
[31]: 0    88719
      1    21800
      Name: Hipertension, dtype: int64
```

```
[32]: df_1['Diabetes'].value_counts()
```

```
[32]: 0    102576
      1      7943
      Name: Diabetes, dtype: int64
```

```
[33]: df_1['Alcoholism'].value_counts()
```

```
[33]: 0    107159
      1      3360
      Name: Alcoholism, dtype: int64
```

[34]:
```
df_1['Handcap'].value_counts()
```

[34]:
```
0    108282
1      2038
2       183
3        13
4         3
Name: Handcap, dtype: int64
```

[35]:
```
df_1['SMS_received'].value_counts(normalize = True)
```

[35]:
```
0    0.67896
1    0.32104
Name: SMS_received, dtype: float64
```

[36]:
```
for i, v in enumerate(df_1.columns):
    print(i, v)
```

```
0 Gender
1 ScheduledDay
2 AppointmentDay
3 Age
4 Neighbourhood
5 Scholarship
6 Hipertension
7 Diabetes
8 Alcoholism
9 Handcap
10 SMS_received
11 No-show
```

[37]:
```
round(df_1['Age'].mean())
```

[37]:
```
37
```

[38]:
```
df_1['ScheduledDay'] = pd.to_datetime(df_1['ScheduledDay'])
df_1['AppointmentDay'] = pd.to_datetime(df_1['AppointmentDay'])
```

[39]:
```
df_1.head(3)
```

[39]:
```
  Gender              ScheduledDay            AppointmentDay  Age  \
0      F 2016-04-29 18:38:08+00:00 2016-04-29 00:00:00+00:00   62
1      M 2016-04-29 16:08:27+00:00 2016-04-29 00:00:00+00:00   56
2      F 2016-04-29 16:19:04+00:00 2016-04-29 00:00:00+00:00   62

     Neighbourhood  Scholarship  Hipertension  Diabetes  Alcoholism  Handcap  \
0  JARDIM DA PENHA            0             1         0           0        0
1  JARDIM DA PENHA            0             0         0           0        0
```

```
2    MATA DA PRAIA            0            0         0           0        0

   SMS_received No-show
0             0      No
1             0      No
2             0      No
```

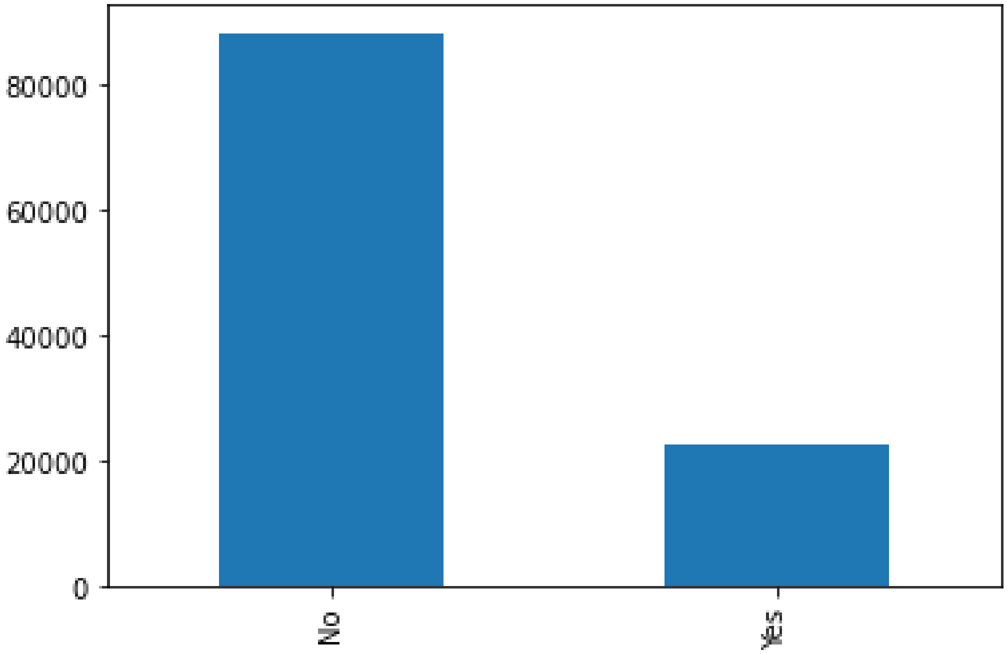
After discussing the structure of the data and any problems that need to be cleaned, perform those cleaning steps in the second part of this section.

## Exploratory Data Analysis

Exploring with visuals, Drawing conclusions and communicating results

1.6.1 Q0.2: How many of them has shown(plotting)

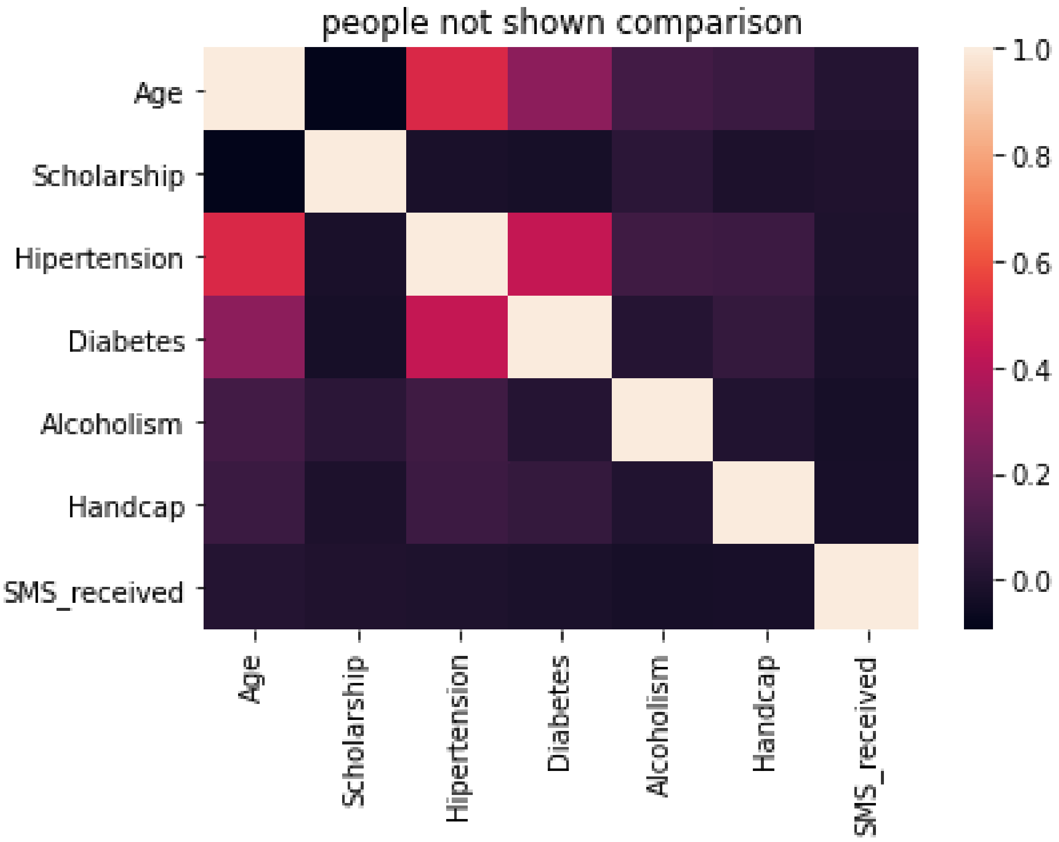
```
[40]: df_1['No-show'].value_counts().plot(kind = 'bar');
```



We will see the correlation between values of our dataframe

