Project: For What Reasons , Patients are not showing up for their appointments in Brazil

Note : noshowappointments-kagglev2-may-2016.csv was used for this analysis

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Introduction

> 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. What factors are important for us to know in order to predict if a patient will show up for their scheduled appointment? Does the Scholarship have an effect on the absence of patients ? Does the age an effect on the absence of patients ? is the location of the patient affect the appointment show ?

In [3]:

```
#   http://ipython.readthedocs.io/en/stable/interactive/magics.html

import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import numpy as np
```

Data Wrangling

General Properties

In [4]:

```
# Loading data and inspect it if there is any missing data ,incorrect data types

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

Out[4]:

	PatientId	AppointmentID	Gender	ScheduledDay	AppointmentDay	Age	Neighbourhood	Scholarship	Hipe
0	2.987250e+13	5642903	F	2016-04-29T18:38:08Z	2016-04-29T00:00:00Z	62	JARDIM DA PENHA	0	
1	5.589978e+14	5642503	M	2016-04-29T16:08:27Z	2016-04-29T00:00:00Z	56	JARDIM DA PENHA	0	

	PatientId	AppointmentID	Gender	ScheduledDay	AppointmentDay	Age	Neighbourhood	Scholarship	Hipe
2	4.262962e+12	5642549	F	2016-04-29T16:19:04Z	2016-04-29T00:00:00Z	62	MATA DA PRAIA	0	
3	8.679512e+11	5642828	F	2016-04-29T17:29:31Z	2016-04-29T00:00:00Z	8	PONTAL DE CAMBURI	0	
4	8.841186e+12	5642494	F	2016-04-29T16:07:23Z	2016-04-29T00:00:00Z	56	JARDIM DA PENHA	0	

In [5]:

```
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
```

In [6]:

```
# checking for duplicates
sum(df.duplicated())
#---> There is no duplicated rows and there are no missing data we only need to correct sc
```

Out[6]:

```
0
```

Check for missing data types and duplicates

Change column names to make them more easy to use

In [7]:

```
newnames =[]
for c in df.columns :
    c= c.lower()
    newnames.append(c)
df.columns = newnames
df.rename(columns ={"no-show" : "no_show" }, inplace = True)
df.head()
```

Out[7]:

	patientid	appointmentid	gender	scheduledday	appointmentday	age	neighbourhood	scholarship	hiperte
0	2.987250e+13	5642903	F	2016-04-29T18:38:08Z	2016-04-29T00:00:00Z	62	JARDIM DA PENHA	0	

	patientid	appointmentid	gender	scheduledday	appointmentday	age	neighbourhood	scholarship	hiperte
1	5.589978e+14	5642503	M	2016-04-29T16:08:27Z	2016-04-29T00:00:00Z	56	JARDIM DA PENHA	0	
2	4.262962e+12	5642549	F	2016-04-29T16:19:04Z	2016-04-29T00:00:00Z	62	MATA DA PRAIA	0	
3	8.679512e+11	5642828	F	2016-04-29T17:29:31Z	2016-04-29T00:00:00Z	8	PONTAL DE CAMBURI	0	
4	8.841186e+12	5642494	F	2016-04-29T16:07:23Z	2016-04-29T00:00:00Z	56	JARDIM DA PENHA	0	

we will covert yes and no to 1 and 0 to see the relationship between columns

In [8]:

```
df.no_show.unique()
new = []
for i in df.no_show :
    if i == "Yes" :
        new.append(0)
    elif i == 'No' :
        new.append(1)
dfv1 = df.copy()
# df_v1.drop("no_show" , axis = 1 , inplace = True)
dfv1.no_show = np.array(new)
dfv1.head()
dfv1.drop(['patientid','appointmentid'] , axis = 1 , inplace = True)
dfv1
```

Out[8]:

	gender	scheduledday	appointmentday	age	neighbourhood	scholarship	hipertension	diabetes	alcoholis
0	F	2016-04-29T18:38:08Z	2016-04-29T00:00:00Z	62	JARDIM DA PENHA	0	1	0	
1	M	2016-04-29T16:08:27Z	2016-04-29T00:00:00Z	56	JARDIM DA PENHA	0	0	0	
2	F	2016-04-29T16:19:04Z	2016-04-29T00:00:00Z	62	MATA DA PRAIA	0	0	0	
3	F	2016-04-29T17:29:31Z	2016-04-29T00:00:00Z	8	PONTAL DE CAMBURI	0	0	0	
4	F	2016-04-29T16:07:23Z	2016-04-29T00:00:00Z	56	JARDIM DA PENHA	0	1	1	
...	...	...	...	...	...	...	...	...	
110522	F	2016-05-03T09:15:35Z	2016-06-07T00:00:00Z	56	MARIA ORTIZ	0	0	0	
110523	F	2016-05-03T07:27:33Z	2016-06-07T00:00:00Z	51	MARIA ORTIZ	0	0	0	
110524	F	2016-04-27T16:03:52Z	2016-06-07T00:00:00Z	21	MARIA ORTIZ	0	0	0	
110525	F	2016-04-27T15:09:23Z	2016-06-07T00:00:00Z	38	MARIA ORTIZ	0	0	0	
110526	F	2016-04-27T13:30:56Z	2016-06-07T00:00:00Z	54	MARIA ORTIZ	0	0	0	

110527 rows × 12 columns

In [9]:

```
df.scholarship.unique() ,dfv1.age.unique()
#age contains -1 wich is impossible we have todrop ros that contains -1 in age
```

Out[9]:

```
(array([0, 1], dtype=int64),
 array([ 62,  56,   8,  76,  23,  39,  21,  19,  30,  29,  22,  28,  54,
         15,  50,  40,  46,   4,  13,  65,  45,  51,  32,  12,  61,  38,
         79,  18,  63,  64,  85,  59,  55,  71,  49,  78,  31,  58,  27,
          6,   2,  11,   7,   0,   3,   1,  69,  68,  60,  67,  36,  10,
         35,  20,  26,  34,  33,  16,  42,   5,  47,  17,  41,  44,  37,
         24,  66,  77,  81,  70,  53,  75,  73,  52,  74,  43,  89,  57,
         14,   9,  48,  83,  72,  25,  80,  87,  88,  84,  82,  90,  94,
         86,  91,  98,  92,  96,  93,  95,  97, 102, 115, 100,  99,  -1],
       dtype=int64))
```

In [10]:

```
dfv1 = dfv1.query("age >= 0")
```

Exploratory Data Analysis

> Now we are going to answer those questions that we have asked before
>
> ## What factors are important for us to know in order to predict if a patient will show up for their scheduled appointment?

Check if neighbourhood has an affect

In [11]:

```
dfshow = dfv1.groupby(dfv1.neighbourhood).mean()
pd.DataFrame(dfshow)
```

Out[11]:

	age	scholarship	hipertension	diabetes	alcoholism	handcap	sms_received	no_show
neighbourhood								
AEROPORTO	53.125000	0.000000	0.250000	0.000000	0.000000	0.000000	0.125000	0.875000
ANDORINHAS	36.106101	0.142794	0.259063	0.132184	0.022989	0.040230	0.250663	0.769673
ANTÔNIO HONÓRIO	36.845018	0.051661	0.018450	0.011070	0.000000	0.003690	0.343173	0.815498
ARIOVALDO FAVALESSA	32.847518	0.184397	0.131206	0.067376	0.049645	0.039007	0.202128	0.780142
BARRO VERMELHO	45.040189	0.000000	0.134752	0.054374	0.004728	0.014184	0.338061	0.784870
...	...	...	...	...	...	...	...	...
SÃO JOSÉ	33.613556	0.091047	0.259484	0.120384	0.041477	0.039960	0.338392	0.783510
SÃO PEDRO	36.038807	0.131127	0.273693	0.101716	0.061275	0.039624	0.284314	0.789624
TABUAZEIRO	34.965517	0.171456	0.227331	0.076628	0.018199	0.027139	0.306194	0.817050
UNIVERSITÁRIO	42.039474	0.032895	0.269737	0.111842	0.013158	0.019737	0.361842	0.789474
VILA RUBIM	44.413631	0.088132	0.273796	0.105758	0.019976	0.049354	0.374853	0.834313

81 rows × 8 columns

In [12]:

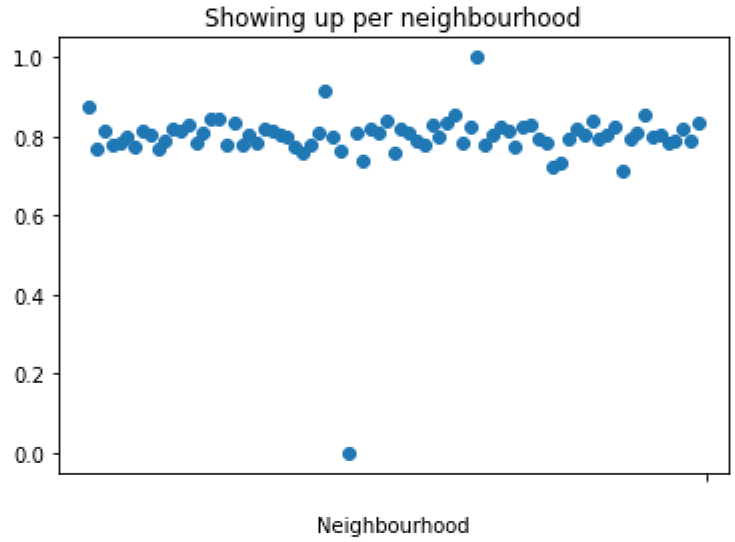
```
dfshow.no_show.describe()
```

Out[12]:

```
count    81.000000
mean      0.794572
std       0.097230
min       0.000000
25%       0.782546
50%       0.802412
75%       0.820093
max       1.000000
Name: no_show, dtype: float64
```

In [13]:

```
plt.scatter(dfshow.index , dfshow.no_show )
plt.xticks(' ')
plt.xlabel('Neighbourhood')
plt.title('Showing up per neighbourhood')
plt.show()
```



We can see that therre is a linear distribution and there is no difference between hospital locations so neighbourhood has no affect on the patient's showing up

Does the Scholarship have an effect on the absence of patients

In [14]:

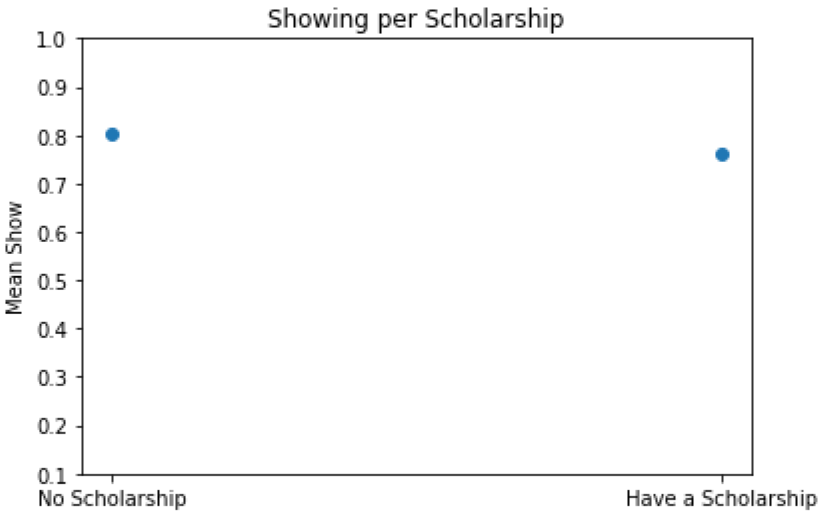
```
dfsch = dfv1.groupby(dfv1.scholarship).mean()
pd.DataFrame(dfsch)
```

Out[14]:

	age	hipertension	diabetes	alcoholism	handcap	sms_received	no_show
scholarship							
0	37.794612	0.199839	0.073988	0.028415	0.022706	0.320845	0.801926
1	30.616242	0.173465	0.052389	0.048614	0.018046	0.322714	0.762637

In [15]:

```
# dflow.scholarship.plot(kind="bar" , subplots = True , figsize =(15,5) )
dfsch.index =["No Scholarship", "Have a Scholarship"]
plt.scatter(dfsch.index , dfsch.no_show)
plt.yticks([0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9,1.0])
# plt.xlabel(['Neighbourhood with low show', 'Neighbourhood with high show'])
plt.ylabel('Mean Show')
plt.title('Showing per Scholarship')
plt.show()
# dfhigh.scholarship.plot(kind="bar" , subplots = True , figsize =(15,5) )
```



We Can Conclude that scholarship has no affect on showing

L'ts check if the gender has an effect

In [16]:

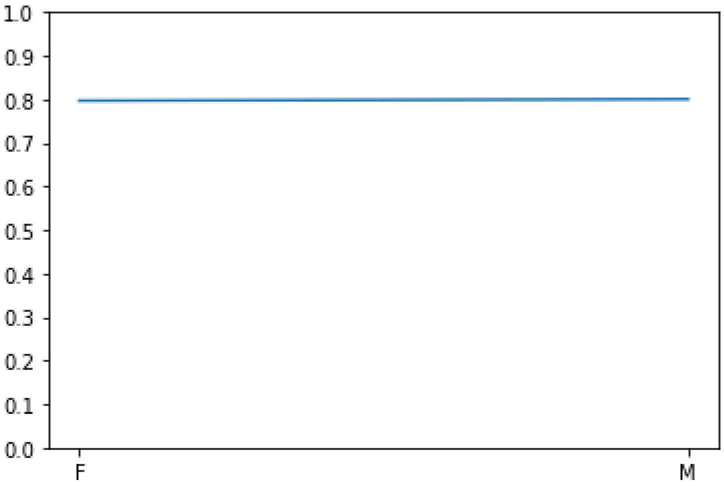
```
dfgender =dfv1.groupby("gender").mean()
```

In [17]:

```
plt.plot(dfgender.index , dfgender.no_show)
plt.yticks([0,0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9,1.0])

# plt.xticks('')
# plt.xlabel(['Neighbourhood with low show', 'Neighbourhood with high show'])

plt.ylabel('')
plt.show()
```



-----> There is no defference in gender (horizontal plot)

Let's Check for types of sickness if they can affect the presence

In [18]:

```
dfv1.head()
```

Out[18]:

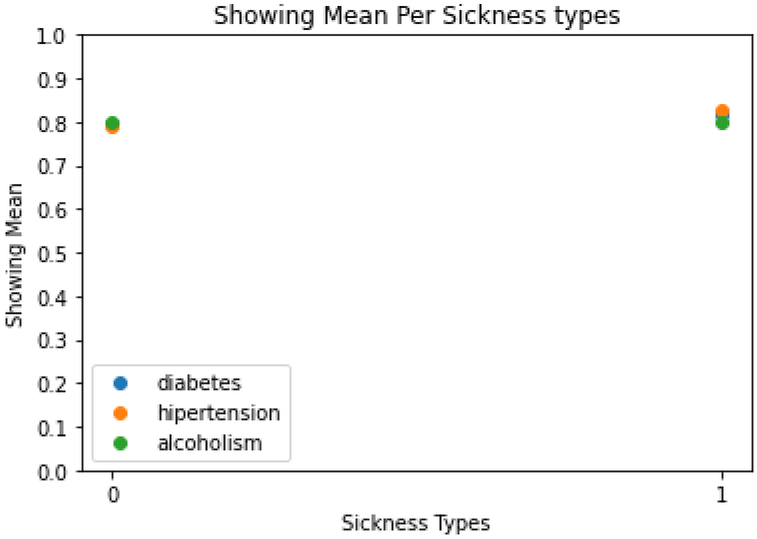
	gender	scheduledday	appointmentday	age	neighbourhood	scholarship	hipertension	diabetes	alcoholism	ha
0	F	2016-04-29T18:38:08Z	2016-04-29T00:00:00Z	62	JARDIM DA PENHA	0	1	0	0	
1	M	2016-04-29T16:08:27Z	2016-04-29T00:00:00Z	56	JARDIM DA PENHA	0	0	0	0	
2	F	2016-04-29T16:19:04Z	2016-04-29T00:00:00Z	62	MATA DA PRAIA	0	0	0	0	
3	F	2016-04-29T17:29:31Z	2016-04-29T00:00:00Z	8	PONTAL DE CAMBURI	0	0	0	0	
4	F	2016-04-29T16:07:23Z	2016-04-29T00:00:00Z	56	JARDIM DA PENHA	0	1	1	0	

In [19]:

```
dfdiabetes =dfv1.groupby("diabetes").mean()
dfhipertension =dfv1.groupby("hipertension").mean()
dfalcohol =dfv1.groupby("alcoholism").mean()
dfhandcap =dfv1.groupby("handcap").mean()
```

In [20]:

```
plt.scatter(dfdiabetes.index , dfdiabetes.no_show , label ="diabetes"  )
plt.scatter(dfhipertension.index , dfhipertension.no_show ,label ="hipertension" )
plt.scatter(dfalcohol.index , dfalcohol.no_show ,label ="alcoholism" )
plt.legend()
plt.xticks([0, 1])
plt.yticks([0,0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9,1.0])
plt.xlabel('Sickness Types')
plt.ylabel('Showing Mean')
plt.title('Showing Mean Per Sickness types')
plt.show()
```

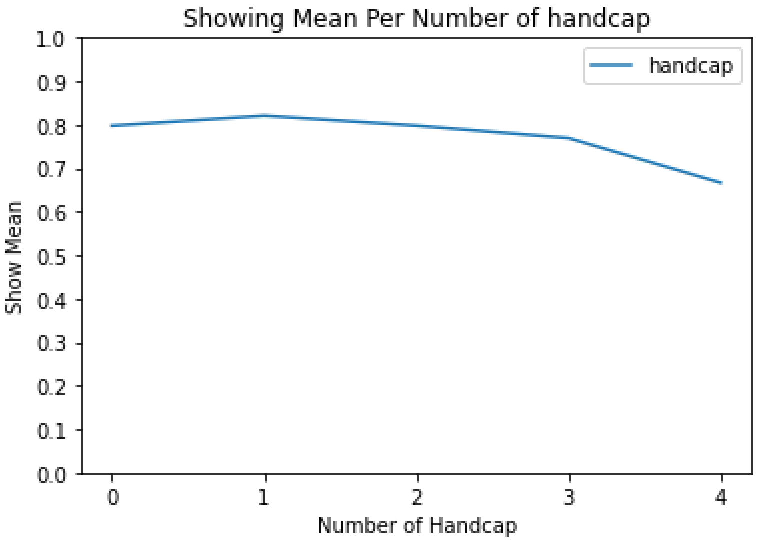


---> Sicknes types have no effect on showing

Let's Check for number of Handcap if they can affect the presence

In [21]:

```
plt.plot(dfhandcap.index , dfhandcap.no_show ,label ="handcap")
plt.xticks([0, 1 ,2,3,4])
plt.yticks([0,0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9,1.0])
plt.xlabel('Number of Handcap')
plt.ylabel('Show Mean')
plt.title('Showing Mean Per Number of handcap')
plt.legend()
plt.show()
```



---> We can see that people that has less probability of getting scholarship are more llikely to be absent

Does the age has an effect on the presence of patients?

In [22]:

```
dfv1.age.describe()
```

Out[22]:

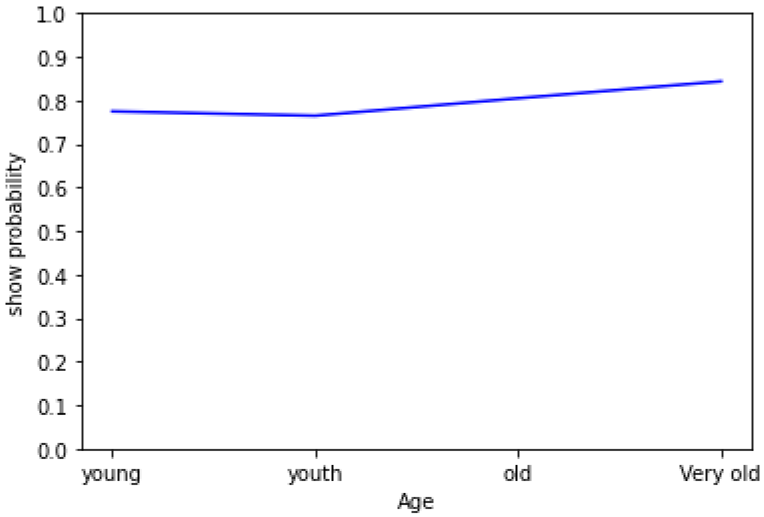
```
count    110526.000000
mean         37.089219
std          23.110026
min           0.000000
25%          18.000000
50%          37.000000
75%          55.000000
max         115.000000
Name: age, dtype: float64
```

In [23]:

```
levels = [0,18,37,55,115]
lvlname =['young' , 'youth' ,'old' ,'Very old']
dfage = dfv1.copy()
dfage['age_category'] = pd.cut(dfv1['age'], levels, labels=lvlname)
dfagef = dfage.groupby('age_category').mean()
```

In [24]:

```
colors =  ["red","blue"]
plt.plot(dfagef.index ,dfagef.no_show ,color="blue")
plt.yticks([0,0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9,1.0])
plt.ylabel("show probability")
plt.xlabel('Age')
plt.show()
```



----------> We can see that line is slightly rising with the age we can assume that people with 35 and older are more likely to be present in the appointment

Does the sms has an effect on the presence of pacients

In [25]:

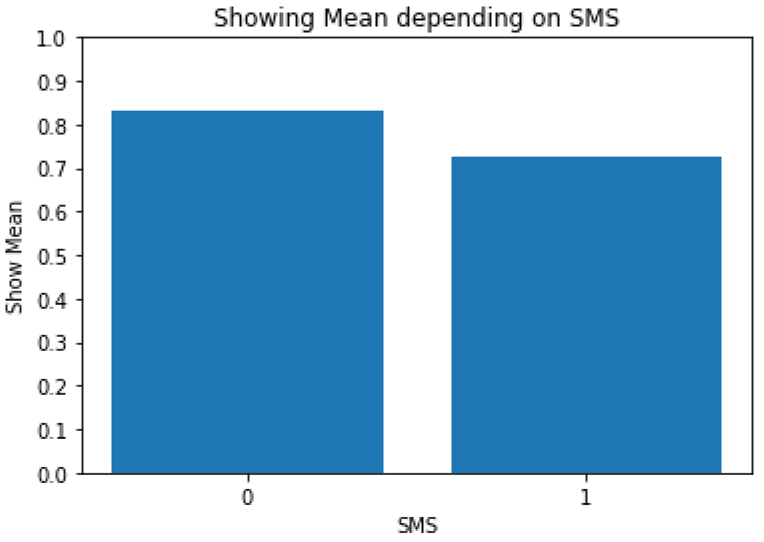
```
dfv1.groupby('sms_received').mean()
```

Out[25]:

	age	scholarship	hipertension	diabetes	alcoholism	handcap	no_show
sms_received							
0	36.888465	0.098022	0.198963	0.07445	0.033487	0.024932	0.832965
1	37.513810	0.098782	0.193619	0.06640	0.023871	0.016572	0.724255

In [26]:

```
plt.bar(dfv1.groupby('sms_received').mean().index , dfv1.groupby('sms_received').mean().no
plt.xticks([0, 1])
plt.yticks([0,0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9,1.0])
plt.xlabel('SMS')
plt.ylabel('Show Mean')
plt.title('Showing Mean depending on SMS')
plt.show()
```



---> We can clearly see that people receiving sms are more likely to be

absent

we are going to make dates daily to get more gloal view on the dataset and inspect the duration between appointment and scheduled day and wich part of the day would have an effect on the presence of pacients

In [27]:

```
dfv1.head()
```

Out[27]:

	gender	scheduledday	appointmentday	age	neighbourhood	scholarship	hipertension	diabetes	alcoholism	ha
0	F	2016-04-29T18:38:08Z	2016-04-29T00:00:00Z	62	JARDIM DA PENHA	0	1	0	0	
1	M	2016-04-29T16:08:27Z	2016-04-29T00:00:00Z	56	JARDIM DA PENHA	0	0	0	0	
2	F	2016-04-29T16:19:04Z	2016-04-29T00:00:00Z	62	MATA DA PRAIA	0	0	0	0	
3	F	2016-04-29T17:29:31Z	2016-04-29T00:00:00Z	8	PONTAL DE CAMBURI	0	0	0	0	
4	F	2016-04-29T16:07:23Z	2016-04-29T00:00:00Z	56	JARDIM DA PENHA	0	1	1	0	

In [28]:

```
dfv1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 110526 entries, 0 to 110526
Data columns (total 12 columns):
 #   Column          Non-Null Count   Dtype 
---  ------          --------------   ----- 
 0   gender          110526 non-null  object
 1   scheduledday    110526 non-null  object
 2   appointmentday  110526 non-null  object
 3   age             110526 non-null  int64 
 4   neighbourhood   110526 non-null  object
 5   scholarship     110526 non-null  int64 
 6   hipertension    110526 non-null  int64 
 7   diabetes        110526 non-null  int64 
 8   alcoholism      110526 non-null  int64 
 9   handcap         110526 non-null  int64 
 10  sms_received    110526 non-null  int64 
 11  no_show         110526 non-null  int32 
dtypes: int32(1), int64(7), object(4)
memory usage: 10.5+ MB
```

In [68]:

```
def split(df , x = None, y= None ,sep = ' ') :
# list of columns to split
    split_columns = ['{}'.format(x),'{}'.format(y)]
    # create two separated dfs to make changes so we won't lose the main df
# and treat every one seperatly
    df1 = df.copy()
    df2 = df.copy()
# apply split function to each column of each dataframe copy
    for c in split_columns:
        df1[c] = df[c].apply(lambda x : x.split('{}'.format(sep))[0])
        df2[c] = df[c].apply(lambda x : x.split('{}'.format(sep))[1])
    return (df1 , df2)
```

In [73]:

```
dfdate = split(dfv1 ,'appointmentday', 'scheduledday' ,'T')[0]
dftime = split(dfv1 ,'appointmentday', 'scheduledday' ,'T')[1]
dftime.head()
```

Out[73]:

	gender	scheduledday	appointmentday	age	neighbourhood	scholarship	hipertension	diabetes	alcoholism	ha
0	F	18:38:08Z	00:00:00Z	62	JARDIM DA PENHA	0	1	0	0	
1	M	16:08:27Z	00:00:00Z	56	JARDIM DA PENHA	0	0	0	0	
2	F	16:19:04Z	00:00:00Z	62	MATA DA PRAIA	0	0	0	0	
3	F	17:29:31Z	00:00:00Z	8	PONTAL DE CAMBURI	0	0	0	0	
4	F	16:07:23Z	00:00:00Z	56	JARDIM DA PENHA	0	1	1	0	

In [74]:

```
dfdate.head()
```

Out[74]:

	gender	scheduledday	appointmentday	age	neighbourhood	scholarship	hipertension	diabetes	alcoholism	ha
0	F	2016-04-29	2016-04-29	62	JARDIM DA PENHA	0	1	0	0	
1	M	2016-04-29	2016-04-29	56	JARDIM DA PENHA	0	0	0	0	
2	F	2016-04-29	2016-04-29	62	MATA DA PRAIA	0	0	0	0	
3	F	2016-04-29	2016-04-29	8	PONTAL DE CAMBURI	0	0	0	0	
4	F	2016-04-29	2016-04-29	56	JARDIM DA PENHA	0	1	1	0	

In [75]:

```
#lets take only the hour of the appointment because minutes won't effecct the decision of
dftime = split(dftime ,'appointmentday', 'scheduledday',':')[0]
dftime = dftime.rename(columns ={"scheduledday" : "scheduledtime" , "appointmentday" : "ap
dftime.head()
```

Out[75]:

	gender	scheduledtime	appointmenttime	age	neighbourhood	scholarship	hipertension	diabetes	alcoholism
0	F	18	00	62	JARDIM DA PENHA	0	1	0	0
1	M	16	00	56	JARDIM DA PENHA	0	0	0	0
2	F	16	00	62	MATA DA PRAIA	0	0	0	0
3	F	17	00	8	PONTAL DE CAMBURI	0	0	0	0

	gender	scheduledtime	appointmenttime	age	neighbourhood	scholarship	hipertension	diabetes	alcoholism
4	F	16	00	56	JARDIM DA PENHA	0	1	1	0

Does The duration between the appointment Day and Scheduled Day affect the absence of patience ?

In [76]:

```
#Covert types of dates so that we canmake the diffrences and mesure the periode between ap
dfdate.scheduledday = pd.to_datetime(dfdate.scheduledday)
dfdate.appointmentday   = pd.to_datetime(dfdate.appointmentday)
dfdate.head()
```

Out[76]:

	gender	scheduledday	appointmentday	age	neighbourhood	scholarship	hipertension	diabetes	alcoholism	ha
0	F	2016-04-29	2016-04-29	62	JARDIM DA PENHA	0	1	0	0	
1	M	2016-04-29	2016-04-29	56	JARDIM DA PENHA	0	0	0	0	
2	F	2016-04-29	2016-04-29	62	MATA DA PRAIA	0	0	0	0	
3	F	2016-04-29	2016-04-29	8	PONTAL DE CAMBURI	0	0	0	0	
4	F	2016-04-29	2016-04-29	56	JARDIM DA PENHA	0	1	1	0	

In [78]:

```
nbdays = [dfdate.appointmentday - dfdate.scheduledday]
days = pd.DataFrame(np.transpose(np.array(nbdays)))
dfdate["days"] = days
dfdate=dfdate.astype({"days" : str})
dfdate.days = dfdate.days.apply(lambda x : x.split(' ')[0])
#
dfdate = dfdate.query("days != 'NaT' and days >= '0' ")
dfdate =dfdate.astype({"days" : int})
dfdate.head()
```

Out[78]:

	gender	scheduledday	appointmentday	age	neighbourhood	scholarship	hipertension	diabetes	alcoholism	ha
0	F	2016-04-29	2016-04-29	62	JARDIM DA PENHA	0	1	0	0	
1	M	2016-04-29	2016-04-29	56	JARDIM DA PENHA	0	0	0	0	
2	F	2016-04-29	2016-04-29	62	MATA DA PRAIA	0	0	0	0	
3	F	2016-04-29	2016-04-29	8	PONTAL DE CAMBURI	0	0	0	0	
4	F	2016-04-29	2016-04-29	56	JARDIM DA PENHA	0	1	1	0	

In [79]:

