Project: Investigate a Dataset (No_show_appointments_Dataset)

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Introduction

importing statements for all of the packages

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

Data Wrangling

General Properties

```
# Loading file

df = pd.read_csv('noshowappointments.csv')
df.head()
```

```
      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
```

```
#Data summary
df.describe()
```

```
          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
```

Data Cleaning(Checking the data)

```
#Check for empty slots
pd.isna(df).sum()
```

```
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
```

```
#checking sample data and columns names
df.head()
```

```
      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
```

```
#Checking the info
df.info()
```

```
# Check for dublicate.
print("Duplicates : ", + sum(df.duplicated()))
```

```
#Check age column for negative values
df[df["Age"]<=0]
```

```
<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
Duplicates :  0
```

	PatientId	AppointmentID	Gender	ScheduledDay	\
59	7.184428e+13	5638545	F	2016-04-29T08:08:43Z	
63	2.366233e+14	5628286	M	2016-04-27T10:46:12Z	
64	1.885174e+14	5616082	M	2016-04-25T13:28:21Z	
65	2.718818e+14	5628321	M	2016-04-27T10:48:50Z	
67	8.647128e+13	5639264	F	2016-04-29T08:53:02Z	
...	...	...	...	...	
110345	1.473952e+14	5702537	F	2016-05-16T12:30:58Z	
110346	5.577525e+12	5777724	M	2016-06-06T14:22:34Z	
110454	6.142460e+11	5772400	F	2016-06-03T15:18:44Z	
110460	4.321846e+13	5769545	F	2016-06-03T08:56:51Z	
110507	4.769462e+14	5786918	F	2016-06-08T09:04:18Z	

	AppointmentDay	Age	Neighbourhood	Scholarship	\
59	2016-04-29T00:00:00Z	0	CONQUISTA	0	
63	2016-04-29T00:00:00Z	0	SÃO BENEDITO	0	
64	2016-04-29T00:00:00Z	0	ILHA DAS CAIEIRAS	0	
65	2016-04-29T00:00:00Z	0	CONQUISTA	0	
67	2016-04-29T00:00:00Z	0	NOVA PALESTINA	0	
...	...	...	...	...	
110345	2016-06-01T00:00:00Z	0	RESISTÊNCIA	0	
110346	2016-06-08T00:00:00Z	0	RESISTÊNCIA	0	
110454	2016-06-03T00:00:00Z	0	RESISTÊNCIA	0	
110460	2016-06-03T00:00:00Z	0	RESISTÊNCIA	0	
110507	2016-06-08T00:00:00Z	0	MARIA ORTIZ	0	

	Hipertension	Diabetes	Alcoholism	Handcap	SMS_received	No-show
59	0	0	0	0	0	No
63	0	0	0	0	0	

```
No
64                  0         0           0        0              1
No
65                  0         0           0        0              0
No
67                  0         0           0        0              0
No
...               ...       ...         ...      ...            ...
...
110345              0         0           0        0              0
No
110346              0         0           0        0              0
No
110454              0         0           0        0              0
No
110460              0         0           0        0              0
No
110507              0         0           0        0              0
No

[3540 rows x 14 columns]
```

Cleaning the data and fixing typos

```
df.rename(columns= {"Hipertension" : "Hypertension","Handcap" :
"Handicap","No-show":"NoShow"}, inplace= True)
```

Fixing date time formate

```
df['ScheduledDay'] = pd.to_datetime(df['ScheduledDay'])
df['AppointmentDay'] = pd.to_datetime(df['AppointmentDay'])

#Re-Checking the info
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  datetime64[ns, UTC]
 4   AppointmentDay  110527 non-null  datetime64[ns, UTC]
 5   Age             110527 non-null  int64
 6   Neighbourhood   110527 non-null  object
 7   Scholarship     110527 non-null  int64
 8   Hypertension    110527 non-null  int64
 9   Diabetes        110527 non-null  int64
 10  Alcoholism      110527 non-null  int64
```

```
 11  Handicap        110527 non-null  int64
 12  SMS_received    110527 non-null  int64
 13  NoShow          110527 non-null  object
dtypes: datetime64[ns, UTC](2), float64(1), int64(8), object(3)
memory usage: 11.8+ MB
```