```
[49]: p = sns.heatmap(df_1.corr());
      p.set(title = "Comparison of different variables")
```

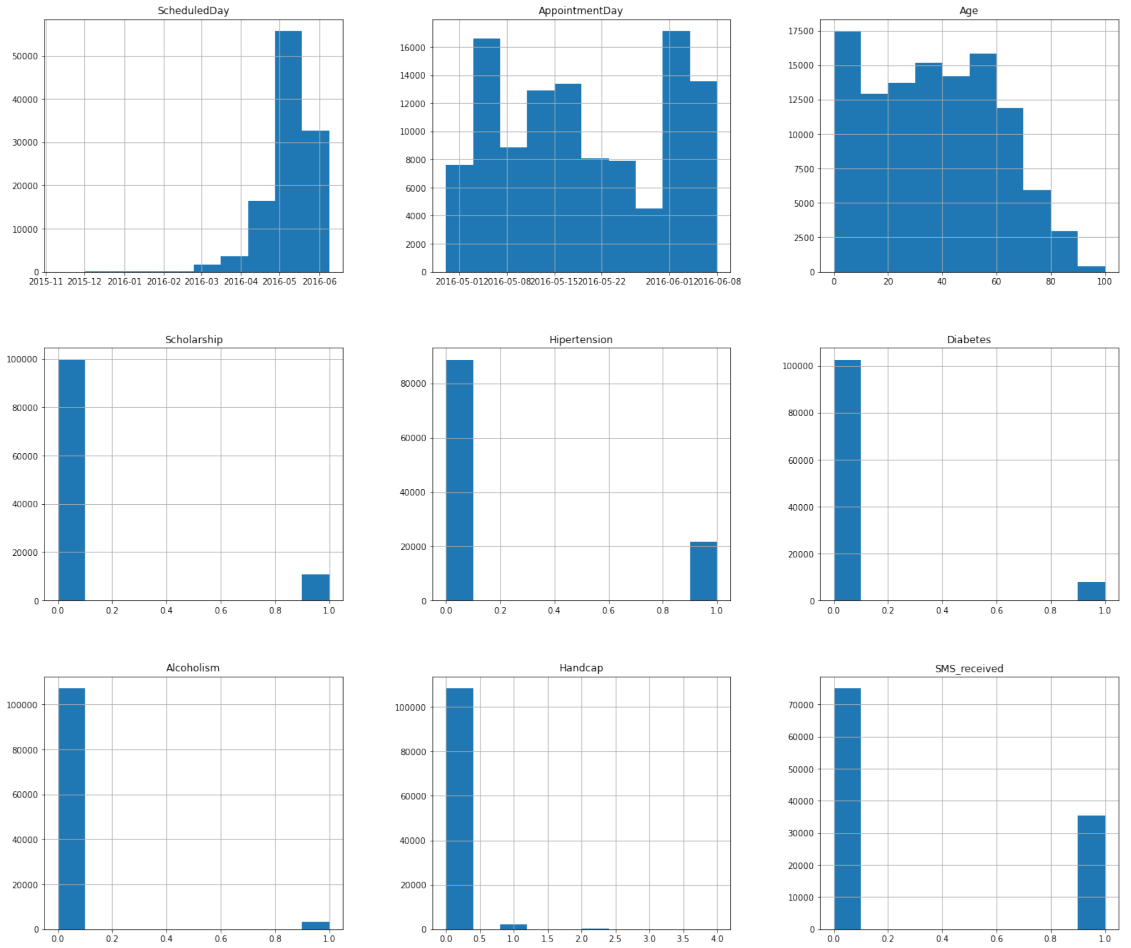
```
[49]: [Text(0.5, 1.0, 'people not shown comparison')]
```



There's a fairly high correlation (> 0.6) between Hipertension and Age

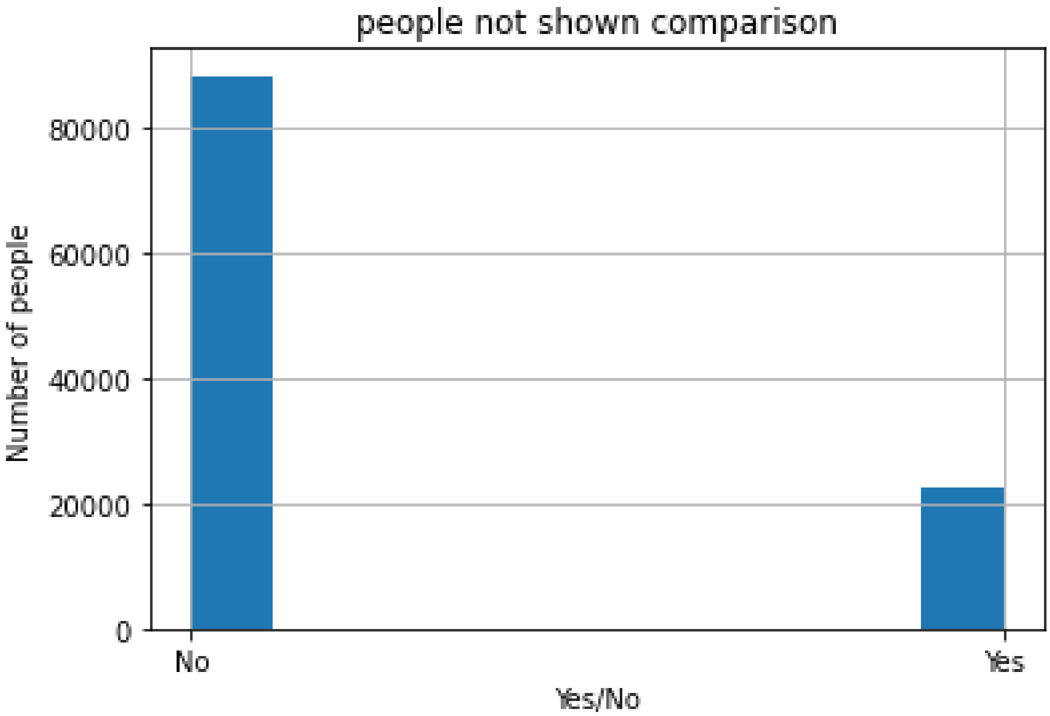
- From our histograms There's a lot of people Scheduled Day between 2 months That are May 2016 and June 2016
- Appointment Day that has most people was at 1st of june and 4th of june 2016
- The highest ages was between 0 and 10 Years old
- nearly 10k of patients has Scholarship
- more than 20k have hipertensions
- nearly 5k of people have diabetes
- nearly 3k are Alcoholism
- nearly 1-2k are handcap
- From 30k - 38k of people has received messages either they confirming the Scheduling or the Appointment Day

[42]:
```
df_1.hist(figsize=(23, 20));
```



[45]:

```
df_1['No-show'].hist();
plt.title("people not shown comparison")
plt.xlabel("Yes/No")
plt.ylabel("Number of people")
plt.show()
```



[50]:

```
df_1.sort_values(by=['AppointmentDay'],inplace=True)
```

[51]:

```
df_1.sort_values(by=['ScheduledDay'],inplace=False)
```

[51]:

```
       Gender              ScheduledDay             AppointmentDay  Age  \
3764        F 2015-11-10 07:13:56+00:00 2016-05-04 00:00:00+00:00   51
46292       M 2015-12-03 08:17:28+00:00 2016-05-02 00:00:00+00:00   34
102795      F 2015-12-07 10:40:59+00:00 2016-06-03 00:00:00+00:00   27
102797      F 2015-12-07 10:42:42+00:00 2016-06-03 00:00:00+00:00   48
102796      F 2015-12-07 10:43:01+00:00 2016-06-03 00:00:00+00:00   80
…       …                       …                       …  …
92442       M 2016-06-08 19:32:25+00:00 2016-06-08 00:00:00+00:00   54
88146       F 2016-06-08 19:32:56+00:00 2016-06-08 00:00:00+00:00   43
88147       M 2016-06-08 19:33:23+00:00 2016-06-08 00:00:00+00:00   27
87219       F 2016-06-08 19:58:52+00:00 2016-06-08 00:00:00+00:00   30
87223       F 2016-06-08 20:07:23+00:00 2016-06-08 00:00:00+00:00   27

         Neighbourhood  Scholarship  Hipertension  Diabetes  Alcoholism  \
3764       RESISTÊNCIA            0             0         0           0
46292       VILA RUBIM            0             1         0           0
102795   SÃO CRISTÓVÃO            1             0         0           0
102797         MARUÍPE            0             1         1           0
102796   SÃO CRISTÓVÃO            0             1         1           0
```

```
…                …          …           …       …         …
92442   JARDIM CAMBURI            0             0         0           0
88146   JARDIM CAMBURI            0             0         0           0
88147   JARDIM CAMBURI            0             0         0           0
87219   JARDIM CAMBURI            0             0         0           0
87223   JARDIM CAMBURI            0             0         0           0

        Handcap  SMS_received No-show
3764          0             1      No
46292         0             1     Yes
102795        0             1     Yes
102797        0             1      No
102796        0             1      No
…         …           …     …
92442         0             0      No
88146         0             0      No
88147         0             0      No
87219         0             0      No
87223         0             0      No

[110519 rows x 12 columns]
```

As we can see we can seperate values of Columns Appointment Day and Scheduled Day to dates and times. we can seperate them into columns have dates only and drop the old one, we will be also renaming our columns

[52]:

```
# ScheduledDay         AppointmentDay
df_1['scheduledday'] = pd.to_datetime(df['ScheduledDay']).dt.date
# df_1['scheduledtime'] = pd.to_datetime(df['ScheduledDay']).dt.time
df_1['appointmentday'] = pd.to_datetime(df['AppointmentDay']).dt.date
# df_1['appointmenttime'] = pd.to_datetime(df['AppointmentDay']).dt.time
df_1.drop(['ScheduledDay','AppointmentDay'] ,axis=1, inplace =True)
```

[53]:

```
df_1.head()
```

[53]:

```
     Gender  Age    Neighbourhood  Scholarship  Hipertension  Diabetes   \
0         F   62  JARDIM DA PENHA            0             1         0
2151      M   33      MARIA ORTIZ            0             0         0
2152      F   50      MARIA ORTIZ            0             0         0
2153      F   69      MARIA ORTIZ            0             0         0
2154      F   65      MARIA ORTIZ            0             0         0

      Alcoholism  Handcap  SMS_received No-show scheduledday appointmentday
0              0        0             0      No   2016-04-29     2016-04-29
2151           0        0             1      No   2016-03-29     2016-04-29
2152           0        0             0      No   2016-03-29     2016-04-29
2153           0        0             1      No   2016-03-29     2016-04-29
2154           0        0             0      No   2016-04-29     2016-04-29
```

[54]:
```
df_1.tail()
```

[54]:
```
      Gender  Age       Neighbourhood  Scholarship  Hipertension  Diabetes  \
92055      M   24         MARIA ORTIZ            0             0         0
99217      F   54  JESUS DE NAZARETH            0             1         0
99218      F   50        SANTA MARTHA            0             1         0
99224      F   64        SANTA TEREZA            0             1         1
91900      M   14          TABUAZEIRO            0             0         0

       Alcoholism  Handcap  SMS_received No-show scheduledday appointmentday
92055           0        0             0      No   2016-06-08     2016-06-08
99217           0        0             0      No   2016-06-06     2016-06-08
99218           0        0             0      No   2016-06-06     2016-06-08
99224           0        0             0      No   2016-06-06     2016-06-08
91900           0        0             1     Yes   2016-05-25     2016-06-08
```

We will seperate the Dataframe into 2 one containing females only and one contains male only

[55]:
```
df_fem = df_1[df_1["Gender"] == "F"]
df_fem
```

[55]:
```
      Gender  Age       Neighbourhood  Scholarship  Hipertension  Diabetes  \
0          F   62     JARDIM DA PENHA            0             1         0
2152       F   50         MARIA ORTIZ            0             0         0
2153       F   69         MARIA ORTIZ            0             0         0
2154       F   65         MARIA ORTIZ            0             0         0
2155       F   25         MARIA ORTIZ            0             0         0
…        …    …                   …          …             …         …
99207      F   38         MARIA ORTIZ            0             0         0
92057      F   48              JABOUR            0             0         0
99217      F   54  JESUS DE NAZARETH            0             1         0
99218      F   50        SANTA MARTHA            0             1         0
99224      F   64        SANTA TEREZA            0             1         1

       Alcoholism  Handcap  SMS_received No-show scheduledday appointmentday
0               0        0             0      No   2016-04-29     2016-04-29
2152            0        0             0      No   2016-03-29     2016-04-29
2153            0        0             1      No   2016-03-29     2016-04-29
2154            0        0             0      No   2016-04-29     2016-04-29
2155            0        0             1     Yes   2016-03-29     2016-04-29
…             …       …             …      …          …              …
99207           0        0             0      No   2016-06-06     2016-06-08
92057           0        0             0      No   2016-06-08     2016-06-08
99217           0        0             0      No   2016-06-06     2016-06-08
99218           0        0             0      No   2016-06-06     2016-06-08
99224           0        0             0      No   2016-06-06     2016-06-08

