Probability Analysis of Medical Appointments

January 19, 2024

0.0.1 About Dataset:

The data associated with Show and NoShow Appointment of patients will be analyzed.

0.0.2 Project Context:

Show or NoShow of a patient to the doctor's appointment.

0.0.3 Contents:

*** Scheduled date, Gender, Age, Scholarship**

*** Hypertension , Diabetes, Alcoholism,Handicap**

*** SMS_received (indicated whether 1 or more messages sent to the patient) regarding appointment.**

0.0.4 Problem Statement:

*** Analyse the data of the patients.**

*** Visualize data of patients.**

*** Find the Probability of the patients with Show or NoShow to the appointment with different conitions (Alcoholism, Hypertension, Diabetes, Handicap Status, Age And Days Scheduled).**

[1]:
```
### Import Libraries and Data
```

[2]:
```
# Import Libraries
import pandas as pd
import numpy as np
import datetime
from time import strftime
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

[3]:
```
# import data
```

```
data=pd.read_csv('C:/Users/amitm/Desktop/New folder/Project/Python Projects/
 ↪medical_appointment.csv')
```

0.0.5 Describing and Geting Information on Data

[4]:
```
#Data description
data.describe()
```

[4]:
```
          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
```

[5]:
```
# Data Information
data.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
```

[6]:
```
# Check for null values
data.isnull().sum()
```

[6]:
```
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
```

[7]:
```
#Get Data head
data.head()
```

[7]:
```
      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
```

0.0.6 Transforming Data for Analysis:

[8]:
```
# Changing Header spellings
data=data.rename(columns={'Hipertension': 'Hypertension', 'Handcap':␣
 ↪'Handicap', 'SMS_received': 'SMSReceived','No-show':'Noshow'})
data.head()
```

[8]:
```
      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  Hypertension  \
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  Handicap  SMSReceived Noshow
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
```

[9]:
```
# Modifying the date and time into standard form
data['ScheduledDay'] = pd.to_datetime(data['ScheduledDay']).dt.date.
 ↪astype('datetime64[ns]')
data['AppointmentDay'] = pd.to_datetime(data['AppointmentDay']).dt.date.
 ↪astype('datetime64[ns]')
data.head()
```

[9]:
```
      PatientId  AppointmentID Gender ScheduledDay AppointmentDay  Age  \
0  2.987250e+13        5642903      F   2016-04-29     2016-04-29   62
```

```
1  5.589978e+14        5642503      M   2016-04-29     2016-04-29   56
2  4.262962e+12        5642549      F   2016-04-29     2016-04-29   62
3  8.679512e+11        5642828      F   2016-04-29     2016-04-29    8
4  8.841186e+12        5642494      F   2016-04-29     2016-04-29   56

      Neighbourhood  Scholarship  Hypertension  Diabetes  Alcoholism  \
0    JARDIM DA PENHA            0             1         0           0
1    JARDIM DA PENHA            0             0         0           0
2      MATA DA PRAIA            0             0         0           0
3  PONTAL DE CAMBURI            0             0         0           0
4    JARDIM DA PENHA            0             1         1           0

   Handicap  SMSReceived Noshow
0         0            0     No
1         0            0     No
2         0            0     No
3         0            0     No
4         0            0     No
```

[10]:
```
# Storing weekdays into a variable for schedule day and appointment day

data['sch_weekday'] = data['ScheduledDay'].dt.dayofweek
data['app_weekday'] = data['AppointmentDay'].dt.dayofweek
data['sch_weekday'].value_counts()
```

[10]:
```
sch_weekday
1    26168
2    24262
0    23085
4    18915
3    18073
5       24
Name: count, dtype: int64
```

[11]:
```
data['app_weekday'].value_counts()
```

[11]:
```
app_weekday
2    25867
1    25640
0    22715
4    19019
3    17247
5       39
Name: count, dtype: int64
```

[12]:
```
# Dropping the negative values
data.query('Age < 0')
```

```
[12]:           PatientId  AppointmentID Gender ScheduledDay AppointmentDay  Age  \
      99832  4.659432e+14        5775010      F   2016-06-06     2016-06-06   -1

            Neighbourhood  Scholarship  Hypertension  Diabetes  Alcoholism  \
      99832          ROMÃO            0             0         0           0

             Handicap  SMSReceived Noshow  sch_weekday  app_weekday
      99832         0            0     No            0            0
```

```
[13]: data.drop([99832],inplace=True)
```

```
[14]: data.query('Age < 0')
```

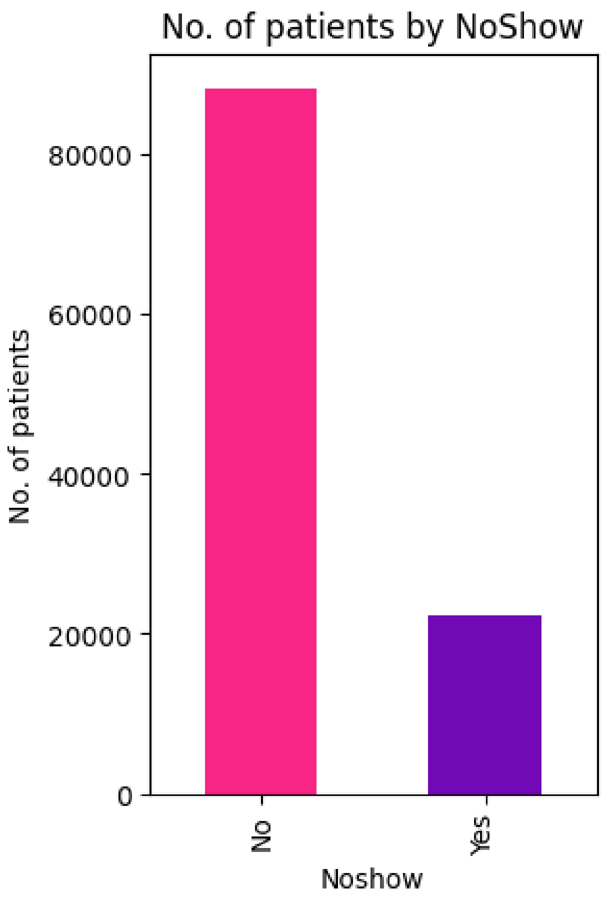
```
[14]: Empty DataFrame
      Columns: [PatientId, AppointmentID, Gender, ScheduledDay, AppointmentDay, Age,
      Neighbourhood, Scholarship, Hypertension, Diabetes, Alcoholism, Handicap,
      SMSReceived, Noshow, sch_weekday, app_weekday]
      Index: []
```

0.0.7 Distribution and Probability Findings for Data

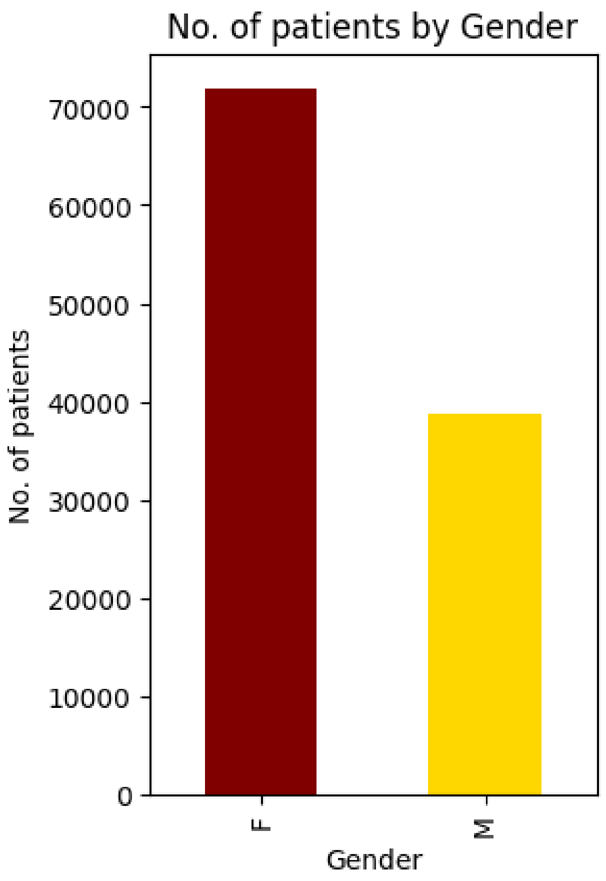
```
[15]: # Show And No-Show patient distribution
      # Yes= No-show # No = Show
      data['Noshow'].value_counts()
```

```
[15]: Noshow
      No     88207
      Yes    22319
      Name: count, dtype: int64
```

```
[16]: #plotting distribution of show and Noshow
      ax = data['Noshow'].value_counts().plot(
              kind='bar',
              title = 'No. of patients by NoShow',
              figsize=(3, 5),
              color=('#F72585', '#7209B7'))
      ax.set_xlabel('Noshow')
      ax.set_ylabel('No. of patients');
```



[17]:
```
#plotting distribution of Gender on a histogram
ax = data['Gender'].value_counts().plot(
        kind='bar',
        title = 'No. of patients by Gender',
        figsize=(3, 5),
        color=('maroon','gold'))
ax.set_xlabel('Gender')
ax.set_ylabel('No. of patients');
```



[18]:
```
# Assigning Variables to Genders

patients = data['Gender'].count()
patients
f_count = data.query('Gender == "F"').count().Gender
f_count
m_count = data.query('Gender == "M"').count().Gender
m_count
print("Total number of patients:",patients)
print("Number of Female patients:",f_count)
print("Number of Male patients:",m_count)
```