Adjusting unlogic ages

```
#logically should no patient has age =<0
#determining the mean value
MeanAge=df['Age'].mean()

#excuting to the dataset
df[df['Age'] <=0] = MeanAge

#checking the results
df.isnull().sum()
```

```
PatientId         0
AppointmentID     0
Gender            0
ScheduledDay      0
AppointmentDay    0
Age               0
Neighbourhood     0
Scholarship       0
Hypertension      0
Diabetes          0
Alcoholism        0
Handicap          0
SMS_received      0
NoShow            0
dtype: int64
```

converting the (yes/No) in No Show column to logical numbers for graphing.

```
df.NoShow[df['NoShow'] == 'Yes'] = "1"
df.NoShow[df['NoShow'] == 'No'] = "0"
df["NoShow"] = pd.to_numeric(df['NoShow'])
```

```
C:\Users\ahmed\AppData\Local\Temp\ipykernel_16028\606932315.py:1:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation:
https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy
  df.NoShow[df['NoShow'] == 'Yes'] = "1"
C:\Users\ahmed\AppData\Local\Temp\ipykernel_16028\606932315.py:2:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame
```

```
See the caveats in the documentation:
https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy
  df.NoShow[df['NoShow'] == 'No'] = "0"
```

After creating some random graphs and charts and returning back to raw data, some typo/ outliners(37.088874211731) have been found hence, accordinly they should be removed to avoid misleading reasults(Bias).

```
df.Gender.unique()
```

```
array(['F', 'M', 37.08887421173107], dtype=object)
```

```
#drop the rows that has this invalid data enteries
df = df[df.Gender != 37.08887421173107 ]
df.Gender.unique()
```