[71832 rows x 12 columns]
```

[56]:
```
df_fem.describe()
```

[56]:
```
               Age   Scholarship  Hipertension      Diabetes    Alcoholism  \
count  71832.000000  71832.000000  71832.000000  71832.000000  71832.000000
mean      38.887487      0.123246      0.213526      0.078043      0.017026
std       22.144363      0.328722      0.409799      0.268241      0.129368
min        0.000000      0.000000      0.000000      0.000000      0.000000
25%       21.000000      0.000000      0.000000      0.000000      0.000000
50%       39.000000      0.000000      0.000000      0.000000      0.000000
75%       56.000000      0.000000      0.000000      0.000000      0.000000
max      100.000000      1.000000      1.000000      1.000000      1.000000

            Handcap  SMS_received
count  71832.000000  71832.000000
mean       0.019490      0.336911
std        0.149838      0.472658
min        0.000000      0.000000
25%        0.000000      0.000000
50%        0.000000      0.000000
75%        0.000000      1.000000
max        4.000000      1.000000
```

[57]:
```
df_ma = df_1[df_1["Gender"] == "M"]
df_ma
```

[57]:
```
      Gender  Age Neighbourhood  Scholarship  Hipertension  Diabetes  \
2151       M   33   MARIA ORTIZ            0             0         0
2158       M   61    ANDORINHAS            0             0         0
2162       M   23   MARIA ORTIZ            0             0         0
2163       M   41   MARIA ORTIZ            0             0         0
2166       M   65      SÃO JOSÉ            0             1         1
…      …  …           …          …           …       …
99208      M   51   SANTO ANDRÉ            0             0         0
99212      M   22        CENTRO            0             0         0
99213      M   58        JABOUR            0             0         0
92055      M   24   MARIA ORTIZ            0             0         0
91900      M   14    TABUAZEIRO            0             0         0

       Alcoholism  Handcap  SMS_received No-show scheduledday appointmentday
2151            0        0             1      No   2016-03-29     2016-04-29
2158            0        0             1      No   2016-03-29     2016-04-29
2162            0        0             1      No   2016-03-29     2016-04-29
2163            0        0             0      No   2016-04-29     2016-04-29
2166            1        0             0      No   2016-04-29     2016-04-29
…           …      …           …     …          …            …
99208           0        0             0     Yes   2016-06-06     2016-06-08
99212           0        0             0      No   2016-06-06     2016-06-08
```

```
99213              0         0             0     Yes   2016-06-06     2016-06-08
92055              0         0             0      No   2016-06-08     2016-06-08
91900              0         0             1     Yes   2016-05-25     2016-06-08

[38687 rows x 12 columns]
```

[58]:

```
df_ma.describe()
```

[58]:

```
                Age   Scholarship  Hipertension      Diabetes    Alcoholism  \
count  38687.000000  38687.000000  38687.000000  38687.000000  38687.000000
mean      33.736863      0.051904      0.167033      0.060408      0.055238
std       24.435221      0.221836      0.373010      0.238244      0.228448
min        0.000000      0.000000      0.000000      0.000000      0.000000
25%       10.000000      0.000000      0.000000      0.000000      0.000000
50%       33.000000      0.000000      0.000000      0.000000      0.000000
75%       54.000000      0.000000      0.000000      0.000000      0.000000
max      100.000000      1.000000      1.000000      1.000000      1.000000

            Handcap  SMS_received
count  38687.000000  38687.000000
mean       0.027270      0.291571
std        0.180917      0.454492
min        0.000000      0.000000
25%        0.000000      0.000000
50%        0.000000      0.000000
75%        0.000000      1.000000
max        4.000000      1.000000
```

1.7 Q1 : Is there a relation between not showing up and if they received SMS?

[59]:

```
df_1.groupby(['Gender', 'No-show']).mean().SMS_received
```

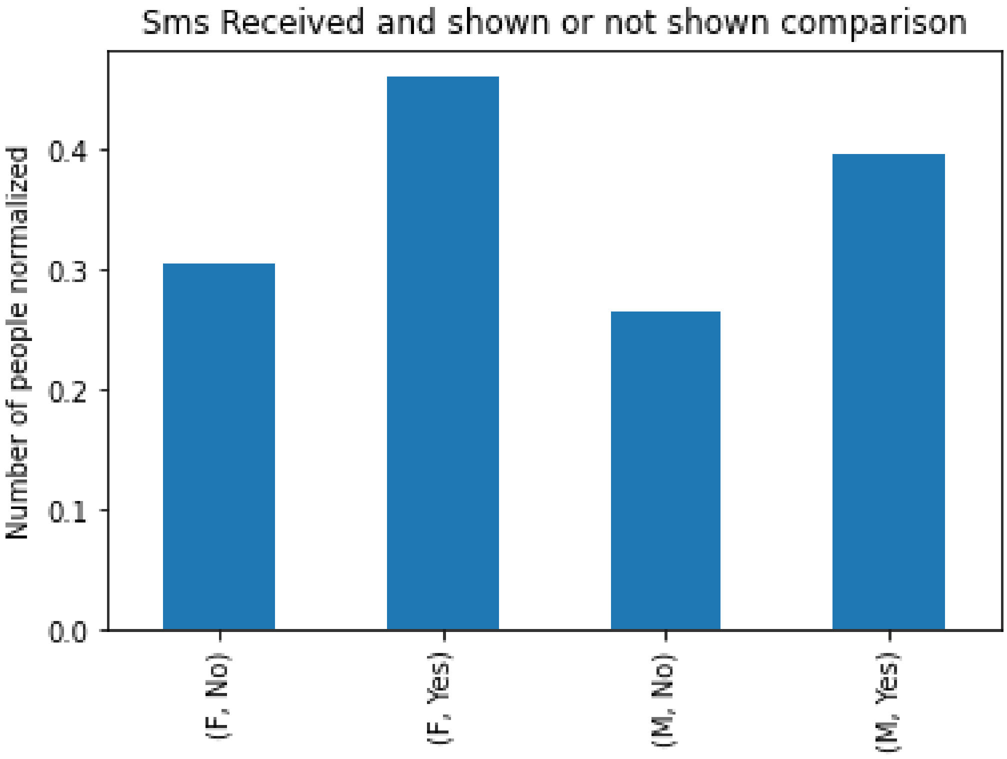
[59]:

```
Gender  No-show
F       No         0.305393
        Yes        0.460558
M       No         0.265358
        Yes        0.396634
Name: SMS_received, dtype: float64
```

As we can see 30% of sent messages to females has shown while 46% not shown and for Males 26.5% of total patients has shown while 39.66% hasn't shown

[61]:

```
df_1.groupby(['Gender', 'No-show']).mean().SMS_received.plot(kind = "bar");
plt.title("Sms Received and shown or not shown comparison")
plt.xlabel("Gender, SMS received or not")
plt.ylabel("Number of people normalized")
plt.show()
```



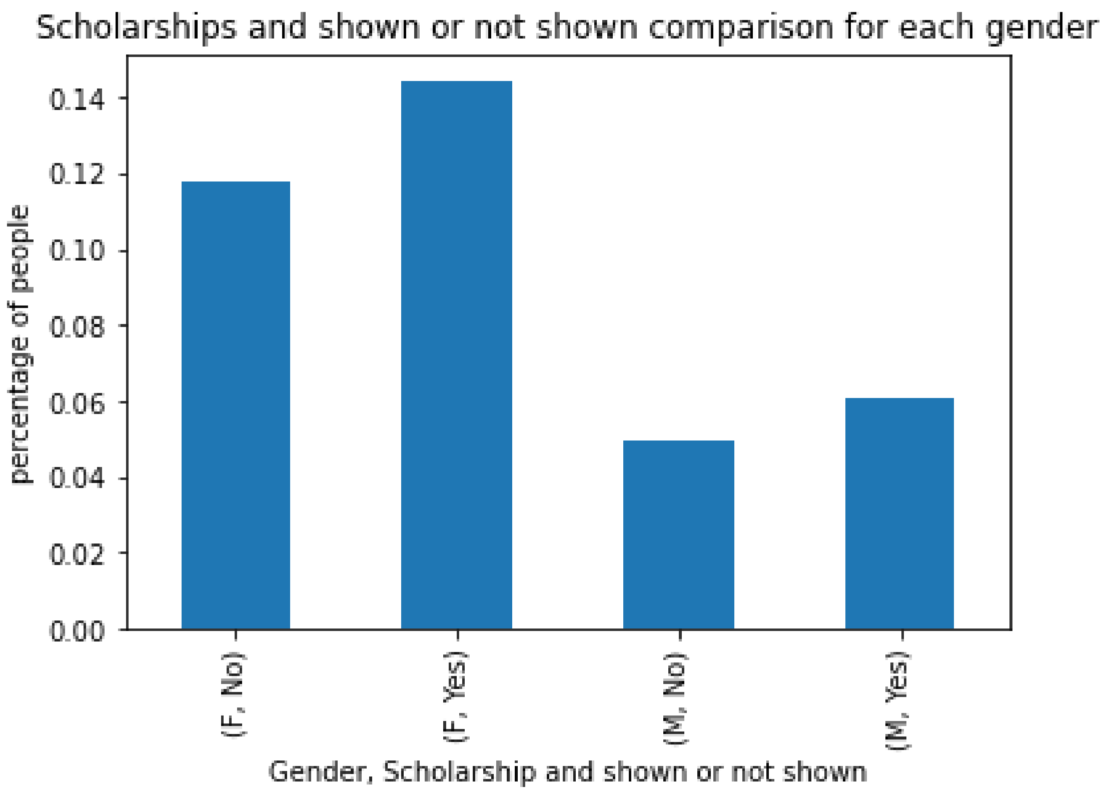
1.8 Q2 : Is there a relation between not showing up and if they were included in scholarship?

[62]:
```
df_1.groupby(['Gender', 'No-show']).mean().Scholarship
```

[62]:
```
Gender  No-show
F       No         0.117870
        Yes        0.144336
M       No         0.049609
        Yes        0.061100
Name: Scholarship, dtype: float64
```

From the values we have seen that most of Females and males although they have scholarships they didn’t appear

[64]:
```
df_1.groupby(['Gender', 'No-show']).mean().Scholarship.plot(kind = "bar");
plt.title("Scholarships and shown or not shown comparison for each gender")
plt.xlabel("Gender, Scholarship and shown or not shown")
plt.ylabel("percentage of people")
plt.show()
```

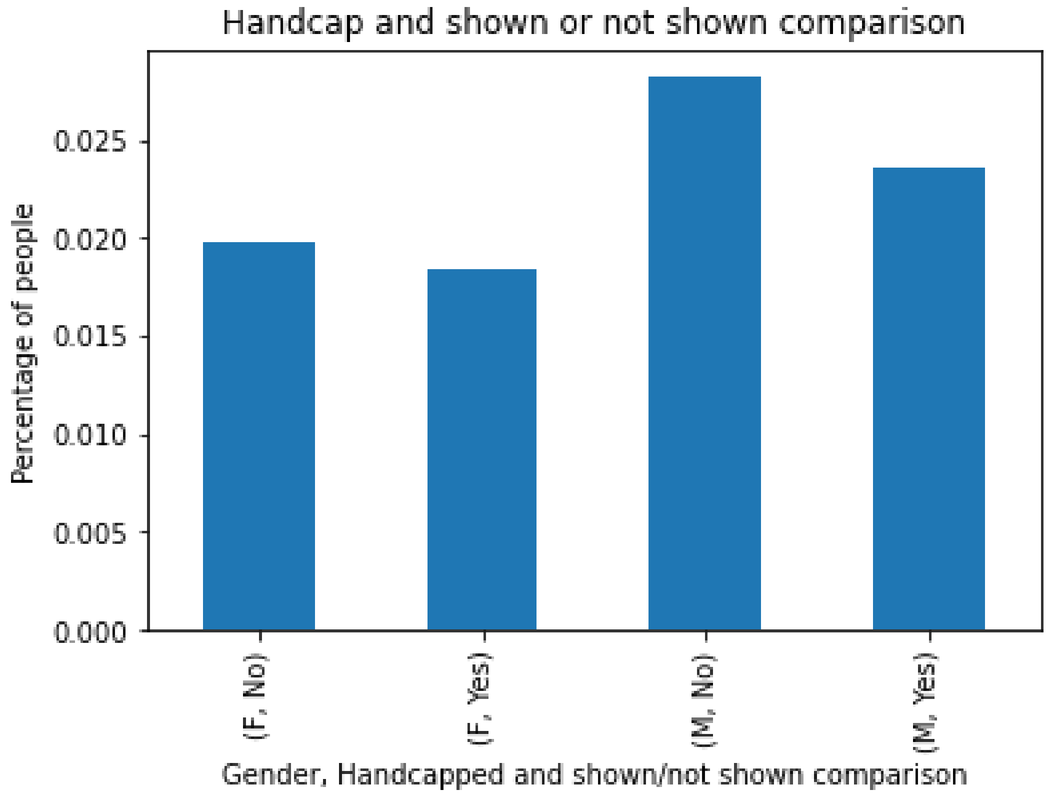


1.9 Q3 : Is there a relation between not showing up and if they were Handicapped?

[65]:
```
df_1.groupby(['Gender', 'No-show']).mean().Handcap
```

[65]:
```
Gender  No-show
F       No         0.019776
        Yes        0.018367
M       No         0.028196
        Yes        0.023560
Name: Handcap, dtype: float64
```

[66]:
```
df_1.groupby(['Gender', 'No-show']).mean().Handcap.plot(kind = "bar");
plt.title("Handcap and shown or not shown comparison")
plt.xlabel("Gender, Handcapped and shown/not shown comparison")
plt.ylabel("Percentage of people")
plt.show()
```

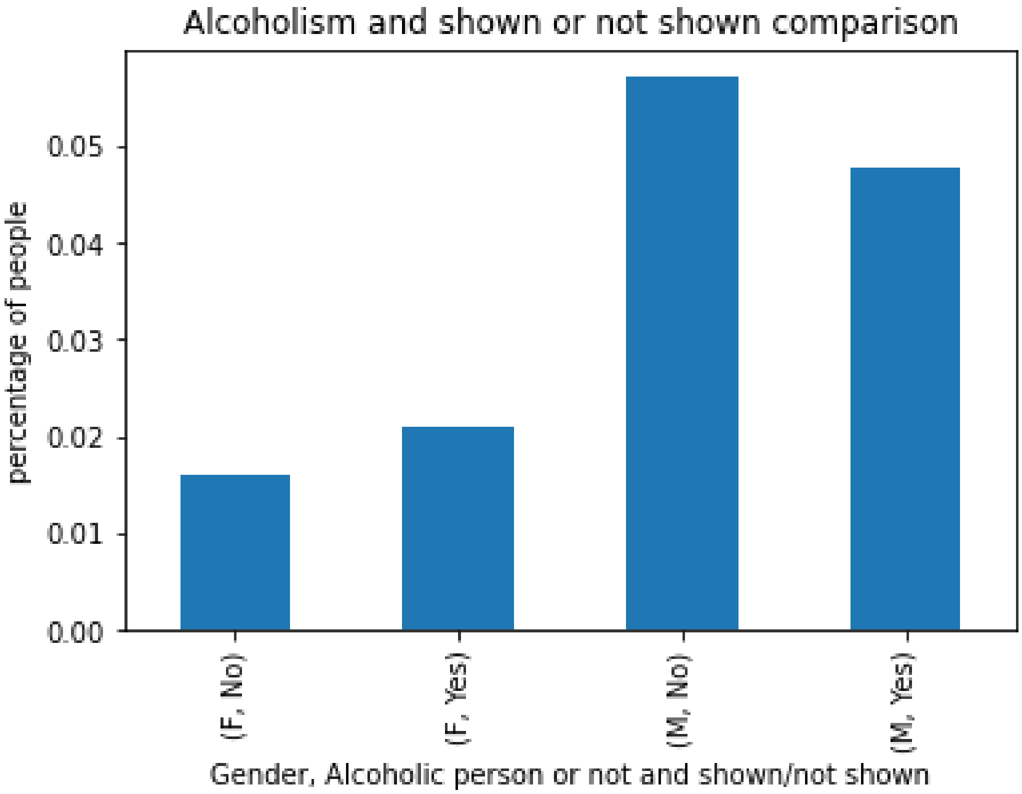


1.10 Q4 : Is there a relation between not showing up and if they had an related history to alcohol?