```
dfdate.days.unique()
```

Out[79]:

```
array([  0,   2,   3,   1,   4,   9,  29,  10,  23,  11,  18,  17,  14,
        28,  24,  21,  15,  16,  22,  43,  30,  31,  42,  32,  56,  45,
        46,  39,  37,  38,  44,  50,  60,  52,  53,  65,  67,  91,  66,
        84,  78,  87, 115, 109,  63,  70,  72,  57,  58,  51,  59,  41,
        49,  73,  64,  20,  33,  34,   6,  35,  36,  12,  13,  40,  47,
         8,   5,   7,  25,  26,  48,  27,  19,  61,  55,  62, 176,  54,
        77,  69,  83,  76,  89,  81, 103,  79,  68,  75,  85, 112,  80,
        86,  98,  94, 142, 155, 162, 169, 104, 133, 125,  96,  88,  90,
       151, 126, 127, 111, 119,  74,  71,  82, 108, 110, 102, 122, 101,
       105,  92,  97,  93, 107,  95, 139, 132, 179, 117, 146, 123])
```

In [80]:

```
dfdate.days.describe()
```

Out[80]:

```
count    110514.000000
mean         10.184375
std          15.255224
min           0.000000
25%           0.000000
50%           4.000000
75%          15.000000
max         179.000000
Name: days, dtype: float64
```

In [81]:

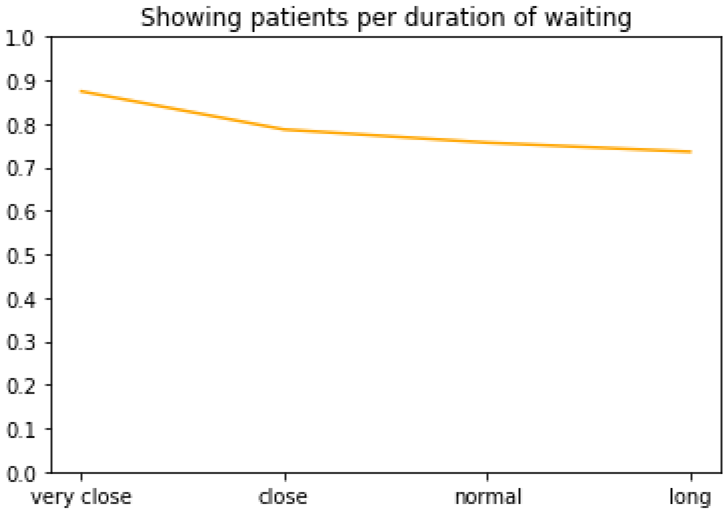
```
duration = [-1,0,4,15,179]
cap = ["very close" , "close","normal","long"]
dfdate["duration_level"] = pd.cut(dfdate["days"] , duration , labels = cap)
dfdate.groupby("duration_level").mean()
```

Out[81]:

	age	scholarship	hipertension	diabetes	alcoholism	handcap	sms_received	no_show	da
duration_level									
very close	35.007365	0.106434	0.180892	0.068518	0.039083	0.025130	0.157421	0.874452	0.0000
close	42.272991	0.082999	0.261170	0.100531	0.029353	0.025746	0.251102	0.786616	2.4058
normal	36.654173	0.108712	0.201926	0.070766	0.028586	0.021556	0.464365	0.756438	8.9868
long	36.630049	0.087677	0.168153	0.056089	0.020233	0.015966	0.473861	0.735482	32.2397

In [82]:

```
#plotting to see the differences
plt.plot(dfdate.groupby("duration_level").mean().index ,dfdate.groupby("duration_level").r
plt.yticks([0,0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9,1.0])
plt.title('Showing patients per duration of waiting')
plt.show()
```



We Can Clearly see that the more the duration of the appointment is far from the scheduledday the more probability of absence of patients

Does the time an effect on the absence of patients ?

In [83]:

```
dftime.head()
```

Out[83]:

	gender	scheduledtime	appointmenttime	age	neighbourhood	scholarship	hipertension	diabetes	alcoholism
0	F	18	00	62	JARDIM DA PENHA	0	1	0	0
1	M	16	00	56	JARDIM DA PENHA	0	0	0	0
2	F	16	00	62	MATA DA PRAIA	0	0	0	0
3	F	17	00	8	PONTAL DE CAMBURI	0	0	0	0
4	F	16	00	56	JARDIM DA PENHA	0	1	1	0

In [84]:

```
dftime.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 110526 entries, 0 to 110526
Data columns (total 12 columns):
 #   Column           Non-Null Count   Dtype 
---  ------           --------------   ----- 
 0   gender           110526 non-null  object
 1   scheduledtime    110526 non-null  object
 2   appointmenttime  110526 non-null  object
 3   age              110526 non-null  int64 
 4   neighbourhood    110526 non-null  object
 5   scholarship      110526 non-null  int64 
 6   hipertension     110526 non-null  int64 
 7   diabetes         110526 non-null  int64 
 8   alcoholism       110526 non-null  int64 
 9   handcap          110526 non-null  int64 
 10  sms_received     110526 non-null  int64 
 11  no_show          110526 non-null  int32 
dtypes: int32(1), int64(7), object(4)
memory usage: 10.5+ MB
```

In [85]:

```
# Convert type of time hours into int
dftime = dftime.astype({"scheduledtime" : int})
dftime.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 110526 entries, 0 to 110526
Data columns (total 12 columns):
 #   Column           Non-Null Count   Dtype 
---  ------           --------------   ----- 
 0   gender           110526 non-null  object
 1   scheduledtime    110526 non-null  int32 
 2   appointmenttime  110526 non-null  object
 3   age              110526 non-null  int64 
 4   neighbourhood    110526 non-null  object
 5   scholarship      110526 non-null  int64 
 6   hipertension     110526 non-null  int64 
 7   diabetes         110526 non-null  int64 
 8   alcoholism       110526 non-null  int64
 9   handcap          110526 non-null  int64
 10  sms_received     110526 non-null  int64
 11  no_show          110526 non-null  int32
dtypes: int32(2), int64(7), object(3)
memory usage: 10.1+ MB
```

In [86]:

```
#check if there is any false values
dftime.scheduledtime.unique()
```

Out[86]:

```
array([18, 16, 17,  8, 15, 12, 14, 11, 10,  9,  7, 13, 19, 20,  6, 21])
```

In [87]:

```
dftime.scheduledtime.describe()
```

Out[87]:

```
count    110526.000000
mean         10.774542
std           3.216192
min           6.000000
25%           8.000000
50%          10.000000
75%          13.000000
max          21.000000
Name: scheduledtime, dtype: float64
```

In [90]:

```
timelvl = [6,8,10,13,21]
timecap = ["early moring" , "morning" , 'mid day' ,'afternoon and night']
dftime["day_parts"] = pd.cut(dftime.scheduledtime , timelvl , labels = timecap)
dftime.head()
```

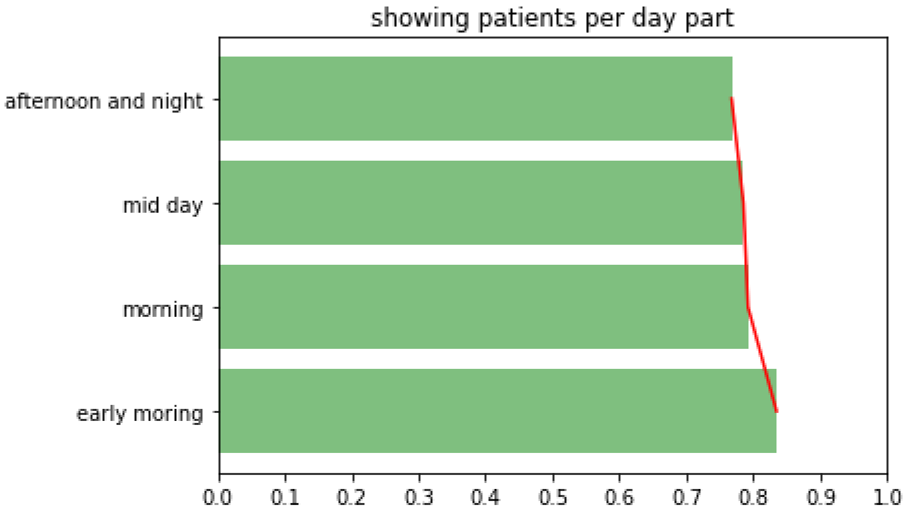
Out[90]:

	gender	scheduledtime	appointmenttime	age	neighbourhood	scholarship	hipertension	diabetes	alcoholism
0	F	18	00	62	JARDIM DA PENHA	0	1	0	0
1	M	16	00	56	JARDIM DA PENHA	0	0	0	0
2	F	16	00	62	MATA DA PRAIA	0	0	0	0
3	F	17	00	8	PONTAL DE CAMBURI	0	0	0	0
4	F	16	00	56	JARDIM DA PENHA	0	1	1	0

In [91]:

```
plt.barh(dftime.groupby("day_parts").mean().index ,dftime.groupby("day_parts").mean().no_s
plt.plot(dftime.groupby("day_parts").mean().no_show ,dftime.groupby("day_parts").mean().ir

plt.title("showing patients per day part")
plt.xticks([0,0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9,1.0])
plt.show()
```



---> We can see that the day part is slightly effecting the presence of patients , infact , patients in the early morning are likely to be present more than any other time

Conclusions

Results : Our data suggest that

1- The figures showed that only duration between appointment and scheduled days , age , receiving an sms and number o handicap affect the presence of patients , in fac the young people are more likely to be absent , added to that the duration has a great effect , the more olog duration is , the more likely patient is to be absent.

2- Moreover , most of the appointments are in the afternoon and later , where patients tend to be absent .

3- Last but not least, the probability of patient to be abscent increase by the number of handicap he has .

Limitations : There are a couple of limitations with our data

1- It would be better if the dataset contains another column of the prices with scholarship and without

2- values are very close in the analysis so that can affect our conclusion a little bit

3- maybe there are some mistakes in the dataset , in fact it would be more logical if the patients that received sms will be present more than the ones who did not

Links i used to help me in the project

https://pandas.pydata.org/docs/

https://matplotlib.org/stable/users/index.html

https://numpy.org/doc/