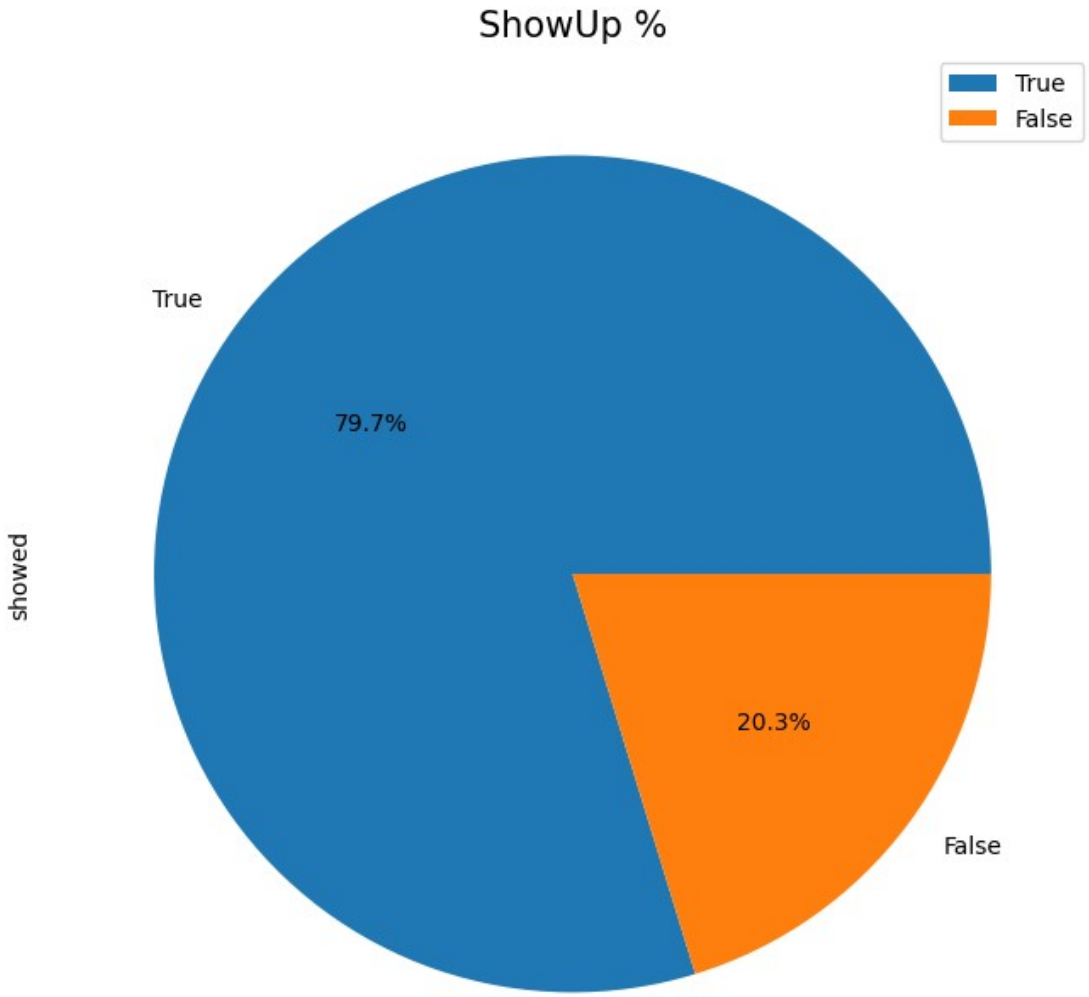
```
array(['F', 'M'], dtype=object)
```

Exploratory Data Analysis

Research Question 1 (appointments show-up and no show-up rates)

```
#creating a mask for people showed up
showed = df['NoShow'] == 0
not_showed = df['NoShow'] == 1
df['showed'] = showed
df['not_showed'] = not_showed

#percentage of showed/not showed up people (pie chart)
showedPeop = df['showed'].value_counts()
print(showedPeop[1] / showedPeop.sum() * 100)
pieChart =
showedPeop.plot.pie(figsize=(8,8),fontsize=10,autopct='%1.1f%%');
pieChart.set_title("ShowUp %", fontsize=15);
plt.legend();
```

```
20.26414424182377
```



Research Question 2 (What is the most variable common with patients showing up)

```
#taking a look at the Raw Data sample
df.head()
```

```
      PatientId  AppointmentID Gender              ScheduledDay  \
0  2.987250e+13      5642903.0      F  2016-04-29 18:38:08+00:00
1  5.589978e+14      5642503.0      M  2016-04-29 16:08:27+00:00
2  4.262962e+12      5642549.0      F  2016-04-29 16:19:04+00:00
3  8.679512e+11      5642828.0      F  2016-04-29 17:29:31+00:00
4  8.841186e+12      5642494.0      F  2016-04-29 16:07:23+00:00

              AppointmentDay   Age      Neighbourhood  Scholarship  \
0  2016-04-29 00:00:00+00:00  62.0    JARDIM DA PENHA          0.0
1  2016-04-29 00:00:00+00:00  56.0    JARDIM DA PENHA          0.0
2  2016-04-29 00:00:00+00:00  62.0      MATA DA PRAIA          0.0
3  2016-04-29 00:00:00+00:00   8.0  PONTAL DE CAMBURI          0.0
4  2016-04-29 00:00:00+00:00  56.0    JARDIM DA PENHA          0.0
```

```
   Hypertension  Diabetes  Alcoholism  Handicap  SMS_received  NoShow
showed  \
0           1.0       0.0         0.0       0.0           0.0     0.0
True
1           0.0       0.0         0.0       0.0           0.0     0.0
True
2           0.0       0.0         0.0       0.0           0.0     0.0
True
3           0.0       0.0         0.0       0.0           0.0     0.0
True
4           1.0       1.0         0.0       0.0           0.0     0.0
True

   not_showed
0       False
1       False
2       False
3       False
4       False
```

```
df.Age[not_showed].mean()
```

```
35.329151291512915
```