```
[67]: df_1.groupby(['Gender', 'No-show']).mean().Alcoholism
```

```
[67]: Gender  No-show
      F       No         0.015985
              Yes        0.021109
      M       No         0.057102
              Yes        0.047767
      Name: Alcoholism, dtype: float64
```

```
[68]: df_1.groupby(['Gender', 'No-show']).mean().Alcoholism.plot(kind = "bar");
      plt.title("Alcoholism and shown or not shown comparison")
      plt.xlabel("Gender, Alcoholic person or not and shown/not shown")
      plt.ylabel("percentage of people")
      plt.show()
```

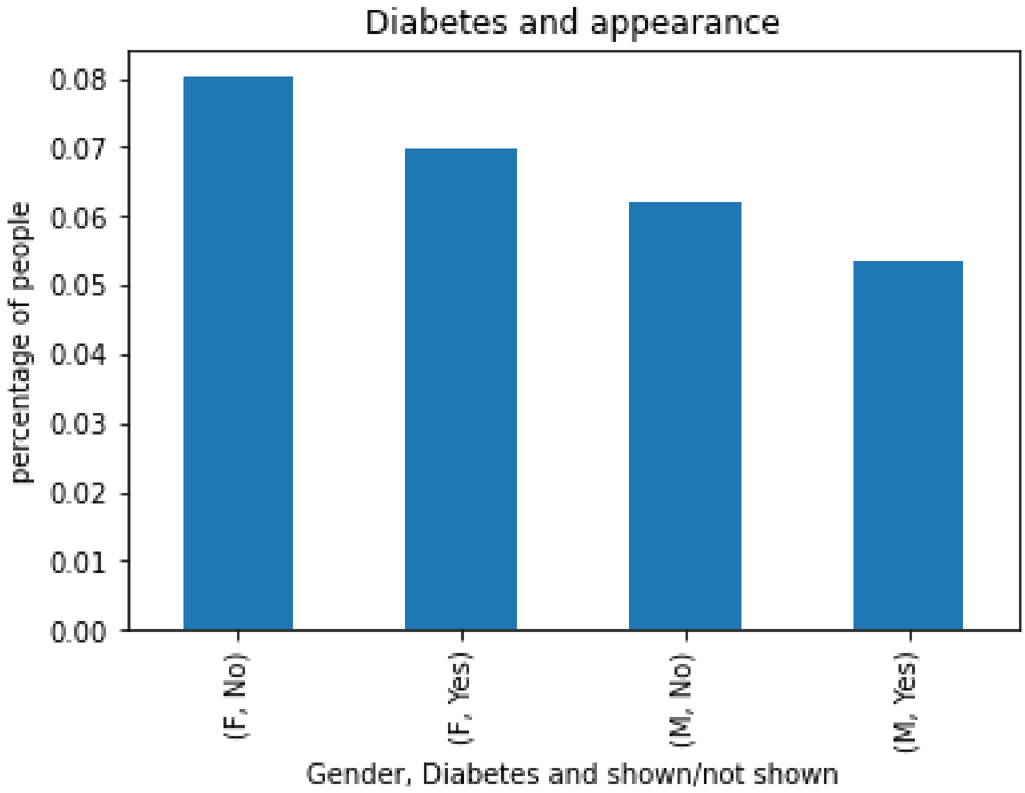


1.11 Q5 : Is there a relation between not showing up and if they had a Diabetes?

[69]:
```
df_1.groupby(['Gender', 'No-show']).mean().Diabetes
```

[69]:
```
Gender  No-show
F       No         0.080170
        Yes        0.069701
M       No         0.062141
        Yes        0.053463
Name: Diabetes, dtype: float64
```

[70]:
```
df_1.groupby(['Gender', 'No-show']).mean().Diabetes.plot(kind = "bar");
plt.title("Diabetes and appearance")
plt.xlabel("Gender, Diabetes and shown/not shown")
plt.ylabel("percentage of people")
plt.show()
```

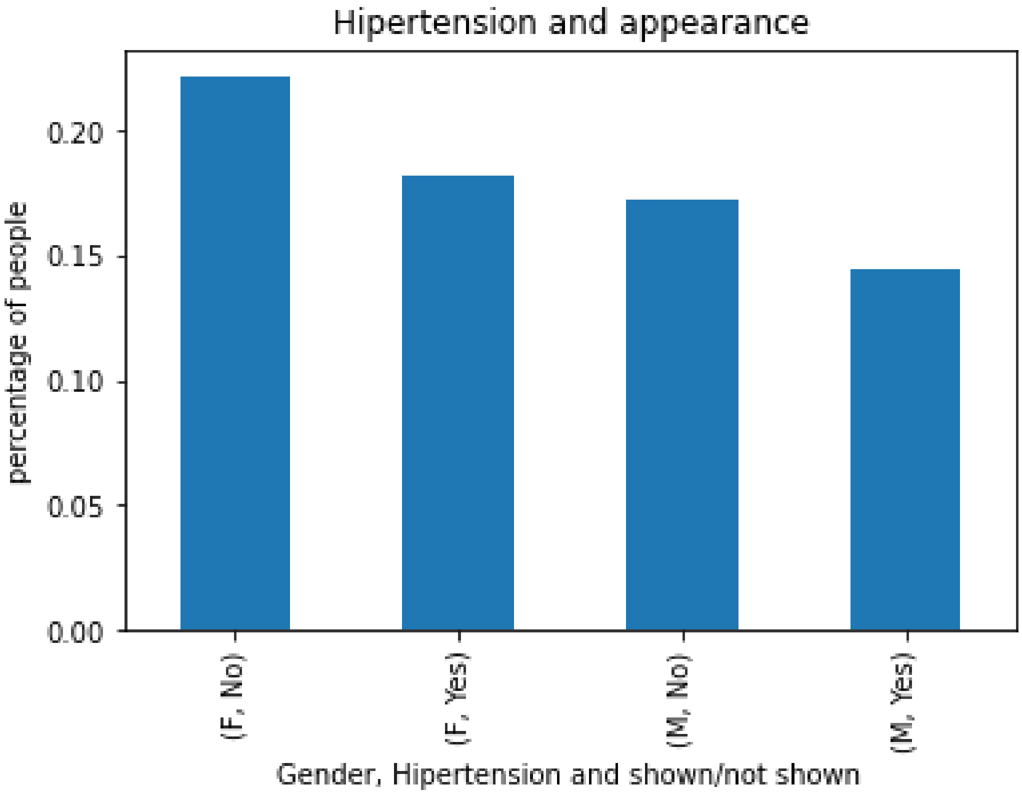


1.12 Q6 : Is there a relation between not showing up and if they had a Hipertension?