```
Total number of patients: 110526
Number of Female patients: 71839
Number of Male patients: 38687
```

[19]:
```
# Changing Value to % for both male and female patient counts
f_percent = (f_count/patients) * 100
f_percent
```

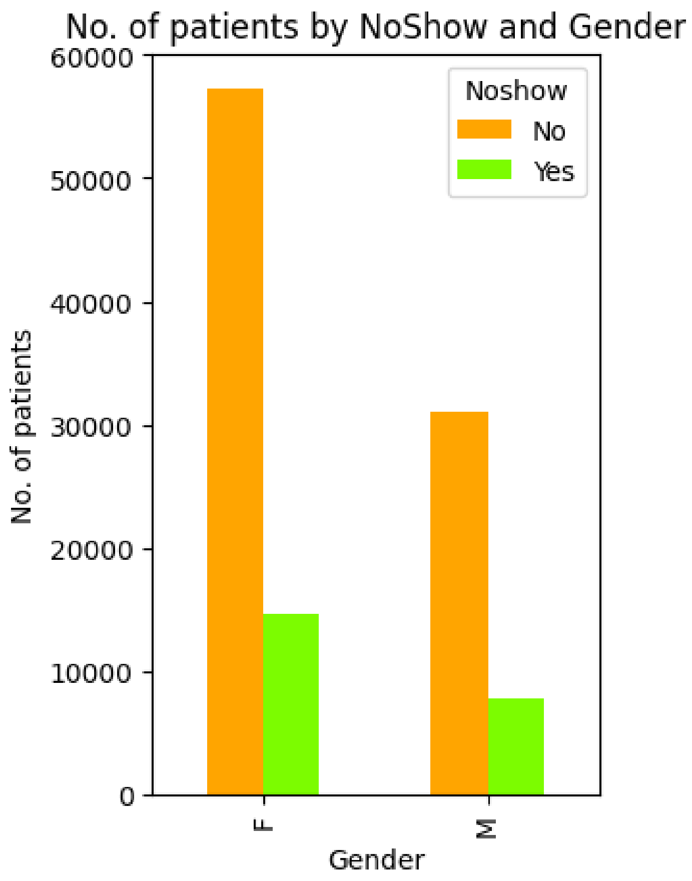
```
m_percent = (m_count/patients) * 100
m_percent
print("Percent of Female patients:",f_percent)
print("Percent of Male patients:",m_percent)
```

```
Percent of Female patients: 64.99737618297956
Percent of Male patients: 35.00262381702043
```

[20]:
```
# pivot table with gender and Noshow column
data_ns = data.groupby(['Noshow','Gender'],as_index=False).size()
ns_pivot = pd.pivot_table(data_ns, values =␣
 ↪'size',columns=['Noshow'],index='Gender')
ns_pivot
```

[20]:
```
Noshow        No      Yes
Gender
F        57245.0  14594.0
M        30962.0   7725.0
```

[21]:
```
# Visualizing the pivot table
ax = ns_pivot.plot(
        kind='bar',
        title = 'No. of patients by NoShow and Gender',
        figsize=(3, 5),
        color=('orange','lawngreen'))
ax.set_xlabel('Gender')
ax.set_ylabel('No. of patients');
```



[22]:
```python
# From Above Pivot Table Separating the Gender Show and Noshow
f_show_count = data.query('Gender == "F" & Noshow == "No"').count().Gender
print('Number of females who showed: ' + str(f_show_count))

# number of females who did not show
f_noshow_count = data.query('Gender == "F" & Noshow == "Yes"').count().Gender
print('Number of females who did not show: ' + str(f_noshow_count))

# number of males who showed
m_show_count = data.query('Gender == "M" & Noshow == "No"').count().Gender
print('Number of males who showed: ' + str(m_show_count))

#number of males who did not show
m_noshow_count = data.query('Gender == "M" & Noshow == "Yes"').count().Gender
print('Number of males who did not show: ' + str(m_noshow_count))
```

```
Number of females who showed: 57245
Number of females who did not show: 14594
Number of males who showed: 30962
Number of males who did not show: 7725
```

[23]:
```
#creating a function for calculating percentages
def percentage(value,total):
    var_percent = (sample/total)*100
    return var_percent
```

[24]:
```
# creating a probability function
def probability(outcome,total):
    prob = (outcome/total)
    return prob
```

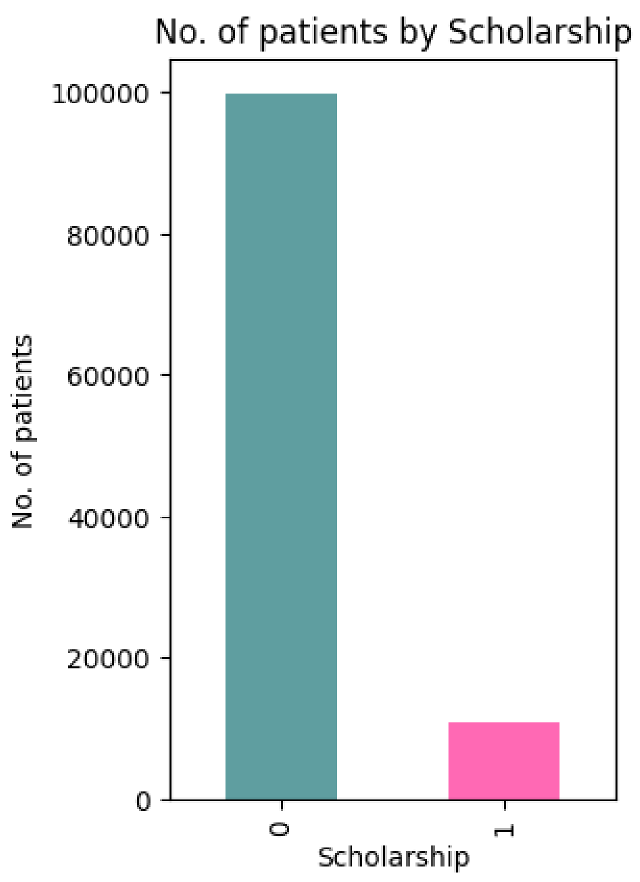
[25]:
```
# probability of a female showing
f_show_prob = probability(f_show_count,f_count)
# rounding to two decimal places
round(f_show_prob,2)
print("Probality of female showing to appointment:", round(f_show_prob,2))

# probability of a male showing
m_show_prob = probability(m_show_count,m_count)
round(m_show_prob,2)
print("Probality of male showing to appointment:",round(m_show_prob,2))
```

```
Probality of female showing to appointment: 0.8
Probality of male showing to appointment: 0.8
```

[26]:
```
#checking distribution of scholarship receipients
data['Scholarship'].value_counts()
```

[26]:
```
Scholarship
0    99665
1    10861
Name: count, dtype: int64
```

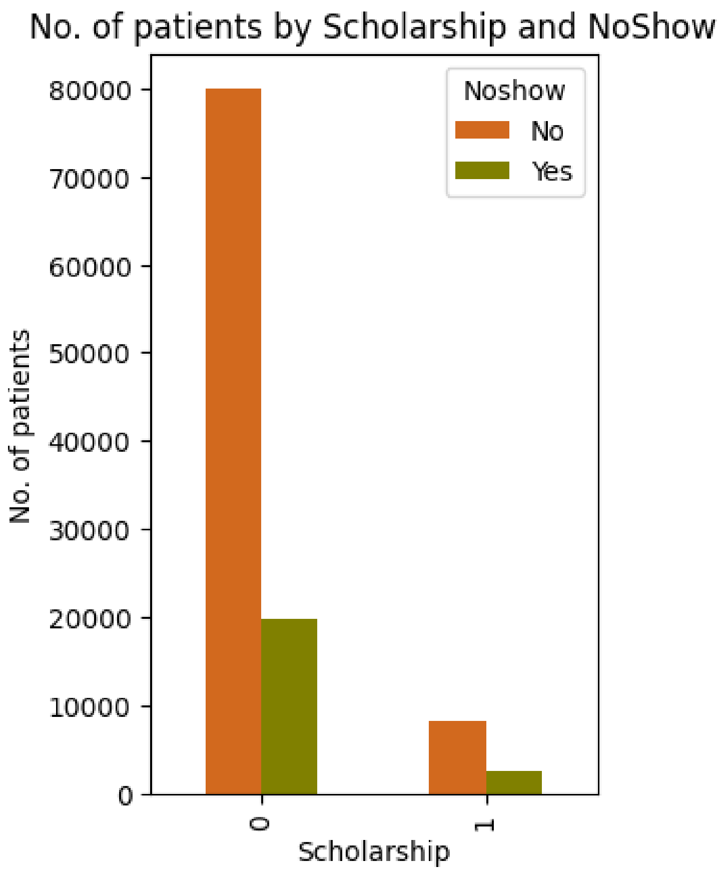
[27]:
```
#plotting the distribution of patients based on scholarship status
ax = data['Scholarship'].value_counts().plot(
        kind='bar',
        title = 'No. of patients by Scholarship',
        figsize=(3, 5),
        color=('cadetblue','hotpink'))
ax.set_xlabel('Scholarship')
ax.set_ylabel('No. of patients');
```



```
[28]: # check if the Scholarship have an impact on the appointments
      #creating a pivot table for Scholarship and NoShow
      data_sc = data.groupby(['Noshow','Scholarship'],as_index=False).size()
      sc_pivot = pd.pivot_table(data_sc, values =␣
       ↪'size',columns=['Noshow'],index='Scholarship')
      sc_pivot
```

```
[28]: Noshow            No      Yes
      Scholarship
      0            79924.0  19741.0
      1             8283.0   2578.0
```

```
[29]: #plotting the pivot table on a grouped bar chart
      ax = sc_pivot.plot(
              kind='bar',
              title = 'No. of patients by Scholarship and NoShow',
              figsize= (3,5),
              color=('chocolate','olive'))
      ax.set_xlabel('Scholarship')
ax.set_ylabel('No. of patients');
```



[30]:
```
# Drawing Probabilities for Conclusion

# variable for scholarship recipients
scholarship_count = data.query('Scholarship == 1').count().Scholarship
print('Number of patients on scholarship: ' + str(scholarship_count))

# variable for non scholarship patients
noscholarship_count = data.query('Scholarship == 0').count().Scholarship
print('Number of patients without scholarship: ' + str(noscholarship_count))
```

```
Number of patients on scholarship: 10861
Number of patients without scholarship: 99665
```

[31]:
```
# number of scholarship recipients who showed up
scholarship_show = data.query('Scholarship == 1 & Noshow == "No"').count().
 ↪Scholarship
```

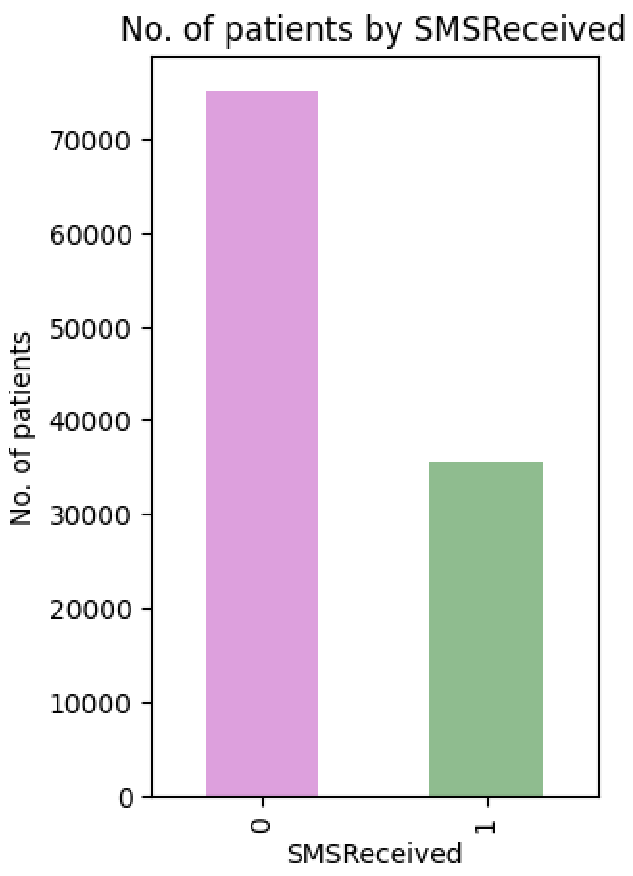
```
# probability of a scholarship recipient showing up
scholarship_show_prob = probability(scholarship_show,scholarship_count)
round(scholarship_show_prob,2)
print("Probability of scholarship recipient Showing up:
 ↪",round(scholarship_show_prob,2))

# number of no scholarship patients who showed up
noscholarship_show = data.query('Scholarship == 0 & Noshow == "No"').count().
 ↪Scholarship

# probability of a non scholarship patient showing up
noscholarship_show_prob = probability(noscholarship_show,noscholarship_count)
round(noscholarship_show_prob,2)
print("Probability of No scholarship recipient Showing up:
 ↪",round(noscholarship_show_prob,2))
```

```
Probability of scholarship recipient Showing up: 0.76
Probability of No scholarship recipient Showing up: 0.8
```

[32]:
```
# Showing and no showing of SMS Recieved patients

# number of patients who did not receive sms
no_sms = data.query('SMSReceived == 0').count().SMSReceived
print('Number of patients who did not receive SMS: ' + str(no_sms))

# no of patients who recieved an sms
sms_true = data.query('SMSReceived == 1').count().SMSReceived
print('Number of patients who received SMS: ' + str(sms_true))
```

```
Number of patients who did not receive SMS: 75044
Number of patients who received SMS: 35482
```

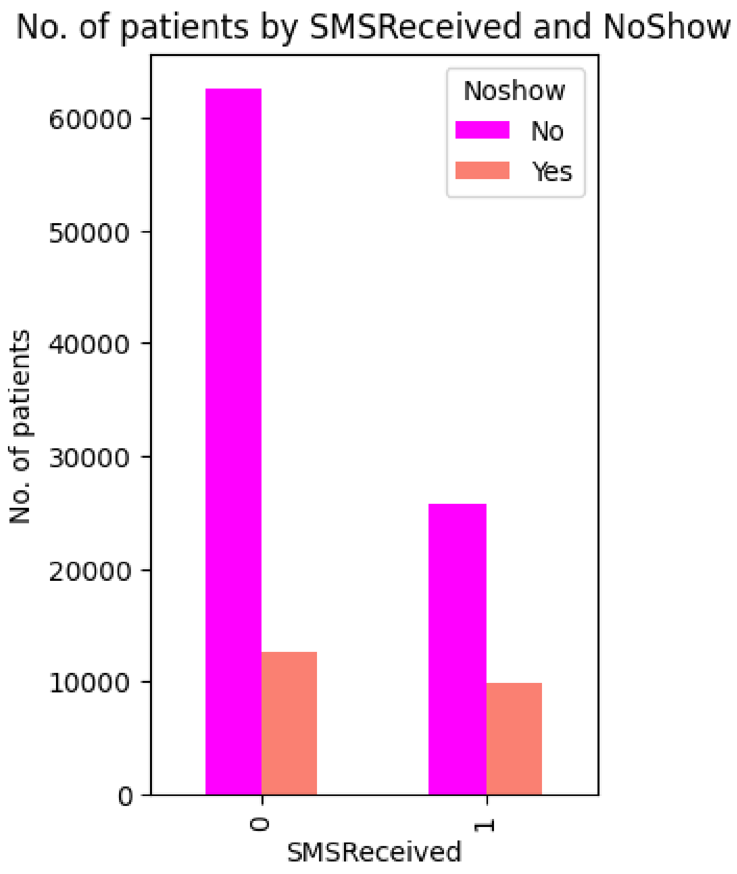
[33]:
```
#plotting distribution of the value counts
ax = data['SMSReceived'].value_counts().plot(
        kind='bar',
        title = 'No. of patients by SMSReceived',
        figsize=(3,5),
        color=('plum','darkseagreen'))
ax.set_xlabel('SMSReceived')
ax.set_ylabel('No. of patients');
```



[34]:
```
#creating a pivot table for the SMSReceived and NoShow columns
data_sms = data.groupby(['SMSReceived','Noshow'],as_index=False).size()
sms_pivot = pd.pivot_table(data_sms, values =␣
 ↪'size',columns=['Noshow'],index='SMSReceived')
sms_pivot
```

[34]:
```
Noshow             No      Yes
SMSReceived
0             62509.0  12535.0
1             25698.0   9784.0
```

[35]:
```
#visualizing the pivot table on a grouped bar chart
ax = sms_pivot.plot(
        kind='bar',
        title = 'No. of patients by SMSReceived and NoShow',
        figsize=(3,5),
        color=('fuchsia','salmon'))
ax.set_xlabel('SMSReceived')
ax.set_ylabel('No. of patients');
```



[36]:
```
#number of patients who did not receive SMS and showed up
nosms_show = data.query('SMSReceived == 0 & Noshow == "No"').count().SMSReceived
print('Number of patients who did not receive SMS and showed: ' +␣
 ↪str(nosms_show))

#number of patients who received SMS and showed up
sms_show = data.query('SMSReceived == 1 & Noshow == "No"').count().SMSReceived
print('Number of patients who received SMS and showed: ' + str(sms_show))
```

```
Number of patients who did not receive SMS and showed: 62509
Number of patients who received SMS and showed: 25698
```

[37]:
```
# probability of a patient who did not receive sms showing up
# assignng above values to show

nosms_show_prob = probability(nosms_show,no_sms)
round(nosms_show_prob,2)
print ('probability of a patient who did not recieve sms showing up:
 ↪',round(nosms_show_prob,2))
```

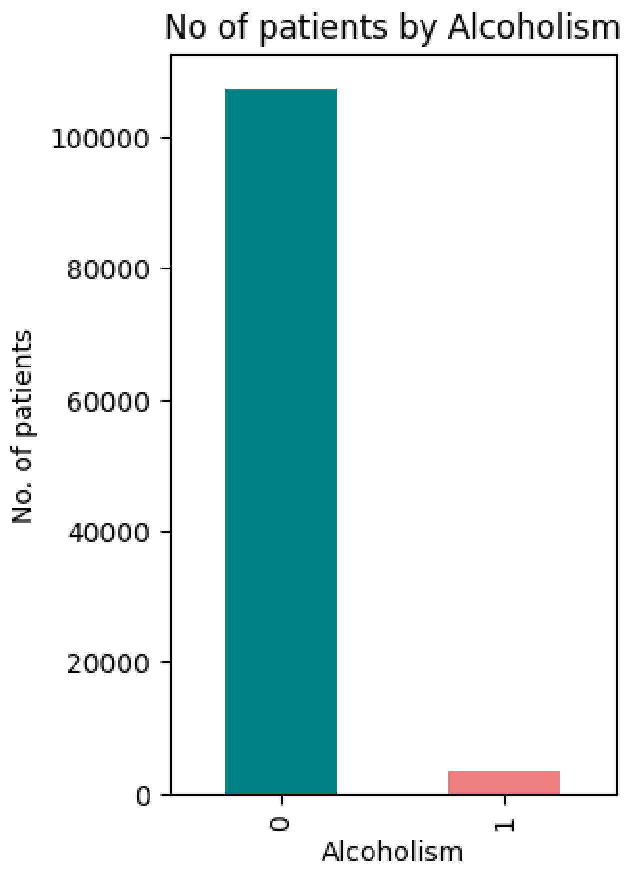
```
# probability of a patient who received SMS showing
sms_show_prob = probability(sms_show,sms_true)
round(sms_show_prob,2)
print ('probability of a patient who recieved sms showing up:
 ↪',round(sms_show_prob,2))
```

```
probability of a patient who did not recieve sms showing up: 0.83
probability of a patient who recieved sms showing up: 0.72
```

[38]:
```
# checking probability for alcoholism
#checking distribution of alcoholism status
data['Alcoholism'].value_counts()
```

[38]:
```
Alcoholism
0    107166
1      3360
Name: count, dtype: int64
```

[39]:
```
# plotting the results above
ax = data['Alcoholism'].value_counts().plot(
        kind='bar',
        title = 'No of patients by Alcoholism',
        figsize=(3,5),
        color=('teal','lightcoral'))
ax.set_xlabel('Alcoholism')
ax.set_ylabel('No. of patients');
```

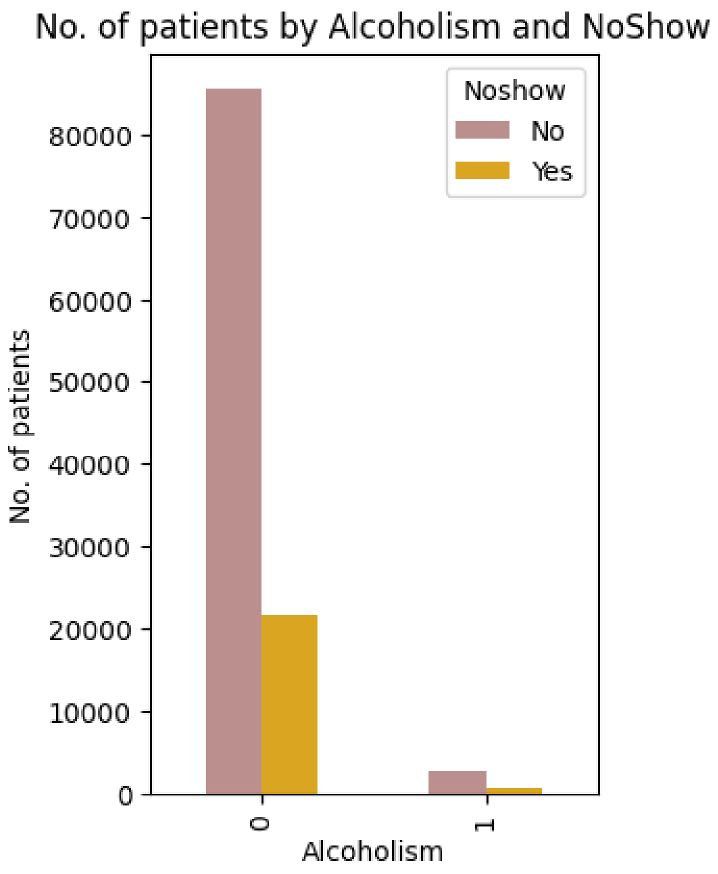


```
[40]: #creating a pivot table for the Alcoholism and NoShow columns
      data_alcohol = data.groupby(['Noshow','Alcoholism'],as_index=False).size()
      alcoholism_pivot = pd.pivot_table(data_alcohol,
              values = 'size',
              columns=['Noshow'],
              index='Alcoholism')
      alcoholism_pivot
```

```
[40]: Noshow           No      Yes
      Alcoholism
      0           85524.0  21642.0
      1            2683.0    677.0
```

```
[41]: #plotting the pivot table above on a grouped bar chart
      ax = alcoholism_pivot.plot(
              kind='bar',
              title='No. of patients by Alcoholism and NoShow',
              figsize=(3,5),
              color=('rosybrown','goldenrod'))
```

```
ax.set_xlabel('Alcoholism')
ax.set_ylabel('No. of patients');
```



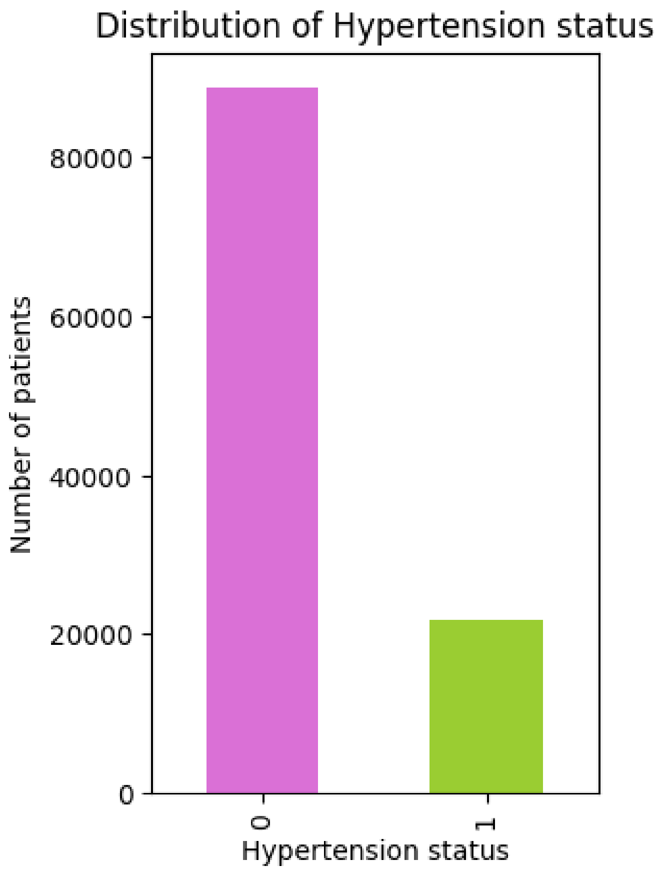
[42]:
```
#calculating number of patients involved in alcoholism and showed up
alcoholism_show = data.query('Alcoholism == 1 & Noshow == "No"').count().
 ↪Alcoholism

# number of patients involved in alcohol
alcoholism_count = data.query('Alcoholism == 1').count().Alcoholism

# calculating probability
alcoholism_show_prob = probability(alcoholism_show,alcoholism_count)
round(alcoholism_show_prob,2)
print('Probability of Alcoholism patients showing up:
 ↪',round(alcoholism_show_prob,2))
```

```
Probability of Alcoholism patients showing up: 0.8
```

[43]:
```
# Probability for Hypertension
# distribution of hypertension
data['Hypertension'].value_counts()
```

[43]:
```
Hypertension
0    88725
1    21801
Name: count, dtype: int64
```

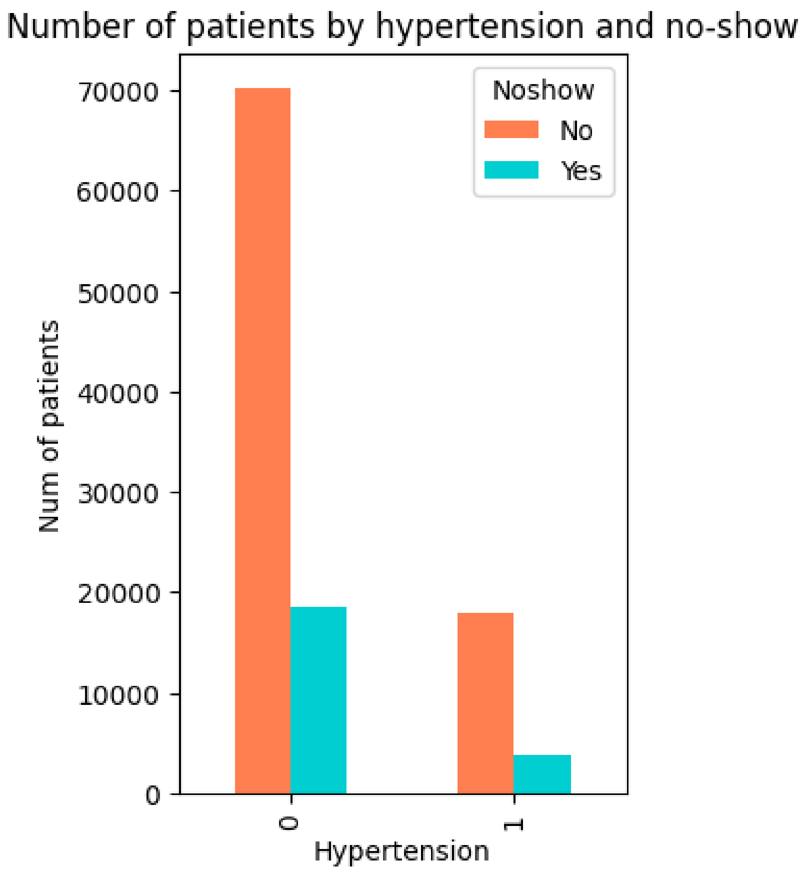
[44]:
```
#plotting value counts
ax = data['Hypertension'].value_counts().plot(
        kind='bar',
        title= 'Distribution of Hypertension status',
        figsize=(3,5),
        color=('orchid','yellowgreen'))
ax.set_xlabel('Hypertension status')
ax.set_ylabel('Number of patients');
```



[45]:
```python
# pivot table of NoShow and Hypertension columns
data_hyper = data.groupby(['Noshow','Hypertension'],as_index=False).size()
hyper_pivot = pd.pivot_table(data_hyper,
        values = 'size',
        columns=['Noshow'],
        index='Hypertension')
hyper_pivot
```

[45]:
```
Noshow              No      Yes
Hypertension
0              70178.0  18547.0
1              18029.0   3772.0
```

[46]:
```python
# plotting the pivot table on a grouped bar chart
ax = hyper_pivot.plot(
        kind='bar',
        title='Number of patients by hypertension and no-show',
        figsize=(3,5),
        color=('coral','darkturquoise'))
ax.set_xlabel('Hypertension')
ax.set_ylabel('Num of patients');
```



[47]:
```
# number of patients with hypertension that showed up
hyper_show = data.query('Hypertension == 1 & Noshow == "No"').count().
 ↪Hypertension

# number of patients with hypertension
hyper_count = data.query('Hypertension == 1').count().Hypertension

# calculating probability
hyper_show_prob = probability(hyper_show,hyper_count)
round(hyper_show_prob,2)
print("probability of Hypertension patients Showing up:",␣
 ↪round(hyper_show_prob,2))
```

```
probability of Hypertension patients Showing up: 0.83
```

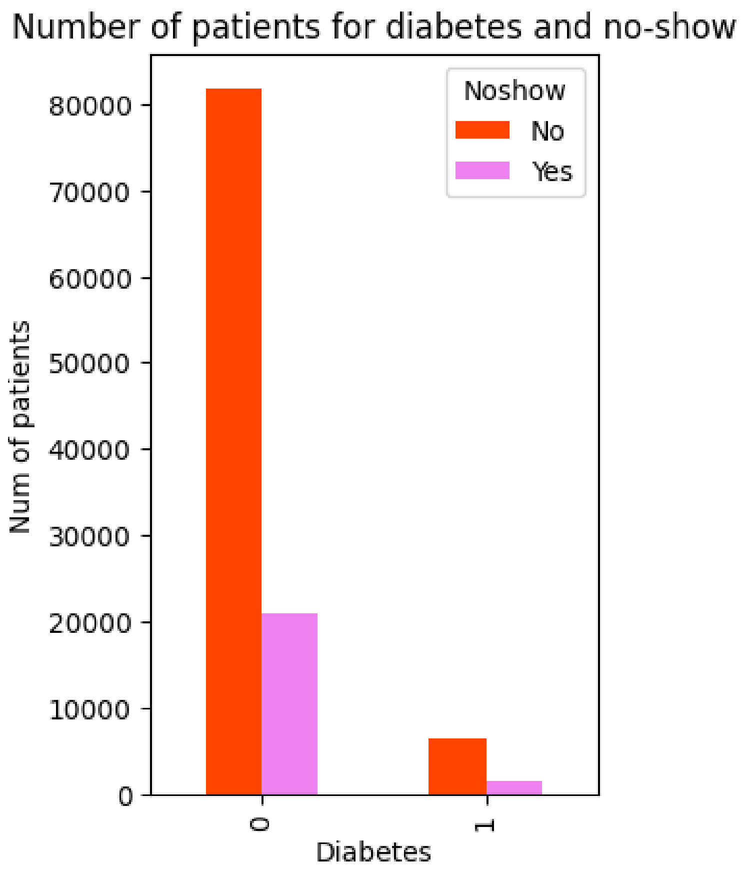
[48]:
```
# Probability for Diabetes
# distribution of diabetes status
data['Diabetes'].value_counts()
```

[48]:
```
Diabetes
0    102583
1      7943
Name: count, dtype: int64
```

[49]:
```
# pivot table of diabetes and no-show column
data_diabetes = data.groupby(['Noshow','Diabetes'],as_index=False).size()
diabetes_pivot = pd.pivot_table(data_diabetes,
        values = 'size',
        columns=['Noshow'],
        index='Diabetes')
diabetes_pivot
```

[49]:
```
Noshow         No      Yes
Diabetes
0         81694.0  20889.0
1          6513.0   1430.0
```

[50]:
```
# plotting the pivot table on a grouped bar chart
ax = diabetes_pivot.plot(
        kind='bar',
        title='Number of patients for diabetes and no-show',
        figsize=(3,5),
        color=('orangered','violet'))
ax.set_xlabel('Diabetes')
ax.set_ylabel('Num of patients');
```



[51]:
```
# number of patients without diabetes
no_diabetes_count = data.query('Diabetes == 0').count().Diabetes

# number of non-diabetic patients who showed up
no_diabetes_show_count = data.query('Diabetes == 0 & Noshow== "No"').count().
 ↪Diabetes

#calculating probability
no_diabetes_show_prob = probability(no_diabetes_show_count,no_diabetes_count)
round(no_diabetes_show_prob,2)
print("Probability of No Diabetes Showing up:",round(no_diabetes_show_prob,2))
```

```
Probability of No Diabetes Showing up: 0.8
```

[52]:
```
#number of diabetic patients
diabetes_count = data.query('Diabetes == 1').count().Diabetes

#number of diabetic patients who showed up
```

```
diabetes_show_count = data.query('Diabetes == 1 & Noshow == "No"').count().
  ↪Diabetes

#calculating probability
diabetes_show_prob = probability(diabetes_show_count,diabetes_count)
round(diabetes_show_prob,2)
print("Probability of No Diabetes Showing up:",round(diabetes_show_prob,2))
```

```
Probability of No Diabetes Showing up: 0.82
```

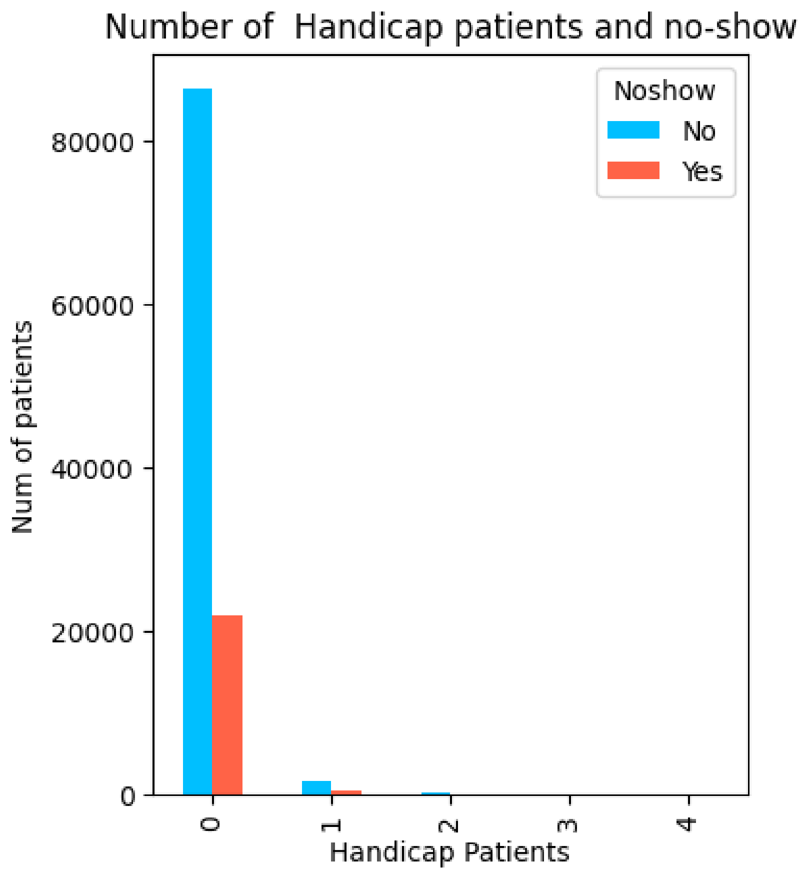
[53]:
```
#distribution of handicap status
data['Handicap'].value_counts()
```

[53]:
```
Handicap
0    108285
1      2042
2       183
3        13
4         3
Name: count, dtype: int64
```

[54]:
```
#creating a pivot table of the handicap column and no-show
data_hc = data.groupby(['Handicap','Noshow'],as_index=False).size()
hc_pivot = pd.pivot(data_hc,values='size',index='Handicap',columns='Noshow')
hc_pivot
```

[54]:
```
Noshow       No    Yes
Handicap
0         86373  21912
1          1676    366
2           146     37
3            10      3
4             2      1
```

[55]:
```
# Chart for grouped pivot Table
ax = hc_pivot.plot(
        kind='bar',
        title='Number of  Handicap patients and no-show',
        figsize=(4,5),
        color=('deepskyblue','tomato'))
ax.set_xlabel('Handicap Patients')
ax.set_ylabel('Num of patients');
```



[56]:
```
# number of patients with zero handicaps
zero_hc_count = data.query('Handicap == 0').count().Handicap

#number of patients with zero handicaps who showed up
zero_hc_show = data.query('Handicap == 0 & Noshow == "No"').count().Handicap

#calculating probability
zero_hc_show_prob = probability(zero_hc_show,zero_hc_count)
round(zero_hc_show_prob,2)
print('Probability for patients with zero handicap:',round(zero_hc_show_prob,2))
```

```
Probability for patients with zero handicap: 0.8
```

[57]:
```
#number of patients with one handicap
one_hc_count = data.query('Handicap == 1').count().Handicap

#number of one handicapped patients who showed up
one_hc_show = data.query('Handicap == 1 & Noshow == "No"').count().Handicap

# calculating probability
```

```
one_hc_show_prob = probability(one_hc_show,one_hc_count)
round(one_hc_show_prob,2)
print('Probability for patients with 1 Handicap:',round(one_hc_show_prob,2))
```

```
Probability for patients with 1 Handicap: 0.82
```

[58]:
```
# number of patients with two handicaps
two_hc_count = data.query('Handicap == 2').count().Handicap

# number of patients with two handicaps who showed
two_hc_show = data.query('Handicap == 2 & Noshow == "No"').count().Handicap

# calculating probability
two_hc_show_prob = probability(two_hc_show,two_hc_count)
round(two_hc_show_prob,2)
print('Probability for patients with 2 handicap:',round(two_hc_show_prob,2))
```

```
Probability for patients with 2 handicap: 0.8
```

[59]:
```
# number of patients with 3 handicaps
three_hc_count = data.query('Handicap == 3').count().Handicap

# number of patients with 3 handicaps who showed
three_hc_show = data.query('Handicap == 3 & Noshow == "No"').count().Handicap

# calculating probability
three_hc_show_prob = probability(three_hc_show,three_hc_count)
round(three_hc_show_prob,2)
print('Probability for patients with 3 handicap:',round(zero_hc_show_prob,2))
```

```
Probability for patients with 3 handicap: 0.8
```

[60]:
```
#number of patients with four handicaps
four_hc_count = data.query('Handicap == 4').count().Handicap

#number of patients with four handicaps who showed
four_hc_show = data.query('Handicap == 4 & Noshow == "No"').count().Handicap

# calculating probability
four_hc_show_prob = probability(four_hc_show,four_hc_count)
round(four_hc_show_prob,2)
print('Probability for patients with 4 handicap:',round(four_hc_show_prob,2))
```

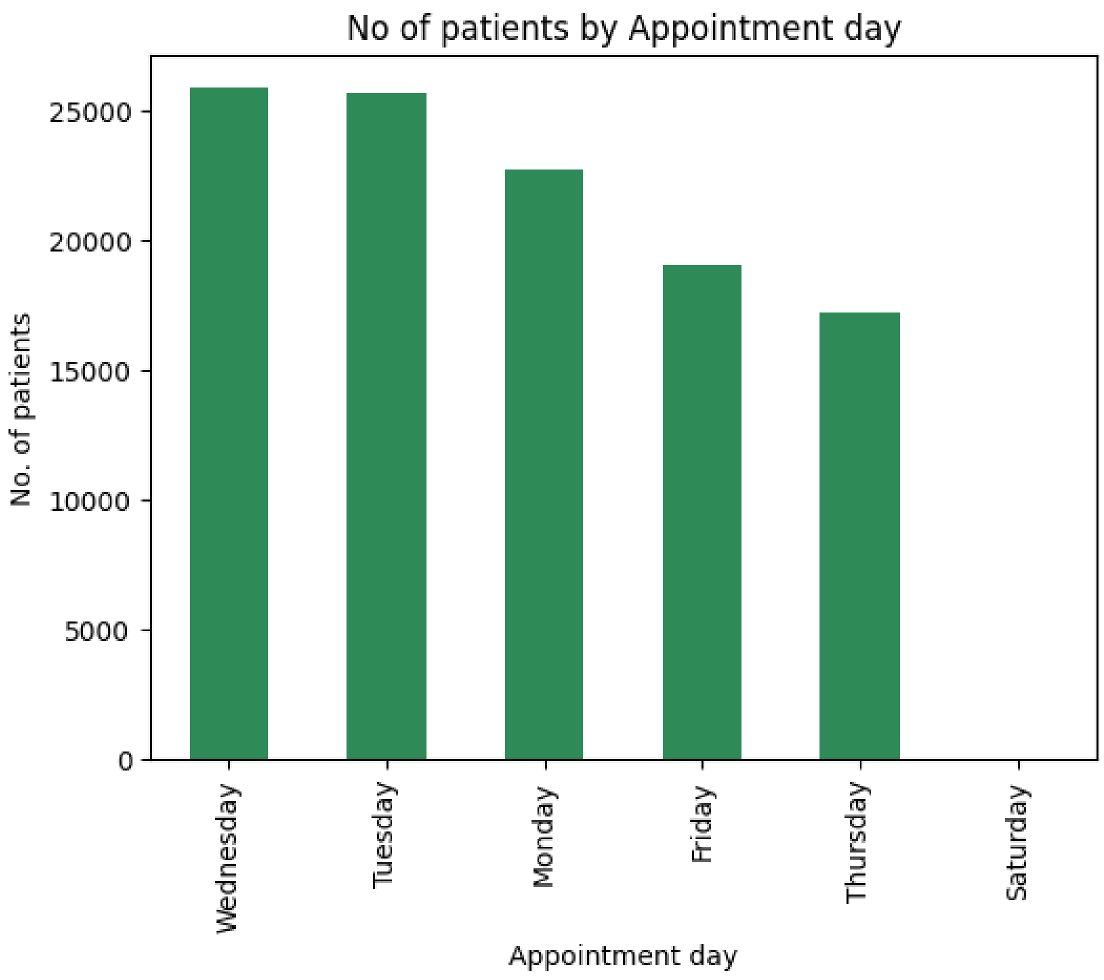
```
Probability for patients with 4 handicap: 0.67
```

[61]:
```
#Probability for days
#creating a new column to contain the day of the week of appointment
data['Day'] = data['AppointmentDay'].dt.day_name()
```

[62]:
```
# checking distribution
data['Day'].value_counts()
```

[62]:
```
Day
Wednesday    25867
Tuesday      25640
Monday       22714
Friday       19019
Thursday     17247
Saturday        39
Name: count, dtype: int64
```

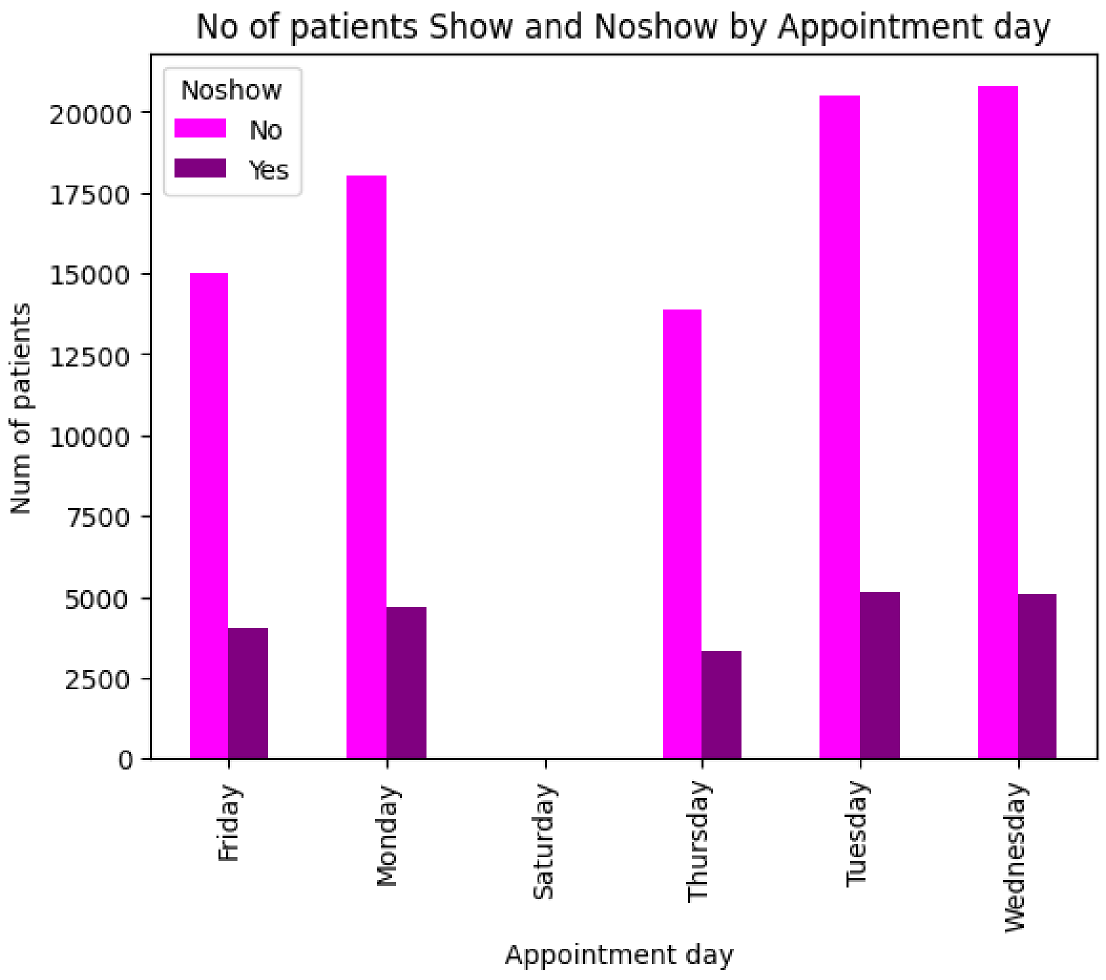
[63]:
```
# plotting value counts above on a bar chart
ax = data['Day'].value_counts().plot(
        kind='bar',
        title = 'No of patients by Appointment day',
        color='seagreen')
ax.set_xlabel('Appointment day')
ax.set_ylabel('No. of patients');
```



[64]:
```
# creating a pivot table
dow = data.groupby(['Day','Noshow'],as_index=False).size()
dow_pivot = pd.pivot(dow, index='Day',columns='Noshow',values='size')
dow_pivot
```

[64]:
```
Noshow        No   Yes
Day
Friday     14982  4037
Monday     18024  4690
Saturday      30     9
Thursday   13909  3338
Tuesday    20488  5152
Wednesday  20774  5093
```

[65]:
```
# Chart for grouped pivot Table
ax = dow_pivot.plot(
        kind='bar',
        title='No of patients Show and Noshow by Appointment day',
        color=('magenta','purple'))
ax.set_xlabel('Appointment day ')
ax.set_ylabel('Num of patients');
```



[66]:
```
#number of patients who had their appointment on a Monday
mon_count = data.query('Day == "Monday"').count().Day

# number of monday appointments who showed up
mon_show = data.query('Day == "Monday" & Noshow == "No"').count().Day

# calculating probability
mon_show_prob = probability(mon_show,mon_count)
round(mon_show_prob,2)
print("Probability of Show on appointment on Monday:",round(mon_show_prob,2))
```

```
Probability of Show on appointment on Monday: 0.79
```

[67]:
```
# number of patients who had their appointments on a Tuesday
tue_count = data.query('Day == "Tuesday"').count().Day

# number of Tuesday appointments who showed up
```

```
tue_show = data.query('Day == "Tuesday" & Noshow == "No"').count().Day

# calculating probability
tue_show_prob = probability(tue_show,tue_count)
round(tue_show_prob,2)
print("Probability of Show on appointment on Tuesday:",round(tue_show_prob,2))
```

```
Probability of Show on appointment on Tuesday: 0.8
```

[68]:
```
# number of patients who had their appointments on a Wednesday
wed_count = data.query('Day == "Wednesday"').count().Day

# number of Wednesday appointments who showed
wed_show = data.query('Day == "Wednesday" & Noshow == "No"').count().Day

# calculating probability
wed_show_prob = probability(wed_show,wed_count)
round(wed_show_prob,2)
print("Probability of Show on appointment on Wednesday:",round(wed_show_prob,2))
```

```
Probability of Show on appointment on Wednesday: 0.8
```

[69]:
```
# number of patients who had their appointments on a Thursday
thu_count = data.query('Day == "Thursday"').count().Day

# number of Thursday appointments who showed
thu_show = data.query('Day == "Thursday" & Noshow == "No"').count().Day

# calculating probability
thu_show_prob = probability(thu_show,thu_count)
round(thu_show_prob,2)
print("Probability of Show on appointment on Thursday:",round(thu_show_prob,2))
```

```
Probability of Show on appointment on Thursday: 0.81
```

[70]:
```
# number of patients who had their appointments on a Friday
fri_count = data.query('Day == "Friday"').count().Day

# number of Friday appointments who showed up
fri_show = data.query('Day == "Friday" & Noshow == "No"').count().Day

# calculating probability
fri_show_prob = probability(fri_show,fri_count)
round(fri_show_prob,2)
print("Probability of Show on appointment on Friday:",round(fri_show_prob,2))
```

```
Probability of Show on appointment on Friday: 0.79
```

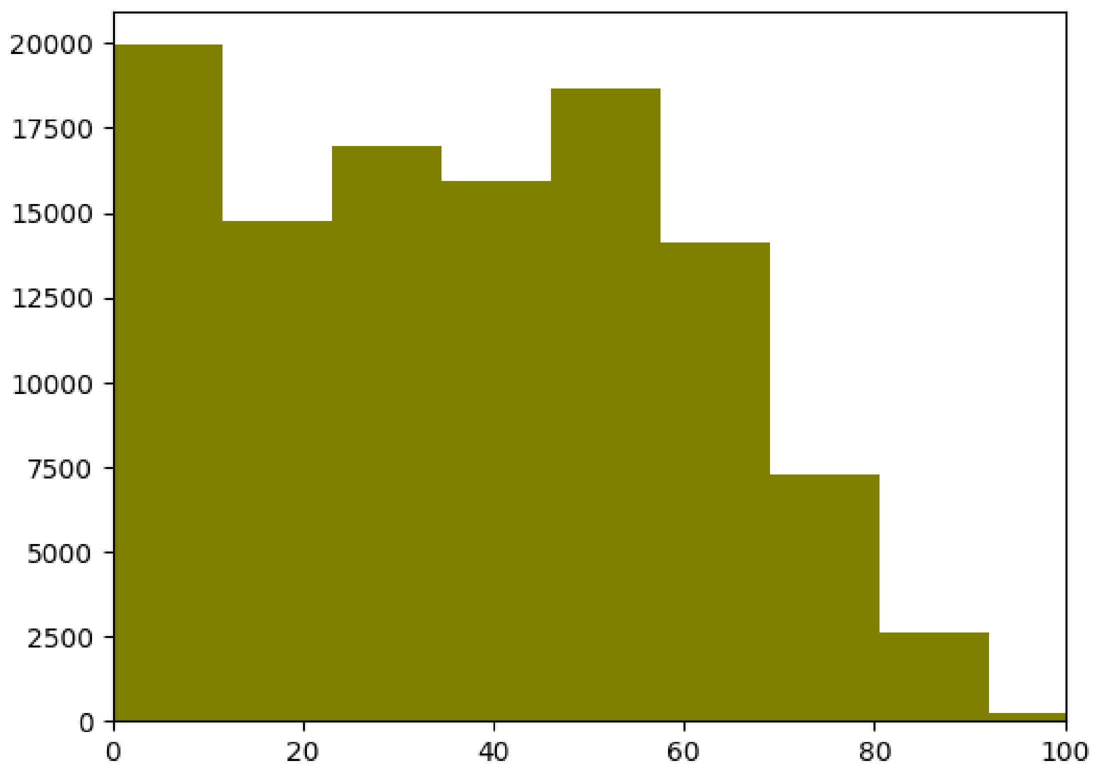
[71]:
```
# number of patients who had their appointments on a Saturday
sat_count = data.query('Day == "Saturday"').count().Day

# number of Saturday appointments who showed
sat_show = data.query('Day == "Saturday" & Noshow == "No"').count().Day

# calculating probability
sat_show_prob = probability(sat_show,sat_count)
round(sat_show_prob,2)
print("Probability of Show on appointment on Saturday:",round(sat_show_prob,2))
```

```
Probability of Show on appointment on Saturday: 0.77
```

[72]:
```
# Probabilities for Age
data['Age'].value_counts()
```

[72]:
```
Age
0      3539
1      2273
52     1746
49     1652
53     1651
       …
98        6
115       5
100       4
102       2
99        1
Name: count, Length: 103, dtype: int64
```

[73]:
```
# plotting distribution of ages
bins = np.arange(0,data['Age'].max()+10,10)
plt.hist(data=data,x='Age',bins=10,color='olive')
plt.xlim((0,100));
```

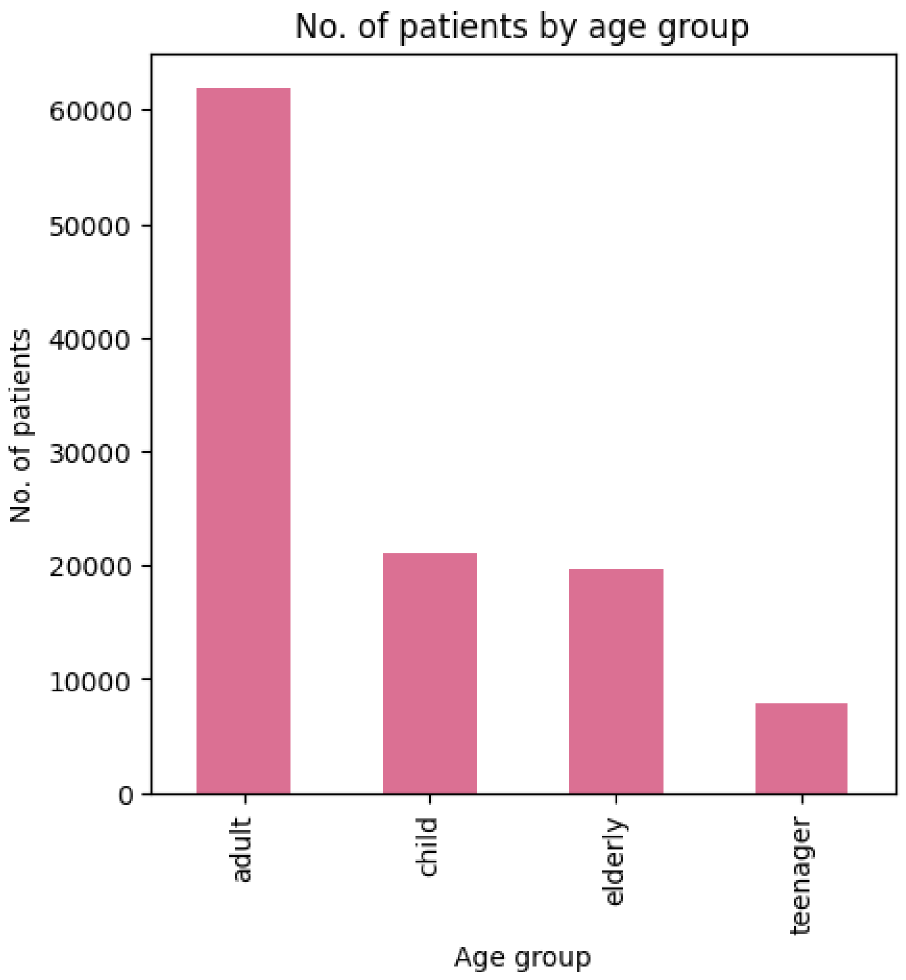


[74]:
```
# breaking ages down into categories
conditions = [(data['Age'] <= 12),
              (data['Age'] > 12)&(data['Age'] <= 18),
              (data['Age'] > 18)&(data['Age'] <= 60),
              (data['Age'] > 60)]
values = ['child','teenager','adult','elderly']
data['AgeCategory'] = np.select(conditions,values)
```

[75]:
```
# checking distribution of age breakdown
data['AgeCategory'].value_counts()
```

[75]:
```
AgeCategory
adult        61898
child        21036
elderly      19762
teenager      7830
Name: count, dtype: int64
```

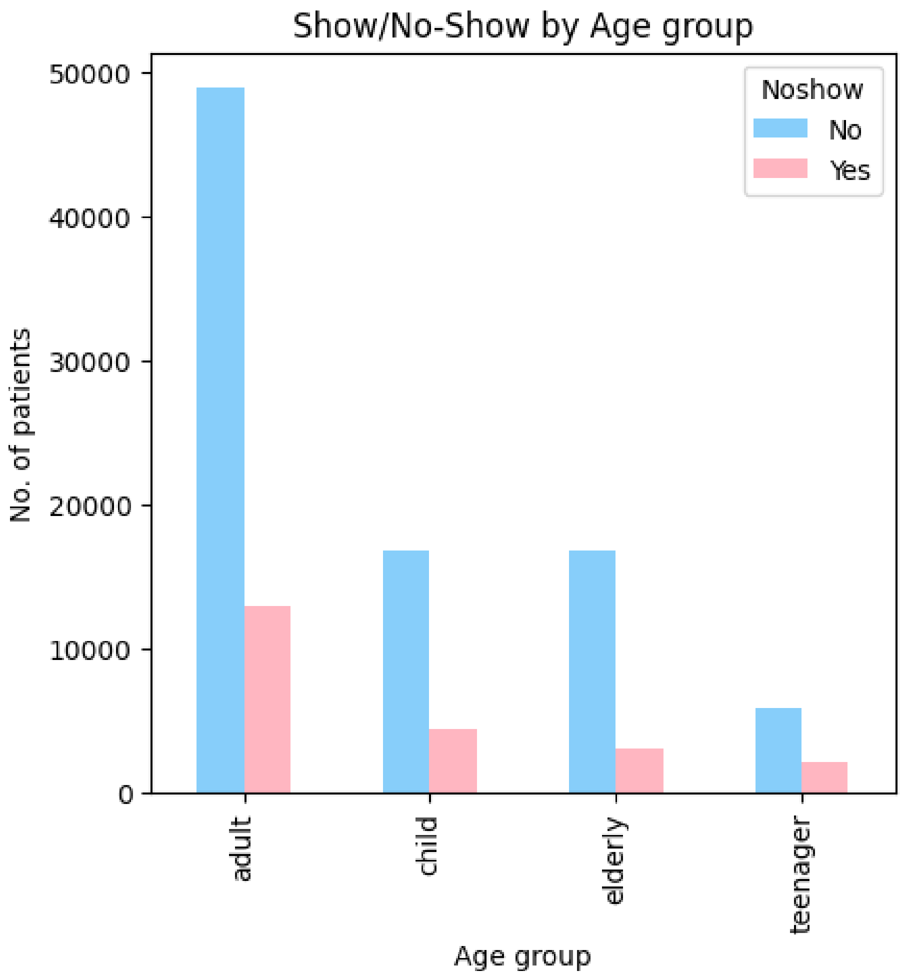
[76]:
```
# plotting value counts above in a bar chart
ax = data['AgeCategory'].value_counts().plot(
        kind='bar',
        title = 'No. of patients by age group',
        figsize=(5,5),
        color='palevioletred')
ax.set_xlabel('Age group')
ax.set_ylabel('No. of patients');
```



[77]:
```
# creating a pivot table
age_cat = data.groupby(['AgeCategory','Noshow'],as_index=False).size()
ac_pivot = pd.pivot(age_cat, index='AgeCategory',columns='Noshow',values='size')
ac_pivot
```

[77]:
```
Noshow          No    Yes
AgeCategory
adult        48932  12966
child        16729   4307
elderly      16756   3006
teenager      5790   2040
```

[78]:
```python
# plotting pivot table on a grouoed bar chart
ax = ac_pivot.plot(
        kind = 'bar',
        title = 'Show/No-Show by Age group',
        figsize=(5,5),
        color=('lightskyblue','lightpink'))
ax.set_xlabel('Age group')
ax.set_ylabel('No. of patients');
```



[79]:
```python
# number of children
child_count = data.query('AgeCategory == "child"').count().AgeCategory

#number of children who showed
child_show = data.query('AgeCategory == "child" & Noshow == "No"').count().
 ↪AgeCategory
```

```
# calculating probability
child_show_prob = probability(child_show,child_count)
round(child_show_prob,2)
print('Probability of Children Show up:',round(child_show_prob,2))
```

```
Probability of Children Show up: 0.8
```

[80]:
```
# number of Adult patients
adult_count = data.query('AgeCategory == "adult"').count().AgeCategory

# number of elderly patients who showed up
adult_show = data.query('AgeCategory == "adult" & Noshow == "No"').count().
  ↪AgeCategory

# calculating probability
adult_show_prob = probability(adult_show,adult_count)
round(adult_show_prob,2)
print('Probability of Adult Show up:',round(adult_show_prob,2))
```

```
Probability of Adult Show up: 0.79
```

[81]:
```
# number of elderly patients
elderly_count = data.query('AgeCategory == "elderly"').count().AgeCategory

# number of elderly patients who showed up
elderly_show = data.query('AgeCategory == "elderly" & Noshow == "No"').count().
  ↪AgeCategory

# calculating probability
elderly_show_prob = probability(elderly_show,elderly_count)
round(elderly_show_prob,2)
print('Probability of Elderly Show up:',round(elderly_show_prob,2))
```

```
Probability of Elderly Show up: 0.85
```

0.0.8 Conclusion:

Majority of people Show-up to their appointments after recieving the reminder messages.