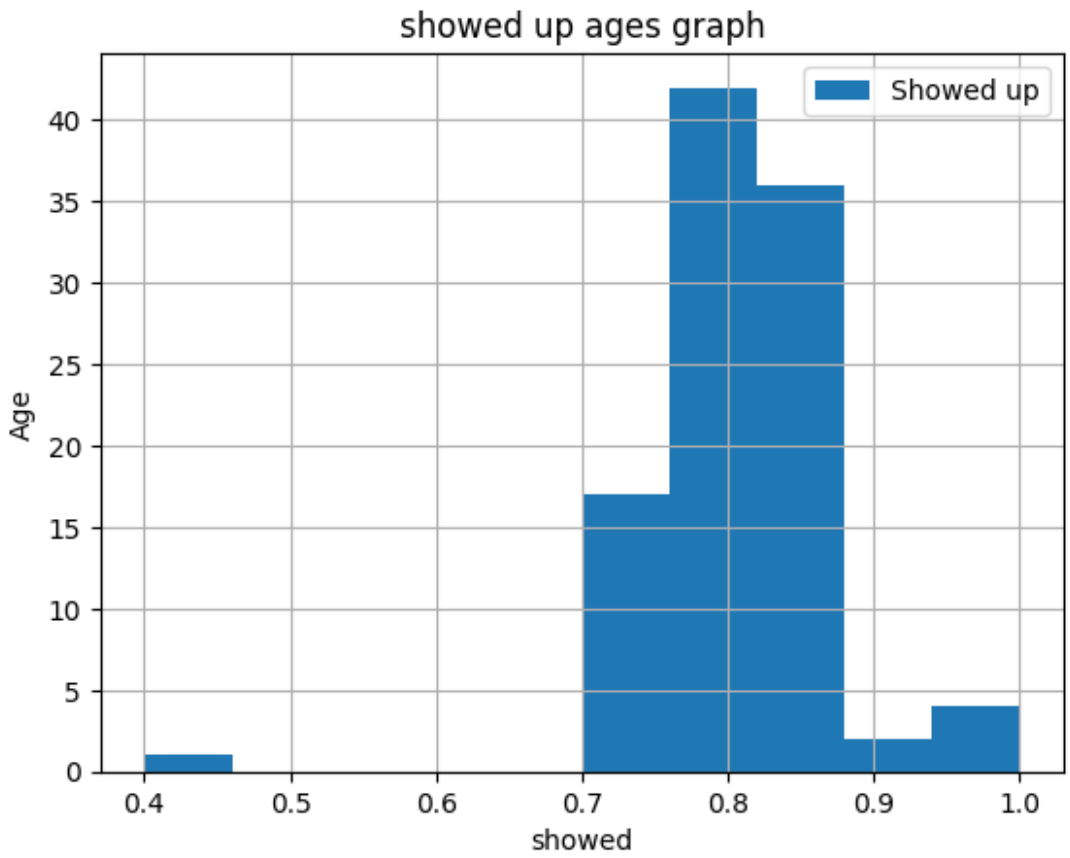
```
df.Age[showed].mean()
```

```
39.07518726482
```

relation between (age, alcoholic people, SMS recivers , Gender,Scholarship) and the showed up people

```
#Visualizng average people who showed up

df.groupby('Age')['showed'].mean().hist(label='Showed up')
plt.xlabel('showed')
plt.ylabel('Age')
plt.title("showed up ages graph")
plt.legend()
```

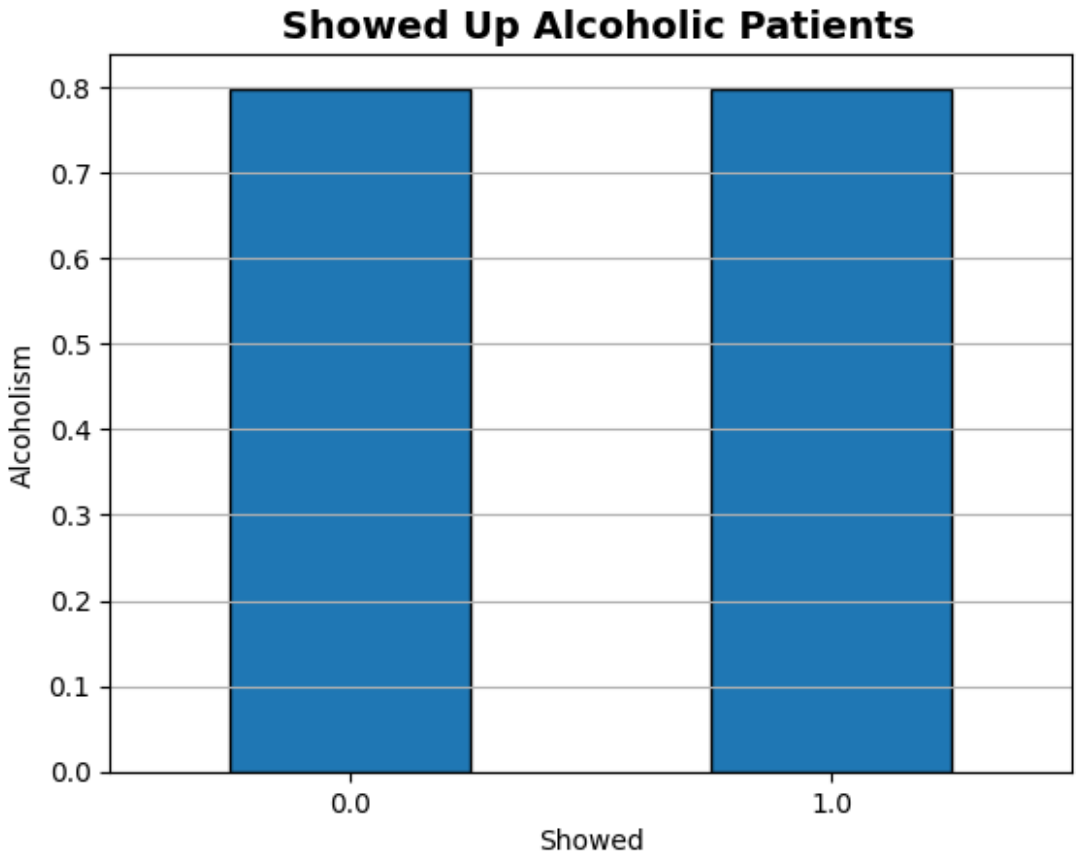
```
<matplotlib.legend.Legend at 0x163d384a050>
```




```
#Saving a new cleaned copy.

df.to_csv('Check.csv')

#defining graphing function

def myGroPlot(df, grpVar, yVar=None,xlabel=None,
color='steelblue',title=None, ylabel=None, rotation=None,
figsize=(14,6), alpha=0.7):
    '''base function for groupby plotting of dependent variables to
no_show column'''
    #data
    print(df.groupby(grpVar)[yVar].mean())
    # plotting
    df.groupby(grpVar)[yVar].mean().plot(kind='bar',label='Showed
up',edgecolor='black',)
    plt.title(f' {title}'.title(), fontsize = 14, weight = "bold")
    plt.xlabel(xlabel.title())
    plt.ylabel(f'{ylabel}'.title())
    plt.xticks(rotation=rotation)
    plt.grid(axis='y')
```

```
#relation bewteen people who showed up and Alcoholism
myGroPlot(df=pd.read_csv('Check.csv'),grpVar='Alcoholism',yVar='showed
',xlabel='showed',ylabel='Alcoholism',title='showed up Alcoholic
patients')
```

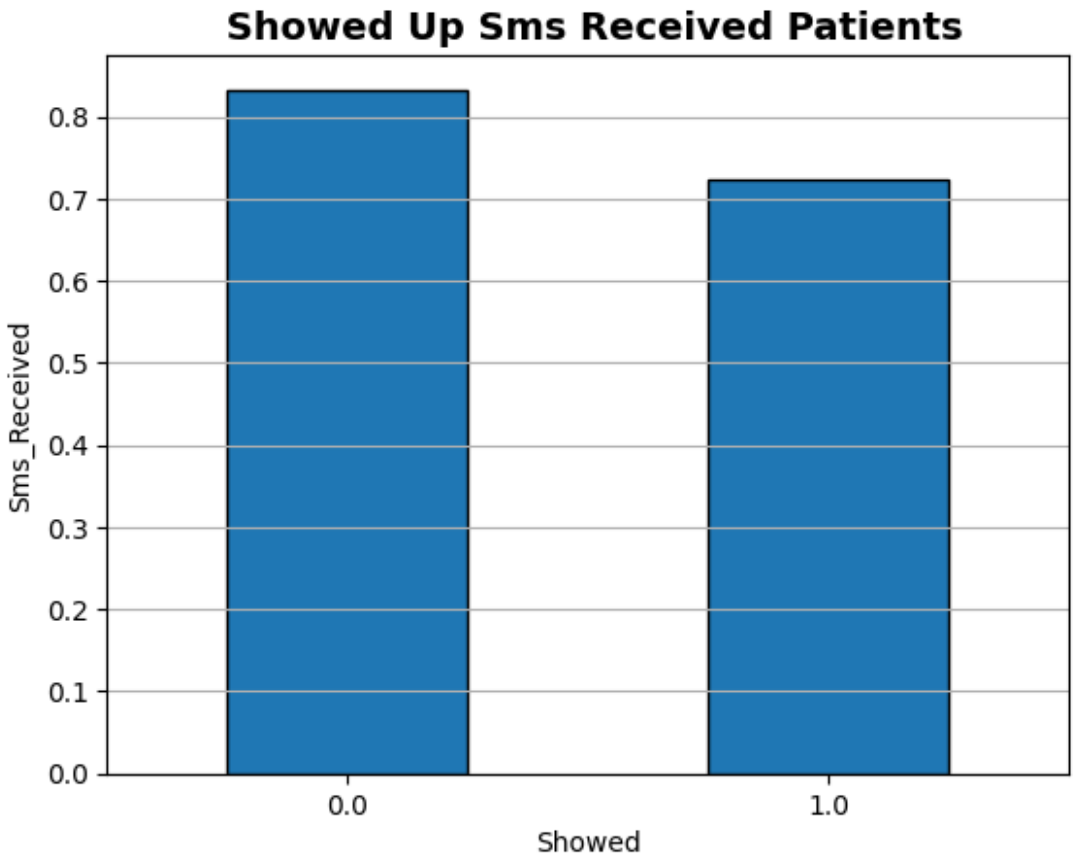
```
Alcoholism
0.0    0.797321
1.0    0.798512
Name: showed, dtype: float64
```



Relation between other featrues:

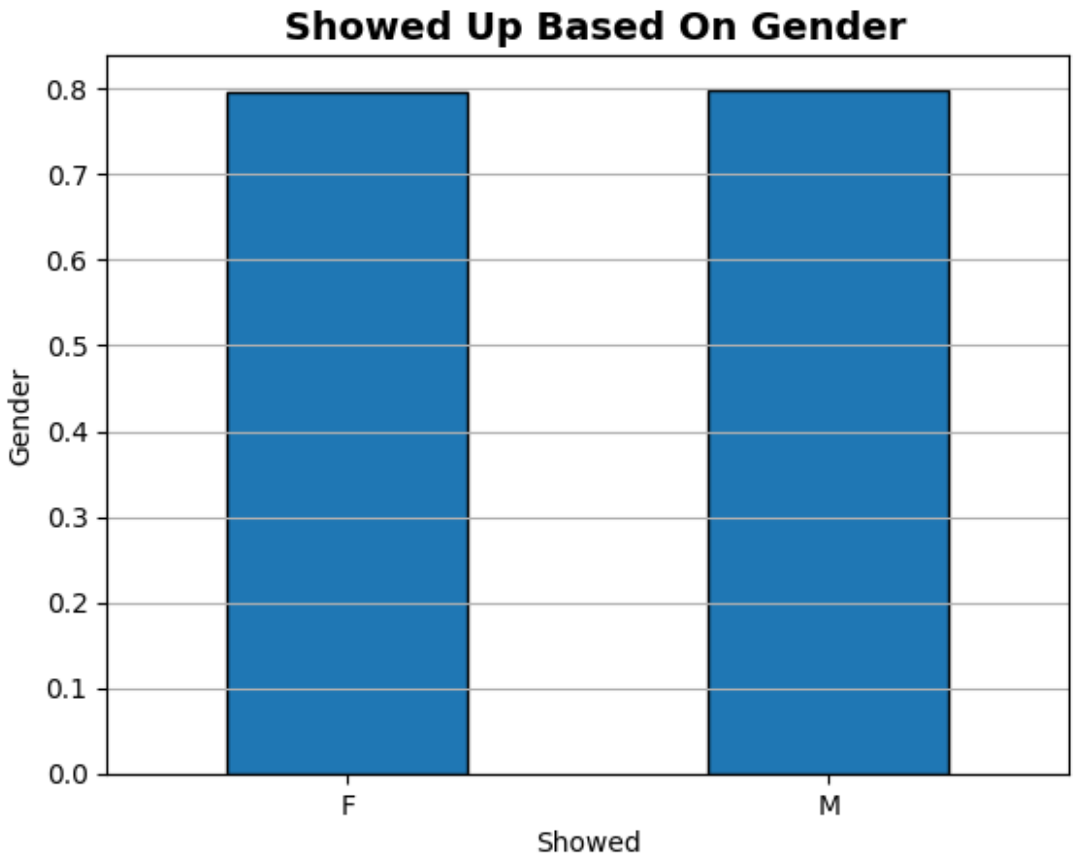
```
#relation bewteen people who showed up and SMS_received

myGroPlot(df=pd.read_csv('Check.csv'),grpVar='SMS_received',yVar='show
ed',xlabel='showed',ylabel='SMS_received',title='showed up SMS
received patients')
```

```
SMS_received
0.0    0.832712
1.0    0.723348
Name: showed, dtype: float64
```



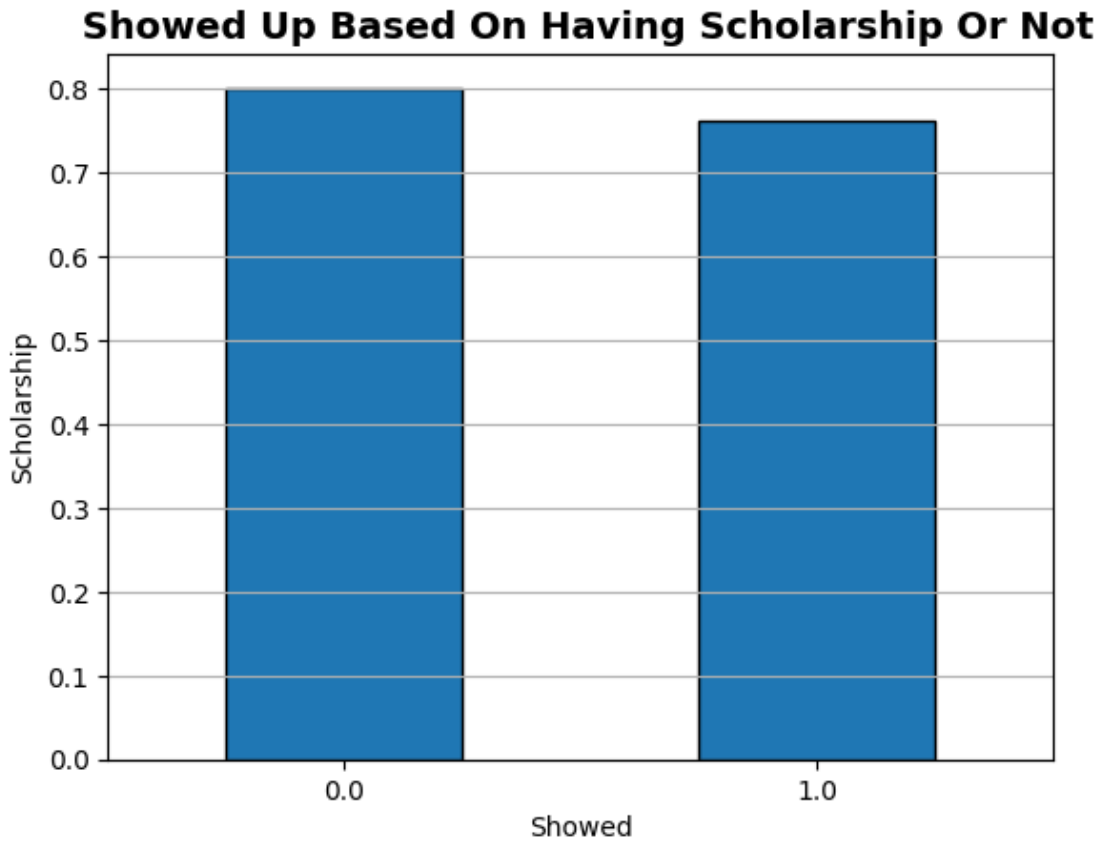

```
#relation bewteen people who showed up and Gender

myGroPlot(df=pd.read_csv('Check.csv'),grpVar='Gender',yVar='showed',xl
abel='showed',ylabel='Gender',title='showed up based on Gender')
```

```
Gender
F    0.796415
M    0.799154
Name: showed, dtype: float64
```




```
#relation bewteen people who showed up based on having Scholarship or
not

myGroPlot(df=pd.read_csv('Check.csv'),grpVar='Scholarship',yVar='showe
d',xlabel='showed',ylabel='Scholarship',title='showed up based on
having Scholarship or not')
```

```
Scholarship
0.0    0.801316
1.0    0.762143
Name: showed, dtype: float64
```



Conclusions

It is clear from that charts that; About 20.3% of the people that schedule an appointment did not mkae it to their appointment.

The Age is the most important factor in our investagtion as you can see the average age of people who will be most likely to come is 39.07519 and the average age of people who are not likely to come is 35.329

there is no relation nor correlation between alchol and showing up.

Sending SMS for the appointment is not neccessary the right option to decide upon.

Also Gender doen't show any relations to showing up or not.

most of people who has scholarship are more likely to miss thier appointments with percentage 76.2% of showing up.

Limitations

Some features maybe more insightful as do the patient has series illness or not, medical insurance available or not... etc