```
[71]: df_1.groupby(['Gender', 'No-show']).mean().Hipertension
```

```
[71]: Gender  No-show
      F       No         0.221537
              Yes        0.182099
      M       No         0.172696
              Yes        0.144337
      Name: Hipertension, dtype: float64
```

```
[72]: df_1.groupby(['Gender', 'No-show']).mean().Hipertension.plot(kind = "bar");
      plt.title("Hipertension and appearance")
      plt.xlabel("Gender, Hipertension and shown/not shown")
      plt.ylabel("percentage of people")
      plt.show()
```



1.12.1 Renaming some columns

```
[73]: df_1.rename(columns = {'No-show':'noshow', 'SMS_received':'smsreceived'},␣
       ↪inplace = True)
```

```
[74]: df_1.head(1)
```

```
[74]:   Gender  Age    Neighbourhood  Scholarship  Hipertension  Diabetes  \
      0      F   62  JARDIM DA PENHA            0             1         0

         Alcoholism  Handcap  smsreceived noshow scheduledday appointmentday
      0           0        0            0     No   2016-04-29     2016-04-29
```

```
[75]: di = {'Yes': 0, 'No': 1}
      df_1.replace({"noshow": di})
```

```
[75]:        Gender  Age      Neighbourhood  Scholarship  Hipertension  Diabetes  \
      0           F   62    JARDIM DA PENHA            0             1         0
      2151        M   33        MARIA ORTIZ            0             0         0
      2152        F   50        MARIA ORTIZ            0             0         0
      2153        F   69        MARIA ORTIZ            0             0         0
```

```
2154       F   65         MARIA ORTIZ            0             0         0
…      …  …                …          …           …       …
92055      M   24         MARIA ORTIZ            0             0         0
99217      F   54  JESUS DE NAZARETH            0             1         0
99218      F   50        SANTA MARTHA            0             1         0
99224      F   64        SANTA TEREZA            0             1         1
91900      M   14          TABUAZEIRO            0             0         0

       Alcoholism  Handcap  smsreceived  noshow scheduledday appointmentday
0               0        0            0       1   2016-04-29     2016-04-29
2151            0        0            1       1   2016-03-29     2016-04-29
2152            0        0            0       1   2016-03-29     2016-04-29
2153            0        0            1       1   2016-03-29     2016-04-29
2154            0        0            0       1   2016-04-29     2016-04-29
…           …      …          …     …          …            …
92055           0        0            0       1   2016-06-08     2016-06-08
99217           0        0            0       1   2016-06-06     2016-06-08
99218           0        0            0       1   2016-06-06     2016-06-08
99224           0        0            0       1   2016-06-06     2016-06-08
91900           0        0            1       0   2016-05-25     2016-06-08

[110519 rows x 12 columns]
```

1.13 Q7 : Which neighbourhood had received most people ?

[76]:
```
df_1['Neighbourhood'].value_counts()
```

[76]:
```
JARDIM CAMBURI                 7717
MARIA ORTIZ                    5804
RESISTÊNCIA                    4431
JARDIM DA PENHA                3877
ITARARÉ                        3514
                               …
ILHA DO BOI                      35
ILHA DO FRADE                    10
AEROPORTO                         8
ILHAS OCEÂNICAS DE TRINDADE       2
PARQUE INDUSTRIAL                 1
Name: Neighbourhood, Length: 81, dtype: int64
```

[77]:
```
df_1['Neighbourhood'].value_counts(normalize = True)
```

[77]:
```
JARDIM CAMBURI                 0.069825
MARIA ORTIZ                    0.052516
RESISTÊNCIA                    0.040093
JARDIM DA PENHA                0.035080
ITARARÉ                        0.031795
```

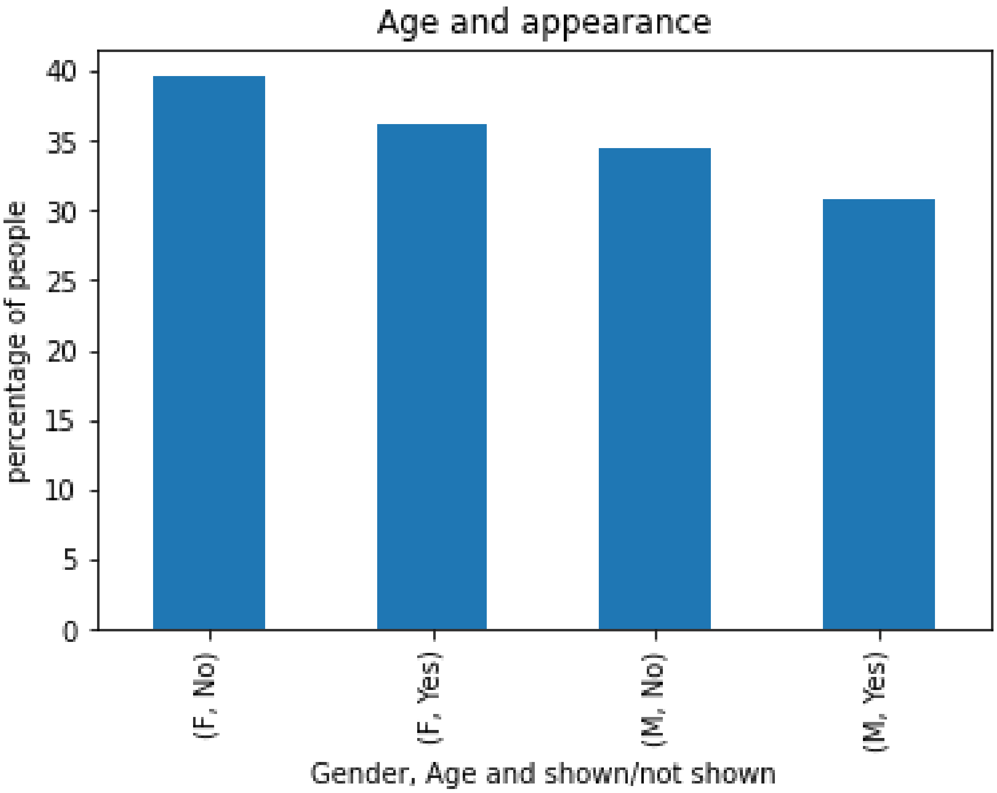
```
                                  …
ILHA DO BOI                    0.000317
ILHA DO FRADE                  0.000090
AEROPORTO                      0.000072
ILHAS OCEÂNICAS DE TRINDADE    0.000018
PARQUE INDUSTRIAL              0.000009
Name: Neighbourhood, Length: 81, dtype: float64
```

1.14 Q8: Is there a relation between not showing up and Age?

[78]:
```
df_1.groupby(['Gender', 'noshow']).mean().Age
```

[78]:
```
Gender  noshow
F       No        39.586311
        Yes       36.145980
M       No        34.461372
        Yes       30.833010
Name: Age, dtype: float64
```

[79]:
```
df_1.groupby(['Gender', 'noshow']).mean().Age.plot(kind = "bar");
plt.title("Age and appearance")
plt.xlabel("Gender, Age and shown/not shown")
plt.ylabel("percentage of people")
plt.show()
```



[80]:
```
df_1.describe()
```

[80]:
```
                 Age    Scholarship   Hipertension       Diabetes  \
count  110519.000000  110519.000000  110519.000000  110519.000000
mean       37.084519       0.098273       0.197251       0.071870
std        23.103165       0.297684       0.397925       0.258274
min         0.000000       0.000000       0.000000       0.000000
25%        18.000000       0.000000       0.000000       0.000000
50%        37.000000       0.000000       0.000000       0.000000
75%        55.000000       0.000000       0.000000       0.000000
max       100.000000       1.000000       1.000000       1.000000

          Alcoholism        Handcap    smsreceived
count  110519.000000  110519.000000  110519.000000
mean        0.030402       0.022213       0.321040
std         0.171692       0.161441       0.466878
min         0.000000       0.000000       0.000000
25%         0.000000       0.000000       0.000000
50%         0.000000       0.000000       0.000000
75%         0.000000       0.000000       1.000000
max         1.000000       4.000000       1.000000
```

[81]:
```
df_ma.describe()
```

[81]:
```
                Age   Scholarship  Hipertension      Diabetes    Alcoholism  \
count  38687.000000  38687.000000  38687.000000  38687.000000  38687.000000
mean      33.736863      0.051904      0.167033      0.060408      0.055238
std       24.435221      0.221836      0.373010      0.238244      0.228448
min        0.000000      0.000000      0.000000      0.000000      0.000000
25%       10.000000      0.000000      0.000000      0.000000      0.000000
50%       33.000000      0.000000      0.000000      0.000000      0.000000
75%       54.000000      0.000000      0.000000      0.000000      0.000000
max      100.000000      1.000000      1.000000      1.000000      1.000000

            Handcap  SMS_received
count  38687.000000  38687.000000
mean       0.027270      0.291571
std        0.180917      0.454492
min        0.000000      0.000000
25%        0.000000      0.000000
50%        0.000000      0.000000
75%        0.000000      1.000000
max        4.000000      1.000000
```

[82]:
```
df_1.shape
```

```
[82]: (110519, 12)
```

1.15 Conclusions

- From our histograms There's a lot of people Scheduled Day between 2 months That are May 2016 and June 2016
- Appointment Day that has most people was at 1st of june and 4th of june 2016
- The highest ages was between 0 and 10 Years old
- nearly 10k of patients has Scholarship
- more than 20k have hipertensions
- nearly 5k of people have diabetes
- nearly 3k are Alcoholism
- nearly 1-2k are handcap
- From 30k - 38k of people has received messages either they confirming the Scheduling or the Appointment Day
- There's 20,2% of people not shown. That means from 100 people there's a posibility that 20 people won't come
- We had to remove outliers like Age == -1 or Ages > 100
- There's 20,2% of people noshown
- Mean Age is 37 yo, 25% of Ages is 18 Yo, 50% are 37 Yo and 57% is 55 Yo
- For males we can see that mean value of Age 34 Yo 25% are 10 Yo, 50% are 33 Yo and 75% are 54 Yo.
- Mean of males that received SMS is 29%

Gender	No-show	SMS_received
F	No	0.305393
F	Yes	0.460558
M	No	0.265358
M	Yes	0.396634

- As we can see 30% of sent messages to females has shown while 46% not shown and for Males 26.5% of total patients has shown while 39.66% hasn't shown

Gender	No-show	Scholarship(mean)
F	No	0.117870
F	Yes	0.144336
M	No	0.049609
M	Yes	0.061100

Gender	No-show	Age(mean)
F	No	39.586311
F	Yes	36.145980
M	No	34.461372
M	Yes	30.833010

As we can see **14%** of **Females** that have scholarships not appeared at appointment Day and There's **6%** of **men** that has Scholarships(enrolled in Brasilian welfare program Bolsa Família) not appeared at appointment Day so We are pretty sure that having scholarship has strong impact on the appearance of patient.Our final shape of our data is there's 110519 rows (values"outliers removed") and 12 columns we removed The first 3 columns (PatientID, Appointment ID) We may need them if we were searching for a specific ID but here we don't want specific IDs we just want to do some Analysis!!!

Here's a link to a mark down File extended Syntax review

Also I should mention Stackoverflow,geeks for geeks and of course github as they helped me alot to remember some syntax besides did some rememorize from course lessons

1.15.1 Limitation:-

- we may needed to divide dataframe by neighbourhoods and do some further analysis but we couldn't as there's a length of 81 value and it will take much longer time.
- There's also a needed data to specify which Sms-Message type is sent "Is it confirmation or a reminder?"

1.15.2 Finally

- Maybe we can Predict which one will show and who won't but further data is needed

[83]:

```
from subprocess import call
call(['python', '-m', 'nbconvert', 'No-show appointments.ipynb'])
```

[83]:

```
1
```

[ ]: